Public Documents of Maine:

BEING THE

ANNUAL REPORTS

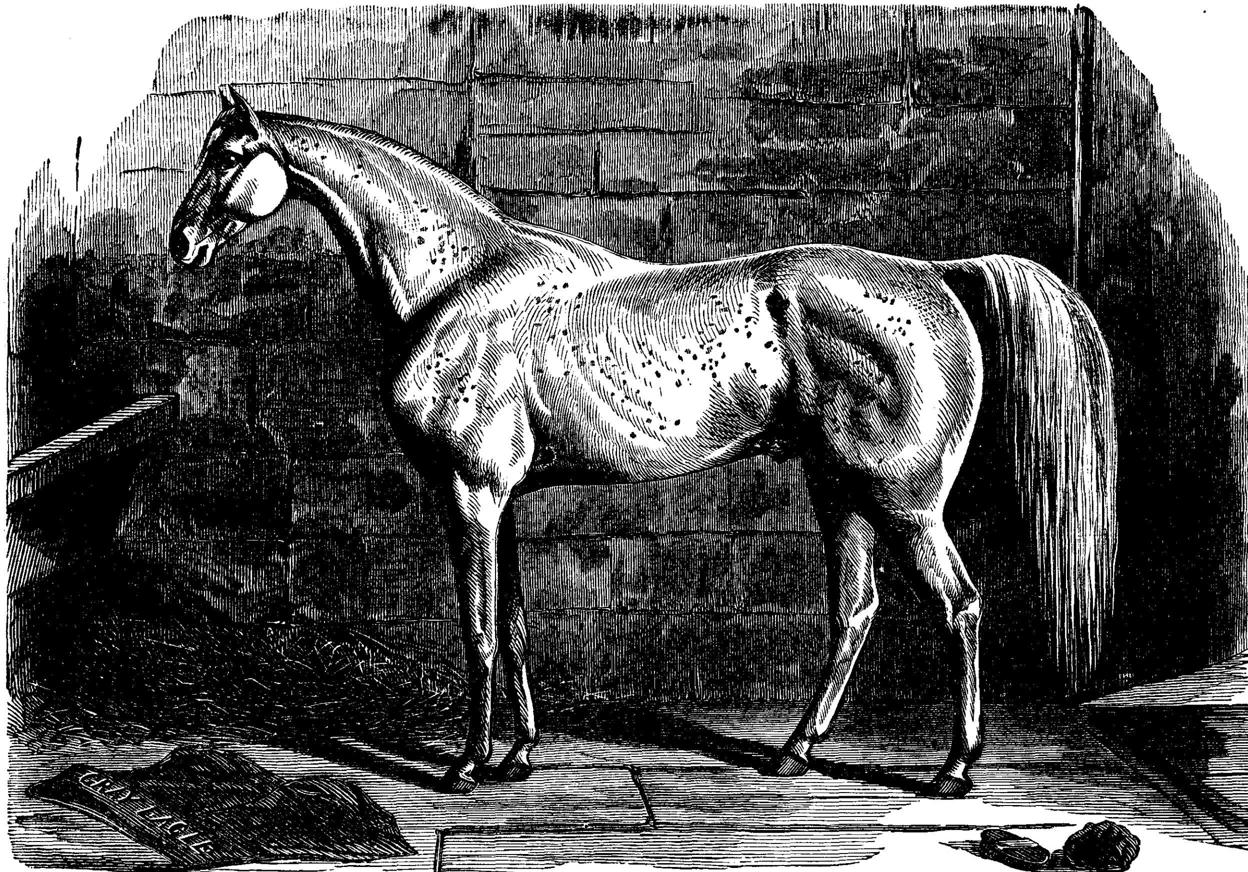
OF VARIOUS

PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEAR

1869-70.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1870



Thoroughbred Trotting Stallion "GRAY EAGLE," the property of Winthrop W. Chenery, Belmont, Mass.

FOURTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Maine Board of Agriculture,

FOR THE YEAR

1869.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1870.

BOARD OF AGRICULTURE.

SAMUEL WASSON, President.
SETH SCAMMAN, Vice President.
S. L. GOODALE, Secretary.

(Term Expires January, 1870.)

NAME.	COUNTY.	P. O. ADDRESS.
Seth Scamman,	Cumberland,	Scarboro'.
Samuel Holmes,	Oxford,	Peru.
Albert Moore,	Somerset,	North Anson.
S. L. Goodale,	York,	Saco.
Wildes P. Walker,	Sagadahoc,	Topsham.

(Term Expires January, 1871.)

Samuel Wasson,	Hancock,	Ellsworth.
Elijah B. Stackpole,	Penobscot,	Kenduskeag.
Jere R. Norton,	Franklin,	Avon.
Luther Chamberlain,	Piscataquis,	Atkinson.
Moses L. Wilder,	Washington,	Pembroke.
Isaac Hobbs,	Knox,	South Hope.
J. V. Putnam,	Aroostook,	Houlton.

(Term Expires 1872.)

Calvin Chamberlain,	State Society,	Foxcroft.
Daniel H. Thing,	Kennebec,	Mt. Vernon.
Z. A. Gilbert,	Androscoggin,	East Turner.
G. E. Brackett,	Waldo,	Belfast.
John Bodge,	Lincoln,	Jefferson.

REPORT.

To the Senate and House of Representatives:

The Board of Agriculture commenced its Annual Session at the State House, in Augusta, on the twentieth of January, 1869, and elected officers as follows:

SAMUEL WASSON, *President.*
SETH SCAMMAN, *Vice President.*
STEPHEN L. GOODALE, *Secretary.*

After the announcement of Standing Committees, and the transaction of other usual preliminary business, Mr. Luther Chamberlain presented the following *ad interim* report on

THE DEGENERATION OF ANIMALS THROUGH THE USE OF YOUNG AND UNDEVELOPED PARENTS.

Dean Swift being once called upon to preach a charity sermon, founded his discourse upon this text: "He that giveth to the poor, lendeth to the Lord;" and his sermon was in the following words: "My hearers, if you like the security, down with the dust." He says this was one of the most effective sermons he ever delivered, although containing one word less than the text.

In treating of the topic assigned me, if I could be as brief and as successful, it would not only be a source of gratification to myself, but to all interested in the theory and practice of stock-breeding; and when asked the question, "Do animals degenerate through the use of young and undeveloped parents?" I might with propriety answer in the shortest possible affirmative, and this answer would be satisfactory, not only to all the members of this Board, but to every intelligent farmer who thoroughly understood his business. But the inquisitive Yankee is not generally satisfied with a plain Anglo-Saxon answer, but wishes to know the reasons for arriving at certain conclusions; therefore it will be necessary for me to give reasons founded on facts, and, as far as I may be able, defend my position, or give those who may view it from an opposite standpoint, some ground for an argument.

It is a well established fact in physiology, that children from parents of middle age are more hardy, less liable to disease, and longer-lived than those from very young or very aged parents. Children from parents who are past the prime of life, come to maturity much earlier and fail much sooner than others; while those from very young parents are later in coming to maturity, and consequently more subject to fatal disease, by being children much longer.

Human growth, according to the best authority, ceases between the ages of twenty and twenty-five; in very warm regions, however, where development and decay are universally allowed to be more rapid, the inhabitants come to maturity much earlier. A superior order of beings can only be produced by selections and exclusions similar to those employed in rearing the inferior orders.

We may rejoice in a Fulton, a Franklin, or a Webster, occasionally, the parents of such being absolutely ignorant of the first principles of physiology; but in the breeders' language, such were in possession of the *prerequisites*. In the first place, they had not entered the marriage relationship prior to the age of reason; the parents were full grown men and women, not boys and girls; they possessed a sound mind and healthy constitution, free from hereditary defects of mind and body, which stunted growth, aided by artificial modes of life, are almost sure to entail. One safeguard, therefore, against stunted growth or ill health, is to avoid a too early use of the reproductive functions; and herein we are not safe, unless proper selections have been made, and faulty animals or persons rejected.

Until within a few years, a wise and salutary law was in operation in the British Isles, which interdicted marriage until the candidates had arrived at the age of twenty-one. That law has been set aside, and consequently the mass of the population of the present day will not bear comparison with that of the past. Believing that the same laws that govern the human race are applied throughout animated nature, these facts established by older and wiser heads than mine, are a foundation upon which to build a permanent superstructure for the almost infallible guide for all farmers and stock-breeders of the present day.

It appears from many ancient writings, that in "olden time" they were as conversant with many of these physiological facts as we are at the present day. It was ordered, according to Moses, that, "Thou shalt not let thy cattle gender with a diverse kind;" but mules were purchased, so that at this early period other countries must have crossed the horse and the ass. It is said Erichthonius, some generations before the Trojan war, had many brood mares, which by his care and judgment in the choice of stallions, produced a breed of horses superior to any in the surrounding countries. Plato in his "Republic," says to Glaucus, "I see that you raise at your house a great many dogs for the chase. Do you take care about breeding and pairing them? Among animals of good blood, are there not always some which are superior to the rest?" To which Glaucus answers in the affirmative. According to Pliny, King Pyrrhus had an especially valuable breed of oxen; and he did not suffer his bulls and cows to come together until they were four years old, that the breed might not degenerate. Virgil in his Georgics, (lib. 3) gives as strong advice as any modern agriculturist could give—carefully to select the breeding stock; to note the tribe, the lineage and the sire; whom to reserve for the husband of the herd, &c. The Romans even kept pedigrees of their pigeons, which shows conclusively that they must have taken great pains in breeding them. Columella gives detailed instructions about breeding fowls: "Let the breeding hens be of choice color, a robust body, square built, full breasted, with large heads, with upright and bright red combs." According to Tacitus, the Celts attended to the races of domestic animals; and Cæsar states that they paid high prices to merchants for fine imported horses. In regard to plants, Virgil speaks of yearly culling the largest seeds; and Celcus says, "Where the corn and the crop are small, we must pick out the best ears of corn, and of them lay up our seed separately by itself"—applying this same fundamental law of nature to the vegetable kingdom. In the great work on China, published in the last century by the Jesuits, and which is chiefly compiled from ancient Chinese encyclopediæ, it is said that with sheep, improving the breed consists in choosing with particular care the lambs which are destined for propagation, in nourishing them well, and in keeping the flocks separate. The same principles were applied by the Chinese to various plants and fruit trees. At about the beginning of the ninth century, Charles the Great expressly ordered his officers to take great care of his stallions; and if any proved bad or old, to forewarn him in good time before they were put to the mares. In the reign of Henry Seventh and Eighth, it was ordered that the magistrates at Michaelmas should scour the heaths and commons, and destroy all mares beneath a certain size. Why were these orders but to prevent their degeneration? The influence of the destruction of individuals having a particular characteristic, is shown by the effects on the average height of the men of France, of the destructive wars of Napoleon, by which many of the tall men were killed, the short ones being left to become the fathers of families. This at least is the conclusion of those who have closely studied the subject of the conscription, and it is certain that since Napoleon's time, the standard for the army has been lowered two or three times.

But to come down to the authors of our own times. Henry William Herbert, better known to us as Frank Forrester, in his work "The Horse of America," says:

"It is commonly supposed that one or both of the parents should be of mature age, and that if both are very old or very young, the offspring will be decrepit or weakly. A great many of our best horses have been out of old mares, or by old horses—as for instance, Priam, out of Cressida at twenty; Crucifix out of Octaviana at twenty-two; Lottery and Brutandorf, out of Mandane at twenty and twenty-one, Voltaire got by Voltigeur at twenty-one, and Bay Middleton was the sire of Andover at eighteen." And in our own day of horses whose parents are known to have arrived at full maturity, Gen. Knox stands first among the horses of New England. His sire was six years old, and dam seven. Gen. Knox got Gilbreth's Knox and the Littlefield horse when he was six years old—the dam of the Littlefield horse being seven years old, and the dam of Gilbreth's Knox died of old age only two or three years after he was foaled. Brown Harry, who in this State stands second only to Gen. Knox, was sired in 1855, by the oldest Black Hawk then living, being probably eighteen years old; and his dam when he was foaled had passed her twentieth year. Prince Harry, who received the first premium as a four-year old, at the last State Fair, was sired by Brown Harry when he was eight years old, and his dam was eleven. No one can doubt that the parents of all these horses mentioned had arrived at full maturity.

On the other hand, many young stallions and mares have succeeded well, and in numerous instances, the first foal of a mare has been the best she ever produced. In the olden time, Mark

Antony and Conductor were the first foals of their dams; and more recently, Shuttle, Pope, Sultan, Pericles, Doctor Syntax, Manfred and Pantaloon, have all been first born. Still, these are exceptions, and the great bulk of superior horses are produced later in the series.

The youngest dam on record was Monstrosity, foaled in 1838, who produced Ugly Buck at three years old, having been put to Venison when only two years of age. Her dam was only one year older when she was foaled, and Venison himself was quite a young stallion, being only seven years old when he got Ugly Buck; so that altogether the last mentioned horse was a remarkable instance of successful breeding from young parents. As in most cases of this kind, his early promises were not carried out, and he showed better as a two-year-old, and early in the following year, than in his maturity. Such is often the case, and I believe is a general rule in breeding all animals, whether horses, dogs or cattle. The general practice is to use young stallions with old mares, and to put young mares to old stallions; and such appears to be the best plan, judging from theory as well as practice." Such is the testimony of one who has made the theory of horse-breeding a life study, and is worthy of belief.

Youatt, in his Treatise on Cattle, says: "The proper age at which the process of breeding may be commenced will depend upon a variety of circumstances. Even with the early maturity of the Short Horns, if the heifers could be suffered to run until they were two and a half or three years old, they would become larger, finer and more valuable, and their progeny would be larger and stronger; but the expense of the keep for so long a time is a question that must be taken into consideration. The custom which at one period was beginning to be prevalent in the breeding districts, of putting the male at one year old, or even at an earlier period, cannot be too much reprobated. At the time when they are most rapidly growing themselves, a sufficient quantity of nutriment cannot be devoted to the full development of the fœtus, and both the mother and the offspring must invitably suffer. From two, to two and a half years old, according to the quality of the pasture, will be the most advantageous time for putting the heifer to bull. In fair pasture, the heifer will probably have attained a sufficient growth at two years. If the period is prolonged after three years, and especially with good keep, the animal will often be too high in condition, and there will be much uncertainty as to her becoming pregnant. That which has been said of the best age for beginning to breed in the cow, will equally apply to the bull. It is absurd and dangerous to begin to use him, as some have done, when a yearling. He will come into season at two years old, he will be better at three; and although the farmer may not deem it prudent to keep him more than two or three years, he may be sold advantageously, in his full prime to another breeder."

W. C. L. Martin, in his "Animal Economy," says: "The heifer ought not to be allowed to breed until turned two years old. The reason is obvious; her own system, before this period, is not sufficiently matured for the tax upon it—a tax which will be paid, not only by the dam, but also by the progeny; for both will suffer from the deficiency of nutriment, the whole of which is necessary for the growth of the former, which during the second year is rapid. With respect to the bull, he does not attain to a due degree of strength till two years old, and is in higher vigor at three, but how much longer the breeder may keep him after that age must depend upon his own judgment and a variety of circumstances."

George H. Dadd, in his "Diseases of Cattle," says: "Victor Gilbert never allowed ewes to have lambs until they had passed their third year; and his bucks were never used until they had arrived at full maturity. He, as well as most sagacious stock-raisers, was probably conversant with the fact, that during the period of growth and development, up to maturity, the reproductive organs are dormant; while at the same time the nutritive was wholly engaged in elaborating chyle and blood for the development of bone, muscle and nerve; and that by calling into requisition the reproductive or generative organs, before the animal had attained full growth, must necessarily divert the elements of matter intended for nutrition, from their legitimate channel, and divert them to the reproductive organs. This is precisely what takes place. A too early use of the purely animal functions induces weakness and stunted growth. Heifers should not be put to the bull until they have attained the age of three or four years; at this period they are in their prime. If they happen to have acquired too much fat, their daily allowance must be reduced. He says he remembers in his school-boy days, it was customary, as soon as a boy had accumulated a few pence, to invest it in a rabbit, (a favorite animal at that period); consequently we had a community of juvenile rabbit raisers; and from the results of past experience as observed by the older boys, a rule was adopted among us that the doe should not be put to the buck until she had attained full maturity. The reason assigned for this rule was, 'Early breeding prevented the doe from growing.' The facts were evident, still we knew not the why nor wherefore, but acted on the spur of experience." Physiologists have assigned the above as the true cause, and have in their writings pointed out the woeful results which often follow a too early use of the purely animal functions and organs. Among the higher orders the same law holds good—in fact there can be no deviation from it without incurring the hazard of paying the penalty.

Dr. George B. Loring says: "There is no doubt that the use of young males in breeding in New England, has been injurious to our stock; I mean so far as size and condition are concerned. You must remember that the bull has always been an outcast. A bull about a farm has generally been considered a nuisance. He does not give any milk, he does not make any beef, neither does he do any work; but is a sort of scullion on a place. He is a *bull*, and that is enough to damn him, and the quicker he serves his cows and gets out of the world, the better everybody is pleased. That has been the feeling with regard to breeding animals, among the the great majority of New England farmers.

Where the art of breeding has been applied wholly to the purposes of producing beef, and the animal has been fed liberally for that purpose, a young male has managed to do his work decently, and possibly, with fair and moderate usage, to keep himself along in good condition. That can be done; but the best Short Horn breeders in England will test what the stock may be, and then wait until the animal becomes more mature before they use him to any considerable extent. But there is a class of breeding where all the functions are to be developed for a prior purpose; where in order to secure the object in view, the constitution of the female must be entirely developed, and that is in the production of dairy cattle in Scotland. There the farmer pursues an entirely different course. The Scotch farmer endeavors to raise a hardy animal for the purposes of the dairy, and knowing that the wear and tear upon his cow when she goes to work, is to be as great as that upon himself when he goes to work, and if she gives from fifteen to twenty quarts of milk a day during the milking season, she is making a draft upon the system which nothing but the best constitution can endure. He never uses his bull until he is three years old. He desires to know that his animal has reached very nearly the point of maturity in his general constitutional condition. He desires to know, moreover, what kind of animal he has got, and he cannot satisfy himself on these points until his animal has reached that age. So that the farmer who is breeding, not for the rapid production of beef, which is so entirely an artificial business, but is breeding to secure animals with good constitutions for specific purposes, allows his male animal to reach that condition of maturity which will enable him to transmit a good strong constitution to his offspring. In this part of the business of breeding, I have no question that our cattle have been injured by the use of young males."

A little more testimony bearing on these general points (the truth of which we can see for ourselves) may not be out of place; and I will bring to your notice some of the premium stock presented at our last State Fair, by Warren Percival of Vassalboro'. The sire of Red Rose 3d, John Bull 2d, at the time of service was four years old, and his dam was eight years old. Gen. Smith also sired Red Lady 2d, when he was three years old. She was out of Red Lady at three years of age. The dam of Roan Lady, Madonna 5th, was six years old.

Mr. Percival says: "From my limited experience, I am fully convinced that the nearer maturity both sire and dam are at the time of conception, the greater the probability that the progeny will be first class animals. As a general rule, I do not allow my heifers to have calf until three years old, and should prefer four, when they are mature, and will breed every year if properly cared for, until twelve or fifteen years old. I have sometimes used yearling bulls from the force of circumstances. This I have done with great care, and only to my own cows. The mischief, in most cases, is not so much in the use, as in the *excessive* use. Some of my best animals, Roan Lady for instance, were sired by yearling bulls; still my calves sired by bulls three years old and upwards, are more fully developed and more perfect in symmetry, size and constitution, than those sired by younger bulls. I have been satisfied of these facts for years, and have so reasoned with the purchasers of blood stock." This is from one of the most successful breeders of Short Horns, a breed that is celebrated for its early maturity.

One more before I close. The following list contains the names of the herd of Devons presented at the last State Fair, by John F.

Anderson of Portland, with the ages of the parents as taken from the catalogue of his herd: Don Bobtail, sire and dam two years old; Nelson, sire four, dam seven; Von, sire and dam three; Zueklah, sire ten, dam nine; Abbess, sire and dam four; Exonia, sire and dam seven; Guerdia, sire three, dam four; Nun, sire eleven, dam six; Buddy, sire three, dam five; Yolola, sire ten, dam five; Zitella, sire nine, dam fifteen; Zivola, sire and dam two; Zingara, sire eleven, dam five. In conclusion, Mr. Anderson says: "The several parents being of the ages named when their respective progeny were born. Although I expect still better animals in the calves, they are too immature to pass upon in this connection. Although I have had some individual animals as good as the best I ever raised, from parents two years old, yet I am quite well assured that as a general rule, the best are obtained from mature parents, after they have reached their prime, and before they begin to decline."

In travelling through those sections of country which supply our larger cities with milk, you will see, with a very few exceptions, almost every herd of a dozen or more cows accompanied by a little yearling bull—coarse-horned, big-headed, slab-sided, long-legged and rough-haired. In the summer, after the time of year has passed when the bulls are especially useful, you will often meet on the road droves of these bulls one and two years old—the sires of the next generation of calves. These, having reached an age when they require more care and are more expensive to keep than calves, are sold for a small price, and slaughtered. The calf which is selected to be raised is usually the one the butcher will not buy. This is not always the case, but it is very rare that a bull is raised because his mother was a famous milker, or for any real or fancied superiority.

This state of things prevails extensively. Farmers argue that they only need a bull in order to get fresh cows; that the calves are of no value to them; that they rarely raise their heifer calves; hence it makes no difference to them what sort of bull they have. The stock of every dairy region is, to a considerable extent, supplied from its own herds. There are comparatively few sections where it does not pay to raise veal, at least until it is four weeks old. The use of a thorough-bred bull, not even excepting the Jersey, will greatly increase the size and value of the veal. Besides, however strange it may seem, it is true that thorough-bred bulls, even of breeds not famous as milkers, get heifer calves which are likely to become great milkers. The use of such immature sires has, according to all observations and analogical reasoning, a bad effect upon the system and functions of their progeny, We therefore have small cows, better calculated to eat and drink than to give milk, or to lay on flesh and fat. There is no greater reason why any good animal should come of such sires, than that a vine should bear figs. This state of things will continue as long as our milk raisers persist in using scrub bulls.

The use of thorough-bred sires for beef is pretty well appreciated, and in the beef-raising districts Short Horns predominate, and the great mass of beef which comes from the West bears marks of this blood to a greater or less extent. The advantage to dairy and milk farmers is quite as real as to beef-raisers. The farmer who buys a thorough-bred bull, and before his heifer calves mature, exchanges him with a neighbor for one of the same breed, and thus every second year makes a change, breeding always from bulls not less than three, and if possible four or five years old, will have the satisfaction of seeing great changes in his herd and in the profits of his dairy. No intelligent farmer should use a scrub or grade bull if he can help it. The temptation to raise grade bull calves is often too great to be resisted. They are very large and handsome, they may have come of favorite cows, and the farmer feels sure that if size and beauty are worth anything in a bull, he will do well to raise such a one. The bull comes to maturity, handsomer than his thorough-bred sire, perhaps ; nevertheless the probabilities are, that the stock of his getting will be little if any better than that of an out-and-out scrub.

Prof. Verrill, in his "Lectures on the Laws of Reproduction in Cattle," draws some practical conclusions that are worthy the attention of every one. Space and time will only allow me to make a few brief extracts. After giving his reasons, he says : "Hence only healthy and vigorous females should be used for breeding purposes, and they should be in the prime of life—not too young or too old." "It is equally important that the male should be perfectly healthy and sound, and free from all constitutional and hereditary diseases or imperfections." "The *excessive use* of the male for breeding purposes, is to be carefully avoided." In speaking of abortion in cows, which is a very common thing in some portions of New York, he says : "Doubtless one of the principal causes of this disease, is the employment of inferior males, or those that have been so overtaxed by excess as to weaken the reproductive organs."

One thing more may perhaps properly belong to this topic, and that is the tainting of the mother's blood, or the influence of the first conception on the after progeny. What I mean by this is, if you have a Jersey heifer, and wish only to get the milk, you put her to a scrub bull of no known breed, and get what you want, viz., milk. If you should afterwards wish to get a thorough-bred calf, the probability is, you would make a failure, as her after progeny would partake in a greater or less degree the qualities of that first conception. The same thing has been observed in the horse, the sheep and the dog. But as this subject will probably be treated at length by others during the Farmers' Convention, I leave it in their hands, only saying to you, if you wish to breed thorough-breds, of whatever class of animals, do not attempt to breed anything else in connection with them, if you do not wish them to degenerate.

After all this array of testimony which I have presented to you, in which more than three-fourths of our most celebrated animals are proved to be from fully developed parents, is it not reasonable to conclude that the only sure way to improve the different breeds of our domestic animals, is to use such and only such for breeders? and if animals can be improved by the use of proper selections of those which have arrived at maturity, will they not by the same laws degenerate by a free and indiscriminate use of the young and undeveloped? I have been asked, during the past year, by a disbeliever in thorough-bred animals, why our different races of wild animals do not degenerate and eventually become extinct? and why the mustang of Mexico, and the wild horse of the Western prairie have not degenerated since their first discovery? Animals taken from their native forests and domesticated by any stock breeder who thoroughly understands his business, can, in a few generations, be so entirely changed in almost every respect as to be hardly named in the same category. All animals in their native wilds are led by their own instincts to destroy all the weakly of both sexes, and breed only after they arrive at full maturity.

The Mexican mustang and wild horse of the West, are not natives of this continent. The first horses known in North America were those that so surprised the aborigines of Mexico during its conquest by the Spaniards. All our wild horses doubtless sprang from the Spanish blood horse of the sixteenth century; and I presume no one will contend that it is not a degenerate race from that celebrated stock. Probably they have remained the same for many generations; their natural instincts, since becoming acclimated and completely in the state of nature, teaching them what to do for their own preservation. Thus it is that Nature does her own work faithfully; but when we take that work into our own hands, many of us show by our want of success, that we really know less than the animals themselves, led only by their own natural instincts.

Having extended this article much beyond what I anticipated at its commencement, and still but scarcely made a beginning in this most necessary work, I may perhaps be pardoned when you consider my own limited experience and what the urgency of the case demands. Hoping those upon whom I have drawn so largely will excuse me, I will conclude by urging upon our farmers and stock-breeders to give this subject that attention which it evidently demands, and by so doing they may prevent many of those evils and failures that are almost constantly occurring.

Some discussion followed the reading of Mr. Chamberlain's paper, in which several members participated, and it appeared that the views set forth in it were nearly in accordance with those of all who spoke on the subject.

Mr. Scamman presented a report on the subject assigned to him last year, as follows:

Salt Marshes.

In selecting Salt Marshes as a topic for investigation it was with the view to call attention to a subject that hitherto had been almost over-looked; a subject too, that on slight observation had the appearance of being of some substantial advantage to the agriculture of the State. That there is a large body of land in a submerged state, or partially so, much of it worthless, and the balance yielding only a small income, lying along our extended sea-coast and beside our navigable rivers, is a fact conceded by all.

But the idea that these sunken, uncouth lands possess inherent properties of fertility, and could be raised from the watery element so as to be the most fruitful and productive portion of our cultivated lands seems to have been nearly dormant in the community. But now, as the former sources of our business and means of livelihood are fast receding from view, namely, our forests of timber and wood, attention must be directed to other sources of business and remuneration. We turn to mother Earth; and it is well for us to look here and see what sources of wealth have been overlooked, what means of providing food for man and beast are to be found at our own doors and within our own domain, before we go to the far West, or to the sunny South in pursuit of them. In one respect we shall find scattered all along our sea board, salt marshes, in lots varying from one acre to two thousand in a body. Some of these marshes are over-flowed at every ebbing and flowing of the tide, others only occasionally at high run of tides. A large proportion of them are in grass of the different varieties known as salt grasses. Near the rivers, creeks and lower parts, a coarse, flat grass called "thatch" grows, standing oftentimes as high as a man's head. The tide usually flows where this grass grows, every day. Next comes goose grass, fine thatch and fox grass, where the tide does not so often flow, being a little higher marsh than the first named. Then comes the black grass and marsh brown-top, mixed sparingly sometimes with other varieties. This marsh is overflowed at high tides. The hay made from these different grasses varies in saltness and quality as the land from which they are cut recedes from, or rises above the tides. The black grass and brown-top approaches nearest to upland hay, and superior to any other hay cut on salt marsh. The quantity per acre will vary from half a ton to four tons, thatch being the heaviest crop. Besides these different grades of marsh where grass grows, there are what are called "Flats"; some of them are clam beds, some muscle beds, and mud. The soil of these marshes are very similar, with the exception of the flats, the sward of the higher portions being very tough and fibrous, and growing more spongy till you come to the creeks, rivers and flats. From the surface downwards it grows less tough and fibrous to the depth of two or three feet, where the whole mass consists of thoroughly decomposed vegetable and fibrous deposit and accumulation of ages to the depth of ten, fifteen or twenty feet. Above what is termed salt marsh, and bordering on the shores, coves and streams adjacent to the salt marsh are quite large plats of semi-salt or fresh marshes similar in soil, producing a kind of fresh grass. The tide hardly ever flows over them. Thousands of acres of these marshes such as have been described are the common heritage of our noble State. Scattered all the way from Kittery Point to Quoddy Head; possessing inexhaustible supplies of food for vegetation, and if reclaimed from the watery element, would produce luxuriant and bountiful harvests to the husbandman, as well as be a source of beauty and delight to all lovers of the beautiful—equal in fertility to the deltas of the lower Mississippi, the banked meadows of the lower Delaware, the broad prairies of the West, or the rich lands reclaimed from the sea in the Netherlands.

The question now naturally suggests itself, can it be done? Is this practicable? The answer I think, in most cases is—yes, it can be done. It is an old but trite saying, "What man has done, man may do." Much may be accomplished by the thorough drainage of all surface water when the tides are out. For salt grass, like English, is very tenacious of its rights, and will not budge a hair if you keep it standing constantly with its feet in the water. The roots need the circulation of the air and the warmth of the sun. Besides if the water is left to puddle on the surface, the sod soon loses its tenacity, settles down, and a miry, salt pond is formed. Draining also improves the quality and quantity of hay, and renders the work of securing it less laborious. But draining simply, is not sufficient. Land flowed twice in every twenty-four hours of every month, cannot yield in kind and quantity what such land is capable of producing, however completely you may draw off the surface water. Something more is needed. That land must be lifted out of the water *bodily*, or what is equivalent, the water must be shut out from it, and only be allowed to come in at pleasure. And that this can be done, we have satisfactory evidence in the numerous examples already accomplished—not many to be sure, in our own State, but enough to establish the fact. In Massachusetts, Connecticut and New Jersey, in New Brunswick and Nova Scotia, on the Frith of Forth and the river Don in Scotland, the Netherlands and various other places on the continent, where dykes or embankments have been built to shut out water, and reclaim just such lands or marshes as are under consideration; and they have accomplished the object in view. Some of them have been built more than one hundred years, and long enough it is to be hoped, to satisfy the most incredulous. Every one may be convinced that it can be done at *some cost*, but every Yankee will want to know if it will pay? This too can be answered with the same unerring certainty in the affirmative, from the same source; and to show this more clearly, several instances will be cited:

About the year 1800, two hundred and twenty-two acres on the river Hallowdale, in Sutherland, were dyked, at a cost of £2,668. Before being dyked it rented at fifteen shillings per acre, yielding an income of £166. After it was dyked it rented for forty shillings per acre, yielding an income of £444, a gain of £278, or $10\frac{1}{2}$ per cent. on the outlay per annum. Admiral Bentrick speaks of dyking one hundred and eighty acres of salt marsh (near Plymouth) at an expense of £4,000, yielding a clear profit of £560 a year. This dyke was a mile and a half long, seventy-two feet wide at the base, and twelve feet high.

I have several communications from gentlemen in New Brunswick, obtained through the politeness of Charles S. Lugrin, Esq., Secretary of the Provincial Board of Agriculture, New Brunswick, and of gentlemen in this State, extracts from which I will quote, as giving information needed. Charles Sidelle, of New Brunswick, says:

"I would say, all the marsh on the Straits of Northumberland has been dyked, and the result has been very satisfactory. It produces on an average, two tons of hay per acre. As to the comparative value of the hay, it is worth three-fourths as much as timothy and clover. Some qualities of it are equally as good for horned cattle as timothy and clover. The soil is generally a kind of blue mud, although a small portion is a gray corky soil; both kinds produce about the same qualities of hay. The marsh produces sedge before it is dyked, and broadleaf after. We dyke from four to six feet high (say two feet above spring tides) from fourteen to eighteen feet wide in the bottom, from four to five feet wide on top. As to cost, a good dyker will put up six feet in length per day, of our largest dyke. Draining is the only treatment it requires after dyking. There is nothing else produced on the marsh but grass. As to the mode of building dykes, we put large dovetail sods, grass side out, on the outside of the dyke on each side, to prevent the tide from disturbing them till they get solid. In a short time they will be held firmly together by the grass roots.

But it requires a good amount of practice to build a strong dyke, as the soil is very light when dry. I have examined several pieces of marsh between Eastport and Portland, and believe the soil to be the same as ours. For the first few years after dyking, the quality of the hay will not be quite as good as afterwards. The most of our marsh has been dyked sixty years, and produces as good a crop now as ever it did. It is worth from sixty to eighty dollars per acre, while our unmanured upland is not worth over ten to fifteen." Howard Freeman says:

"The cost of dyking will depend largely upon the soil out of which you have to make your dyke; and the cost of keeping up or repairing, will depend altogether upon the pressure to which your dyke is subjected. The advantages of dyking marsh to us can scarcely be estimated. Without it we could not rent it. Our marsh is not worth anything before it is dyked. A kind of salt grass grows upon it, but it is so covered with a muddy sediment deposited by the tide waters, that it is not worth saving. The soil is of two kinds—the one blue, the other red. The dykes are made of this soil thrown up with spades. The first cost of making dykes with us was from twenty-five to fifty dollars per square rod; and about the same per acre to keep it in repair. I spoke of the blue and red soil. The one grows English hay, timothy, clover, couch; the other a kind of broad leaf grass which gives the marsh its name—broad leaf marsh. This broad leaf hay is not shipped, but used for home consumption; worth five dollars per ton; the English, ten dollars. Marsh worth from thirty to forty dollars per acre for broad leaf marsh; and the English from sixty to one hundred dollars." W. B. Smith of Machias, says:

"The whole quantity of Salt Marsh in this town, Marshfield, East Machias and Machiasport, all of which towns were comprised in the original township of Machias, I estimate to be about five hundred acres. Of this, some four hundred acres are dyked. The largest portion of the dyked marsh is in one body, and lies on the shores of Middle river, a small branch of the Machias West river, and contains three hundred and thirty acres. The dyke enclosing this tract crosses Middle river near its mouth. It is ninety-three rods long. It was commenced in 1866, and finished the following year. In the deepest place this dyke is twenty-two feet in height. This depth is where it crosses the channel of the river, and extends some twenty rods. The remaining portion of the dyke as it approaches the shores, averages about eight or ten feet. The base of the dyke, in the widest place, is nearly fifty feet, narrowing as it runs shoreward from the channel to an average of fifteen feet. On top, this dyke varies from two to three feet. The main material of the dyke is composed of clay brought from the adjoining shore, intermixed in some places with layers of green boughs and small trees of fir and spruce. But little of marsh sods or mud was used. The contract price for building was $15,000. I presume it must have cost the contractor more. There is a fresh water stream running through this tract, which is sufficient to carry a saw mill some three months in a year, and does carry one situated about two miles above the marsh.

Previous to the building of this dyke in 1866, nearly two-thirds of the marsh it encloses had been dyked for many years in separate parcels, according to ownership, from six to twenty acres; but getting out of repair, and the lands deteriorating by neglect in this particular, the enterprise of 1866 was undertaken. Below this tract, on the northeastern side of Machias West river, there is another tract of about sixty acres, which has been dyked over thirty years. The dykes enclosing this, average ten feet in height —being nearly twenty feet where they cross the large creeks emptying into the main river—and average twelve feet at the base by two feet on top. These dykes extend up and down the river about three quarters of a mile. They were built of marsh mud and sods. A small brook of fresh water runs through this tract.

Originally on the the lower grounds and sides of the creeks a coarse, tubular grass, commonly known as 'thatch' grew abundantly. On the higher grades, a flat grass grew, quite good for stock, with brown-top intermixed, while near the upland, brown-top and clover are intermixed with flat grass. Upon being reclaimed by dykes, in the course of two or three years, brown-top chiefly, and clover mixed with flat-grass, took the place of the original crops. No persistent effort has been made to cultivate these lands after being dyked. Occasionally in times past an effort in this way has been undertaken but without any encouraging success. The roughest parts are generally plowed over and harrowed, (when the salt has somewhat leached out) and seeded down with oats, which have grown very well. Nothing beyond this is done.

The best kind of marsh lands for dyking are those which are interlaced the most with small creeks, as by means of them the drainage becomes more rapid and perfect. No manure is used. When moss begins to grow and extend on the marsh, as it does sometimes after four or five years, the salt water is let on to the tract so as to overflow it. This kills the moss effectually and the grass crops are restored. No advantage is gained by an overflow of fresh water as manure. It may aid in freshening the newly dyked lands. By dyking these marshes the crops are considered here to have nearly or quite tripled in value." Mr. Owen Wentworth of Kennebunk, says:

"According to my best judgment, I have dyked about twenty-five acres of salt marsh, costing in 1858 $1.25 per square rod. It would cost much more now. Width at bottom, seven feet; at top, three feet; material used, marsh; height, three to four feet, according to elevation of marsh. There are two streams of fresh water running through it, regulated by gates. Before being dyked the upper part bore no grass of any consequence—the lower parts grew fox grass, and sampore or goose grass—nearly valueless. After being dyked, the grass resembles brown-top mixed with herds and witch grass. The quantity is quadrupled, and quality much improved; good hay for stock; value of marsh quadrupled; soil, tough—marshy; have not cultivated anything but grass on it. There are, including mine, about forty acres in town dyked—about two hundred not dyked. None dyked in Wells that I know of; and from six hundred to seven hundred acres not dyked."

At Old Orchard in Saco, there are about thirty acres dyked. I saw the crop of grass on it in 1868, a short time before it was cut. On some parts of it, where it was hardly worth cutting before it was dyked,—as I was informed by one of the owners with me—and that of poor quality, stood a heavy crop of marsh brown-top and black grass of good quality, and the whole lot was looking extremely well. The improvement in this lot has been so great, that efforts are now making to dyke the whole of the Old Orchard marsh, containing in the neighborhood of five hundred acres.

Many years ago, Dr. Southgate of Scarboro', dyked a large piece of the Scarboro' marsh. The quality and quantity of the grass were very much improved. On some parts of it he carted clay, and mixed it with the soil, and sowed it with herds grass and clover with oats. It is said by the oldest inhabitants in that vicinity, that such oats and grass they never saw grow before. On some parts too of the dyked marsh he planted his garden vegetables, which succeeded well. But the dyke not being built sufficiently strong to resist the pressure of extraordinarily high tides, it was broken and never repaired. In the town of Scarboro', there are about two thousand acres of salt marsh, besides a large amount of fresh marsh adjoining, which would be quite as much improved as the salt marsh by dyking. The P. S. & P. Railroad passes through or over it. By using the railroad as a dyke, and putting water gates into the fresh water stream, the salt water would be most effectually shut out from about seven hundred acres of marsh.

There is another consideration of much importance, why these marshes should be dyked, namely, that the hay may be secured at the proper time. Oftentimes the tides forbid cutting the grass till it is too late to make good fodder; and then in short tides if the weather is unfavorable, the hay must be put up before it is in a suitable condition, or be left to soak in the water. It would be great economy even in securing the harvest, if the salt water could be shut out at that season of the year. Then the grass could be cut at the proper stage, and secured as well as other hay crops.

Much might be said in relation to the manner of constructing dykes; the material to be used, and the size and strength of them. But each locality differs so much from every other, and the obstacles to be encountered and overcome are so various, that it would be difficult to lay down any fixed rules to be governed by in all cases. Much must be left to the skill, good judgment and application of the undertaker. Care however, must be taken to have a thorough examination and survey of the work to be accomplished and the end to be attained, and then a proper application of those principles that govern every successful enterprise will secure the desired results. The higher the dykes are to be raised, the broader must they be at the base. The greater the pressure to be brought against them, the stronger must they be built. In all cases they must not be less than two or three feet above high water mark. I have desired very much to see more of the dykes and dyked marshes in this State and the Provinces, that I might be able to speak from personal observation. But circumstances beyond my control have prevented me, so that I have had to depend mainly upon what is written in books, and upon correspondence and conversation.

I have endeavored to call attention to some of the more important points and facts touching this broad subject, so that thoughts might be awakened that would lead to investigation, and result in such action that soon those owning these marshes will set themselves earnestly at work and reclaim them to higher agricultural purposes, as I must candidly believe most of them may be, thereby at least, doubling their value to their owners and adding so much to the agricultural interests of the State.

In the discussion following the reading of Mr. Scamman's paper it appeared that few members were personally acquainted with salt marshes, and the results of dyking, and the remarks naturally turned to fresh marshes as a more familiar subject. Mr. Norton introduced the following:

Whereas, The hay crop being one of the most important crops to the farmers of Maine, therefore,

Resolved, That we recommend the clearing and draining of meadow lands, where the elements of nutrition from cultivated lands have been annually washed down into some neglected bog, which by draining and cultivation may be made the most productive and valuable part of the farm.

He also stated his experience in draining a bog or meadow of about four acres in extent, which by being improved in this manner, had been changed from a worthless piece of ground to one of the most valuable portions of the farm.

Mr. Wilder said that the reclaimed meadows and swamps, furnished the heaviest grass crops of any in Washington county. The high lands will produce well with frequent supplies of manure, but the drained swamps yielded freely without additions of manure. He found such reclaimed lands twice as profitable as high lands, and hoped the farmers of the State generally would come to appreciate them at their real value.

Mr. Bodge spoke of a meadow upon his own farm, that had been doubled in the quantity of its produce, by being cleared. The value of low meadows as an aid to upland farming in furnishing keep for stock, and a means of making manure, is greater than is generally known.

Mr. Scamman regarded the reclaiming of fresh meadows and swamps as even more important than the reclaiming of salt marshes, because the latter were found only along the coast line, while the former were scattered over the length and breadth of the State.

Farming in Maine cannot be carried on successfully without manure; we cannot depend upon commercial manures solely for the permanent improvement of our farms, although they are well in their way. From whence then must this manure come? From our farm stock; and the more hay the farmer grows the more manure he can make. Stock has been high for the past few years, and money has been scarce, and to raise money farmers have sold off both stock and hay. In consequence of this the farmers' manure heap has dwindled, his farm has been deteriorating, and his crops diminishing. This cannot go on for many years—farming upon such a course in a few years would run out. Our farms must be stocked to the full extent they will carry, in order that the manure heap may be increased. Clearing up these meadows and bogs will give additional facilities for growing hay to keep stock. These bogs, often unsightly and breeding disease throughout the neighborhood—are in fact the best grass lands we have. If cleared and drained they will not only produce grass but vegetables and grains.

In answer to a question Mr. Goodale remarked that while water was absolutely essential to vegetation, any excess of it in the soil was injurious, unless it could be kept in a state of activity.

Salt marshes have been spoken of; these naturally produce a growth of little value, but not for lack of the elements of fertility. What we need to know is, not how to bestow upon them what our hungry uplands need, but rather how to relieve them from the disabilities under which they labor. The truth is that salt marshes and many fresh meadows are scarcely poorer in point of natural endowment than good upland prairies. Float the best piece of prairie in all the West twice daily, the year round, in weak pickle, and what crops would you expect to grow upon it? Soak another piece to saturation in stagnant fresh water and how much better would that be than if it were in salt water?

One of the wonderful things about the effect of water upon vegetation is, that there may be a large surplus with no injury but great benefit, *provided it could be constantly moving.* Hence the wonderful degree of fertility which was induced by irrigation; where the ground was not only saturated, but a sheet of water was constantly moving over the surface. Water stagnant in a soil was always injurious, whether in a bog or upon uplands.

The bogs and meadows of the State may not only be reclaimed into its most fertile and most profitable portions, but they may also frequently be made to contribute materially towards fertilizing the uplands;—and this both directly, in furnishing materials for the compost heap, and indirectly, by the manure yielded from the consumption of their growth of grasses.

In conclusion, Mr. Scamman, at the request of the Board, assumed the continued investigation of the same topic during the year to come.

Mr. Moore of Somerset, presented the results of his *ad interim* labors in the following report on

The Culture of Wheat.

We have high official authority for saying that "the State of Maine needs 650,000 barrels of flour, yearly—nearly all of which is imported," at an expense hitherto of nearly ten millions of dollars. At the same time an agriculturist writes in one of our State papers, that wheat "is one of the legitimate crops of Maine, belonging to the family of cereals, and of more value to the State than all others beside"; and he instances the "vast quantities of wheat growing hundreds of miles north, in the British possessions, with its cold, forbidding climate." If both these statements are true, there is something radically wrong in the agriculture of Maine. That the last is true is witnessed by the fact, that in the early history of the State wheat was a staple crop, not only affording ample supply for home consumption, but contributing largely to the exports from the State. A few intervening years of the prevalence of the smut disease is the only exception to this general rule, up to about 1850—thence to 1860, the ravages of the midge rendered the crop so uncertain as to cause its abandonment, with exceptional cases on high, airy situations, where its culture was continued, with fair success. Since 1860 the midge has been abating, and has apparently ceased its ravages, and fair crops of wheat are again realized.

We find from the Agricultural Reports, that the wheat crop of Maine in 1866 was more than an average yield, of both bushels and money, with all the States reported—being 12.7 bushels per acre in Maine, and 10 bushels in the general average of the States,—fourteen States averaging more, and seventeen less than Maine. Hence it is believed that we may venture to return to the cultivation of this valuable cereal again. In view of these facts the question becomes of great importance to our farmers. A great deficit of bread-stuff meets them face to face. A deficit too, that *must* be supplied in some way. How to supply it is the important question. Shall we continue to raise oats to buy our flour with, as we have been doing hitherto? A proper answer to this question involves an enquiry into the relative value of these two crops.

The Report of 1866 gives 15,208 acres of wheat in this State, at an average yield of 12.7 bushels per acre, and average price of $2.86 per bushel,—equal to $36.32 per acre; of oats 95,800 acres averaging 27.7 bushels per acre, at 69 cents per bushel—equal to $19.11 per acre, a difference in favor of the wheat of $17.21 an acre. If the 95,800 acres of oats had been sown with wheat, instead, the yield of money to pay out for flour would have been increased $1,639,138—more than enough to purchase 100,000 barrels of flour. The relative exhaustion of soil, as well as the value of wheat and oats for a seeding crop, are also considerations of no mean importance, in comparing the merits of these two crops. It may seem an extravagant calculation that counts nearly two million dollars annual loss to the farmers of Maine, in growing oats instead of wheat; but these are the figures, and figures are said not to lie. They are significantly suggestive, to say the least.

We raise but little winter wheat in Maine. The crop has been frequently tried and as often abandoned, and the failure attributed to the severity of the climate. But late sowing and careless cultivation are more probable causes. That winter wheat can be raised in Maine is demonstrated by the success of the crop in New Hampshire and the Canadas. Mr. Levi Bartlett of Warner, N. H., in 1862, writes the Commissioner of Agriculture, that "those sowing as early as the first of September, on suitable soil, realized a yield from sixteen to twenty bushels for the bushel sown," and adds :—"for ten years I have grown winter wheat every year, and without a single failure in raising a fair crop. On my farm winter wheat has proved a surer crop than either corn, potatoes, or oats. I have come to the conclusion that fall sown wheat is as sure a crop in New Hampshire as it is in any other State in the Union." If winter wheat is a sure crop in New Hampshire it can be no less sure in Maine. If our spasmodic attempts to cultivate this crop have proved failures, it is because of our inattention to proper cultivation, and early sowing. Freezing and thawing in spring is oftener the cause of failure, than anything else. Early sowing will give the plant a strong start before winter sets in, and prevent this. Situations sheltered from heavy winds, where the snow neither blows on or off, are most desirable to prevent smothering or freezing out. With these precautions observed, rich culture, care in seeding and covering, we may expect reasonable success in raising winter wheat in Maine.

Spring wheat has been mostly cultivated hitherto. The club variety is preferred in Somerset county. Early sowing is of the utmost importance. There is hardly an instance of failure where it has been put in early, with the ground in a suitable state. The most common method of cultivation is to break the sod and sow to oats without manure; take off the oats and plow in the fall; next spring, manure and plant potatoes; the third year manure again and plant to corn, and plow again in the fall; the fourth year, as early in the spring as practicable, sow two bushels of wheat to the acre, and seed down with clover and herds grass for hay, using generally no additional manure, considering that the soil that will produce good corn will produce good enough wheat. Here is where this method is at fault. Too much is presumed for the soil that has just carried a succession of exhaustive crops. An additional manuring should attend the wheat sowing. The seed is sown broadcast by hand and harrowed in, unevenly at best; hence it germinates and grows unevenly to maturity. Drill sowing would seem the better plan, although in Somerset county this implement is wholly unknown, and is used little if any in the State. It is claimed that the drill distributes more evenly and covers at a uniform and proper depth. The grain germinates and comes up all at once and starts out for maturity with equal chances. It is also claimed that the drill will save half a bushel of seed to the acre, and the yield be much more. These considerations would seem to make its use as worthy of trial, at least here, as elsewhere. Wheat above all other crops requires rich and careful cultivation. With our virgin soil we had no difficulty in raising wheat. But *now* exhaustion is written on every hand, and without systematic culture and a bountiful supply of fertilizers adapted to its growth, we may well expect to fail.

We must awake to a realizing sense of the situation if we would reap a golden harvest from our labors. But if we would bestow the same care and expense upon the preparation of the soil and the cultivation of the wheat crop, that we do upon breeding "fast horses" or fine-wool sheep, we should be amply remunerated, though there might be fewer 2.40 horses, or thousand dollar bucks in the State. If wheat is a legitimate crop, as stated, it is assumed that our soil, in proper condition, is sufficiently adapted to its growth to warrant its cultivation. As a prerequisite to proper condition, underdraining, where the soil is not naturally dry, is essential. Next in importance is a free application of suitable fertilizers. With the soil in its virgin state, a good crop may be produced "by working blindly and by main force," but with our present worn-out fields, farmers need to work "understandingly and skillfully." Our fields are exhausted and can only be restored by proper appliances to the soil by returning to it the elements abstracted by the crop removed from it. This can only be done by a liberal application of manures in some form. What that form is must be ascertained by skill and experience. With barn-yard manure in sufficient quantities the farmer would feel confident that persistent and continued application, even by "main force," would secure good crops, as well as rich and fertile fields. But this is often unattainable. For the want of barn-yard manure, artificial or commercial manures are necessarily resorted to. Here is an unexplored field for the untaught farmer. Science has yet much to impart on this point. For wheat, the free use of lime, ashes, plaster, superphosphates, &c., are highly recommended. These are all, doubtless, beneficial, but with varied results on different soils. The adaptation of either of these, or a combination of all or a part to any given soil, can only be determined by experimental application. A thorough knowledge of the constituents of the soil would enable the farmer to apply, intelligently, any or all of these as the case might require. But our farmers are not able to determine the wants of their soils; and when the farmer applies lime where vegetable mould is wanting, he fails to understand why it has not the same effect as in its presence, and so of other ingredients that are only beneficial in the presence of still other lacking constituents. Actual experiments alone will enable the farmer to apply skillfully and successfully. As a possible exception to this rule, I have been interested in the preface to a course of lectures by Prof. Ville of the Museum of Natural History in Paris. Prof. Ville, it is said, "commencing with barren sand and a flower-pot, added to that barren sand certain constituents necessary in agriculture,—for instance, phosphate of lime, potash, nitrogenous substances, and lime. He found that when one constituent was added, certain plants would grow in it, while others refused. Two of these constituents being added, a still larger number of plants would grow; and when, in short, all the necessary constituents were added in their proper proportions, a full, and abundant crop, was obtained."

"To operate with greater certainty, Prof. Ville removed every element of error or doubt from his experiments, and proceeded by the synthetic method. He took calcined sand for his soil, and common flower-pots for his field. Ten years of assiduous observation and experiment led him to recognize that the aliment preferred by cereals, is *nitrogen;* by leguminous plants—*potassa;* by roots—*phosphates;* we say the *preferred,* but not the exclusive; for these three substances, in various proportion, are necessary to each and all, and even lime, which humus renders assimilable, must be added."

"By adding, according to M. Ville's system, nitrogenous matter, phosphate of lime, and potassa—that is to say, a normal or complete manure to calcined sand, the seed-wheat, being equal to 1—the crop is represented by 23."

"Upon withdrawing the nitrogenous matter from this mixture of the four elements, the crop fell to 8.83."

"Upon withdrawing the potassa, and retaining all the others, the crop only attained to the figure 6.57."

"When the phosphate of lime was omitted, the crop was reduced to 0.77; vegetation ceased, and the plant died."

"Lastly, upon abstracting the lime, then the crop, the maximum of which was represented by 23, was only 21.62."

"From the above facts we draw these conclusions: "That if the four elements of a perfect manure, above named, act only in the capacity of regulators of cultivation, the maximum effect they can produce implies the presence of all four. In other words, the function of each element depends upon the presence of the other three. When a single one is suppressed, the mixture at once losses three-fourth of its value."

"It is to be remarked, that the suppression of the nitrogenous matter, which causes the yield of wheat to fall from 23 to 8.33, exercises only a very moderate influence upon crops, when the plant under cultivation is leguminous. But it will be quite otherwise if, in such cases, we remove the potassa."

"If we extend the experiment to other crops, and successively suppress from the mixture one of the four agents of production, we arrive at the knowledge of the element which is most essential to each particular crop, and also which is most active in comparison with the other two. For wheat, and the cereals generally, the element of fertility *par excellence*—that which exercises most influence in the mixture, is the nitrogenous matter. For leguminous plants potassa, for turnips and other roots, phosphate of lime."

"Suppose we wished to cultivate wheat indefinitely. We should at first have recourse to the complete manure, and afterwards, administer only the *dominant* element, or nitrogenous matter, until a decrease in the successive crops showed that this culture had absorbed all the phosphate of lime and potassa. As soon as a diminution in the crops manifests itself, we must return to the complete manure, and proceed as before."

"Suppose that, instead of an exclusive culture, it be desired to introduce an alternate culture in a given field; we commence with the agent that has most influence on the plant with which we start. If that be a leguminous plant, we at first administer only potassa. For wheat we should add nitrogenous matters. If we conclude with turnips, we have recourse to phosphate of lime; but when we return to the point from which we started, all four elements must be added."

Although a thorough experimental trial of M. Ville's methods is desirable, dependence upon it as a practicable substitute for barn-yard manure is highly problematical; and even if it proves as effective as is claimed, the expense of the materials may render it too costly for general use. For the present, at least, I apprehend that the uncertainty and the expense, and the difficulty in procuring the artificial manures, will prevent their general use —hence the farmer must look in some other direction for a supply of fertilizers. The lack of barn-yard manure, so severely felt everywhere, must be supplied in some way, and we know of no plan so easy of excution, and so likely to succeed, as that of green manuring.

The practice of green manuring for wheat, so common in some sections, has as yet received but little attention in this State. Great merits are claimed for this method, by agricultural writers, wherever it has been adopted. But the subject is so ably and thoroughly discussed in a paper recently issued by the Secretary of this Board, that I allude to it only to present a few items from writers who have published essays on the subject. Mr. John F. Wolfinger of Milton, Pa., ante-dates this practice to ancient Greece and Rome, in a treatise on the subject, published in 1864. He says: "The inhabitants of Flanders (now Belgium) in Europe, were the first among modern nations to sow and grow suitable plant and grass crops to be plowed down for manurial purposes, to wit, such as red clover, spurry, sanfoin, &c. They were driven to the use of this kind of manure through 'necessity the mother of invention;' for their soil generally consisted of white, loose, and porous sand, ill adapted to the growth of wheat—their soil was naturally very much like the sandy district upon our sea coast in

New Jersey and Maryland. But they gradually converted this barren soil into a most fertile loam; they at first cultivated those districts to a depth of three or four inches, but by degrees plowed deeper as their soil became enriched by the application of manures until they at last secured for themselves a very deep and loamy soil upon those ancient sandy barrens. In 1819 their average crops per acre were said to be 32 bushels of wheat. Radcliffe in writing about them says: '*Without clover no man in Flanders would pretend to call himself a farmer*'—a maxim worthy of adoption by our American farmers."

Commending the use of clover as a manure, Mr. Wolfinger says: "As a plant it has numerous and strong stems branching upwards and sideways from a single seed or root, and broad, succulent, and shady leaves, and long, thick, and strong tap roots. When we consider that it is a very hardy plant, tillers well, covers the ground thickly, displaces weeds, extends its roots more deeply into the soil, than any of the grasses, yields largely to the acre, absorbs much from the air, and also grows well on every variety of dry soil, we need not wonder at its great celebrity as a manurial plant in our northern and middle States. Its stems, leaves, and roots, when ploughed down as a manure, not only renders the soil porous, mellow and permeable to heat, air, and moisture, but also enrich and fit it for the production of all other valuable farm crops, such as wheat, corn, and the like. The wheat and corn grown on clover lays are generally more free from disease and larger in their yield and better in their quality than those grown on or with animal manure." * * * "One square yard of growing clover will, in an ordinary season, from the first of April to the first of September, yield from two to three pounds weight of tops and roots, and if we multiply this by 4,840, the number of square yards in an acre of ground, and divide the product by 2,000, a ton's weight, we shall find that the clover tops and roots grown on an acre of ground between these two periods of April and September will weigh from five to seven and a fourth tons of rich vegetable matter, all ready, too, without any hauling, to be ploughed down as a manure, just where it stands. A well-set clover lay imparts to the soil as much strength as ten or twelve loads of barn-yard manure to the acre will. Hence our wisest farmers never sow wheat, rye or oats without accompanying it with clover seed to form manure for their after crops."

He enumerates the advantages of green manuring as follows:

"It restores to the soil all of those mineral and saline elements that its growing plants had absorbed or drawn from the soil, to wit: alumina, lime, magnesia, potash, soda, sulphur, oxide of iron, &c., for growing plants absorb or suck up from the soil, through the spongioles or numerous little mouths of their roots, these and other substances that are essential or useful to their growth, and retain them in their stems and leaves."

"It also restores to the soil all other fertilizing substances that its growing plants had absorbed or derived from the atmosphere. We thus in plowing down *the whole* of a green manurial crop, not only restore to the soil all that its growing crop had received from the soil, but at the same time, also, what it had received from the air; and so we must of necessity, make the soil better or richer than it was before, since we really add to it more fertilizing matter than the plowed-down vegetation had taken from it."

"Green manure ferments and decays very rapidly,* (especially if its mass be heavy and dense,) in consequence of its soft and and sappy nature, and this produces an immediately beneficial effect upon the very first crop of grain, grass, and the like grown upon it or its decaying roots, stems and leaves."

"It makes the stems of wheat, rye, oats and other cereal plants, grow up stronger and stiffer, and bear larger and heavier kernels or grains, than animal manures alone."

"It makes the soil loose and mellow, because the vegetable matter so plowed down becomes, through the future action of the plow, harrow, and cultivator, so intermixed with the hard particles of earth as to render them softer, and gradually to crumble down into a dark-colored and porous loamy soil."

"It makes the soil warmer, because its fertilizing vegetable matter acquires and evolves heat while undergoing the process of fermentation and decay."

Prof. Johnston of England, says: "In no other form can the same crop convey to the soil an equal amount of enriching matter, as in that of green leaves and stems. When the first object, therefore, in the farmer's practice is so to use his crops as to enrich his land, he will soonest effect it by plowing them under in the green state."

A writer in the Rural New Yorker thus relates the practice of

* Sometimes, when a very heavy and juicy crop is turned under in hot weather, injurious effects have been observed; perhaps due to the fermentation being too rapid or going too far.—(S. L. G.)

treating clover as a manurial crop in Michigan. He says: "A wheat crop is taken off once in three years, and during the rest of the time the land is occupied with clover. The first year after seeding, this is allowed to grow and go down entirely on the land; it is neither mown nor pastured. The second year the field is summer fallowed, all the previous dead growth and a fresh growth up to the blossoming stage being plowed under. They raise fine wheat in that way."

The evident advantages of plowing under clover as a manure for the wheat crop are such as to recommend to every farmer a fair trial of its merits. There is neither complication nor great expense in the method. It requires nothing but what every farmer has at hand, to test fully the value of green manuring, as a renovator of old and exhausted fields, and their capacity to produce a good yield of wheat. What has been done successfully, whenever and wherever tried, can be done in Maine as well.

Mr. Moore also offered the following for action by the Board:

Ordered, That the several Agricultural Societies be required to offer the same premiums for wheat culture, as last year.

A discussion followed which was participated in by many members, but of which only a very imperfect report was retained. It appeared that in some counties the crop of wheat during the past year was very good, and greatly larger than it would have been had the premiums not been offered; in other counties the crop was not good, and scarcely any greater breadth was sown in consequence of the offer of the premiums; and the conviction was general in such portions of the State that it was easier to raise potatoes enough to pay for the flour required, than to grow wheat. The result was the passage of the following vote:

"*Voted,* That the several Agricultural Societies receiving bounty from the State be, and they are hereby directed, to offer in premiums for the encouragement of wheat culture, a sum not less than one-fourth of the amount of bounty so received during the present year (1869), and during the two succeeding years, to wit., in 1870 and 1871.

"Provided, however, that if the Legislature by statute enactment, provides for a bounty on wheat culture during either of the years herein indicated, then for such year or years the before mentioned requirement upon Agricultural Societies shall be null and void."

The following report made to the Board, at its session a year previous, and omitted accidentally from the report of its doings for last year, is here given.

The Committee appointed to consider so much of the Governor's Address as relates to the culture of wheat; also to sum up and report upon the deliberations of the Board on the same subject, report as follows :

That the Chief Magistrate makes this subject a specialty in his annual address, is indicative of its paramount importance to the people of the State. He does the State a lasting service, when he so earnestly and conclusively points out, as he does, the excessive draft on our resources, consequent upon the neglect of so important a branch of agriculture, and clearly indicates the remedy to be applied, and earestly enjoins the application of that remedy—an increase in the area, as well as a better cultivation. It is apparent from the prominence given to it in his address that Governor Chamberlain considers the culture of wheat paramount to all else pertaining to agriculture in Maine.

The discussions of the Board of Agriculture and the interest manifested by its members, also attest to the importance of the subject, not to farmers alone, but to all the people, as well. From what has been said here we find that the time was when wheat was a sure crop in Maine; that for a long time after the first settlement of the State, a sufficient quantity of wheat was grown to furnish bread for its people ; that after a lapse of years the midge made its appearance, and made such havoc on the crop that it was abandoned in nearly all parts of the State—so that the farmers of Maine, from sellers of wheat became purchasers of flour. It further appears that in the few years past the wheat crops have received but little injury from the midge, and where wheat has been cultivated, fair crops have been raised. May we not, then, safely encourage a revival of the wheat growing interest in our borders ; and if it be true, as stated here, "that all other crops grown in our State, whether sold or consumed, would not pay for the flour brought into the State," is it not high time that we waked up to the situation, and that we should put forth every effort to cut off, if possible, this enormous drain upon our hard-earned money.

It is not the purpose of your Committee to discuss the origin or operation of the wheat midge, nor the habits or analysis of the wheat plant, nor particular methods of culture, nor the properties and application of manures; but simply to advert to some few statistical and certified facts, tending to show the feasibility as well as the advantages of growing wheat in Maine. The evils of the enormous draft on our resources for the purchase of flour, need not be adverted to. These are seen and *felt* on every hand—however we may distrust the practical operation of the remedies suggested to cure these evils. Their magnitude are thus alluded to in the Governor's Address: "With our population, now probably upwards of 650,000, we need at least as many barrels of flour yearly, which at $15, the average price for the last year, amounts to $9,750,000. This is nearly all imported, and probably no one article of export equals this in value," and then suggests this remedy: "With our 70,000 farmers an average of four acres would easily produce, at fifteen bushels to the acre, upwards of 4,000,000 bushels of wheat a year, and this experiment is worthy of being tried," and, continues the address, "few subjects are of more importance to our farmers, however they may be prejudiced or discouraged by working blindly and by main force, rather than understandingly and skillfully. There is tactics in peace as well as war." "The only question is, can wheat be profitably raised in Maine?" or in other words, compared with other grass-seeding crops; will it pay to raise wheat in Maine, at the average yield and cash value of each? To test this let us appeal to the figures—believing the cost of cultivation nearly the same for all. The Report of the Commissioner of Agriculture for 1866 and 1867 furnishes us with these, as follows:

1866.

Wheat,	average	per acre,	12.7	bushels.	$2.86	per bushel.	Cash	value	$36.32	per acre.
Rye,	"	"	17	"	1.39	"	"	"	24.23	"
Barley,	"	"	24	"	1.02	"	"	"	24.48	"
Oats,	"	"	27.7	"	.69	"	"	"	19.11	"
Buckwheat,		"	31.	"	.89½	"	"	"	27.75	"

1867.

Wheat,	average	per acre,	10.6	bushels.	$2.79	per bushel.	Cash	value	$29·57	per acre.
Rye,	"	"	14.8	"	1.61	"	"	"	23.83	"
Barley,	"	"	18.3	"	1.13	"	"	"	23.79	"
Oats,	"	"	22.	"	.80	"	"	"	17.60	"
Buckwheat,		"	21.9	"	.99	"	"	"	21.68	"

It is seen that the cash value per acre of the wheat product for these years, is largely in excess of either of the other crops. It appears from the same authority that the average yield of wheat per acre in Maine exceeds the grand average of the States reported. The cash value per acre also exceeds that of the others. It is conceded, however, that the cost of cultivation per acre in Maine exceeds that of the others. But the question is not whether wheat can be raised in Maine with profit compared with the great wheat growing States; but whether, compared with other grain crops, it can "be profitably raised in Maine." Let these figures answer.

What is required is more acres. Only 16,000 acres are devoted to this crop in Maine. Governor Chamberlain's experiment involves many multiples of these figures. Can they be reached? "The experiment is worthy of being tried." Will our "70,000 farmers" make the trial? Will they test the capabilities of the State to produce its own bread? This is the question now to be answered. Let it be answered wisely.

If with our present careless and exhaustive methods of culture we now produce twelve bushels to the acre, may we not double or treble the number of bushels, by adopting a more thorough and scientific system—by applying a little more brain-work to our operations, instead of relying on "main force" and muscle alone. Brain-work, time and experience, will teach us a more excellent way—that as a prerequisite to good crops, we must not only supply the fertilizers freely, but adopt a judicious rotation of crops, clean culture, thoroughly pulverize the soil and seed liberally; in short, follow the precept of the Governor's Address: "The intelligent farmer knows that he must sow on dry ground or underdrain, so as to get the seed in early and avoid the midge; that he must pulverize clayey soils so that they will absorb and hold the nitrogen or ammonia upon which the cereals depend; and that the wheat should be followed by crops like clover, turnips or peas, which do not dissipate ammonia, and those crops be kept upon the farm and returned to the soil as dressing.

In the light of the experience of the past three or four years, and the hopeful prospects for the future, your Committee unite in recommending to the farmers of Maine an increased culture of wheat. Let them devote at least a portion of their cultivated acres to this important crop.

ALBERT MOORE,
PETER W. AYER, } *Committee.*
J. V. PUTNAM,

Mr. Norton presented the following paper on

THE CULTURE OF FRUIT.

Fruit culture should be a leading interest in Maine. With land so well adapted to the production of the apple and other fruits, there is no good reason why we should not only produce freely for home consumption, but for export also. It is true that there has been a partial failure for a few years past. But it is equally true that there is no crop grown which has not at times been a failure. We have not given up raising potatoes because they have rotted, or the growing of the different grains because they have suffered from blight, rust, or insects.

Our crops of all kinds are more or less liable to failure; and though apples, plums, and cherries have not been so productive as formerly, we ought not to give up trying to raise them on that account. But it is useless to attempt to raise an orchard unless we give the trees that care and attention which is necessary to produce a crop, though, perhaps, on newly cleared lands we may be able to raise orchards as well as formerly, if the trees are protected from cattle and insects. There has been so much said and written upon the different varieties of apples and manner of setting trees that it seems unnecessary for me to add anything in that direction. But I wish to say a few words with regard to shelter and protection of fruit trees. I have observed that sugar maples of second growth (which we know grow on the best of soil for orcharding), are thriftiest in a position sheltered either by forest growth, or on a southerly or easterly slope, being protected from the north winds. We may learn a lesson from nature in this, and I will add a word regarding my own experience. In the spring of 1856 I purchased a hundred New York apple trees, which were set out carefully. They all lived and grew finely the first summer, but in the winters of 1856 and 1857 most of them were winter killed, because, as I believe, set in an exposed situation, with no shelter.

My neighbor, Joseph S. Kempton, Esq., procured a hundred of the same kind of trees, the same season; he set them on land sloping to the east, a little higher from the river than mine, and in a sheltered position. Very few of his trees were winter killed, and I have frequently heard his orchard spoken of as being worth one thousand dollars. I could mention a number of other similar instances.

I am confident that more attention should be given to shelter for orcharding; but I believe the main cause of failure of apple orchards is, the lack of proper food given to the tree. Old orchards, in most instances have been permitted to grow for years without being manured or mulched, until there is not ability in the soil to enable the trees to make much growth, and less to produce fruit, and as the object in planting fruit trees is, of course, the production of fruit, that treatment only is proper which maintains the trees in a healthy fruit bearing condition. In order to maintain this condition, it is necessary that the soil should be favorable to the growth of the tree. It is also well known that the greatest growth is not always immediately connected with the greatest productiveness; on the contrary, it is a fact that a tree does not display great vigor of growth and *at the same time* bear a large crop of fruit. Here then is a hint for our guidance in determining the question as to whether an orchard should be cultivated and manured or laid down to grass. When trees are young it is well to push their growth until they reach a proper fruit bearing size, then if they give no indication of fruiting it would be well to lay down to grass. Stable manure will be found to give satisfactory results if it be composted with muck and leached ashes, wet with soap suds. As to when orchards should be manured, we should judge by their growth. If the soil is so rich that they make annual shoots of two feet or more, it will be needless to give additional stimulus. There are few orchards which after reaching a good bearing state throw out annual shoots more than one foot long. The owner may lay it down as a rule that when his trees do not grow one foot each year they need more manure. By observing the growth he can resolve all doubts of this kind without difficulty. Another cause of the failure of fruit crops is the ravages of insects. The borer is more destructive to the apple tree than any other insect, and if it is not checked destroys the tree. It is not my purpose to give a minute description of the borer or its habits, for that has been better done by others than I can do. But I wish to suggest some preventive that may in part obviate the destruction of so many of our trees. I have put white birch bark around trees to prevent them from being destroyed by the mice. I have found this to be a very sure protection of the tree against the borer.

I have found washing with soap suds the last of May or the first of June to kill the eggs of the beetle. We should not be troubled with either the borer or bark louse, if we washed the trees thoroughly with soap suds at the proper time. It makes the bark smooth and glossy, and drives away various insects which before preyed upon the juices of the tree. The tent caterpillar is another insect that has been at times very troublesome to our trees, but for two or three years past they have not been so plenty as they were formerly. I have observed that when the Blue Jays visited the corn crib in the winter, there were but very few caterpillars the next season. I have frequently seen them picking the eggs from the twigs in the winter. The common apple worm is very destructive to our apple crop. I believe the hog the best remedy for this that can be had. If put in an orchard, he eats up all the wormy fruit that falls. Domestic fowls, turkeys, hens and chickens will also do good service in the orchard, for they are always on the alert for insects. Those who contemplate setting out young orchards should select a good soil and a sheltered situation; and should remember also, that there is little land in Maine that will not be benefitted by a liberal application of manure. If this be neglected at the outset no subsequent culture will atone for its lack.

Few pears are raised in Franklin county. They require a strong, moist and rich soil. Shelter is also of great service to the pear. Its leaves are tender when partly grown, and easily bruised by high winds. We should select the hardiest varieties to raise in this State. The Goodale, is very highly recommended, of large size, excellent quality, and a good bearer, trees hardy. The Nickerson is spoken very highly of as being a good bearer, and of excellent quality.

The cranberry is one of the most profitable of all the small fruits, and any one who has a location suitable for its culture, possesses a very valuable piece of property. The best location I believe to be where the soil is peat, two or three feet in depth, and where the surroundings are such that during the summer months the water can be drained off one foot below the surface, and at the same time such, that water can be let on in a few hours, in a sufficient quantity at any season of the year, to cover the surface from four to six inches in depth; and also in the vicinity of good sand. In preparing the soil, the surface should be removed down to the peat; it should then be covered with at least three inches of sand. In selecting plants, care should be taken to use such as are known to produce good crops. The month of May is the best time to transplant the vines. The water at the time of setting of the plants should be nearly even with the surface and remain so for a few days, and then be drawn off gradually. I have known the berry sown, and vines raised from the seed, but I would not advise this method, if vines can be procured. The first season care should be taken to keep out all grass and weeds; if possible, they should in the winter be kept covered with water, nor should they be left entirely out of water until all danger of frost in the spring is over. When the worms make their appearance, flowing the land for a short time is sufficient to destroy them. In the month of September, if it should be cold, the water should be let on, and the fruit thus protected. It is very essential that they be not shaded.

Grapes have suffered much the past two years from the extreme wetness of the seasons. Very few, except in the most favorable situations have ripened. These years however, may be an exception, and may not be repeated for many years to come. The safer course will be to cultivate early varieties only, and such as are comparatively free from mildew.

Strawberry culture requires care and attention to make it a success. Unless the soil is kept in rich condition, and all weeds and grass carefully destroyed, and the runners cut, we can expect but little fruit, and that of a poor quality. But with proper care nothing yields better then the strawberry. The fruit is delicious and refreshing, and particularly so, coming, as it does in the early part of the season. Set in August—they will yield a partial crop the next year, and this at less labor than to keep up an old bed.

The raspberry can be raised with the least outlay and care of any of the small fruits—especially in a section like ours, where the snows are usually deep enough, and continuous enough to protect them fully. It likes a rather dry, sandy soil, and does not require very high manuring. The American Red and Black, are very good varieties for garden culture. The habits of this plant are peculiar. In the fall, the shoots will extend themselves to great length, bending over in a curve towards the ground as if aiming to reach it, which they are very sure to do; they then send out roots, and fasten themselves to the soil, and furnish good plants to set out the next spring. The raspberry bears on new growth, that is on last year's canes. The best way to treat them, is, soon after the crop is off to cut away at the ground all the bearing stems, and all feeble young ones, leaving three or four of the best new canes. Then manure and work it in. I have not found it necessary to lay them down in winter. In the country, where the wild fruit grows in abundance, and where there is little market for them, it will not pay to bestow much labor; but where they are not to be had wild and plentifully, we may well give them a place in our gardens, and we shall find that no luxury is more cheaply obtained. I would say to every person, who cultivates a garden, raise small fruits abundantly for family use; they come in the hot season of the year, promote health, are agreeable to the palate, and every way worth the cost of cultivation, and a great deal more.

Mr. Stackpole presented the following report on

Poultry.

The term poultry attaches to all kinds of domestic fowls. The keeping and rearing of poultry has become quite an important branch of rural economy. Until within a few years the subject has attracted but little attention. It may at first be received as too insignificant to merit serious consideration from the farmer. This is natural; little things are frequently treated with contempt, although, in the aggregate, they assume magnitude. Because a fair stock of hens, turkeys, geese and ducks, can be bought for a few dollars, they are regarded by many farmers as beneath their attention, as a money making matter. Yet, although the breeding stock of poultry on a farm may be estimated at a few dollars only, a fair valuation of all the poultry in the country gives them a commercial importance ranging with some of our best productions. And although many persons think the profits from this kind of stock is doubtful, yet I think no farmer can consider his establishment complete without a supply, for when rightly managed, they are a source of considerable profit. It is true that poultry, to be a source of profit, must receive attention, as well as other stock; the eggs must be gathered daily, coops must be provided for chickens as they are hatched, and they must be fed. It has been shown by our Agricultural Reports, and by personal experience, that the stock of poultry on the farm may be made, and by many farmers is made, a source of profit exceeding that of any other investment on the farm, in proportion to the expenses, and that it contributes its full share of profits and comfort to the farmer. The use of poultry and eggs have become a necessity, and how to obtain them in the cheapest manner is now receiving more attention than it did formerly; the number of breeds has been largely increased, and all the poultry of the country has been improved, and its use for food has become much more common among all classes of society than formerly.

From reliable data, it seems probable that the annual production and consumption of poultry and eggs in the United States, exceeds $20,000,000 in value. I have no doubt that it would be for the interest of every farmer to keep fowls of some kind on the farm, as there is always in warm weather some waste or spare matter about the premises to feed them, and at the same time they are of much service to their owner by destroying numerous insect depredators. The hen and her brood of chickens, the hen being confined in a coop, placed in the vicinity of the kitchen garden, not only keep the insects from destroying the plants, but they destroy the insects themselves, and convert them into a source of profit instead of loss, by devouring them as food. Poultry of all kinds usually do much better when allowed to run at large, than when shut up in narrow limits, in coop or yard. Their health is improved, their flesh is finer and better flavored, and they produce more eggs when at large than when confined. To have poultry healthy, vigorous and profitable, they should not be kept until very old. There is no objection to preserving a favorite cock, so long as he is active and lively, but hens after three years will not produce so many eggs as when one or two years of age. Much, however, depends on the breed kept, but more on the manner of keeping them. Old hens are better to breed from than young pullets. Fowls that are nearly related, should not be bred together. Most of our poultry is bred in this way: A person procures a setting of eggs, and hatches them, a brother and sister or sisters are selected and kept for stock-raising purposes, they breed; an accident happens to one of the parents, and the other breeds the next season from its own offspring. A. obtains a setting of eggs from these, and the product goes through a similar course of in-and-in breeding for many years, and then the breeder comes to the conclusion that the birds are delicate and difficult to raise, and consequently they are discarded. It is wonderful, however, that any so bred are left to breed from.

Birds of the largest size and the best forms, those that mature early, should always be selected and kept for breeding purposes. There is great difference in the shape and hardiness of fowls, as is known by every one who has paid any attention to the subject; some are hardy and profitable, others are weakly, and scarcely pay their way under the most favorable circumstances, the kindest treatment, and the best management possible. A lady giving her experience in keeping poultry, says:

"For persons living in the country, and having no constant social occupation, it is possible for a little fowl fancier-ing to become very interesting. It is really amusing to watch their endless manœuvres, and study their various characters. Now, a 'green' person surveying a regiment of dame partletts and consequential gallants, would perceive no difference, save in shape and tints. As well go into a gathering and conclude all these were mentally alike, simply because formed after the universal model. I do not believe there are many leading instincts in the human mind, which do not find their counterparts in these bipeds. In our own collection, we have fowls of every shade of character—the weak minded hen, the well balanced biddy, and the regular virago. Hens there are who one positively respects for all those qualities which demand the same sentiment in humanity. Others we equally despise as 'shiftless' hens, hens who have not the moral courage to set the allotted three weeks, and if otherwise, to bring up a family with any success."

For general use a hen should be a good layer, sitter, and mother; she should be a good feeder too; beside she should be of good size, and selecting, choose those with breasts plump and full forward, and legs not too long. Having selected the best pullets to start with, give them the warmest place possible for their habitation, a plenty of light, and a low place to roost. They should, like all other farm stock, receive the kindest treatment, so that when one goes to feed and care for them, they will know that it is a friend, and not an enemy ready to harm them. Give them plenty to eat, and clear water to drink; they should be fed frequently, or what is better, should have access to food at all times. Their main food should be sound grain, but they should not be confined to one kind of grain, but should have a variety, such as wheat, corn and buckwheat, also cooked or raw vegetables. They should be furnished with some kind of animal food, in winter,—meat in some form; milk or milk curds make a very good substitute. It is necessary that they should have access to dirt or gravel, and a box of ashes to roll in, so that they may be enabled to destroy the insects on them. They need lime in some form, old plastering and egg shells will answer, without which they cannot make the egg shell. In short, giving them milk or meat for animal food, with some soft vegetables, lime to make shells of, plenty of water to drink and supply the liquid portion of the egg, as much mixed grain as they like to eat, and gravel to grind the grain, clean, warm quarters, and nests in some out of the way place, where they can lay their eggs without being seen or disturbed, good lodging places, with air, light and sunshine to keep them healthy, then you will have done your duty to them, and they will richly pay you for all your care and attention to them; although you may not realize to the extent of the old ballad about a speckled hen, that

> "Used to lay two eggs a day,
> And Sundays she laid three."

Careful breeding greatly increases the size of the turkey. Experience teaches conclusively that turkeys from two to three years of age are much better for breeding purposes than young birds. To breed good turkeys, the best females from two to three years of age should be selected, then procure a male about the same age, and not related to the females. Breed from these three or four years, and then procure another male not related to the hens with which he is to breed. This course should be repeated every three or four years. The size of the young chicks depends as much upon the hens as upon the cocks. By following these simple rules, with proper feeding when young, the breeder will have the satisfaction of increasing the hardiness and strength of the young chicks and the size of his mature birds. Turkeys have been very much increased in size, and improved by the infusion of wild blood from Canada and the West. When we take into consideration that this splendid bird becomes once in the year almost a religious necessity to every one of the people of New England, it is something to have it increased in size fully 25 per cent. These birds are very shy about their domestic arrangements. Their nests are usually secreted in the most out-of-the-way places, and apart from other fowls. They should be indulged in this; nesting places should be prepared for them in some quiet corners of the out-buildings, where they will not be disturbed. The hen turkey sits very steadily, and hatches in about twenty-eight days. When she comes off her nest with her young, great care is necessary in keeping the chicks from the wet; make a pen about 10 or 12 feet square and 16 or 18 inches high (in some dry grassy place) to confine the young; the mother will not wander far from them; they should not be allowed out of the yard until after the dew is off, nor during rainy weather, until four or five weeks old. Then they may be allowed to shift for themselves. The food of all young animals is of an animal nature. In the earlier period of the existence of young birds, it consists of the yolk of the egg. On this they live before and some time after they leave the shell. They are never hungry when first hatched, and may go two or three days unfed, without harm to them. Feed the young poults with hard boiled eggs, chopped fine, or a little milk-curd, four or five times a day for the first week or two, afterwards stale bread crumbed fine, will answer until they are strong enough to follow the old bird. They soon learn to range for food, and no bird is more active in the pursuit of grasshoppers and other insects than the turkey. Comparatively few people have uniform success in raising turkeys. When the old birds are watched, shut up, and made to sit when they can be controlled, and the young receive great care from the first, they seem to do no better, and often not so well as when the old hen steals a nest in the woods, and brings her brood home only when she finds it hard to provide for them. Turkeys as well as other fowl must get their growth, or nearly so, before they will take on flesh and fat readily. All poultry should be fatted before being butchered. We rarely see well fatted poultry in our markets; certainly the reason for this is not because people will not buy it, for many people will buy high priced things, simply because high prices are the only indication of superiority which they appreciate. Upon every farm and about every house with a small piece of land, a certain number of fowls may be kept at a small expense; in warm weather they get most of their living by devouring insects, and picking up food about the buildings that would otherwise be wasted or lost.

At this age of the world, poultry and eggs have become a necessity; and the assertion is warranted, that the production of domestic poultry is not sufficiently appreciated, and that it should receive more attention from the farmer. Some one has well said, "It should be the constant aim of every farmer to make all parts of his domain tributary to his finances; and for this purpose he should levy frequent contributions upon his fields, his pastures, his woodlands, orchard, garden and the farm-yard. 'Monarch of all he surveys,' he should summon all his possessions to aid him in the attainment of that competence that is necessary to his personal independence, happiness and moral improvement."

Mr. Holmes presented the following, on

The Vegetable Garden.

It has been said, that "he who makes two blades of grass to grow where but one grew before, is a public benefactor;" and he who will induce one person to cultivate a vegetable garden, who never did it before, has a just claim to the same honorable title, provided, not a single spear of grass is allowed to grow in it.

Two classes are chiefly interested in this subject. The first are those who make it an exclusive business to cultivate vegetables for market, and the second those who cultivate a small garden to aid in furnishing their own table with its luxuries. As the first class is small, and confined to those who live near large cities, we do not propose to dwell upon this branch of the subject, though we believe great importance attaches to it, and that farmers favorably situated on any line of railroad might share in its profits much more than they do.

The soil in many places in the interior of our State is quite as well adapted to these products as that now employed in suburban towns, and should farmers generally devote more attention to it, they would find a sale by shipping to some one of the extensive markets which the State affords.

This subject recommends itself on another account, and that is the profit of raising any and all these garden vegetables for the growth of stock; thus the more remote cultivators are not compelled to sell at a losing price, neither would consumers be compelled to purchase at exorbitant rates, whenever the supply of any of these products might fall short, where usually grown. A more uniform price would be established, and our markets not be as liable to be found destitute at one time of onions, at another time of turnips, cabbages, or some other vegetable.

With these hints we leave the consideration of the subject as a source of *income*, and turn to the second class of cultivators; and when we look over the broad area of the State, behold the farmer with his pastures covered with kine, and his fields with bending corn and golden grain, the mechanic busy in adding to productive wealth, the teacher laying the foundation of knowledge and imparting the truths of science, the professional man guarding society against the evils of oppression, disease and sin, and in fine, every member of society who strives to be useful, and occupies a cottage with a few square rods of land, we find that all are, or should be, interested and engaged in gardening. Many, however, neglect its proper cultivation, and we seem to hear them inquire, "What are the inducements?" We answer:

1st, To provide luxuries for the table, such as no one can afford to be without.

2d, To have them fresh, without being wilted in the market place, or bruised in transportation, and therefore more wholesome and more delicious.

3d, To have them at such times and in such quantities as desired.

4th, To afford pleasure to those who delight in observing the operations of nature, and desire healthful employment for leisure hours.

5th, Economy.

Upon the first and last of these we desire to make a further suggestion, as some may scorn the thought of classing garden vegetables among the luxuries, yet the same persons will buy a box of strawberries for fifty cents that may be raised in one's own garden for ten ; or half a dollar per pound for grapes that may be obtained for a little care and attention, that would be repaid in the pleasure of seeing them grow. Who then will deny that they are luxuries or fail to see the economy ? No one who has not tried it can properly cultivate a vegetable garden without being astonished at the amount that may be produced on a very small piece of ground. One fourth of an acre, well taken care of, will half support a family of six persons from the middle of June to the middle of October, and furnish something for the winter store besides.

On this surface may be cultivated potatoes, carrots, turnips, beets, cabbages, onions, peas, strawberries, raspberries, currants, lettuce, cucumbers, melons, squashes, and other varieties of vegetables, with a little labor and care every day that would hardly be felt, or regarded as labor by an industrious man.

One secret of gardening as well as of farming in general, is in enriching the soil, and this is the first thing to be considered. While the farmer can always find some choice manure particularly adapted to the fertilization of the garden, the mechanic might complain of a want of all means to enrich his, and assign this as a reason for neglecting to cultivate it. Yet this difficulty may be overcome by a little perseverance. By the use of loam with the night soil, and the drainage from the sink, as recommended by almost every treatise on fertilizers, there need be no lack of manure for a quarter acre garden, though destitute of all other means.

When the garden is once manured let no gardener be afraid of mixing it too thoroughly with the soil, or be satisfied with the ordinary amount of manure used in the field. It matters not how finely the soil is pulverized, and the more useful implements for doing this are the spade and hoe. Wood ashes, leached or not, may be mixed with the soil to great advantage and profit.

The introductory exercises being thus faithfully performed, the garden may now be considered ready for the seed. The packages of garden seeds as usually sold, have labels, giving time of planting and other useful directions. Having arranged the different sections for the several varieties that may be desired in some regular order, in accordance with the taste of the gardener, plant the seeds with care, observing to have all properly covered, nor be too lavish of the seed. Plant enough, and plant it where it should grow, thus avoiding a needless amount of thinning which sometimes proves injurious to the plants that remain, besides which order and regularity may be established in seed time, which will enhance the beauty of the garden throughout the season, and increase the gratification of him who cultivates it.

With the appearance of the first tender shoot above the ground begins the watchful care of the gardener, for coeval with the expansion of the germ in the good seed begins to germinate a thousand seeds which send forth an array of weeds to choke every thing else, if not conquered in the beginning. Let a few moments now be spent daily in loosening the soil, destroying the weeds and guarding the plants from destructive insects, and the whole labor is accomplished.

The process is simple, the labor pleasant, and the reward is abundant, both in the products of the garden and the gratification of beholding its gradual development; a two-fold profit, and all may be achieved by almost every artizan in our numerous villages, and it is the bounden duty of every farmer to accomplish it.

In conclusion we would urge this subject especially to the attention of *every farmer;* at the same time confessing our past neglect, and to have felt its importance since having the matter under consideration at this time more than ever before.

In the discussion following,

Mr. Gilbert said there were three requisites in the successful management of a garden: first, good manuring; second, fine pulverization of the soil; third, keeping mastery of the weeds. He recommended the use of thoroughly decomposed manure applied in the fall. He alluded to the difficulty of procuring seeds true to their name, from the seedsmen; and suggested as a remedy that farmers raise their own seeds. Care must be taken that the varieties do not mix. Cabbages could be raised successfully and at a profit, for from $20 to $25 per ton. A young man in his county who had recently engaged in market gardening, had grown the past year one acre of cabbages, the heads from which weighed from twenty to twenty-five pounds each, after the head had been trimmed. The variety was a new one, imported from Germany. He had raised last year a new variety of onion known as the "Multiplier"—not the potato onion—a variety that multiplies at the root; from the root of one five will grow. They are of large size, and ready for use early in July. It is a valuable market variety, there being no difficulty in keeping it through the winter, as its storing qualities are equal to potatoes. It differs from the potato onion in being larger, and never grow more than five, usually three from one onion, while the potato onion often multiplies to ten or twelve small onions. In regard to cabbages, he thought the Winningstadt the best variety. It is early, does not cook quite so quickly as some other sorts, but when cooked is remarkably sweet and delicate.

Mr. L. Chamberlain said onions could be successfully grown from the seed if the ground was prepared, and the seed sown in the fall. An application of hen manure he believed to be a sure preventive of the onion maggot. Before planting his seed he turns boiling water upon it, and lets the seed soak twenty-four hours.

Mr. Wasson alluded to the importance of good seed, and the introduction of destructive insects by seeds imported from other places. The eggs of insects destructive to the plants in which they are found, are sometimes obtained with seed procured from abroad, and hence the presence of many kinds of new insects among us. The safest way was to turn scalding water upon all seeds, as recommended by the member from Piscataquis. The seed however should not remain long in so hot water.

Mr. Goodale, who last year distributed seed of the Keyes' Early Tomato among the members, inquired in regard to their ripening and yield with those who had tried them. Mr. Putnam thought it about two weeks earlier than the other kinds; Mr. Wilder said it was not earlier than the varieties previously cultivated although they did not rot like other sorts; Mr. Stackpole said they were not earlier than the Round Smooth Red, but yielded better. Mr. Stackpole spoke at some length upon the general subject, giving his experience in the care of a garden; and stated that at the last county fair he exhibited fifty-one varieties of garden vegetables, including nine varieties of squashes. The best way to keep parsnips through the winter he found to be to put them in the cellar and cover with earth. In this way they can be had any time during the winter, and they keep far better than if left in the ground. He found no difficulty in raising onions, if the ground is prepared in the fall, highly manured, and the seed sown very early in spring.

Mr. Hobbs presented a report on the subject assigned him at the last session, to wit:

The Saving and Application of Manures.

Manure, according to Webster, is anything that will fertilize land, or furnish food for crops. The question before us is, how can we, to greatest advantage, save and apply this fertilizing and crop-producing food? "Without manure," as has been well said, "successful farming is impossible."

It has been asserted that every family of five persons creates refuse enough in a year to manure an acre of land. If this be true, it is evident there is a wide field open for us in the saving of manures. One of the most frequent sources of loss is in the waste of liquid manures. If the urine of animals be wasted there is a loss of one-half of what should be always employed. To secure this, absorbents must be used. Bedding of some kind should be freely used for all stock. This serves a double purpose, since it keeps them clean, thus adding to their comfort and health, as well as by absorbing the liquid excretions. Every slaughter-house, privy and cesspool should be so arranged that no liquids escape, nor any offensive odors be evolved to contaminate the atmosphere and endanger health. Plaster and charcoal dust serve a useful purpose in absorbing ammonia. By the free use of muck a large amount of valuable manure can be saved from the privy and sink, by allowing none of the urine, soap suds or other slops to go to waste or gender hurtful effluvia. Economy and health alike demand this to be done. In warm weather especially all such liquids decompose rapidly, and gases noxious to man but vitalizing to the plant pass into the air unless retained by some absorbent.

Another neglected source of manure is the hennery. Fowls are high livers, their excrements are therefore rich, abounding in urate of ammonia, and phosphate of lime, two most valuable substances in manure. The best method of preserving the droppings of domestic fowls is to keep the floor, or ground under their roosts, well littered with muck or earth, as both liquids and solids are voided at once; this litter is essential for its proper retention, and the quantity of manure is greatly *increased* without materially impairing its value. Dead animals, not used as food, should become an ingredient in the compost-heap, decomposed flesh being one of the most powerful of all fertilizers, and next in concentrated fertility is night soil. Let us then save, and return to mother earth, all that we can, so that *she* will return to us of her abundance, without exhaustion.

The application of manure to the soil in order to produce the greatest benefit to the crop and land, should vary according to circumstances. Our soil, climate, and seasons differ so much, that no definite rule can be laid down which can be applied with equal advantage to all locations, and crops. How much of the manure is lost by exposure to the elements, how much by leaching, and how it shall be applied, whether in the fresh green state, or after fermentation has taken place, are questions which are drawing the attention of scientific and practical men. One writer says, "farm-yard manure never possesses more of the elements of plant-food, than in the original unfermented state." There is a fear in the minds of many farmers, that if the manure be spread on the surface of the soil, there will be great loss by evaporation. Dr. Voelcker says, "that the loss by evaporation of ammonia is very small, when the manure is spread on the ground. The loss of ammonia is chiefly when the manure is *piled,* and rapid fermentation is going on, and great loss is by washing of rains." It would seem that if long or coarse is to be applied, it should be covered by soil. The true method will be to follow the example of the painter, who mixed brains with his colors. The farmer must use his brains as to the time and manner of applying his manure.

Mr. Gilbert said that it had been his practice for the past ten years to stable his cattle at night in summer as well as winter, and by having the barn well supplied with dried loam or muck, he thinks but very little is lost. A stock of cattle is, however, not the only source for obtaining a supply of manure. Swine will manufacture a great deal of valuable manure, if farmers will give their pens proper attention, and supply them with materials to be converted into manure. Sheep and hens both furnish a source of making manure that should not be overlooked, but is by far too much neglected among farmers. The privy was also alluded to, as the fertilizer it furnished was powerful and active. The muck bed was a great auxiliary to the manure heap, and as an absorbent he regarded muck as better than loam, because it was lighter to handle than loam. Some farmers in his county are hauling muck two miles, and consider themselves well paid for doing so, others do not do so well. In fact wastefulness is the rule, rather than the exception in the matter, and our lean pastures and barren fields attest the too general wastefulness of farmers. If the farmer *saves* every particle of manure made, he will have small need of commercial fertilizers. A barn cellar was of the greatest importance in saving manure, and those about to build a barn or to improve those they now have, should make provisions for a cellar.

Mr. Thing said the hog-pen could be made a more profitable source of manure than any other agency upon the farm, provided the contents of the horse stable and privy, together with house and sink slops, with a sufficient quantity of dried muck, were all worked over together. As a dressing for corn, such manure had always been satisfactory. The secret of making manure was to keep constantly at it, doing a little every day, putting in a wheel-barrow load of loam or muck as opportunity occurred, and not waiting to do a great deal at a time.

Mr. Scamman asked "What can be done to save manures by those who have not cellars to their barns?" The bedding of horses is an almost universal practice, and where straw cannot be obtained, saw dust and other materials are used. In some cases muck is used. But little is said or done about bedding neat stock; he believed there was scarcely one farmer in fifty, throughout our State, who uses sufficient bedding for his neat stock. Bedding was an act of mercy and justice to the animals, and farmers were guilty in compelling them to lie down in their own excrements. Again, a loss occurs in the manure pit. Neat stock should be bedded as much as horses, and the refuse forage, straw, orts, &c., now so often wasted, should be used for this purpose. By this method the cattle are made comfortable, and a large amount of liquid manure is absorbed and saved. He alluded to his method of managing and tending his stock of neat cattle, (twenty-nine head), and by bedding them with damaged salt hay and other waste forage, he is able to save a great amount of manure. He strongly recommended the bedding of neat stock to every farmer.

In reply to an inquiry as to the comparative value of the liquid and the solid excreta of animals,

Mr. Goodale said their comparative value varied according to food supplied.

If cattle were fed upon clover hay or upon cotton seed meal, the liquids voided were worth more than the solid portions; in fact with these two articles of food, a good deal more. When herds-grass is fed, the reverse is true, the solid being the more valuable portion. The too common waste of cattle urine is one great reason why clover is not properly valued. Used to advantage, both as food for animals and food for plants, clover might be made one of the most effectual agencies for enriching the soils of Maine.

Neither should the liquid manures be allowed to run to waste, nor the solid suffer loss by washing rains, nor wasteful treatment in any respect. To save their whole value he believed that for many farmers the free use of muck was the cheapest and best resource. The value of what passes under this name is extremely variable. Some, which has its origin in decomposed mosses and other low grades of vegetation, and from the leaves of evergreen trees, possesses little value except as an absorbent. But there is some of what goes under the same name of muck, which are chiefly decomposed vegetable matter from decayed leaves of deciduous trees. This is not of uniform quality, but it is uniformly of much more worth than the others. In some cases he had seen it produce results almost equal to farm-yard manure, even without any previous treatment.

Sawdust has been mentioned here and various opinions expressed as to its worth or its worthlessness; one member relating decidedly injurious effects from its free use. He supposed the fact to be, that the resinous constituent of fresh pine, spruce and hemlock sawdust, as usually obtained at the mills, was injurious rather than beneficial, and unless this was more than counterbalanced by absorption of liquid manures, little good came of its use. Hardwood sawdust is not liable to this drawback, and whichever is used as an absorbent, it should be *as dry as possible*, wet sawdust being almost useless for this purpose. There is much sawdust used in the vicinity where I reside, which is obtained from the beach near the mouth of the Saco river. It has been washed in the river and soaked in the sea for an unknown length of time, until finally driven ashore. It appears to be wholly destitute of the resinous principle of fresh pine or spruce, and is so highly valued by many farmers as to be carted away to distances of ten miles and upwards, as seaweed is. I have never used it myself; but the results of employing the ordinary sawdust from the mills have been such that I greatly prefer loam. Farmers may all use this, whether they can readily obtain muck or sawdust or not. The power possessed by ordinary loam to retain ammonia, and also various fertilizing gases and salts, is really surprising to those who have not fairly tested it.

Night soil may be made to contribute very largely to the fertilizing resources of the farm, instead of being a waste and a nuisance as it so frequently is ; and for this purpose nothing equals *dry* loam. In summer it should be added daily, or at least twice a week. For winter use a store should be laid in, thoroughly dried, and application made weekly. No one who gives this one faithful trial, and applies the compost to his grass land, will abandon the practice afterwards. We have, in this matter, an important lesson to learn from the Chinese. While all their practice is not to be imitated, we may well emulate their economy of this neglected but most valuable manure.

The manure question is paramount to all others in New England agriculture. Not only should there be effort to save all, and to apply all to best advantage, but there should be *a constant endeavor towards gain*. If a little be gained each year, *and the gain held*, to add to future gains, the increase will go on with greater speed. The simple power of accumulation is wonderful. Put a sum of money at interest, and let the interest be also put at interest yearly, and although for a brief term, the results seem moderate, yet after a while they pile up into enormous sums.

When once the farmer begins in earnest to save all the manure within his control, applies it to advantage, *and* uses his crops in a way that shall return to the soil what they have taken from it, he is on the high road to success ; for the agencies of nature are constantly at work for him, every year liberating from the soil locked up elements of fertility. His gains *may be* much more rapid than of money at legal rates of interest compounded every year, and besides this, there is no danger whatever that his bank of deposit will fail. Let the farmer profit by the lessons taught in the success of the capitalist regarding the *power of accumulation.*

And when he buys commercial manures, let him do it with a view, not merely to larger crops for the year, but in view of the fact that these larger crops, *if rightly used,* will enable him to put on much more manure the following year, *without buying it,* being furnished him by the crops grown by virtue of his purchase.

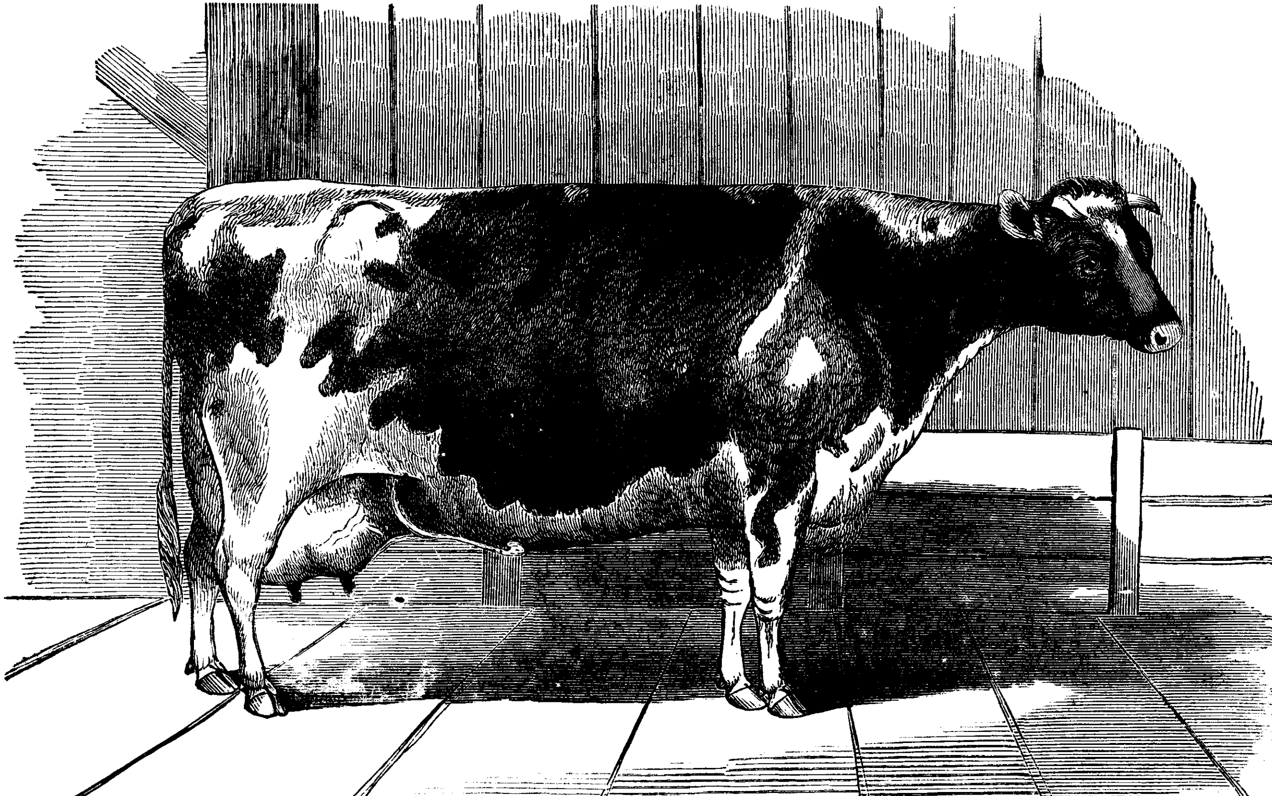
Mr. Gilbert presented the following paper on

Dairy Farming—its Relation to General Farm Improvements.

The keeping of cows for dairy purposes has been too much neglected by the farmers of Maine, and the subject of dairy farming in its advantages to the successful improvement of our exhausted fields and neglected pastures, as well as its relation to the renovation of the farmer's treasury, has been almost entirely neglected by those wide awake, progressive farmers, who are laboring for the advancement of agriculture in our State, and the consequent improvement of the yeomanry in all that contributes to their happiness, success, and welfare. It is true that the Secretary of the Board called the attention of the farmers of the State to this important subject, by very able and valuable papers in his Reports for 1862 and 1863, but since that, as well as before, it has received but little attention or encouragement, in the public prints or otherwise, by our leading agriculturists. Other branches of farming have been dwelt upon, and held up to the farmer in all their attractive lights, but the dairy has remained in the shadow of what must be supposed to be more attractive pictures.

I propose to consider in this paper the relation of the dairy to successful agriculture, both in its connection with the improvement in the productiveness of the soil and the consequent increase in the value and attractiveness of the farm, and in its relation to an increase of the farmer's wealth when measured by the standard of dollars and cents. The production of a choice article of butter, notwithstanding that the truly "gilt-edged" article is very attractive to the eye, and still more inviting to the palate, and the detail of manufacturing a first-class article of cheese, will form no part of this treatise.

It is a fact often adverted to, and one which many of the members of this Board have referred to during this session, that



DUTCH COW "TEXELAAR," Dam of "Van Tromp." Imported and owned by Winthrop W. Chenery, Belmont, Mass.

the greater part of the farmers are not improving their farms—that they are not laying up wealth and coining independence, happiness, and prosperity, by deposits in that safest of all banks, their own soils. There are individual exceptions to this sweeping assertion, and all honor to them, for they are setting a worthy example, and are exerting an influence as wide-spread as their reputation. There are still others,—and their number is far too great—who are prospering when measured by the standard of dollars and cents, but it is done at the expense of their farms. They raise hay in large quantities, which is sold from the farm and finds its way through the channels of trade to Boston and other distant markets; they raise large quantities of potatoes, which, through the same channels, reach the same markets, for which they realize seemingly remunerative prices; oats are grown in large quantities, with little attention to manuring, for the lumberman to take back into the unsettled forests. All of these products are a sure and fatal draught on the willing soil, which sooner or later will inevitably manifest itself in unproductive fields, empty barns, and unhappiness and discontent in the owner, unless an equivalent is brought back for consumption on the farm, or manure is realized from some other source. This is not done, nor can it ever be, to any considerable extent. It may be laid down in emphatic words, that *the true course of farming is to consume what we raise, or its equivalent, on our farms, and realize our money chiefly from the income derived from the stock which consumes the farm products,* taking care at the same time that we return to the soil all the elements which have been drawn from it by the growing plant. In this way alone can we increase, or even keep up the fertility of our soils.

Dairy Farming offers the most liberal income, when the system above recommended is followed, of any special farming pursued in this State. Especially does it recommend itself to farmers situated at a considerable distance from populous towns or from railroad communication. The cost of transportation is no inconsiderable item in the consideration of the question of what shall we raise on our farms. I will illustrate this point by a little mathematical calculation. A team of two horses will draw one ton, or 2000 pounds to market. If loaded with potatoes their value at the present market price would be $23.33; if with oats the value would be $52.80; if with cheese, $400.00; with butter, $800.00. Assuming the expense of the team and driver,—which would of course depend on the distance travelled—to be ten dollars, and the cost of transporting a load of potatoes would be, discarding small fractions, 42 per cent. of their value; of oats 20 per cent.; of cheese $2\frac{1}{2}$ per cent; of butter $1\frac{1}{4}$ per cent. If the expense of the team was only five dollars, then the figures would stand .21, .10, $.01\frac{1}{4}$, $.00\frac{5}{8}$. These are figures which the farmers of large sections of the State, favored with the richest pasturage within its borders, will do well to carefully consider. Of the comparative income from the forage grown on our farms, when fed to the dairy cow, or fed to other kinds of stock, I can speak from my own experience, and from the experience of others with whom I am conversant; and do not hesitate to say that it will be largely in favor of the dairy. This branch of farming, conducted with reference to the production of butter and cheese, has received more attention probably in the county which I represent, and in a small section of an adjoining county, than in any other section of similar extent in the State. From accurate accounts kept by myself, and from figures in my possession kept by others, the income from a cow may be put down in round numbers to be from fifty to eighty dollars per annum, according to the season and the market. These figures will be reached where the cows have been kept in the manner that cows are usually kept by the common farmer. Individual instances might be cited of course, where the income far exceeded this, but these are the average figures of an ordinary herd. Though they are much smaller than the amount usually realized by the dairyman of New York, and in western part of Massachusetts, still they are a larger amount than would ordinarily be realized from the feed, if consumed by other kinds of farm stock. It is the invariable testimony of those who are engaged in it, that it is the most profitable branch of stock husbandry pursued in the State, *when the cash receipts alone* are taken into consideration. Then if in addition to this, we couple the fact that we are returning to the soil the elements of fertility which have been drawn from it in growing the crops fed out, instead of sending them away in the form of oats, hay, and potatoes, we shall make it doubly sure that the premises assumed are correct. In Herkimer and Orange counties, New York, where dairy farming receives so much attention, land is much more valuable than here; and shall we say that they can manufacture cheese and transport it to the State of Maine, here to sell it for a less price than we can afford to make it for ourselves? Mr. Goodale says in his Report of 1862, that "it is a very important branch of stock husbandry, and well deserving greater attention at the hands of the farmers of Maine than it has yet received." He further says in 1863. that "the extensive introduction into this State of a branch of industry so profitable as this is at the present time, and promises to be in the future, appears to me to be a matter of so great importance, that it is deemed a duty to submit some further remarks on the subject at the present time." "There can be no doubt that it is at the present time profitable beyond any other branch of stock husbandry." This was said when a pound of wool was worth as much as two and one-half pounds of butter. How much more emphatically the statement may be repeated to-day, when we consider the fact that a pound of butter or two pounds of cheese will buy a pound of wool!

I know there is a standing objection to the dairy, viz: that it involves too much labor. I cannot admit the force of the objection. No branch of farming can be carried on without work, and hard work too. Admitting the fact that the manufacture of butter and cheese requires a large outlay of labor, it does not necessarily follow that the woman who presides over it should be overworked, especially when we take into consideration the profits of the business. It then becomes a source of independence and leisure. As it is now pursued, in a small way, in connection with other duties, it becomes a seeming burden; and all thoughts of increasing the business is associated with an increase of the already overpowering burden. The business is not large enough to pay for hiring, so the diligent wife struggles on. But, *in proportion as we increase it and make it a special business, the burden is lessened.* I would not increase woman's burdens unnecessarily, neither would I exclude her from assisting in the maintenance of the family, and in the accumulation of so much of wealth as is necessary to their happiness.

Believing the subject is worthy of attention, and hoping some hints have been thrown out which may be the means of inducing farmers to give the subject careful consideration, and that by these considerations they will be induced to put in practice the recommendations herein presented, I close this brief essay.

Mr. Wilder presented the following on

Fish Offal as Food for Sheep.

From careful observations, close calculation, and long experience in sheep raising, I have come to the conclusion that Fish Offal used as food for sheep, is not only cheaper, but much superior to any other kind of provender I have ever used.

I keep about one hundred sheep; have fed fish offal to them for the last ten years; and I have wintered my sheep for the last three winters on thrashed straw, with one half pound per day to each sheep of dried fish pumice, or one pound of green (as it shrinks one half in drying), and they came out in the spring in much better condition than when fed on good English hay with corn. I consider the dry pumice worth as much as corn, pound for pound. When I have had enough to give them one half pound per day, I have found that the weight of the fleece was increased one quarter, and not only that, but also the carcass in a like proportion; the weight of the fleece per head averaging from five to seven pounds. I shear my sheep the last of March or the first of April.

I prefer early shearing to late, for several reasons. They get rid of the tick and suffer much less from the heat of May, and by housing them nights and through the cold storms they become gradually hardened, and suffer less from the inclement weather than when sheared later in the season.

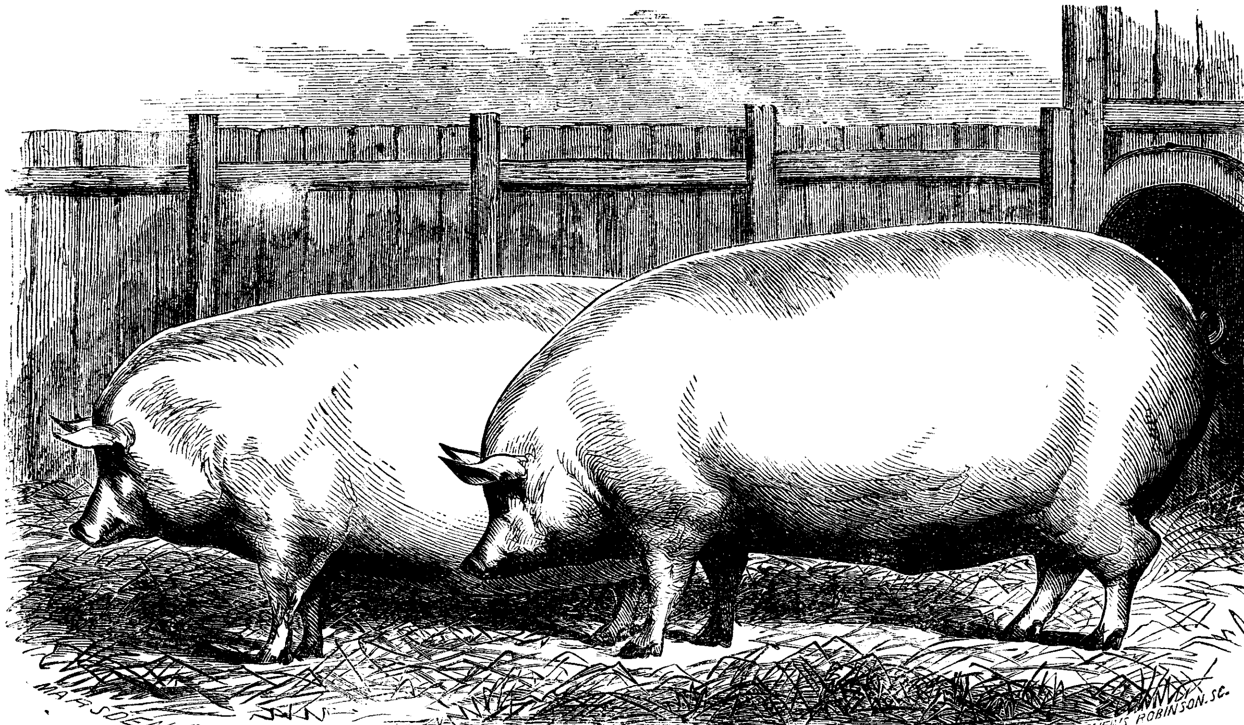
The fish offal which I use is made from herrings, caught in weirs, seined, and dipped into boats, then taken to the press house, where they are salted the same as for smoking; after which they are cooked and the oil pressed out, leaving a pumice for which sheep are more eager than for grain.

Mr. Thing presented the following paper on

Swine upon the Farm.

I do not know whether the Committee on Topics really thought there was any peculiar fitness in assigning to me the subject which they have, but I feel that they have been fortunate in their selection, for I have ever had the good fortune, or the faculty of making myself perfectly at home among hogs.

Allow me to remark at the outset, that the animal of which I intend to speak at this time is the sleek, smooth, long-bodied,



YORKSHIRE BOAR AND SOW. Imported and owned by Winthrop W. Chenery, Belmont, Mass.

deep-chested, deep-sided, long-hipped, short-faced, thin-skinned, intelligent quadruped, of the breed known as the White Chester, or some grade in which this blood predominates; and which are to be comfortably housed at all times, with plenty of food and a dry bed at night; and not the gaunt, long-legged, long-nosed, slab-sided, thick-skinned, big-eared land sharks which in our boyhood days were turned into the highway to shirk for themselves as best they might, their owners taking care to ornament them with—now relic of the past—a hog-yoke, unless they adopted the other alternative of tying a knot in their tail to keep them from running through the fence.

The subject of "Swine upon the Farm," is necessarily connected with all the branches that go to make up what is known as "mixed husbandry," for without manure we can do nothing at farming in Kennebec county in any direction; and unless we keep hogs I know not how we are to have the big piles of rich and valuable compost which we now have; and I know not how we can profitably keep hogs unless we also keep cows, upon the skimmed milk of which we almost wholly keep our hogs through the summer. We certainly cannot keep cows unless we cut hay, and we in Kennebec county have not learned to raise hay to any considerable extent, without plowing up our mowing fields as often as they fail or "run out," and manuring and re-seeding them. So it would seem that the hog, in a large portion of our State, is like the negro in American politics, irrepressible. That being the case, it becomes alike our duty and our interest to make him pay the best possible price for his board and lodging, or in other words, the greatest net profit on the investment, and the man who owns one of the old worn-out farms of Kennebec, and cannot make it pay 7 3-10 interest may make up his mind that farming is not his forte.

I would have the farmer who keeps four or five good cows, commence the spring with two, which have been wintered, both of them breeding sows. I would have him sell all the pigs he raises except two barrows, to fat and kill in the fall or early winter, and two sows to keep over. I would have all the pens and yards securely covered from the rain, with a tight floor, stone if possible. I would have a surface of about 500 feet, with the floor slanting, the side where the feeding troughs are being about a foot and a half higher than the other, so as the more easily to keep them free from dirt. About ten days before planting corn, or rather before the manure is to be used, I would have it thrown out into piles, mixing in a good sprinkling of plaster while being thrown out, and about four ox-cart loads of muck, loam or sods, immediately spread over the pens as a basis for next year's compost heap. I would have the litter from the calf-pen, the cobs from the corn-barn, about one week's accumulation from the horse stalls, and a peck of plaster mixed with it as it is put in the pen. Now we have the receptacle prepared which is to receive everything found upon the farm not fit to be put anywhere else. I may be pardoned for going into detail in the matter of ingredients, for until one is initiated, he will hardly perceive the tithe of what may be converted into valuable manure, and at the same time be got rid of, in many instances, as a nuisance. This pen is to receive all the horse manure made through the summer, which in these days of horse mowers and reapers is considerable. Very nearly over the place where the horse manure is thrown in, is to be situated the privy, under which is to be thrown every day one quart of leached ashes, or dry if you have them, and a small handful of plaster. Once a week the whole is to be spread over the pen and a slight sprinkling of plaster thrown over it. Each day it is to receive all the slops from the house not good enough to put in the swill tub, all the water with which soap has been used, all the refuse pork or beef brine, all the whey which the hogs do not eat, all the water used for soaking butter firkins, all the weeds growing about the buildings, all the accumulations in the corners of the garden and dooryard from the shade trees and other sources, all the cleanings and sweepings from the barn when it is cleared up for haying, all the wool and woolen rags good for nothing else, all the refuse from the vegetable cellar, all the brakes and bog onions that can be profitably mowed in the pastures, and in addition to all this, enough of dry muck, or loam, or scrapings from the forest are to be thrown in during the summer to keep the whole just as dry as it can be and not heat. Just before winter sets in I would have the whole taken to the field where it is to be used the following spring, closely piled up and sprinkled with plaster.

Then immediately put in two loads of loam or muck and two loads of leaves, all the horse manure during the winter, together with the slops and privy as before. In the spring throw out the same long enough before using to have it heat enough to make fine, and put it, together with what was hauled out in the fall, into the hill for corn, or spread it for roots.

I have said nothing as yet about pork, and it may be needless to do so, for if any one having more tillage than manure will faithfully follow out the ideas and directions herein set forth he will not need to ask any one whether it pays to keep swine, for the fifteen cords of manure would be cheap at almost any price.

I would have the two old hogs kept well all the time, and have them ready to sell during the month of October, when they should weigh from six to seven hundred, often more. The two barrow pigs I would have kept until the weather is cool enough to freeze up the lean part for winter use, when I would have them killed and salted for the family. All that is not salted I would have eaten at home, always remembering to give a piece to the poor neighbor, and to the minister. If you do not want to eat the salt pork sell it next summer and kill a fat wether to get hay on.

Having hauled out our manure and killed our pork, let us now for a moment look at it in its financial aspect, remembering that there are in Maine 70,000 swine, probably, there having been in 1860 nearly 58,000. If each of these manufactured two cords of compost—and they ought to make three—it would equal the sum of $700,000 at five dollars per cord. But it is not with aggregates that I have to do at this time, but items and details. We will say nothing of the two store pigs, as they are to be kept as a permanent capital. If we have four or five good cows, the milk, together with the swill from the house, the weeds from the garden and yards, together with two bushels of cheap potatoes per week, will keep them all till the middle of August, and keep them growing. The potatoes should be boiled and put in a large tub while hot, in which all the swill is to be kept. From the middle of August to the middle of October, the two old ones will need, in addition to the swill, two quarts of sound Northern corn meal, scalded, night and morning. This will fit them for the butcher by the middle of October. Now put the two pigs to be killed by themselves, and give them all the good feed they will eat, till pretty well into December, when they are to be killed. After these are put by themselves the others are to be kept on slops. Now for the result:

	Dr.
Interest on $40 capital	$2.40
Milk, 75 days to middle of August.....................	30.00
20 bushels small and poor potatoes to same time, at 40 cts.	8.00
8 bushels of corn to middle of October..................	12.00
Feed for the four pigs and swill for the old ones same time	15.00

To fat pigs to middle of December	$20.00
To store pigs the remainder of the year	24.00
Labor	30.00
4 cords horse manure at $4	16.00
10 bushels ashes at 10 cents	1.00
2 bushels plaster	1.20
	$159.60
	Cr.
15 cords manure at $5	75.00
2 old hogs sold, 650 pounds at 12½ cents	81.25
2 pigs for home use, 450 pounds at 12½ cents	56.25
Pigs sold, estimated six at $2.50	15.00
	$227.50
Deduct	159.60
Leaving balance in favor of swine	$67.10

I am aware that gentlemen with large incomes may look upon the above as a small matter for so much time and trouble. But it is quite an object for a Maine farmer to get fifteen cords of good dressing even by paying for it, and it is worth something to get rid of all the rubbish of which it is composed."

In the discussion which followed the reading of the foregoing paper, Mr. Thing, in reply to a question, said, that he found the manure from the hog pen more free from weed seeds, than any other which he made on his farm. Also, that for use in his own family, he much preferred pork from swine not older than six or eight months.

Mr. Gilbert, from his own experience, did not entertain so high an opinion of the value of the Chester breed as the writer of the report. The pork packers at Lewiston also held that, while Chester pork is thick on the back, it rapidly fell off on the sides, and furnishes less clear pork than the Suffolk.

Much difference of opinion appeared to exist among the members regarding the comparative merits of the various breeds; and that it was useless for the Board to recommend one breed as superior to all others, for the same reasons as exist with regard to other farm animals, since locations and surroundings and circumstancies vary as they do in a State of large geographical magnitude, it was impossible to succeed equally well, everywhere, with any one kind.

Mr. Gilbert said he would not put hogs to work over what was already good manure, as that from horses, &c., as frequently done, but would supply them with raw materials which needed conversion into manure, such as muck from the swamp, turfs from roadsides, and the like. He would also retain it under cover during the summer, and not apply to the land until a year old at least, and well decomposed.

Mr. Wilder, said that great deterioration was generally suffered, and would be with any breed, however good it might be, by breeding from too young sows. They should attain maturity before breeding, if we would retain the desirable properties of health, thrift and profit.

Mr. Calvin Chamberlain presented a highly interesting and instructive paper on the present status and future promise of Forests in the several counties; embracing their influence on climate and productiveness, the present and prospective market value of their growth, together with other topics of importance in the same connection. The paper received several readings, was discussed at some length, and resulted in the appointment of a committee charged to present the subject to the Legislature then in session; and to ask for the enactment of a statute encouraging the growth and cultivation of forest trees.

The following Memorial, shortly after drawn up by Mr. Chamberlain, and presented by the Secretary, in accordance with the unanimous wish of the Board, embraces in a somewhat condensed form, most of the facts and arguments set forth in the paper before mentioned, and is earnestly commended to the thoughtful consideration of the whole people of Maine, as well as to their Representatives in Legislature assembled:

To the House of Representatives in Legislature assembled:

The Maine Board of Agriculture at its meeting in Jan. 1869, appointed the undersigned a Committee to present to the Legislature the subject of Forests; and to suggest the expediency of inaugurating a State policy encouraging the preservation and production of forest trees; and also to call the attention of the Congress of the United States to the same subject.

In obedience to these instructions we here present concisely, and with the utmost degree of brevity consistent with the magnitude of the subject, some leading considerations, which will commend themselves to your attention, in the following

MEMORIAL:

Man, in all ages and in all countries, has been a wasting agent, rather than an aid or conservatory of nature in fitting the earth for his continuous occupancy. Not the least of the evidences showing the progress of man in the present era, is his ability and his desire to examine the physical conditions of the habitable portions of the earth, and to estimate the past and present effects of his own labors as they have contributed to those conditions. As man has increased in the numbers of his kind, and extended his agricultural and pastoral industry, he has of necessity encroached upon the forests which once covered the greater part of the earth's surface otherwise adapted to his occupation. The removal of the woods has been attended with consequences so vast and varied, that the importance of human life as a transforming power is clearly seen in the changed conditions of soil and local climate. Countries once densely peopled are now waste deserts. These extreme changes of condition, we have now much reason to believe, were the slow but sure results of man's own improvidence.

When we look at the multitude and extent of architectural ruins, and of decayed works of internal improvement, that show a once dense population over the present thinly inhabited districts of western Asia, northern Africa, and southern Europe, we may apply to this vast region our present theory of cause and effect, and see in the gradual waste of natural forests, a corresponding change in climate—a decrease of humidity, and as a consequent, a diminished productiveness of soil. These physical changes in this garden of the world were extended over vast epochs of time, and the high civilization there attained, the perfected state of science and art, conceived and executed the most gigantic works of irrigation, by which the mountain streams for a time contributed to man's prolonged occupancy of these fair fields. If we compare the present physical condition of these countries with the description of them by the ancient historians and geographers, we see the luxuriant harvests of cereals that waved on every field from the Rhine to the Nile, the vine-clad hill sides of Syria, Greece and Italy, the olives of Spain, the domestic animals known to ancient husbandry,—all these, the spontaneous or naturalized products of these fair climes, the cumulations of centuries of persevering labor,—all this wealth, has in extensive districts been surrendered to hopeless desolation, or at least to a great reduction in both productiveness and population. The forests have disappeared from the mountains, the vegetable earth accumulated through untold ages, the soil of the mountain pastures are washed away; the once irrigated meadows and fields are waste and unproductive, because the reservoirs and the springs that fed them are dried up; rivers famous in history have shrunk to brooks, and the trees that protected their banks are gone; the rivulets have ceased to exist in summer, and in winter they are torrents of terrible force. The decay of these once rich and flourishing countries, is mainly the result of man's ignorant disregard of the laws of nature. He may for a time struggle against oppression and the destructive forces of inorganic nature; but after a shorter or a longer contest, he yields the fields he has won from primeval nature, to fall into a dry and barren wilderness.

The evils of man's abuse have been perpetuated and extended to later times, and it is but recently that, in some parts of Europe, public attention has been awakened to the necessity of restoring the disturbed harmonies of nature, whose well-balanced influences are so propitious to all her organic offspring, of repaying to our mother the debt which the prodigality of former generations has imposed upon their successors.

We propose to present this subject only in the two-fold aspect of the intrinsic value of forests as wood and timber, and the conservative influences of trees on climate.

No country possessed by a civilized people, has ever been seen to preserve for any considerable time a proper proportion of its surface in forest growth. It is but the work of an hour to destroy a tree, that has been reared by the patient labor of centuries. The motives for such destruction are almost innumerable; and the objects of the restoration are equally numerous; but unfortunately they have generally been considered as beyond the province of governments and the power of the masses. The condition of the forests of Europe is much the same in each of the countries, with perhaps the single exception of Norway. An inquiry concerning one is equivalent to an inspection of the whole. In 1750, France had by estimate forty-two million acres,—about 32 per cent. of the whole country in forests. In 1860 they were reduced below twenty million acres. It is now estimated that the proportion in 1750 was not too great for permanent maintenance. During this period of waste, France neither exported manufactured wood or rough timber, nor derived important collateral advantages of any sort from the destruction of her forests; but on the contrary, during a portion of that period she drew largely from the forests of other countries, in timber for naval and other purposes. Active measures are now in progress in France for the restoration of the forests. The governments and the people in other countries of Europe, are more or less engaged in the same work.

The subject of American forests is suggested here as of primary importance,—the first to be considered by the National and State governments,—the first to occupy the attention of all the people of these States, after the immediate provision of food and clothing. We are destined soon to be startled by the unpleasant fact that a famine for wood is upon us, unless immediate measures are adopted whereby the supply may be increased, and the destruction of what remains diminished. Coal and peat may and should be substituted for wood, as fuel, but for a vast number of purposes in the mechanic arts there is nothing yet that will take the place of wood. This fact gives to the subject a grave importance, and when we note the constantly increasing value of wood and lumber, the grounds for serious apprehension seem to be substantial. A circular issued in the name of the Board of Agriculture, in May 1868, served to disclose the fact, that wood lands in the well settled portions of this State have advanced in value in the last ten years from fifty to two hundred per cent. Wood, as fuel, has advanced in about the same ratio; and lumber very uniformly about one hundred per cent. After making allowance for our depreciated standard of money value, there remains a fact to be accounted for only on the basis of short supply. The probabilities of demand and supply in the next ten or twenty years, favor a farther advance in prices. Very little wood has been planted or encouraged to grow on lands that have purposely been cleared for other crops. Other important facts have been disclosed in the pursuit of this inquiry. That the county of Androscoggin retained in wood in 1859 only 38 per cent. of its entire area, and the county of Sagadahoc only 39 per cent. Some other counties were reduced in their percentage of unimproved lands nearly as low. Since 1859 the extension of manufactures and increase of population, particularly in Androscoggin, has seriously reduced the area of wood lands, and many towns are now nearly cleared of trees. Estimates carefully made in several countries of Europe, determine the proper proportion of permanent wooded surface to the entire area at 20 to 40 per cent., varying with the physicial features of the country, and the humidity of the amosphere as affected by neighboring water surfaces. It is proper to remark here, that these estimates are based more on the facts that will be presented under our second view of the subject, than on any calculation that the annual growth of such forests will be equal to a liberal supply of wood and timber for the crowded population of those countries.

We here give it as our opinion, sustained by the best informed minds, that our whole country should have in permanent wooded surface 40 per cent. of its area, and *that* very generally diffused over the States, to ensure best results. It will thus be seen that Maine, in extensive districts, has already reduced her wooded surface below a just standard.

But this subject is a National one, and can only be treated to satisfactory results by harmonious concert of action between the several States.

Among the things that are fundamental to a nation's material growth and prosperity may be named cheap bread, cheap houses, cheap fuel and cheap transportation.

"A nation which produces the raw material for every species of manufactures and commerce,—whose people provide their own houses, and raise all they consume,—which can move its people, its products and manufactures, quickly and cheaply, is in a condition to establish the most complete division of labor, and to give to every person the result of his or her abilities, energy and skill. Such a nation must prosper. Its people will save and accumulate from their respective earnings; and this subject of wood enters largely and constantly into each one of these great departments of industry and living."

The older portions of our country are now drawing their supplies of lumber from the newer States. The States of Michigan, Wisconsin and Minnesota, are sending their pine, oak, black walnut, and other valuable woods to the Atlantic and the Gulf sea-board, in values of tens of millions, for domestic consumption and the supply of foreign nations. France depends very much on the forests of the United States for her ship-timber; and the timber getters are constantly at work for French agents, cutting down the yellow pines in the south, while in the north white pine deck-plank enough to cover the decks of fifty ships, has been shipped from Saginaw in Michigan, to Havre in France, in one year. It has been well said, that our white oak and yellow pine forests are ravaged by everybody for indiscriminate purposes. "From navy yards to cooper shops, from railroads to street alleys, and from bridge building to shingle making, there is no quarter given to the oak and no peace to the pine." The white pine and other resinous trees, the ash, hickory, chestnut, and other timber trees of the north, are beset wherever they exist, and are fast melting away, with little or no thought for their renewal in kind, or for young trees of any sort to take their places.

Within the ten years from 1850 to 1860, more than fifty millions of acres in our whole country was brought under cultivation. Allowing one-fifth to be prairie and destitute of wood, and we have remaining an area equal twice that of Maine, or thirteen thousand three hundred and thirty-three acres of woodland permanently alienated from timber growing, for each of three hundred working days for each year, during those ten years.

Increasing population swells these evils. Between 1850 and 1860 our population increased 8,080,785, or 35.59 per cent. It is now supposed to be advancing one million annually. While the increase in manufactured lumber, for home consumption and exportation, was $37,390,310 in 1860 over that of 1850, or 63.09 per cent. This shows that the demand for timber, notwithstanding the vast increase in the use of iron, brick and stone, increases each year with the advance of the nation in age and wealth.

If for twenty years to come the demand for lumber shall advance in the same ratio to the population as in the past twenty, more than two hundred millions of dollars' worth of American sawed lumber will be needed each year; and the same ratio in the increase of population, which has called the fifty millions of acres into use in ten years, will then be calling it in at the rate of more than one hundred millions of acres each ten years. Our native-born and foreign population will have farms, lots and houses, fences, furniture, vehicles and agricultural implements; but every year they will be impoverishing the United States more and more of her lumber, and all these things will demand a higher price.

The State of New York, which has furnished more lumber than any other State, as long ago as 1850 reached the maximum of its ability to furnish it. That State from 1850 to 1860 increased her population 783,341, while with the enhanced price of lumber, she diminished her supply almost one million of dollars each year.

One of the most cunningly devised schemes ever invented by the master of mischief to waste the entire timber of a country in one generation, was that to relieve the country people of that State from the burthen of keeping their common clay roads in repair, by chartering companies to build upon them plank roads to the extent of thousands of miles. The loss to the State through this means, that will never be restored, is ten thousand fold greater than all resultant advantages.

In our own country the dwellings of twenty-five millions of people are chiefly made of wood, and in the world there may be six hundred millions who dwell in wooden habitations. When we look at this perishable material, as it enters into the construction of the out-buildings of Americans, and think of its amount, then of the fences of the country, which cost more in material and in labor than all the buildings on farms, added to that of all the villages and cities, and take into the account that all this wood is destined to decay sooner or later, or be burned up,—fix all this in mind, and we have made one point in illustration. The evils of past destruction are now experienced in all our cities and large towns—and the broad country may not be left out of the account—in the great increase of cost of fuel, and in the price of lumber and timber. High rates of fares and freight charges on our lines of travel, result in the main from the increased cost of building steamboats and railroads, and running them.

Railroads are enormous consumers, of recent introduction. The sixty thousand miles now in use or soon to be completed, demand an almost incalculable amount of wood. With 2,500 ties or sleepers to a mile, these roads require one hundred and fifty millions; and these ties decay and require renewal in about five years. This vast number causes the destruction of a nearly equal number of incipient timber trees—for they are usually cut when of a size suitable for only one or two sleepers.

The lumber used in fencing these roads, in building bridges, depots and cars, is quite an item to be added to former consumption. Then of the fuel! It is estimated that the distance run each day by trains on all the roads is 308,000 miles. Each engine with an ordinary train consumes about one and three-fourths cords of wood for every twenty-five miles. This gives a daily consumption of wood for this purpose alone of 21,560 cords, or six and one-half million cords annually. Telegraph poles are a recent item in demand. It will require half a million trees annually to supply the decay on the lines now in use.

The late civil war caused the destruction of much wood in all the region of conflict. It was cut for fuel, for fortifications, to hinder the movements of opposing forces, and to open the country for military operations. Costly railroads with their bridges and buildings were burned,—towns and farm buildings shared the same fate. Some of the finest parts of Virginia are laid waste to a degree such as to offer no attractions to immigrants.

In their haste to bring land under cultivation, men cut and burn large tracts of magnificent forests, while they could, with great advantage to the crops and the general health and beauty of the country, leave every field or every farm with a belt of timber surrounding it. Much land in Maine and other States has been cleared, which should have remained permanently in wood, by reason of rocks and other obstructions—worth just nothing as cleared land—in locations where the wood, if spared, would have attained a permanent value of one hundred dollars per acre.

There are several kinds of trees indigenous to these eastern States, that now are, and must continue to be far more valuable in the arts than for fuel alone. The oak, hickory, and ash, in particular, for purposes of carriage building, and for farm-tools, implements and machines, are admitted to be superior to the timbers of any other country; and the care and culture of these trees might in time give our country the markets of the world in these departments of manufacture.

Taking a comprehensive view of American forests, we find in California no wood for a lever or a pick-handle, better in quality than a pine limb. In the whole western half of our country no timber is grown suitable to make a carriage, a wheelbarrow, or any kind of farm implement. All these are supplied from the East. As population spreads over our vast possessions lying west of the Mississippi, and railroads are built through them, the one great impediment to prosperity will be the want of trees. All the surplus of timber now on the Pacific slope, and in Texas, will soon be wanted on those vast plains. East of the Mississippi are the prairie States, and now other considerable districts of country with no wood to spare. The available forests now remaining to furnish all the wood of commerce, are embraced in a few of the States.

Having in this cursory manner passed in review the general subject of trees, it remains to us to consider in the second place the influences they exert on climate. Climate is made up of delicate and nicely adjusted elements, subject to disturbance through various causes. Our summers, that preserve a genial temperature from April to October, maturing the crops of the field, often run on the verge of destruction to those crops. A slight increase of a disturbing power among the elements would lay waste the labors of the husbandman—and this increase may be wrought by the acts of man himself.

The atmosphere at all times contains vapor of water that is being constantly raised by the process of evaporation from land and water surfaces. This vapor—usually about fourteen parts in one thousand—is perpetually changing in amount and proportion, and is almost always below the quantity that the atmosphere at its existing temperature is capable of sustaining. This circumstance causes wet bodies soon to become dry, and the surface of the soil, though saturated with moisture, soon to become dusty. Upon variations in the quantity of moisture present in the atmosphere, the peculiarities of climate mainly depend. The frequency of rain, and other phenomena of the highest interest and importance, are greatly influenced by it. Evaporation from moist surfaces is hastened by a breeze, and very much increased by a strong wind. The evaporation must depend on the nature of the surface; and is less from naked earth than from water surface. Experiments in this department of physical science, being much more easily and simply conducted upon water than upon other evaporating surfaces, we find most observers, so far, confining themselves to the simplest form of such observations. This is to be regretted; and the present national interest attaching to this inquiry, should stimulate our scientific schools to enter at once upon such a series of observations as may result in a more thorough understanding of the whole subject than has hitherto been reached. Such observations promise to be practically useful, if continued through successive years in a primitive country where the forests are being rapidly removed, and we fear we have very little of country exempt from such changes, where any great number of trees are remaining. In this field of inquiry we are, at best, dealing with rather intractable elements. Some experiments indicate that evaporation from the moist earth may be from one-tenth to one-sixth of that from water. Other experiments show that land, with the trees or other vegetables growing upon it, emits considerable more vapor than the same space covered with water. Evaporation from the leaves of plants is very considerable; some vegetables transmitting more than half their own weight daily. We are now very far from absolute knowledge in this direction, and possibly at our best estate may not be materially wiser. The observed phenomena on a few square or cubic yards of earth must be insufficient data from which to reason upon the meteorology of a State. It is safe to say that no one can now tell what percentage of precipitation is evaporated; what carried down to the sea by superficial channels; what absorbed by the ground and carried off by subterranean conduits; what drawn from the earth or the air by a given extent of forest, of short pasture vegetation, of tall meadow grass, or a crop of cereals or any other farm product; what given out again by surfaces so covered, or by bare ground of various textures and composition, under different conditions of atmospheric temperature, pressure, and humidity; or what is the amount of evaporation from water, ice, or snow, under the varying exposures to which they are subjected in actual nature. But divesting the subject of the labyrinth of difficulties with which it seems beset, there are seen some simple facts that are of interest in this connection.

The subject matter of aqueous downfall, evaporation, and the excess of the former, so far as it retires by superficial channels—representing the water-power of the State—will probably be treated at length in the Report of the Hydrographic Survey. It is not within the scope of our present effort, to trench farther upon this ground than is necessary to elucidate the few and simple positions that follow.

From observations made near Philadelphia, the amount evaporated from water surface in one year was 32.88 inches. The amount deposited as rain and snow in the same year, 43.79 inches. During the summer months of the same year, 18.62 inches evaporated, and but 8.03 inches deposited. At Ogdensburg, N. Y., in one year, 19.94 inches were evaporated in the summer months, and for the year, 49.37 inches. At Syracuse, N. Y., in one year 23.53 were evaporated in the summer, and 50.20 inches during the year. At Salem, Mass., as the result of extended observations, the annual evaporation amounted to 56 inches; and the same result is reported from Cambridge. From many calculations made at Baltimore, the average evaporation for the summer is 19.91 inches—about twice as much as the rain-fall in the same time. Observations made at the Agricultural College of Michigan, for

1865, for March 15th to Nov. 14th—8 months—give 25.35 inches rain-fall, and 30.85 inches evaporation. For 1866, rain-fall for 8 months 29.78 inches, evaporation 32.03 inches. Observations made at Milwaukee, Wisconsin, extending through five years, and taken from March 15th to Nov. 14th—8 months of each year, the average rain 23.61 inches, while the average evaporation for the same period was 32.58 inches. In the open country where drying winds prevail and much land is exposed by tillage, evaporation may take place to the extent of three-fourths of the rain-fall throughout the year, or more than twice that fall for the entire summer. Hence the value of forests as arresters of evaporation, or as barriers against the sweep of drying winds, becomes obvious.

Observations near London, England, show a mean evaporation of 19.11 inches; and at Manchester of 25 inches. "The chief cause of the difference in dryness between the United States and England, may be found in the fact that the humidity is there borne from the ocean, while the prevailing west winds bear our land moisture away from us towards the sea, drying us, instead of increasing our store of vapor."

Researches into the phenomena of heat have disclosed the extraordinary fact that vapor of water is opaque to the rays of heat of low intensity, such as that which proceeds from the soil and from plants by night; in other words, that the heat of the earth cannot be radiated or projected towards the sky, if there exists in the air above the spot observed a large proportion of aqueous vapor. Through pure, dry air, the heat may pass off as readily as if no air there existed. It has been calculated that of the heat radiated from the earth's surface, warmed by the sun's rays, one-tenth is intercepted by the aqueous vapor within ten feet of its surface.

Hence the powerful influence of moist air upon climate. Like a covering of glass, it allows the sun's rays to reach the earth, but prevents, to a great extent, the loss by radiation of the heat thus communicated. In accordance with this theory, is the fact that the withdrawal of the sun from any region over which the atmosphere is dry, is followed by quick refrigeration. On the elevated plains of central Asia, "the winters are rendered almost unendurable from an uninterrupted outward radiation, unimpeded by aqueous vapor."

Professor Tyndall says, "The removal for a single summer night of the aqueous vapor from the atmosphere that covers England, would be attended by the destruction of every plant which a freezing temperature would kill." In the torrid desert of Africa, where it has been said, "The soil is fire, and the wind is flame," the refrigeration at night is painful to bear, so that ice is sometimes formed there. Wherever the air is dry the daily range of temperature will be very great. A traveller in Spain relates, that in the valley of Grenada, where the trees have all been destroyed, the heat by day in the sun's rays was oppressive, while the hoar frost was lying white in the shade. Allusions to the same law are found in an ancient writing, where the Hebrew shepherd while tending the flock of Laban, experienced great hardship through drought by day and frosts by night, sleep departed from his eyes. The desert and mountainous regions of our own country illustrate these phenomena of radiation. In the mountain valleys along the Pacific railroad, the thermometer may stand at 90° in the afternoon, and at night fall below the freezing point. Near Salt Lake, Utah, it is difficult to grow Indian corn, though the mean temperature is ten degrees above that of Maine. The local cooling at night, and the higher heats by day are both unfavorable to the crop. Men who have been extensively engaged in making hay in the elevated valleys of California, assure us that they have had their filled water-pail frozen over by night, so that by keeping it in the shade the ice remained through the following day. These facts are important as applicable in the future to human comfort. A close connection exists between diminution of humidity and reduction of temperature; and the remedy, if any, is in protection from influences causing excessive dryness. A remedy applicable to wide areas of northern territory where low temperatures occur unseasonably, through the precipitate descent of cold air from the high region of the atmosphere, may not be found; but in the regions where the extremes are not so great, where they just border on the freezing temperature, they may be applied with much promise of success. The principal cause operating around and above us, producing excessive dryness in the atmosphere and in the soil, is the westerly wind, which alone is competent to reduce the amount of vapor in the air, and to render it incapable of preventing the escape of heat absolved by the earth during the day.

On the Pacific coast the prevalence of westerly winds gives a great uniformity to the temperature, and the most of the rain comes from that quarter. These winds bear their moisture up the slopes of the mountains, where it is condensed into clouds, and is deposited as rain and snow; so that as they pass eastward they are dry winds, and must so continue over the desert region which spreads out towards the Mississippi. These conclusions are so well established, that it has long been remarked of the northern Atlantic States, "so long as the westerly winds continue to blow in winter, there is no cessation to your cold; and so long as they continue to blow in a broad, regular stream in summer, there is no end to your drought."

Our only protection from the baneful influences of this great drying agent—the westerly wind, is in ample and systematic planting of evergreen trees on the cold sides of our fields, orchards and gardens generally.

The success that has ever attended the introduction of such improvements, both in Europe and America, places the matter at once above and beyond all questions of practicability and expediency.

The action of the forest, considered merely as a mechanical shelter to grounds lying to the leeward of it, would seem to be an influence of too restricted a character to deserve much notice, were it not for the multitude of facts that concur to show its importance as an element in local climate. A writer from Belgium may be quoted in point: "A spectator placed on the famous bell-tower of the cathedral of Antwerp, saw, not long since, on the opposite side of the Schelde only a vast desert plain; now he sees a forest, the limits of which are confounded with the horizon. Let him enter within its shade. The supposed forest is but a system of regular rows of trees, the oldest of which is not forty years of age. These plantations have ameliorated the climate which had doomed to sterility the soil where they are planted. While the tempest is violently agitating their tops, the air a little below is still, and sands far more barren than the plateau of La Hague have been transformed, under their protection, into fertile fields."

A decline in fruit products in Maine has been apparent for a considerable time. Other farm crops are seemingly in a decline also. Potatoes, oats, and wheat, now rarely give such crops as they did thirty or forty years ago. Fruit trees take on diseases, apples become scabbed and distorted; pears often knotty, cracked, and extremely perverse, plum and cherry trees forget former habits and old friendships, blight and rust and insect destroyers are everywhere. The farmer's crops are invaded from all sides. The cry of local exhaustion of the elements in the soil, negligent culture, and a long chapter of local complaints fail to account for any portion of the difficulty. In the newer States, where the settlement has been more rapid, similar changes are noted. The States of Ohio and Michigan, in particular, originally most admirably wooded, have had a growth so rapid as to work great physical changes in a single life time. In such a field for observation, correct theories and conclusions can hardly fail to be reached. Deterioration in fruits and other crops, through climatic causes in those States, is now clearly shown as being intimately connected with the removal of their magnificent forests. Recent changes in our local climate are doubtless somewhat influenced by the general change experienced in the western States. A severe summer drought over the valley of the Ohio must affect the humidity of the winds passing thence to the Atlantic. From Ohio we have dreary accounts of recent climatic changes, working defeat to the intent of the husbandman, and involving the country in losses innumerable and almost incalculable. Fruits that once grew everywhere abundantly and of the greatest excellence, have failed almost entirely, destructive floods and desolating droughts are items of annual record.

We find this subject of climate so ably and thoroughly presented and discussed by Professor Kedzie, of the Michigan Agricultural College, that no better service can be rendered the American people than to give broadest circulation to every sentence he has so thoughtfully and forcibly uttered. Extended quotations from that gentleman will give a clearer view of the points we desire to bring out, than any other matter or facts within our reach; and for the liberty we take, we feel that no apology is due to any party but the Hon. Doctor himself. In an address before the Livingston County Agricultural Society, in 1867, on "The influence of Forest Trees on Agriculture," Prof. Kedzie says: "You remember how Ohio was deluged with rain last fall—large districts flooded, vast quantities of corn and other grain washed away; flocks and herds drowned, railroads submerged, while at the same time the New England States were parched and dry. How is it this year? A despatch from Cincinnati, Sept. 27th, says: 'The weather continues dry. The reports regarding the corn and potato crops are even more discouraging. Farmers are selling off their stock as fast as possible. Water is very scarce.' In northern Ohio, 'The pastures are heaps of dust, and an examination of the ground and its contents in a potato patch, would hardly reveal the kind of crop planted.' Sandusky, Sept. 30, 'Never before in the memory of the living, has northern Ohio suffered from such a terrible drouth as is now prevailing. For nearly three months, hardly anything to be called a shower has fallen. Cisterns long since went dry, and now nine-tenths of the wells are nearly exhausted. For nineteen miles back from the shore people depend upon the lake for water. The great drouth reaches from Rochester, New York, in a belt 200 miles in width, to central Iowa. At present there is no prospect of relief,' Elmira, N. Y., 'Pastures are an utter failure, and cows are rapidly drying up on hay, which is fed out to them as though it were mid-winter. Wells are dry, and the beds of streams, instead of flowing water, show yellow belts of burning sand.' Pass on east of the Hudson, where the drouth was 'master of the situation' last year, and now the country is wasted and destroyed by extraordinary floods—the Connecticut river rising ten feet in one day. 'What shall we conclude in regard to such fluctuations and irregularities in the distribution of the rainfall? No reasonable person will deny that for all these changed manifestations of natural effects, there has been a corresponding change of natural causes; and it becomes us to inquire whether this derangement has arisen from circumstances within the control of man, and hence capable of a remedy, or whether they arise from causes beyond his control, and to whose effects he must submit with patient endurance, because they are remediless.'" "The rainfall of any region is influenced by a variety of causes; the nature and direction of its prevailing winds, the influence of mountain ranges, &c.; but a cause which is very marked in its influence and which is also within the control of man, is forest growth. When we see how rapidly these forests have disappeared under the hand of the woodman, and how steadily the climate of the United States has changed with the disappearance of the forest, have we not good reason to suspect that man's own hand has drawn down these evils upon himself?

If by this thoughtless destruction of this barrier against the fickleness of the weather, we have laid ourselves open to the operation of causes whose disastrous effects we are only *beginning* to experience, is it not time to pause and consider whether we have not gone as far in this destructive process as is safe, and whether a wise prudence in regard to the future does not warn us to stay our hand?"

We can obtain a better conception of the beneficial actions of forests upon climate, by considering the condition of a portion of our country almost destitute of them. An observing traveller writes to Prof. Kedzie as follows: "I am greatly interested in your report on forest trees and their influence on climate, especially as it explains much that I saw and experienced on the great plains lying east of the Rocky Mountains. While riding over these vast plains without a tree or bush, the heat by day was almost unendurable, yet the cold at night was excessive, so that we could not sleep unless wrapped in blankets and buffalo robes. This vast region, scorched by the sun by day, and chilled by excessive radiation at night, the abode of countless swarms of grasshoppers, can never be the permanent home of civilized man until he can protect himself and mitigate the excesses of the climate by planting trees."

"It was a question with me whether it was possible to cause trees to grow at all, but as I came upon the bluffs back of Nebraska City, I there found the problem solved, for I there found a vigorous grove formed by planting the locust and cotton-wood, and then I became convinced that these vast and desolate plains would some day be the happy home of millions yet to be." "I returned from Fort Laramie on horseback, and went directly across the country from Fort Kearney to Nebraska City. The land is very rolling and beautiful, rich in all that a farmer wants, and yet it produces nothing but the short buffalo grass. About fifty miles west of Nebraska City, the prairie chickens began to appear, and with them the grass grows to a greater height. This grass indicates the nearness to the Missouri river. On the Missouri bottoms there is plenty of wood, principally cotton-wood. All the wood I saw growing was on bottom lands, and hence my interest in the nursery of thrifty locust and cotton wood on the bluffs which I passed on approaching Nebraska City. It occurred to me that if they would grow there on that high land, a little effort would carry them back and back gradually towards the plains, and in that case the desert would be redeemed in a change of climate."

"Kansas and Nebraska both lie within the belt of country which suffers most for want of rain. In 1863 it did not rain at Fort Laramie for eight months, and it was dry in Kansas. It cannot be considered an agricultural State on account of its frequent drouths and consequent grasshopper plague—for I consider the grasshoppers a result of the dry climate of the plains. There is not enough rain to drown the rascals." "But all this, it seemed to me, might be changed by tree cultivation. Now for my reasons. The belt of timber on the Missouri bottoms affected the grass for fifty miles in the interior, the climate was so changed by the timber belt that the high rolling lands grew grass sufficiently high to hide the prairie chickens. Of course the volume of the river did something towards this; but the trees served to hold the vapors which arose, and, it may be, helped to diffuse them. The circumstance, then, that trees would grow on the high lands was a fact, it seemed to me, which solved the question of the future of Kansas and Nebraska."

Michigan, in advance of any other State, has given attention to the subject of trees. She appears to have patriotic citizens who are devoted to her *future* as well as her present welfare. Having been a citizen of that peninsula when she took her position as a State in the Union, it is natural that the writer* should watch with interest her growth and her history. At the period of her change from a territorial government, her wealth of forest was enormous. Could wise and prudent men from that day have managed her domain, the value of present product from her farms would be much more than it is—probably doubled. So recently has winter-wheat been their successful leading crop, that, without sufficiently noting the rapid change going on in the climate, farmers have persisted in sowing their broad fields, till the State has lost in the winter-kill of the crop, twenty million dollars in four years. Instead of being what it should have been,—the orchard and fruit garden of America,—it is fast losing its ability to grow a home supply. But, under wise counsels, the people have there set about repairing the damage done; and the initial legislation of the State is a perpetual reminder to the citizen, that he owes other duties to his State and country besides the payment of his annual assessed taxes.

Maine as a State, has yet a vast amount of forest, and may continue to have for centuries to come, but their preservation will be through the obstacles that nature has thrown around them, guarding them from approach, rather than by the forbearance of the present wood-cutting Yankee. The location of the great mass of our forests is such as to exert but little climatic influence over the agricultural districts. To learn of the effects of trees on

*C. C.

atmospheric humidity and the crops of the farm, we need not look to Europe nor the far West. Instances are noted within our own State, where contiguous farms under different extremes of condition, manifest corresponding extremes of results, both in fruit products and the grasses. To receive the greatest benefits from improved physical conditions of country at the hand of man, his efforts should be exerted at once on every portion of his domain; yet a single State may in a degree be benefitted—and to an extent richly compensating for the expenditure of labor by and through independent action. Local acts in the great economy of nature are followed by local results. The spirit in matter is not confined to operations on the largest scale.

There is a portion of Hancock county along the coast that is now nearly denuded of trees. During the heat of summer, the radiation from the parched surface affects the atmosphere to excessive dryness. The electrial rain-bearing clouds that approach from the westward, as they come within this dry atmosphere, are absorbed and dissipated before their watery contents can reach the earth, while the clouds just north of them float on over a better wooded district, and yield copious rainfall; and on the other hand, the showers continue abundant in the more humid atmosphere of the contiguous bays and ocean. The observing sea-faring inhabitants of that district, after years of perplexity over the fact and the hidden cause, at last inquired in all seriousness, whether a telegraph wire located to the north of them does not unfairly "switch off" the showers that rightfully belong to them.

Whatever is done for the preservation or the restoration of our forests, and thus mitigating the fluctuations of temperature and humidity, and restraining the action of the winds, cannot be commenced too soon. The people need to be agitated and a wholesome public sentiment created. The present theory in regard to physical laws and conditions must be understood and adopted, or discussed and rejected. Wise and able teachers are wanted in this, if in no other matter of present urgency. Men need to be taught that we have no moral right to follow blindly an instinct that leads only to present personal advantage, regardless of wide-spread future evils as a consequent. That we are but tenants of this beautiful earth, not owners in perpetuity—that we have no right to injure the inheritance of those who succeed us, but rather a duty to leave it the better for our having occupied it our allotted time.

Men need to be taught to plant trees, and their children taught to plant trees and to love them. Owners of poor lands need advice and direction in planting wood upon them, as a crop more hopeful in riches to future heirs than usual expectations from wasted fields. Owners of *good* lands in Maine, or elsewhere, will, in the future, learn that their bleak fields, if judiciously planted with wood to the extent of forty per cent. of area, will produce on the remaining sixty, more in all kinds of crops than the whole now does or can be made to do under any other possible course of treatment. Lands well sheltered, can and do produce winter wheat in Maine as well as in England or on the new lands at the West. An immediate adoption of shelter to all lands, would result—as soon as such shelter could be matured—in the independence of our State from imported grain. We speak confidently, because advisedly on this point. While the State has manifested a laudable ambition in developing its resources, while it has wisely provided guardians for the Fisheries, and a Commission on Water-power, it has not yet recognized the more important public concern that underlies both those, and all other interests. We believe this to be an important public matter that does not lie outside of legitimate legislation. Shall the legislative voice continue silent on the matter of *forests*, till the last tree shall be cut, thus ensuring dry channels to the *rivers* and the consequent death of the *fishes?*

Must the man of Christendom be taught that Monarchies alone are competent to guard and preserve physical nature so as to yield its sustenance in a perpetual round? Or shall a professed Republic for once arise from an unaccountable lethargy, and assert its force in its determination to perpetuate itself, and make its declaration of intention to have a country in the distant future worth possessing and worth preserving still?

We have extended this paper beyond the limits that we would gladly have assigned to it; but there was a seeming necessity to here show to the sons of Maine, that no part of our extended domain was without the blighting effects of climatic influences. That the means here at home are as available to the creation of desirable homes for ourselves and our posterity as elsewhere. Though man's past history is but a dark picture of physical misfortunes and seeming failures, yet we are hopeful for the future. We hope to see the energy, the wealth, the increased intelligence of men more employed to overcome the physical evils that surround them. After so much of the earth has been made fertile without man's agency, it would be pitiful if he could not assist in finishing the remainder. We hope to see the sons of New England, rather than stray westward to there find the necessity for labor in in the world's physical redemption, choose to remain at home and contribute to the renovation of good old New England, by planting her hard hill-tops with trees.

We believe the time has come for action, and that some stimulus through legislation is demanded. We therefore suggest to your Honorable body the expediency of referring to a competent committee for consideration, the following draft for enactment.

CALVIN CHAMBERLAIN,
S. L. GOODALE.

Augusta, February 16th, 1869.

An Act for the encouragement of the growth of Forest Trees.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

SECTION 1. That any landholder in this State who shall plant or set apart any cleared lands for the growth and production of forest trees, within ten years after the passage of this act, and shall successfully grow and cultivate the same for three years, the trees being not less in numbers than two thousand on each acre and well distributed over the same, then on application of the owner or occupant of such lands, to the assessors of the town in which the same is situated and is so successfully cultivated to forest trees, and at the same time of such application shall file with said assessors a correct plan of such lands with description of their location, and setting forth all the facts in relation to the growth and cultivation of said grove of trees or incipient forest, the same shall be exempt from taxation for twenty years thereafter; provided such grove or plantation of trees shall during that period be kept alive and in a thriving condition.

SECT. 2. Any person owning or occupying land adjoining any highway of the usual width in this State, may plant or set out trees in regular rows on either side of such highway contiguous to his land, and such trees if set within six feet of the margin or boundary of said highway, and the trees not more than six feet apart, and of any evergreen variety, and so trained as to promise to result in a wind-screen to protect the the highway from the obstruction of drifted snows, such person so setting and training trees successfully for three years, shall thereafter be entitled to receive in account for any assessed highway, poll or other tax, within the corporate where the such highway is situate, annually, at the rate of ten dollars for each mile of road so protected on either side, for the period of twenty years; *provided,* said row or rows of trees are kept entire and alive, and in a growing condition.

SECT. 3. Any person who shall wilfully injure, deface, tear, or destroy any tree, thus planted along the margin of the highway, or purposely left there for shade or ornament, shall forfeit a sum not less than five nor more than fifty dollars for each offence, which sum may be recovered in any court of competent jurisdiction, at the suit and to the use of any citizen within the town where such offence is committed; *provided,* that whenever it shall appear to the selectmen of any town in this State, that any shade or ornamental trees therein are an obstruction or an injury to any highway, the said trees may be cut down or removed by their order.

SECT. 4. Any person who shall negligently or carelessly suffer any horse or other beast driven by or for him, or any beast belonging to him, and lawfully or unlawfully in the highway, to break down, destroy or injure any tree or shrub not his own, standing for use or ornament in any highway, or negligently or wilfully, by any other means, shall break down, destroy or injure any such tree or shrub, shall be subject to an action for damages in a sum not less than one nor more than twenty dollars for each offence, to be recovered at the suit and to the use of the owner or tenant of the land in front of which such tree or shrub stands, or at the suit of the surveyor of the highway in whose road-district such tree or shrub may be situated; in which case one-half the sum recovered shall accrue to such surveyor, the remainder to be paid by him to the town treasurer, to the use of the town. All penalties recoverable under the provisions of this act shall be by action of debt, before any trial justice, municipal or police court, or other court of competent jurisdiction.

The action of the Legislature on the foregoing memorial and draft of an act, (it being late in the session when presented,) was confined to its being ordered to be printed for the use of the two branches, and referred to the next Legislature. It is confidently hoped that it will then receive the attention which its importance demands.

Mr. Goodale introduced the following resolutions:

Resolved, That the recent spread of the fatal contagious lung disease commonly called Pleuro Pneumonia, causes a deeply anxious desire for its speedy arrest, before its hold upon the cattle of the United States becomes so established as to defy control.

Resolved, That we respectfully urge upon Congress the adoption of suitable measures to accomplish this end, including the prohibition, under heavy penalties, of the transit of diseased cattle between the several States.

Resolved, That the prevalent dearth of veterinary knowledge and the urgent need of it, furnish powerful and abundant reasons for the establishment of an institute for the acquisition and diffusion of veterinary science.

After reading the same, the Secretary gave a brief statement of the first introduction of the disease into New York, its continuance there from that time to the present, its gradual and almost unnoticed spread from there, so unlike the rapid diffusion which took place upon being subsequently introduced into Massachusetts, about 1860, through the Dutch cattle imported by Mr. Chenery. From the recent investigations of Prof. John Gamgee, it appears that the disease is now found in New York, New Jersey, Maryland, District of Columbia, Pennsylvania, Virginia, Ohio and Kentucky.

After further statements and remarks by several members, on motion of Mr. Calvin Chamberlain, it was

Ordered, That the subject matter of this discussion be presented to the Legislative Committee on Agriculture by the Secretary of the Board; and that he also be instructed to prepare and forward to the Congress of the United States a memorial, on behalf of the Board, touching the same.

These instructions were obeyed by the Secretary, but with what results we are not advised.

Mr. Wasson introduced the following, which was adopted:

Voted, That each member during the morning hour of to-morrow's session, report to the Board, the names of such weeds as infest the fields and gardens in their respective counties, especially such as are of recent introduction.

When the above was carried into effect, an hour was occupied by Mr. Frank L. Scribner, of Manchester, an enthusiastic young botanist, in exhibiting from his extensive herbarium specimens of many of the common and rarer weeds of Maine, giving with each, both its scientific and trivial name, and the synonyms by which it is known, together with a brief statement of its habits, &c. Mr. Scribner's collection was large, the specimens very carefully and skillfully prepared, and well arranged; giving evidence of rare devotion to scientific pursuits, as well as of earnestness and diligence of application under difficulties.

The thanks of the Board were voted to Mr. Scribner for his very instructive lecture.

On motion of Mr. Gilbert, it was

Voted, That a Committee be appointed to take in charge the catalogue of weeds, with instructions to report thereon, for the purpose of bringing information to farmers in advance of the introduction of new varieties with which they may be threatened, and to classify varieties known in different sections by local names.

Messrs. Gilbert, Brackett and Thing, were appointed the Committee.

On motion of Mr. Luther Chamberlain, it was

Voted, That the members of the Board be requested to preserve, during the next season, specimens of the several weeds growing in their respective counties (while in blossom), and present them on the first day of the next session.

On motion of Mr. Brackett, it was

Voted, That each member of the Board be requested to visit the annual exhibition in some neighboring county, and report thereon to the Secretary of the Board by the middle of November; also that the member resident in each county notify the visiting member of the time and place of such exhibitions, as soon as may be after the same is determined.

A designation of the members, each to a county, in accordance with this vote, was subsequently arranged and adopted, as follows:

The member	from	Cumberland	County	to visit	Waldo County.
"	"	Kennebec	"	"	Cumberland.
"	"	Waldo	"	"	Androscoggin.
"	"	Androscoggin	"	"	Maine State Exhib.
"	"	Maine State Society		"	Lincoln.
"	"	Lincoln	"	"	Sagadahoc.
"	"	Sagadahoc	"	"	Oxford.
"	"	Oxford	"	"	York.
"	"	York	"	"	Kennebec.
"	"	Penobscot	"	"	Aroostook.

The member	from	Aroostook	County	to visit	Penobscot County.
"	"	Hancock	"	"	Somerset.
"	"	Somerset	"	"	Franklin.
"	"	Franklin	"	"	Piscataquis.
"	"	Piscataquis	"	"	Washington.
"	"	Washington	"	"	Knox.
"	"	Knox	"	"	Hancock.

Mr. Wasson introduced the following preamble and resolution:

Whereas, It appears from the published doings of some Agricultural Societies, that premiums or other tokens of approbation or endorsement have in some cases been bestowed upon articles or implements where no tests of their merits have been instituted; therefore

Resolved, That the Board of Agriculture regard such awards as not only entirely unwarranted, but damaging to the usefulness and influence of such societies as guides toward the formation of correct judgment, and liable to result in serious injury to the interests of agriculture.

The discussion which ensued was participated in by several members, but the remarks submitted were imperfectly noted at the time. No differences of opinion appeared to exist on the snbject. All agreed that the matter was one of vital importance to the societies, and that *a reform must be made,* or the influence and usefulness of these organizations will greatly suffer.

Messrs. Wasson, Scamman and others, spoke of the hasty and imperfect manner in which examinations were too often conducted by adjudging committees, and of the premiums, diplomas and other marks of commendation sometimes given where no *evidence* of merit appeared. Instances were related where unproved new inventions and implements of husbandry thus received public commendation and went out to farmers at large as fully endorsed by such and such Agricultural Societies; and also where commercial fertilizers had premiums and diplomas awarded for no better reason than the plausible statements of interested agents and venders who were voluble in their praises, accompanied by certificates from persons whose qualifications to judge regarding merit, or lack of merit, were doubtful or unknown, and obtained by means or inducements equally doubtful and unknown.

The resolution was unanimously adopted and on motion of Mr. Brackett, the Secretary was instructed to communicate the same to the officers of the several county societies throughout the State.

FARMERS' CONVENTION.

There has been growing for some time among the members of the Board, a belief that their sessions might be made more useful if certain changes could be effected. The usual length of the sessions hitherto (two weeks) has proved too brief to permit the accomplishment of a great deal either in the way of original investigation, or of writing for publication ; both of which, to be successful, require deliberate and uninterrupted attention. At the same time, the sessions were found longer than was absolutely necessary for the presentation of papers previously prepared, and the discussions naturally arising from the same, together with such other matters as usually came up for action.

It was also believed that, if a considerably larger number of farmers could be induced to attend the sessions, and to contribute active aid, there would be the gain which almost always obtains where the giver and receiver communicate face to face, over what accrues to the reader of a written or printed communication.

Several other States having adopted the plan known as Farmers' Conventions, at which lectures are delivered and discussions opened by persons who have made preparations therefor, to be followed by others present giving the results of their several observation and experience, and this plan having been shown to possess many excellencies, it was decided to attempt a beginning in this way at the present session.

Accordingly several days were devoted to this purpose. Assistance was kindly rendered by several gentlemen, eminent in different departments of agricultural science and practice, some of them residing in the State, and some from without our borders, in response to an invitation to be present and participate. To these gentlemen the thanks of the Board were voted, and are due from the agriculturists of the State.

The first day was chiefly devoted to a consideration of the Potato, its culture and varieties, specimens of numerous varieties being exhibited, and their characters discussed.

Mr. Wasson read the following paper on the

History of the Potato.

The Potato—a remarkable instance of what human skill can do—is of the *Dicotyledonous* class, one of the *Night-shade Family*, of the genus Solanum, the species *tuberosum*, of varieties numberless.

Our word potato, is supposed to be a corruption of the Indian word *batatas*. In South America it is called *papas*, corrupted in Spain into *battata*, in Portugal softened into *batata*, in France into *patate*, in Italy into *patata*.

"Royle's Botany of the Himalaya Mountains" says: "The Old World is indebted to the New World for the potato. It was first found in a wild state in 33° south latitude, in the mountains near Valparaiso about 1550."

It has since been found on the mountains of Mexico and Central America; from which fact Humboldt concluded that as it was not known to the Mexicans in the time of Montezuma, it must have travelled north "in the course followed by the Incas in their conquests."

Humboldt also states that "the potato is not indigenous in Peru, and that is nowhere to be found wild in the part of the Cordilleras situated under the tropics."

Certain European botanists, among them Deppe and Schiede, conclude as probable that the English colonies in North America did not receive the potato from South America, but that this plant was originally in some country of the Northern Hemisphere, as it was in Chili. It is now asserted that the potato has been found wild on the Himalaya Mountains in Asia.

Says Dr. Smee: "The potato plant does not grow wild in any part of North America; but in its natural state, is only to be found on the western side of South America." A writer in 1597, said: "It groweth naturally, where it was discovered by Columbus."

It is beyond a doubt that the potato, at the time of the discovery of America, was already cultivated in South America, although it was not known in Mexico.

The history of the discovery of the potato, in connection with that of the sweet potato, is involved in obscurity. The sweet potato—believed by many to be of Asiatic origin—was the potato of the old English writers in the early part of the 14th century.

It was this to which allusion is made in Shakspeare "Let the sky rain potatoes."

In "Gerard's Herbal," published in 1597, is a recommendation to eat the sweet potato as common food, but the roots of the Virginia potato to be eaten as a delicate dish.

Sir Joseph Banks says: "The sweet potato was used in England as a delicacy long before the introduction of our potato; it was imported from Spain and the Canaries, and was supposed to possess the power of restoring decayed vigor."

The accounts of the introduction of the potato into Europe, are conflicting. The first published account on record, is said to be in *La Cronica del Peru*, printed in Seville in 1553, in which it is described and illustrated by an engraving.

Gerard was the first author who gave it the name of solanum tuberosum, which Linnæus and his followers have adopted. He received seedlings of the potato about 1590.

Sir Walter Raleigh is said to have carried it to Ireland in 1610. The *London Encyclopedia* says they were first introduced into Ireland in 1565, and thence into England by a vessel wrecked on the western coast, at North Meols, a place still famous for their production. It was forty years after their introduction, however, before they were cultivated about London, and even then, were grown in the gardens as a curious exotic. About 1684, they were first planted out in the fields, in small patches, as rarities.

In 1728, the potato was carried to Scotland, but the people opposed the introduction of this new vegetable, because its name was not mentioned in the Bible.

The priests in the Ionian isles, alleged that the potato was one of the forbidden fruits, the cause of man's fall, and its use was irreligious. In Sweden a royal edict was published in 1764, which introduced its culture.

M. Noel says: "This vegetable was viewed by the people of France with extreme disfavor." In vain did Louis XVI. and his court wear its flowers in the button-holes of their coats to enlist popular favor. At last, Parmentier the chemist, hit upon the following ingenious plan. He planted a field near Paris, put up notices around the field that all persons who stole any of the potatoes, would be prosecuted with the utmost rigor of the law; *within a fortnight, thereafter, every potato had been stolen and eaten!*

The potato was doubtless introduced into Spain in the early part of the 16th century, from Quito. It was imported into Italy from South America, about the same time. In all probability the Papists who early had a strong footing in that quarter of the globe, transmitted the root to the Pope. In those times it had a great reputation for aphrodisiac properties and was especially avoided by those who made vows of celibacy.

It is somewhat remarkable that in nearly every State in Europe its introduction met with great opposition; even as late as 1723, its use was interdicted in some of the German States, being accused of producing dysentery and leprosy. To *scarcity* and *famine* was its introduction due.

In 1663, the Royal Society of England took measures to encourage the cultivation of this vegetable to prevent famine; yet in the popular agricultural publications of England, as late as 1719—a hundred years or more after its introduction—it is hardly noticed.

Says Cobbett's "Poor Man's Friend": "It was during the old American war that the poor people of England and Ireland began to eat potatoes as something to save bread. The poorest of the people, the very poorest of them, refused for a while to use them." In 1822, Mr. Wakefield, an English writer says: "The misery and degredation of the Irish were chiefly owing to the use of the potato as the sole food of the people." Hanning made a still stronger assertion when he declared that "the Irish laborers ate only potatoes for breakfast, for dinner, and for supper." In a "Treatise on Cottage Economy," the author advises above all things to abandon the use of "Ireland's lazy root." Dr. Drennan adds: "It is the root of slovenliness, filth, misery and slavery."

The period of its introduction into the British North American colonies is not precisely known. Whether Admiral Raleigh when he discovered that part of America called Norombega, became acquainted with the potato, or whether it was sent to him by one of the first Governors of Virginia, is uncertain. It is first mentioned as one of the cultivated products of Virginia and Georgia in 1648, and among the products of New York and New England in 1749.

In its wild state, it is a watery, bitter, unwholesome plant, with tubers rarely an inch in diameter, or exceeding half an ounce in weight. Its flower is white. The skin of the tubers are either red or yellow, but never variegated.

The "New American Cyclopædia" says "there are two principal varieties, as shown in the color of the tubers."

The potato is now regarded as one of the most important of farinaceous plants for America; yet it required 200 years of cultivation, ere it obtained its fullest reputation. The most important constituents of the plant are starch and albumen. The amount of starch differs in different varieties, and also in the same variety in different months, having nearly four per cent. more in November than in August. It is well adapted to be eaten with lean meat, which contains much nitrogen.

To this country especially, where every one eats meat, it is invaluable, supplying as it does the elements wanting in that food. The muscle and brain-feeding principle resides chiefly in the seed end about the eyes. The salts of potassa are always found in the ashes of the potato; and it cannot flourish in any soil however fertile in other respects, which contains no potash; hence it is sometimes called a potash plant. The tops contain much lime.

The varieties of the potato are almost numberless. More than a hundred years ago, two hundred varieties were cultivated in the Horticultural Gardens of London. The Rev. Mr. Goodrich is said to have originated more than thirty thousand kinds.

The duration of the life of a variety is altogether unknown, for it is uncertain whether a variety is capable of being indefinitely propagated, or whether after a certain time it becomes enfeebled, and ceases to live from old age. There is a strong impression among farmers in favor of this latter hypothesis. Among the Germans, the duration is limited to fourteen years. With American farmers, few sorts continue to be cultivated even that number of years.

The varieties of the potato differ widely in shape of tuber, in foliage, flavor, and in productiveness. The leaves are pinnate, composed of five or seven lancecolate oval leaflets, having lesser ones between them. The blossoms are white, violet or pale. The tubers are rounded or oblong; their exterior is smooth, rough or warty, and in color, white, yellow, pink, purple, blue, black and spotted. The eyes or buds differ in form, position and color. The manner in which the tubers are arranged is different. Thus in the *Gurkin* variety the tubers form a pyramid with the apex downwards. The tubers differ in flavor and quality, varying from waxy to mealy. They differ in period of maturity, and in their capacity for long preservation. Some sorts are prolific in flowers and seed-balls, others are deficient in them.

New varieties are produced by sowing the seeds from the ball.

The potato balls should be gathered when perfectly ripe, and the seeds rubbed out with the hands. At the end of the second year some idea of their value can be obtained, for when raised from seed no special resemblance to their parents in form, color, or general characteristics, can be anticipated. Instances are on record where, out of 300 seedlings, not one resembled the parent. The Rev. C. E. Goodrich—who devoted a life-time to originating new varieties from seed—saved as worthy of propagation, only about a dozen sorts out of some 36,000.

Several theories have been propounded to account for the origin of sub-varieties. Every egg in the animal world—every seed in the vegetable world—is the combined product, or the result of sexual action. The pollen from the stamen falling upon the pistil impregnates it and causes the formation of fruit containing seed.

Variation by mingling in the hill is believed in by some. Mr. Trail stated before the Botanical Society in Edinburgh, that he cut about 60 blue and white potatoes into halves, through the eyes, and then carefully joined them, destroying at the same time the other eyes. Some of these united tubers produced white, and others blue tubers. Some were partly blue and partly white, and some were mottled.

The "Gardener's Chronicle" says: "A single eye in a tuber of the old *Forty-Fold Potato,* which is a purple variety, was observed to become white; this eye was cut out and planted separately, and the kind has since been largely propagated and kept true to its color of *white.*" Dr. Anderson observed the same phenomenon in the Irish purple variety.

Kemp's Potato is white, but a plant in Lancashire produced two tubers which were white, and two which were red; the red kind was propagated by eyes and soon became known as a red potato, under the name of *Taylor's Forty-Fold.* The California potato is much inclined to "sport," producing kinds widely differing in both shape and color from the parent form. Such sports, involving change of the form and color of the tuber in the hill, is probably due to the law of "reversion" or a returning back to some former type.

The catalogues enumerate more than 500 varieties. Many of them have several synonyms or misnomers. The Chenango—for instance—is known as the Mercer, Meshannock, Neshannock, Philadelphia and Gilkey. Some of these kinds, notoriously unproductive or uncertain, are re-christened with a *taking* title, and sold with extravagant recommendations, like the *Dioscorea Batatas*, which it was said "would produce sixty tons to the acre."

Throughout the United States during the year 1866, there were planted, in round numbers, 34,500,000 acres of wheat, to 1,000,000 acres of potatoes. In Maine the value *per acre* of these several crops were as follows in 1866 :

Potatoes, $79.56 ; Corn, $44.55 ; Wheat, $36.32.

England plants 500,000 acres, Austria 300,000 and France 1,000,000 *acres more* of potatoes *per year*, than are planted in the entire United States.

In Maine, the varieties which are of real value, are second only, as an article of diet, to bread and meat alone. From 1820 to 1840, the enlarged cultivated acreage of the potato in this State, was almost a surprise. In 1840 the aggregate number of bushels exceeded ten millions. In 1843, the "rot" made its advent (to all but the observing few,) with such wide-spread malignity as to cause general alarm that the potato was to be swept from off the face of the earth, and become extinct. Although the malady somewhat subsided after a few years' run, a decade or more of years were required to allay the panic and restore confidence. In 1860 the crop was computed at 6,400,000 bushels, evincing that something had been learned of the nature of the disease and the preventives, one or both.

Until 1843, the potato, unlike all other plants which are extensively cultivated under varied circumstances of soil, climate, condition and artificial treatment, was supposed to be exempt from any disastrous form of *distinctive* disease. It is true that much suffering was caused in Ireland in 1822, in consequence of the rotting of the potato after being stored. In 1831 famine and pestilence succeeded the failure of the crop from the same cause. It reappeared in 1838, *but this time in the fields*. In the meanwhile the disease was working its way all over the world, baffling the inquiries of scientific men. In 1846 a single week's time was sufficient for it to destroy the entire crop. "The observing few" claim, that the chain of evidence is unbroken which fastens the origin of the disease or rot, upon the country which gave us the potato. They claim that the pathway is visible as it followed the trade winds and ocean currents from Chili and Bogota to England by St. Helena and Madeira; and from England on the "highway of nations" to America.

The deterioration of the potato was observed in Prussia more than 60 years ago. In Germany a soapy taste has been observed for more than 40 years.

Notwithstanding these evidences of a coming pestilence, no sanitary measures were taken. The majority of farmers treated the potato as if its acme of hardiness was impossible to obtain—as if its vigor was absolutely incapable of injury by climatic changes, defective seed, indifferent culture or stimulating manures.

The cause of the disease is still regarded by many as a mystery "sealed with seven seals." It has been exceedingly fruitful of theories, but many a theorist has shown his wisdom in his retreats, rather than in his victories; has evinced a knowledge more of secondary than of primal causes.

Says a distinguished writer: "The Almighty has established certain laws by which animal and vegetable life are perpetuated, and although man may, for a *time* violate these laws with benefit to himself, ultimate destruction ensues. Look at the potato as it comes from the hand of its Maker, a rank weed bearing a few tubers of no value to man, but plenty of blossoms, plenty of seed, sowing itself and perpetuating its kind *ad infinitum* and in infinite variety. Man steps in now and modifies the original law; he ignores the seed, the true life, but selects a tuber and plants it instead, tenderly cares for it, stimulates an abnormal growth, increasing its size and improving its edible qualities, and calls it one of the best gifts of Providence. But the potato lives an *individual* life, not from 'generation to generation,' (like wheat reproducing itself according to its primal law,) and as an individual must succumb like a man to the inevitable feebleness of age. It can now hardly raise its own head. Its sapped vessels are weakened; a hot sun after a moist day, the most stimulating weather for growth, causes such a rushing circulation that the almost decayed arteries burst under the pressure, and blight and destruction ensues, just as the same causes rust in wheat. It is probable also, that this gradual decay has produced a change in the fluids of the plant, rendering them less rank than in its vigorous condition, and more inviting to the insects now preying upon it. It is evident that death is coming over the whole species, and in a few years it will be utterly extinct, in spite of the so-called remedies suggested by fumbling among second causes—instead of digging down to the great underlying laws of God in nature."

As an article of food, the potato possesses great value as it contains hydrogen, carbon, nitrogen, phosphorus, sulphur, iron and lime ; all elements of nutrition.

It is also valuable for medicine. It is of great efficacy—either cooked or raw—when used for scurvy. An extract of its leaves is a powerful narcotic, serviceable in chronic rheumatism, and painful affections of the stomach and uterus.

The starch of the potato is extensively employed in the arts. It is much used in the preparation of calicoes. It is often sold under the name of English arrow-root. Sometimes it is used as a substitute for flour in thickening soups and sauces. By heat starch may be converted into dextrine, or British gum. This substance is largely used as a substitute for gum-arabic. Postage stamps are gummed with potato dextrine. Potato starch acted upon by sulphuric acid with water, affords grape sugar. Cheap sugars are often adulterated with it. Alcohol may be made from potatoes. A French writer says 100 lbs. of potatoes will afford 30 lbs. of spirit. Even frosted potatoes are employed for the production of ardent spirits. Three and one-half bushels afford the same quantity of spirit as one of malt. The refuse of potatoes from starch making is employed for cleansing woollen cloths without injuring their color, and the liquor decanted from the starch is excellent for cleansing silk.

The Mexicans and the Peruvians are said to preserve potatoes for years by exposing them to the frost and drying them in the sun. In some sections of Michigan the potato has become a naturalized weed from living in the ground over winter. Some farmers say it the worst weed they have.

A French writer says : " The use of potatoes as the sole aliment of certain populations, is one great cause of the decrease in stature of the human species. For instance, in France the height of soldiers in 1789 was 5 feet 6 inches ; in 1823 it was 5 feet 3 inches, and now is only 5 feet." In Germany, says Liebig, where the people feed almost exclusively upon potatoes, the diminution of height is still more marked. We incline to believe that the custom among *civilized* nations of selecting the tallest men for the army, leaving those of low stature to procreate, is a more potent cause of diminution of height.

The custom, almost universal with American farmers of reproducing from "sets" or segments of the tuber, is one of the borrowed mal-practices of the Old World.

In the selection of seed, cut or uncut, there is a marked want of uniformity. One, dictated by a mistaken economy, selects small potatoes and grows small ones, in obedience to an irrevocable mandate that "what a man sows, that shall he reap." Occasionally, and under favored conditions, small potatoes may produce large ones. But such is not the rule, only the exception.

Another markets the choicest, and from the refuse gathers up the ripe and unripe, healthy or diseased, and at harvest finds demonstrable proof, that "like begets like." Says Virgil:

> "I've seen the largest seeds, though viewed with care,
> Degenerate, unless the industrious hand
> Did yearly cull the *best*."

In the choice and cultivation of varieties the same indifference is too often manifest. Each variety possesses certain characteristics peculiar to itself; as it may require a full season to mature, or it may ripen early, or it may have slender upright stalks fitted for close planting, or profuse foliage, with large inclining branches, demanding excessive area—it may be tender or hardy, a good bearer or shy—it may be true to its kind or disposed to return to some former type, yet to each kind with its individual peculiarities, is meted out the same measure of culture.

The effect of cultivation, at best, is to change the character of the potato from its normal condition, with excess of stalks and leaves and connected with deficiency of tuber, to a diseased or abnormal condition having excess of tuber, and deficiency of leaves, and compelling those tubers—or more properly mere dilations of the stem—to perform the offices of reproduction, for which the flowers and fruit were destined.

The seed of varieties strictly speaking, is not natural seed. It has another element in it, and unless this element has its peculiar wants supplied, it becomes modified, diseased, or is lost.

Every farmer should have a knowledge of the characteristics of different varieties, and of the correct names and genuine forms of each, and should endeavor to ascertain which are most perfect in their structure and possess most fully the qualities he may wish to perpetuate.

To this end, and in view of the value and importance of the potato, its uses as well as its abuses,—the annually increasing varieties—the deterioration, from causes known or unknown, controllable or beyond control, of the older and favorite kinds—the true and false conceptions of the cause and nature of the disease,—the confusion of names—the record of failures in two volumes, that of successes, in one,—it is assumed *that there is truth somewhere*, which has not been ascertained; and as a preliminary step towards its attainment, it is suggested that the Board of Agriculture cause to be made, a catalogue of all the varieties cultivated in the State, to which should be added year by year, new varieties as they appear.

In all probability, there is not a cultivated variety of the potato, which retains intact the aboriginal characteristics of the wild prototype. Each is a fruit of crossing, many times repeated, which has given to us a potato modified by cross impregnation, and by all the influences connected with soil, climate, culture and local condition. How much this has led to divergence of characters, or rendered this modified plant impotent to resist the attacks of insects or disease, is not fully known.

Many plants change in character under domestication. The proportion of gluten in wheat differ much in different climates. The pea shows a strong tendency to vary in certain soils. Some varieties completely change character. The sugar beet has doubled its saccharine juice since its cultivation in France. The hemlock will not yield conicine in Scotland. Rhubarb grown in England partly loses the medicinal qualities which make it so valuable in Chinese Tartary. The sassafras in Europe loses the odor proper to it in America. The oak is worthless when grown at the Cape of Good Hope. The cabbage will not head in tropical countries. The yellow of the cotton goods so popular forty years ago, known as *nankin* or *nankeen,* is said to be due, not to any artificial coloring, as is natural to suppose, but to the peculiar soil in which the cotton grows. This soil is strongly impregnated with iron.

A word of caution and encouragement, and I close. The present excitement in regard to new varieties in a measure rivals that of the tulip mania in the 17th century.

When a cow has been exchanged for a single potato—when $50 have been tendered for one tuber without buying it,—when $20,000 have been offered and refused, for a limited number of bushels, it is hard to tell which most abounds, sense or nonsense.

With the new sorts already offered, with others to come, we may anticipate some interesting developments in potato culture. We deprecate a panic.

We are far from believing that the potato has reached its acme of palatable or prolific qualities. Its history—the developments incident thereto—the laws of progress—all inculcate and strengthen such belief. And more, whoever produces a better potato than we already have, is a public benefactor, and if he gives us one which will produce more to the acre, he adds largely to the wealth of the country.

During some remarks by several members, after the reading of Mr. Wasson's paper, a question was addressed to the Secretary regarding what constituted a variety, or a sub-variety.

Mr. Goodale in reply said, there was among plants a *genus*, that is to say, a group of plants, having certain characteristics in common, which characteristics distinguished them from other plants, called "Solanum." This genus embraces the potato, the tomato and several others. The *species* of Solanum called "tuberosum" is the potato, "tuberosum" being its specific name, and embraces all varieties of the potato. Like many other species, the Solanum tuberosum, or potato, was *subject to variation when grown from seed.* When grown in its native habitat, and under the conditions of nature, the variations were comparatively slight and might escape notice; but when cultivated under differing conditions of soil, climate and food, the variations increased rapidly, and reached a wide divergence from the original or normal type. Many seedlings grown under the care of the gardener resemble each other closely, yet undoubtedly, no two of them were exactly alike in all respects.

If Mr. Goodrich raised thirty thousand seedlings, as reported, he produced that same number of *varieties*: although probably not more than one in a thousand of them was worthy of extensive cultivation as a field crop.

Another style of variation sometimes appears; for we find occasionally that a part of the product grown from the planting of one tuber shows a difference in form or color from the rest. This is called "sporting," and is more commonly noticed with parti-colored varieties, or mottled ones, than with self-colored ones. If such a sport be planted, it may perpetuate itself, or it may revert back, or part may continue the sport or divergence, and part may not. If a variation *thus originated* be perpetuated, you have what may with propriety be termed a "sub variety;" and this, I conceive, is the way in which some diversities of shade in color, or of form, may appear in the same variety; and sometimes lead to doubts as to its identity; but these sub-variations, so far as I am aware, rarely go so far as to affect the general character or value for purposes of cultivation, of the variety.

I do not believe that putting two tubers of different varieties in the same hill will cause any mingling. In the case mentioned in Mr. Wasson's paper, on the authority of Mr. Trail, the result is easily accounted for as an ordinary sport; while all the other instances mentioned are obviously the same thing and nothing else.

But in order that our gathering to-day may yield the most profit, I suggest that we now proceed to take up, one by one, some of the varieties shown here, which are most prominently before the public, and compare the results of experience in different sections, in order to obtain more definite knowledge of their actual and comparative value, and I think it would be well to begin with the Orono. This being agreed to, that variety was taken up.

ORONO. Mr. Goodale:—Here we have the potato most largely grown in this State, especially for export. Its great popularity is partly due to the fact that hitherto it has grown well and yielded well upon almost all soils and under almost all the conditions in which potatoes are grown in Maine; and partly to its possession of those qualities desirable in a market product; productiveness, good color, and attractive appearance generally, a large proportion being of saleable size, and very uniformly of fair quality. It is grown under many names, but mostly sold abroad either as "Orono" or "Jackson white." Although sufficiently distinct from the Jackson while growing, the tubers bear a close resemblance to each other, the principal difference being that in the Jackson the eyes are rather deeper.

Having found it grown in different sections as the "Reed," "Carter," "Foote" and "Holmes," as well as "Orono" and "Jackson," I would suggest that it is competent and would be desirable for this convention to decide here what the true name is.

Mr. ————. I move that it be known hereafter as the "Reed," since Mr. Reed of Orono originated it, and it should bear his name.

Mr. Goodale. My impression is that the rule adopted by the Pomological Congress in regard to names of fruits would be applicable here. It is understood to be this: that the person who originates or first introduces a fruit to notice has a right to name it and that name, unless palpably inappropriate, or offensive to good taste, is to be held to be the proper name. But if he sends it out among cultivators without a name, and becoming disseminated, it picks up several names, that one should be adopted by which it has become most widely known. If this potato was first grown by Mr. Reed and he had disseminated it as the "Reed," or by any other name which he pleased to bestow, that name should most certainly be deemed the proper one. This does not appear to be the fact, but rather that he ignored, or waived the right to name it. So far as my observation has extended, those who know it as the "Orono" are many times more numerous than those who know it by any other single name; it would therefore seem that this should be fixed upon as its name, and the others discarded as leading to confusion.

This proposal was agreed to, a vote being taken, fixing its name as the "Orono."

Mr. Frank Buck of Orland. The Orono has been for years our shipping potato and we think it will continue to be, unless something better than we know of at present is found to take its place. I am glad the name is definitely decided upon.

Mr. Gilbert of Greene. The reputation of the Orono, in my section, is fast waning, and it is being superceded by other varieties. My opinion is, that west of the Kennebec it is "running out," and has had its day.

Mr. Thing of Mt. Vernon. My residence is west of the Kennebec. They were brought into our section twelve to fifteen years ago by Mr. Philbrick of Garland, with the name of "Orono," and they are generally known by the same name now. It is decidedly the leading potato, and I think likely to be for some time to come. We have a very pretty, smooth, white potato known as the Snowball, of about the same character as the Orono, but most people prefer the latter.

Mr. Brackett. In Waldo county this potato is largely grown, and many thousands of bushels are every year shipped from Belfast to Boston, where they are quoted as Jacksons. It is almost universally planted, is commonly known among us as the "Foote" potato, and considered above all others *the best* for market purposes.

Mr. Stackpole of Kenduskeag. The Orono is, as yet, our most profitable variety, but it is beginning to fail, and we should be on the look-out for a substitute to take its place, and that before very long.

The next variety taken up was the

Early Goodrich.—Mr. Gilbert of Greene. A strong grower, free from rot, production not large, not early, not first-class for the table, but very popular, and generally gives good satisfaction.

Mr. Perley of Naples. The yield with me was at the rate of 238 bushels per acre, about one-eighth rotted; not early, quality fair.

Luther Chamberlain of Atkinson. Ripens a little earlier than the Jackson, and two weeks later than Early Blue.

Mr. Atherton of Hallowell. Fully two weeks earlier than Jackson, and a little later than Sebec. Size above medium, long and roundish, and the eyes slightly raised. Skin dull white, flesh white, cooks mealy, and is of fair quality. For some reason, I know not what, it is getting a bad reputation in Boston; said to grow small in Massachusetts and poor in quality. It may be because they cannot raise good potatoes in Massachusetts anyway. With me it yields largely, rots little, and is a good table potato.

Mr. Wasson of Surry. Needs the whole season to grow in, is very productive and of superior quality for the table.

Mr. Buck of Orland. Yields from 35 to 40 fold, rots but little, is of fine quality in fall, and fair quality in spring; is working its way into favor rapidly.

Samuel Taylor of Fairfield. A fair table potato, not the best; grow uniform, neither late nor early. Ripens with the Jackson, and do not rot.

Mr. Brackett of Belfast. Produces well. Quality only fair, not generally liked as a table potato.

Mr. Pettengill of Augusta. Have been raised with us one year. A fine table potato in late summer and autumn, but not good in winter and spring. Very productive. Uniformly a good grower and early.

Mr. Goodale of Saco. Have grown it two years. Vigorous, healthy and productive. On sward land, plowed in spring, and manured with Cumberland super-phosphate alone, the yield was at the rate of 312 bushels per acre. Was disappointed in the quality. In autumn they were inferior to several others. In spring, rather better than the Orono.

Mr. Wilder of Pembroke. Hardly first-class for table, but very productive. The first year I raised them the yield was fourteen bushels from one peck planted.

Sebec.—Mr. Atherton. Is a very fine table potato, but do not yield largely. If planted early, on dry ground, are pretty sure, but otherwise will rot badly. Size medium, skin white, bluish about the eyes, flesh white, sometimes slightly tinged blue, round, slightly flattened, eyes deeply set, quality first-rate. Two weeks earlier than the Goodrich.

Mr. Frank Buck of Orland. Some of our farmers grow this for a fall table potato. It is slightly shaded with blue under the skin. In some localities it rots, but not very badly; on the whole its culture is declining. Many prefer the old Chenango and raise it more successfully.

Mr. Gilbert. Large, of average productiveness, but rots badly, is not planted so extensively as formerly.

Samuel Taylor of Fairfield. Consider the early Sebec as fully equal to any other early potato. It is a *white* variety; the eyes are not blue.

Mr. Thing of Mt. Vernon. What is known with us as Early Sebec is usually a white potato, but there seems to be, as cattle breeders say, two or three strains of blood in this variety, and while most are white, some have dark eyes, others are largely shaded or streaked with blue, showing color plainly after being boiled. They all appear to have the same general good qualities otherwise, and all claim to be genuine. I hope we may find out what the "Early Sebec" is, for I think it destined to be extensively cultivated as a garden potato.

Mr. Brackett of Belfast. It is early, of fine quality, skin white, flesh blue veined, roundish oblong, a fair producer, liable to rot. Its cultivation is fast diminishing.

Mr. Chamberlain of Atkinson. The town I live in is next to the town of Sebec. We have known this potato many years. It is of good quality and produces well, but so liable to rot that very few attempt raising them.

Mr. Goodale. Can any one enlighten us as to the origin of this potato? It seems to be generally supposed abroad, to have originated in Piscataquis County, but I have not been able to learn that anybody in Sebec claims it for a native of that town, or thinks so highly of it as Massachusetts people do.

Mr. Stackpole of Kenduskeag. It did not originate in Sebec. It is a white variety, not very early, about the same as Jackson, good in autumn, but does not winter well, and rots badly.

Mr. Calvin Chamberlain of Foxcroft. I have had much trouble with that name, but have at last I believe, got through with it. I happen to live just outside of Sebec. Some years ago, while visiting a friend near Boston, a market gardener, he asked me to procure some seed potatoes for him—the Early Sebec—direct from headquarters. It was the first time I had heard the name; but being supposed to know something of the important events that transpire agriculturally in my immediate neighborhood, I thereupon took special care to inquire if any man or woman in the town of Sebec ever claimed to have produced a good potato. All my inquiries were unavailing. Recently I have learned that a fellow dealing in "truck" in Boston, who claims to have lived once in Sebec—the town is probably none the better for it—to "raise the wind" put this name to a good old potato. The name is applied to a variety that was brought to this place by Mr. Wm. Mitchell of Dover, about forty-five years ago. Mr. M., then an old man, worked a long time in the Province of New Brunswick, receiving his pay as was the custom of the times, in silver coin, which he brought in his pack through the forests by the way of Houlton. He found a potato in the Province so satisfactory to his taste, that he brought seed in that toilsome journey, from which our part of the State has rejoiced ever since.

Harrison.—Mr. Gilbert. A strong grower, uniform, large size, pure white, very productive, quality second-rate.

Mr. Brackett. White, long, eyes sunk, quality good, produces well, free from disease. The coming potato in our section.

Mr. Buck of Orland. Yields from 35 to 45 bushels from one bushel planted. Is rather late, but a strong grower, and retain their good quality until time for early potatoes. Are pushing their way into cultivation stoutly.

Mr. Atherton of Hallowell. From one bushel planted last spring we dug twenty-five bushels. They were very handsome, cooked well and we were highly pleased with them. But towards spring they became poor in quality, cooked soggy and hard, and the ends of some became black.

Mr. Pettengill of Augusta. We have grown the Harrison only one year. From two bushels sowed on one-sixth of an acre the yield was sixty bushels. Others in the same vicinity have done as well. It is free from rot and keeps well. In quality not quite equal to the Orono, but we expect it to improve. Is now a good eating potato in the fall. It is white, shaded with a little pink about the eyes.

Mr. Stackpole of Kenduskeag. I have not grown the Harrison, but those who have raised it the past year in my neighborhood speak much in its praise, both as to quality and productiveness, and certainly its appearance is much in its favor for a market sort. It has seemed to me more likely than any other to be adopted in place of the Orono, which shows signs of failing.

Mr. Samuel Taylor. A healthy, good potato, quality not equal to Jackson; not liable to rust or rot.

Mr. Elisha S. Carr of Hancock, exhibited good specimens grown from sprouts alone; 25 sprouts yielded about half a bushel.

Mr. Samuel F. Perley. Raised from eight pounds seed, 844 pounds; of which 130 to be deducted for small and rotten.

Garnet Chili.—Mr. Wilder of Pembroke. A very prolific sort, second only to the California in productiveness, do not rot even upon low land; grows large, and is late, the flesh yellowish white; is of inferior quality for the table.

Mr. Gilbert. A good grower, and productive, free from rot; in quality resembles Davis' Seeding.

Mr. Goodale. Has been led to think that, notwithstanding some points of resemblance between Davis' Seeding and Garnet Chili they differ widely in this, that the Davis succeeds better in a rather heavy soil, and the Garnet Chili in a lighter one. In his own case, on heavy loam Davis' proved better in quality (for spring use) than was anticipated, and yielded more heavily than any other, while the highest expressions of value in the Garnet Chili as a general rule came from those who grew them on light soils.

Mr. Gilman of Brunswick, on light soil, prefers Garnet Chili to all others. He raised the past season from six to seven hundred bushels. He tells me this year for the first time many were false hearted, but deems it an exceptional result.

Davis' Seedling.—Mr. Gilbert of Greene. A strong, healthy, uniform grower, productive, very free from rot prior to 1868 when it rotted badly. Quality good; grown extensively.

Mr. Thing of Mt. Vernon. It is largely grown for stock, taking the place formerly held by the California, which have had their day, and mostly passed away, I hope never to return. Davis' Seedling is very productive, and does not rot more than most other sorts; is of fair quality for the table, but its color is against it for market purposes.

William P. Atherton, Hallowell. Profitable for stock, but hardly fit for the table;—at least not until spring. It cooks mealy upon the outside, but falls to pieces before cooked through. It is sometimes called the "Scotch Apple." Rots but little if planted on dry ground.

Mr. Stackpole of Kenduskeag. A good table potato—healthy, hardy and productive.

Mr. Lowell of Augusta. A strong grower, liable to neither rot nor rust; good for table use.

Mr. Brackett of Belfast. Red, round, flesh white or tinged a little, fine quality, very productive, grows late, not specially liable to rot, the best late spring and summer potato known among us.

Union.—Shown by Mr. Gilbert of Greene, who stated that it was a new variety, originating in the town of Minot. In color, form and quality, almost identical with Early Sebec, but the eyes less sunken, and ripens earlier. The tubers attain large size at a very early period. Valuable for early use, but like nearly all first-class table potatoes is liable to rot.

Early White.—(Long Potato) Exhibited by Mr. Gilbert. The earliest known variety. Has no other good quality; is not fit to be eaten when grown.

Mr. Brackett. Very early, rot badly, deteriorating fast, and but little cultivated.

Buckeye, or Bickford.—Shown by Mr. Gilbert. A medium size, smooth, handsome, red potato—a good grower, quite productive, free from rot; by some deemed first quality for spring and summer use.

State of Maine.—Mr. Gilbert of Greene. This potato originated in the town of Hebron, where it was known as the "Bearce" potato. A quick, early grower, formerly quite productive, but not doing so well now; liable to rot, but not seriously. Quality number one all the year round.

White Mountain—Mr. Gilbert. Quality second rate, but sells well on account of its size. On some soils gives good returns, on others it fails.

Mr. Wilder. What we call "Mountain Whites;" of fair quality, and not liable to rot.

Mercer.—Shown by Samuel Taylor of Fairfield. Mr. Taylor said: This is reported to be a seedling from the old Chenango or Philadelphia, has been grown in my neighborhood for three or four years, and now occupies a higher position than any other. It resembles the Orono very closely, the difference being that it is rather smoother, the eyes not quite so deep, skin a trifle darker and rougher. More uniform in size and better flavored than the

Orono, but not equal to the Jackson. It is less liable to rot than any other known in these latter days; planted side by side with Orono, with same soil and treatment the yield is two-sevenths greater. I intend to plant very few of any other than these and Jackson. The Mercer for market and the Jackson for home table use.

MONITOR.—Shown by Samuel Taylor. The most productive of all potatoes, not excepting California; rots badly, watery, very poor quality.

GENERAL GRANT.—Shown by Andrew Archer, Esq., of Fairfield. Mr. Archer stated that this potato originated in Phipsburg on the farm of Capt. Thomas Oliver in 1856, was then known as the "Golden Seedling," and more recently as the "Oliver" potato. Was introduced into the town of Fairfield by Mr. Emery and at first known there as the "Emery," but latterly as the "General Grant." They are held in high esteem, being a very early, reliable, fine table potato, producing well and not liable to rot. Grown on a heavy clayey soil in 1867 and 1868 he found them, on on his own land, to be the earliest he had ever grown, producing well, free from rot, very mealy and fine flavored.

(It is to be regretted that the reports of discussions on the subject of potato culture were imperfect when taken, and were mostly mislaid, so that they did not reach the Secretary for use in this Report.)

Mr. Stackpole said, that in the culture of potatoes, his preference was for pasture sward,—to have a light dressing of barn manure on the surface, well harrowed in,—to be planted early, in drills made by a marker drawn by a horse, marking three rows at a time, three feet between the rows, seed from medium sized, smooth potatoes, cut so as to require about eight bushels to the acre, one piece of seed in a place, 15 inches apart in the drills, well covered; and when about six inches high well cultivated between the rows, and then hoed with a horse hoe. In digging, I take the horse cultivator and drag off most of the dirt from the sides of the rows, thereby saving much hard labor in digging.

Mr. Wilder said, we have always been in the habit of seeding too high. I have found that when I put but two or three eyes in a hill, I have raised more potatoes, of larger size, with fewer small ones, than when I planted whole potatoes, or cut them up and planted without regard to the number of eyes in a hill.

Such kinds as the "Jacksons" and other varieties having a large number of eyes, I cut into pieces containing one eye each, never planting the seed end, on account of there being so large number of eyes in so small a space, making it difficult to separate them.

I plant in hills, putting about three eyes in a hill, and succeed better than in drills.

We have a great variety of potatoes in our section of the State, the oldest of which is the "White Blue Nose," so called, which has been raised there for the last forty years. Specimens of this variety presented at our county fair last year, were as perfect, and large and fair as those raised forty years ago. I prefer them for the table to any other kind. They are several weeks earlier than any other variety.

Mr. L. Chamberlain said, the Early Blues produce well in Piscataquis county, but rot badly during the winter, although perfectly sound when housed. The Royal Purple is considered with us as the best table potato known. It does not yield very largely, neither rots very badly, and every man who has had them on his table one year *will* raise them again.

Mr. Thing said: In nearly every garden in Kennebec county may be found the "Early Blue Nose," known in many places as "Dummers." My mother brought them on to my farm forty-three years ago from the farm of Shepard Bean, Esq., of Readfield, and they have been grown there ever since, and, though I am not a prophet or the son of a prophet, I predict that when the Early Rose, Early Goodrich, Harrison and Garnet Chili live only in history, the Early Blue Nose will be as well known and as well liked as it is to-day. Give them good soil, good cultivation and a cool dark cellar for storing and they are so near perfect the year round that I do not ask for anything better.

Our potatoes are generally grown on sward land, with a light coat of green manure spread on, with plaster in the hill, a fair crop of merchantable potatoes, (Oronos,) is two hundred bushels per acre. Potatoes are often grown with a little super phosphate and plaster in the hill, with no other manure, and they do extremely well; I think this way of manuring is on the increase. It is thought they rot less than on yard manure, the weeds are got rid of, and with Chandler's horse hoe and a boy, one may plant and hoe as many potatoes as they please. It has been the universal practice to cut the seed, and put two or three pieces in a hill, but

I find farmers are talking about planting whole potatoes, and putting in more seed. I hope the question will continue to be agitated until we learn whether the lessons to be drawn from the careful and elaborate experiments published in the last Report of the Secretary of this Board apply equally well in New England as in Old England.

Dr. Loring of Salem, having been called upon to express his views upon the cultivation of the potato, remarked that he hardly felt authorized to give an opinion on a subject in which the farmers of Maine were so much better informed than the farmers of almost all other sections of the country. Maine, he said, is especially adapted to the cultivation of this plant. The new soil and the high and bracing latitude are peculiarly fitted to that crop which is beginning to decay in older soils and under milder skies. The valleys of the Penobscot and Aroostook, as well as many of the more northerly and interior sections of Maine seem to be the home of the potato, from which not only the best crop can be raised, but where can be found also the most healthy seed for crops elsewhere. He would always renew his seed from Maine; and not from western or southern lands. And he urged the necessity of great care in the selection of potatoes, and nicety in the preservation of all the distinct varieties, in order that purchasers from abroad could obtain what they desired with unerring certainty.

With regard to the cultivation of the potato it was evident to him that new soil, and non-nitrogenous manures were indispensable for a large and perfect crop. From remarks made at this meeting, by the cultivators present, he had learned that neither night-soil nor a liberal supply of solid barn-yard manure was useful. The effect of large quantities of strawy manure, in which the soluble mineral matters of the decaying straw were furnished liberally to the potato, seem to be very striking. And there seemed to be no doubt that the same manuring which answered for the Swedish turnip would also answer well for the potato. For the Swede, super-phosphates in their best forms have proved invaluable. And so for the potato he would furnish an abundant supply of fertilizers of this description. The excessive stimulus of nitrogenous manures evidently forces the potato into an unhealthy condition. And he urged the avoidance of them especially in crops from which our seed potatoes are to be taken.

From further experiments and observations reported at the meeting, he concluded that seed potatoes should be of medium size, and should be planted either whole or cut into not more than two pieces. It is evident that long continued use of the eye alone from year to year has materially diminished the crops of many localities. It is evident also that the planting of the stem end alone produces a comparatively small number of potatoes, of even growth and firm consistency, while the planting of the sprout end gives an abundance of potatoes in number, less uniform in size, and great luxuriance of vine. The potato itself is a plant, and in order to get the best result from the planting it should have the well-balanced effects of both ends—the stem and the sprout. A whole potato then, for seed; or a potato cut in two pieces, from sprout-end to stem-end, in order that the balance may be preserved. Of the size of the seed potato, it should neither be too large nor too small. Small potatoes are immature, and are as unfit for seed as an immature animal is unfit for breeding. Overgrown potatoes are usually coarse in fibre, and unhealthy, and they are as unfit for seed as an overgrown, coarse and feeble animal is unfit for breeding. Immaturity on the one hand, and excessive growth on the other, should be avoided. Either may answer for a short time—but in the end, the evil effects will become manifest.

Dr. Loring concluded by allusion to the value of the potato crop, which has passed out of the list of common and cheap farm vegetables into the list of luxuries; and urged the utmost care in its cultivation as the only source of profit.

The exercises of the day following were opened by the delivery of the following lecture on

THE BREEDING OF HORSES,

BY HON. THOMAS S. LANG.

Mr. Chairman and Gentlemen:—I was not aware that I was to be called upon to speak upon any subject before this Convention until too late to prepare such matter as I should feel satisfied to read to you.

So far, through life, I have made it a point to do any thing in my power that could add to the interest of agriculture, or any of its branches. Therefore, I have answered the call of your Committee of Arrangements.

The subject assigned me, "*The Breeding of Horses,*" is so broad, to go into detail, as to inspire misgivings that in the time allotted I shall be able to interest you.

And as progress is the watchword of the nineteenth century, a watchword which I fear animates me too sensibly at times, especially when speaking of such a fast subject, I shall be happy to be criticised by any of you if you see me going astray.

If what I offer serves to call out from others the theories and experience by which they are acting it will do no harm. I have no expectation of pointing out anything new for your consideration in the rearing of horses. The subject has often been exhausted by men of greater experience. My treatment of the subject must be general.

But I cheerfully add my mite, acknowledging the honor which the invitation conveys from the farmers of Maine.

The rearing of horses is a matter of more importance than is generally supposed by those who do not give the subject thought, and is a class of breeding in which there are more and graver mistakes than any other.

The ox, cow or sheep, can be made to meet the wants of man as food after their usefulness in labor, or production of wool or their kind is ended. Unlike other domestic animals, we are unwilling to eat the horse when he is unfit for labor. I have no doubt however, that the day will come when the meat of the horse will be used as food in this country.

Four years ago there were two or three shops in the city of Paris where the meat of horses was sold as an article of food, and to-day there are over two hundred shops where it is sold exclusively. It is sold exclusively because few can discover it from other kinds of beef, and thus the Government guards against imposition.

In this country, however, the horse is only wanted for purposes of labor or pleasure, and when from old age or other causes he no longer answers the demands of his owner, his death ends expenses of keeping, his value is gone. I was curious enough to inquire several times in the market in Paris for horse beef, the relative value of the living animal in fair condition and that of dressed beef. The answers were from 50 to 65 per cent. in beef of his worth as a laborer.

It will be readily seen that the successful rearing of horses admits of fewer mistakes than that of cattle and sheep. Yet with few exceptions do you find breeders of horses considering thoughtfully the laws which govern their reproduction.

I do not wish to be understood that I believe there are laws which may be studied and conclusions which may be adopted that will lead one in a successful road always.

For one constantly finds exceptions which are without the accepted rule of "like producing like," but are generally made plain if we carefully study cause and effect, allowing our investigations to go back through several generations. All such investigations will make us stronger in the belief of the correctness of the general theory of generation.

Here is a point to which I would like especially to call the breeder's attention, although I do not doubt your own observations have led you to adopt the conclusions (*and it is applicable to all kinds of stock-breeding*): That the safe plan in selecting a representative animal, a dam or sire, especially the sire, is that they should not only be in the line of acceptable stock for several generations, but that they should be individually capable of transmitting these desirable qualifications.

I have in my mind several animals of good antecedents and such as I would select if pedigree and configuration only were to be consulted, who never produced an acceptable animal. And I may go further and say that I have known own brothers, one of them capable of determining the character of most of his get, while the other was worthless in this respect, and was not followed by animals of his size, color, or constitutional powers, yet these brothers were nearly alike in general appearance.

The fact is noticed by many writers upon the subject of breeding of horses.

I. H. Walsh, author of *British Rural Sports,* treats of this subject at some length, citing such examples as Touchstone and Launcelot, own brothers, of same color and appearance, yet the get of Touchstone were nearly all patterns of himself even to color, dark bay or brown, while Launcelot's were of all colors and of but little account upon the turf.

If then we grant that there is no certainty in our efforts, it would seem that we are afloat for a safe course to pursue as a rule.

I do not wish to convey that I believe it chance, beyond our reach, although it may be to a certain extent beyond our control, unless experience step into the place left for it by science.

To repeat: I do believe in breeding in a line of desirable qualifications as the foundation of our success in any branch of breeding whether of cattle or horses, or of any particular class of horses.

But be sure that the animal selected to represent this class or reproduce it, be proved by trial to possess physical power and nervous energy enough to determine the qualifications of its get.

If the animals selected are types of your wishes, know that they can reproduce these types, or you are afloat without compass, and while you may land somewhere in the direction of your wishes, yet with no certainty at the desired haven.

In selecting animals to breed, as a matter of course you will consider which class of horses you desire to produce. The running horse for sporting purposes, the trotting horse which may be used for any purpose as a gentleman's horse, the carriage horse for family use, the truck horse or a combination which is found among the horses raised by the farmers of New England. Each class has its *sine qua non* of excellence suited to the uses for which it is desired.

The lumberman of Maine or Minnesota would be unwilling to accept the thoroughbred horse of Kentucky for his business. Or the truckman of our cities would not accept the gentleman's driving horse for the sturdy labors of the trucks.

Therefore having selected that class which you desire to produce, next comes choice of sire and dam, as the first consideration.

The sire is of the most importance, because experience teaches that he determines the character of the progeny much more than the dam.

Dr. Alexander Walker in a work upon intermarriage treats this subject with distinct and convincing arguments. He asserts that the breeding of domestic animals is conducted in the most uncertain manner for want of practical knowledge of the power of each sex to give his or her organization, and he clearly expounds that one class of organs is propagated by the male, and others by the female. And the inference which I draw from his writings that these evidences are better defined in domestic animals, on account of the less mental influences to which they are subjected at the time of conception. The late eminent physiologist, Dr. Knight, as well as Dr. Walker, argues upon this point among others, that the sire gives character to the locomotive organs and the dam to the nutritive organs.

So far as the locomotive organs are concerned, I may cite you to the fact that nearly all the produce of trotting stallions bred to pacing mares, are trotting progeny, while that of pacing horses with trotting mares is pacing colts. An important fact to be remembered when considering these influences is that stallions are kept in *healthy, strong, determining, energetic* condition, much more than the mare, and this brings me to the point claimed by the best writers, and I believe it,—that the blood horse determines the peculiar type of his get much more surely than mixed blood. His constitutional powers have been kept up to the highest point by careful, judicious selections of the most able, vigorous animals in each generation. And when they are stinted to mixed blood or cold-blooded mares, the type is in favor of the horse.

In selecting a sire to breed, I should first select an animal in the line and class desirable. His health and vigor are of the first importance; also the health and vigor of the sire and dam, and grandsire and grand-dam.

Their size, formation, color, temper, &c., follow to be considered. The size is determined by the use the animals are intended for. If for trotting (*a class that brings the highest price*) 15 hands to 15.3 is the desirable height, and 900 to 1000 lbs. weight in *unfit* is best, as all over this weight is surplus weight to be carried. And while there are many fine trotters 16 hands and over and weighing 1100 lbs. and over, yet experience proves that, qualifications being equal, the tenons give away under the action of greater leverage and the feet oftener give out under the force of impingement and weight which larger animals generally are subjected to.—This is equally true in the running horse and roadster; the 900 to 1000 lbs. roadster lasts better than a larger one, while in the team horse weight is needed and speed must be given up to a great extent.

Having selected a size suited to the proposed stock so far as pedigree is concerned, formation is next to be considered. If you wish to have running stock for sporting purposes, the running horse exercised and bred to that exercise must be selected; as in almost all cases the peculiar motion and fitness of the joints and muscle attachments in this class of horses are suited to this movement and not to trotting movements. Yet these characteristics are modified by one or two crosses, particularly when trotting stallions are stinted to running mares.

Let the hearer examine the position taken by the hind feet of trotting horses of approved open gait while standing at rest, and those of the majority of running horses, and he cannot fail to see the effect of the formation to which I refer. It would be absurd to expect a trotter, however well the animal might be formed in other respects, if his stifle formation and muscle attachments prevented the proper trotting movement.

Having selected the horse in the long line of good ones, of right size and movements, good health and temper are to be considered as positively necessary. If he has good health, good temper generally follows, but not always. If health is lacking he will not be able to give good health to his progeny. Lack of robust health lays aside all chances of success in performing labor requiring speed or great bottom. And where the temper is bad, all other qualifications being good, the animal is of little value especially in trials of speed in company. While speaking of health in a sire I am led to wish that I might be favored to convince you, as I have been convinced, in the course of careful observation, of *the absolute necessity of this point*. Do you, gentlemen, expect animals to reproduce anything but him or her self, or both, and the combinations which have made up their animal organisms through the generations succeeding? Then why not demand that the animals which you couple shall not only combine the antecedent qualifications, but also a thorough physical organism in their own bodies. I would accept no sire who was not sound in every respect touching his constitution, free from all affections of the blood, from which,—*now mark*,—from which nearly all the ills horse-flesh is *heir* to, descend. Chapped heels, scratches, flat feet, thin-shelled hoofs, liability to false quarter, spavins, curbs, pinched feet, navicular disease, as well as very many other difficulties which I need not mention, have their origin in the condition of the blood. Your own experience must convince you that to drive a horse and heat up his blood and then let him stand in a draft or without cover until he cools, will certainly produce a feverish state of the blood. In the human race it rushes to the head generally.

In horses it goes to the feet, or its effect is felt at the feet, for two reasons,—first because it is supplied more fully to the feet than elsewhere. The other reason is owing to the peculiar constitution of the foot inside of its horny walls, thus there is no room for the swelling produced by the inflammation which must follow this distorted action; and the greater the disturbance the greater the pressure, and consequently more disastrous. Now my point is to assure you that a dam (*the dam especially*) who, although possessing a naturally good organism, has had her blood operated upon by these accidents (*and my wonder is there are not more of them*) and her feet affected by this distressing fever, must surely qualify her progeny, and especially if she is suffering its pain while in foal. This affection of the blood was feverishness from outside influences, and is equally applicable to like difficulties induced more readily when the blood is rendered turbid by strong feed without exercise enough to throw off the feverish state or element in the blood.

To return again to the subject, I want to refer you, those of you who have examined the stock of American Star, a horse nicely bred so far as pedigree is concerned, yet with so light muscle attachments that few of his progeny pull through without trouble. And I might mention many other horses known to you, which have constitutional defects that have been bred to the great damage of the breeder.

I wish I was able to impress upon the minds of all present the importance of thorough health and constitutional perfection. I believe I speak from experience and with reflection when I urge this point.

Since I have been engaged in breeding, I have had opportunity to observe these points in the get of many stallions of my own and others, and I have made a point of recording for a number of years a description of all mares stinted at my stables, their points, defects, &c., and comparing as far as practicable this record with their produce.

This record some years amounted to 200 mares,—thus we were drawn to conclusions which have materially changed our opinions upon many points. Many sound horses which have gone through many hard trials safely, have produced colts which were proverbially unsound when placed at work. And I have been unfortunate enough to have purchased very fine animals of approved stock at large prices, whose stock was of little value. If by acknowledging these mistakes and pointing them out it shall be of advantage to any, it will be well.

Before passing from this subject, I wish to remark that the form and structure of a horse indicate to what extent he can perform what may be required of him.

If great speed and prolonged action, he must be supplied with sufficient bone and muscle, and the processes must be prominent. To use the words of another: "Considered mechanically the bones form the frame work of the animal machine; in the limbs they are hollow cylinders admirably fitted by their shape and texture to resist violence and support weight." The character of the substance of the bone is of the greatest importance, and the difference between the bone of the thorough-bred and one not thorough-bred is very marked, calling the attention of the most careless observer.

The bone processes, or projections, which serve as levers for the muscles to act upon, must be prominent and well defined, or the animal cannot make great efforts,—no matter how good wind, and temper, and vital powers he may have,—without danger of injury by slipping of the muscles from the bones by the action of the muscle in contraction between these attachments. This slipping or strain of the unprotected muscle produces spavins, curbs, &c., as the fluids ossify, or form into bone, involving the joints and action of the muscles.

If these conclusions are correct (and I have endeavored to study such causes carefully) how many men who breed horses post themselves carefully and act understandingly, when selecting animals to breed of either sex?

Of the many mares brought to my stable each year for breeding purposes, nearly half are unfit to breed from, expecting to produce the best stock, or satisfactory results, and I doubt not many breeders can say the same. It is very hard to convince many men that their favorite mare is worthless as a breeder—the chances being entirely against the breeder. They are willing and anxious to pay the fee of service and expect to get a satisfactory result therefrom, or the horse is to blame.

Shall I draw a supposition or two like which there are many examples? A gentleman of means in some city has a favorite mare who has served him well but having become broken down by hard usage, accident and good feed, finds it necessary to supply her place with a more vigorous animal, sends her to the country to breed to some horse who has trotted fast, or whose owner has had his horse well posted in the public journals, without any idea by examination of his physical powers, or antecedents, or how they will couple, yet is disappointed when he succeeds in getting a colt, that it is small, ill-formed and worthless, and is disgusted with his experiment, and if kept a stallion, as they are in many cases, is sent to the country to spread his faults further. Another class of mares used for breeding, and they are nearly four-fifths of all in New England, is the farmer's mare of all work, which from under size, bad color, broken wind and unsoundness of all kinds, or ill-temper, are set to breeding because they cannot be sold for a fair price in the market. Yet these mares are expected to breed fine colts if they are only bred to a fashionable horse, and the horse bears the blame.

To cure some of these, I have thought that a good tax upon a stallion kept for service or royalty upon his service, and the same upon breeding mares, would have the effect of reducing the number of poor ones, and would result in being a great benefit to all in a short time.

When you have selected the stallion you desire, his colts from approved mares being satisfactory, your next consideration must be the dam and her qualifications.

If your stallion is selected on account of his gait and physical make for a trotter, then must your mares partake of similar make and motion if you expect success with reasonable surety. If your stallion is selected to breed gentlemen's carriage horses, then the taller mare with more upright shoulders, narrow loins and closer and shorter gait, closely corresponding to the stallion intended for such a class, is best.

These two classes are combined with success oftentimes so as to make a good carriage horse, quite fast. But beauty, fine carriage and fine size must give way to a great extent if great speed is required.

The finest gentleman's horses I have ever seen were in France. There breeding is carried as near perfection as possible in this class as well as in the sporting horses in which the French people seem to be much interested, and bid fair to beat the world. An afternoon ride in the Bois de Bologne of a fine day would show an observer many hundred pairs of bay 16½ hands horses as near perfection in motion and symmetry as possible, and admirably bred for the uses intended.

While in that country I had opportunity to converse with many breeders, especially at the annual fair held in Paris which was visited by the eminent breeders of the empire. And these conversations led me to observe the point dwelt upon as important as a principle or element in breeding,—the close assimilation of the male and female in general characteristics if you would keep up the standard that you may have with reasonable success.

In conversation with a gentleman who was interested in the an agement of the National Society for the improvement of Horses, he said, "Our Emperor is doing a great work in improving the horses of the empire, bringing to the work the best physiologists and men of position and judgment, and they have reduced the breeding of the best horses in the different classes to a science."

"In pursuance of this plan," said he, "the Government selects and brings in the appropriate sires," and he gave me a list of the government stallions then in the stud of France, amounting to 350 animals, all selected for their fitness in the class where they were wanted, and located in 26 different places in the Empire.

No mean animal could be kept, and if he was ever so fine himself, if his get proved ordinary, he was placed at work and removed from the stud.

Thinking this a proper opportunity to inquire in regard to the class of dams to be used, and their qualifications, he assured me of the necessity of similarity in size, form and character of sire and dam, if a given type was desirable.

I referred to the fact that Gen. Fleury who has charge of the government stables, had been breeding for several years, as I heard, the best "Norman" mares, which are very large, with the best English thoroughbred horses, for cavalry purposes. He at once said this is true. The English had a cavalry horse that could outlast ours on account of blood and long lines of breeding to lasting qualities, but they were deficient in limbs and feet, and soon broke down on them. Therefore the smallest compact Norman mares were selected and bred to the best of these stallions, and the second cross is an animal that can last, and is equal to any horse in the world upon the road or hard land. He admitted that the first cross was far from satisfactory in many cases, but succeeding crosses were a success.

I hope you will pardon me for this reference to foreign management, but it so agreed with my convictions in my small opportunity of observation, that I could hardly refrain from speaking of it in your hearing.

To return to the selection of a dam. After selecting one in a desirable line and such as you wish in every particular, it is necessary that care should be used to select one in full vigor, not too young and undeveloped, or too old and past her prime.

Many young or old mares may give you fine colts. Yet it is safer to select mares of full strength and vigor.

Many writers upon breeding, especially the breeding of horses, admit that animals may be bred with success when one is quite young or old, provided the other is in full vigor. I am willing to admit that this may be so in many instances, but as a safe rule to follow it is not correct, especially if it be the dam which is selected to be the young or old one.

Females of domestic animals and the human race seem to have three distinct periods of life which are fixed by Nature, qualified to some extent by climate, habit and food.

1st, The undeveloped period of early life.

2d, The developed period of middle life.

3d, The decline of physical power in age.

In the life of animals when the organism has so far advanced as not to require vegetative life for its own progress, it then becomes capable of reproduction. And the power to reproduce increases, as the waste of vegetative life increases in the system. What a wonderful consideration is here presented. Nature supplying a regulator whereby health is maintained if the female does not reproduce. The waste is expelled from the system at regular periods. The whole action of these functions to be changed as soon as conception takes place, and the waste goes to supply the embryo.

Leibig, who is standard authority, says that *"every drop of the superabundant blood goes to produce an organism like the mother."*

Now for our point:—

If the dam is too young to be fully developed, she can have no surplus to provide for her progeny, or must divide it between the embryo and her own wants, and both are thereby injured. On the other hand if too old, past the second period, the decline of vegetative power affects in a corresponding degree the progeny.

Next to mature age the dam needs to be so formed as to give plenty of room for the embryo. Width across the hips is very much to be prized. If the pelvis and back ribs are not large and deep the fœtus will not have sufficient room.

Be sure that the udder is well developed so as to secrete plenty of nutriment for the foal, or so as to contain it if secreted.

If the dam is ever so good physically, and the sire equally so, the foal will not meet your expectations unless he is well fed the first six or eight months of his life, as during this time the character of the bone and muscles and muscle attachments are formed.

Would you hoe or manure a plant after it has matured and commences to ripen, or while the sap is running vigorously and the plant is forming would you water and cultivate?

What is kept from the colt the first year can never be fully supplied. Therefore let the dam be a milker, or well developed if she has never bred previously, so as to make as sure of the fact as you can. Let her temper be good, yet filled with nervous susceptibility, and her health perfect, then will she impart strength and size to the embryo while she carries it, and it depends entirely upon her for nutriment while it lies in the uterus, and is attached to it. Previous to that contact it is supplied from the yolk of the ovum the same as the fowl before hatching. Therefore, it will be seen how necessary it is that the dam be in perfect health, and that all the secretions be perfect and the absorbents and canals which convey the secretions, which are to supply life and characteristics, be perfect.

I had occasion some years since, to dissect the well known mare "L'Esperance," formerly owned in New Orleans. After a sickness brought on by calculus in the bladder, or formation of stone, this increased very rapidly after the first month of pregnancy. The dissection took place after the 6th month of pregnancy. The embryo was perfectly formed to the eye, for the time. And the attachments of the uterus and placenta were perfect so far as I could judge. Yet on account of the want of the proper supply of nutriment the embryo was not larger than a cat. This was an extreme case, but it served, with many other cases from other causes, to convince me that it was highly necessary to keep the dam in perfect health.

Do not fear to use good feed after six months from the time of stinting. Oats, good hay and oat meal, and gentle exercise, out of excitement, yet in company so as to be cheerful and contented. And as soon as the foal is dropped and the attendant inflammation is reduced let liberal feed be given, changing occasionally so that appetite shall be kept up. Old oats, oat meal or bruised oats, are preferable as a standard food (*barley never*) with good grass from old high land pastures. Sweet feed if possible, and avoid the luxuriant feed of manured fields.

When the colt is weaned, or before, if he will eat them, let him eat all the oats he will and not get too fat. This seldom occurs, *never in my experience.*

This is the practice of the best breeders in this and other countries. In a letter received not long since from one of the best breeders of horses in Kentucky, he urged me to spare no efforts in good care and feed of the dam three months before foaling and of both afterwards. This point is understood by the Arabs, who give the best of the family supplies to the foal mare. And in this connection I will refer to what has been said upon the relative influence of sire and dam upon the progeny, and the idea which is common among us when speaking of the Arab, and their devotion to the mares of the tribe, from which the idea is obtained that the dam is of more consequence in breeding than the sire. Not long since I read a letter to "General Dumas," written by the celebrated *Arab Chief*, "Abd el Kader," which was published in the fifth number of "*Bailey's Magazine of Sports*." He remarks—"It is true that the foal proceeds from the sire and from the dam, but experience of ages has proved that the essential parts of the body, such as the bones, the tenons, the nerves, and the veins, proceed always from the sire. This is beyond all doubt, and the meanest Arab knows that any malady of the bone under which the sire is suffering at the time of service will be perpetuated, such as splints, blood and bone spavins, &c."

This is going too far, in my opinion, especially in reference to nerves, as the thorough health of the dam, whose blood in the main makes up the strength of the nervous system, has, so far as my experience and observation goes, a controlling influence. And, further, I have in mind a stallion who is spavined in both legs, who has been stinted to hundreds of mares, and a large number of colts pulled through sound, while few were spavined like the sire. These spavins in the sire were caused by excessive labor and exertion. I am willing, however, to adopt in general the proverb of the Arab, as given by Abd el Kader: "El hor ilebal el fahal,"—"The foal follows the sire."

My reasons for this conclusion have been previously given. And as English and French writers upon horses dwell much upon the writings of this celebrated Arab chief, in his descriptions of his favorite animal, I shall take the liberty to give his ideas of the relative value of the sexes. He describes the horses of the desert as distinguishd under the following heads: "*El Horr*," "*El Hagdin*," "*El Mekueref*," "*El Berdoune*." "El Horr" is that in which the sire and dam are both of noble race, and thus takes the lead.

"El Hadgin" is that in which the sire is noble and the dam of common race. It is considered less than "El Horr," its name Hadgin, or defective, being derived from the word "Hurdjess," which signifies faulty.

"El Mekueref" is that in which the dam is high bred and the sire half bred. Although this approaches the Hadjess, it is of much less value. The name of this class is derived from "*haraf*," *mixed*.

"El Hadgin" is superior in quality on the same principle that a man whose father is white and whose mother is a negress, is superior to him whose mother is white and father a negro.

"El Berdoune" is that class in which both sire and dam are badly bred.

And he adds, "This animal is a stranger to our country. The value of a horse is his breeding."

I may have tired you with this subject and will pass to another point not so well established, but one that nevertheless is beyond doubt of much importance; that is, the effect of the first impregnation upon succeeding progeny.

The influence of the first impregnation may qualify all subsequent ones. That it does many of them in a marked manner is well known to many breeders, here and elsewhere. I was urged to visit the College of Surgeons in England and examine the examples to be seen there preserved, which were the result of experiments to that end. I have regretted that I did not do so. Very marked instances have come under my own observation, and so convinced am I of this qualifying effect that I would not breed a mare which had been previously bred to an objectionable horse. And if I desire to breed in direction of the sire as much as possible I would select a mare that had never been stinted to any horse but the one selected.

I have in my stable at home a chestnut gelding by Gen. Knox. This gelding has a striped face and very peculiar hind feet and pasterns, and a peculiar manner of placing his feet upon the floor, a peculiar gait and temper. His dam was white by a white horse and Knox is black by a black horse. This colt has no resemblance to either sire or dam but is a second edition of a colt of the mare by Hiram Drew, and the build, temper, color and marks of Hiram Drew and a close resemblance to that horse's colts in many instances.

Now if the embryo is the result of the contact of the semen with the ovum may not more than one of the ovaries be influenced by the same contact, and while one is fructified may not the other be influenced so that a subsequent copulation may bring it to life somewhat under the first influence. This is urged by many writers and thinkers. Is there any other satisfactory theory for the effect of coupling King Charles spaniels and black and tan dogs, and the results which are patent to the experience of many, or with black and white breeds of swine.

I have not spoken of these influences because Herbert, Stonehenge, McGillivray, Carpenter, Goodale and others have written, or placed theory and facts before the public, but because I have seen practically the operations of these influences or phenomena, not only in horses but swine and dogs.

Thus the breeder has not only the complex influences of the sire and dam on their progeny to care for in his plans, but also the effect of former breeding of the same dam, and "taking back" as it is called, in the line of both sire and dam, and still another influence not much believed in and until lately the subject of much amusement in observing the efforts of some men whom grooms have thought to be superstitious.

I refer to mental influences at the time of copulation which may influence the dam at the period of conception and during pregnancy.

I do so far believe in and adopt this idea as to always endeavor to control the nervous impulses of both male and female at the time of conception.

My grooms are always enjoined to place the mare, as far as may be, several hours under the influence of the horse while in heat and before service, and also to avoid other horses and their influences at this time. And to this end I have dispensed with the use of teazers in my stable.

Within a day or two I have unexpectedly fallen upon an extract from a work written by the physiologist Walker, spoken of, which expresses my belief and convictions so closely and in so much better terms that I decided to offer them in evidence. Speaking of mental organs, he says: "It is evident that in all voluntary acts in which two sexes are engaged, two thinking systems are involved; and, as the first portion of the thinking system, sensation and observation, is passive or dependent on impression, and the last portion dependent on passion and volition, is active and exciting to locomotion, it is evident that, in the act of reproduction, one or the other sex will be relatively passive, and the other relatively active. Hence the progeny will receive from the one parent the organization in which, in the thinking system, sensation and observation depend, and from the other that in which passion and volition spring; for the very term reproduction implies the communication of similar organs and functions, *and of the most energetic and characteristic ones.*" And the writer sums up the entire law by saying that the thinking organs are in equal and distinct portions derived from both parents; while the dam gives the whole of the nutritive, and the sire the whole of the locomotive organs. Now, while I believe this for the most part true, yet experience proves many individual cases exactly opposite from the writer's theory, and I am prepared with living witness of the fallacy of this conclusion as a rule.

I now have one mare who has five colts, the first four with her exact shape of leg, and motion, and subject to the same difficulties which the dam had,—curb and infiltration of the hock joint,—the fifth was formed like the sire in the leg, and had the sire's motion. This mare was by American Star, and higher bred than the stallion stinted to her, and of tremendous nervous power. She determined her get, until, by a happy condition of the same stallion, he altered the produce. This change was looked for and prophesied by my superintendent.

While speaking of mental influences, I wish to cite an example which I believe illustrates that point. A black mare whose sire and dam were black, was coupled with the black horse Black Hawk Telegraph whose sire and dam were black. And this was her first produce—it was chestnut, with *white face, wall eyes*, and four white legs. I was disappointed in the result, and was led to conclude that a colt of Trotting Childers which had those marks must have been stinted to this black mare, but my superintendent convinced me by reference to the books that this *Childers'* colt was castrated some weeks previous to this mare's coming to my place, but that while in heat she was in an adjoining yard, and in communication over the fence with this odd marked colt, and that while under this influence she was taken to the black horse, which, not having much service at the time, came out noisily and abruptly, terrifying the mare very much. If breeding is subject to such influences, how many are there who endeavor to counteract or control them?

The subject of *in and in* breeding ought to occupy more attention among the breeders of horses than it does. Because the effect is bad if kept up too long or injudiciously, is no reason that the effect is not excellent to a certain extent, especially in fixing a type.

There can be no doubt that Nature fixes about two generations as the limit that may be profitable.

The wild horse of the plains selects his own daughters until his age and strength give way to younger and stronger contestants, who in time follow the same course. To breed in once, and then out once or twice, then in again to the first line, I have no doubt will give good results.

This subject is treated to such length by authors whose experience is worthy of your consideration, that I will leave it with the endorsement given. I may add that I am trying the experiment in a few cases with fine success, so far.

Before closing allow me to remark that the rearing of horses is capable of being a remunerative business by study and good judgment, which is only directed and made good by investigation into and adopting the theory of generation as closely as possible. Without this it is certainly the poorest branch of farming interest, and admits of fewest mistakes.

But with a dam decidedly well-bred (*thorough-bred, if you will*) of good form and size, and good temper,—no matter if nervous if under control,—(*and one always has a certain index of this point in the width of the brain between and over the eyes*) and good color and structure, coupled with a horse of good size, say fifteen hands and three inches, and good form and color, with prime health and temper, good bone and feet, straight hind leg, hock not too low, and reasonable slope to the shoulder, and natural trotting movement, must give a class of animals that will always bring a remunerative price in New England for road and gentlemen's use. For trotters, the best thorough-bred mares for dams, especially if they have been bred to trotting movements. I would then select the horse for his constitutional powers, and true, steady, trotting movement; and the better bred he be, the better. The longer he has been bred in the line of those qualifications which you wish, the surer you are of satisfaction in his progeny, and this repeated point is more observable in this class than any other. There are many practical points which are worthy of consideration in connection with this subject, which we cannot discuss for want of time.

One point claims the attention of horse-breeders, as well as of agriculturists generally, viz,—trials of speed at agricultural fairs. Several New England journals of agriculture seem disposed to use their influence against these trials, and propose not to allow the breeder to show his animals at speed during their exhibitions. If it is wrong, if it decidedly involves any principle of right or morality, to train and exercise a horse to that qualification which is demanded in the market, then it should be stopped. That it is allowed to engross too much attention, I will not gainsay. Who are to blame, the managers of a society, and the judges who control the exercises, or the jockeys and roughs of society? If trustees make suitable rules, select suitable judges, and have spunk enough to control such occasions subject to their views, I see no reason of complaint. Men will bet upon the relative speed of horses, so they will upon elections, the probable condition of the money market, and shall all such exciting measures be lain aside, entirely as a sanitary measure, because a few men bet, or a society cannot get talent enough to apply a remedy?

Maine has 100,000 horses. Is it out of proportion to assume that 20 per cent. of all are bred to speed for gentlemen's road and pleasure use? Hardly a breeder that does not wish that all were speedy. Allow $200 to be an average price (*and it is far below for this class*) you would have quarter of a million of dollars in fast horses in this State. Now will not their training and public exposition be likely to increase their value from 25 to 50 per cent.? Yet this increase must be given up because ability enough cannot be displayed in the management of societies to control the bad tendencies.

Fast fine horses are wanted in the market, and so are wheat and barley. Should encouragement be withdrawn from all, because whiskey and beer are made from them, or money is bet upon the trials of horses? The man who breeds horses pays taxes as well as the breeder of cattle and sheep, and his rights ought to be respected with others, especially when his efforts bring out cash to pay premiums to all.

Push him out, and is the community bettered by his having these trials by himself? The people will certainly go to see a good horse trot. And if once a year a community can spend a day or two and see cattle and sheep, and swine, and farm products, and horses, and have the pleasure of seeing them show their fine points and action, it cannot fail to bring a crowd, and give satisfaction. I have been breeding horses 20 years, and attending legitimate exhibitions of horses at societies' exhibitions, and have seen no occasion to think less of myself, that I have been engaged in breeding fast horses. Nor do I believe I have lost the respect of the public because I have added this interest to the other interests in breeding, or of agriculture in which I engage. As to the general influences which the rearing of horses has upon individuals and society, compared with other branches of stock breeding, I know of no material difference. And a careful examination of the laws which govern success in these pursuits cannot fail to build substantially upon our characters as thoughtful men.

The influences of such a pursuit need take nothing from our dignity as members of society ; for I firmly believe that the man who by observation and research, becomes acquainted with the wonderful theory of generation and its innumerable changes, and the ease with which it is made applicable is answering to the wants and pleasures of man, will be led to acknowledge the power of nature to mould and fashion at his will, forms of beauty and intelligence for his use. He trusts no longer to uncertain chance, but bowing in the light of science to the wisdom of every combination, and the philosophy which surrounds the conception and pathway of every living thing, he becomes purer and better.

It is a matter of deep regret to the Secretary that he is unable to furnish reports of the discussions which followed the delivery of the above lecture, and also of those in connection with the lectures subsequently delivered.

The same inability attends the two very interesting and instructive lectures delivered by Hon. Henry F. French of Boston, on Under-Drainage.

Provision having since been made for the services of a phonographic reporter, it is hoped, in future, that those unable to be present may be furnished with the substance of what is listened to by those attending the Conventions.

The following lecture was delivered by Prof. George L. Goodale of Bowdoin College,

On the Diseases of Plants.

Mr. President, and Gentlemen of the Convention :—I invite you to study at this time some of the diseases of plants. Even in its strictly scientific bearings, the subject is of importance to every farmer, and it becomes of engrossing interest to him when the study of plant-diseases leads to sound practical suggestions as to means of cure. The science of vegetable pathology which treats of the diseases of vegetation is based upon facts developed in certain departments of chemistry and botany. To these we must add a branch of study which has of late years risen to the rank of a science, microscopy. A clear understanding of the laws relating to the diseases of plants presupposes familiarity with the sciences just named, as well as close and prolonged investigations in the laboratory and on the farm. Very little attention has been devoted in this country to the subject, partly from lack of material for methodical study, and partly from lack of opportunities for field experimentation. The subject is an obscure one. Nearly all the light which has been thrown upon it has come from the libraries and the laboratories of European botanists and chemists. The facts which I present now have been derived from a survey of the English, French and German works upon the diseases of plants, and I wish to be distinctly understood at the out-set as refraining from expressing my own opinions relative to disputed statements and contradictory hypotheses. I shall bring before you the trustworthy records of foreign observations, and leave you to draw your own conclusions in regard to matters still in dispute.

Let us first gain a clear idea of a disease. The word disease originally meant a want of ease, and in this sense it is used by an early English writer. It is so employed in Wickliffe's translation of the New Testament, in the 33d verse of the 16th chapter of John, "in the world ye shall have disease," that is want of ease, but in the translation which we all use, it reads "in the world ye shall have tribulation." The word disease has now a wider signification than this. It is applied to maladies and morbid states of the body. The word is now defined by medical writers to mean a derangement of the normal function of any part of the body, thus being used almost synonymously with the term "disorder." Normal means according to a standard or a rule; and the harmonious working together of the functions of all parts of the body, according to the normal or standard, gives us what we know as health. Now when we establish a straight line as a standard of health, it is plain that we may have deviations above as well as below this line. Do not understand me to say that a person can be too healthy, that is impossible. It is, however, obvious that any part of the organism may do more than its proper work, may be too active in the discharge of its function, and this deviation from the line of health is above it, and is, as truly, a disease as if the same part of the body failed in activity. When the eye fails even in the brightest light to distinguish objects, we say that the organ is diseased, it fails to perform properly the function required of it.

But, as you know, the eye may be too sensitive instead of dull. It may shrink even from the faint light which struggles through a darkened window. In this case the organ is performing more than its proper work, and it is truly diseased. It is important therefore to remember that any part of an animal or vegetable organism may be either sluggish or too active in the discharge of the function which the Creator has imposed upon it, and either the torpidity or the excessive activity constitute disease. If this is clear we are prepared to consider certain conditions which constitute disease in plants. Let us now apply our definition of disease to vegetation. Is a plant diseased when any part of its organism deviates from its normal function? Plainly the answer is yes, and considered strictly as a scientific question, it is a correct answer. But for the purposes of the present paper, the answer must be *no*. A farm or garden plant is not necessarily called a diseased plant, even when any of its parts deviate from their normal function, and we must distinguish carefully between conditions which you term disease in plants, and those which a botanist would recognize as such. A few illustrations will make this plain.

Take the wild rose, for example. This beautiful single flower is made up of four circles of organs, two outer to envelop and protect the two inner. The inside circles are the reproductive organs of the plant, and by the proper discharge of their function, the ovules are fertilized and become seeds, or embryo plants. In order to ensure the perfection of the seed, the two inner whirls, or circles, must be complete and active. Both the third circle which is made up of yellow threads yielding a fertilizing dust, and the fourth circle, containing the ovules, must be present and sound. Now if you transplant the wild single rose from the thicket in which it hides to your rich flower gardens, and place it in the most fertile soil, you will observe that a change gradually occurs in successive flowerings. For a year or two, you will see that the four whirls remain as before, two enveloping and protecting, two to carry on the mysterious office of producing seed. After a while it will be perceived that many of the yellow threads of the third circle give place to the purple petals of the second circle, and eventually they disappear, being merged into petals and forming what we call a double rose. The double rose, in which the yellow dust-threads have all been changed by cultivation into the purple petals, is incapable of reproducing its kind by seed. The flower has thus been made to deviate from its normal function of producing seed, and by our definition, the double rose is a diseased flower. Nevertheless, the gardener seeks, by careful selection and cultivation, to transform all the yellow stamens into colored petals; and by his art the richest of all flowers is produced. You will see, at once, that there is a wide difference between a double rose, the type of health, and a flower attacked by what a gardener terms a disease. It is plain that the gardener has a different conception of a disease from that which is conveyed by our definition.

There is a plant cultivated in gardens for its fine crimson foliage, which well illustrates the difference. The plant, like the common barberry, has green leaves which are to assimilate in the air and sunlight, the crude juices brought from the roots through the stem; this power of assimilating the crude sap and working it over into food for the plant, resides in the green tissue of the leaves, and this power is diminished by a change in the color of the leaves. When the barberry leaves become purple through some causes imperfectly understood, it is my belief that the assimilative power of the plant is lessened, and the plant is diseased. But this diseased condition may be perpetuated by the care of the gardener, and the purple color rendered a characteristic feature of the plant. In the case of the purple barberry, and the other plant, to which I have referred, the gardener has succeeded in rendering permanent a disease of the leaf, because the diseased plants are deemed more desirable for cultivation in gardens, than the same species in perfect health. It is the design of the gardener to render certain plants diseased because they bring a higher price.

Therefore, we must for the purposes of this paper, modify the definition of disease as applied to plants, and while we admit that a diseased plant, is, scientifically speaking, one in which there is a deviation from the normal function of any part, we must urge that, in plant culture, a plant-disease is a condition in which there is any such deviation from the normal function of any part as unfits it for man's use.

I shall ask you to accept the following definition as one adapted to the maladies of agricultural plants. A cultivated plant is diseased when there is any departure from the normal function, so that the value of the plant becomes impaired for the use of man.

Viewed in this light, the subject is very practical and bears directly upon the interests of agriculture. Primarily the object of farming is the production of those plants which afford clothing and nutriment to man and food for domestic animals. Plants, which from any cause fail in the accomplishment of this object and are hence of less value, may be said to be diseased.

This being plain, I will now ask you to bear in mind that there is a remarkable analogy between the diseases of plants and those of animals. Thus we may have plant-maladies which come upon whole districts as epidemics come upon whole communities; we have those which spring up among plants of a certain locality and which reappear year after year from local causes just as we have endemic diseases among men. We may have general diseases affecting the whole plant, and special diseases affecting only a part. As we shall soon see, we have diseases of plants which closely resemble diseases affecting man and the domestic animals, and in some cases the causes of the diseases seem to be absolutely identical.

Before commencing the study of either the general or the special diseases of plants, we must review the elementary facts in vegetable anatomy. These dry details are, by no means, interesting in themselves. The recital of them is, on the contrary, dull, and it will tax your patience; but at the risk of tiring you, I must notice some of the more important features.

We shall study first the anatomy of a flowering plant, and I shall select for this purpose the ordinary buckwheat. It consists of roots, stem, leaves and flowers. When a piece of this plant is picked in midsummer and carefully examined in the laboratory, it is found to consist largely of water. The water gives it roundness and freshness. Its amount can be accurately estimated by comparing weights of the plant before and after drying. The percentage of water in the buckwheat is 70 per cent. Having dried the plant and driven off 70 parts of water in every hundred, we may proceed in two ways to determine the other constituents, by burning the tissue and saving all the products of combustion. One of these ways consists in heating the plant in a vessel of glass without allowing the air to have access to it. Upon the application of heat, the plant is seen to give off slight fumes of vapor, and to rapidly darken in color, until at last only a mass of unconsumed carbon is left in our retort. The carbon retains the form of the dried plant, just as charcoal preserves the shape of the wood from which it is made. The carbon which we have thus made *is* charcoal. It constitutes 10 parts in 100 of the buckwheat when air-dried. The vapors which were given off, and which have nearly all condensed in the cooler parts of the glass apparatus, are found to consist of coal gas, coal tar and water, composed of carbon, hydrogen and oxygen. The other way is to burn the plant cautiously in a glass or platinum vessel, with a slow current of air supplying the oxygen necessary to complete combustion, and with an apparatus to save all gases given off. At the conclusion of this experiment it will be found that a little fragile skeleton of the plant is left behind, but it is not black like the carbon residue. It is white and very light, and weighs only two per cent. of the whole plant burned. This skeleton is called the "*ash.*" It is composed of various compounds of lime, soda, and other substances which we must soon notice more in detail. The vapors which were given off are made up of carbonic acid and water. The carbon in the latter case is burned, in the former experiment it was saved chiefly as charcoal.

In recapitulation it must be seen that the constituents of the buckwheat are compounds of carbon, hydrogen, oxygen, calcium, sodium, &c., but these elements do not exist in these forms in the plant. The skeleton which was left after burning the plant contained phosphates, silicates, sulphates and chlorides of various elements; the gases which were given off during the combustion existed in the plant in complex compounds known to chemistry as water, cellulose, starch, &c. Sometimes the ash constituents are spoken of as inorganic, and the volatile portions as organic, because the former exist also in the inorganic world or mineral kingdom, while the latter are found only in organized structures. It is also said that the inorganic constituents are obtained from the soil, while the organic portions are built up from gases which exist in the air or dissolved in water. But the distinction between organic and inorganic constituents is not as plain as it would at first seem, for they are so closely interwoven that it is almost impossible to say where one leaves off and another begins. Still the distinction between an organized structure and an unorganized substance is such as admits of no mistake. This brings us to a study of the plant from another point of view, namely, one strictly anatomical instead of chemical. If any part of the buckwheat which we have taken for an illustration be carefully sliced into a very thin section, it will be found under a high magnifying power, to be made up of what are termed cells. These cells form organized structure. They are made up of the ash-constituents and the vapor-constituents so intimately interwoven that they are both essential to the vitality of the plant. These cells must be very plainly described. They consist primarily of little spheres, or globes, composed of two layers and liquid contents. The outside layer is to protect the inner one; the inner one is the growing lining to which has been given the power of increasing in size and number. The cell is, at first, a sphere, perfectly round in its contour. Upon pressure the cell may be made to assume almost any shape. Two cells lying together form one long cell, with a double partition which may be broken down. Cells may be made by pressure to assume a flat shape or a prismatic form. Out of these cells all tissues of every part of the plant are made, even the tubes or vessels in which part of the sap is conveyed being formed out of contiguous cells which have lost their partition walls. The living, or exterior cells are constantly producing new cells for new tissue, while the older cells are packed away in the interior of the stem to constitute that which we know as woody fibre. I have said that these live cells are constantly producing new cells in every exterior part of the plant. I should have said provided the proper food is given to the plant and proper surroundings such as light and air and moisture are secured, and provided no new influence comes in to affect cell-growth. The life and even the health of the plant depend upon the growth of these primary cells. Any influence which destroys or disturbs cell-reproduction has a direct effect upon the growth of the plant. It is our purpose to see what influences there are in nature which operate adversely to cell formation and multiplication, and in our further progress I shall ask you to bear in mind several important facts which we have noticed in our brief review.

First, The fact of the existence of cells in every plant.

Second, The fact that these cells are made up of fixed constituents, such as salts of lime and soda, &c., and of volatile constituents which are broken up and driven off at a high temperature.

Third, The fact that cells grow and multiply by means of the formative power inherent in their lining, or inner layer.

Fourth, The fact that influences which hinder cell-reproduction affect unfavorably the growth of the plant; and that upon the health of the cell the health of the plant depends.

I have endeavored to sketch briefly the chief facts of vegetable anatomy, or rather histology, in order to show you that the laws governing the hygiene of the plant are extremely simple. We have incidentally seen that the functions of the parts of the plant are plainly recognized; that of the root to imbibe sap and gaseous food, that of the stem, whether above or below ground, to convey it, that of the leaves to work it over into food for the plant, that of the flower to produce seed to reproduce its kind. These simple facts constitute the physiology of plants. It would be very pleasant to me to depart at this point from the line of study marked out, and call your attentlon to some of the curious facts in vegetable physiology. It would be interesting to notice the phenomenon of increased heat at the time of flowering, and the obscure motions of many water plants, and the startling but still more mysterious flashes of light emitted by some flowers. It would be entertaining to observe the peculiar irritability of many plants, as for instance, the fly-trap, which grows in our southern States, and the more delicate sensitive plant. These irritable plants, which recoil from the touch, can be etherized, and be made to become perfectly insensible to even the rudest violence. But these facts lie out of our path at present, and we must therefore pass on to study plant-pathology.

We will for the sake of system, arrange plant-diseases into three great classes.

First, Those which result from mechanical injuries.

Second, Those produced by flowerless parasites.

Third, Those arising from improper or insufficient plant-food.

First, Those which result from mechanical injuries.

These may be produced by flowering parasites and by animals. The only flowering parasite which proves destructive to field crops in New England, is a salmon-colored vine which climbs over the stalks of clover and various grasses. This leafless vine belongs to the same botanical family as the sweet potato and the morning glory. The plant has very small flowers, which bear four seeds ripening in autumn. These slender vines twist around the stalks of clover and strangle them. The plant is called Cuscuta, or Dodder, and it is divided by Botanists into many species. One of these species is usually found with flax, and it is therefore named flax Dodder. The plant is termed a parasite. A vegetable parasite is a plant which lives at the expense of other plants, drawing all its nourishment from its unfortunate neighbors. The seed of the Dodder germinates in the soil exactly as a clover seed germinates; but when the delicate stem begins to cling to the stalks of other and stronger plants it is making arrangements to live upon their food. The Dodder soon sends forth roots which insinuate their way into the tissues of the victim and there absorb the sap which it regards as its legitimate plunder. The parasite first strangles the plants on which it climbs, and then, having lessened the demand for sap, takes it itself, adding insult to injury. When its roots are well fastened in the tissues of its neighbor the ground root is no longer of use, and hence the connection with the soil ceases. In flax-growing countries this plant is of great injury to the stems of flax, holding them in a firm grasp, living upon their life. Both the mistletoe and the broomrape are plants of this class, but they are not so widely disseminated nor so destructive to the plants on which they live, as the parasite just described.

The injurious effects produced by animalcules and insects are to be treated in this class of diseases produced by mechanical injuries. The wheat-eel or vibrio tritici, is the cause of a disease termed ear-cockle. The late Professor Henslow of Cambridge University, attentively studied this affection, and gave the results of his investigations in the Journal of the Royal Agricultural Society of England, volume second. Just one century before Professor Henslow began his investigations, Needham had examined under the microscope the blighted grains of wheat affected by the vibrio. "The grains which are thus infected turn dark green at first, and ultimately nearly black; and they become rounded somewhat, resembling a small peppercorn, but with one or more deep furrows on their surface. The husks of the chaff spread open, and the awns are twisted, by which means the infected ears are readily observable among the standing corn. Upon opening the blighted grains, they are found to be filled with a moist cottony substance; but to contain no flour. When Needham placed this cottony mass in a drop of water, under his microscope, he perceived to his surprise, that it was composed of a multitnde of minute eel-shaped animalcules, which were in active movement, twisting and wiggling to and fro, like so many eels and snakes." Remember that these observations were made one hundred and twenty-five years ago. Since the time of Needham numerous students have confirmed his results. "When a sound grain of wheat is sown by the side of one infested with the vibrio, the young plant which springs from the former is not infected," until the warm weather is fairly begun; but then the animalcules begin to find their way from the blighted grain into the earth and thence into the young grain. They gradually ascend within the stem till they reach the ovule (or young state of the seed) in the flower-bud, even before the ear has shown itself. The young are hatched in about eight or ten days after the eggs are laid, and speedily attain to about the one thirty-third of an inch in length, and the one twelve-hundreth of an inch in diameter. When full grown, the vibrio acquires a monstrous size compared with one of the multitude which composes the cottony mass in the blighted grains, becoming a quarter of an inch long, and the one-eightyeth of an inch in diameter. The most curious circumstance which observers have noticed in the economy of this animal is the wonderful property it possesses of retaining its vitality under conditions in which we should have supposed it impossible that it could have lived. If a mass of them is suffered to become so perfectly dry that the slight touch of a hair might reduce them to powder, and they are again moistened in a drop of water, they will speedily revive and become as active as before. They may be thus dried and revived many times before they are killed. "It does not appear that the vibrio naturally attacks any other grain than wheat." Scalding water kills the vibrio, and this suggests the possibility of exposing infected samples to a temperature that might be sufficiently high to kill these animalcules, without being so hot as to destroy the germinating powers of the grain.

The wheat midge is an insect infecting wheat. It has been so well studied by American entomologists, and so many valuable treatises upon it have been placed within your reach, that I shall not trespass upon your time to speak now of its nature and habits. The valuable practical entomology now being published by Dr. Packard of Salem, is an excellent guide to all desirous of studying the diseases produced by insects.

Dr. Packard was formerly attached as entomologist to the State Survey of Maine, and his "Guide to the Study of Insects" is exceedingly well adapted to the wants of Maine farmers because the author is so familiar with the insects of his native State.

There are two plant-diseases produced by insects which must be alluded to under this head, Galls and Stunted Spruce. The first is an affection of the oak and willow leaves. "A minute insect wounds the bark and leaves while depositing its ova, or eggs, and the irritation excited causes the formation of a deposit around them." The cells, which I have previously described, are ready to make good any loss of tissue. In some cases the repair forms an excresence, and this we term a gall. You have, no doubt, observed them upon the leaves of many species of willow and oak. Some of these galls in "Eastern' countries are of a rich purple color, and are varnished over with a soft substance of the consistence of honey. They shine with a brilliant lustre in the sun, and appear like a tempting fruit, but when chewed they have an intensely bitter taste. By some botanists they are supposed to be the Apples of Sodom." The ordinary spruce is liable to be attacked by an insect which produces a curious disease in the plant. "The disease consists of an alteration in the color and form of the leaves, which become aggregated together in the shape of cone-like excresences. A naturalist who has carefully investigated the subject, says that "the original matriarch lives outside the spruce gall, remaining all winter in a dwarf state at the root of a bud. As soon as the bud swells, she revives likewise, and speedily becoming enlarged with the juice imbibed, she lays some hundreds of eggs. The bud, meanwhile, instead of growing in length, becomes fleshy, and this fleshiness is communicated to the leaves. The consequence is an arrested bud, into the recesses of which, the young issuing from the cluster of ova on the outside of it, betake themselves, and soon become closed in by the increased irritation occasioned by their presence in its interior." In every swamp you may have seen this curious dwarfing of the spruce.

In this class of diseases, produced by mechanical injuries, I should place all wounds caused by bruises or by the pruning knife, all loss of sap occasioned by pruning at the wrong time, and numerous affections arising from violence in transplanting. But most of these maladies have been well studied by you in a practical manner, and therefore I will not occupy your time with their consideration.

The second group of plant-diseases comprises all those produced by or accompanied by flowerless parasites. Let us first examine the difference between a flowering and a flowerless plant, and then notice some characteristics of the latter. The plants which you cultivate on the farm, such as corn, turnips, and the various forage grasses, are known to be reproduced by seeds through the agency of the flower. These we term phenogamic or flowering plants. There are others forming numerically a larger class, which are reproduced not by seeds, but by spores formed without any flowers. These are denominated cryptogamic or flowerless plants. They are such plants as sea-weeds, ferns, mosses and mushrooms. They are generally of unattractive aspect, but some possess surpassing beauty of form and richness of color. In the geological ages preceding man, the scanty soil was clothed with species of cryptogamic plants. Many impressions of these are found near coal mines where the slates have locked up their treasures for the later times; nay more, the very coal we burn is largely made up of fossil flowerless plants of the coal-forming period. In historic time the succession of vegetation has been found to be as follows: Upon the sterile rock the lichen makes its hold secure, and living principally upon the air, it gradually disintegrates the solid granite to which it clings, and thus a soil is made in which the humbler plants can live. The flowerless precede the flowering plants, acting as their pioneers. But when the flowering plants are thrifty, the flowerless disappear; where the flowering plants, from local causes, become diseased or unhealthy, the flowerless dispute their place and even attack the enfeebled vegetation. It is in thick swamps, and on poor soil, and at high altitudes that you find the flowerless plants predominating over flowering plants. This struggle for supremacy is an unequal one. With the assistance of man to modify the character of wet soil by underdraining, and to change the constituents of a wretched soil by the application of fertilizers, the flowerless plants may be made to almost wholly disappear from a given locality.

It would not be worth our while to notice the flowerless plants at this time, if it were not for the fact that some of them live not upon poor soil, nor upon dead plants, but upon enfeebled vegetation to aggravate its disease. These cryptogamic plants we call flowerless parasites. They belong to the great mushroom family. They are distinguished from Algæ, to which sea-weeds are assigned, by their never growing in water, and from the Lichens by their more fugitive nature. Representatives of this family of plants are found of all sizes, from the minutest cells to immense masses of tissue weighing many pounds. Professor Berkeley describes a fungus which grew in three weeks to seven feet, five inches in circumference, and which weighed thirty-four pounds. These fungi are found everywhere in nature existing upon lifeless or enfeebled organisms. They possess widely different properties, some being deadly in their nature, while others are very wholesome. Many communities in Continental Europe make much use of edible fungi as an article of food. The yearly average of taxed mushrooms in Rome during the ten years from 1837 to 1847 was between 60,000 and 80,000 pounds weight. Dr. Badham, an English writer, quoted by Balfour, was shocked to see numerous edible fungi rotting uncared for at the time when famine prevailed. He says, "to see pounds innumerable of extempore beefsteaks growing on our oaks in the shape of Fistulina hepatica, Puff balls which some have compared to sweetbread, Hydna as good as oysters, Agaricus deliciosus, like tender lamb-kidneys; the Agaricus ruber and virescens to cook in any way and good in all."

You will call this rather extravagant language, but it was called forth in a time of famine. It is the utterance of a botanist who knew that whole tribes in Western Australia subsist for months together upon esculent mushrooms. In China fungi are largely used as articles of food, one which grows upon the decaying stem of the castor oil plant being highly esteemed as a great delicacy for soups and stews. You will however hardly be prepared to believe that a family of plants which contains so many useful to man, can comprise any of a totally different nature, but such is the case. There are many fungi which are poisonous in the extreme. There are many which are the inevitable accompaniment of certain diseases both in animals and plants.

Fungi are propagated by spores which correspond to seeds in flowering plants. These seeds or spores are so minute that in great quantities they resemble smoke. Spores of such minuteness find their way everywhere, into old attics which are unused, into mines far down in the earth. Near Dresden there is a coal mine which is lined with the dark-mine fungus. This fungus is luminous, and it is described as giving to those places the air of an enchanted castle, the roofs, walls and pillars being entirely covered with it, the beautiful light almost dazzling the eye.

Dr. Dancer of Manchester, England, found the air of the city loaded with invisible spores of fungi. Thus it is seen that the fungus spores can find their way into places far from their origin and sealed from their approach. Some of these fungus spores are the prolific cause of many plant-diseases, and for this reason they have required this somewhat prolix introduction.

The parasitic fungi which concern the farmer most are those infesting the cereal grains, and the potato. They have been carefully studied by Henslow, Berkeley and German botanists, and the facts which I present are from their writings. They are the fungi which you cannot examine without the assistance of powerful microscopes, the sporule being so minute as to be unrecognizable by the naked eye.

The first one to which I invite your attention is the fungus termed by Henslow, *Bunt*, which affects wheat. "When examined under the microscope this fungus is seen to consist of vast numbers of extremely minute globules of a dark color, and which are at first attached to a mass of matted thread-like matter. A single grain of wheat would contain more than four million such spores, but it is hardly possible to conjecture how many sporules each spore contains, since they appear, under the microscope, to be a faint cloud of vapor whilst they are escaping from the ruptured spores. Although this fungus confines its attack to the young seed, it seems to be a condition essential to its propagation, that it should be introduced into the plant during the early stages of its growth, and that its sporules are most readily absorbed by the root during the germination of the seed from which the plant has sprung. It has been clearly proved that wheat plants may be easily infected and the disease thus propagated, by simply rubbing the seeds before they are sown, with the spores, or black powder, of the fungus. It is also as clearly ascertained that if seeds thus tainted be thoroughly cleansed the plants raised from them will not be infected. The grains containing traces of fungus spores have a little oily or greasy matter, which causes the spores to adhere with much tenacity to the the surface. Lime removes this oily substance and cleanses the grain. The odor of grain infected by Bunt is very disagreeable, and this serves to distinguish it from Smut, which is a kindred fungus. The smut-fungus destroys the ear by first occasioning the innermost parts of the flower to become abortive, while the little stalks on which these are seated, swell and become very fleshy. The fungus then consumes the whole of this fleshy mass, and at length appears between the chaff scales in the form of a black soot like powder. This disease not unfrequently attacks wheat, and it is common in barley, and also in oats. In this country there has been much inaccuracy in the use of the word Smut as applied to grains. It has been most generally used with reference to the fungus disease of wheat. The fungus called Bunt is termed Uredo Caries by botanists, and Smut is Uredo Segetum. Another Uredo, having the specific name Rubigo, is known as Rust. "This Uredo forms yellow and brown oval spots and blotches upon the stem leaves and chaff, and when the spores have burst through the outer covering they are readily dispersed. A fungus closely resembling this is called by botanists, Puccinia graminis, or mildew, and its resemblance is so great to some forms, or stages of Rust, that they have been frequently taken for each other. The latter parasitic fungus has little dark brown, club-shaped spores, having the thicker end divided into two chambers, each filled with sporules. They taper gradually into a fine stalk at the base. Both these fungi make their appearance in little cavities, seated immediately beneath the pores of the leaves, which certainly looks very much as if the sporules entered there. The pores, or stomata, of the leaf, are naturally exhaling organs, continually discharging under the influence of light, a large proportion of the water imbibed by the root. But in moist weather this function is impeded, if in some cases it be not actually reversed; when it would be easy for the almost invisible sporules to enter these invisible stomata with the moisture imbibed by them. A generally healthy state of the plant, without any over-luxuriance of vegetation, which we saw early in this hour, was a *diseased* state of the plant, is most likely to secure a crop against the attacks of the rust and mildew fungi.

A notion has long prevailed in England, but not on the Continent, that the barberry bush (Berberis vulgaris) is in some way or other frequently connected with the production of mildew in wheat. Now whenever you find a general belief in an asserted phenomenon, you may be pretty sure that it has a basis of truth, and that the apparent phenomenon is a reality. In the present case practical men are by no means well agreed as to this statement, and they are not unanimous in denouncing the barberry. Some experiments by Staudinger at Flotbeck, seem to contradict the opinion so generally received. Staudinger and Horneman planted wheat and surrounded it with barberry bushes, and repeated the experiment several times without obtaining any mildew. Mr. Knight, an English botanist, obtained negative results in experiments of the same kind. Professor Henslow says that in the only case of barberry growing near wheat, he found the wheat more mildewed than at any other point. Now the best way to reconcile these different opinions is to experiment with wheat and mildewed barberry. It will then satisfy the experimenter that the fungus of an infected barberry will produce by migration a disease in the wheat near it, and that a sound barberry will have no effect whatever. Parasitic flowerless plants, like the entozoa, treated of in Prof. Brackett's lecture, are restricted in their powers of attack, being able to live on certain species only, and even on particular parts only of particular individuals of these species. It is my own belief, based upon a careful study of the literature of the subject, that the spores of the species of Uredo, and of Puccinia (if we consider that a distinct plant) must migrate from a diseased grain to a plant of barberry, there to undergo a transformation analogous to changes in animals, spoken of by the lecturer upon animal parasites. The fungus of the barberry is Æcidium, and this appears to be a fully ripened form of the mildew fungus, ready to recommence its ravages.

Unger, a Vienna botanist, thinks that the rust and mildew are cases of vegetable exanthemata. Exanthematous diseases are those which belong to the group of measles and allied affections; and Unger advances the hypothesis, based upon his observations, that these fungous diseases of plants are closely connected with if not identical with these exanthematous diseases of man. These views have of late received unexpected confirmation from the independent experiments of Dr. Salisbury and Dr. Jules Lemair. Dr. Salisbury has obtained from malarial districts in Ohio, specimens of the fungus which produces miasm. He caught some of the spores of the malarial fungus upon glass, and transferred the spores to a district where malaria was unknown, and the disease termed fever and ague was produced. Dr. Lemair has proved that these spores exist in Europe, and produce the same disease there. Dr. Salisbury also shows that many other diseases are caused by fungi, one in particular being produced by the fungus of mildewed straw. This disease is inoculable, and it closely resembles the measles.

Dr. Muecke is of the opinion that the rust of wheat is an effect not the cause, or at least a second not a first cause, being itself superinduced by the corrupted state of the juices of the plant. He says that where the rust destroys we may safely infer that the plants were in a suffering state before they were attacked. The red rust, he says, has not destroyed the crops of South Australia, it has merely furnished the eruption thereto. But on the other hand, it is equally true that on vast surfaces the red rust has been the main cause of the destruction of plants in regard to the formation of grain. He gives the following proof of his theory. Part of a field of wheat in which wild oats had prevented the wheat from growing, was cut for hay. Immediately the wheat sprung up healthy and vigorous and developed full ears and fully grown grains; not a particle of rust was perceptible on these parts of the field, whilst the surrounding thick and high wheat was completely covered with it. The cause assigned is, that the wheat in one instance did not grow till the time was passed in which the influences supervened that pre-disposed the plants; consequently they became strong and healthy. While the red rust spores passed over them they were not infected, because the spores did not find the conditions of their existence, that is diseased sap and weak cells upon them. This is clear enough; because surrounded as these mown spots must have been by the wheat on which the rust prevailed, the former could not have escaped if the same conditions had prevailed in them as in the other. The following tabulated results will show how contradictory are the opinions held by different members of the South Australian Commission:

Red rust is caused, say some,	Red rust also prevails:
1. By the exhaustion of the soil.	1. On newly cultivated lands.
2. By late sowing.	2. By early sowing.
3. By manuring.	3. Manure prevented it.
4. White straw is the best.	4. Purple straw is the best.

These results are very contradictory.

Ergot is a diseased state of grain in which the unimpregnated seed or grain takes on the form of a spur. "Ergot consists of a very dense tissue formed by polygonal cells united intimately with one another and filled with an oily fluid." Ergot attacks rye principally, and this diseased grain is used sparingly by physicians in certain diseases coming under their care. When this diseased grain is used with common rye as an article of food, it produces most terrible maladies in domestic animals and man. In the case of a duck which was forcibly fed with flour mixed with the powder of ergot, forming a seventeenth portion of the whole compound, drops of blackish blood oozed from its nostrils at the end of five days; the beak soon afterwards changed color, and the tongue rotted at the extremity; the animal died in ten days, after having taken altogether one ounce and seven grains of ergot. Other experiments equally striking have been made, and their results are such as to cause us all to join in the wish expressed by Professor Henslow, that they may never be repeated. But the importance and propriety of making them once will be readily admitted when it is known that they were undertaken expressly to test the probability of ergotted rye bread being the cause of dangerous gangrenous epidemics among the poor in certain districts of France. The details of the sufferings to which these persons are occasionally subjected are shocking to humanity. Their extremities rot off; and some have been known to lose all their limbs, which in the progress of the disorder fell off at the joints before the shapeless trunk was released from its torment. In one instance, related by Tessier, a poor man whose family were in a state of starvation, ventured to make bread of some ergotted rye which he had begged of a farmer, but had been cautioned against using it. It killed himself, his wife, and five out of his seven children. Of the two which recovered from the effects of the ergot, one became deaf and dumb, and had one of its legs drop off.

Now this ergotized state of grain attacks, or is liable to attack all grasses and cereals, but particularly rye, and I have called your attention to it in order to suggest that some obscure veterinary diseases may be traced to its use.

Some grasses, particularly rye grass, *Lolium perrenne,* is subject to the same disease, and little doubt is entertained, by those who have most fully investigated the subject, that many cases of abortion in cows can be directly traced to this cause. Dr. Bucknam, Professor of Botany at the Royal Agricultural College of England, relates that some years since the late Earl Ducie suffered considerably from the dropping of the calves of some of his most valuable stock. At this time a quantity of ergotized rye grass was gathered in the field where these accidents took place, and he believed this diseased grass to be the cause.

I would gladly devote time to a consideration of other parasitic fungi attacking cereals, but I shall now pass to a brief consideration of a fungus which produces a disease in the underground stems, or tubers of the potato. Instead of presenting all the contradictory theories relative to this disease, such as the hygrometric theory of Liebig, and the exhaustion theory of Crum, I shall give in a few words the most widely accepted theory of what has been such a destructive malady. It is caused by a fungus, Peronospora. Dr. Speerschneider of Germany has experimented with certain phases of the potato disease, and his results have been confirmed by Kuhn and DeBary. These investigators have not merely looked at the blighted leaves and seen the fungus there, but have watched the fungus as it rapidly sends out its branches into the still fresh and healthy portions of the leaf, and literally devours them, appropriating their juices to its own nourishment, and leaving behind a disorganized and decayed mass as the track of its desolation. The fungus comes from a spore which is oval and somewhat flattened, and bears at each extremity a hair like prolongation. These spores are produced to the number of 12-16, together in a spore sac at the extremity of a branch of the fungus. They are kept in a peculiar rapid motion by the vibration of hair-like appendages, and when ripe they burst the spore sac and are discharged. Their motion continues about half an hour, when it becomes slower and shortly ceases. Then the spore begins to change its figure, the hairs disappear, and shortly a thread-like branch begins to protrude from its side; this rapidly increases, and if the spore is upon the potato-plant, the branch which is, so to speak, the seedling fungus, penetrates the tissues of the potato, leaf, stem or tuber, as the case may be, and forthwith commences its parasitic life. The young fungus buds out in various directions, sending into the juices and cells of the potato, its feeding branches or mycelium; while other or fruit branches pass out into the atmosphere and reproduce spores with marvellous fecundity. The growth of the parent plant continues as long as it can find food and the requisite warmth and moisture. When the supplies existing in one place are exhausted, the plant dies in that spot, but the branches which had previously extended into the neighboring regions continue to grow, so that the devastations of this fungus are like a fire which spreads in all directions where it can find fuel." Professor Johnson, to whom I acknowledge my indebtness for these interesting facts, has satisfied himself that where this fungus is there is potato disease, and where the potato disease is there is this fungus. The connection between the two, as cause and effect, is beyond all question, and it is idle to ignore the relation. The various remedies proposed for this disease need further trial, and I forbear at the present time to present any of them.

We are thus brought to the consideration of the last class of diseases, comprising all those produced by improper and insufficient plant food.

A plant may be poisoned, starved or stuffed. Plant poisons are very numerous. They may be said to be innumerable. They may float in the air as noxious gases, or they may be carried by the air as solids in a state of fine subdivision, or they may be applied to the plant through the medium of the soil. In manufacturing districts in Europe, where the chemical works are continually giving off traces of hydrochloric acid into the air, vegetation is depressed. The fields do not look bright and healthy. But before the works were compelled by law to save the hydrochloric acid, which is now utilized for the manufacture of bleaching powder, and volumes of this gas rose in the air, the country around the chimneys was black and dead.

The influence of the sea breeze, carrying with it saline matter, is prejudicial to most plants. There are some plants that withstand the sea air better than others, and the vegetation of the seashore is unlike that of the interior. "At Gorford, near Edinburgh, there is an estate where the trees, on reaching the tops of a wall, are stopped in their growth by the sea breeze, and their tops form an inclined plane proceeding inwards from the wall to the base."

But the most fruitful cause of disease in plants other than those produced by parasites, is the improper or insufficient supply of plant-food. This portion of the subject has such an exceedingly wide scope in its practical applications, that the limits of a single lecture would serve only to give you a meagre outline, and faint idea of its importance, and having already occupied so much of your time, I can only give you a hint regarding its general lesson. It is this: A plant in order to be healthy needs food, of proper kind, in suitable quantity. Plants must have this food either from a soil naturally rich enough, or from one which becomes so by manurial applications. Unless they have this food the plants will be feeble, and, if feeble, they cannot resist adverse influences, whether climatic or from parasitic fungi, but they are in a condition to fall an easy prey. You have an exact analogy in the case of man. When an epidemic of a typhus type prevails, the well-fed, healthy man escapes, but the ill-fed, anxious, depressed succumbs. So with plants. Let me refer to an illustration in the matter of climate. Your great crop is grass, for hay. The amount of hay depends very greatly on the season, whether wet or dry; if wet, your poorer fields produce considerable grass, if dry, very little. Now how is it with your rich mowing fields, say those good enough to yield 2 to 3 tons per acre? Will not the experience of every farmer present bear me out in saying, that they do not suffer to an equal extent with the poorer ones? The crop is light to be sure in a dry year, but unless the drought is excessive, does not suffer so much.

A treatise by Prof. Johnson of the Sheffield Scientific School, on Vegetable Physiology and the Chemistry of Plants, should be carefully studied by every farmer in New England. The work is entitled "How crops grow," and is the first of a series by this careful and thorough student of agricultural chemistry. You will learn from his work the exact relations which a plant bears to other forms of organized matter, and to the inorganic world. By a study of his treatise you will be less likely to overfeed, underfeed, or improperly feed your crops, and you can thus guard against a prolific cause of plant-disease.

As I said at the commencement of this paper, the cells need for their growth, inorganic matter in requisite amount. Liebig has lately* examined again these amounts, and his views will soon be placed in your hands through the Secretary of the Board. It is enough to say at this time, that the great German chemist shows conclusively that plant diseases arising from a lack of food must be met in a common sense way, by giving just the right amount of food and at the proper season.. At some future time it may be my privilege to place before some of you the results of studies in this department of vegetable pathology.

In bringing to a close these remarks in regard to plant diseases, I must be allowed to say that chemists and botanists in America can do little in the line of original agricultural study unless they have the hearty co-operation of farmers in furnishing materials for study. Bearing this in mind, Professor Brackett and myself respectfully ask you to place in our hands material for the careful investigation of entozoa and the plant diseases of Maine. If you will transmit to us any specimens of parasites or of diseased vegetation which may come under your observation, it will give us much pleasure to examine them with care, and suggest such rational means of cure as may be known.

Hon. Simon Brown of Concord, Mass., (Editor New England Farmer,) delivered the following lecture on

Progressive Agriculture.

Agriculture is the necessary calling of perhaps four-fifths of the population of every civilized age and country. Food is the first want of man, the first object of wise and laborious pursuit. * * An agricultural population is the main source whence principally

* Journal of Royal Agricultural Society, 1868.

the mechanic arts, the pursuits of mechandise and commerce, and the learned professions draw fresh recruits to fill up the wasting ranks of each; a striking comment, alike, on the sanitary influences of the one, and the destructive tendencies of the other.

Even learning, music and poetry will take their tone, in a great measure, from the success which attends this employment. It would not be too much to say, that the morals and religion of any community are greatly affected by the estimation in which agricultural employment is held. It is its nature to lead the mind to social and amiable habits and high purposes. Surrounded as the farmer is, by the glowing manifestations of deity,—*his* calling has an elevating influence scarcely to be expected in the marts of commerce or in the harassing pursuits of mercantile life. But all avocations are indispensable as parts of the whole. The carpenter, cabinet-maker and ship-builder, all act an important part in the web of life—each is a connecting link in the great chain of human pursuits. Drop but one of them, and the woof of society is broken.

A high degree of civilization requires a great diversity in the trades and arts to meet its demands. The bow, the spear and fishing-hook, with a few simple utensils hollowed from the rock or formed from the bark of a tree, answered all the wants of generations who occupied these lands before us. They lighted their forest fires, and woke the solemn aisles with human tones. They lived their day—fulfilled their mission, and passed on. Other generations followed, and still further prepared the way for us. But yet the finger of God points onward. No degree of perfection attained should prompt us to pause. The Old World is plethoric with human population—with men and women, whose hearts beat with emotions as lively as our own, and to whom comes the momentous question of *subsistence* with a power which we cannot feel, because we have not stood face to face with starvation and death.

Other generations have subdued savage men and beasts, and the boundless forests; they were the pioneers to these fair fields, these teeming hills and vales; these spires pointing to heaven, these peaceful homes where domestic love ripens into bliss. The dangers and hardships incident to early settlement have been endured by others, and we have entered upon the possession of a fair and prolific land. It is in us, then, a high duty to *progress*, and make such use of it as shall meet the approbation of our own sense of right, and of those who are to succeed us.

It may be profitable to inquire whether we *are*, faithfully discharging our duty?

Does the soil which we first broke, and which then poured forth it fruitful stores, *continue* to yield an equal amount? And if not, what must be the result of such practice if continued through a few more successive generations? The reply is plain. In the distance will be seen neglected and forsaken fields, delapidated homes, wandering families, decaying commerce, prostrated manufactures, and a wretched population; literature, the sciences and arts, music, painting and poetry, and all that goes to enable a nation, would follow in the dismal train. Patriotism and love of country, would soon die out from the hearts of the people, and this fair fabric become a prey to the rapacity of other nations.

But such shall not be the fact with you—your presence here to-night declares that *the art of dressing and keeping the land*, and the increase of its products shall progress among you.

"The agriculture of no people or country is complete in itself. Everything valuable in our gardens and fields is the result of improvement. We have hardly a plant or fruit in its original state. Our vegetables and fruits, and grains, are improvements by change of climate and culture on inferior or worthless stock. Fruits as delicious as the peach, and vegetables as delicate as celery, have been derived from the most acrid and poisonous originals. Of a mere thorn man has made, as if by enchantment, the beautiful and fragrant rose. Before he thus labored, the olive was dry and offensive, the peach bitter, the pear had but a hard, woody flesh, and the apple tree was full of thorns. Man labored, and the thorns fell; the rose doubled and trebled its flowers, the peach and the pear filled with perfumed juice, the olive lost its bitterness, and the wild grasses were converted into waving fields of life-sustaining grain. A French agriculturist has tamed every individual member of the family of thistles,—exposing to the sun those that grow in the shade, and burying in the dark those that derive acridity from the solar rays—and has rendered them savory and fit for human food."*

The celery, for instance, once a tough, bitter and dangerous plant, repulsive in its appearance, and shunned by man and beast as worthless as food, and a blotch upon the fair face of nature, but

* G. F. Magoun.

now by the skill and care bestowed upon it, has become a crisp, tender, and delicious salid, affording nutritious vegetable juices, eminently adapted to our wants as winter food. It is also highly ornamental to the table, and is considered as one of the essentials to a fashionable dinner. It is easily raised, and may be had by every family cultivating a small garden, with but trifling care.

So the effects produced on animals by better care in keeping and breeding, and change of climate, are almost beyond belief. The average yield of wheat in Michigan is fifteen bushels; in Virginia five, while in the United States it is only nine bushels per acre; Germany, twenty-nine; in England it is thirty-two. The difference is not in the climate; ours is better adapted to that plant; nor in the soil; ours is comparatively new, and that of England has been worked for six hundred years. It lies chiefly in improved culture. Oxen were once considered large among us that would girt six and seven feet, and weigh thirty and thirty-five hundred pounds per pair. Now we sometimes see them measuring nine feet and upward, and weighing three thousand pounds each. One hundred dollars was then considered a high price for a pair of fat oxen; now they frequently sell quick at double that sum; and during the past year, in an adjoining State, a pair was sold for $500, not as fancy stock, but for beef! Similar improvement has been made in swine and horses; the flesh of the former being better, and the speed and powers of endurance in the latter enlarged.

At a former period of our farming, it was the practice to keep *store swine* through the winter for the next year's supply of pork. The expense attending this course *now*, would be as much as the whole value of the animal when slaughtered, and no *profit* would be left. It was urged that the animals would grow well through the winter *without much* to eat. Under this practice they were kept eighteen months—that being the length of time which was supposed the most profitable to keep them. But under more recent experiments, and a more careful investigation of the matter, one half that time is ascertained to be the age to which they may be kept and yield the largest profit.

Here, then, in the management of this animal, one indispensable to the farm, and which enters so largely into the articles of family support, we cut off nine months' keeping and the cost of attendance through a winter, and still find a profit greater than under the old practice. The gain to the farmer must be considerable in this particular.

So with cattle. The opinion prevailed that oxen must be kept until seven or eight years old, and then a summer of pasturage and two or three months of stall feeding be given them before they were fitted for the shambles. The fact was overlooked, that in the course of the third, fourth and fifth years, there were unquestionably periods when these cattle were fat upon the common products of the farm, and might then have been sold at a remunerating profit; but nobody thought of the matter, or investigated the physiology of the animal sufficiently to learn how impracticable it would be to fatten him quickly after the natural period of growth and vigor had passed. The erroneous idea was, in supposing that oxen were not fit for labor until they had passed the period when they grow and fatten rapidly.

Now, however, much of the best beef produced is from oxen four, five, and six years old, which have been under the yoke through the winter and spring, turned to good summer pasture and fall feed, and indulged with roots, hay and grain for a few weeks in the months of October and November. In this way the labor of the animals will nearly equal in value the cost of keeping during the last half of their lives, and they are prepared for market during that period when they naturally grow and take on fat the fastest. The difference, then, between fatting oxen at this favorable moment, or postponing it until the natural tendency to take on fat and flesh has passed, and when it can only be obtained by extraordinary care and expense, will be so great as to rob the farmer of all profit in this branch of his husbandry.

At the period, too, of which I speak, a fleece of six pounds of wool was considered a remarkable product—and so it was, for it was rarely obtained—and a three or four month's lamb sold heavily at a dollar, or a dollar and a half! But knowledge, reduced to systematic effort, now produces fleeces of the finest wool of 10, 15, 20, and 25 pounds weight, and lambs that sell readily at $2, $3 and $4. I speak of those sold for the shambles; scores sell annually for breeding at prices ranging from $20 to $500 each, and are well worth the money they command.

Science has taught us, in sheep, how to breed for the largest product of wool, or for muscle or fat; and we have, accordingly, races distinguished for one or the other of these qualities. About the commencement of this century, the average weight of good fair sheep would not exceed 20 pounds per quarter, in England; now it is by no means rare to find mutton weighing 40, 50, and

60 pounds per quarter. There has also been a corresponding increase in the quantity and fineness of the wool. For this valuable improvement we are mainly indebted to the profound physiological knowledge and patient exertions of Robert Bakewell of England. Spanish and French Merinos are now acclimated and prolific here, and a single animal often produces as much wool as three of the sheep common with us fifty years ago, and of a much better quality. In oxen the same knowledge has taught us where to place the sinews of strength and lines of beauty, or to lay on the best steaks or stores of tallow; in swine, how to reduce the long snout, the flapping ears and coarse limbs, and carry the amount to jucy tender-loins and snowy lard! And what is almost paradoxical, these advantages are realized at a less cost than that at which we used to obtain an inferior product under the old system.

Careful and long-tried experiments have shown, that almost any desirable points and qualities, may be gained in the size, shape, and productive powers of our animals, by patient and systematic attention.

For instance—to an hundred cows whose average product of milk is three quarts a day, you may apply the aids which science presents, and increase that average one quart, without any increase in the cost of keeping; then if we have 150,000 cows in the State, it will give at four cents per quart, $6,000 per day, or $2,190,000 a year in one common agricultural item, in a single State—a sum sufficient in a few years, added to the other industry of the people, to reclaim all the waste places of your farms, to erect new and substantial dwellings, with all the modern improvements, to those who need them, to supply churches, school houses, and halls for the transaction of public business, and the convenience of your lyceums and agricultural gatherings, and give to your hills and valleys the aspect of teeming fertility.

A similar result may also be obtained in horses; their value for the market, for docility, for speed and draft, may be materially enhanced by a judicious course of breeding and training; and while their productive value would be essentially greater, the cost of keeping them, it is believed, would not be so much as that of inferior animals.

These principles which I have briefly illustrated, apply with peculiar force to every branch of farming. Low lands, producing natural grasses and coarse herbage to the amount of a ton to the acre, and at an average value of $6 or $8 per ton, by proper draining and reclaiming, may be made to yield an average of a ton and a half or two tons of the most nutritious grasses. This fact is established by numerous cases open to the observation of all; and the principles upon which reclamation is made, are so plain, that all ought to be familiar with them. They equally apply to plowing, to the use and application of manures, to the mechanical changes often necessary to be effected in soils, and to seeding and harvesting.

The subject of *Capital,* also, in agricultural industry, may properly be considered in this connection. Errors prevail among farmers, and are constantly indulged, in this *sinew of agriculture,* as well as of war. The shrewd and successful merchant rarely diverts his capital from his legitimate pursuits. If his transactions leave a surplus or profit, that profit is usually added to the original investment. He thus enlarges and strengthens his business, and creates a new power to control the markets and circumstances about him. Year by year his profits swell, because his operations are governed —not only by vigilance and economy—but in accordance with the laws of trade.

Such should be the policy and practice of the farmer. The profits realized from the crops of this year should be invested in permanent improvements in the soil he cultivates, or in the erection of such buildings or changes as will facilitate his efforts. One hundred dollars, expended in labor and manures upon five acres of land, will often increase the products per acre from one ton of hay worth six dollars, to two tons, each worth twelve dollars. Here, then, for the use of the twenty dollars expended, would be a gain of eighteen dollars per acre, and for the use of the one hundred dollars on the five acres a profit of ninety dollars! This result might not always be obtained the first year—though it often is— but the interest on the sum invested, after all allowances, would not fall short of fifteen or twenty per cent. per annum, with the satisfaction that the principal is invested in a bank which will never refuse a discount, is not subject to revulsion or to stop payment! These facts are amply demonstrated every year in many parts of our State. Plain and obvious as they are, however, they have not yet induced hundreds to invest their capital on their homesteads, and unembarrassed by rents, clerkships and bonuses to the State.

A desire exists among farmers to become owners of stocks in banking or manufacturing companies, in railroads or steamships, or mining, lumbering, or perhaps some fancy scheme which promises large dividends with but little labor. Every where, they have diverted their capital from its true purposes to invest it in one or all of these pursuits, and thus vast sums—the earnings of their patient and honest toil—have passed into the hands of speculators and drones, and are lost to them forever, or become so entangled in the intricacies of a business they do not understand, as to be a perpetual source of vexation and loss. This is an evil of such magnitude, that, until it is in a great measure corrected, I cannot hope for that enlightened progress which ought to distinguish us as an agricultural people.

The average interest of stocks in New England probably does not exceed six per cent., and many of them are so fluctuating and unsafe, as to justify anxious apprehensions in the minds of those who hold them, and are not intimately acquainted with the stock market. Thousands of fields remain unimproved, and yield no more profit than they did under the dimmer light of a former age; generation after generation plow and mow around the same rocks; sour grasses readily usurp the places of those more valuable, for the want of proper drainage; old buildings, inconvenient and unsafe, and farm implements, awkward and unprofitable, are kept in use, because *capital* is forced from its natural channel. So large tracts of the best lands are abandoned to a luxuriant growth of water brush, reptiles, and the generation of poisonous exhalations. A portion of this capital—rightly directed—would increase the productive power of impoverished pasture lands to many times their present fertility. Capital is power, and the fact must be enforced upon the mind of the farmer, that its employment is as proper and necessary in agricultural pursuits as in mercantile or mechanical, and that its use will prove as lucrative in farming as in any other business.

In England, great attention has been given to the cultivation of root crops, and farmers are enabled to double the amount of stock heretofore kept on the same acres, because so much more nutriment can be raised from the same land, than when appropriated to grass alone. The cultivation of the turnip, of the beet, the parsnip and carrot, as winter food for stock, will eventually work important changes in the economy of the farm.

A passage in the New Edinboro' Encyclopedia, says: "The introduction of turnips into the husbandry of Britain, occasioned one of those revolutions in rural art which are constantly occurring among husbandmen, and, though the revolution came on with slow and gradual steps, yet it is completely established. Before the introduction of this root, it was impossible to cultivate light soils successfully, or to derive suitable rotations for cropping them with advantage. It was also a difficult task to support live stock through the winter and spring months; and as for feeding and fatting cattle and sheep for market, during these inclement seasons, the practice was hardly thought of, and still more rarely attempted, unless when a full stock of hay was provided, which only happened in a very few instances. The benefits derived from the root husbandry are, therefore, of great magnitude. Light soils are now cultivated with profit and facility. Abundance of food is provided for man and beast. The earth is turned to the uses for which it is physically calculated, and by being suitably cleaned with this preparatory crop, a bed is provided for grass-seeds, wherein they flourish with greater vigor than after any other preparation."

In the agricultural improvements which have been effected, the mechanic has done more than his full share. His activity of mind has wrought greater changes in the improvement of farm implements, than the skill of the farmer has, in the management of soils and crops. The introduction of a simple and cheap implement—the wheel hoe—enables us to raise carrots at half the cost it requires without it. The use of the double plow, by separating and turning the sward into the bottom of the furrow, so that the harrow and cultivator will not bring it up, saves considerable expense in the cultivation of the crop. The reapers and mowers are inventions which only would have been made where labor is too scarce and dear for the harvesting of vast tracts of cheap land. Though we are behind England in production; we have surpassed her, I think, in enabling a boy to do in the field the work of ten men.

Jethro Tull's theory, more than a hundred years ago, (1731) was, that the secret of producing large crops, lay in the frequent stirring and minute pulverization of the soil. His practice and teachings then, fell upon cold hearts and deaf ears. But the light which science has since shed upon the subject, has convinced us that his theory in some important particulars, was correct; and implements for this purpose have been devised, far beyond any thing he ever conceived in effective power. The horse-hoe of to-day, and that of his invention, have scarcely a point of resemblance.

I have thus imperfectly shown that the farmers of the present day live under the most favorable circumstances for making great advances in the art of cultivating the earth. Peace pervades the land, leaving commerce free to seek new sources of demand for agricultural products, while the increased attention to manufacturing pursuits creates new markets at our doors. Facilities for transportation have also given agricultural productions a remunerating value. "A ton of corn is estimated not to be worth hauling by wagon, when one hundred and seventy miles from the market; while at the same distance upon a railroad it would be worth twenty-two dollars ten cents. A ton of wheat two hundred and thirty miles from market is not worth the hauling by wagon, but by railroad it would be worth forty-four dollars, thirty-five cents." We have more and better markets than our predecessors; better implements and machines to work with, and more valuable fertilizing agents.

What more, then, it may be asked, is wanted of the farmer? Why is he not *now* discharging his full duty to the soil and to those who are to succeed him?

I answer—He does not do justly by the soil, because, as a general practice, he annually takes away from it more than he returns, and this principle, carried out, would result in the starvation and extinction of the race. The census tables show that the wheat crop of New York, in some counties, has fallen as low as eight bushels to the acre, where formerly from thirty to forty were produced. Lands deemed inexhaustible, have been cropt almost to barrenness. Large sections of territory in Virginia, formerly very productive, have become utterly sterile, and been abandoned by the original cultivators. An average crop of corn in that State is now only 15 bushels per acre, and of wheat only five! Our own forest lands have not only been stript of their noble trees, but robbed of their original richness, until nearly all the elements of fertility are exhausted. Five to ten acres of pasture lands are now required to fed a cow, where one acre was once sufficient.

No well-devised system for the preservation of manurial agents exists even on our farms; and in the cities, the products of our fields flow down the gutters and sewers into the remorseless maw of the sea and are lost. Our pastures are barren mostly from the exhaustion of their phosphates, fed off by herds of cows, and carried away in milk, butter and cheese. Nor is the value and importance of the manures well understood, nor the benefits of the application of chemistry to our fields. "For 50 years it has been known, in England, that bone-dust was a fertilizer for grain fourteen times as effective as barn-yard manure." And it was probably in reference to the use of bones that Liebig thought he could judge of the commercial prosperity of a nation, by the quantity of *sulphuric acid* it used, and Mr. Pusey said it was a good index of the degree of civilization of a people. A few years since—says a recent writer*—in the little town of Spaulding, in England, 27,000 pounds of sulphuric acid were used in a season in dissolving bones. The bones were purchased even in foreign lands; our own country was scoured for them; the imports into England amounted to nearly $1,000,000 a year. Now, however, chemistry has established another fact, viz: that certain stones and masses of rock contain the same fertilizing substances as bones,—phosphate of lime—and by a simple chemical process, these before useless rocks, are converted into the condition of bone-manure, and given as food to crops.

Specimens of the deposit of phosphate of lime, recently developed in South Carolina, are said to yield eighty or ninety per cent. of pure bone phosphate of lime. How wonderful, that this vast mine of wealth should remain unemployed until this time, when a new power is acting upon the soil, that of *free labor.*

Mistakes occur in every day practice which dishearten the farmer and keep his profits low. He applies crops to lands naturally unsuited to them, or after they have been exhausted of the elements which the crop he applies requires; grasses and grains are harvested at periods when great loss is sustained; valuable woods for timber and fuel are cut at a time when they are most liable to perish readily, and in most cases seed is wasted by sowing grains broadcast instead of in drills. On this point I will cite a single instance: An extensive and practical cultivator in England states that upwards of seventeen million bushels of grain, and peas and beans, are yearly thrown away in that country, in superfluous seed,—independently of the additional produce which might be obtained by the use of the drill. Actual experiments have proved that a bushel of wheat sown in drills will produce an average of three bushels more than when sown broadcast. This will allow us to multiply the seventeen million by three, and to find an aggregate of fifty-one million of bushels; thus confirming the statement of the writer,

*Magoun.

that "a clear saving of twenty-five million dollars might be made in the article of seeding in a single year." What then must be the annual loss in our extended country? From an estimate I have made, which is undoubtedly an approximation to the truth, I have no doubt the loss in this State in over-seeding is half a million of dollars annually!

But I will not longer indulge in this view of the subject. Plenty of noble examples have made it sufficiently clear that the soil is *capable of being made to produce treble what it now reluctantly yields.* The lion in the way, is *the want of knowledge—we know not how to treat it.* To gain this knowledge, and enable the farmer to avail himself of all the helps which benificient Nature has placed within his reach, is now clearly his duty, and ought to be his pleasure. How he shall do this, and through what agencies and influences, is a question more difficult to settle.

In the first place, *individual* effort must lead the way. In imitation of mechanics and manufacturers, the farmer must exercise close and constant *observation,* and bring to his own operations the advantages to be derived from the study and experiments of others. The cotton or woolen manufacturer acts upon a suggestion of the slightest improvement, and varies a color of his fabric to suit the public taste, or alters its shape to adapt it to the machinery he drives. The architect studies every form in nature to enable him to present an elegant or imposing facade, or to span rivers with bridges of gossamer work, yet of surpassing strength—and so does the sculptor, to give life and beauty to the marble under his hands.

The mechanic eagerly seizes every suggestion of genius, and transfers his thought to our machines, and supplies us with Reapers, Threshers, Mowers and Seed-gatherers, and thus averts a vast amount of human toil. The machinist catches the results of other reasoning minds, adds them to his own, and perfects his work, so that we are rapidly carried on our way at forty miles an hour, or produce cotton cloth for the world at the rate of thousands of yards in a day from a single mill. These are examples for the farmer; he must be a *thinker* too, as well as a worker. He must transfer to his own fields the experiences of others—make their results his starting points—then, adding his own careful investigations, advance to higher modes of culture.

But the farmer must not be content with the aid derived from an appropriation of the ideas of active and ingenious minds about him. He may avail himself of these, but a most intimate knowledge of the mechanical powers alone, will only partially qualify him for his profession. It was Cicero, I think, who said the orator must not only possess a good education, and be familiar with the laws which he is to apply and explain,—but he must have a general knowledge of the whole range of the sciences. If this be requisite for the orator or lawyer, how much more so for the practical farmer. The lawyer may argue a case of "flowage," or "trespass," and scarcely need a term of chemistry or physiology, or an hundred other cases where hydraulics or geology could shed no light on legal lore. But the farmer has no such case. He cannot build, or stir the soil, or plant, or harvest his crops with enlightened wisdom, without the immediate application of some one of the sciences. There is *no* profession demanding so wide a range of scientific knowledge, as that of the farmer. It were as wise to enter upon the cultivation of his soil without some chemical and geological knowledge of its constituent parts, as for the manufacturer to set his wheel in motion, not knowing whether his looms were to be impelled backward or forward!

The artist, watches with eagle eye the blending of colors on his pallet, and reasons and reflects upon their effects on the canvass. So should the farmer on the lock of hay he feeds to his cow. If in his investigations he has studied the structure and functions of his animals, and the offices their organs perform, he will be better able to estimate what a given amount of food will produce in flesh or milk. A knowledge of their structure will also enable him to prevent or control the diseases to which they are liable. And this acquaintance with some of the principles of physiology, is as essential to the farmer, as a rotary motion to the mechanic, or Blackstone or Coke upon Littleton to the lawyer.

Without some acquaintance with botany, the farmer gropes as in a labyrinth among his plants. The names of a few are familiar, but their derivation is hidden in deep mystery, and thus a pleasing feature of his occupation is lost. He does not reflect that language gives expression to *things*—for instance—that the stem and kernel of the wheat he cultivates, mean "hope," and "bearing," and that to a hungry world this meaning is full of encouragement as well as beauty! This science will enable him to learn the names and to select the grasses on his farm, some of which will be nutritious and worthy of cultivation, while others are worthless. He will also learn the habits and wants of trees, the circulation of

11

the sap, and the art of managing them so to surround himself with fruits more delicious and profitable than sunnier climes ever yield. The flowers, now sealed books, will show their distinctive characters, and unfold new volumes of wisdom to his mind.

But the great essential is chemistry—to a course of high, enlightened, and successful farming, some acquaintance with this science is indispensable. As well may the clergyman succeed deprived of the volume of inspiration, the physician of his pharmacopœia, or the lawyer his brief. Chemical influences and effects enter into every department of his operations, and without some knowledge of the substances he employs as fertilizers, he is constantly liable to imposition, vexation and loss. His ashes and lime may be applied where alkalies already abound; his plaster where clover grows in rank profusion, and fresh muck where his fields are covered with "nature's grave-clothes"—the incorrigible sorrel. There is chemical action every where about him; in his mows of hay, his chests of grain, his compost heaps, his ripening crops. The importance of this science to the farmer has rarely been overstated by theorists or by the books; its relations are so intimate with all he does, that its employment cannot be dispensed with.

These are some of the laws of nature which he must understand, and there are others after which he must seek with diligent curiosity. Some knowledge of meteorology would often enable him to secure his crops when the indifferent would see theirs wasting by storms. He would so skilfully prepare his soils as to draw stores of fertilizers from the atmosphere, and thus feed his crops from that great reservoir of wealth, through the action of natural laws. He ought to acquaint himself with the principles of draining, of irrigation, sub-soiling and entomology.

These are some of the acquisitions he should strive to make. The gates of knowledge stand open, inviting him to enter and supply them. The earth lifts up her hands and cries for better treatment. It expands with generous benevolence to all who work it with an enlightened wisdom. It will not forever yield, and receive nothing in return. It has not been so constituted by Him from whose plastic hands it came. Like the laws of trade, it must be compensated for its bounties. To ignorance and indifference, it will refuse a reward. But to systematic application, to those who act in unison with natural laws, to the *observer* and *inquirer*, it will yield its richest fruits.

Individual effort, then, is the first step in agricultural progress. The next must be *associated* effort, beginning with town clubs and exhibitions, then the county and State. These are in progress among us, and should be cherished as the moving cause of a degree of prosperity greatly desired, and which may be attained through their influence. No other means of spreading improvements among the people, are so direct and applicable as those flowing from club discussions and public exhibitions. They bring men, women and children to feel an immediate and home-interest in the matter; their pride and their skill are alike interested by the general competition, and an ambition is awakened rarely felt by those outside of these associations. This ambition prompts to new excellencies in everything relating to the farm;—its buildings, fields, crops, fruits, stock, fences, drainage;—to dairy products, implements and vehicles; to neat and tasteful cultivation, and promotes a desire for something of the ornamental and picturesque.

Encouragement to agriculture as a science cannot be a mistaken idea, when a whole nation, as it were with a common impulse, has raised its voice in its favor. But, as in political affairs, the people are in advance of their rulers. They know that aggregated wealth, with the protection afforded by government, has brought our manufacturing interests to great prosperity, and in point of excellence to compete with the world. But the farmer cannot pursue his business in this way. His occupation is peculiarly a solitary one. He is more alone in his pursuits than the mechanic, the merchant or the professional man. His work *must* be done in the country, where opportunities to compare opinions, practices and results must be few. He cannot afford to raise funds to establish schools or colleges to teach his children the science of agriculture, while at the same time he bears his full proportion to support those founded for other purposes. In a spirit of enlightened liberality, this should be done by the fostering care of the State. A wise investment of the public funds—either State or national—in rendering facilities to the people for agricultural improvements, would be returned in a four-fold degree to the public treasury. So sensible have most of the States become of this fact, that they no longer hesitate to make special appropriations for this purpose. Iowa, young as she is, saw this and appropriated $200 to each county society. The Legislature of Michigan gave in 1846, $400 a year for five years; Indiana

$1,000 for two years; Maryland and Virginia have appropriated liberally, and Massachusetts has paid out about $25,000 annually for several years.

Each State should establish a legislative agricultural society, where, during the sessions of the legislature, the general interests of the profession may be freely discussed by practical and scientific men, and especially by the legislators themselves.

The agricultural education of our youth should no longer be made a secondary matter. Establish such schools, colleges, or model-farms, as will enable them to unfold the mysteries which surround us,—and bring to light the hidden secrets of the earth and air! These things may be done, men and women of New Hampshire, by you—they lie in your power. If you will it, the work will go on—if you are indifferent, the earth will refuse her increase, and your children will be scattered abroad.

But a true patriotism—love of country and home, the memory of those who have fought your battles and achieved your victories, of your scholars, statesmen, philanthropists and noble women,—all forbid this desecration of the soil, and the mind! Abandon not your grand scenery, your noble rivers and mountains for the turbid waters and miasma of western lands. Like the Swiss for his early songs, and rocks, and glens, you would languish for your native hills, and be glad to return to them with the ardor of a first love. Your soil, and climate, urge you to speed the plow. Nature has done all for you that you ought to ask. She has given you a fertile soil, swiftly running waters, bright suns and an invigorating atmosphere. Your hills are crowned with noble forests, your plains swell with corn in its season, and your valleys are covered with the other great New England staple, grass.

For the products of all these, your extended sea-coasts offer you an outlet to the markets of every clime,—so that you can say, with the poet,

"No pent-up Utica contracts our powers;
The whole boundless Continent is ours!"

No other climate produces so large a variety of wholesome and delicious vegetables, or a finer display of beautiful and fragrant flowers and fruits, denied the masses in most lands, are common upon your tables.

Reared among your native hills, your frames are firm as the granite on their sides, and yet as elastic as the breezes which sweep their brows. Fitted, then, to the work before you, make it yield not only the necessaries of life, but the medium through which the highest moral and intellectual culture may be attained; as these are secured, so will be the money profits of your calling. He who knows most, in any pursuit, will generally succeed the best, and agriculture will not prove an exception. Men are selected for places of responsibility and trust, because qualified for them by study and observation.

The farmer's occupation has been too much looked upon as one of drudgery. Let it be so no longer. No profession has so much of the true poetry of life as his. He labors amid the purity and freshness of Nature herself, and good thoughts are ever suggested by the beautiful things around him. He who gives voice to poetic inspiration, comes to your forests and fields, or on your mountains and along your fertile vales, for the materials of his portraitures and imagery! Agriculture has now also an elegant literature. Some of the best minds have been occupied by it. Numerous persons at home and abroad, might be cited, who have given their chief thoughts to it, and whose names will ever be uttered as benefactors. The *poetry* of the Sciences, too, is so intimately connected with it as to become the handmaid of our great art.

To these add but a single *other* feature, and the profession of agriculture becomes pre-eminently attractive, and promises all that man may expect in this condition of his being—that feature is *Agriculture in its social relations.*

In most other pursuits the *family* is excluded from a participation. It is not so in this—every member may not only *feel* an interest, but may *take part* in its active employments, either in-doors or out, and thus the social feelings are enlisted in the general welfare. But where Woman is cut off from a proper share in the common interests of all, neither a high degree of refinement, nor a full and complete mingling of the affections can exist.

I have said that the occupation of the farmer is peculiarly a solitary one; so in the same sense are his enjoyments—they are domestic; he will realize them in the bosom of his family; not in gay saloons, or the unsatisfying exactments of artificial life. In the intelligence of his wife and children must he find mental as well as physical help in his profession. Polite learning should find a congenial home around his winter evening fire, and the scholar, the artist, and the statesman find kindred spirits there too.

Woman, free and unconstrained by unequal laws and harsh restrictions, would move in her charmed circle, softening and modifying our rougher natures, and like the gentle south wind on icy rocks imperceptibly influence all within her reach, and mould them to her own perfections. Use well, then, the means so munificently placed in your hands. Then shall the time come, when you may beat your swords into plowshares, and your spears into pruning hooks. Then

"The stormy clangor
Of wild war music o'er the earth shall cease:
Love shall tread out the baleful fire of anger,
And in its ashes plant the tree of peace."

Lecture by Prof. C. F. Brackett of Bowdoin College, on

Parasites of Animals.

Mr. President and Gentlemen:—I propose to offer some remarks on one of the great divisions of animal parasites—the Entozoa.

These are animals which, during some period of their lives, reside either in the natural cavities, or in the organic substance of other animals. They present a more or less elongated form, and a jointed structure. Except touch, organs of special sense are apparently absent.

Their wide distribution and occurrence in closed cavities have given rise to many speculations and theories as to their origin and modes of propagation; and it is only a comparatively short time since we began to be possessed of any reliable information in regard to these points.

It will serve to bring what is known more clearly before us if we pass in review one of the more prominent hypotheses. I refer to that of "Spontaneous Generation," sometimes also called "Equivocal Generation."

The readiness with which the lower forms of life so abundantly appear wherever organic matter is left to decay, would seem to find an easy explanation if we could believe that, instead of suffering ultimate decomposition, such matter employs its residual force in effecting transformation into organisms occupying a lower plane than that occupied by the organism from which it was derived.

Thus, urine, blood, milk, vegetable infusions, etc., left exposed to the air under ordinary conditions, will, if properly examined, after a short time, be found to contain countless thousands of minute animated forms, exhibiting an intense activity. These may be imagined to be transformed directly from the matters named.

Again, most of us have observed, wriggling in some puddle, a long thread-like worm, known commonly as the horse-hair worm, so named from the popular notion that they are in fact but transformed horse hairs; and so confident are some good people in every community that this belief is correct that they are quite eager to assure us that they, or their fathers, have watched the entire process of transformation, and hence there can be no doubt about it. This being admitted, it is easy to suppose that conditions might frequently exist which would favor the genesis of similar organisms in the bodies of animals while yet living. With the purpose of determining if possible the truth or fallacy of this hypothesis, many observations and experiments have been made by investigators whose skill and general accuracy are admitted. Pasteur's researches on fermentation have led him to conclude that the phenomena of fermentation and putrefaction are dependent on the presence of an animal ferment of the genus Vibrio; and he regards each of the five or six known species of this genus as having the power of producing a special kind of putresence. If a putrescible liquid, containing air in solution, be hermetically sealed up in glass vessels and left to itself, minute infusoria at first appear, to which the names monads and bacteria are given. These absorb the oxygen and give out carbonic dioxide. When the oxygen is exhausted they die; but if the germs of the vibrio chance to be present, as is most likely, they find in this liquid, thus freed from oxygen, in its uncombined state, the proper conditions for their growth. With their development putrefaction commences.

But if the putrescible liquid be freely exposed to the air, the monads and bacteria are at first developed in such numbers that they form a pellicle over the surface of the liquid, which is constantly renewed, and thus the oxygen is entirely absorbed and its entrance into the liquid wholly prevented. Then the vibrios begin to be developed and putrefaction commences.

Professor Wyman undertook, some years since, a series of experiments in order to determine whether germs, which might be presumed to be so minute as to escape observation, were actually present in all cases where putrescence occurs, before its inception. His mode of experimenting in general resembled that employed by Pasteur, but greater pains were taken with the details. Liquids containing various infusions were boiled, and then sealed without contact of air, save such as had been admitted through tubes heated to redness. The results were far from decisive, not warranting either an affirmation or a denial of the hypothesis. "If," says Professor Wyman, "on the one hand, it is urged that all organisms, in so far as the early history of them is known, are derived from ova and therefore from analogy we must ascribe a similar origin to those minute beings whose early history we do not know; it may be urged with equal force, on the other hand, that all ova and spores in so far as we know anything about them, are destroyed by prolonged boiling; therefore, from analogy we are equally bound to infer that Vibrios, Bacteriums, etc., could not have been derived from ova, since these would all have been destroyed by the conditions to which they have been subjected."

Madam Lüders believes that she has proved that Vibrios are the developed spores and germinal filaments of various fungi. She has carried on her investigations with the greatest patience and care. All the glasses used were subjected to the strong and long continued heat of a spirit lamp, that every germ accidentally present might be destroyed. The liquids to be employed were boiled at high temperatures, and then secured from contact with any sources which could possibly furnish fresh germs. In every instance, there failed to appear any organisms when such precautions were taken.

On sowing these liquids, in which only negative results were found, with spores of fungi, a cloudiness was often observed in the course of a few hours; and within twenty-four hours they swarmed with Vibrios.

These experiments, repeated, with certain modifications, by Professor Hensen, gave results entirely confirmatory.

The experiments and observations of Schröder point to the same conclusions—namely, that there is, as yet, not the least evidence, of a positive nature, to indicate that the hypothesis of spontaneous generation is correct. Meanwhile careful observers have not been wanting to take up another line of investigation. It was found that the common hair-worm (Gordius) was invariably full grown when first observed free. Certain thread-like worms were noticed in act of escaping from the bodies of insects, and by comparison they were proved to be identical. It only remained to seek the mode of propagation. Success awaited the search; and it was found that the recently escaped individuals are not yet sexually developed. They become so, after a little time, when free to move in the moist earth, or in muddy puddles. The female then produces a long agglutinated string of ova. These being speedily hatched, the young brood attach themselves to some passing insect and penetrating to the interior of its body, remain till sufficiently matured to escape as their parents had done before them; or, if the eggs are first devoured, they are hatched within the insect, and there developed as in the other case. There are then in the history of the Gordius, two clearly marked periods. The immature mostly passed in the body of its host, and the mature reached after its escape. This is not a solitary instance, but will suffice to exhibit the law of development in this and other genera analagous.

Thus, at least, some of the supposed cases of equivocal reproduction are found to be under the operation of the same laws of sexual development.

If we carefully observe the modes of reproduction exhibited by the Aphides (plant lice), we find them truly surprising—offspring appearing which bear no resemblance to their immediate progenitors—and this fact may hold for several successive generations. But at last individuals appear like those with which we commenced our observations; and the cycle is produced continuously, the various forms succeeding in the same order. This is called *Alternate Generation.*

We find it illustrated in various classes of animal parasites. There may be found in company with certain fresh water molluscs, in stagnant pools, numerous small worms with triangular heads. They are furnished with suckers by means of which they firmly adhere to the bodies of the molluscs; soon they lose the tail, which before had served for locomotion, and become surrounded with a mucous substance, or in short become encysted. While in this state it becomes transformed into an intestinal worm—the Distoma. This however will not be developed fully unless it pass into the intestine of some animal suited to its nature. This may easily happen by the mollusc being swallowed by the sheep, the ox, or even by man—in either case it will speedily be digested, and thus the encysted worm will be liberated, and in due time will make its way to its proper position, the liver, for example, in the sheep, and is then called Distoma hepaticum, or in common language, the fluke, whose pestilential effects are but too well known. In the liver of their host, these Distomata, or flukes, become sexually mature, and produce immense numbers of eggs, which pass into the intestines and thence with the feces they escape and fall upon the soil. These eggs firmly protected by their hard shell, may be washed by the rain into stagnant pools, where they may soon be found developed into *Cercaria-sacs*, and living in the abdominal cavities or among the reproductive organs of the molluscs which are to furnish them their proper entertainment while they perfect and bring forth their broods of young *Cercaria*, similar to those with which this curious history began. Now in general, we expect to see offspring resemble their parents, but in the case of Cercaria four generations and one metamorphosis are required before this resemblance is reached. Many other instances very similar are known, in which insects, birds, reptiles, fishes, etc. may be concerned. The old practice of shepherds, which did not allow their sheep to go out to graze till the dew had entirely disappeared, would seem to protect them against the fluke, since the grass being dry there is less danger that snails will be adhering to it, and hence less danger that they with their encysted cercaria will be swallowed.

It is easily seen, too, why high, mountain pastures are fitter for flocks than low, wet ones.

The principle of Alternate Generation finds its illustration in the Cestoidea or tape-worms. The importance of this subject will be a sufficient reason for presenting some of the principal facts.

There is often found infesting the livers of rats and mice, an encysted worm, whose destiny was for a long time unknown. Feeding experiments and careful observation have shown that when they have passed into the stomach of the cat, they do not undergo digestion, but develop into tape-worms, the joints of which becoming sexually matured in the intestine, produce vast numbers of eggs, which will in due time be expelled; and by far the greater part being lost, a few will find their way into the stomachs of other mice or rats, where they will find a fitting home for a few days, after which they actively emigrate to the liver or other organs in which they become encysted only to be liberated by some other cat devouring their host. And this cat thus becomes possessed of tape-worms in like manner. So also in the intestines of the meal-worm—may be found small encysted worms which with the worm may be swallowed by the mouse, or by certain birds; and when liberated by digestion, they find in the intestine of their devourer, the proper conditions for their growth and sexual maturity, which they soon reach as tape-worms, and then are expelled either containing countless numbers of eggs, or having previously discharged them. These eggs, swallowed by other meal-worms, will soon be hatched, and the young cystic worms will migrate by cutting their way to the proper organs, where they, becoming encysted, patiently await the day when the destruction and digestion of their host shall make possible their final development into tape-worms.

One of the tape-worms which infest the intestines of the dog in like manner, while immature, passes its encysted state in the brain of the sheep, thereby causing that troublesome disease, the staggers.

The matured joints of the tape-worm escaping from the dog with its fecal matter, are scattered upon the ground and the eggs adhering to the wet grass, are swallowed by the sheep, in whose stomach and intestines they are hatched; the embryos beings are armed with six little hooks with which they actively make their way to the points where they may properly become encysted. To do this they have only to enter a circulating vessel and be carried to the brain along with the current of blood, or to such other place as their instincts determine, when they fix themselves and becoming encysted, they await the time when they may pass into the stomach of some suitable animal in which to fulfill their final destiny.

The pig and man stand in the same relation—the tape-worm in man, in becoming matured, produces millions of eggs, some of which will easily be swallowed by swine, and hatching, will migrate, and becoming encysted, produce "measly" meat. This if swallowed without thorough cooking, may give rise to tape-worms as before. The remedy is thorough cooking or abstinence.

Many other similar instances might be cited; the law appearing to be in all, that two hosts are required for the complete evolution of the tape-worm—one of these furnishing the home for the cestoid development, the other for the tape-worm proper. Moreover one of these hosts is destined to be eaten by the other; hence we should not expect to find the tape-worm in the intestine of an herbivorous animal, like the sheep and ox. And as a matter of fact these do furnish the encysted worm which give rise to the staggers, by the inflammation and pressure they cause in the brain—but not the tape-worm, since they do not devour other animals in which the encysted forms occur.

However, it is easy to see that exceptions to this rule may occur; thus, the dog may swallow the eggs of the matured worm, which have escaped with his own feces, and thus become infected with the encysted worm, and some of these may be discharged by ulceration into the intestines where they will reach their final and perfect condition, or the eggs matured in the intestines may be thrown into the stomach in vomiting.

The same may, in rare instances, occur in the strictly herbivorous animals, yet the likelihood of such occurrences is not great.

The fact stands thus: the cestoid worm which occurs in the sheep (Coenurus cerebralis), is naturally destined to become a tapeworm in the intestines of the dog. Some latitude is, however, possible, for if the cestoid worms, which are formed in the pig, in the sheep, or in the ox, find their way into the stomach of the dog or into that of man, the development will go on. Many feeding experiments have shown, however, that the different species are confined within narrow limits.

Perhaps the most remarkable case of Alternate Generation is exhibited by the *Ascaris nigrovenosa.* In the lung of the frog these are found to produce viviparously. The very minute young pass into the intestines. When they are set free they pass into the moist earth and become little snake-like organisms, which develop into males and females. The eggs produced by these, when placed in the frog's mouth pass into the lung, where they develop into the viviparous form again, which appears to be hermaphrodite.

Here then is an alternation of monoecious and dioecious generations, together with a surprising metamorphosis!

Lecture by Dr. George B. Loring of Salem, Mass., on

Raising Neat Stock.

Gentlemen:—The importance of a judicious selection of cattle for our farms is fully recognized by all who take an interest in agriculture. The domestic animals are man's allies and partners in the tillage of the earth. And of them all, none are so intimately connected with all farming operations, as the many breeds of horned cattle. In their various forms they constitute a large proportion of our agricultural capital.

There is an old French proverb, "no cattle, no farming—few cattle, poor farming—many cattle, good farming." And we learn that when Cato, the wise and sagacious Roman, was asked—"what was the most assured profit arising out of the land?" made answer—"To feed stock well." Being asked again, "What was the next?" he answered, "To feed with moderation." And we can easily imagine the contrast which exists between that aboriginal production of food, which the sinewy savage practices as he pursues the still more sinewy cattle across the plain, and even the first dawn of domestication in the management of animals—and the still greater contrast which exists between the wild and flying drover of the pampas—and that calm and solid and imperturbable specimen of humanity, who winds his placid way from the valley of the Tees, to Smithfield market, realizing, as he follows his rolling and wallowing Shorthorns, the truth of the saying, "who drives fat oxen, must himself be fat." There is a long interval between "the five hundred yoke of oxen" of Job, and the stupendous beeves which graze upon the fat pastures of England, bred and reared by rule into an exact estimate of each "pound of flesh."

And to us who are engaged in farming, among all the modern improvements, it is a matter of special interest to know the processes by which the present breeds of cattle have been brought to their existing proportions, and how they can be preserved in their condition. An Ayrshire cow, and a Shorthorn bullock, are by no means the result of accident. They have been produced by the application of the highest and most intelligent skill, at the hands of the Bakewells, and Parkses and Nichols and Collings—under whose treatment, as has been truly said,—"the long-legged, slab-sided, ill-bred oxen are metamorphosed into small-boned, quick-fattening Devons, and elephantine Shorthorns;" and the "lean hurdle-backed Norfolk rams" have become "beautiful, firkin-bodied South Downs." We have the advantage of the experience and the products of these distinguished and successful breeders; and it specially becomes us to inquire what advantage we can derive from all they have done. We must have cattle adapted to our soil and climate, cattle which can be profitably fed, cattle which will make the best return for the labor and produce bestowed upon them.

I am aware that there is no breed of cattle universally adapted to the New England States, or even to any one State. The valley of the Connecticut, and the hills of Berkshire and Essex in Massachusetts even, differ almost as much as the valley of the Tees and the Highlands of Scotland. And we shall find that in selecting a breed of cattle for each locality, we must be obedient to nature, or nature will take the matter into her own hands, and will bring about a certain conformity between herself and the animals which she is to nourish. When I tell you that Shorthorns have not flourished in some parts of the New England States, and that

Ayrshires have shown too great a disposition to take on fat in the rich pastures of Maryland, owing perhaps to a bad selection of animals, you will understand what I mean by saying that nature will have her way in these things.

Still we may learn from statistics what our people demand most in this branch of farming, as well as all others large and small among us. I find for instance that in Massachusetts, in 1865, the number of cows was 134,121; the number of oxen and other cattle is 122,874. The value of the cows and heifers is estimated at $7,041,352; the value of the oxen and steers is $4,715,333. In New Hampshire, the number of cows was 77,000; the number of oxen, heifers and steers, 121,521. The value of the cows was $3,026,100; the value of the other cattle, $4,055,081. In Maine the number of cows was 135,059; the number of "cattle and oxen" was 172,823. The value of the cows was $5,802,078; the value of the oxen, &c., was $6,203,341. In New York the number of cows was 1,220,200; the number of oxen and other cattle was 726,412. The value of the cows was $54,067,082; the value of the oxen, &c., was $24,082,062.

The average value of cows in Massachusetts was $52.50 per head; in New Hampshire, $39.30 per head; in New York, $44.31 per head; in Maine, $43.70 per head.

These figures show the value and importance of the dairy. On the East, and on the West, on the North, and on the South, in every direction, at the fountain head of our grain crops, before corn has been quadrupled on the original price of the producer by long transportation, and by speculation, there where the rich valleys and prairies of the West offer an abundant and cheap sustenance for cattle, and where a propitious climate economises food and labor, while all about us beef is growing as it were spontaneously, we in New England can never expect to adopt this as an extensive branch of our farming interest.

It is the dairy therefore which occupies the attention of most of our farmers. Every man who owns land keeps a cow—or ought to. The milk-pail is one of the first utensils provided for carrying on the domestic economy. The rich man is never satisfied, until his table is furnished with milk and cream from his own favorite animal. The poor man finds his establishment incomplete he has added a shed for his cow; and his farming is never perfected, until he occupies the highway as a pasture, and gleans his winter's store of fodder from the neighboring meadows. Every larger farm has its dairy, proportioned to its size and cultivation. And as we look abroad, it must be apparent to every intelligent observer, that he will be a true benefactor to our farming community, who will improve the dairy stock of New England, and bring it to as high a degree of uniformity as possible, making all due allowance for diversities of climate and locality.

Now, the observation of every man of experience will teach him that wherever we find a locality famous for good cattle, the high quality of that stock has come from some pure importation. More than fifty years ago, Mr. Vaughan, a liberal and intelligent gentleman, who conceived that England without Priestly was no place for a christian to live in, followed that great philosopher and divine in his flight to our shores, and settled on the banks of the Kennebec. He imported Durham cattle of that day—the improved Shorthorns of ours; and you may find to this day, grazing in the valley of that river, a large, thrifty, quick-growing, solid, massive breed of cattle—the indigenous Shorthorns of that region, indigenous, because they have become adapted through generations to that soil and climate, and are now among the most profitable products of the State. Go to Portsmouth and the surrounding towns, and you will find cattle of similar quality and description, the fruits of the more recent importations of Colonel Pierce;—a native stock now, but possessing certain characteristics, which they never lose either in succeeding generations or in various families. An importation into the valley of the Connecticut by the late Mr. Williams, whose herd has been transmitted to as much judgment and skill and intelligence as can be found even in the old Country, has stamped the stock of that section with points of value seldom equalled. I had often been struck with the excellence of the cows in the Aroostook country, and thence to the Bay of Fundy—a well bred, hardy, dairy-looking race of animals; and I soon discovered that some choice Ayrshires had been brought into that region. The oxen of Meredith Bridge and Lake Winnipisseogee—who has not admired their stately carriage, their rich color, their symmetry of form, their thrift, and their size and endurance. They are the modern Devon blood, mixed with the Shorthorn—engrafted upon that soil, and brought to a high degree of perfection by judicious care. In an obscure town in Massachusetts, there was a remarkable cow, known of all men thereabouts, distinguished from all the "old red stock," for her outline, her milking qualities, her beauty; her owner said she was English on inquiry I found that she had descended from a herd of Ayrshires brought into that section many years ago—and now nearly extinct. There are certain portions of Massachusetts, where I can always replenish my herd of cows without much difficulty, and with many chances of finding good animals; and I always find that either Parsons imported into that region, or such men as Pickering and Newell brought thither choice imported animals from other parts of the State. And I think you will find that whether you are searching for beef or milk, as a general rule, the further you get from the "old red stock" the better off you will be, always granting that they possess certain qualities which furnish an excellent opportunity for improvement.

Without discussing the merits of the specially beef-growing animal of modern days, such as the improved Shorthorn produced by the skilful breeding of England and adapted to the luxurious feed of the West and Southwest; or the Devon which in England is a large, even, compact animal, often dressing fifteen hundred at four years old, while here it is apt to be small and inelastic; or the Hereford, which has never succeeded well in America; or certain breeds claiming to be dairy animals, because they certainly are nothing else; I call your attention to that section of Great Britain whose soil and climate are analogous to our own, and where the development of dairy-stock has received the attention of the most intelligent men of the community. The farmers of Ayrshire and Wigtonshire, find in their immediate neighborhood a market for fresh dairy products, and as there is no profit in feeding cattle for beef in that region, they have applied themselves to the work of obtaining the best dairy cow that can be put together. This is the origin of the breed of cattle called Ayrshire. They are comparatively modern in their introduction into the list of breeds, not having been mentioned at all by Parkinson sixty years ago, and having been derived, as many assert, from a mixture of Shorthorn blood with the native blood of the region.

These animals are the model of a dairy cow. Hardy, well shaped, of medium size, and giving an ample return for the amount of food which they consume, they are well adapted to our short pastures, and to our long cold winters. Without presenting any uncommon peculiarity, excepting a remarkable symmetry, they would be selected at once by one of our intelligent dairymen as the pattern of a cow suited to his purposes. I am speaking now of a farmer's cow. In this latitude we require an animal which can easily traverse our hilly pastures—not too heavy, and with short, strong, muscular limbs. Our pastures are not very luxuriant, and we need a cow which is a rapid and not too large a feeder. Our hay crop is valuable—and a profitable cow must be satisfied with a moderate amount of hay in winter. Grain is expensive here—and we cannot afford to feed it to our cows to any great extent—especially when they are dry and are merely stored for the winter. It is easy to see that a large animal may find it hard work to supply herself on a rough hill-side, during our summer months, when grass is not over abundant. She may, and generally does, winter poorly on the ordinary fodder provided by most of our farms. She is liable to come up thin in the autumn, and to go out thinner in the spring. It is evident too that a cow of small size may be too delicately constituted to undergo the trials which I have described. The labor of pasturing may be too great for her—the work of feeding on short grass, a long summer day, and then travelling home at evening—together with the exhausting process of producing milk, may be too hard for her. And you seldom see a really valuable dairy cow with a feeble general appearance—a small delicate head —a narrow muzzle—a long leg—a flat side—a large, distended carcass with feeble quarters—a narrow back—a broken chine—a rough misshapen rump—and a small cheerless eye. There may be exceptional cases—in which all rules fail. But if you desire to select a good cow for this section, regardless of breed, you would choose one with the following points, viz:

Head of medium size, with a strong, well marked, bony structure, broad between and high above the eyes, and wide between the roots of the horns; with a capacious but not clumsy muzzle, full nostril, an eye full and mild, not too large and prominent, jowls thin and wide, horns small, well curved, clear, slightly turned upwards,—and with a calm and at the same time strong and resolute expression; neck long, well muscled, slender, tapering toward the head, with little loose skin hanging below, and not dropping too much forward of the shoulders; shoulders thin and sharp at the top, and lying close to the chine; somewhat prominent, strong-muscled, and loose, jointed at the base, long from the elbow to the point in front of the base; fore quarters light, comparatively, with a straight, slender fore-leg, especially below the knee—broad knee, and broad, flat, capacious foot; carcass deep, round and full about the heart, and increasing largely towards the hind quarters; back straight and loosely jointed; pelvis wide over the hips, long and supplied with strong muscles; hind quarters broad, strong on the outside, and well cut out on the inside, with strong hock and a long, tapering hind foot; tail long and slender, strong at the roots, and set on in a line with the back, not too high nor too low; udder evenly divided into four quarters, extending well forward, filling the cavity between the thighs behind, not hung low, and with a large, long, and crooked milk-vein; teats set far apart, and of medium size and length; hide loose and elastic, but not too thin; hair soft and silky, and of lively appearance and abundant in quantity; ribs broad and flat-surfaced, with thin edges, and especially the two last widely separated. Picture to yourselves a cow possessing all these points, and you have an animal which any dairy farmer might desire, either for butter or cheese, or the supply of milk to the market. The general appearance of such a cow impresses you at once as that of an animal possessing strength, firmness and vigor without being too compact, and one capable of producing milk in a large quantity during many months of the year, without exhausting her own system, or impoverishing her master. A cow of any breed, or of any grade, whether Alderney or Shorthorn or Devon, or all combined, possessing these points, is very sure to be a good one. And you will find such cows in every section, where breeding and feeding for the dairy has been long followed; and you find them of every variety of color. I have seen grade Devons which answered the description well—and were good milkers. I have seen grade Shorthorns, which had in a long series of years become reduced in size by the feeding which they had had for generations, brought well up to this mark. I have seen some Alderneys, and more grade Alderneys, which would bear this test. And in all this they have come up to the standard of an Ayrshire cow—a farmer's cow—a cow which can give an abundance of milk, make an ample supply of cheese, furnish a reasonable amount of butter, and whose milk is of nutritious quality, well supplied with caseine and not overloaded with fatty matter. "Every cow should fatten one pig"—is an old rule and a good one. That is, the daily product of a good cow should be in buttermilk or whey enough to fed one pig, after the cream and cheese are extracted. With regard to the size best suited to dairy purposes—I think on our ordinary New England pastures, a cow that will dress in good condition, six hundred pounds, is the most desirable.

Among the Ayrshires is a race partaking strongly of the nature of Shorthorns, round, compact, thick-meated, close-shouldered, which are to be avoided. Some are found also with a peculiar shelliness of skin, a hard unyielding inelastic feel, which is very objectionable. Some of the bulls, especially, are broad on the top of the shoulders, rough in the chine, short-quartered, with uneven rump, and thick, round, heavy thighs, presenting the appearance behind of a draught-horse. These should be avoided. The oxen of this breed, are remarkable for activity and vigor, grow well after they are two years old, reach easily the weight of thirty-three or four hundred to the yoke in working condition, and and have great thrift when fed for the shambles. They are remarkable for their strong, straight limbs, and their true and steady gait.

One of the most important matters, after having obtained a herd for dairy purposes, is the best mode of feeding the young, so as to preserve and develop the qualities most desirable. In rearing dairy stock, the quality of the food and the mode of feeding, with reference to the animal structure, are so important that I beg your indulgence while I dwell upon the subject at some length. It is comparatively an easy matter to breed and feed animals, which by their aptitude to fatten will remunerate the feeder. The qualities belonging to an animal structure designed for this purpose are very perceptible, are easily transmitted, and are easily preserved and improved by feeding. Mr. Bakewell learned almost the precise mechanism adapted to his wants as a producer of size and fat, —the form and quality of bone, the shape of the parts containing the vital organs, and the organs of nutrition, that "feel" which an expert understands, so that he may almost be said to carry eyes in his fingers' ends, capable of exploring the internal organization of every animal. And this bone, and shape of body, and texture of the skin, are easily preserved and transmitted. Breeding does much, and feeding does more, towards this preservation and transmission. When Mr. Colling saw Hubback he knew that his stomach and glandular system, and nervous organization, all tended toward the development of fat, and he believed it would be easy to transplant such lethargic faculties as these. He did this on good soil, and with proper care succeeded in making a creation of fat.

Mr. Aiton and his predecessors, had a very different and a much more difficult task to perform. That delicate organization, which is called into operation when the food taken into the body is to be converted into milk, is much more difficult to comprehend or control. True, there is a certain physical conformation indicative of a large capacity for secreting milk; but when we remember that this capacity violates all law, and is as erratic as genius, we can comprehend how many difficulties they labored under, who, in Scotland, endeavored to establish a breed of milkers. They might secure the bony structure, the quality of skin, the shape of the muscle, the general outline, the form of udder most approved, and after all this, there might be some deep defect in the powers of assimilating the food, in the glandular system, in the nervous organization, which entirely destroyed the utility of the animal. This accounts for the wide differences which exist in individuals belonging to every well known and long established breed of milkers, as the Ayrshires and Jerseys. Thousands of animals are driven from Shorthorn and Devon regions, so nearly alike in weight and size and shape, that the law of their reproduction seems to be as fixed as that which gives to the casting the shape of the mould, be it repeated times innumerable. But no one can find a race of milkers, all brought up to a high standard, and all capable of transmitting that standard. We approach it, but are often vexed at the unexpected failures.

Now it would seem that the great rule to be observed in the rearing of dairy stock, is not to interfere with this delicate organization, by the food furnished in early life. Why cannot the system of a heifer be injured by food, so as to disorganize her glandular functions, as well as the system of a cow, which can be forced into diseased action, with the greatest ease; which, in fact, requires constant care lest in her business of manufacturing milk, she may take on disease? Why may we not, for instance, lay the foundation for garget, long before the udder contains a drop of milk? We do not feed a milch cow as we do a fatting cow, unless we are willing to run the risk of ruining her. For the wholesale statement so often made, that what produces milk, will also produce fat, and vice versa, is shown to be wholly unfounded by a comparison of the effect of rowen hay, brewers grains, shorts, and green food, with corn meal, and oil cake.

A cow, moreover, never reaches perfection in her line, until she has arrived at maturity; and she must reach this period of life, with all her faculties unimpaired, if we expect her to be as good a cow as nature intended her to be. She differs in this respect from the best beef-growing animals, which are mature, as it were, from the start; and whose organizations, instead of being impaired for their business, by generations of high early feeding, are, rather, more and more adapted to it.

We all know that the oldest and best families of Shorthorns, are not remarkable for constitutional elasticity and vigor. They have not great muscular strength, are not nervous and powerful in their action, and are deficient in the procreative faculties. Like the thorough-bred horse, which has also been forced to early maturity, and early decay, for many generations, they have become enervated, and constitutionally delicate. High feeding has done this, in both instances; and as "a short life and a merry one," in the animal is most profitable to the breeders of beef, and horses fit only for the turf, high feeding has accomplished what was desired—the gain being greater than the sacrifice.

Not so, however, with the cow. Her powers mature slowly, and depend very much upon the strength of her constitution. When this is impaired, her value is diminished. For in the work of giving milk, in which her whole life is passed, the tax upon her vital forces is such that none but the most robust can endure it. In establishing a dairy breed, therefore, early maturity, with its accompanying evils, is not desirable. On the contrary, it should be avoided; and that mode of feeding should be adopted, which will be conducive to health in the individual, and in the breed, and which will in no way exhaust the powers, or shorten the life of the race.

In addition to this, great regard should be had in raising dairy stock to the effect which different kinds of food produce upon the animal economy. Whatever enlarges the bony structure of the female calf, beyond what is necessary for her strength, is worse than useless. A coarse-boned cow rarely reaches that standard of excellence, both in the quantity and quality of her milk, which is attractive to the breeder, or satisfactory to the consumer.

So too of the fat. The fat-cells, that tissue of the body in which adipose matter is deposited, are found in fat and lean animals alike—the difference consisting in the amount of their contents and their number only. For the supply of fat, certain organs are provided, which are capable of receiving all that excess of non-azotized compounds, such as starch, oil, &c., which is contained in the alimentary matter taken into the body. Where there is a ready absorption of these compounds into the vessels, fat is produced, especially if with this absorption there is combined a vigorous power to generate adipose tissue. Where they are not absorbed, accumulations of fat do not take place; and when they are absorbed, without being provided with adipose tissue, they would accumulate injuriously in the blood, if not drawn off by the liver. Hence it is that in warm climates, where there is diminished excretion through the lungs, and non-azotized food is not got rid of by the respiratory process, the liver is overworked, its function becomes disordered from its inability to separate from the blood all that it should draw off, and these injurious substances accumulating in the blood, "produce various symptoms that are known under the general term bilious." Hence, also, some persons never become fat, however large the quantity of oily matter taken into the stomach; and it is in such persons that the tendency to disorder of the liver from overwork is most readily manifested; they are, therefore, obliged to abstain from the use of fat-producing articles of food. It is the power, therefore, to absorb these fat-producing articles of food, and to generate adipose tissue for their reception, that saves the liver from being overtasked, and results in accumulations of fat. The constituents of fat are termed stearine, margerine and oleine.

We have dwelt upon the production of animal fat, and the organs engaged in its manufacture, in order to show how distinct a part of the animal enconomy it is, and how naturally the fat-producing functions can be transmitted, independently of all others, and may be cultivated at the expense of all others.

The secretion of milk is a very different matter; and is performed by certain glands, whose business it is rather "to elaborate from the blood certain products, which are destined for special uses in the economy, than to eliminate matters whose retention in the circulating current would be injurious." These glands, called mammary glands, perform, as is supposed, the chief part of the work of elaborating the elements of milk; although it is not yet ascertained how much of this elaboration takes place in the blood during its circulation. Be this as it may, the production of milk is a very difierent business from the production of fat, and does not result in the combination of the same elements as are contained in the adipose tissue and fat-cells.

It is well known, moreover, that the proportion of two at least of the principal ingredients of milk, is liable to great variation with the circumstances of the animal. Dr. Playfair has ascertained "that the proportion of butter depends in part upon the quantity of oily matter in the food; and in part upon the amount of exercise which the animal takes, and the warmth of atmosphere in which it is kept. Exercise and cold, by increasing the respiration, eliminate part of the oily matter in the form of carbonic acid and water; while rest and warmth, by diminishing this drain, favor its passage into the milk. The proportion of casein, on the other hand, is increased by exercise; which would seem to show that this ingredient is derived from the disintegration of muscular tissue." The experience of every farmer teaches him that an animal which has a large, heavy, muscular development, and is thus furnished with the means of rapid locomotion, is seldom a good milker. Her digestive apparatus is more devoted to her fleshy fibre than to the preparation of milk. The same may be said of fat and bone. So true is this, that among cattle bred expressly for the stall, the females often furnish hardly milk enough to sustain their own offspring; and in countries where the bone and muscle of the cow are developed by labor, her service in the dairy amounts to but little.

It would seem, therefore, that in feeding young animals for the dairy, care should be taken that the young are not so fed as to develop a tendency to great size, either in frame or in adipose tissue; nor so as to establish in the end, a race which has every faculty except that of producing milk. We have all seen how high feeding of the young has in a few generations, and sometimes in one or two, removed from a family of vigorous, nervous, muscular and active horses, all traces of those characteristics which have given them value. What they had acquired on the homely fare of their native hills, they lost when brought and bred into greater prosperity. The hard and wiry tendon vanished, the elastic and well defined muscle was rounded off into graceful effeminacy, the carcass and adipose tissue had gained the ascendency, through the aid of good living, and a luxurious life from youth upward. Some of us have seen a promising heifer calf, the offspring of a good milker, pampered in its youth, and fed until it became anything but the dairy animal which its ancestry promised.

We would not advocate a deficiency of food for young dairy stock; but we would argue against an excess of articles of a highly stimulating quality. The plan of the Ayrshire farmers is undoubtedly a good one—to take their calves early from the dams, feed them from the dish, and bring them to solid food or pasture as soon as the condition of the young stomach will allow. Instead of linseed meal, they use a great quantity of oat meal,—an article of food much less predisposing to fat, and keeping up a vigorous growth. We have in New England the best quality of English hay as a basis of feeding; and after the calf is weaned, or after he has had milk enough to give him a fair introduction into life, hay, in the form of hay-tea, and afterwards of rowen, is undoubtedly the best food the animal can have, especially when aided by a few roots, such as turnips or carrots. In some cases, milk is abandoned at a very early age, and skimmed milk is advantageously used as a substitute. We would not recommend the use of grain, especially that containing a superabundance of oily matter, as Indian corn or linseed for young dairy stock. Perhaps corn meal sparingly, or barley or oatmeal may be used in winter, should the animal seem not to thrive well. But a calf that is properly weaned, and fed after weaning, and furnished with a good pasture, will be carried through the first winter most satisfactorily on good sweet hay, especially rowen, with roots. In this way can a uniform well-balanced animal be produced, which when put to dairy service will not become coarse, nor take on fat at the expense of the milk-pail.

I have endeavored in these remarks upon feeding with special reference to what is to be required of the animal structure, when brought to perfection, to impress upon your minds not only the importance of scientific rules, but also the power which every agriculturist may exercise over the animal kingdom, which he has devoted to his purposes. The laws of variation are well known—those laws by which we have been able to produce so many varieties from one origin—the setter, and pointer, and spaniel, and shepherd's dog, from a single family—the Ayrshire and Devon and Shorthorn, from the same parentage in the beginning; and have secured from the original uniformity, every diversity that can please the eye or supply the necessities of man. The most common observation and practice have taught us how to preserve and transmit acquired faculties and qualities until they become the fixed characteristics of a class. But there are certain tendencies of the animal kingdom which the ambitious farmer is obliged to resist with all his skill and watchfulness. Our domestic animals are entirely subjugated to our will. We control their increase, and their physical condition. They are shut out by us from those conflicts which, in a wild state, enable the strongest of the herd to impress themselves upon the coming generations. And it is for us to say how largely their varieties may increase, and how successfully they may resist the influences of climate, and a tendency to revert to their aboriginal condition.

I have already alluded to the effects of climate and soil upon the animal economy. Against these effects the good farmer arms himself as best he may. And in a climate and on a soil like ours, he resorts to every means in his power, by judicious breeding and good feeding, to prevent the degeneracy of his animals. It is by this same process that he resists their tendency to return to an original and uniform type. Let man be stricken from the face of the earth, and a few generations would melt all the breeds of cattle which his skill has created into one homogeneous mass, in which the characteristics of each would be lost, as they all returned with hasty strides to the condition of their common ancestry. Wherever man resigns himself to the hard conditions of nature about him, and provides himself and his animals with scanty food and insufficient shelter, the animal product of his locality will gradually approach what might be the native herds there. So true is this, that I doubt not many of you can at this moment recall herds of cattle driven from bleak northern pastures, so aboriginal in all their qualities, as to remove at once from your mind all thought of domestication. Not only had the short pastures and the cold winters reduced their size, but their roving habits had brought them to the very verge of their brethren on the plains and pampas. It is the return of his animals to barbarism which man is called upon to resist. And in doing this, he is not only called upon to raise and feed them properly, but to humanize them as far as may be by the gentleness and intimacy of his association. Upon him and his wisdom, and good judgment, and good nature, they depend mainly for all they are, in their scale of being. Let him see then that good physical qualities and faculties are transmitted in his herd. Let him see that a calm and quiet temperament is the inheritance of his young animals. Let him teach them that they are best fed by the hand of man; and that all his care for them, and association with them, will render them truly "domestic," and will enable them to resist the depressing influences of soil and climate by which they are surrounded, and to escape that return to barbarism, which is the "second danger" of man and his flocks and herds. If the hillsides and valleys of Maine are to be pastured at all, they should be pastured to the best advantage and profit. The struggle which the farmer has here, is, I am aware, not an easy one. But that progress may be made in this branch of agriculture, no one need doubt; nor is there any reason why, with proper selection, feeding and care, the average value of cattle here, of cows at least, should not be brought up to that of States considered more fortunate in soil and climate. A cow here should be worth as much as a cow in New York; I mean a source of as much profit to the owner.

I have presented these few thoughts to you not with any hope of exhausting the subject, but in order to impress upon your minds the importance and interest of the subject, and to introduce you to one of the most pleasing and profitable branches of agriculture. I need not tell you how we all depend upon the dumb creatures which wait upon us during life, and at their death feed and clothe us. From valley and hill, from prairie and mountain, they come flocking in, the patient servants of an imperious master. They offer themselves a living sacrifice to the majesty of civilized man, suffering as he yields to povery and hardship and barbarism, and rising with him as he rises, into his conditions of luxury and ease, and economy and fitness of purpose. The great community of cattle! Who shall write its history? How it has been controlled by the laws which make the world what it is—how it enables the great community of man to dwell here on the face of the earth—how it stands the pedestal on which a nobler fabric rests—how its condition tells the tale of races higher in the scale of being. That strange and mysterious relation between man and animals, everywhere recognized, everywhere felt—that mutual dependence each upon the other—that intelligent appropriation and cultivation on the one hand, that unconscious and entire obedience and submission of all the great vital forces on the other—who can tell it all? And superior as we may be, powerful, controlling and independent, can any man contemplate the magnitude of the change were the sovereignty of this great community of cattle to be asserted and man's dominion be suddenly broken? From the feeding of armies and the sustaining of the busy throng who fill our places of power and trust, down to the nourishing drop which supports the feeble child in its first grasp on life, it is the domestic animal which hears one long and constant human appeal, and never hesitates in its devoted and self-sacrificing reply. In parks, in meadows, before the cottage door, with an entire and unresisting submission to circumstances, there come to man from his dumb ally, food and raiment, and an unceasing claim upon his skill and his humanity. It is the animal kingdom which forms one of the liveliest charms of a cultivated landscape, in motion and in repose. And man never succeeds in subduing the earth and revealing its quiet domestic beauty, until he has enlisted those servants, without whose aid agriculture must fail, and whose value is commensurate with the progress made in the great business of applying all animate and inanimate nature to the necessities and adornments of civilized life.

Lecture by Henry Boynton, M. D., of Woodstock, Vt., on

Sheep Husbandry in New England.

Mr. President and Gentlemen of the Convention:—I congratulate myself upon the singular good fortune that enables me to share with you the rejoicings and the benefits of this occasion.

The mental vibration, resulting from the thought that originated this Convention, reached me in my home among the mountains, and with willing feet have I hastened to join you in this Feast of the Tabernacles—this Jubilee after the harvest.

And, Gentlemen, I count it an honor to meet in council with those, by whose intelligent foresight and patient industry your State has been placed, as regards its agriculture, in the very front rank of all the States in the nation. The influence of this movement for a Farmer's Convention, is already widely felt, and to-day the dwellers along the Green Mountain valleys send through me their words of greeting and of good cheer, well knowing as they do, that neither the science or the art of agriculture will ever be allowed to suffer at the hands of that commonwealth which in all matters pertaining to the civil, political, or military history of our common country, has ever proved herself a faithful and watchful sentinel on this northeastern bastion of the great structure of the American Republic.

We meet to consult in regard to the condition and the needs of the various branches of that calling which is at once the most difficult and the most sublime of all the employments of man.

When we remember that the interests of the human race repose upon agriculture, and that agriculture reposes upon fixed and invariable laws, do we see the deeper science—the nobler dignity—and the immense responsibility of our work.

We are frequently reminded of the light which science has within the past few years thrown upon the farmer's duties and office—and as frequently are we pointed to the magnificent results which this new light has enabled us to achieve—but these results as grand

and noble as they are, are but as a few clusters of grapes which our scientific spies have brought back to us from the "promised land"—the destined inheritance of an enlightened and well developed humanity.

We have been wandering, not forty years, but forty centuries, in the wilderness of sin and ignorance, and are but now approaching the banks of that Jordan which divides the present, with its uncertainties and doubts, from that future which shall be characterized by an intelligence competent to understand the laws of nature—and to direct every industrial enterprise in accordance therewith.

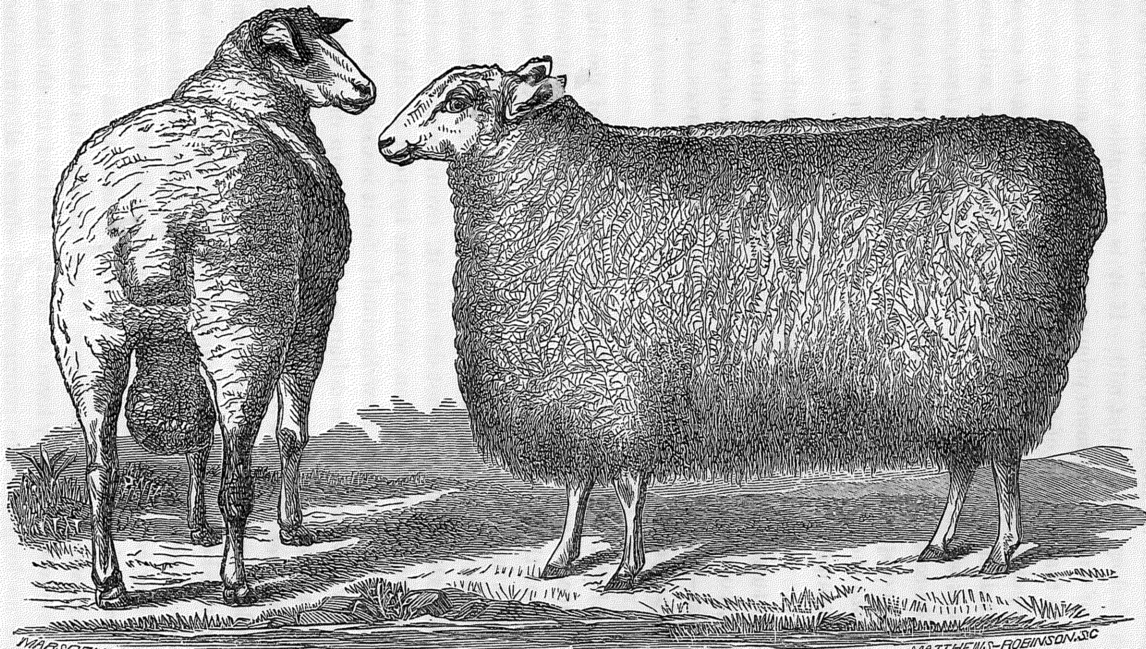
With these preliminary words, let us come to the subject of the hour—"*Sheep Husbandry in New England.*"

I do not now propose to speak of any particular class of sheep, or to advocate any special system of breeding, or to give statistics to prove the profitableness of sheep husbandry—for these questions are all two-edged swords—quite as likely to wound him who handles them as those against whom they are used. I propose rather to hint at some of the principles which underlie this subject, knowing well that this intelligent audience will need no aid of mine to enable them to deduce correct conclusions from well established principles.

In this as in other departments of human activity, we need, as a motive for self-action, not so much an analysis of any given class of facts, as an intelligent view of the principle which regulates them, and around which they all center. Since modern science has demonstrated the correlation of the differently named forces of nature, we learn that the ultimate source of that power by which both the farmer and the manufacturer produce the varied results of their labor, is one and the same.

By solar heat a constant evaporation is carried on from all the land and water surfaces on the globe. But a short distance above the surface of the earth, this evaporated moisture is driven about by air currents, and finally descends to the earth again in the form of rain. Hence the streams are filled, and an abundance of water is ready to turn the wheel which human ingenuity has placed in its pathway. Here is the source of power for the manufacturer. If he convert the water into steam, it is but the same thing in another form.

The amount of water power that a given stream will furnish, is then the first question to be settled when a capitalist wishes to



"LINCOLN" BUCK and EWE. Imported and owned by W. W. Chenery, Highland Stock Farm, Belmont, Mass.

build a mill. The machinery must be proportioned to the power. Water cannot be freighted from a distance with which to run a cotton factory or a grist mill. If it is desirable to use steam instead of water—the same primary considerations must be had in regard to the expense of fuel.

These points being settled, the kind of *machinery to be employed* will next demand attention, and the skilful operator will always select that which will produce the *best results, with the least expense* Failing to recognize this fundamental principle, he will soon find that his competitors are putting a better and cheaper style of goods into the market than he can produce, and his enterprise will result in hopeless failure.

Now the same force in nature which gives the manufacturer the water to turn his wheels, and wood and coal wherewith to run his engines, comes to the door of the farmer in the form of grass, hay and grain—and the machines by which these sources of power may be converted into bread upon our tables, or money in our pockets, are *our domestic animals*.

In the light of this truth, it becomes a matter of the highest importance for us to ascertain which class of our domestic animals will give us the largest returns in proportion to cost of keeping.

I do not here propose to go over the whole question of the comparative profitableness of different kinds of farm stock—the subject of the hour does not demand it, even were it desirable. There are causes in operation, which year by year are diminishing the number of cattle in New England; for it is useless for a man, where hay is worth fifteen dollars a ton, and corn one dollar and fifty cents a bushel, to compete with an Illinois farmer in the production of beef. It is as contrary to sound business principles to undertake to make beef from grain transported a thousand miles, as it would be to think of running a cotton factory with water brought from lake Erie. There will always be a definite demand in New England for the ox for the plow, and for the cow for dairy purposes, and that demand will always regulate itself. The dairy is paying large profits just now, but what will the dairyman do with his cows when they have exhausted his land till the business can be no longer made remunerative?—for of all our domestic animals none makes so small and so poor a return to the soil in manurial agents, as the milk-giving cow. Who of us has not seen whole townships in New England impoverished by this system of drainage—the best qualities of the soil strained into the milk pail, and sent to the distant market.

So, too, the work of our farms will always require that a certain number of horses be raised—but I think no man would be ready to hazard the assertion, that the grass, hay, and grain of our fields can be profitably sent to market in the form of horse flesh. And it may be questioned whether those gentlemen, who with wealth accumulated in other branches of business, are now raising horses under the most favorable circumstances, find that their investments make such returns as would enable a man of more limited means to live thereby. New England farmers are every year placed under immense obligations to this class of liberal minded gentlemen, since they are thereby, at small expense, enabled to improve the quality of their own horses, which, from their present mixed condition as regards blood, are so liable to constant deterioration. These men are public benefactors, and long may their love of a beautiful horse blind their eyes to the meagre returns they receive for their labors.

In order now to learn what sheep, when well cared for, will do for the New England farmer, we must first look at them, as meat producing animals, compared with cattle.

In the examination of this question science fortunately comes to our aid, and gives us safe and reliable guidance.

We are indebted to Messrs. Lawes and Gilbert, the distinguished farmer chemists of Rothampstead, England, for the most extensive and perfect series of experiments that have ever been instituted, to demonstrate the actual mean weights of our domestic animals, in the various stages in passing from a lean to a fat condition, and to ascertain the whole effect of food upon them. Hundreds of oxen, cows and sheep, were slaughtered to furnish the necessary data, in these experiments. The amount of food consumed in fattening was carefully noticed, and its effect upon each animal. These examinations were even carried so far as to enable them to determine the proportions of all the different organs and parts of the bodies, in the different classes of animals, and to estimate the percentage of dry substance, and of water in the carcass, and in the offal respectively.

The amount of care, labor, patience and capital devoted to these experiments, entitle them to our fullest confidence.

As a starting point in our comparison between sheep and cattle, we find from Mr. Lawes' experiments that the proportion of dry substance in the carcass of a half-fattened sheep, is four per cent. greater than in the ox of the same condition, and six per cent. greater when fattened. The percentage of dry substance in the offal parts of the half-fattened sheep are at the same time two per cent. less than in the ox, and when fat, three per cent less, while the percentage of water in the offal parts are somewhat greater in the sheep than in the ox, in the different stages of fattening. Thus we see that the carcass of the sheep, by its very constitution, possesses an advantage at the outset, over that of the cow or the ox. Not only is this true, but we further learn, that while both parts of the body, the carcass proper, and the offal, increase during fattening, the increase of the former is greater, and that of the latter less, in the sheep, than in the ox and the cow.

As might be inferred from the foregoing facts, we also learn that sheep will make a greater increase of live weight from the same amount of food than will cattle. The difference stated is about 25 per cent. Or given in other words, of a mixture of good hay, meal and roots to be fed to fattening animals, a sheep will make as much meat out of 75 pounds of the mixture, as the ox will from 100 pounds.

On this point we can clearly trace the comparative value of these two machines, which nature has given us, with which we may convert the products of our fields into a marketable commodity. How long could a cloth-maker afford to run a set of machinery that wasted 25 per cent. of the wool fed to it? or which made one-fourth less cloth than another, from a given amount of material?

While upon this point, it may be as well to notice an objection which will be raised here, namely:—that the higher price of beef in market is always sufficient to more than compensate for this assumed loss in feeding cattle. The objection is worthy of notice, but may not prove as formidable as would seem at first sight.

As a people the Americans, and New Englanders in particular, have a strong prejudice against mutton as an article of diet, and for the best of reasons—our markets furnish but a scanty supply of anything deserving that name. The tough, lean, blue carcasses that are sold under that name, would disgust any meat eating animal, from man downward, and it is by comparing the price of beef with this dry and juiceless trash, that the objection has arisen which we are now noticing.

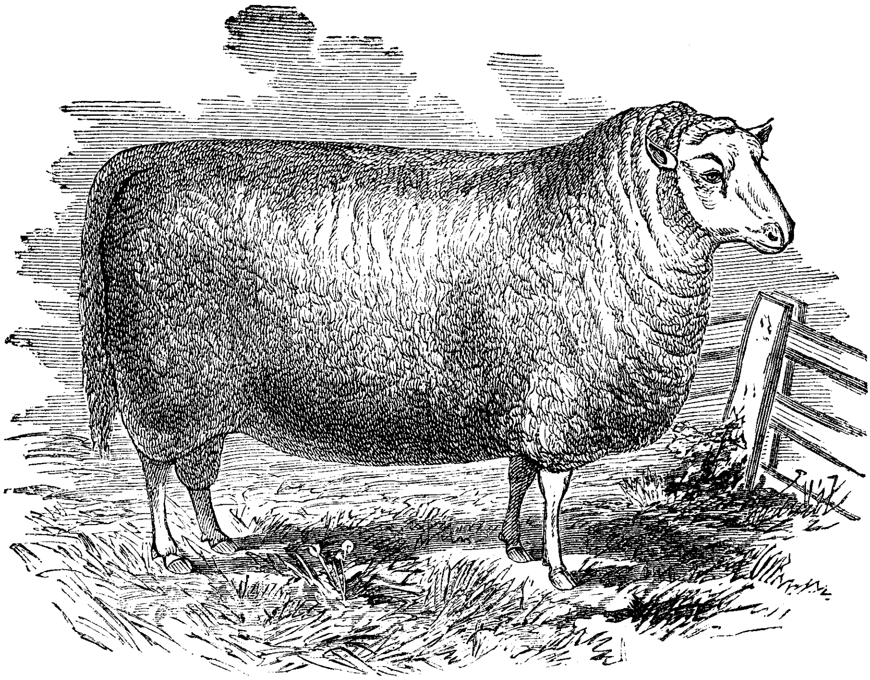
Poor mutton has always sold at a low figure, and always must, while a good article will command a high price, even in our communities where we find so few lovers of this meat. Not only is this true, but in the principal markets of our country, Boston and New York, choice mutton has for many years sold higher than the best beef. In England this fact is still more noticable. For years there, mutton has commanded from one cent to one and three-quarter cents more than their world renowned Durham sirloins. Put a better article into our markets, and the same fact would show itself here, while a general love for this food would at the the same time be produced.

Sheep have been multiplied in England, till there are now enough to give one to every acre, but the statistics of the English markets show that the consumption of mutton has been for years steadily on the increase. Let them be increased in the same proportion in New England, and at the same time the quality of the mutton improved in the same ratio, and it will no longer be said that this variety of meat will not give the producer a remunerative price in our markets.

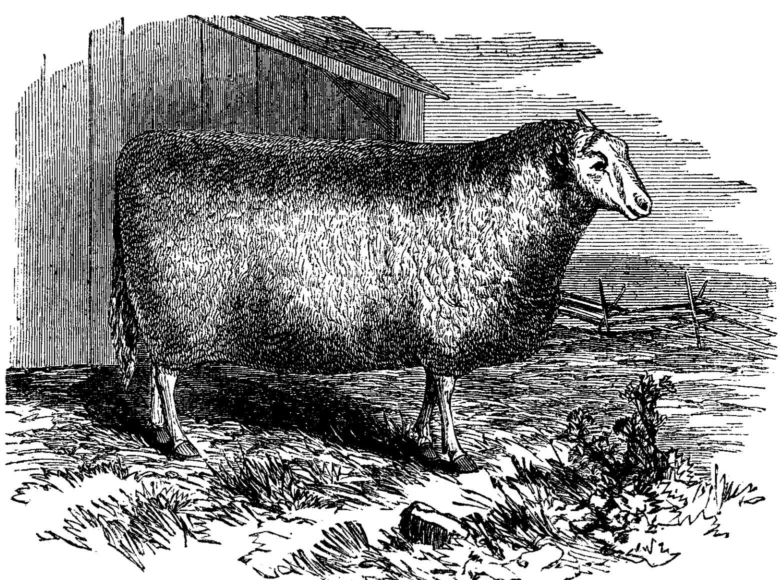
With the present rapid decrease in the number of our beef cattle in all our territory east of the Hudson river, no man need fear that our New England markets will ever be glutted with meat. Our cold climate will always compel us to be large meat-eaters, and in proportion as cattle fail, we must look to the sheep fold for our supply. To meet this constantly increasing demand of our rapidly multiplying population, opens a field for intelligent enterprise, as broad, and promises a return as munificent as the most ambitious farmer can desire. He who first sees this fact and prepares to meet this demand, which will surely come upon us, will be the first to reap the unfailing reward.

While upon this point we should not fail to notice another fact herewith connected, namely, in addition to causes already hinted at, the increased consumption of mutton will be largely augmented by economic considerations. In our cities and densely populated districts the laboring man will endeavor to supply his meat-wants at the most economic rates, hence his experience will soon teach him what science already demonstrates, that mutton *loses less in cooking than any other animal food.*

English chemists and experimenters teach us that one hundred pounds of beef in boiling loses twenty-seven pounds, while one hundred pounds of mutton loses only twenty-one pounds. In roasting, one hundred pounds of beef loses thirty-two, while the



"TEXEL," OR "MOUTON FLANDRIN" RAM.



"TEXEL," OR "MOUTON FLANDRIN" EWE. The property of Winthrop W. Chenery, Belmont, Mass.

same amount of mutton loses only twenty-four pounds. This may seem an unimportant fact, but it will have a wide influence upon this question in the future.

Still more, as a knowledge of the laws of health and disease becomes more generally diffused among the masses, as Doctors gradually come to be what their title implies, *Teachers* of the people, it will then be understood that not only is mutton the most economical but also it is the most nutritious of all varieties of animal food. When then the laboring men in our factories and shops, on our railways and in our fields, learn that they can have just as large a roast for fifteen cents as they can for twenty-two, and at the same time one which will give them more strength for their daily tasks, New England farmers will not have to wait long for customers for the meat-proceeds of their sheep-folds.

But a well fattened carcass is not the only return that the sheep makes to her faithful keeper; she yields him an annual revenue in the form of Wool.

I am well aware that my subject here encounters the objection so often and forcibly raised against the business of sheep husbandry, that the wool market has been so fluctuating that no man could calculate with any safety upon the annual returns for his clip of wool.

As the work of raising wool is intimately connected with that of making it into cloth, the ups and downs that have characterized wool-growing for the last fifty years, have been just such as have marked the business of woolen manufacturing. They have not been enjoyed over-much by either party.

As great as these fluctuations have been, they have been exceeded by those of some other departments of our industry. For the past sixty years, the price of fine wool has never but once dropped below thirty-five cents a pound, and that for a single year,—the first under the tariff of 1857—while for this entire period it has averaged somewhat over fifty cents a pound. For about forty years previous to the stimulus given to wool-growing by the late war, fine wool but once reached seventy cents—the year 1831—under the tariff of 1828. This surely is not a very wide fluctuation, when we remember that during these same years, wheat has oscillated between thirty-seven cents and two dollars per bushel, and corn showing variations in prices, four-fold greater than have characterised the wool market.

Such facts teach us that there is little in the objection under notice, which should discourage the growers of wool. The changing fortunes of all other branches of business, must attend this also, and the man, who, in perilous times changes his boat for some other, expecting thereby to find smooth waters, will soon learn that he is on the same tumultuous ocean, whose waves ebb and flow in obedience to the great law of supply and demand.

It should here be remarked, that if New England farmers made wool less a specialty, they would feel these market changes far less seriously. A little more attention to the price current of Quincy Market would aid them greatly during these times of depression. Let them keep sight of the value of mutton, as well as of wool, and they will suffer less from a poor market for either.

The day has passed when wool-growing of itself alone can be made largely profitable in New England. In the production of this staple, we cannot compete with the Western farmer—still less with the lords of the immense herds on our south-western prairies, even if we could feel sure of a protective tariff which would exclude foreign wool from competition in our markets. It would be idle to undertake such a work;—but the breeding of superior animals, which will be needed to invigorate the worn-out blood of flocks in other sections of our country, is a work for which the climate and soil of New England, not less than the intuitive skill of our farmers, are peculiarly adapted. What the future demand for wool will be in our country, may readily enough be calculated when we take into account our rapidly increasing population, and remember that it takes four pounds to clothe every individual in the nation for a single year. What then must be the demand when our present thirty-five or forty millions shall have become seventy-five or eighty millions?

Calculate, if you can, the myriads that are spreading over our Western prairies—filling up all the fertile valleys along the eastern borders of the Rocky Mountains—and soon to pour down the western slope to the shores of the Pacific—and then say if wool-growing in America will be a precarious business, or if such stock as New England brains can produce upon New England soil, will be likely to make a vain search for a market.

But, gentlemen, there is still another side to this question, which we should not pass unnoticed—hence I wish to call your attention to Sheep as agents in renovating worn-out Pastures.

One of the most urgent questions which we are called upon to answer to-day is, "How can we best renovate our impoverished lands?" The answer that comes to us from England, which long ago passed through the agricultural pupilage that we are now experiencing—the answer that comes to us from the older countries of Europe—not less than the unmistakable answer that science writes out for us to read, is—*a well conducted Sheep Husbandry.* How strong soever the others may have been, here lies the strongest inducement for an increased attention to sheep culture. In consequence of the value of the manure which they return to the soil, the English farmer is enabled to pay a rental, equivalent to the value of many of our farms, and they tell us that but for this source of profit they could not live. The Italians have a proverb, that "A sheep is the best dung cart"—and modern science tells us on what the truth of that proverb is founded. It is because thirty-six pounds of sheep manure are equal, as a fertilizer, to one hundred pounds of ordinary farm-yard manure. Richer in nitrogenous substances than the manure of the cow or horse, it is scattered upon the field, the sides and tops of the hills, in the most desirable form to be easily trodden into the earth and mixed with the soil.

We send our ships to the islands of the most distant oceans, and manure hunters to far away Continents, while our chemists and geologists harrow the face of the country, searching carefully along our bays and water courses, and even plowing up the hard rocks, to secure the means wherewith our sterile fields may be enriched, while we overlook the best of all agencies with which nature enables us to accomplish that object.

As we are yearly paying out millions of dollars for foreign fertilizers, let us stop long enough to inquire if here may not be a shorter and surer way to that position for which we are all laboring.

Such then are the facts relative to the profits which sheep will return to us for a liberal and generous culture, and it should be further noticed that they will manufacture this delicious and healthful mutton, and the valuable fleeces which they lay at our feet—enriching at the same time every rod of soil on which they tread—all from forage which other animals refuse to eat. Your pastures, which are stocked to their full capacity with cattle or horses, will still give acceptable sustenance to a few sheep.

From briars and thorns, shrubs and bushes, with such grasses as the dainty cow passes by, they glean an abundant living, and from what the winds would blow away or the waters carry down into the river, they return to us a right royal benefaction for the little they ask at our hands. As "rag mills" make an excellent quality of cloth from worn out garments, and from rags picked from the gutters, so sheep seemed constituted by nature to gather up the very fragments of the vegetable kingdom, and work them up into materials of the highest use and importance to man.

In striking your balance, for and against this department of profitable and economic industry, let not this item be omitted.

Any farm that can support one cow, can also, with the addition of a trifling expense, have one sheep added, and larger farms in proportion. How meek and confiding these timid creatures become, when made the pets of the farm-yard and the pasture; when kept in this manner they contribute largely to the variety, life and beauty of rural life, and never fail to enrich the hand that feeds and cares for them.

If then, you now, or hereafter, reach the conclusion that there may be some profit in sheep hnsbandry even in New England, you will ask: What breed of sheep shall we keep? As I hinted in the outset of my remarks, we should ascertain what principles nature teaches, and shape our efforts in accordance therewith, if we would hope for success. So here, to answer your question you must consult first, your soil; second, your climate; and third, your market. If you have a rough, highland farm, with not over abundant grasses, put the tough, hardy Merino upon it. This class of sheep love high lands, high latitudes, and a pure air. It is as natural for them to run up hill, as it is for water to run down. I would like to see that hill, the top of which a flock of Merinos would not find in a single day. As a general rule, they do not flourish on low lands, or near the sea, unless they are put upon a high promontory, and for the same reason that sugar maple trees will not thrive in a salt marsh.

But if you have a rich valley farm, with a deep alluvial soil, yielding an abundance of luxuriant grasses, and especially if within easy communication with a good market, you should by all means select some one of the many families of coarse wooled sheep. The Cotswolds, the Leicesters, the South Downs, any one of them, will enrich any good and faithful keeper.

With our variety of climate, and the widely differing qualities of our soils, no one breed of sheep can ever largely crowd out all others, though particular kinds, under local and prejudicial stimulus will now and then preponderate. That you have a particular breed of sheep is of far less importance, than that you bestow skillful care upon what you have. The man that has those which have heretofore made him good returns, should not be persuaded to give them up for others, whose habits and wants are not as well understood.

This field of enterprise is broad enough for all who wish to enter it, so broad there need be no envious jostlings, for every man who can produce a first-class animal, in any of these families, will find a buyer waiting at his door.

I have thus, gentlemen, briefly alluded to some of the principles upon which an intelligent and reliable conclusion relative to Sheep Husbandry in New England may be based. That this subject is to receive far more attention, as our populations grow more dense, and our increasing demands for meat fail to be supplied by beef alone, I have no doubt. To this enterprise we must look for means wherewith permanently to enrich our impoverished fields, and hence to make fat and flourishing every branch of agriculture. The enviable success which some men in this country, and many men in England have achieved, in breeding a selected variety of sheep, should stimulate us to attempt even greater achievements. As perfect in appearance as are our beautifully moulded Merinos, our faultlessly shaped Leicesters and Cotswolds, none of them have been carried beyond the line where further improvements are no longer possible. To keep them where they now are, and not allow them to slide backward to the types out of which the present wonderful developments have been wrought, will tax the keenest intelligence and the most unwearied energy. And herein lies the dignity of our work ; the difficulty of keeping our domestic animals bred up to a high and affluent point. That man *can* do this, is the crowning triumph of human genius.

God makes no perfect animal—He speaks into existence no mammoth Durham, no fine-turned Merino—no fleet roadsters. He gives to man the coarser materials, in bones and blood and muscle, and leaves it for human genius to work out these miracles of art, these wonderful victories in flesh and blood, wherewith to adorn the world.

Lecture by the Secretary of the Board, on

Commercial Manures.

The subject of commercial manures has been forcing itself upon the attention of the New England farmer for some years as one of steadily increasing importance. What has contributed to this more than any other one thing, is the enhanced price of labor. In years gone by, when, with the help of his boys or with labor hired at $10 or $12 per month, and by using the manure of the farm-yard, he could get satisfactory crops, making both ends of the year meet, or perhaps finding a positive gain after the store bills and taxes were paid, in ready money or in betterments on the homestead, he gave little thought to the matter of far-fetched, artificial aids to fertilization.

But times have changed; values have changed; boys generally do not love the farm as well as they did when he was young. If he wants labor now, he must put up with a poor quality at a dear rate. It is evident that the conditions of success have changed, and that some new path must be found or he will be left astern. He now hears that concentrated manures may be bought; manures very unlike what he is accustomed to, but nevertheless able to bring good crops; and cheap enough to yield him handsome profits. He sees that, *if this is true he can yet prosper by using more manure in proportion to the amount of labor* than he did formerly; because sixty bushels of corn grown on one acre costs less than sixty bushels grown on two acres, by nearly the difference of half the labor bestowed on the two acres; and it is labor which he most needs to economise. He learns also that the price and the real value of these commercial manures do not uniformly correspond to each other; that some are high priced and yet very cheap, and that some are lower priced and yet quite dear, and some are dear at any price. Many are at a loss whether to buy or not.

Previous to my acceptance of the position yet occupied as Secretary of this Board, I had given the subject of Commercial Manures only cursory thought; but the law defining the duties of the office, specified the investigation of such matters as pertained to the interests of agriculture; and there was no room for doubt, that among these the subject of manures held a very prominent position. Its chemistry was a pleasant task, for I well remember, when a lad, that my favorite play-room was the laboratory, and that more pocket money went for chemicals and apparatus than for jack-knives and skates.

Although I make no claim to having kept up with the rapid progress of chemical science during the intervening years, the endeavor has been made to keep within hailing distance, and on speaking terms.

Latterly, some thought has been given to the subject of manures in the way of business; and how that came to be I will relate.

Several years ago, being applied to by some of our leading farmers about where and how to obtain a satisfactory concentrated manure, the suggestion was offered that they make it for themselves; a company being formed, and power, machinery and all needful facilities being obtained, so as to work to advantage. The suggestion, although not immediately, was not long afterward adopted; and I have since served them as chemical director of the work. If an inferior article has ever been sent out by the Cumberland Bone Company, the blame is mine; for the only instructions ever given me were to make a very good article. I mention this business connection, in order that you may judge whether, and to what extent, partiality, or interest may find expression in the remarks submitted, and make allowance accordingly.

While no purpose is entertained to employ the present occasion to advertise the wares of one or another manufacturer, it may be permitted to say, that very soon following the establishment of the works alluded to, the commercial manures sold in competition with what was there made, rapidly improved in agricultural value—in one instance, several hundred per cent.—so that, whether the establishment was pecuniarily successful to those directly interested in it or not, the farming community has reaped immense benefit.

Before speaking directly to the subject, it may be well to offer a few preliminary observations. And first, What do New England soils lack, which we need to buy?

Chemistry enables us to answer this question with a good degree of certainty.

First, They lack Nitrogen *in some combination from which plants can get it.* Four-fifths of the atmosphere consists of nitrogen, but *uncombined;* and in this state plants cannot appropriate it to their use. It may be supplied by nitrates, or by ammonia, or by any substances which yield ammonia during their decomposition, like fish, flesh, &c.

It is a curious fact, that those crops which at harvest time *contain* the greatest amount of nitrogen, like peas, beans, clover, &c. are also those which receive least benefit from its application;

while those containing less (like wheat, for instance) receive greater benefit from its use. The function of nitrogen seems rather to yield force, or to stimulate growth, than to supply plant food.

Second, our soils lack potash in an *available* form. New England soils generally contain enough, but it is there as a silicate, in a combination so nearly insoluble that it is virtually *locked up*. It is liberated thence only by slow degrees; by freezing and thawing, air and rain, especially by rain water, containing, as it does, a little carbonic acid.*

The third want is phosphoric acid. All soils capable of producing crops contain more or less of this, but nearly all in so scanty measure that it is more frequently needed than any other ash constituent of plants; and when present in insufficient quantity, plants make a feeble growth, are liable to many casualties which healthy and vigorous plants escape, and cattle fed upon the herbage of such land are subject to what is known as "bone disease."

These three substances, Potash, Nitrogen, and Phosphoric acid, are the most important and the most expensive which the farmer has need to buy; and all commercial fertilizers sold, whatever the name they bear, be it ground bone, guanos, of whatever name or kind, phosphates, or super-phosphates, or "perfect manures," or whatever else, which are really worth more than half a cent per pound, owe their value mainly to the presence of one or more of these substances.

An interesting question relative to means of fertilization is, whether it be the better policy for the farmer to buy manures directly or indirectly; that is to say, whether to buy commercial fertilizers, or commercial articles of cattle food, to be converted partly into meat or dairy products, and partly into manure. It is too broad a subject for discussion here, but it deserves more consideration than it receives. The true answer I believe would vary with circumstances, sometimes one and sometimes the other, and it should be the business of each farmer to ascertain which would be best for him.

The term "Commercial Manures" may be understood as embracing all those manurial substances which are usually purchased by the farmer, in distinction from those usually obtained from his own resources.

* Late investigations have shown that potash is liberated from its insoluble connections by the agency of acid phosphate of lime, and to this fact, probably, is due a considerable degree of the surprising efficacy of a genuine Super Phosphate in not a few instances.

I do not propose to treat of them all in detail, but only to touch briefly upon the leading features of the more prominent among them;—and the first I will mention is *Lime.*

On some soils lime is useless or even injurious, but on others it may be used to great advantage, and it might be profitably used to far greater extent than it is.

It has happened with lime as it has with many other things in this world of ours; after having been extolled above their merit, they sink in estimation as far below their true value. The truth is, that lime is a special manure, and by no means a general one. Some things it can do with great advantage, and others it cannot do, but if attempted, perhaps harm instead. To a very limited extent lime may be usefully applied to furnish plant food—but ordinarily, soils contain enough for this purpose.

The chief office of lime seems to be that of an *alterative.* When applied to stiff clays, and to some soils neither clayey nor stiff, but rather mossy and wet and indolent; in a condition resembling, as near as anything, the chronic shiftlessness of some people we occasionally meet;—upon all such soils lime frequently causes highly beneficial changes, partly chemical, and these only partially understood; partly mechanical, but certainly beneficial; thus stiff clays are rendered more friable, and wet lands are made drier, as well as unproductive lands more fertile. Increase of fertility, by means of the use of lime, is probably as often due to its action in liberating potash from its insoluble combination with silica in the soil, as to any other effect of its application.

Lime is also usefully employed as an ingredent in composts of peat and muck, since it promotes the decay of vegetable fibre, and the destruction of certain harmful compounds of iron not unfrequently met with in mucky deposits.

The next I mention, is *Gypsum;*—Plaster of Paris,—or, as the chemists call it, Sulphate of Lime. On some soils this is a very efficient manure and the cheapest to be had. On other soils it is useless, and its price, whatever that may be, is thrown away. *How* it operates,—whether by furnishing plant food directly, or indirectly, or in whatever way inducing fertilizing results, nobody fully knows. There are plenty of guesses about its mode of operation, and some actual knowledge, but I am not aware that the numerous researches directed to this point, have resulted in satisfactory conclusions. If you would know—each for yourself—whether it will pay for you to use it—my advice is, that you submit the question to the only party who will give you an answer to be depended upon,—and I pledge my word that you will not be charged an extravagant fee for the opinion. Lay the case before your own soils, and your own crops. Put some gypsum on your land and then put on the crops, and in autumn listen for the answer. You need not use much;—half a dozen quarts, on as many different square rods, in various parts of your farm, will give as distinct replies, as would the same number of tons on as many ten acre lots.

There are wide breadths of land where gypsum will cause an abundant growth of *clover*;—and with clover you can so manure land as to produce good crops of corn, or wheat, or grass. If you have *such* land, be sure not to stint the application of gypsum and clover seed.

Bones. The value of these depend largely on the phosphoric acid they contain, and which amounts on an average to twenty-three per cent., or nearly a fourth part of their weight. It exists mostly in combination with lime, (as tribasic phosphate), a very little also with magnesia. Besides this earthy phosphate, bones have animal matter, containing nitrogen, enough to yield five to six per cent. of their weight of ammonia upon decomposition. Bones, for the most part, are very tough, and require powerful machinery to reduce them to fineness. This is necessary if we desire early returns from their application, for a bit of hard bone weighing a quarter of an ounce will last ten or twenty years in the soil, before being fully decayed.

The phosphate in bones is of the kind usually called insoluble (i. e. tribasic), but it exists in particles so very minute as to be invisible, singly, to the naked eye. These are glued each to its neighbors by the animal matter. As the animal matter decays in the ground the molecules of phosphate fall apart, and so extremely fine are they as to be slowly yet sufficiently soluble. Hence it is, that bone dust can often be used to advantage without being first treated with acid.

Some farmers are beyond reach of a bone mill. Such may, if they will, utilize bones in the following manner: Break them as small as possible, at odd jobs and leisure times; mix with unleached ashes, and wet the mass. If possible, warm it also, which is easiest done by the heat of fermenting dung. The combined action of heat, moisture and caustic alkali causes the animal matter to give way, and the atoms of phosphate fall apart in a state of such extreme division, as to be, for practical purposes, almost as useful as if made into superphosphate.

The difference between a bone manure thus prepared, and a "Super Phosphate" (properly so called) is, that in the latter the phosphate is rendered "soluble" by a chemical change in its proportions, effected by means of acid; while in the former there is simply a physical subdivision effected by means of a chemical action which decomposes the cement which holds together the extremely minute molecules of phosphate in the bone. To give some idea of the extent of this subdivision let me say, that, were a cubic inch of bone divided into a million of little cubes, (each measuring the one-hundredth of an inch on either side) every one of them would be more than a thousand times larger than the particles as they exist in bone. Now, because the degree of solubility of substances difficult of solution is greatly enhanced by being made fine, you can readily see why I stated that bone thus treated was nearly as useful as if made into superphosphate.

The next commercial fertilizer which I mention, is Peruvian guano. This, as formerly imported, contained from 15 to 17 per cent. of ammonia, but latterly from 11 to 13 per cent. The high price it bears is chiefly due to this content; for of all the manurial agents which the farmer has occasion to buy, the dearest is nitrogen in such form or combination that plants can appropriate it to their use. Peruvian guano contains a small percentage of potash; also about one half as much phosphate as raw bone; but as before remarked, its chief commercial value is due to its nitrogen.

Like other ammoniacal manures, its principal use is for grain and grass crops; and the chief profit from its use is realized upon lands rich in mineral constituents.

Peruvian guano cannot be continuously used and the crops sold off, without rapid impoverishment of the land, except upon soils rich in dormant mineral resources. A considerable portion of the land in the Southern States is of this character, and hence the high repute in which Peruvian guano continues to be held there.

But to use it with impunity in New England, it is *imperatively necessary*, that the bulk of all which is grown by it should be consumed upon the farm and returned to the soil in manure.

For general use among us, it is found that the proportions of ammonia and the phosphates in Peruvian guano, are not those which may be employed to advantage. There is too much of the former in proportion to the amount of the latter.

It is found that a manure containing more phosphate and less ammonia is safer, and better to use, and cheaper to buy ; and this experience, coupled with the fact that we have in fish guano, or porgy chum, so largely produced along our coast line, abundant supplies of a manure nearly identical in character and results, with Peruvian guano,—has caused an almost total abandonment of its use in this section. It is true that our fish guano is of less uniform quality and less concentrated, but its cheapness makes amends for the difference.

It is much to be regretted that so large a proportion of the fish refuse is not better cured, so as to retain the manurial efficacy which it has while fresh. Within the last ten years, however, there has been a vast improvement in this respect, and yet there is need of a great deal more. When well dried immediately upon coming from the press, fish guano may be deemed to be one-half as valuable as Peruvian guano.

I come now to the consideration of SUPER-PHOSPHATES, of which probably a larger amount is used in New England than of any other concentrated manure.

What is commercially known as a "Super-phosphate," is a *concentrated compost manure,* containing a considerable proportion of soluble phosphoric acid, together with a portion more or less insoluble, and usually a quantity of nitrogenous matter or of ammoniacal salts. It ought to contain as large a proportion of phosphoric acid in a condition available to plants, as it can be made to contain and yet be sold at a price admitting its profitable use in agriculture. It is not expected to be a chemically pure soluble phosphate, for this would place its cost far beyond the possibility of economical use. Go to a chemist and inquire the price of potash. You can find it good enough for surgical use for about one dollar per pound, but for chemically pure the charge will be much higher. It is clear that no one will buy at such prices to put on land, or to make soap with, when he can obtain the same quantity in commercial potash, mingled with some impurities, but good enough for the use required, for a dime or two.

So too, if he asks the price of the purest phosphoric acid in the market, he will find it about three dollars per pound, but he can buy the same *quantity* in several pounds of a good superphosphate for a quarter of one dollar, and possibly for rather less.

To be commercially pure, a superphosphate should be made *with skill, from good materials, and with no additions made to cheapen its cost,* thereby reducing its quality.

To be entitled a really *good* article, it should contain not less than thirty per cent. of phosphates, and about one half this amount in a condition to be dissolved *at once*, and the other half as fast as it may be required by the plants. Such an article manufactured on a large scale can be afforded at the present time for about three cents per pound, at wholesale. At this price, and also with the additional cost of a pretty long transportation, it will, in a great majority of cases, where *judiciously used*, pay a large profit, both in increased quantity, better quality, and earlier maturity of the crops grown.

The *aim* of the manufacturer *ought* to be, to give the largest amount possible of fertilizing constituents, in the *best relative proportions to each other, at the smallest cost.* Whether all do so is quite another matter.

Let me here offer a word regarding the chemistry of the manufacture of superphosphates. What is commonly called phosphate of lime—or as chemists term it, *tribasic* phosphate of lime, or more recently, tricalcic phosphate,—is a combination of three equivalents of lime with one of phosphoric acid, hence the name "tribasic,"—three of base with one of acid. This is the form in which it commonly occurs in nature. It dissolves in water very slowly and with difficulty, and hence is called insoluble. To convert this into soluble phosphate, or as known to chemists, monophosphate of lime, or monocalcic phosphate, it is needful to take away from tribasic phosphate *two* of its three equivalents of base, (that is to say, of lime,) leaving one of lime in combination with one of phosphoric acid. Combined in this proportion it is very easily soluble. Indeed, if made dry, by artificial means, it has such an attraction for water that it will take it from the air and become wet again. This change from a tribasic to a monobasic phosphate, or from insoluble to soluble, is effected by the agency of sulphuric acid, which has a stronger affinity for lime than phosphoric acid has, and so the sulphuric acid takes away lime and combines with it, forming sulphate of lime, which is the same thing as gypsum. We do not put sulphuric acid with tricalcic phosphate for the sake of making gypsum. By no means; for we can get enough of this ready made from sources in nature cheaper than we can make it. But we do it for the sake of the other result, viz., the conversion of insoluble phosphate to soluble.

Thus you see that when only pure tricalcic phosphate and sulphuric acid are put together you have a mixed result, *a compost,* consisting of soluble phosphate of lime and sulphate of lime. Still more is the product a compost if bone is used in place of phosphate of lime alone; for only half of bone is phosphate—the rest being chiefly animal matter. This animal matter, while decomposing in the soil, yields ammonia from the nitrogen it contains, and this is as far as possible from being an objection, for we find that a superphosphate, the value of which consists solely in its phosphoric acid, is only a special manure, and fitted for certain crops, as turnips, peas, clover, &c., and for soils particularly destitute of this substance. But let it contain also a fair proportion of ammonia, or of nitrogen in any form useful to plants, and it is adapted to many crops—Indian corn, grains generally, and vegetables generally, and to a great majority of soils. In other words, it is no longer a *special* but more nearly a general manure. You see also, that the term "Superphosphate" is a commercial and not a chemical term. Formerly chemists used the term superphosphate to indicate the salt now known as monophosphate, but it is obsolete at present and only retained in commerce. It is equally shown that a superphosphate is, and necessarily must be, a compost, *and one the value of which depends wholly upon the skill and fidelity with which suitable materials are combined in suitable proportions.*

Many commercial manures sold under other names are simply superphosphates, such as "Ammoniated Guanos," "Soluble Pacific Guano," "Phosphoric Guano," and many others. The change of title is probably due to the odium attached to the word superphosphate in the minds of many, and this in its turn is due to the vast amounts of trash which have been palmed off for Superphosphate.

The first general remark offered regarding the use of commercial manures is, that I would never recommend their *substitution* in place of farm-yard manures, nor in place of any manurial resources which can be procured at home.

The first business of every farmer should be to secure ways and means to preserve fully all the excreta of his cattle, liquid and solid;—and I would here remark, that the liquid portions are rarely sufficiently thought of. For, where some kinds of food are employed, as clover hay for example, or cotton-seed cake, the value of the liquid far exceeds that of the solid portions.

I would have him by the employment of *dry earth*, daily applied, preserve fully the manurial value of the excreta of his family;—and this is a resource, the importance of which to the farmer is vastly greater than is commonly supposed. There are whole nations of the most successful agriculturists on the face of the earth, who depend almost wholly upon this alone. We may well profit by their example in economy; and in doing so, reap a double advantage,—not only make large gains, but avoid a too frequent nuisance. In a word, I would have every home resource laid under contribution and taxed to its utmost, (within the limits of economy) before he turned to any outside resources whatever.

I said I would never recommend the *substitution* of commercial fertilizers *in place* of the home supply. I would no more do so than I would recommend the substitution of commercial illuminators in place of sunlight,—and I would not do this for two reasons; first, the sunlight is better, and, second, it is cheaper. Nevertheless, there are times and places where sunlight is not to be had, and people who pay money for commercial illuminators usually believe that they get their money's worth, and this, too, in spite of fraud, which manifests itself in the fact that gas sometimes lacks illuminating power, and is sometimes loaded with noxious vapors, offensive to the senses and deleterious to health; and in spite too, of the fact that petroleum oils occasionally explode in the hands of those who use them and burn deeper than barely to make a hole through their pockets.

Notwithstanding all the drawbacks which exist to the use of commercial illuminators, they are extensively used. Their manufacture is a respectable business, and for aught I know, a lucrative business. On the whole, taking all their merits and demerits into consideration, they who buy and use are content to buy and use again; and I venture to predict that this will continue to be the case for a long time to come.

It is not to be denied that there has been, and is still, a great deal of cheating in connection with the manufacture and sale of commercial fertilizers. It is a business which furnishes great facilities for fraud, and dishonest men take advantage of them. This is chiefly due to the fact that *the color, smell and general appearance of the article sold furnish no trustworthy indication of its real value.* This can only be determined by a careful and somewhat costly chemical analysis, or by full trial in the field, upon various soils and crops and in different seasons. But there is nothing to prevent honest and capable men from manufacturing and selling a good article at a fair price.

The question is so frequently asked, what security can we have against fraud? that I may be allowed to offer a few hints. The popular demand, if judged by the echoes of the agricultural press, is for "a rigid system of inspection," under a law to be enacted for the purpose. The fatal objection to this is, that insuperable practical difficulties lie in the way of its execution. It would be a very different matter to inspect concentrated manures from inspecting beef and pork, or fish and flour. For these and the like, a careful examination by trained senses would suffice; but neither sight, touch, taste or smell afford any criterion of the value of a manure. If these are to be the tests, it is easy to make the worst appear as well as the best.

In the case of manures, analysis *is indispensable*; and this requires days of time, and some outlay for chemicals and apparatus for every sample. Unless the inspector stood by during the whole process of manufacturing and packing, every package must be inspected separately, and *the cost would exceed that of the manure itself.* And then how could grades enough be fixed to distinguish between the various shades of quality, from the worst to the best?

Even analysis itself, valuable and indispensable as it is, does not supply all the information desirable. At least no ordinary analysis, requiring not more than a week of time, or costing not more than twenty-five dollars, can furnish *full* data for an estimate of value; and between different manures must sometimes fail to give correctly comparative values.

This may be best shown by illustration. Suppose a chemist should take the superphosphate made by the Cumberland Bone Company, near Portland, (and I mention this because it is the only commercial fertilizer, so far as I know, which is made as that is) he could readily determine the amount and proportion which it contains of soluble and of insoluble phosphoric acid, and of ammonia, and also whether the latter be ready formed or is yet to be formed in the soil by changes to take place in nitrogenous matter contained in it, but he cannot so readily determine the source from whence that portion of phosphoric acid which he calls insoluble is derived, nor can he readily determine the degree of ease with which plants could appropriate it to their use. The chemist terms a portion *insoluble* because it does not dissolve at once in pure water, which is the solvent he employs for this purpose; yet if its presence is due to pure, finely ground, raw bone, used in its maunfacture, as it is in the article I have named, it is wholly available to the needs of the plants after being in the soil for a month or two, and fully as fast as they require it; for, although not soluble in pure water, it is gradually soluble in rain water, which always contains some carbonic acid.

Suppose now another superphosphate is submitted to his analysis which is made from a mineral or fossil phosphate, and which by his process shows the same constituents in the same quantities and proportions as the first. Most people would say at once, it must have the same value; and so it would so far as the soluble phosphoric acid is concerned, for this would act with the same promptness and efficiency whatever its source might be, but it would be very different with that portion which he calls insoluble. This is dissolved with ease in the powerful acids which the chemist employs, and so he knows it is there contained, and he sets down its quantity with precision and accuracy, but it is no more soluble in rain water, nor of any more use to the plants than is the potash which is contained in many rocks.

We may pulverize feldspar, or granite, of which there are millions of tons all about us. Both contain potash in considerable quantity; but the ground rocks would not help plants grow as ashes would, and why? Because in one case it exists in a really insoluble condition and not available to the plants, while from wood ashes the plants can get it as fast as they need it. The difference in the effect of two such superphosphates as I have described, provided they contained not less than three or four per cent. of soluble phosphoric acid, might not be noticeable upon the crops during the first year, or at least not until near harvest time, but either at the harvest, or in the second and subsequent years, it would be very marked.

Take another illustration. Suppose a sample of pure, finely ground raw bone be sent to the chemist for analysis. He will report about 23 per cent. insoluble phosphoric acid in its earthy portion, and in its animal matter, nitrogen equal to about 5 per cent. of ammonia, and he says truly. Now let him analyse a mixture of ground apatite (mineral phosphate) and leather chips. He finds the same constituents as in the bone and in as large amounts; yet the latter will have about the same effect on crops as so much gravel, and would be about as worthless, while pure fine bone dust everywhere readily brings a price nearly equal to that of good superphosphate. The reason is simply this, that the bone, if fine enough, gives to the plants what they want, nearly as fast as they require it, while the phosphate of the mineral is insoluble in reality as well as nominally, and the leather, unlike most animal substances, resists decomposition and refuses to yield its nitrogen as ammonia. This is an extreme case, not likely to occur frequently, and cited to illustrate the point in hand; but in larger or less degree there is usually a difference between intrinsic value and that indicated by analyses made in the usual methods. But notwithstanding the imperfections of analysis, it is the only available method, and is abundantly sufficient to drive out the great bulk of trashy matters so persistently urged upon farmers.

In Great Britain the usual method has come to be, to buy by *guaranteed analysis.* That is, you buy an article warranted to contain a stated amount of soluble and insoluble phosphate, ammonia, &c., and if it fails to give satisfaction, you cause a sample to be analyzed, and if it be found to contain less than the guaranteed amount, recover damages of the vendor.

What I would like to see is, a law compelling every manufacturer to affix a label stating the contents of its more valuable constituents, with provisions for recovering a fixed and sufficient sum for every pound which might be found deficient therein.*

There is another method of obtaining a fair degree of security against fraud, which is to buy of honest manufacturers and dealers; and if you cannot be sure of finding such as possess true integrity of character, connected with sufficient intelligence, you can find those who have invested more of reputation and more of capital than they are willing to put in jeopardy by fraudulent dealings. Such men cannot afford to cheat. They have understanding enough to enable them to comprehend and act upon the low grade commercial truth contained in the adage that "Honesty is the best policy."

Another hint may be of service. When you see a quack nostrum, or anything else, *extensively advertised, and pushed off by agents at large expense,* does not the idea suggest itself, both that the article brings a large profit, and also that it so far lacks real merit as to *need a special fertilizer in order to bring up continuous crops of customers?* It is very well to advertise a new article sufficiently to bring it to notice, but after that it should find buyers on its merits, without excessive expenditure for either advertising or agents. It does not require much of that sort of effort

* Such a law was enacted at the session of 1869 by the legislature of Maine, and will be the subject of remarks farther on in this report.

to sell St. Louis flour or Portland kerosene, or some other manufactures which might be named.

I am aware that it is very common to hear observations implying that frauds abound with commercial fertilizers, beyond any other branch of trade. I doubt if this is the case. When you go to the druggist to get powdered rhubarb, or ipecac, or a bottle of wine or brandy, for a sick member of your family, do you always get that which is pure? When you go to the grocers' for pepper, or ginger, or soap, or cream of tartar, do you never get anything but what you ask for? Is all which is sold for roasted, ground coffee quite innocent of peas and rye? When you buy a coat, does it never contain any more shoddy than is set down in the bill?

There is one single fact bearing on the proportion of fraud to fair dealing, in the sale of commercial fertilizers, which comes to my mind with the force of mathematical demonstration. It is the steady and rapid growth of the manufacture and sale,—from nothing to great magnitude,—within a term of less than thirty years. It was about 1840 when Peruvian guano was first imported for agricultural uses. Very nearly at the same time the value of superphosphate, i. e. of a true soluble phosphate, was first recognized. The introduction of both was slow during the earlier years following, but latterly it has been more rapid. What amount is now sold annually I cannot state; but I can give a few facts bearing on the subject. In 1839, the first consignment of Peruvian guano arrived in England. It consisted of thirty bags. The first cargo arrived in England in 1841. About a dozen years later the sales amounted to upwards of £1,000,000 annually.

One of the most interesting papers relative to commercial fertilizers which has come to my notice, is a chapter devoted to the "Industry of Manures," in the Chemical Report of Dr. Hoffman, of the International Exhibition held at the (Sydenham) Crystal Palace in 1864. It is there stated, that the amount of superphosphate mixed daily at the establishment of Mr. Lawes (one of the earliest manufacturers, as well as one of the most successful, and who deserves the gratitude of every farmer for his untiring labors and liberal expenditures in aid of progress in agriculture), was one hundred tons, and his yearly product was from eighteen thousand to twenty thousand tons; and he estimates the amount made at that time in England to be from one hundred and fifty thousand to two hundred thousand tons annually. A statement more recently made, and believed to be correct, is, that the present amount exceeds two hundred and fifty thousand tons annually.

The introduction of commercial manures into use in the United States was later and slower than in Great Britain, and their employment is chiefly limited to a moderate distance from the seaboard. Yet, it is believed that the annual consumption of superphosphate now reaches one hundred thousand tons yearly, and is both steadily and rapidly increasing.

Now consider that the trade in commercial manures has grown to its present magnitude *under the patronage of farmers alone*—that these large amounts are bought and used and paid for by a class of men who are habitually cautious about introducing new ways into their practice, averse to parting with money except for "value received," and are as capable as any other class of judging whether they get money's worth for money. I do not say that a farmer may not be cheated as easily as another man,—*for once*,—but to believe that farmers, as a class, for a series of years will continue to pay out money in sums larger and larger every year, for what does not give satisfaction, I can no more believe, than that five and five are equal to forty. Do not the facts rather prove, that so much as has been skilfully and honestly manufactured, must have been very good, and very profitable at the price it bore? How else, by any possibility, could the trade be sustained, and exhibit a steady growth under the accumulated odium of all the frauds connected with it?

Fraud is not the only reason why commercial manures sometimes fail to produce the results anticipated. Ignorance has something to do with it. I have been witness to a degree of ignorance on the part of a manufacturer who advertises and puffs his wares loudly and persistently, which, if it had only been related to me I should have been slow to believe, except upon testimony impossible to discredit. And there is more or less, not very unfrequently, of mismanagement in their application and use—and let me say here, that ample experience has shown that the best method of using either Peruvian guano, or superphosphate, or fish guano, *is not to put the whole amount used in hills*, as is most often done, but to compost two-thirds or three-fourths of what is to be applied with barnyard manure, if any of this is also to be applied, and then to spread and harrow it in, applying only the remainder in the hills. If no other substance is to be applied to the land, then let the two thirds or three-fourths be spread and harrowed in, and *only enough* *put in the hills to give a good start to the plants, and let this little be spread in the hill,* and not merely dropped in a small pile. It should be covered with a little earth, also, as well as spread, to avoid injury to the tender germs. To expect tender rootlets to thrive by pushing into a small pile of concentrated manure, such as you desire to buy, is as reasonable as to expect a sucking child to thrive on a diet of beefsteak and brandy.

It appears to me that the general tenor of the American agricultural press is not altogether what it might be, nor that which is calculated to throw the truest light on the subject of commercial fertilizers. Instead of giving the results of critical, impartial and thorough investigation, thereby imparting real instruction, we get more of simple reflection of current opinion. And the expression of that opinion comes mostly from those who are, from any cause, disappointed in their use. Successful instances are sometimes given; *but the great mass of those contented with their purchases and results, are also contented to pocket their gains and to continue to buy* without troubling editors or the public with narratives of their opinions or their operations.

We have, also, scattered through the columns of agricultural newspapers, a good deal of well meant, but I think injudicious advice addressed to farmers. I refer now chiefly to the advice, so common, for farmers to prepare their own superphosphate, in place of buying it. They direct the farmer to take a given amount of bone dust, and add so much oil of vitriol, and so much water, and perhaps, also, some other substances to "extend" it or to make it bulkier or drier. To show that this is injudicious advice, it will suffice to state a few facts. In the first place, the farmer must buy his bone dust. He cannot make it. With considerable labor he may break them up somewhat; but this will not suffice for this purpose. They should be made as fine as common sawdust;—and if he goes to buy, and can find such as is pure, he has to pay as much for it as if he bought it already made into superphosphate; and he will also be likely to learn that the *adulteration of bone dust is quite as great as that of superphosphate;* clam shells, oyster shells, and the turnings of vegetable ivory, and other trash being not unfrequently mixed with it. Then he must buy his oil of vitriol at retail, and pay more for it than the man who buys in large quantities, or who manufactures it for his own use. On the whole, he will find that, even counting out all imperfections in his product, arising from lack of practical skill, or chemical knowledge, and also any accidental loss or damage from breaking carboys, or spilling a powerfully corrosive liquid upon his clothes or his person, he is still working as really at a disadvantage as if he attempted to do his own paper making by grinding rags to pulp, and working this into sheets by hand labor, as was done years ago; or by inducing his wife to spin and weave cotton for the sheets and shirts of the family, instead of exchanging his farm products for factory made goods.

Sufficient evidence of this is found in the fact that although farmers are sometimes induced to try the experiment for once, it is very rare for any to repeat it a second time. One dose of this sort of experience, (so far as my observation has extended) suffices for a cure in nineteen cases out of twenty.

If authority be wanted, I might quote from a lecture delivered in Bath, (England,) by the well known Prof. Voelcker. He said: "I do not recommend the system of home-made superphosphates. For some time we made our own at the Agricultural College Farm at Cirencester; but taking the quantity of soluble phosphate produced, we found we could not make it so cheap as it could be bought. *There is a decided advantage in buying superphosphate.* All that was required was to take care that what they bought was a good sample. It is a manure which can be produced at a cost varying from £5 to £12 per ton. (That is, from $25 to $60 per ton, *gold.*) It was desirable, therefore, that the farmer got the full value for his money." Again, in the same lecture, Dr. Voelcker says: "I lay particular stress on the term *intelligent manufacturer*, because I believe it to be a *hazardous undertaking* for the farmer to prepare his own superphosphate, considerable knowledge being required, together with practical acquaintance with the method, and proper appliances."

There is some editorial advice bestowed upon farmers to which I know not what epithet to apply. It seems impossible to charge it to ignorance, or to a willingness to deceive;—judicious, we cannot call it, injudicious, is not sufficiently descriptive. Let me read you a sample of what is now referred to. It is from "The Boston Journal of Chemistry," "Devoted to Chemistry as applied to Medicine, Agriculture and the Arts. Edited by Jas. R. Nichols, M. D." The number for April 1, 1868. It appears in the editorial column, in leaded type, and with every appearance of being from the pen of the editor. It reads as follows:

Superphosphates.—Several of our agricultural friends have written to us, asking which *kind* of "superphosphate" we would recommend them to purchase. Certainly there ought to be only *one kind* of superphosphate, and that a genuine superphosphate of lime, containing at least ten per cent. of soluble phosphoric acid, and an equal quantity of insoluble, in addition to the phosphate of lime. We do not know of any brand we can recommend as being properly manufactured, genuine superphosphate of lime. If there is any in the market, we have not been able to find it, and we have searched diligently. As the inquiries are presented, we can make no answer. If the questions should assume another form—"What compounds, composts, or mixtures, such as are put up in barrels, and labelled 'superphosphate,' we would recommend," we should still be unable to reply; as we have found these mixtures to vary so exceedingly in fertilizing value, little reliance can be placed upon them. In *color*, some are quite dark; others gray, or light yellow. In *odor*, one is like fish offal, another like carrion; others have a kind of sulphurous smell. The color is due to an admixture of charcoal, or bone-coal, or sugar refiners' waste, in varying quantities. As regards the origin of the differing odors, we suppose, when the manufacturers run short of cheap fish pomace, they substitute dead cats and dogs, or other decomposing flesh. As a rule, that "superphosphate" which has the darkest color and the most abominable smell, sells the best, as it is regarded the "strongest." Manufacturers understand this, and take advantage of it. True, genuine "superphosphate" is almost *colorless*, and has but a faint acid smell, not in the least unpleasant. To manufacture such, all that is required is to dissolve fine bone-dust in oil of vitriol, 150 pounds of the former to 80 of the latter, with the addition of sufficient water to form an intimate and perfect mixture. In the home manufacture of this fertilizer, 60 pounds of acid, with 150 of fine bone may be employed, as it is better to avoid the risk of any free acid remaining in the mixture after the action is over. We have given, in a former number of the *Journal*, full directions for making superphosphate upon the farm. Farmers can and should make their own superphosphate.

I have not the honor of a personal acquaintance with the writer of this article, but it is due to say, that Dr. Nichols is understood to enjoy the reputation of being a very estimable gentleman, a practical and scientific chemist, and farmer also, and occupies a position at the head of an establishment for the manufacture and sale of chemical preparations, chiefly medicinal. It is also proper to say that the Journal in question has been the vehicle of much information and advice which was accurate, sensible, and effective for good.

I quote this editorial partly because it utters no uncertain sound, partly because its authorship secures its acceptance by many who would scrutinize as loud a statement if made. by one possessing less reputation as both a chemist and an agriculturist, but chiefly because, appearing in a journal claiming twenty-five thousand readers, and having been extensively copied into agricultural and other newspapers, has obtained a very wide circulation. Copies were sent me last spring from various parties, with the inquiry what answer I had to make. But I replied to none. I had enough else to do, and part of it was connected with the manufacture of a respectable superphosphate. I felt some as Nehemiah did, when invited to come down from the wall he was building, and hold a conference on the subject. He felt that the wall was worth more than talk about walls; and I thought the making of a good superphosphate was the best answer to the article. You can judge, nearly enough, what reply I would deem appropriate to most of its allegations, but I will remark in relation to the diligence of search for a good superphosphate, said to have been made, that I can conceive of no obstacle which need prevent one possessing ordinary locomotive powers, in the usual condition of the streets of Boston, in less than ten minutes' walk from the office of the Journal of Chemistry, from reaching several places where a ton or a hundred tons of good quality could be had at a fair price.

It seems strange, too, that it never occurred to the Doctor that the "strong odor" might possibly have had another origin than from "dead cats and dogs." In one superphosphate extensively sold, a strong, garlicky smell is due to the addition of ammoniacal products obtained from the destructive distillation of bones in the manufacture of bone charcoal; and an effective addition it is,—rendering it more stimulating to vegetation. In the superphosphate of the Cumberland Bone Company is an addition made for the purpose of rendering it repellant to vermin in the soil infesting plants, like wire-worms, onion maggots, etc. But the chemistry of the article quoted, and its arithmetic, are fairly open to criticism. The writer says that "there ought to be only one kind of superphosphate, and that a genuine superphosphate of lime, *containing at least ten per cent. soluble phosphoric acid, and an equal quantity of insoluble in addition to the phosphate of lime.*"

Ten per cent. soluble and an equal quantity of insoluble make twenty per cent. Bear this in mind, and then note that lower down he tell us how to make just this same "genuine superphosphate." He says "*To manufacture such* all that is required is to dissolve fine bone dust in oil of vitriol—one hundred and fifty pounds of the former to eighty pounds of the latter;" (with the addition of water, &c., but as the water mostly dries out again, though some is retained in combination, we will not count that in). The product of superphosphate weighs one hundred and fifty pounds, (for the bone) plus eighty pounds acid, making two hundred and thirty pounds at the least. Now, bones contain one half their weight of phosphate, (if the bone be old and hard a trifle more; if young and soft rather less; fifty per cent. is a full estimate and more than the Doctor himself puts it in another place.) Of this phosphate less than half is phosphoric acid,* (about forty-six per cent.) so that, as near as may be, avoiding small fractions, bones contain twenty-three per cent. of their weight of phosphoric acid (as I stated a little while ago). Now, if one hundred pounds of bone contain twenty-three pounds of phosphoric acid, one hundred and fifty pounds contain thirty-four and a half pounds. If two hundred and thirty pounds superphosphate contain thirty-four and a half pounds phosphoric acid, *what per cent. is that?* If my answer is right, it is just *fifteen* per cent.,—yet he tell us "containing at least" twenty per cent.! Here is a serious falling off, but the astonishing part remains. He tells us "containing at least ten per cent. soluble phosphoric acid, and an equal quantity of insoluble, *in addition to the phosphate of lime.*" Why! every particle of the phosphate in bones, whether phosphate of lime or the trifle of phosphate of magnesia, has been used up to furnish fifteen per cent! There is not an atom of phosphoric acid in bone except in its phosphates, and yet he tells us twenty per cent. phosphoric acid *in addition to the phosphate of lime!*

All I have to say about this is, that if the facts are as he states, the case more than equals a realization of the desire of the boy who wanted to "keep his pie and eat it too"—for here the pie, weighing only fifteen ounces before it is eaten, weighs twenty ounces "at least" after it is eaten. Ought such advice to be termed judicious—or injudicious—or what?†

Permit me now to read a brief extract from a recent British periodical. It reads as follows: "The development of the artificial manure trade has been most remarkable; and, whilst

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* Known in the new nomenclature of chemistry as *phosphoric anhydride* or *phosphoric oxide* (P O 5)

† Dr. Nichols seems to have been unfortunate in his arithmetical statements in connection with commercial manures on other occasions; one instance of which may be named here. In a lecture before the Massachusetts Board of Agriculture, given in Flint's Report for 1866–7, page 237, we read as follows: "A direct estimation of the nitrogen gave in 1000 pounds of bones, 50 pounds. * * * * Hence we find they afford about 20 per cent. of nitrogen in their fresh condition." The error here, in calling a twentieth part, 20 per cent, instead of 5 per cent., is so gross and palpable that any careful reader would readily detect it; and it would pass for a slip of the pen, were it not that, in a book published not long subsequently, entitled "Chemistry of the Farm and the Sea," consisting chiefly of previously written papers, newly arranged and revised, we find the same error repeated in the same words.

unmistakably advantageous from one point of view, we are led to question whether the facility with which we have been supplied has not led us to be careless about our own resources. The very materials for which we pay so heavily are too often permitted to ooze away into the nearest ditch and pollute our streams. Baron Liebig, to whom in great degree we owe our present knowledge, denounces this terrible waste, and warns us that the time will come when our reckless extravagance will bring down on us heavy discomfort; and that the decay of our great country will date from the day when our supplies of phosphates fall short. Without going quite so far, we would *earnestly impress our readers* with the importance of taking care of the manure of the farm. It is sad to see the ignorance that is apparent in unspouted yards, washed out manures, and the porter-colored horsepond. *Even if it could be proved that the waste thus incurred can be more economically made up by the purchase of artificials than by the outlay necessary to prevent it,* it would still be clear that, taking a comprehensive view, and duly considering the future, our practice is most reprehensible."

Here too are words of warning, and words of advice, but a new front is presented; the burden is changed; the words have another ring to them. Now, the trouble is, that commercial manures are *so good and so cheap, that the imminent danger is, of forgetting the farm-yard;* and the appeal is, *not to permit the prospect of present gains to induce forgetfulness of the future, and of the needs of posterity.* He talks in the strain a wise man would have used with the settlers in Aroostook fifteen or twenty years ago, or in Western New York at an early day, when he saw them carting manures to the nearest stream, merely to be rid of them.

Let me say here, that the trade in commercial manures seems to be passing through the same phases which it underwent in Great Britain a few years earlier. About 1855, Dr. Voelcker made the following statement: "If ever there was a time when the agriculturist had need to exercise special caution in the purchase of artificial manures that time is the present, for the practice of adulterating standard fertilizers, such as superphosphate, guano, &c., has reached an alarming extent. * * * It is but right, however, to mention that it is far from us to censure indiscriminately the whole class of manufacturers and dealers; for we know many highly respectable, fair dealing and skilled parties who well deserve the support and encouragement of the agriculturist, and who are as anxious as every right minded person to put a stop to the scandalous proceedings now and then revealed to us."

Recently, he says in his annual report as chemist to the Royal Agricultural Society, "The number of analyses made for members in 1868 is four hundred and thirty-two, a larger number than in any previous year. By far the larger proportion of the class to which superphosphate belongs were found of good quality, well prepared and worth the money at which they were offered for sale. Of late years the manufacture of superphosphate has much improved, and notwithstanding its superior quality and intrinsic value the market-price has not been increased."

It would seem, therefore, that the manufacture and sale has for the larger part, passed into the hands of "highly respectable, fair dealing and skilled parties;" and no doubt can be entertained that a similar result will be reached in this country, and with greater rapidity than obtained in England.

The remark is frequently made, "I don't believe that any commercial fertilizers are as good as barn manure, *and therefore* I will have nothing to do with them." To such my reply is, that the premise is admitted without the slightest hesitation, but the legitimacy of the conclusion is open to doubt. *If you have farm-yard manure enough, you are the very man to let commercial manures alone.* But have you?

Suppose I was to visit the shop of a surgeon-mechanic, and after critically examining the artificial legs and arms and crutches and splints and supporters, should tell him that I thought his wares were vastly inferior to those of nature's providing, and that I would have none of them; I submit whether he would not answer my objection fairly, and fully, by replying,—"I do not expect you to buy of me. I labor not for the whole, but for the *crippled.* There are those who are willing to avail themselves of my assistance, and to pay me for my labor."

So it is with most of us. *There are few New England farmers who do not have to deal with crippled land*—land unable to bear the burdens of a successful agriculture without artificial helps—unable, too, in part, because we, and our fathers before us, have dealt hardly by it. We have taken too much from it, and have given too little to it; and the day of reckoning has come, as come it always will, in every case, sooner or later, where the laws of order are violated. It is well for us to remember that *God's laws all take care of themselves,* in due time, and equally so whether the laws be about theft and adultery and idolatry, or about gravitation and nutrition and fertilization; and they require neither detective police, nor judge, nor jury, nor sheriff; they execute themselves—nobody dodges one of them. The man is to be pitied who confounds His laws with statute enactments manufactured by legislatures.

It is our duty, and our privilege to repent, to try to make good the evil of our misdeeds in the past, and thus to leave our lands to our children better, and not worse, than we found them. And this brings me to the consideration of a very important point in the use of commercial fertilizers, and one which is too often overlooked, which is this: We all know that crutches are used with various intent. By the hopelessly lame they are used for temporary relief only; but by those not incurably crippled, they are used with the purpose of getting well,—they are used in a way calculated to accomplish the end in view, in such a way as may enable to lay by strength, so as, by-and-by, to do without artificial helps.

Such should be our intent also. Our lands are not hopelessly crippled. If we can but add manure enough for a limited term, to enable us to get good crops, *and then use those crops in a way which shall enable us to return to the land the means of future fertilization which they are capable of yielding,* then we may retain and sustain the degree of fertility which we obtained by temporary artificial aids.

We hear it often said, that special manures tend to exhaust land. I tell you *manures never exhaust land.* It is *the crops,* which the manures enable you to take from the soil, which exhaust it. If we sell these off from the farm, returning nothing in their place, the land is, sure enough, in a fair way to run down; and the more it produces, after this fashion, the faster it will run down. But if we will deal honestly with it, first converting the crops into meat and milk and wool, *and manure,* and then *save the manure and apply it,* thus returning a fair proportion of what we have taken from the soil, we may have, for our own use, or to sell, all which has been contributed to the crops from the atmosphere and from the dews and rains of heaven, and besides this, a *portion* also of the ash constituents of the plants grown, these being annually liberated from the hidden, dormant resources of the soil, through the agencies of nature and of cultivation. And this will suffice to support us handsomely, and *such practice can be kept up, with increasing fertility,* as long as the world stands.

Dr. Geo. B. Loring of Salem, delivered the following lecture on

The connection of the State Board of Agriculture with the Agricultural College.

Gentlemen:—Agricultural education is yet in its infancy. The business of farming has, it is true, attracted the attention of the most enterprising and thoughtful in all ages; the statesman and political economist have recognized its importance to society and to the state; science has explored its mysteries; to the wealthy and ruling classes it has furnished opportunities for gratifying the finest tastes and adorning the earth; to the laborer it has always brought the necessaries of life; it has never yet failed; and it is as diverse in all its processes as are the soils, and climates, and markets, and social and civil organizations, on the face of the globe. Every prosperous and cultivated people has an interest in agriculture. A State without a rural population is but half a State. A country without products from the land is no country at all. And whether we turn to the semi-barbarism of Asia, or to the half explored regions of Africa and the islands of the southern seas, or to the refinement and poverty of Europe, or to the social equality of our own land, we find everywhere an appeal to the earth by the devoted cultivator, and a liberal response to the call. Agriculture is as old as man, and as universal. And yet we search in vain for any system of agricultural education among ancient records; and we look in vain for any entirely successful system in modern times. The early books on agriculture are chiefly valuable as a history of the superstitions and popular delusions and daily tasks of the olden times; and the later books are an interesting record of the facts brought out by practical men, and of the efforts of science to classify those facts, and to draw from them positive rules of action. But we find no satisfactory system of education.

This is the more extraordinary, when we remember, how always and everywhere the mind of man has labored to throw light upon an occupation which is recognized as the fundamental art. Among the treatises on government and society which have been produced by the great intellects of every age, may be classed the works of those who have taught mankind how to divide, own and till their lands. And I have often thought that no library would be more interesting, curious and instructive, than one containing all the volumes written to enlighten the husbandman, from the days of

Hesiod and Aristotle, down to Liebig's ingenious theories, and that modest effort entitled "Farming as it is."

In addition to these admirable endeavors of eloquent and careful authors to impart agricultural knowledge, many forms of associated instruction have been established from time to time. Early in the eighteenth century, about 1720, there were nearly thirty agricultural societies in France. Ere long attention was turned to the science of agriculture, which was publicly taught in the Swedish, Danish and German universities. And private fortunes were devoted to the endowment of special schools of agriculture. The patronage of government, too, has not been wanting. In Italy, in Sweden, in Denmark, in Switzerland, in France, in England, every branch of agriculture has been encouraged by the government; and "even Spain, naturally inactive on these occasions, in spite of all the prejudices of a bigoted religion, invited Linnæus, with the offer of a large pension, to superintend a college, founded for the sake of making new inquiries into the history of nature and the art of agriculture." And Bonaparte, in his liberal policy toward agriculture, greatly increased the number of societies, established professorships, botanical gardens, &c., all of which concurred to elevate the study of agriculture in the estimation of those capable of bringing to its aid the principles of the abstract sciences. In fact, the only obstacle in the way of a rapid advancement in agricultural information during the last century in Europe, was the indifference of the popular mind, and its devotion to tradition, rather than to the results of careful investigation. "Book-Farming" had no charms for the common people, who looked on with distrust and jealousy, while the educated explorer endeavored to elevate their calling, enlighten their minds, and relieve the heavy burdens of labor.

There is no doubt that the establishment of Boards of Agriculture is the most important step that has yet been taken in the work of agricultural improvement, and that the labor of Sir John Sinclair, as the founder of such organizations, entitles him to the respect and gratitude of all tillers of the soil. A century and a half before he began his work, Hartlibb, and more recently Lord Kames in the "Country Farmer," had pointed out the utility of a board of agriculture; but it was left to his zeal and untiring effort to call into life that valuable auxiliary to agricultural progress, and the board was created in 1793. To its establishment, more than to any other movement of that day, England is indebted for the present high and prosperous state of her agriculture. It brought men together from all parts of the kingdom, made them acquainted with each others' views, and with the modes of culture prevailing in sections of which they had previously been ignorant. Take away from our present knowledge of agriculture, or indeed of any other practical art of life, all that has been learned from the mere mental stimulus of associated effort, and the attrition of mind upon mind, and there would be a comparatively small amount left. It was through the encouragement of the board of agriculture chiefly that Sir Humphrey Davy was led to investigate the elements of the soil, and to apply the science of chemistry to the improvement of agriculture; and here begins, properly, the real progress of the art; for without a knowledge of the simple substances of nature, agriculture could not be expected to take the rank of a science. The lectures of Davy before the board of agriculture, from 1802 to 1812, mark an important epoch in the history of modern agriculture. The substance of these lectures was embodied in his "Elements of Agriculture," published in 1813, and translated into German in 1814, and into French in 1829. This work offered the very kind of information which Arthur Young declared to be the great want of the day. It opened to the reflecting farmer new and interesting views of the principles of fertility and vegetation. It explained the physiology of plants; it analyzed the manure best adapted to their growth; and contained careful experiments upon specific fertilizers. It was indeed the introduction of scientific agriculture, opening the path which has since been trod so zealously, and erecting a monument to the wisdom which guided the board of agriculture in its selection of the great philosopher as its guide in agricultural education.

After reviewing the various attempts made by Marshall, Young, Bakewell, Anderson, the Duke of Bedford, and other noblemen, in advancing the art, Dr. Dickson says: "But neither the distinguished example of the sovereign, the endeavors of provincial societies, nor the exertions of private individuals, with whatever zeal and attention they may be directed, are probably sufficient to extend the knowledge of husbandry to that degree which is necessary for its complete and radical improvement. This could only be fully accomplished by the powerful influence and expensive exertions of a national establishment instituted for the purpose. Such an institution has at last been brought forward and established by the intelligent and persevering efforts of Sir John Sinclair, to the honor of the country, the age, and the individual who suggested it. The institution of a board of agriculture and internal improvements has already contributed materially to the extension and advancement of the knowledge of rural affairs. The state of the art in the greatest part of the kingdom has been ascertained, a great variety of new and interesting facts and practices have been brought to view, and improvements in the instrumental and other parts suggested. Among these the elucidation of the principles and practice of draining or removing the injurious wetness of land, arising from springs and other causes, as laid down and explained by Mr. Elkington, is of great importance and deserving of notice, not only as the basis or foundation of many improvements in the art, but as leading to the convenient and easy application of water for irrigation and other purposes."

This board of agriculture, so well described by Dr. Dickson, and whose service has been so useful and important, is the foundation of that system which has been introduced into our own State, and whose business, as an organ of education, we have met to transact.

It will be observed that every mode of improving agriculture by process of mental discipline, has had immediate reference to the *practical business of the farm.* The most poetical and imaginative of agricultural writers have always kept the farm-yard and the furrow in view. The most elaborate scientific investigations into the nature of the soil, the qualities of plants, the structure of animals,—chemistry, botany, physiology,—have all been subjected to that hardest of all tests, the details of agricultural life. However broad may have been the policy, however large the design of those who, by school, and society, and volume, have endeavored to increase the wealth and power of the State, by draining its lands, and dividing its fields, and protecting its forests, and encouraging its productions, and introducing the mechanical improvements of the age, they have all been obliged to take their stand and apply their knowledge and their forces to an individual farm in order to test their value. And when a disciple of Liebig applies successfully the theory of his scientific master to a rood of land, Liebig's triumph is there. When the industrious and untiring Agassiz finds the laws of reproduction, which he has laid down after long study in the closet, practically applied by the intelligent and enterprising farmer for the improvement of his flocks and herds, then it is that the philosophy of Agassiz plants its foot upon the earth and benefits mankind. The knowledge which science has already unfolded belongs to the farmer, if he will but accept and exercise it. And the best teacher of agriculture is he who can present this knowledge written out upon the fields and gardens, which his own intelligent skill has brought up to usefulness and beauty. The best agricultural college is that which sends forth from its halls a band of successful cultivators, admiring and believing in nature, because they are familiar with her laws. This may be called an industrial school, perhaps; and it may be deemed unworthy of the high position which a New England State should take as a fountain of the highest knowledge. But let such a college once be established here—a college in which the theory of the student will receive the stamp of its actual value—a college in which the experiment of the laboratory will be put to a final test—a college in which all the best culture of the schools will be so moulded and directed as to give us a cultivated population, devoted to the land, with an understanding of its mysteries, and devoted to social and civil life, with a proper and refined conception of their duties—give us a college like this, and New England will have accomplished an educational work, which will give her an influence wherever land is divided among freemen and cultivated by an intelligent yeomanry. Nearly half a century ago, one of the best observers, thinkers and writers on agricultural topics in this country, one of the earliest advocates of agricultural education, labored for an institution like this. I refer to Judge Buel of Albany. In his correspondence I find the following: "I consider the plan suggested by the Albermarle Society as defective, inasmuch as it makes agriculture an *auxiliary* study. It ought to be the *principal*, and botany, chemistry, polite literature, &c., made subservient to this great study. The pupil should go to it with the express view of learning to be a farmer, and should be taught so much science, blended with experimental and practical knowledge, as should best promote this primary end. Of what vast importance would a well-conducted experimental farm connected with such an institution soon become to the agricultural interest, and to the Union at large."

I do not think that a practical agricultural college would be derogatory to the dignity of any State, or that it would belittle and cramp those engaged in the business of conducting it. He who will guide such an institution into successful operation need have no fear that his light will be "hid under a bushel;" his candle would flame from every house-top in the country, beneath whose shelter the farmer, and gardener, and lover of the land and animals, finds repose. To that altar all explorers might bring their gifts. The geologist with his strata and soils, the chemist with his laboratory and tests, the natural historian with the laws of the animal and vegetable kingdom written down in his scientific statute-book—all might find there a common hearthstone around which they might gather, and find a common object of interest—the subduing and utilizing the earth on which they have made their investigations. And if there are those who believe that the great minds of this and all time would find no home on such a spot, let them remember that for such a purpose as that to which this institution would be devoted, labored those wise and thoughtful statesmen and philanthropists, who, while they toiled for man's civil and social elevation, remembered that man is but Antæus, drawing strength from the earth on which he treads; let them remember that it has been found easier to organize churches and schools and found States, than it has been to construct a system of agriculture; let them remember that the division of landed estates and the modes of farming adopted by any people are as indicative of their social condition as their churches and school-houses—perhaps more so; and if they are citizens of New England, let them remember that around such an institution stands an intelligent, inquiring, investigating, free and equal, rural population, ready to seize and apply all the practical information which the profoundest student can offer for their benefit, and capable, moreover, of teaching, in some measure, those by whom they are to be taught.

I have said that every mode of improving agriculture by process of mental discipline has had immediate reference to the *practical business of the farm*. This is especially the case in Massachusetts, and in this respect her example is worthy of being followed. The board of agriculture organized by Sir John Sinclair was not more perfect in its design than that established in that State in 1851, and has since been in successful operation. Every provision of the acts defining the duties of this board, and bestowing conditional bounties on agricultural societies, is marked by a thorough appreciation of the wants of the community, and a true understanding of the best means of acquiring and using agricultural knowledge. I think we cannot be too grateful to those men who formed these acts. Bearing in mind that they provide for the intimate connection between the board and the government of the Commonwealth, through the governor, lieutenant-governor and secretary of the Commonwealth, we should also remember how they require the utmost vigilance in observing and collecting all facts valuable to the farmer. The board is a representative body —a collection of delegates—one from each agricultural society; and these societies are so organized as to include every farm and accommodate every farmer in the State. The board is authorized, with its secretary, to "investigate such subjects relating to agriculture in this State as they think proper;" and as if to fix definitely the nature of its duties, it is also empowered to "*hold in trust, and exercise control over donations or bequests made to them for promoting agricultural education.*" It is required to make a detailed report of its doings annually to the legislature; and the secretary of the board is authorized to "appoint one or more suitable agents to visit the towns in the State, under the direction of the board, for the purpose of inquiring into the methods and wants of practical husbandry, ascertaining the adaptation of agricultural products to soil, climate and markets, encouraging the establishment of farmers' clubs, agricultural libraries and reading-rooms, and of disseminating useful information in agriculture by means of lectures and otherwise." From the above provisions of the act establishing the board, it is evident that its founders intended it as an educational system, obtaining information wherever it could be found, and sending it abroad throughout all the agricultural districts of the State. The power to hold property in trust for the benefit of agricultural education should not be forgotten. And the power granted to the secretary to appoint "suitable agents," missionaries, as it were, to the societies and clubs and agricultural libraries, creates a system of investigation and teaching hardly equalled by the well-endowed organization of the board of education.

The encouragement which the State has given to agricultural societies by bounties, is coupled with a provision, which also shows how devoted to the work of "agricultural education" were the framers of this series of acts, and how entirely they intended the board and the societies as institutions of agricultural learning. The section containing this provision I shall quote entire, for it seems to me that it has been somewhat overlooked by those who receive the liberal bounty of the State, and who should be willing to bestow an equivalent to that bounty. The section reads as follows:

"SECTION 5. Every society shall annually, on or before the tenth day of December, make a full return of its doings, signed by its president and secretary, to the secretary of the board of agriculture, embracing a statement of the expenditure of all money, specifying the nature of the encouragement proposed by the society, the objects for which its premiums have been offered, and the persons to whom they have been awarded, and including all reports of committees and all statements of experiments and cultivation regarded by the president and secretary as worthy of publication; *and shall accompany the same with such general observations concerning the state of agriculture and manufactures in the State as it may deem important and useful.* The return, whether in printed or manuscript form, *shall be marked in such manner that those passages in the several reports and statements deemed by such officers most worthy of public notice, study and application, may be easily distinguished.*"

It is difficult to conceive a more excellent arrangement than is contained in the portions of these acts which I have quoted. An appeal is made to an educated and industrious community of farmers to become at once teachers and learners. Had Arthur Young enjoyed the privileges which have been bestowed upon the Board of Agriculture and its Secretary in Massachusetts, the agriculture of England might have been advanced a century through his instrumentality alone. Every experiment, however small, every essay however humble, every investigator however rude and primitive his processes, receive direct encouragement from the State, and find listeners and learners in every farmhouse, where may also be found the experimenters and writers of the art.

The history of the Board and of the societies in Massachusetts, and this is true also of Maine, shows that their work has thus far been well done. If there was ever any doubt of the disposition and ability of the farmers of Maine or Massachusetts to acquire and impart information, that doubt should be removed by the series of volumes entitled the Agriculture of those States. Turn to the "Abstract of the Returns of the Agricultural Societies of Massachusetts," contained in those pages, and you will find a record of facts, figures, opinions, theories and laws upon almost every matter of interest to the farmer, a record drawn from the soil itself by the well-educated cultivator, or from the stalls and folds and pens of the successful managers of the domestic animals used upon our farms. Page after page presents to your consideration the refined sentiments, and generous speculations, and encouraging thoughts, not only of educated men who are called to address our societies at their annual exhibitions, but of those also, who, as practical farmers, ennoble their calling and add their daily contribution to the productions of the State. The literary work performed by the members of the Board, a voluntary and unremunerated act, without parallel in any other public service known to the State, contained in this Annual Report deserves more than a passing mention here, especially, lest, like so many unobtrusive charities, it be overlooked and forgotten.

In the year 1859 I find that the members of the Board furnished 182 pages, including their reports upon the societies; and the subjects treated were Manures, Pasture Lands, Cattle, Diseases of Vegetation, Fruit Culture, Root Crops, Market Days, and Agricultural Education.

In the year 1860 the members of the Board furnished 217 pages, and the subjects treated of were Sheep Husbandry, Diseases of Vegetation, Root Crops, Horses, and Flowage.

In the year 1861 the members of the Board furnished 179 pages, and the subjects treated of were Diseases of Vegetation, Cattle Husbandry, Protection of Sheep and Lambs, Wastes of the Farm, and Wheat Culture.

In the year 1862 the members of the Board furnished 187 pages, and the subjects treated of were the Application of Manures, the Cultivation of Tobacco, the Arrangement of a Catalogue of Fruits adapted to Massachusetts, and Grape Culture.

In the year 1863 the members of the Board furnished 95 pages, including their discussions; and the subjects treated of were Agricultural Education, Grape Culture, the Growing of Meat, Preparation of Land for Crops, and the Cranberry.

In the year 1864 the members of the Board furnished 181 pages, and the subjects treated of were the Management of Farms, Agricultural Education, the Corn Crop, Grape Culture, Pasture-lands, Cattle Husbandry, Sheep Husbandry, Root Crops and Garden Vegetables, Planting Pines and other Trees, Farm Buildings, Fruit Cultivation, and Grapes.

In the year 1865 the members of the Board furnished 289 pages, and the subjects treated of were the Cattle of Massachusetts, Agriculture as an Employment, the Diseases of Cattle, Sheep Husbandry, Plants, Grape Culture, Manures, Drainage, Fruit Trees, Forest Trees, the Dairy, Farm Accounts, Seeds, and Surveys of several counties in the State.

It is this Board, designed, as I have shown it to have been, for educational purposes, organized as it is by the connection of agricultural societies with the highest officers in the Commonwealth, laboring as it has done continually in the cause to which it is devoted—it is this Board which, by the Act of May 26, 1866, is constituted a board of overseers of the Massachusetts Agricultural College.

In what I have already said, I have endeavored to show the direction which intellectual efforts in every form have taken for the benefit of practical agriculture. I have traced the way from individual labors in the form of books from masterly hands up to that associated duty which has been so well discharged by boards of agriculture in every State where they have been founded. And I have pointed out how especially our own Board was originally organized for the purposes of agricultural education in the hands of practical teachers.

While this labor has been going on in Massachusetts, the State of Maine has been by no means idle. The industrious investigations and admirable reports of Mr. S. L. Goodale, the Secretary of the Board of Agriculture here, have passed into the most valuable of our agricultural literature; the practical papers published in his annual reports, and his essay on breeding, being familiar to every intelligent farmer. The discussions, also, of the members of your Board have brought out many valuable facts and theories. During this present session, I have been especially attracted by the scientific essays of Professors Goodale and Brackett of Bowdoin College, who have brought with them from the halls of that institution an accuracy of knowledge, and a felicity of expression which have filled me with admiration. It is especially gratifying to know that the best culture of the State is interested in our calling, and I trust these young scientific explorers will be encouraged in every way to offer future contributions to the valuable store of knowledge which you are accumulating here. In expressing my own obligations to them, I am sure I speak the sentiments of this entire assembly.

I consider that the CONNECTION OF THIS BOARD WITH THE AGRICULTURAL COLLEGE is a matter of the greatest importance to both institutions.

To the Board, which I think has richly earned this distinction by the services to which I have alluded, the connection is undoubtedly important. That the Board of Agriculture should have been made the trustees of the college by the act of incorporation, there can now be but little doubt; and having been deprived of this opportunity for honor and usefulness, its elevation to the position of overseers is but an act of justice. The labor which it has hitherto performed, in spite of public indifference, and without that authority which an organized institution of learning always enjoys, may be largely increased in value by being connected with the recognized head of agricultural education in the State. The investigations which have been made by the Board, the essays which the members have published, the experiments which they have recorded, would have been laid before the public with much more effect, had they undergone the scrutiny of a scientific body laboring in the same cause. It is not difficult to see that the annual report of the Board may be raised above what it already is, if it shall be made the receptacle of the careful investigations carried on at an experimental farm connected with the college. Add to what we now have in the volume, the results of analysis and comparison made at the college under the eye of science, and what a flood of light might be poured upon the dark places through which we now grope. You will all agree with me, I am confident, that the character of our agricultural literature may be improved, and that any effort which will raise it to the standard of foreign writing on the same subjects should be speedily and energetically made. Is it too much to hope that our annual report may be made a model volume, by the stimulus and illumination which may come to it from an agricultural college?

These meetings for discussion, too, how might they be guided and improved by the instruction of those whose business it is to keep their minds prepared for the work of education. The success of a debate almost always depends upon the manner in which it is opened. Make it the duty of the professors and young men of the college to take part in these public assemblies, and you will find at once that their value and importance are largely increased—to ourselves as well as to the community.

And when we would apply that section of the act incorporating the Board, which provides that the Secretary may appoint an agent "to visit the towns in the State, under the direction of the Board, for the purpose of inquiring into the methods and wants of practical husbandry," in what better way can this be done than by submitting section after section of this State, or county after county, to the careful exploration of the college, until its resources in soils, capacity for crops, in forests, in peat and minerals, in all productiveness, be thoroughly understood, and their value thoroughly appreciated? "County surveys," made in this way might be invaluable, and the Board might rank in this respect with any similar bureau in the Old World or the new, and Massachusetts take the lead in collecting and arranging the statistics of agriculture and natural resources—in which work the department of agriculture under the general government has so lamentably failed. The information which the Board has already collected is of great value. How much more important may it be made by being brought to the college, and thence diffused through lecture and publication.

It seems to me, moreover, that by the connection proposed, the Board of Agriculture may do much towards the support of the college. Representing, as the members of the Board do, every farm in the State, they enjoy an especial opportunity to bring the college under the notice of all farmers, and to enlist the sympathy of others who have acquired the power to own land and the taste to adorn and improve it, and who only ask for sufficient knowledge of its management to be able to develop all its capacity and beauty. Let us bind, then, the farm, the agricultural society, the board and the college, into one grand system of agricultural education, in which each may aid the others in performing well their part.

It should also be the duty and privilege of a Board of Agriculture to examine the students in the college, either by sub-committees or as a body, at the close of each term of the course, or at such times as the faculty might designate. Examinations of this description are common in other colleges; and nothing could be more appropriate than the plan I have proposed, when we consider the wide-spread interest in and knowledge of the college, which it would naturally create. It forms a part of that system of co-operation and support which I think is due from the agricultural community to an institution founded for their especial benefit. To encourage and strengthen the hands of the president and faculty, in their endeavors to establish a system of agricultural education, is a service to which the Board of Agriculture may well devote itself—a service which it can perform without interfering in any way with that part of the government of the college which belongs to the trustees; a service, which, if properly discharged, may stamp the college as an institution devoted to teaching the science and art of agriculture, and may develop a successful and useful mode of instructing our farmers, and of giving greater certainty to their business.

Having considered the advantages which the board may derive from the proposed connection with the college, I now come to the benefits which would accrue to the college itself from such a connection.

I stated, in the commencement of my remarks, that agricultural education is yet in its infancy. And it is so. But while the application of science to the art of tilling the earth has attracted the attention of the best educators of the age, it has been determined, as a general rule, that devotion to matters of practical importance lies at the foundation of the best system of instruction in this branch of education. In the school founded by Fellenberg, at Hofwyl, in Switzerland, were combined: 1, a pattern farm; 2, an experimental farm; 3, a manufactory of agricultural implements; 4, a school of industry for the poor; 5, a boarding school; 6, an institute of agriculture, theoretical and practical. And so successful was this institution, that at one time its pupils were "employed at high salaries, in various parts of Europe, to superintend and direct the labors of agriculture. Dr. Bright, in his recent travels in Hungary, saw one of them who had the superintendence of an extensive estate which he visited, the products and revenues of which had been quadrupled in a short time by his judicious management. The same traveller enumerates eight schools, on the Hofwyl plan, which had been established by the government, or by individuals, in the Austrian States. In these the course of study generally lasts three years, in which time the pupils are instructed in natural philosophy, chemistry, natural history, and veterinary science; while upon large experimental farms they are taught agriculture, the management of fruits and forest trees, and the care of cattle, sheep, swine and bees."

The Emperor Napoleon established a school at Alfort, where "all the branches of science connected with agriculture are taught. Chemistry, botany, the anatomy of cattle, farriery, with the mechanics, and as much of geology as is known, and farm work and domestic economy in every branch, and down to the smallest article, are there exhibited and explained." The effect of this school was to improve in many respects the agriculture of France, by introducing new and better modes of cultivation, machinery of various kinds, and by sending into the provinces scientific men, so educated that their science was made practically useful.

"At the school established by the Emperor of Prussia at Möglin, the value of the farm was increased, in twelve years, from 2,000 to 12,000 rix dollars. The branches taught in this school were mathematics, chemistry, geology, botany, veterinary science, entomology, &c. An experimental farm and a botanical garden were also connected with this establishment, as well as a repository and manufactory of agricultural implements."

I have enumerated these schools because I know that their results are such as must recommend them to the judgment of every successful and enlightened farmer. The well cultivated acres around a college building, and the success of those cultivators who have been taught on those acres and within the halls, are the testimony which will weigh upon the minds of an observing community.

In a community like ours there exists a necessity, it is true, for instruction in all those branches which constitute what we call a good education, as well as those which are immediately applicable to the business in hand. Algebra, geometry, trigonometry, mechanics and optics, engineering, astronomy, climatology, all belong to the course of study which should prepare every mind for the work of life. Of languages, French and German open rich stores to the agricultural reader. Of sciences, geology, chemistry, botany, anatomy, zoölogy, belong especially to the well-educated farmer—each one tending to throw light upon his profession. Beyond this is opened the great range of studies more particularly applicable; and we desire, by books and lectures, to secure all the knowledge possible upon landscape gardening, rural architecture, domestic animals, their increase, improvement, use, feeding, health and disease,—animal and vegetable physiology, the cultivation of plants, pomology, practical agriculture, &c. And still further on, a familiar knowledge of the processes of the farm should surmount the whole, and make the system complete. The association of the scholar with the fields, and flocks, and herds of the farm, until he has learned their mysteries—so far as man may learn them—is all important. In no profession, unless it be that of medicine, are constant observation, quick perception, a cultivated eye, ready resource, more important than in agriculture. The success of its practice depends mainly on an ability to adapt any system of farming to surrounding circumstances, and to decide quickly and readily to what animals and to what cultivation the land is adapted. I will not say, here, for the sake of argument alone, that the good farmer must love his profession; but I will say, that between the good farmer and his land and animals there must be a sort of secret understanding, which can only be secured by the most familiar acquaintance. And with us, the domestic economy of the farm, the farmer's home, his modes of thought, his modes of labor, how he can best live on the land, and be a good husbandman, in-doors and out, and a good citizen, all form an important part of that education which is to elevate and improve our agricultural population. I can hardly express my high estimate of the opportunity for usefulness and distinction which falls to the lot of him who would organize a successful agricultural school, as its president, its guide, its vitalizing force. But next to him in the work stands the man who shall demonstrate to that school the interesting results of an intelligent and scientific appeal to the land, and shall unfold to them the comfort and happiness of a well-organized farmer's home. Much of all this can be encouraged by the Board of Agriculture. From them to the college may be imparted the tone and flavor which appropriately belong to such an institution. Of the practical topics which I have enumerated, they should be the special patrons; upon all the work to which I have alluded they should bestow the benefit of their constant interest and observation. They could not do a better work than to recommend, from year to year, the subjects of a special course of lectures, to be furnished from their own members, as far as possible, and so far as is consistent with the regular course of instruction.

I know and respect, and would carefully recognize the functions of the trustees of the agricultural college, as conferred upon them by the act of incorporation. But, in order to perfect the institution, I would have the Board of Agriculture stand around it with fostering care, giving it all encouragement, and applying to its development and guidance all those powers which have enabled them, year after year, to present to the community a valuable volume, and have won for them an honorable reputation, as devoted students of the profession which they represent in the State. If encouraged, or even if unhindered, they may aid in making the college not only a source of light, but a protector of the farmer against the innumerable temptations which are thrown in his way, to fertilize his lands, and ameliorate his toil; and which too often end in disappointment and loss. Upon them has thus far fallen the labor of discussing the value of fertilizers, the preparation and application of manure, the value of different crops, the merits of the various breeds of domestic animals, the comparative value of various articles of food, the economy of pasture lands, the modes of drainage. Let them bring these questions to the careful investigation of the agricultural college, and the practical utility of both institutions will be recognized, I am sure, even by those who are pleased to think lightly of all efforts in behalf of agricultural education.

I have dwelt long upon the matter before us, longer, perhaps, than is accordant with your patience, but not longer than its importance deserves. I remember with pride the achievements of New England in literature, science, and the arts, her schools, and all her industries. I remember the oft-repeated efforts of her rich men and her wise men to raise her agriculture up to the standard of all her great enterprise. And it now remains for her to erect industrial schools, in which the maxims of her early patrons of this art shall be renewed, reformed, improved, by the influences which her best science can bring about them,—schools worthy of herself, agricultural colleges where thought and labor can meet for mutual benefit and encouragement.

The foregoing lecture of Dr. Loring closed the exercises of the Farmers' Convention.

The Board, upon meeting again, took up the subject suggested in that lecture, which was discussed at some length.

A conference was also held with the legislative committee on agriculture, at which there was a free interchange and comparison of views and sentiments. Being unable to report the remarks offered by those who spoke, it may suffice to say that, the result reached was, the introduction of a bill into the legislature which shortly afterwards became a law, as follows:

An act to secure harmony of action between the Board of Agriculture and the State College of Agriculture and the Mechanic Arts.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

SECTION 1. The secretary of the Board of Agriculture is hereby constitutued a member *ex-officio* of the Board of Trustees of the State College of Agriculture and Mechanic Arts.

SECT. 2. In addition to the members of the Board of Agriculture, as constituted by chapter one hundred eighty-six of the laws of eighteen hundred and sixty, the Governor, with the advice of the Executive Council, shall appoint five members at large, of whom two at least shall be from the faculty of the State College of Agriculture and the Mechanic Arts. The term during which these shall severally hold office shall be determined in the same manner as the other members.

SECT. 3. The Board of Agriculture shall hold two sessions annually, of not exceeding four days each, one of which shall be held within such convenient distance of the State College of Agriculture and the Mechanic Arts as will enable the attendance of the students and faculty of said college, so that they may have the advantage of the addresses and discussions before the Board. The other session shall be at such time and place as may be from time to time determined by vote of the Board. The first meeting under this act shall be held at such time and place as may be determined by the secretary of the Board of Agriculture and acting president of the college.

SECT. 4. Members of the Board of Agriculture shall be paid their actual necessary expenses incurred by travel and attendance at the sessions aforesaid, an exact account of the same being first rendered by each member through a committee of the Board and reported thereon. But members shall receive no compensation for time and services rendered.

SECT. 5. The secretary of the Board of Agriculture is hereby authorized to procure such aid and facilities as may be needful to render the sessions useful and profitable to the public, the aggregate expenses thereof not to exceed four hundred dollars annually.

SECT. 6. All acts and parts of acts inconsistant with this act are hereby repealed.

SECT. 7. This act shall take effect when approved.

Approved March 1, 1869.

Of the farther doings of the Board at this session which are of public interest, was a vote requiring the several agricultural societies to expend, during the current year, one fourth of the amount of bounty received during the year from the State, for the establishment of farmers' clubs, or for agricultural lectures. The Secretary was also instructed to endeavor to procure the enactment of a law to prevent fraud in the sale of commercial manures. The law which was enacted, together with the reasons which governed those who framed it, and how and why it should be enforced, will form the subject of a subsequent paper.

The Board finally adjourned on the second of February.

WEEDS OF MAINE.

A Synopsis of the Principal Weeds found growing in Maine: Arranged according to the Natural System adopted by Gray in his Manual.

BY FRANK L. SCRIBNER.

SERIES I.

Flowering plants, those producing true flowers—*Phœnogamous.* Class I. Plants which increase by annual additions to the outside; and the embryo furnished with a pair of opposite cotyledons or seed leaves—*Dicotyledonous* or *Exogenous.* Sub-class I. Plants with the seeds inclosed in an ovary or pericarp—*Angiospermous.* Division I. Plants having the divisions of the corolla separate—*Polypetalous.*

Order 1. CROWFOOTS—Ranunculaceæ. A large family, chiefly natives of Europe. They are mostly acrid plants, and some of them, as the Monks-hood, (*Aconitum*) are acrid narcotic poisons.

1. Common Meadow Rue—*Thalictrum cornuti.* *Root* perennial. *Stem* three to six feet high, much branched, furrowed, and hollow. *Leaves* large, ternately-decompound, leaflets roundish, obovate and three lobed. *Flowers* white, showy, arranged in large and very compound panicles.

The meadow rue is a worthless weed, found only in meadows which have become too moist for the growth of any crop worth the harvesting. Proper drainage and cultivation will eradicate it as well as encourage the growth of more valuable plants.

2. Bristly Crowfoot—*Ranunculus Pennsylvanicus.* *Stem* clothed with stiff spreading hairs, 2–3 feet high. *Leaves* ternately parted, the divisions stalked and cleft *Flowers* small, yellow.

A homely native species, with inconspicuous flowers; growing in wet meadows and along the borders of streams. It is not common enough to be very troublesome or injurious to crops.

3. Kidney-leaved Crowfoot—*Ranunculus abortivus.* *Root* of thick tufted fibres. *Stem* smooth, about one foot high, simple or branching. *Leaves* of the root on long stalks, kidney-shaped, one to two inches in diameter. *Flowers* small and inconspicuous.

This species, which is also a native, I have seen quite abundant in moist meadows and fields, especially on a clayey-loam soil; its presence indicates a want of draining.

4. Bulbous Crowfoot—*Ranunculus bulbosus.* *Stem* erect, rising from a bulb-like base to the height of about one foot. *Radical* leaves, three-divided, the side divisions sessile, the terminal one-stalked, and three-parted. *Flowers* deep glossy yellow, often more than an inch broad.

A weed of European origin, which has made itself perfectly at home with us, growing in fields, meadows and pastures throughout the eastern States. The juice is very acrid, especially in the bulb, and it is said that the "Beggars in Europe use it for the purpose of causing ulcers in order to excite sympathy." "Before the introduction of Spanish flies, this and other species were used to produce blisters; being uncertain in their operation they are now seldom employed," (*Darlington's American Weeds and Useful Plants.*) Wherever it makes its appearance it should be eradicated as soon possible, "as it is a troublesome weed when fully established."

5. Creeping Crowfoot—*Ranunculus repens.* *Stem* at first erect, finally sending out creepers or runners to the distance of two or three feet. *Leaves* in three divisions, which are, at least the terminal one, long stalked and cleft. *Flowers* often larger than those of the common Buttercups, and of a bright, shining yellow.

A low native species, very common in many parts of the State, growing in abundance by the sidewalks and by the roadsides; as well as in moist meadows and along the borders of streams, which are its more common places of growth. By cultivation this plant becomes perfectly double, and presents a very pleasing appearance.

6. Common Buttercups—*Ranunculus acris.* *Root* perennial. *Stem* one to three feet high. *Flowers* about an inch in diameter, bright yellow.

An introduced species—the most common of its genus, growing in meadows and pastures, sometimes so abundant as to make the field appear at a distance like a sea of gold. It has become thoroughly naturalized. The juice of this species also, is very acrid and bitter when green, and cattle will not eat the plant until it has become dry, when it loses its volatile acrid principle. Buttercups make very poor fodder at best, and are generally considered a nuisance by farmers. The best mode of eradication is by a rotation of *Spring* crops. Both R. bulbosus and R. acris become perfectly double by the transformation of their organs of fructification into petals, and are sometimes cultivated in gardens.

Order 2. POPPIES—Papaveraceæ. Mostly natives of the temperate parts of the northern hemisphere. They are principally herbs with a milky juice, which, in most species, is acrid and narcotic.

7. Common Poppy—*Papaver somniferum*. *Root* annual. *Stem* smooth, covered with a greenish white mealiness. *Leaves* clasping the stem, the wavy margin incised and toothed. *Flowers* large, generally purple or rose, sometimes white, with a black or deep purple mark at the bottom of each petal. *Pod* or *capsule* roundish, flattened below and surmounted by a crown-like expansion—the persistent stigma—which is marked by numerous diverging rays.

This annual plant is often seen in gardens and in waste places about dwellings. It is an introduced species from Europe, and has become partly naturalized in many places. The plant was *originally* a native of the warmer parts of Asia. It produces the opium of commerce. The capsules possess *anodyne* properties, and when boiled in water are employed as fomentations to ulcerated surfaces. Its extirpation is most readily effected by hand weeding.

8. Common Celandine—*Chelidonium majus*. *Root* spindle-shaped, perennial. *Stem* one to two feet high, branched from near the base, brittle, somewhat hairy. *Leaves* three to five inches long, with five to seven segments. *Flowers* small, yellow. *Pods* about an inch long, swelled out in obtuse ridges.

This plant is a native of all Europe, with the exception of Lapland. It is probably an introduced plant with us, and it is said to have become quite an abundant weed in some places, growing about dwellings and in waste grounds. The saffron colored juice, which exudes from the fresh stem when broken, is very sour and bitter, and was formerly much used as an application to warts, ringworms, and the like. As the Celandine is a perennial, it must be eradicated root and branch.

Order 3. FUMITORIES—Fumariaceæ. An unimportant order, numbering about fifteen genera. A few species are possessed of much beauty, and are highly valued as garden plants. The members of this family are chiefly remarkable for their singularly irregular flowers.

9. Fumitory—*Fumaria officinalis*. *Annual*. *Stem* herbaceous, at first erect, finally becoming much branched and spreading. *Leaves* finely parted and very delicate. *Flowers* small, pale red, tipped with deep red or purple, and arranged in dense racemes.

This little plant is exceedingly annoying in many flower gardens. The seeds are carried from one garden to another on the roots of garden plants, and when it first makes its appearance it is much admired, and its growth is encouraged. But in a short time it spreads over all the garden, giving much trouble to its unwitting benefactor, who, too late, had found out the plant's true character. It should be known and carefully pulled up before it has time to blossom and mature its seeds, for by these alone is it propagated.

The leaves of the Fumitory are saline and bitter to the taste. The expressed juice has been used in medicine to correct acidity in the stomach, and an infusion of the leaves has been used as a cosmetic to remove freckles and clear the skin.

ORDER 4. MUSTARDS—CRUCIFERÆ. But few species of this important family are natives of North America. The more useful plants of the order, such as the cabbage, turnip, cauliflower, &c., as well as those classed with weeds, have been introduced from Europe. "It is the universal character of the cruciferæ to possess antiscorbutic and stimulant qualities, combined with an acrid flavor."—(*Lindley.*) In all the species the parts of the flower are in fours, and opposite each other in the form of a cross, whence the Latin name *cruciferæ*, which means "bearing a cross."

10. HEDGE MUSTARD—*Sisymbrium officinale*. *Root* annual. *Stem* one to two feet high, branched. *Lower leaves* runcinate, upper ones somewhat hastate. *Flowers* small, yellow. *Racemes* elongated after flowering. *Pods* erect, half an inch or more long, awl-shaped, appressed to the rachis.

This troublesome little foreigner is an unwelcome intruder in our gardens, and in waste places. The plant is warm and acid to the taste, and when cultivated has been used as a pot herb. "It was formerly held in some repute in Europe as a remedy for coughs, the hoarseness of singers, and the like." It is said to be a useful remedy in ulcerations of the mouth and throat. As this plant is propagated by seed it should be removed from the grounds before flowering.

11. FIELD MUSTARD, CHARLOCK—*Brassica Sinapistrum*. *Annual*. *Stem* simple, or branched, twelve to thirty inches high, bristly with stiff recurved hairs. *Leaves* oval or oblong, lower ones somewhat pinnatifid, all toothed. *Flowers* quite large and showy, of a sulphur yellow color. *Pods* knotty, ascending on spreading stalks; beak two-edged, fully one third the length of the pod.

The authors state that this plant is found as a noxious weed in grain fields, from Pennsylvania and New York westward. I was hoping that it had not been introduced into this State; but while in Waterville the past season I saw a grain field thickly sprinkled with the yellow blossoms of this most unwelcome intruder, which seemed to have taken possession of the ground and made itself as much at home as though the field had been cultivated expressly for its own benefit. Todd, in his excellent work, the "*Young Farmer's Manual,*" says: "We know of no weed in the grain-growing districts of New York that is so difficult to exterminate as this.

Canada thistles, daisies and dock can be eradicated with facility, in comparison. * * * The seeds will remain in the ground a lifetime without losing their vitality. We have cultivated a field sixteen successive seasons, allowing no mustard to go to seed; but deep plowing brought seed to the surface the seventeenth year, so that the ground was nearly covered with the young plants. * * There are two things indispensably necessary to exterminate mustard. One is to allow no seeds to mature; and the other is to cultivate such crops as will induce all the seed to vegetate, that the plants may be destroyed. * * When mustard comes up very thick, harrow the ground thoroughly, as soon as the crop of grain has been removed. After a few weeks have elapsed harrow it again. This will destroy most of the young plants in the seed leaf. After this use a cultivator instead of a harrow. These repeated scarifyings will cover the seed and bring others to the surface, so that a large portion vegetates and dies before winter. The next season harrow the ground early in the Spring, so as to start a new crop of seed. Plow it soon after the time for plowing for Indian corn. Harrow again in about two weeks. After another fortnight plow, and sow buckwheat; as soon as the buckwheat is harvested harrow the ground again. The next season manure well, and raise a hoed crop; and allow no mustard to go to seed. Next sow a crop of winter grain. The mustard may now appear quite thick, but none of it will have time to ripen before winter, when every plant will die. A limited number of plants will appear the next season among the standing grain. When they are in full blossom let every one be pulled. A careful, faithful man will be able to pull all the mustard in a day that will appear on several acres, after the soil has been treated in the manner recommended. After this any kind of grain may be raised. But for more than twenty years mustard will come up every season, and must be pulled before it ripens. This is the only way that our cultivatable fields can be rid of this pestiferous plant. Incessant vigilance from year to year will exterminate it effectually."

If the Charlock, as well as many other weeds, be not exterminated by the above method no blame can be laid to the cultivator.

12. Black Mustard, Common M.—*Brassica nigra.* *Root* annual. *Stem* three to six feet high, *smooth*, much branched. *Leaves* petiolate; lower ones large, lyrate and scabrous; upper ones narrow and entire. *Flowers* yellow, arranged in elongated racemes. *Pods* appressed to the rachis, about three-fourths of an inch long.

A native of Europe, cultivated, or found in abundance in fields and waste places. The seeds are black, like those of Charlock, and are possessed of equal vitality, as they will remain buried in the ground to the depth of three or four inches for ages without germinating. If this plant becomes too abundant and troublesome, as it surely will if not checked, it may be eradicated much in the same manner as Charlock.

13. SHEPHERD'S PURSE—*Capsella Bursa-Pastoris.* *Root* annual. *Stem* six inches to two feet high, often several from the same root. *Leaves* of the root in a *rosulate cluster*, mostly pinnatifid ; those of the stem arrow-shaped. *Pods* inversely heart-shaped.

A well known plant from Europe. It has become very troublesome in gardens and cultivated grounds. It can be "suppressed by careful culture, and inducing the growth of more useful plants."

14. WILD PEPPERGRASS—*Lepidium Virginicum.* *Stem* a foot high or more. *Flowers* very small. *Pods* roundish and notched at the end.

"This plant is a native of the southern portion of this country, and is abundantly naturalized in many parts of Europe, thus making a partial return for the abundant supply of weeds which have crossed the ocean to our shores. * * The reddish brown seeds are sometimes found in *clover seed,* and excite apprehensions of some pernicious intruder; but, although a worthless little weed, if there be nothing worse among the clover seed the farmer need not be alarmed."—(*Darlington.*)

15. WILD RADISH. JOINTED CHARLOCK—*Raphanus raphanistrum.* *Root* annual. *Stem* low, much branched. *Leaves* rough, lower ones lyre-shaped. *Flowers* yellow, turning white or purplish, veiny. *Pods* necklace form.

A plant naturalized from Europe, troublesome in some places, though probably not very common.

ORDER 5. ST. JOHN'S WORTS—HYPERICACEÆ. This family is very generally distributed, flourishing in all localities, on mountains and valleys, marshes and dry plains, meadows and heaths, in Europe, America, Asia, Africa and Australia. The leaves are opposite and punctate with pellucid dots. A gargle for sore throat is prepared from *Hypericum connatum,* a native of Brazil.

16. COMMON ST. JOHN'S-WORT—*Hypericum perforatum.* *Root* perennial. *Stem* one to two feet high, branched, smooth. *Leaves* from half an inch to an inch and a half long, narrowly oblong in outline, full of pellucid dots *Flowers* in open cymes, numerous, yellow, the edges of the petals are marked with small black dots.

An introduced species, growing to the height of about two feet. It has become thoroughly naturalized with us, and is very common in pastures and by the roadside, and also in meadows. The flowers tinge spirits and oils to a fine yellow color. "The common people of France and Germany gather it with great ceremony on St. John's day, and hang it in their windows as a charm against storms, thunder, and evil spirits. * * * In Scotland it was formerly carried about as a charm against witchcraft and enchantment."—(*Loudon.*) Many years ago this plant was considered the cause of cutaneous ulcers, which affected white cattle, and horses with white feet and noses, during the pasture season. But either the plant has lost its power, or the above idea was erroneous, which is the most likely; for the plant still remains too common, but the above mentioned sores have not been noticed for a number of years past. A general rule for its extermination, which will also apply to many other plants, is: *Let none go to seed; and cultivate well the soil.* There are two other species of Hypericum (*H. mutilum* and *H. canadense*), found on low grounds and by the roadside quite common. They are small species and not very troublesome.

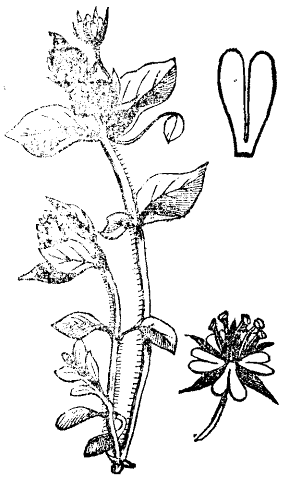
ORDER 6. PINKS—CARYOPHYLLACEÆ. Mostly herbs with swollen or tumid joints, and opposite leaves. Many species are cultivated in gardens, and are among the most fragrant of cultivated plants. Most of the species growing wild here are weeds, although, with few exceptions, they are not very troublesome.

17. BOSTON PINKS—*Saponaria officinalis.* *Root* perennial. *Stem* about a foot high, smooth. *Leaves* one to three inches long, lanceolate, sessile. *Flowers* large, often double, rose-colored, in dense terminal clusters.

The roots of the Saponaria, as well as the leaves, form a *lather* when swashed about in water, which is said to be a sure cure for blisters produced by *Mercury* or *Poison Ivy.* I have tried it with satisfactory results. It is an introduced plant from Europe, and has become quite troublesome in many places where it has been allowed to take root. The roots spread extensively, making the plant quite difficult of eradication. "Its presence gives a very slovenly appearance to the farm, and no tidy farmer will allow this nuisance to disfigure his premises." Common Soap-wort, and Bouncing Bet are other names for this plant.

18. CORN COCKLE, OR ROSE CAMPION—*Agrostemma Githago.* *Plant* clothed with appressed hairs. *Root* annual? *Stem* two to four feet high, branched. *Leaves* linear, three to five inches long. *Flowers* large, reddish purple.

Frequently found in abundance in grain fields, especially wheat. The numerous, rough, black seeds "are injurious to the quality and appearance of the manufactured flour." They also injure the looks of the cleaned grain. To exterminate it no seeds should be sown with the grain. If this cannot be avoided, the plants should be pulled as soon as they are about a foot high, or at least before they go to seed.



COMMON CHICKWEED.

19. COMMON CHICKWEED—*Stellaria media.*

Too well known to need describing. A very common foreigner from Europe, found in moist, cultivated and waste grounds, especially where it is moist and shady. It is very hardy, remaining green and even flowering during the winter months. Small birds and poultry eat the seeds as well as the whole herb. The latter may be boiled for the table like spinach. Frequent underdraining and cultivation will exterminate it.

20. MOUSE-EAR CHICKWEED—*Cerastiun viscosum. Perennial. Stem* six to fifteen inches long, hairy, spreading. *Leaves* about an inch long, sessile, rather broad at the base. *Flowers* forked-umbellate, rather crowded.

A worthless stranger from Europe, common everywhere, in highly cultivated grass-lands as well as in neglected fields and pastures.

21. TARES. CORN SPURREY. DEVIL'S FLAX—*Spergula arvensis. Annual. Stem* about a foot high, erect or spreading, smooth. *Leaves* one to two inches long, numerous, thread-like, in whorls. *Flowers* white.

A foreigner from Europe, where it is cultivated as a forage plant, sheep and cattle being very fond of it. It is said to greatly enrich the milk of cows; and mutton fed on it is considered preferable to that fed on turnips. "Hens eat Spurrey greedily, and it is supposed to make them lay a great number of eggs." The seeds of *Spergula saliva* are large, and smooth, and afford on expression a good lamp oil. The flour obtained from them is frequently used in Norway and Gothland for edible purposes, and when mixed with wheat or rye makes a healthful food. With us the Spurrey is considered only a pernicious weed, found in grain fields and cultivated grounds.

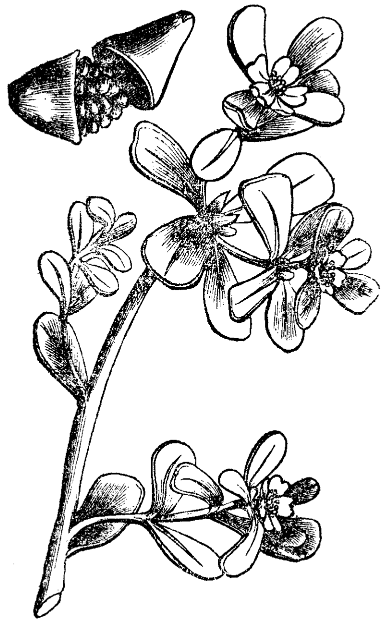
22. CARPET WEED—*Mollugo verticillata. Annual. Stem* prostrate, branching in all directions, forming patches a foot or more in diameter. *Leaves* spatulate, clustered in

whorls at the joints, about an inch long. *Flowers* small, white, in the axils of the leaves, forming little clusters.

A weed introduced from the South. Frequently troublesome in sandy soil.

ORDER 7. PURSLANES—PORTULACACEÆ. Plants of this order grow mostly in arid or dry situations. They possess no remarkable properties.

23. COMMON PURSLANE—*Portulaca oleracea*. *Annual*. *Stem* six to fifteen inches long, prostrate, fleshy, smooth and branching, reddish. *Leaves* fleshy, about one inch long, wedge-shaped. *Flowers* small, yellow.



COMMON PURSLANE.

This is one of the most common and pernicious of garden weeds. It is doubtless a naturalized stranger with us, thought to have been introduced from Europe. It is considered native west of the Mississippi. The name *purslane* comes from an old French name for the plant, *pourcellaine*. The specific name *oleracea*, is derived from the Latin *olus*, a *pot herb*, indicating that the plant was formerly used as food. It is even now used as such by some people. The purslane is very tenacious of life, continuing to grow even after having been kept between papers for weeks. This makes the plant very difficult to eradicate, for the stems, if not removed from the ground, will quickly take root again.

ORDER 8. MALLOWS—MALVACEÆ. This family is most abundant in the tropics. The important and well known *Cotton plant* is a member of this order. Many of the species from their beauty are much sought for by florists.

24 COMMON MALLOW—*Malva rotundifolia*. *Perennial*. *Stem* one to three feet long, prostrate or spreading from a deep root. *Leaves* one to three inches in diameter, round, kidney-shaped, on very long petioles. *Flowers* small, nearly white.

COMMON MALLOW.

Naturalized in many places; introduced from Europe. Found about dwellings in waste places, frequently quite troublesome. It should not be overlooked in the general destruction of weeds.

ORDER 9. GERANIUMS—GERANIACEÆ. The true Geraniums are mostly natives of the Northern temperate zones. Species of this order are found everywhere cultivated as ornamental plants. The wood-sorrels are noticeable for their sour juice.

25. BALSAM-WEED—*Impatiens fulva*. Also called *Celandine* and *Jewel-weed*. *Stem* two to four feet high, very smooth, green, at length rather tawny. *Leaves* two to three inches long, tawny underneath. *Flowers* deep orange, sprinkled with numerous brown spots, loosely panicled at the ends of the branches, hanging gracefully on their slender nodding stalks. *Valves* of the pods coiling elastically and scattering the seeds violently when they burst.

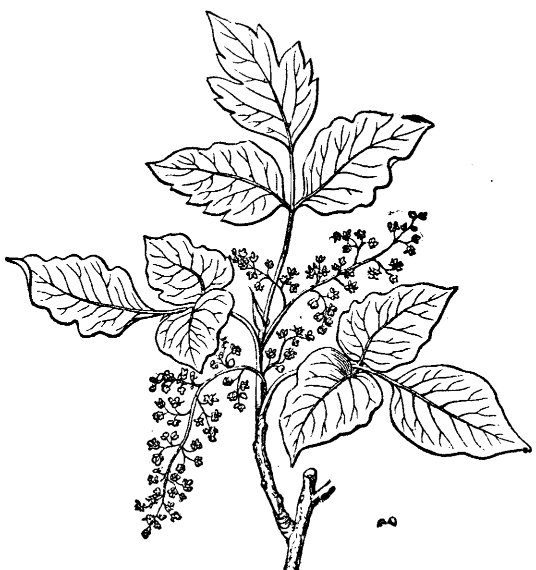
A native of swamps and low grounds, yet frequently abundant about dwellings in moist rich soil. Its presence greatly mars the appearance of one's grounds. Though not particularly troublesome it is of course eradicated by all neat farmers. The mature capsules, or pods, are a source of amusement to children, as they burst with considerable force at the slightest touch, whence the name, *touch-me-not*, by which it is sometimes known.

26. YELLOW WOOD SORREL—*Oxalis stricta*. *Roots* producing long, underground, branching stolons, which throw up at intervals new plants. *Stem* three inches to a foot in height, branching. *Leaves* divided into three heart-shaped divisions. *Flowers* yellow, on long stalks.

A very common native plant, found in fields and pastures. The plant has a pleasant acid taste, and is often eaten by children. Probably not very troublesome.

ORDER 10. SUMACKS—ANACARDIACEÆ. Mostly natives of the tropics. The plants abound in a resinous juice, which in some species is very poisonous. "In several the juice is white and clammy, and afterwards turns black, and may be used as a varnish," (*Emerson*.) Some species furnish a good indelible ink.

27. POISON IVY. POISON OAK—*Rhus toxicodendron*. *Perennial*. *Stem* shrubby, one to three feet high, climbing by rootlets over rocks and stumps, or ascending trees. *Leaves* divided into three ovate leaflets; these from two to six inches long. *Flowers* small, yellowish green, in slender racemose clusters.



POISON IVY.

This species is noticed here on account of its being very poisonous to many persons, as swollen and blistered hands, &c., have often borne witness. I notice the following cure for the poison of this plant in the "Gardener's Monthly," Vol. XI. (1869) page 248: "Simply bathe the parts affected with hot water, as hot as can be borne; keep increasing the temperature till it can no longer be used without burning. Press a soft towel against the parts, so as to absorb the water, and avoid rubbing; then apply a rather strong solution of strong navy, or plug chewing tobacco, on the poisoned places, and let it dry. The solution is best when the water is hot. I have tried it, and have been cured, or very nearly so, in two days—four days at the most." For another cure see Boston Pinks. The woodbine (*Ampelopsis quinquefolia*) is often mistaken for this plant, but the two may be readily distinguished by observing that a woodbine leaf has five oblong leaflets, while the leaf of the poison ivy has but three. The poison ivy "should not only be known to the farmer, but diligently expelled from his premises," (*Darlington.*)

ORDER 11. LEGUMINOUS PLANTS — LEGUMINOSÆ. The members of this family are very generally distributed throughout the world. It numbers about 6500 species. It is one of the most important orders, whether we regard the beauty or the utility of the species embraced in it. Among the more useful plants may be mentioned, peas, beans, clover and lucerne. Many species are important in medicine. Indigo is obtained from one species.

28. RABBIT-FOOT OR STONE CLOVER—*Trifolium arvense*. *Annual*. *Stem* two to ten inches high, much branched. *Leaves* composed of three narrow leaflets, on short, hairy stalks. *Flowers* in oblong or cylindrical heads, which become very soft, silky and of a grayish or redish color.

A naturalized species from Europe, frequent in dry, barren soil. "Its presence is a pretty sure indication of a thin soil, and neglected agriculture; and the appropriate remedy is to improve both."—(*Darlington.*)

ORDER 12. ROSEWORTS—ROSACEÆ. Another large and important family, producing many valuable fruits, and many plants cultivated for ornament. It numbers about one thousand species.

29. WATER AVENS. CHOCOLATE—*Geum rivale*. *Root* perennial, jointed, about six inches long. *Stem* twelve to eighteen inches high, somewhat hairy. *Radical leaves* interruptedly pinnate, four to six inches long, terminal leaflet large, roundish and lobed. *Stem-leaves* in three segments. *Flowers* nodding, yellowish purple, petals veined. *Carpels* in a stalked head, very hairy.

Quite common in meadows and low grounds. The whole plant is purplish in color. The dried roots have an astringent and bitterish taste, and as a domestic medicine are used in diarrhœa, and dyspepsia. They are also sometimes used as a substitute for coffee.

30. POTENTILLA—*Potentilla Norvegica.* *Annual.* *Stem* one to three feet high, rather coarse and stout. *Leaves* in three divisions. *Flowers* numerous, yellow, petals soon falling off.

A coarse native plant, very common in pastures, waste places about dwellings, and in well cultivated grass lands. Not troublesome.

31. FIVE-FINGER CINQUEFOIL—*Potentilla Canadensis.* *Root* perennial. *Stem* six to twenty inches long, slender, producing runners. *Leaves* in five divisions, like a hand; divisions one to three inches long. *Flowers* yellow.

A worthless native plant, common in dry, gravelly fields and pastures. Its prevalence in grass lands is indicative of poor soil and neglected agriculture. "Some land when kept as pasture fields seem to have an almost incurable tendency to lose the valuable grasses, and to become speedily overrun with Cinquefoil. Lime and manure, however, will work wonders in the worst of soils."—(*Darlington.*)

32. SILVERY CINQUEFOIL—*Potentilla argentea.* *Perennial.* *Stem* procumbent or ascending, with white-woolly, slender branches. *Leaves* in five divisions, which are about half an inch long, green above, white with silvery wool beneath. *Flowers* small, yellow; petals soon falling off.

This native herb is common in dry, sterile fields and pastures. A worthless and harmless weed, of much the same character as the preceding.

ORDER 13. ONAGRADS—ONAGRACEÆ. None of the species are of any agricultural importance. The Fuchsia and Clarkia are cultivated for ornament.

33. FIRE-WEED. WILLOW-HERB—*Epilobium angustifolium.* *Perennial.* *Stem* four to six feet high. *Leaves* two to five inches long, with purple veins. *Flowers* numerous, pink-purple, very showy.

A native species found on low waste grounds, and especially on newly cleared land where it has been burnt over. I do not know that it is at all troublesome.

34. COMMON EVENING PRIMROSE—*Œnothera biennis.* *Annual* or perennial. *Stem* erect, two to five feet high, stout. *Leaves* three to six inches long. *Flowers* numerous, quite large and showy; yellow.

A coarse native herb of variable appearance, producing several well marked varieties, as the *Œnothera b.* var. *grandiflora,* which is sometimes tolerated in and about flower gardens. The evening primrose is a conspicuous and rather common weed in fields and by the roadside. Small evening primrose (*Œ. pumila,*) is a small half-erect species with a slender stem six to ten inches long, and small flowers. It is abundant in pastures and grass lands.

ORDER 14. HOUSE-LEEKS—CRASSULACEÆ. An order of no particular importance.

35. LIVE-FOR-EVER, GARDEN ORPINE—*Sedum Telephium*. *Perennial*. *Stem* two feet high, stout, very leafy. *Leaves* oval, thick and fleshy. *Flowers* dark purplish, in dense terminal leafy clusters.

This partly naturalized plant from Europe is a very troublesome weed when it has once got a firm foothold in gardens or fields. It is very difficult to eradicate, and quite injurious to the growth of valuable crops. Unchecked, it spreads rapidly. Often it is introduced into gardens for its showy flowers and oddity of appearance; but whoever does this has to pay pretty dear for his whistle, for it is quite sure to cause much labor to keep it within bounds. The herb is so tenacious of life, that even after being severed from the root it will continue to grow and blossom for weeks, if kept in a shady place. It should be eradicated, roots and all, before it matures its seeds; otherwise it will remain in the soil and soon be as troublesome as ever.

36. DITCH STONE-CROP—*Penthorum sedoides*. *Perennial*. *Stem* ten to eighteen inches high, with a few short branches. *Leaves* two to three inches long, narrow. *Flowers* greenish, placed on the upper side of several spreading branches.

A homely native weed, common everywhere in ditches and moist places. Unlike the Live-for-ever, this plant is not fleshy.

ORDER 15. UMBELWORTS—UMBELLIFERÆ. A large and well defined order, chiefly natives of the cooler portions of the globe, very few species being found within the tropics. Many of the Umbelliferæ are poisonous or have narcotic properties. Among these we may mention the *Conium maculatum*, presently to be described, *Cicuta maculata*, and *Æthusa cynapium*. Among the useful members of this order we might name the *carrot*, *parsnip*, *celery* and *parsley*. "Some medicinal gums are furnished by this order, such as Asafœtida, Galbanum and Ammoniac."—(*Darlington.*)

37. COMMON CARROT. WILD CARROT—*Daucus carota*. *Root* spindle-shaped, biennial. *Stem* two to three feet high, striate, branching. *Leaves* numerous, pale green, cut into many small leaflets. *Flowers* white or cream color, with one dark purple, abortive flower in the centre of each little umble.

The common garden carrot, *Daucus carota, var. sativa* of *De Candolle*, is the cultivated form of our wild carrot, sometimes troublesome on clayey loam in fields and by the roadside, where it has been allowed to become established; indicating a "careless, slovenly farmer." It is a partially naturalized herb from Europe; spreads rapidly and should be diligently eradicated before it matures its seed. The flowers, which appear during July and August, are arranged in slightly convex umbels. When in fruit these are dense and deeply concave, much resembling a bird's nest. "In case of snow, with a smooth surface crust, the mature umbles break off and are driven by the winds to a great distance, and thus annoy an extensive district."—(*Darlington.*)

38. COMMON WILD PARSNIP—*Pastinica sativa.* *Root* biennial, spindle shaped, large and fleshy. *Stem* three to five feet high, stout, hollow, branched. *Leaves* much dissected. *Flowers* yellow, in large terminal umbels. *Fruit* thin or very flatly compressed on the back, with a thin single winged margin.

A well known homely weed, common in waste places and by the roadside. The root of the parsnip in its wild state is much smaller than when cultivated, of a hard texture, acrid and poisonous, and is by no means edible. It is an unsightly and often troublesome weed, and should be carefully eradicated.

39. GREAT ANGELICA—LIFE OF MAN—*Archangelica atropurpurea.* *Root* perennial, large and fleshy. *Stem* four to six feet high, furrowed, smooth, hollow, sometimes dark purple. *Leaves* very large, one to three feet wide, two to three ternately compound; *leaflets* toothed, terminal one, sometimes three lobed. *Leaf stalks* (petioles) large, with mnch inflated sheaths at the base. *Flowers* greenish-white, arranged in large spherical umbles, which are six to eight inches in diameter.

This is an exceedingly large and coarse looking native herb, often found in low meadows and by the wayside, in moist rich soil, especially along the banks of streams. It is native from New England to Pennsylvania, Wisconsin and northward. The root is held in some repute as a domestic medicine. The presence of this weed gives one's grass lands a slovenly appearance. Proper cultivation and drainage will quickly exterminate it.

40. POISON HEMLOCK—*Conium Maculatum.* *Root* biennial, spindle-shaped, whitish and fleshy. *Stem* two to seven feet high, round and hollow, streaked with green and yellow, and often spotted with dark purple. *Flowers* small, white, in terminal umbels.

"This foreigner is partially naturalized in many places, and being a powerful narcotic poison, it ought to be known by every person on whose premises it may occur. The plant, when bruised, emits a disagreeable odor. It is supposed to be the herb with which the ancient Greeks put their philosophers and statesmen to death, when they got tired of them. An extract prepared from this plant was formerly used for the treatment of scrofula and malignant tumors, but it is now believed that the only benefit, if any, derived from it was that of a palliative anodyne."—(*Darling-*

ton's American Weeds and Useful Plants.) The poison hemlock grows only in waste and uncultivated fields, especially meadows, and ditches near towns. It is easily destroyed by cultivating the ground for a season, or by cutting the stems just before seeding.

41. CARAWAY—*Carum carui.* Well known plant, needs no description.

Caraway seeds have a pleasant odor, and a warm aromatic flavor, and are much used in seed cakes. The plant often spreads, becoming quite a troublesome weed. It should be carefully kept within bounds.

ORDER 16. GINSENGS—ARALIACEÆ. This family is represented in the Eastern States only by the genus *Aralia.* The European Ivy—*Hedera Helix*—cultivated here for ornament, is a member of this order. Some of the species possess well known medicinal properties, viz., spikenard, sarsaparilla and ginseng.

42. BRISTLY SARSAPARILLA. WILD ELDER—*Aralia hispida. Perennial. Stem* one to three feet high, shrubby at the base, and covered with stiff prickles; herbaceous above, much branched. *Leaves* with numerous leaflets, ending in a long point. *Flowers* greenish in simple globose umbels. *Fruit* of dark colored nauseous berries.

A native plant, common along the borders of fields, and around stumps and stone heaps. The dark purple or black berries are about the size of peas, and have a sickening sweetish taste. The whole plant has a rather disagreeable smell. It is probably not very troublesome, yet no neat farmer will tolerate it.

DIVISION II. THE PETALS OF THE COROLLA MORE OF LESS UNITED—*Monopetalous.*

ORDER 17. MADDERWORTS—RUBIACEÆ. "A very large family, the greater part, and all its most important plants (such as the coffee and Peruvian bark trees,) tropical."—(*Gray.*) "The *madder*, one of the most important dyes, is furnished by the root of *Rubia tinctoria.* * * * Coffee is the hard albumen of the seeds of *Coffea arabica*, a tree of moderate size, with a light brown trunk, and a conical-shaped head. Leaves shining, light green. Flowers white, fragrant. The berries are black when ripe. Coffee is said to have been used in Ethiopia from time immemorial. In Paris and London it seems to have been in general use earlier than the year seventeen hundred."—(*Wood.*)

43. BLUETS INNOCENCE—*Houstonia cærulea. Biennial. Stems* three to five inches high, slender. *Leaves* about half an inch long, oblong. *Flowers* light blue, fading to white, with a yellowish centre.

A pretty little native, frequently very abundant in dry sterile fields and by the roadsides. In May we have seen barren fields literally white with the small but showy flowers of the Houstonia. It generally forms patches of greater or less extent. Good cultivation will soon eradicate it.

ORDER 18. COMPOSITES. — SUN-FLOWERS. — ASTER-WORTS—COMPOSITÆ. A brief description of this truly Royal Family of plants will greatly abridge the specific descriptions.

Mostly *herbs*. *Leaves* never truly compound. *Flowers* few to many, crowded on a compound receptacle, into a close head, surrounded by numerous leaflets or scales, forming an involucre. The separate flowers are often furnished with bracelets (*chaff or paleæ*). The limb or border of the calyx is divided into bristles, hairs, or scales (*pappus*). The Corolla is either tubular and five lobed or strap-shaped and five toothed.

This vast family comprises about a tenth part of all flowering plants; numbering about one thousand genera and nine thousand species. The whole family may be known at a glance by their capitate (arranged in heads) flowers and united anthers. The flowers are either *polygamous, monœcious, diœcious,* or all perfect. The plants of this family are diffused throughout the world. According to Humboldt, they constitute about one-seventh of the flowering plants of Germany; one-eighth of France; one-fifteenth of Lapland; one-sixth of North America (north of Mexico); and one-half of Tropical America. All the composite plants of the temperate regions are herbaceous, while towards the tropics they gradually become shrubs and even trees. "A bitter astringent principle pervades the whole order; which in some species is tonic, as in *Chamomile,* the *Boneset* or *Thoroughwort;* in others combined with mucilage, so that they are demulcent as well as tonic, viz: Elecampane (*Inula Helenium*) and Colt's-foot (*Tussilago Farfara*); in others aromatic and extremely bitter (as Wormwood and all species of *Artemisia*); sometimes accompanied by acrid qualities (*Tansy* and *May-weed*), the bruised fresh herbage of which blisters the skin. The species of *Liatris* (Button Snakeroot or Blazing-Star), which abound in terebinthine juice, are among the reputed remedies for the bites of serpents; so are some species of *Mikania* in Central America. The juice of *Silphium* and of some sunflowers is resinous. The leaves of *Solidago odora,* which owe their pleasant anisate fragrance to a peculiar volatile oil, are infused as a substitute for tea. From the seeds of sunflower, and several other plants of the order, a bland oil is expressed. The tubers of *Heli-*

anthus tuberosus are eaten under the name of *Jerusalem artichokes; Girasola,* the Italian name for sunflower, having become anglicized into Jerusalem. True *artichokes* are the fleshy receptacle and imbicated scales of *Cynara Scolymus.* The flowers of *Carthamus tinctorius,* often called Saffron, yield a yellow dye, much inferior in quality to true saffron. The Ligulifloræ, or Cichoraceæ, all have milky juice, which is narcotic, and has been employed as a substitute for *opium.* The bland young leaves of the garden Lettuce are a common salad. The roasted roots of the Wild Succory (*Cichorium Intybus*), are extensively used to adulterate coffee; and the roots of some species of *Tragopogon* (Salsify, Oyster-plant) and *Scorzonera* are well known esculents."—(*Gray.*) When the heads have the outer flowers strap-shaped or ligutate, and the middle flowers tubular they are called *radiate,* when all the flowers are tubular the head is called *discoid.* As has been said, the scales which grow upon the receptacle, among the flowers, are called *chaff;* when destitute of these the receptacle is *naked.*

44. Iron-weed— *Veronia Noveboracensis. Perennial. Stem* two to six feet high, reddish, becoming firm and woody with age. *Leaves* three to seven inches long, numerous, somewhat tough and leather-like. *Flowers* dark purple, in discoid heads. *Involucre* shorter than the flowers, the inner scales longest. *Receptacle* naked. *Pappus* of many capillary bristles.

This plant is probably most abundant near the seashore. Darlington says in his valuable little work, edited by Prof- Thurber, that this plant is quite common in moist low grounds and along fence rows. From its worthless character and coarse hard stem it is justly regarded as an obnoxious weed. "The root of this must be cut like the Canada thistle before the flowering season in spring, or the danger will be imminent of its overrunning the whole area in a short period by means of its floating seeds."

45. Thoroughwort—*Eupatorium perfoliatum.* This well known plant is frequently so abundant in wet meadows and low grounds as to be considered an objectionable weed. Its presence is rather an indication of a careless farmer. The medicinal properties of the plant are well known in domestic medicine. Purple boneset, also known as trumpet weed and joe-pie, is found in similar situations as thoroughwort. It is a stouter plant, with light purple flowers and large leaves in whorls of three to five at the joints.

46. Asters. The genus is characterized as follows: *Heads* radiate, many-flowered. *Scales* of the involucre, more or less imbricated, usually with herbaceous or leaflike tips

Receptacle flat, with little pits or cells like a honeycomb (alveolate.) *Pappus* of capillary bristles.

Mostly perennials; flowering in autumn, with white, purple, or blue rays, and yellow disk flowers. FROST WEED, *Aster puniceus*, is a native plant, growing in swales and meadows. It has a stout and much branched stem, four to six feet high; the branches, especially on the sunny side, generally dark purplish; the flowers are abundant and showy, with blue rays. It is called frost weed from the fact that it is often seen in full bloom after severe frosts. There are about twenty species of Asters known to be natives of Maine. Many of these are merely worthless weeds, abundant in thin sterile soil, and may be readily eradicated by cultivation; while many others are well worth introducing into flower gardens for their beauty.

47. HORSE-WEED. BUTTER-WEED—*Erigeron Canadense.* *Annual.* *Stem* six inches to five feet high. *Leaves* narrow, one to three inches long. *Heads* very numerous, small. *Rays* inconspicuous. *Flowers* white.

A native plant common in pastures and waste places, worthless and comparatively harmless. "It has disseminated itself more or less abundantly all over our country, and it is said all over Europe. * * * Good farming is the mode for smothering out such intruders."—(*Darlington.*)

48. DAISY.–FLEABANE—*Erigeron strigosum.* A well known biennial weed with rather small heads, furnished with numerous narrow, white rays. Common in grassy fields and by the roadside. The fleabane is particularly abundant in the first crop of upland meadows after a series of grain crops. Formerly the fleabane had the reputation of expelling fleas and insects by its smell. The DAISY–FLEABANE or SWEET SCABIOUS (*Erigeron annuum*), is found common with *E. strigosum.* They are both equally worthless and unwelcome weeds.

49. GOLDENRODS—*Solidago.* *Perennial* herbs. *Stems* erect, generally branching near the top. *Leaves* alternate. *Heads* few to many flowered, interminal or axillary racemes. *Flowers*, with one exception, yellow. *Ray-florets* few, pistillate; *disk-florets* tubular and perfect.

The genus Solidago is very large, affording many worthless weeds. They bloom from August to October, and are the characteristic flowers of autumn. The name solidago is derived from the Latin word *solidare*, signifying to unite, in allusion to reputed vulnerary qualities. *S. bicolor* is quite a common species, remarkable for having white or cream-colored rays.

50. ELECAMPANE—*Inula Helenium.* *Root* perennial, thick and elongated. *Stem* stout, three to six feet high. *Radical leaves* one to three feet long, ovate, petiolate; stem leaves smaller, partly clasping the stem. *Heads* very large, yellow, many flowered, with a single row of very narrow rays.

A coarse European plant, partly naturalized, common along road-sides and in pastures. The roots of the Elecampane possess well known medicinal properties, and are thought to be beneficial in *Dyspepsia* and *Chronic Catarrh.* The presence of this plant gives to one's premises a very slovenly appearance.

51. BITTER-WEED.–RAG-WEED.–ROMAN WORMWOOD—*Ambrosia artemisiæfolia.* A well known *annual* plant, with *twice pinnatifid leaves.* It is very common in gardens, cultivated grounds, and waste places. Frequently it springs up in great abundance among the stubble after a crop of grain. "If the land be good, the plant seems to be smothered or choked out the next season by the crop of clover and timothy."—(*Darlington.*) This plant is sometimes called Hog-weed. *Ambrosia trifida,* a coarse native weed, is often found in waste places.

52. COCKLEBUR.–CLOTBUR—*Xanthium Strumarium.* *Annual.* *Stem* two to three feet high, bristly. *Flowers* few together, terminal, globular, green. *Pistillate* flowers in sessile axillary tufts. *Fruit,* a hard two-celled bur, nearly an inch long, covered with stiff, hooked prickles.

A coarse, vile weed, found in barn-yards and waste places. The burs often adhere to the wool of sheep. It is easily subdued by cultivation.

53. THORNY CLOTBUR—*Xanthium spinosum.* *Annual.* *Stem* one to three feet high, with slender, yellow, three-parted spines at the base of the leaves. *Leaves* one to three inches long, white-downy beneath. Sterile flowers in the upper axils of the leaves, fertile in the lower.

This plant is said to be found in this State, probably in the Southern part, and not far from the sea-shore. Darlington, in speaking of this plant says: "It may frequently be seen along the sidewalks and waste places in the suburbs of some of our northern seaport towns, and is a vile nuisance wherever found. I have understood that the authorities of one of our cities, a few years since, enacted an ordinance against the plant, in which enactment it was denounced by the name of the Canada Thistle! The misnomer probably did not impair the efficiency of the ordinance; yet I cannot help thinking it would be decidedly preferable that both lawgivers and farmers should avoid confounding objects which are essentially distinct, and learn to designate even *weeds* by their proper names." Like most introduced plants, this intruder is steadily advancing inland, especially towards the west; but it is hoped "that all good cultivators will see that he does not reside long enough with them to be able to get his naturalization papers."

THORNY CLOTBUR.

54. CONE-FLOWER.—"NIGGER HEADS."—YELLOW-WEED—*Rudbeckia hirta.* *Perennial?* *Stem* simple or branched from the base, one to four feet high. *Leaves* two to three inches long. *Heads* large and showy. *Disk*-flowers dark purple. *Rays* twelve to fifteen, bright yellow. *Receptacle* conical.

Not many years ago this plant was almost unknown in this State, but within a few years it has become very abundant in our grass lands. Each succeeding season it seems to be more prevalent than the one previous. It is a more villainous plant than the white-weed, for the more the ground is cultivated the more abundant it will be. Last season we saw a grass field under good cultivation, just yellow with the showy flowers of the cone flower. This plant was introduced in grass seed from the West.

55. JERUSALEM ARTICHOKE. COMMON ARTICHOKE—*Helianthus tuberosus.* *Root,* bearing oblong tubers, perennial. *Stem* four to six feet high, stout, and clothed with stiff hairs. *Leaves* four to seven inches long. *Heads* rather large, with yellow rays.

The artichoke is a native of Brazil, introduced to this country for its fleshy tubers, which were pickled and used as a condiment.

The tubers when cooked form a good substitute for potatoes, and are by some preferred. Many animals eat them with avidity, and they are especially recommended for sheep.—(*Penny Ency.*) In the Report of the Secretary of the Maine Board of Agriculture for 1866, the Jerusalem artichoke is suggested as worthy attention in some cases as a cheap and profitable farm crop for feeding stock. The plant is frequently troublesome about old gardens, where it was formerly cultivated. When once established it is very difficult to eradicate, as any one of the many tubers will continue the plant.

56. COMMON BEGGAR-TICKS. BUR MARIGOLD—*Bidens frondosa.* Hardly needs a special description. It is a disagreeable weed, very common about barns and in moist, rich, cultivated grounds. The flat seeds are furnished with two barbed awns, and are the cause of much annoyance, for they adhere to the clothing with great tenacity, and to the fleeces of sheep. The seeds are thus carried from place to place. *B. chrysanthemoides* has large bright yellow rays, and is the species found common in low wet meadows and ditches. As these plants are both annuals, they would soon be exterminated if not allowed to go to seed.

57. MAY-WEED. FETID CHAMOMILE. DOG'S FENNEL—*Maruta Cotula.* *Annual.* *Stem* much branched, six to fifteen inches high. *Leaves* divided into a multitude of narrow segments. *Rays* white, at first spreading horizontally, but finally turning back towards the stem, reflexed. *Disk florets* yellow.

A strong scented weed, very common in hard dry soils, by the roadside, and in yards. Though very nauseous, the May-weed is sometimes employed as a substitute for *chamomile.* Linnæus says "it is grateful to toads, drives away fleas, and is annoying to flies." The plant was originally introduced from Europe. Eradicated by thorough cultivation.

58. COMMON YARROW. MILFOIL. SNEEZEWORT—*Achillea Millefolium.* *Root* creeping, with smooth, reddish, subterraneous shoots, perennial. *Stem* erect, about a foot high. *Leaves* twice pinnatifid, the divisions very narrow, toothed, pointed. *Heads* numerous, small, arranged in a dense flat-topped cluster. *Rays* short, white. *Disk florets* whitish.

A thoroughly naturalized plant from Europe, having rather an agreeable taste and smell. On account of its creeping roots it is generally considered a "bad weed," yet it has been recommended for cultivation by some English writers. Its nutritive properties are, however, much inferior to those of some other plants, equally adapted to light soil. An ointment made from the leaves of the yarrow is recommended for the scab in sheep.

59. Ox-Eye Daisy. White-weed—*Leucanthemum vulgare.* *Root* branched, tough, and woody, with many fibres, perennial. *Stem* one two two feet high, often several stalks from the same root. *Flowers* in large, showy heads. *Rays* white. *Disk flowers* yellow.

This almost omnipresent weed was quite rare thirty years ago. "It is a positive injury to any soil, and any location. The richer the land the less apparent damage ; while a farm that is naturally cold and poor is decreased in value by its presence and growth at least *twenty per cent.*" "Dried daisies for fodder are about as nutritious as an equal quantity of fine *brush.* Pity the sorrows of the poor animal that is compelled to subsist on daisy hay!"—(*Todd.*) "The seeds are very tenacious of life, and will germinate after passing through the stomach of an animal. Various means have been suggested for destroying it, one of which is to feed it down by sheep. But this is never to be recommended, as the sheep will grow poor upon it, and more will thus be lost than will be gained by ridding pastures and fields of the weed. Thorough cultivation is the only thing that will completely eradicate it, which can be given as follows: The first year plow the sod thoroughly, plant with corn, hoe and cultivate well once a week. The next year sow and plow in two crops of buckwheat, and on the third year manure well and plant corn again, then again two crops of buckwheat for two years more. This will completely exterminate the daisies, and the land will be left in excellent condition."—(*Mr. S. L. Boardman.*) The number of seeds which a single root of the ox-eye produces is immense. In one head over four hundred seeds have actually been counted. There are from fifty to four or five hundred heads from one root. Estimating the number of seeds in a head to be two hundred, and the number of heads to a plant to be seventy-five, we have *fifteen thousand* seeds as the product of a single root. These, as well as the seeds of many other pernicious intruders, are often introduced into one's fields in the grass seed. It is therefore quite important that farmers should be able to tell foul seed, and thus avoid much trouble. "The white daisy has a seed considerably larger than timothy seed, shaped somewhat like the seed of a carrot, but smooth and destitute of fuzz. Its color is light drab and brown, in parallel stripes, running from one end of the seed to the other. When once known it is easily detected."—(*J. J. Thomas.*)

60. Common Tansey—*Tanacetum vulgare.* A coarse, ill-smelling plant, too well known to need describing. Partially naturalized

from Europe. Escaped from cultivation, assuming the character of a weed in many places. It was formerly much cultivated for its aromatic and tonic qualities.

61. Poverty-weed—Everlasting—*Gnaphalium decurrens*. *Perennial*. *Stem* woolly, stout, one to two feet high, branched. *Leaves* linear-lanceolate, sessile, with the two edges continued down the stem (decurrent). *Heads* numerous. *Flowers* whitish. *Rays* none.

A native, homely weed, common in pastures and by the wayside. *G. polycephalum*, is an annual, common with the last; the leaves are not decurrent, and the plant has a strong agreeable odor. *G. uliginosum*, or Low cud-weed, is a small spreading species, covered with whitish down, common in moist ditches and low grounds by the roadsides. Root annual.

62. Everlasting—Pearly Everlasting—*Antennaria margaritacea*. *Perennial*. *Stem* one to two feet high, leafy, clothed with white and cotton-like down. *Leaves* very narrow, taper-pointed. *Heads* many flowered, surrounded with numerous *pearly-white* and opaque scales. *Flowers* yellowish. *Rays* none.

This plant is very abundant in dry pastures and by the roadsides. It is collected for winter boquets, for the flowers are fadeless, or, as the name implies, everlasting. Plantain-leaved Everlasting or Mouse-ear, is a smaller species, flowering in early spring; common on sterile knolls in pastures and fields. The heads are somewhat fragrant, and have a peculiar taste, thought by some to resemble that of brown-bread.

63. Fire-weed—*Erechthites hieracifolia*. *Annual*. *Stem* one to six feet high, grooved, succulent and tender when young. *Leaves* three to eight inches long, toothed. *Heads* numerous, many flowered. *Rays* none.

This plant is almost always abundant in newly cleared districts, especially where the ground has been burned over, whence the name *fire-weed*. When bruised the plant exhales a strong and disagreeable odor.

64. Golden Ragwort—Squaw-weed—*Senecio aureus*. *Root* perennial. *Stem* one to two feet high, branched, striate. *Leaves* one to three inches long, varying in form on the different varieties; *petioles*, or leaf-stalks of the *radical leaves* one to seven inches long; *stem leaves* sessile or partly clasping. *Heads* many flowered, with yellow rays.

The Golden rag-wort is often found in abundance in low meadows. It is a worthless though probably not a troublesome weed. There are many varieties.

65. Common Thistle—*Cirsium lanceolatum*. Altogether too common to need a description. The flowers are purple in erect terminal heads which are about an inch in diameter. The plant is sometimes called *Bull Thistle*. It is an introduced plant from Europe, very

common by the roadsides and in pastures. The seeds, if allowed to mature, are disseminated far and wide by the winds. "During the first year of its growth a cut with the hoe, or a table spoonful of salt applied to the crown of the plant will destroy it." (*American Agriculturist.*) It is biennial, and produced only from seed.

66. CANADA THISTLE—CURSED T.—*Cirsium arvense. Rhizoma* or root-stalk perennial, creeping horizontally six inches to six feet below the surface of the ground, and sending up numerous erect branches. *Stem* one to three feet high, slender and smoothish, branched above. *Leaves* oblong or lancelot, prickly-margined. *Heads* much smaller than the preceding, numerous. *Flowers* rose purple.

This is no doubt the worst weed with which the farmer has to contend, and like most of our troublesome weeds, was brought from Europe. About two hundred years ago a Scotchman brought some of the seeds to Canada, and sowed them in his garden; in due time some seeds were blown by the winds to his neighbors' lands, where they took root, and now "it is a pest, decreasing the annual products, when abundant, from *twenty-five to fifty per cent.*" It delights in a rich soil, but will grow in almost any if not too wet. The following mode of eradication is taken from ol. III, page 101, of the "*Illustrated Annual Register of Rural Affairs,*" by J. J. Thomas. "*The roots cannot live unless they breathe through their lungs, the leaves.* Keep the portion of the plants above ground from growing, and the whole patch may be destroyed in a single year. This may be accomplished in several ways. Small patches may be smothered by covering with boards, closing the joints with a second layer, to prevent a single plant from finding its way through. Sawdust, tan, or straw will accomplish the same end if laid on thick enough. If a single plant, however, escapes, it will sustain life in a portion of the roots. Another way is to cut the plants off daily even with the surface of the ground, so that not a single leaf can grow. The best way for common practice is to plow them under, and continue the plowing often enough to keep them smothered. If well and deeply done, once a month will answer the purpose. This mode succeeds best on heavy or clayey soils, which do not permit the thistles to find their way readily upwards. But even on such soils, the work must be very carefully performed, for if a portion of the weeds are but partly covered, they cannot be destroyed. On gravelly and other porous soils it is more difficult to destroy them by plowing. The operation must therefore be more frequent on such soils, and greater care taken to do it deeply, and in the most thorough manner." It is a law in France, and a most excellent one it is too, that a man may sue his neighbor who neglects to destroy the thistles on his grounds at the proper season, or he may hire it done at the other's expense. It is hoped that some such law will be passed here, and rigorously enforced. We have a few other species of thistle, but none of much importance compared with the above.

67. COMMON BURDOCK—*Lappa officinalis*, var. *major*. *Root* long and thick, biennial. *Stem* two to four feet high, stout and much branched. *Leaves* of the root one to two feet long, of a triangular shape, and light green color; *stem leaves* smaller, and more or less ovate. *Involucre* scales coriaceous at the base, tipped with a spreading awl-shaped, hook-pointed appendage. *Flowers* purple.

A coarse homely weed, common in waste ground, by waysides, and among rubbish. The herbage is very bitter, and the bruised leaves are sometimes applied by nurses to the soles of the feet in hysterics. The large, so called, burs of this plant often become entangled in the wool of sheep, hair of horses and cattle, and in the clothing. The burdock is easily eradicated by cutting off the root a few inches below the surface of the ground. This should be done just before the flower buds form.

68. SUCCORY or CICHORY—*Cichorium Intybus*. *Root* perennial, long and tapering. *Stem* two to three feet high, much branched. *Radical leaves* four to ten inches long, numerous. *Heads* few-flowered. *Flowers* and *rays* bright blue or varying to purple.

A well known plant, becoming quite common in some parts of this State. It is a native of Europe, and is extensively cultivated in Belgium, Holland and Germany. It is recommended to be cultivated as a forage plant by some of our trans-Atlantic agricultural writers. But it imparts a bad taste to the milk of cows fed upon it; which of course is a great drawback to its cultivation. The dried root is often used as a substitute for coffee. True lovers of the beverage, however, will not be likely to substitute it for the genuine article.

69. HAWKBIT.-FALL DANDELION—*Leontodon autumnale*. *Perennial*. *Acaulescent*. *Leaves* more or less toothed, spreading, about six inches long. *Flower stalk* (*scape*) six to eighteen inches high, hollow, much thickened near the flowers. *Heads* yellow, about one inch in diameter, much resembling the Common Dandelion.

An introduced plant, common in many parts of the State, found by the roadsides, and in grass plots. The blossoms begin to appear in June and continue until the frosts.

70. COMMON DANDELION — *Taraxacum Dens-leonis*. Too well known to need describing. The dandelion is an indigenous peren-

nial plant, common in door yards, by the roadsides, in fields and in pastures. The root is long and tapering, full of milky juice, and quite difficult to exterminate; it is employed medicinally, and is frequently used as a substitute for, or to mix with coffee. The leaves and flower buds are used for greens; for this purpose it would be much better to cultivate the plants in the garden. The name *dandelion* is a corruption of the French name *dent de leon*, or lion's tooth. The seeds are furnished with copious hairs—the persistent pappus—which enable them to be carried to a great distance by the winds. To exterminate the dandelion it is necessary to cultivate the soil well, with three or four years rotation of crops.

71. Wild Lettuce—*Lactuca Canadensis*. *Biennial*. *Stem* two to nine feet high, thick and hollow, leafy, smooth, often purple. *Leaves* deeply cut and toothed, three to eight inches long, the upper ones narrow, entire. *Heads* very numerous. *Florets* yellow, varying to purplish.

A coarse rank weed, common in rich damp soil along the borders of fields and thickets. A thick milky juice exudes from the stem when broken. It is often known by the name of Milk-weed. For its extermination, allow none of it to go to seed.

72. Common Sow-Thistle—*Sonchus oleraceus*. *Annual*. *Stem* one to three feet high, hollow, tender. *Leaves* three to eight inches long—lower ones deeply cut with spiny teeth, on short stalks—upper ones clasping the stem. *Involucre* dilated at base. *Flowers* yellow.

This introduced plant is quite common in some sections, growing in gardens, waste grounds, and among rubbish. The juice is milky and bitter. In England the leaves are often eaten with other culinary herbs; and the roots have sometimes been made into bread.

Order 19. LOBELIADS—Lobeliaceæ. A small family of about three hundred and seventy-five species, which are all more or less poisonous. The Cardinal-flower (*Lobelia cardinalis*) is one of the most beautiful native plants.

73. Indian Tobacco—Eye Bright—Puke-weed—*Lobelia inflata*. *Annual*. *Stem* ten to eighteen inches high, much branched, clothed with spreading hairs, and very tough. *Leaves* one to three inches long, ovate or oblong in form. *Flowers* rather inconspicuous, pale blue. *Pod* much inflated.

A native plant, common in fields, and woods, and by the roadsides. The plant is acrid and poisonous, but is used by so called "botanical doctors." When employed in medicine it should be used with great caution. It has been surmised by some persons that this plant caused the ptyalism or "*slabbering*" of horses. This supposition, however, is doubted by good authority, for the horse is remarkable for the care and skill with which it selects its food.

ORDER 20. PLANTAINS—PLANTAGINACEÆ. Mostly acaulescent herbs, with no important properties.

74. COMMON PLANTAIN—WAY-BREAD—RIBWORT—*Plantago Major.* *Perennial.* *Stem* none. *Leaves* three to eight inches long, strongly nerved or ribbed smooth. *Scape* one to two feet high. *Flowers* in a long slender spike, greenish white.

This naturalized foreigner abounds wherever civilized man has settled, growing along his footpaths and around his dwellings. It is also very apt to spread and become very troublesome in grass fields. Vast numbers of the seeds are devoured by small birds. The bruised leaves are much used for dressing sores and blisters, like that produced by *poison ivy. Plantago lanceolata,* rib-grass, has long narrow leaves, and is quite common in grass fields and pastures. This species is frequently allowed to grow and even encouraged as a forage plant; but this is by no means profitable. They may both be eradicated by cutting off the root beneath the surface, or by a rotation of crops.

ORDER 21. FIGWORTS — SCROFULARIACEÆ. A large family, numbering about 1800 species, very generally distributed throughout the world, "from the equator to the regions of perpetual frost." The snap dragon, musk plant, and fox-glove, with many others, are cultivated in gardens. We have three species noticeable as weeds.

75. COMMON MULLEIN—*Verbascum Thapsus.* A well-known plant with a stout, woolly stem, and yellow flowers, in a long dense spike. The plant is annual, and spreads only by seed. It is often very abundant in dry pastures and by the roadside. It is sometimes seen in the grass fields of careless farmers. It can only be kept in subjection by a careful eradication while young. "If neglected, the soil becomes so full of seeds that the young plants will be found springing up in great numbers, for a long succession of years."—*Darlington.*

76. TOAD FLAX—BUTTER-AND-EGGS—RAMSTED—*Linaria vulgaris.* *Perennial* *Stem* one to three feet high, very leafy, with numerous short branches. *Flowers* in a dense raceme, yellow, with the palate of the lower lip bright orange color, furnished with a long tail or spur.

A showy but pernicious plant, originally from Europe, common in old fields and by the wayside, escaped from cultivation. Cattle, it is said, will not eat it nor the grass it grows with. The woody roots creep extensively, and are very tenacious of life, thus making it very difficult to eradicate. For exterminating it, J. J. Thomas recommends repeated plowing and harrowing. Todd says: "Never let a plant go to seed. Mow it in pastures and meadows, and plant Indian corn one year, and sow buckwheat the next. This will destroy it."

TOAD FLAX.

77. LOUSEWORT—WOOD BETONY—*Pedicularis canadensis. Perennial. Stem* one foot high, clustered around the root. *Leaves* three to six inches long, mostly radical. *Flowers* greenish yellow and purplish, arranged in a short, dense spike. *Pods* flat, somewhat sword-shaped.

This plant we noticed very common in neglected sandy fields and pastures in Waterville, and it is probably found in similar situations throughout the State. The plant may be readily recognized by its dark reddish brown or purple color, especially when young. The blossoms appear from May to July. Easily eradicated by thorough cultivation.

ORDER 22. MINTS—LABIATÆ. Mostly *herbs* with square *stems*, and two-lipped flowers (corollas). It numbers about 2350 species, chiefly natives of the temperate regions. "Not one species is poisonous, or even suspicious. Many are cultivated for ornament; and a large number are well known for their medicinal properties, as the *Horsemint, Peppermint, Pennyroyal, Lavender, Sage, Catmint*, and *Horehound.*

78. WATER HOREHOUND—BUGLE-WEED—*Lycopus Virginicus. Perennial. Stem* six to eighteen inches high, obtusely four angled, sides concave. *Leaves* narrowly oblong, toothed and short stalked. *Flowers* minute, in small capitate clusters.

An extremely bitter plant, common in moist shady places, and in ditches. A variety of Lycopus Europæus is also abundant in moist soil.

79. AMERICAN PENNYROYAL—*Hedeoma pulegioides. Annual. Stem* about six inches high, much branched. *Leaves* oblong-ovate, opposite, on short petioles. *Flowers* very small, bluish.

A well known fragrant herb, native in barren fields and pastures. Its prevalence in grass lands is a pretty sure indication of a poor soil or neglected agriculture or both.

80. CATMINT OR CATNIP—*Nepeta cataria.* A partially naturalized plant from Europe, much branched, and clothed with a whitish down. The flowers are nearly white and dotted with purple; they are arranged in spiked clusters, around the stalks at certain distances. From the fact that cats are exceedingly fond of rolling on this plant, and chew it with seeming avidity, it has received the name *Cat*-mint or nip. It is considered a somewhat troublesome weed, and is found common about farm buildings, especially in old settlements. Another species (*Nepeta Glechoma*), commonly called Ground Ivy or Gill-over-the-ground, has procumbent stems, and kidney-shaped leaves. The flowers are light blue or bluish purple, generally three together in the axils of the leaves. The ground ivy makes a very pretty hanging plant. It is quite common in damp waste grounds near dwellings.

81. COMMON SELF-HEAL OR HEAL-ALL—*Brunella vulgaris. Perennial. Stem* six inches to two feet high. *Leaves* one to three inches long. *Flowers* violet purple (rarely white), arranged in a short dense spike, at the top of the stem.

A native plant, which can hardly be ranked with the troublesome weeds, yet from its abundance in fields and pastures we thought best to call attention to it. In ancient times it had the reputation of healing wounds, whence its common name.

82. HEMP-NETTLE—*Galeopsis tetrahit. Annual. Stem* one to three feet high, much swollen just below the joints, bristly-hairy. *Leaves* ovate, hairy on both sides. *Flowers* purple or variegated, in dense whorls in the axils of the floral leaves.

A very common and troublesome weed in waste and cultivated grounds. The teeth of the calyx are tipped stiff and sharp spines, which make the plant a very disagreeable thing to handle, particularly after it has become dry, for these spines are numerous and almost as bad as those of the Canada Thistle. It is best destroyed by allowing none to go to seed.

83. MOTHERWORT—*Leonurus Cardiaca. Perennial. Stem* three to five feet high, square with concave sides, much branched. *Leaves* palmate-lobed; upper leaves narrow and three-cleft. *Flowers* hairy, purplish, in close whorls in the axils of the leaves.

"A native of Tartary, whence it was first introduced into Europe and thence to America, ever following the footsteps of civilized man."—(*Wood.*) It abounds in cultivated grounds and waste places. The calyx teeth, like those of the Hemp Nettle, are tipped with sharp spines. "It is an utterly worthless weed—unsightly and disagreeable—and speedily gives a forlorn appearance to the premises of the slothful and slovenly farmer."— (*Darlington.*) The Motherwort is well known in domestic medicine.

ORDER 23. BINDWEEDS — CONVOLVULACEÆ. Chiefly herbs, with trailing or twining stems, numerous species parasitic. The well known *sweet potato*, a native of the South, belongs here. Many species are cultivated for ornament.

84. RUTLAND BEAUTY—HEDGE BINDWEED—MORNING GLORY—*Calystegia sepium. Perennial. Stem* twining six to twelve feet high. *Leaves* two to four inches long, triangular, halberd-shaped. *Flowers* large, two inches long, white, or generally tinged with flesh or rose color.

A rank twining plant, often introduced into yards and gardens for its beauty; but soon it becomes a most detestable weed, quite as troublesome, and as difficult to eradicate as *twitch grass* or *couch grass*, (*Triticum repens.*) It is a native of this State, and is frequently found along the moist banks of streams and on low grounds. The white and somewhat fleshy roots creep extensively like those of twitch-grass. Farmers should try every means to destroy this plant, as it is very injurious to crops. A method of eradication similar to that recommended for the extermination of *Cirsium arvense* (Canada thistle, on page 263.)

85. FLAX DODDER—*Cuscuta Epilinum. Annual. Stem* thread-like, reddish orange colored. *Leaves*, none. *Flowers* yellowish white, in small, dense clusters.

We are not aware that this curious plant is troublesome, or even found in this State; we will make a few observations, however, in regard to its habits, so that any one finding the plant may be able to recognize it. It is a parasite on flax, and does much injury to that crop in Europe. It is said to be sparingly introduced with flax seed into the Northern United States. *Devil's guts* and *hell weed* are common names for this rascally plant, and are also applied to the next.

86. THE AMERICAN CUSCUTA, DODDER, OR LOVE-WEED—*Cuscuta Gronovii*—is found abundantly in many parts of the State, on low grounds, especially in shady places, and is parasitic chiefly on the coarser herbs and small shrubs. The seeds of the dodder take root in the soil, and soon the young plants are tall enough to seize the stem of some fated golden-rod, around which it quickly coils. At all places of contact with other plants the dodder sends out short sucker-like roots, which penetrate the bark of the doomed plant, and absorb the needed food. When a few turns have been made around one plant, the dodder reaches out for another and another, until it appears like a tangled mass of brass or copper wire. We have seen patches of this plant several

yards in extent. As the roots soon become useless they wither away.

ORDER 24. NIGHTSHADES—SOLANACEÆ. "An order comprising plants with widely different properties; sometimes the foliage and fruit are highly poisonous, while on the other hand it affords some of our most valuable esculents" (*Darlington*), as the potato and tomato.

87. COMMON NIGHTSHADE—*Solanum nigrum*. *Annual*. *Stem* one to two feet high, branched. *Leaves* ovate, two to three inches long, the margin cut as if gnawed by insects. *Flowers* white. *Berries* globose, black.

Not uncommon about rubbish, in old fields, and in waste places. It is a homely weed, and said to be poisonous. It should be carefully eradicated. BITTERSWEET—*Solanum Dulcamara*. A well known species, found on moist banks and about dwellings. The stem is shrubby. Plant perennial. Flowers blue. Berries red, said to be poisonous.

ORDER 25. GENTIANWORTS—GENTIANACEÆ. A family presenting many beautiful species. A bitter-tonic principle pervades the whole order.

88. BLUE FRINGED GENTIAN—*Gentiana crinita*. *Annual ?* *Stem* six to sixteen inches high, smooth. *Leaves* one to two inches long, broadest at base. *Flowers* bright bluish-purple, the segments finely fringed around the margin.

A truly beautiful and interesting plant, yet growing in such abundance when it has once got foothold that it may be considered a most pernicious weed. It delights in cool, low grounds, and, in such situations, we have seen fields fairly blue with its blossoms. The flowers appear in August and September. The seeds are frequently introduced in clover and grass-seed. The plant should be carefully eradicated upon its first appearance, before any seeds have matured. This may be accomplished on a small scale by hand-pulling, during the month of August.

ORDER 26. DOG-BANES—APOCYNACEÆ. The Oleander and Periwinkle represent this order in our gardens. The juice is milky and often exceedingly poisonous. One of the most violent poisons is extracted from the seeds of *Strychnos Nux vomica* of India,—the Strychnine of commerce.

89. SPREADING DOGBANE—INDIAN HEMP—*Apocynum androsæmifolium*. *Perennial*. *Stems* smooth, branched above, reddened by the sun, about three feet high. *Leaves* two

to three inches long, opposite ovate. *Flowers* pale rose-color, open bell-shaped, very numerous.

A common native plant, growing along the borders of fields and thickets. The juice is thick and pure white. This plant, as expressed in the common name, spreads very rapidly when not checked. It should be vigilently watched, and thoroughly extirpated if possible. Both the species above described, and *A. cannabinum*—a plant growing along the banks of rivers and lakes—are well known in medicine.

ORDER 27. MILKWEEDS—ASCLEPIDACEÆ. Chiefly a tropical family, of about nine hundred and ten species, noticeable for their singular flowers. Many species are useful in medicine. The milky juice has a bitter acrid taste, and contains caoutchouc. The fibre of the inner bark is long, fine, and very strong.

90. COMMON MILKWEED—SILKWEED—WILD COTTON—*Asclepias Cornuti*. *Roots* much branched, perennial, long and fleshy. *Stem* two to three feet high, stout, leafy. *Leaves* four to eight inches long, and two to three inches wide, oval, on short stalks. *Flowers* greenish purple, in large globular umbels four to five inches in diameter. *Pods* large (three to five inches long), opening by a longitudinal slit. *Seeds* flat, furnished with a long tuft of silky hairs.

A native plant, often plentiful, and exceedingly troublesome. When the stems are cut or broken an abundance of thick milky juice exudes from the wound, whence the common name of *Milkweed*. The plant is often called *silk-weed*, on account of the copious hairs attached to the seeds. By means of these hairs the seeds are wafted by the winds to a great distance. Owing to the deep running roots, which are very tenacious of life, the milkweed is quite as difficult to extirpate as the Canada Thistle. To effect its thorough destruction, pull or cut up every plant as soon as it appears above ground, thus allowing it no chance to breathe through its lungs, the leaves. (See page 263.)

DIVISION III. PLANTS DESTITUTE OF PETALS OR COROLLA—*Apetalous Exogens.*

ORDER 28. POKEWORTS—PHYTOLACCACEÆ. A small order of twenty genera, pretty generally distributed throughout the world. Their properties are either purgative or emetic.

91. COMMON POKE or SCOKE—GARGET—PIGEON BERRY—*Phytolacca decandra*. *Root* very large, perennial. *Stem* smooth, four to eight feet high, filled with a large pith, deep purple when mature. *Leaves* about five inches long, oval. *Flowers* greenish white,

in clusters or racemes which are from three to six inches long and borne opposite the leaves. *Berry* dark purple, almost black, flattened, ten-seeded, filled with an abundant rich purple juice

In low situations, along the borders of fields and clearings, this native plant frequently becomes troublesome. It has become naturalized in Europe, thus making a small return for the many weeds which that country has sent us. The root of the pokeweed is highly medicinal. The young and tender shoots are often used as a substitute for asparagus. The pith is peculiar for being divided into horizontal layers, which are easily separated after the stem has been killed by the frost. The pokeweed is readily destroyed by cutting the root just below the surface of the ground with a stiff hoe.

ORDER 29. CHENOPODS—CHENOPODIACEÆ. "Mostly inert or innocent, weedy plants; several are pot-herbs, such as spinach and beet."—(*Gray.*) Soda is obtained from the common saltwort (*Salsola,*) and saltwort or samphire (*Salicornia,*) maritime plants.

92. PIGWEED—*Chenepodium album*. *Annual*. *Stem* three to five feet high, angular or grooved. *Leaves* one to two inches long, whitish-mealy, especially on the under side. *Flowers* mealy, in dense clusters.

A well known weed, plentiful in gardens and cultivated grounds. It is known in some localities as *white goose-foot* and *lamb's quarters*. Sheep and cattle will eat it, and hogs devour it greedily. In some parts of England it is said to be used as a pot-herb. We would not, however, recommend that it be cultivated for such a purpose, or even permitted to grow of its own accord. The rapidity with which this weed would multiply under favorable circumstances is astonishing. The following is in the American Agriculturist for May, 1861: "A single pigweed (*Chenopodium album*), if left undisturbed, will ripen more than ten thousand seeds, each capable of producing a successor. * * * This is not mere guess work, for pains-taking investigators have actually counted and calculated the increase. A single pull at the commencement of the season will destroy the whole progeny." We see that by the above rate of multiplication—10,000 seeds to a plant—we should have for the fourth years' crop, 10,000,000,000,000,000 seeds, which might the fifth year produce plants enough to cover a little more than 18,365,472,910 acres, allowing 100 plants to a square foot!

"Now rid your fields of one year's seeding
And save the toil of seven years' weeding."

Some weeds are much more productive than the Pigweed. The extirpation of the Pigweed is easily effected, when the plants are small, by simply cleaning the ground of them with a hoe or cultivator.

ORDER 30. AMARANTHS—AMARANTHACEÆ. "Genera 46, species 480, most abundant within the tropics. The properties are not important. A few are cultivated for their richly-colored imperishable flowers; others are mere weeds."—(*Wood.*)

93. GREEN AMARANTH.–PIGWEED—*Amaranthus retroflexus*. *Annual*. *Stem* two to four feet high, branched. *Leaves* two to five inches long, ovate or rhombic-ovate. *Flowers* green, small, in close clusters in a stiff panicle. *Bracts* awned.

Equally prevalent with the *Chenopodium album*, and should be destroyed in a similar manner.

ORDER 31. SORRELWORTS—POLYGONACEÆ. According to Meisner, this order contains 690 species. They are chiefly natives of the northern temperate zone. The juice is watery; acrid or rubefacient in the Smartweed, Water-pepper, Knotweed, &c.; agreeably acid in the Sorrel (*Rumex*), and Rhubarb. The seeds of the Buckwheat furnish a nutritious flour.

94. LADY'S THUMB.–SPOTTED KNOTWEED.–SMARTWEED—*Polygonum Persicaria*. *Annual*. *Stem* one to two feet high, smooth, branched, often purplish. *Leaves* two to four inches long, lanceolate, usually marked with a dark triangular or lunar spot near the middle. *Flowers* generally rose colored, in a dense spike one to two inches long.

A very common and troublesome weed, naturalized from Europe, growing in waste and cultivated grounds, about buildings, fences, &c. The *P. Pennsylvanicum* much resembles the Spotted Knotweed, but may be distinguished by its larger growth and unspotted leaves. Both species are worthless weeds, and should be carefully eradicated. POLYGONUM HYDROPIPER.–WATER PEPPER.–SMARTWEED, may be known from the two preceding by its minutely pellucid punctate leaves, and slender, nodding, loosely-flowered spikes. It generally inhabits moist grounds and ditches, but is frequently found with the preceding. Like the *P. Pennsylvanicum*, it is indigenous. The juice is extremely acrid, "sometimes causing obstinate ulcerative inflammation when incautiously applied to the skin."—(*Darlington.*)

95. GOOSE-GRASS—DOOR-WEED—KNOT-GRASS—*Polygonum aviculare*. *Root* annual, long and fibrous, very tough. *Stem* spreading in every direction, generally prostrate, much branched, leafy. *Leaves* alternate, one half an inch to an inch and a half long,

lanceolate or oblong. *Flowers* small, two or three together in the axils of the leaves, white.

The most common weed in door-yards and along foot-paths; frequently abundant in cultivated fields. The seeds are acutely three-angled, black, and are much eaten by small birds, whence it is sometimes called bird's knot-grass. As a domestic medicine, it has been strongly recommended for diarrhœa. A variety,—var. *erectum,*—is abundant in rich, shady places.

96. Arrow-leaved Tear-Thumb—Scratch-grass—*Polygonum sagittatum. Annual. Stem* two to four feet long, slender, four-angled, angles very rough, with fine and exceedingly sharp, saw-toothed prickles. *Leaves* one to three inches long, half an inch to an inch wide, arrow-shaped. *Flowers* in small terminal clusters, whitish.

A native species common in wet grounds and ditches, about buildings, &c. The prickles on the angles of the stem will cut the hand if drawn against it.

97. Black Bindweed—Knot Bindweed—*Polygonum Convolvulus. Annual. Stem* twining or procumbent, two to three feet long. *Leaves* one to two inches long, halberd-heart-shaped. *Flowers* whitish.

A naturalized species from Europe, common in grain fields, climbing around whatever it can lay hold of, doing much damage to the crops. In gardens it is exceedingly troublesome and quite difficult to destroy. Do not let any plants go to seed and it will soon become scarce.

98. Buckwheat—*Fagopyrum esculentum.* This useful plant often becomes a troublesome weed, about places where it has been formerly cultivated. It is an annual, and should have the same treatment as Black Bindweed.

99. Curled Dock—*Rumex crispus. Root* spindle-shaped, yellow, long, perennial. *Stem* two to four feet high. *Leaves* lanceolate, wavy-curled margin, eight to fifteen inches long. *Flowers* green.

Too common a weed in cultivated and waste grounds, naturalized, from Europe. Other common names, than the one given above, for this plant are, *Yellow Dock, Sour Dock, Narrow Dock.* It is highly esteemed as a domestic remedy for cutaneous diseases. Rumex obtusifolius—*Bitter Dock,* is another introduced species, common with the preceding, more worthless, but not so prevalent. Rumex sanguineus—Bloody-veined Dock, is also a foreigner. It grows in cultivated and waste grounds, though less common than either of the above species. It is readily distinguished by its *red-veined* leaves.

100. Sheep Sorrel—Field Sorrel—*Rumex Acetosella.* *Roots* perennial. *Stem* six to twelve inches high, slender, branching. *Leaves* one to two inches long, acid. *Flowers* small, numerous, reddish or brownish.

A despicable little foreigner, which may almost be classed with *Canada thistles* or *witch grass* for troublesomeness, and is quite as difficult to eradicate. We have seen this weed so abundant in certain fields as to present an unbroken appearance of brownish-red when in blossom. To keep one's land free from this most contemptible plant, the introduction of the seed should be scrupulously guarded against. Under the present perfection of seed-separators, one can have but small excuse for sowing foul seed, no matter what it is. A machine has been constructed by S. Adams, Esq., which will separate *twelve* different kinds of seeds at once. If the sorrel has taken full possession of the field, the best and only way to make *sure* work is to thoroughly cultivate the ground, applying barn-yard or stable manure freely. Sorrel and three tons of hay can not grow on the same acre; and where wheat yields thirty bushels to the acre sorrel is a rare plant. There is no greater fallacy than that which teaches that where sorrel is abundant the land is sour and needs an alkali to neutralize the acid. Because the leaves of the sorrel are sour, we are not to suppose that the soil upon which it grew is sour also, any more than to believe that the soil upon which crab-apples are grown must be sour. Very sweet and exceedingly sour apples are not unfrequently found on the same tree. The acidity which we find in certain plants is not drawn directly from the soil, but is a vegetable product. Sorrel will grow upon a limey soil as well as upon any other, The only effect which the application of lime has to eradicate sorrel is in its promoting the growth of other plants which tend to choke it out. The prevalence of this plant is a strong indication of a light or impoverished soil, and its extirpation can only be effected by high cultivation or rotation of crops.

Order 32. SPURGEWORTS—Euphorbiaceæ. A large (2,500 species, *Lindley*) and interesting order, affording many valuable species. From the roots of the Mandioc (*Janipha Manihot*) is obtained a starch which affords the tapioca of commerce. Croton oil is procured from the seeds of *Croton Tiglium*, an Indian plant. The *Siphonia elastica* yields the true caoutchouc or gum elastic. Boxwood, so invaluable to the engraver, is afforded by *Buxus sempervireus.* From the *Crozophora tinctoria* we have the beautiful purple dye known as turnsole. Nearly all the species have an acrid milky juice.

101. PETTY SPURGE—*Euphorbia Peplus. Annual. Stem* erect or ascending, five to twelve inches high, becoming greatly branched. *Leaves* ovate, tapering towards the short petioles, thin. *Flowers* greenish. *Seeds* curiously sculptured with two longitudinal grooves on the inner face, and four rows of little pits around the back, less than a twelfth of an inch long.

We fain would omit this pretty little plant from our general denouncement of weeds, but our conscience will not permit us. We must include it among the "devoted to destruction." We are unacquainted with this leafless plant outside of our own flower garden, where, a few years ago, it was introduced with some seeds, and we permitted it to grow for a season on account of its beauty—it has a truly elegant shade of green on its profuse foliage—and its pleasing effect in boquets. We soon found, however, that we were entertaining a very impertinent fellow—we had given it an inch and it began to take an ell, in a most wholesale manner, for some of our beds were completely covered by this saucy little intruder. It is a native of Europe, and is said to be almost "rare" in this country, and it is hoped that it will long remain so. We nearly eradicated it by pulling the plants before they had ripened their seeds.

102. CYPRESS SPURGE—*Euphorbia Cyparissias. Perennial* with extensively creeping root-stalks. *Stem* smooth, much branched, very leafy, six to twelve inches high. *Leaves* one-half to three-quarters of an inch long, one-twelfth of an inch wide, crowded. *Flowers* yellowish green, becoming reddish.

This, like the preceding, is an introduced species from Europe. As yet it is not common. It spreads rapidly by its running root-stalks, and should, therefore, be regarded with suspicion. It has the character of a pernicious weed. As it delights in a dry sterile soil it can, probably, be destroyed by high cultivation.

ORDER 33. NETTLEWORTS — URTICACEÆ. A large order, mostly tropical, comprising the elm, the plane tree, nettles, hops, hemp, and the fig tree.

103. STINGING NETTLE—*Urtica dioica. Root* perennial. *Stem* two to three feet high, obtusely four-angled, clothed with stinging hairs. *Leaves* ovate, heart-shaped, two to five inches long, on short stalks. *Flowers* small, green, in branching axillary clusters.

It was a saying of that quaint old herbalist, Culpepper, that "nettles might be found by *feeling* on the darkest night." There are not a few who can testify to the truth of his remark. Nothing gives one's premises a more slovenly appearance than the prevalence of nettles. Tall Nettle or Slender Nettle—*Urtica gracilis*—is, like the preceding, common in waste places, along fence rows, and by the roadside. The stem grows from three to seven feet high, four-sided, and slightly hispid with a few stinging hairs. Leaves four to ten inches long, lanceolate sharply toothed along the margin. Flowers green, in axillary branched panicles.

Richweed or Clearweed—*Pilea pumila*—is a low species with a shining succulent stem, three to eighteen inches high, destitute of stings; leaves smooth, on long stalks; flowers green, in short clusters. A native weed, abundant in moist waste places, where it is cool and shady.

Class II. INSIDE GROWERS—Endogens.

Order 34. AROIDS—Araceæ. A small family of about 240 species, mostly tropical. "An acrid volatile principle pervades the whole order, which is, in some instances, so concentrated as to become poisonous. The corms and rhizomas abound in starch, which in some cases, when the volatile acridity is expelled in drying or cooking, is edible and nutritious, as in Colocasia, and the like."—(*Wood.*)

104 Skunk Cabbage—*Symplocarpus fœtidus.* *Root* perennial, with fleshy fibres from a thick truncate rhizoma. *Acaulescent.* *Leaves* appearing after flowering, at first roundish, becoming ovate and very large—often two feet long, and a foot wide *Flowers* in a compact orbicular head, enclosed in a little hood or spadix.

This native plant, found quite abundant in wet meadows and low grounds, is quickly known by the strong skunk-like odor, which it emits when bruised.

105. Sweet Flag—Calamus—*Acorus calamus.* *Root* (rhizoma) perennial, thick and spongy, very aromatic, as well as the rest of the plant. *Leaves* two to three feet high, narrow, sword-shaped. *Flowers* in a sort of fleshy spike which issues from the side of a leaflike scape, presenting a very curious appearance.

The Sweet Flag—well known by its aromatic and pungent rootstalk—frequently becomes quite troublesome, as it spreads extensively. Thorough under-draining, and seeding with red-top or herds-grass, will extirpate it.

Order 35. TYPHADS—Typhaceæ. A small and unimportant order, of about thirteen species.

106. Common Cat-tail or Reed-mace—*Typha latifolia.* Well known to every one. Common along the muddy borders of ponds, and on

marshes. We also remember to have seen it growing in abundance in "Mr. Slack's" meadow, where proper under-draining would have destroyed it, and put the land in good condition for valuable grass crops.

ORDER 36. IRIDS—IRIDACEÆ. This order affords several garden plants, as the Iris, Tiger-flower, Paradanthus, Crocus and Gladiolus. We have two species which may be classed as weeds.

107. COMMON BLUE FLAG—*Iris versicolor*. A well known plant, growing, generally, in wet grounds; with sword-shaped leaves; and blue or purple flowers. We have observed this weed growing in abundance in dry upland pastures. Near Waterville there is a small marsh completely covered with Blue Flags, so that when they are in blossom it presents an unbroken surface of blue. When troublesome on wet lands we would recommend draining and thorough cultivation.

108. BLUE-EYED GRASS—*Sisyrinchium Bermudiana*. This is a little harmless weed, having a grass-like appearance, with small bright blue flowers. Its stems are from six to twelve inches high. It is quite common in grass lands, especially in yards about houses.

ORDER 37. LILYWORTS—LILIACEÆ. Among the useful plants of this large order, we will mention the Asparagus, the Onion and the Garlic; among those cultivated for ornament, the Tulip, the Lily, the Solomon's Seal, and the Hyacinth.

109. INDIAN POKE—AMERICAN WHITE HELLEBORE—*Veratrum viride*. *Roots* perennial, fibrous, very poisonous. *Stem* two to four feet high, stout and leafy. *Leaves* broadly oval, *lower ones* about twelve inches long and half as wide, strongly veined, and plaited. *Flowers* yellowish green, numerous, in dense spike-like racemes forming a pyramidal panicle.

This coarse looking weed is common on low grounds and in swamps. We have noticed in meadow hay from Hebron a great abundance of this vile plant. It is utterly worthless for fodder, and should be carefully exterminated. It should be treated in the same manner as Common Blue Flag. (See number 107.)

110. WILD YELLOW LILY — *Lilium Canadense*. This plant, though beautiful when in flower, and well worth garden culture, deserves to be classed as a weed from its frequency in moist meadows. If abundant it greatly injures the sale and quality of the hay with which it is cut. LILIUM PHILADELPHICUM—*Wild orange-*

red lily—is plentiful on dry sandy soil, especially in the vicinity of water.

ORDER 38. RUSHES—JUNCACEÆ. Sedge-like in appearance, neither possessing beauty or value; growing chiefly in wet places.

111. SOFT RUSH—BULLRUSH—*Juncus effusus*. *Perennial*. *Scapes*, or culms, two to three feet high, soft and pliable. *Flowers* small, green, in a loose spreading panicle, which protrudes from a fissure opening in the side of the culm about half way up.

A very common species in ditches and wet meadows. Its prevalence in the latter situation is a sure indication that the land needs draining.

112. TOAD RUSH—*Juncus bufonius*. *Annual*. *Stem* low and slender (three to nine inches high) tufted. *Flowers* greenish. *Pods* oblong obtuse.

This is a most rascally little weed, growing by the roadside and in hard worn paths, seeming to thrive best when most trodden upon. A friend of ours, who is noted for his neatness, and whose garden is a perfect model, as far as the entire absence of all weeds is concerned, remarked that the Toad Rush was the most troublesome weed he had to contend with, as it was the most difficult to eradicate. It would grow in spite of all his efforts to keep it down. A species much resembling the Toad Rush is the Juncus tennis—slender rush—and it abounds in similar situations. It has tough wiry stems, nine to eighteen inches high.

ORDER 39. SEDGES—CYPERACEÆ. The sedges are grass-like, or rush-like herbs, with fibrous roots and solid stems (not jointed as in the grasses.) *Leaves* grass-like, with closed sheaths. *Flowers* green, rarely white or yellow, each in the axil of a little *glume* (or *bract*,) forming spikes.

This family numbers about 120 genera, and 2,000 species, distributed generally throughout the world, growing principally in moist meadows, marshes and swamps. Few species rank higher than worthless weeds; all are destitute of the rich nutritive qualities which so characterize the grasses, and make them so valuable to the agriculturist; and none are worthy of cultivation. According to Prof. G. L. Goodale, there are nine genera and about 120 species of this family found in Maine. Among the most obnoxious species inhabiting meadows we might mention Diandrous Sedge, Bullrush—*Scirpus pungens*—Cotton Grass, and the like. Of the genus Carex, which affords to Maine over eighty-five species, the most noticeable ones are, first, the Fox Sedge, often very abundant in wet meadows; the stems are about two feet high; the ovate oblong spikes are about three inches in length. Second, the long-pointed sedge (*Carex tantaculata,*) common in low wet meadows and swamps. It grows to the height of from twelve to eighteen inches; whole plant somewhat yellowish; spikes usually three in number, oblong-cylindrical, about two inches long and a half an inch in diameter. Third, Tussock sedge, the most troublesome and most common of all. Darlington, in speaking of this sedge, says: "It is true that a pedestrian, in crossing neglected boggy meadows, finds its dense tufts quite a convenience to step on, yet it is decidedly more farmer-like to provide good walking in such places by ditching and draining. The tussocks formed by the matted fibrous roots of this species of Carex, are often very large and very durable. I once hauled a quantity of them into the barnyard, with a hope that they might decompose and make manure; but they effectually resisted decomposition, and were tossed about the yard for years, as large, and almost as indestructible, as so many hatters' blocks. The best way to dispose of them, is to collect them, when cut out and dried, into a heap, and burn them, taking care afterwards, by appropriate draining, to prevent the growth of others." The prevalence of sedges in meadows is a pretty sure indication that the land is insufficiently drained, or that its agriculture has been sadly neglected.

ORDER 40. GRASSES—GRAMINEÆ.

Roots annual or perennial, fibrous. *Stems* hollow, round and jointed, joints closed. *Leaves* alternate with split sheaths. *Flowers* held in two-rowed bracts or glumes, the inner bracts are called palets, arranged in spikes or panicles.

This vast order comprises about 230 genera and 3000 species, distributed throughout the whole world. It is by far the most important family in the vegetable kingdom both to man and beast, for their nutriment is largely drawn from it—from the herbage as well as the seeds. From the Sugar Cane we obtain the most of our sugar. Rye, Oats, Barley, Wheat, Corn and the like supply us with flour and meal. Rice is grown in the the warmer climates, where it is almost the sole food of whole races of men. Among the most important grasses cultivated for fodder are the Timothy or Herds-grass, Bent-grass, Red-top, Orchard-grass, Goose-grass, June-grass and Meadow Foxtail. Besides the many valuable plants which this order affords to man, there are several species which are worthless weeds, and one which is thought by some persons to be the most pernicious of all weeds—this is the Couch-grass, (*Triticum repens*).

113. CHEAT or CHESS—*Bromus secalinus*. *Annual*. *Stem* or culm smooth, two to four feet high. *Leaves* rather narrow, six to twelve inches long, rough. *Flowers* in a spreading, drooping panicle.

A partly naturalized weed from Europe, too common in grain fields—wheat especially—and in waste places. That Chess is degenerate wheat is a vulgar error, and we presume that there are few who entertain such an idea in the present state of knowledge. Wheat belongs to an entirely different genus from that of chess. It would be much more reasonable to consider Twitch or Witch-grass degenerate wheat, for they are very nearly related, belonging to the same genus. Several years ago, when Cheat was first introduced from Europe, it was known as Willard's Chess, and fabulous prices were offered for the seed, but it was not long before the true character of the plant was found out and the people became aware that they had been doubly "*cheated*," for the grass was both too meagre in quantity and too poor in quality for cultivation, and they had been encouraging the growth of a troublesome weed.

To exterminate Cheat, simply sow clean seed, and keep the waste grounds clear of the plant. The seed of Cheat is much smaller than that of wheat, from which it is readily separated by the modern fan-mills, of which Nutting's is said to be the best.

114. COUCH GRASS—QUITCH GRASS—QUACK GRASS—QUICK GRASS—TWITCH GRASS—WITCH GRASS—DOG GRASS—CHANDLER GRASS—*Triticum repens*. *Perennial*. *Culm* two to five feet high. *Leaves* three to six, flat, lance-linear. *Flowers* in spikes, as seen in the accompanying cut.

"This is the most catholic of all grasses in its tastes and habits, in so much that scarcely a garden or field, pasture or roadside, be the soil what it may, which is not occupied by it to a greater or less extent; and if permitted, its long creeping roots—or more properly, *rhizomes* (under ground stems)—pushing in every direction, will soon have full possession, and monopolize all the plant food within its reach."—(*Goodale.*)

Besides the long list of names above given for this grass, are Quake Grass and Squitch Grass. As Couch Grass is the name most generally used, we will adopt it in preference to all the others, which are merely local. The leaves of the Couch Grass, and those of one other species, are eaten by dogs for their medicinal qualities in exciting vomiting. This plant is considered by good farmers, a most troublesome and obstinate weed, in comparison with which, all others pass into insignificance. There are

COUCH GRASS.

a few exceptions to this statement, however; for some men have said that they would use every means in their power to introduce it upon their farms if they were without it.

For hay, Couch Grass is much inferior to most other grasses, as it stands thin, exhausts the soil, and "binds out" all other plants. Corn may be grown with tolerable success on land infested with this weed, but potatoes grown on it are generally a failure.

Many methods of destroying this pest have been proposed. We select the following from the "Illustrated Annual Register of Rural Affairs," Vol. III: "The best mode of eradication, is to select a time when the weather and soil are in the driest state, and plow, harrow and rake the roots into heaps, with a spring-toothed or other horse-rake, and when dry burn them. Repeat the operation till all are extirpated. Or the roots may be fermented and killed in layers, with manure, forming compost. As every fragment of the roots will vegetate in moist soil, harrowing will only extend the evil in such soils. E. Marks, of Onondaga Co., N. Y., states in a former number of The Cultivator, that he destroyed this grass in one season by *smothering*—plowing it under seven times during the season, each successive plowing being a little deeper until ten inches was attained."

115. OLD WITCH GRASS—*Panicum capillare. Annual. Culm* upright, often branched from the base, and forming a tuft. *Leaves* and their sheaths very hairy. *Flowers* in a large pyramidal, hairy compound, and very loose panicle, often purple.

A very common grass in dry gravelly fields and waste places—frequently abundant in corn fields. It appears during the latter part of summer. "In autumn the dry culms break off and the light divaricate panicles are rolled over the fields, by the winds, until they accumulate in great quantities along the fences and hedges." (*Darlington.*)

116. BARN-YARD GRASS—*Panicum Crus-galli. Annual. Culms* two to five feet high, rather coarse, smooth. *Leaves* nine to fifteen inches long, half an inch broad. *Flowers* in alternate spikes, arrayed in a dense panicle.

A coarse, homely, foreigner from Europe,—very abundant in moist, rich or manured soils, along sink drains, in gardens, and the like. "Some experiments have been made to cultivate this common species in the place of millet, to cut for green fodder. It is relished by stock, and is very succulent and nutritive, while its yield is large." (*Flint.*) It can easily be eradicated by pulling, before it matures its seeds.

117. FOXTAIL GRASS—*Setaria viridis. Annual. Culm* one to three feet high, branching near the base. *Leaves* three to eight inches long, lanceolate, flat. *Flowers* in a cylindrical spike, green. *Spike* bristly.

A common grass in cultivated and waste grounds, sometimes called Wild Timothy, from the general resemblance of the spikes. BOTTLE GRASS—*Setaria glauca*—is rather more common than the preceding, especially in the stubble of grain fields. There are often several stems from the same root. The spikes are from two to four inches long furnished with tawny or orange colored bristles. Both species are from Europe. If they are not allowed to go to seed they will soon disappear.

SERIES II.

FLOWERLESS OR CYPTOGAMOUS PLANTS.

CLASS III. GROWING FROM THE APEX—ACROGENS.

ORDER 41. HORSETAILS—EQUISETACEÆ. A small order of one genus and about ten species.

118. COMMON HORSETAIL—*Equisetum arvense. Roots* perennial, deep *Fertile stems* erect, simple, hollow, of a light brown color, furnished at the joints with a sort of sheath of a darker color. Spores (seeds) in a cone-like head at the top of the stem. *Sterile stems* green, eight to sixteen inches high, hollow, grooved, bearing at the joints long and slender drooping branches.

The fertile stems of this plant appear in April and May, growing in low damp grounds often in great abundance; after they have shed their spores they die away. About this time the sterile or barren stems appear and continue through the season. From their resemblance to miniature pine trees, they are sometimes called low pine and ground pine. We have noticed this plant in greater profusion on the sandy banks of railroads than any where else. The common horsetail, or as it is sometimes called, the field horsetail, is thought by many to be very injurious to horses, causing the disease called "staggers," and that cattle and sheep eat it with a decided relish and without injury. Others consider it injurious only to cattle and sheep. Some writers say it is perfectly harmless to any kind of stock. We will not, however, discuss this question here, but refer to the "*Agriculture of Maine*" for 1867, page 223, and to "*Todd's Young Farmer's Manual*," Vol. 2, page 399, where it is discussed at length. The horsetail may be considered a bad weed, which ought to be eradicated. Thorough draining and good culture will effect its destruction.

ORDER 42. FERNS—FELICES. The ferns constitute a large family, distinguished by their elegant plume-like foliage. In the temperate regions they are of low habits, but within the tropics there are some species which attain the height of fifteen to twenty-five feet, presenting a very beautiful appearance.

119. COMMON BRAKE—*Pteris aquilina.* A well known and abundant plant in woods, pastures, and waste grounds, often quite troublesome. There are numerous species, the prevalence of which imparts a slack or neglected appearance to one's lands.

Class V.—PLANTS WITH NO DISTINCTION OF STEM AND FOLIAGE—Thallophytes.

It was not our intention to notice these mostly minute organisms, considering them entitled to an article by themselves. Therefore we will only mention a few of the more important species.

Order 43. LICHENES—Lichens. No species of this order can be considered as weeds. They grow on the ground, on the bark of trees and on rocks. They draw their nourishment directly from the air.

Order 44. MUSHROOMS, MOULDS, ETC—Fungi. Plants of this order are parasitic, generally drawing their nourishment from living, though more commonly languishing plants and animals; but often appropriating the organized matter of dead and decaying animal and vegetable bodies. Puff-balls and mushrooms belong to this family.

Gooseberry Cluster-Cups (*Æcidium Grossulariæ*) may be found on the leaves and fruit of the Currant and Gooseberry in June.

Mildew or Rust (*Puccinea Graminis*) is often very injurious to the herbage of corn, grains and grasses, in damp muggy weather.

Blight, Smut or Brand (*Ustilago segetum*, Ditm.) is the cause of much damage to the ears of corn and grain, filling the kernels with a copious black dust.

Bean Rust (*Trichobasis Fabæ*). On beans in August and September.

Potato Mould (*Peronospora infestaus*). Very common since about the year 1845, on the leaves, stems and tubers of the potato, causing the potato murrian.

Erysiphe Martii, is the mildew or blight which effects the leaves of peas, imparting to them a chalky appearance.

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SHRUBS.

In the foregoing pages we have noticed, with one exception, only herbaceous plants, thinking it more eligible to notice the shrubs by themselves.

1. Poison Sumach—*Rhus venenata*. A shrub or small tree, frequent in swamps and low grounds. The trunk is often several inches in diameter. The leaf-stalks are red, bearing seven to thir-

teen leaflets, which are about three inches long. The small green flowers are arranged in axillary panicles. The fruit is greenish yellow, about the size of peas.

This plant is even more poisonous than its near relative, the *Rhus Toxicodendron*, described on page 249, and should therefore be known. It is sometimes called Poison Elder, and Poison Dogwood. Many persons are badly poisoned even by standing in the immediate vicinity of this plant, as its pernicious effluvium taints the air to some distance around. If it occurs on one's premises, a person who is not affected by its properties should be engaged to eradicate it, root and branch.

2. Common Sumach—*Rhus typhina.* Is a common species, on dry rocky hills and around the borders of rocky fields. The young branches are thick and densely clothed with soft velvety hairs, and have a slight resemblance to young stag's horns, whence the plant is sometimes called *Stag's-horn Sumach.* The leaves are one to three feet long, divided into from eleven to thirty-one leaflets. The berries—or more properly *drupes*—are in a dense cluster, covered with very acid crimson down. It is a plant to be eradicated from the field-borders, as its prevalence imparts a neglected appearance to the premises, and the roots, which creep extensively and send up numerous suckers, are really troublesome.

3. Hardhack — Steeple-Bush — *Spiræa tomentosa.* This well known shrub is frequently very abundant in dry rocky pastures, and by the roadsides. The light purple or rose-colored flowers are very numerous, forming a slender pyramidal cluster of considerable beauty. If it was extirpated from the field-borders and pastures, where it may be considered a weed, and found only in the gardens where it is truly an attractive shrub, it would be a decided change for the better. "This plant possesses considerable astringency, and is in common use in New England as a domestic remedy in diarrhœa and other complaints where astringents are required."—(*Thurber.*)

Another species of Spiræa—*Spiræa salicifolia*—having white flowers, in a more or less spreading panicle, is more common along the borders of low fields and in meadows.

4. Common High Blackberry — Bramble — *Rubus villosus.* A common shrub along the borders of fields and on newly cleared lands. In the former situation it is often very troublesome, spreading extensively by its large creeping roots, which send up

at short intervals new plants. The fruit of the common blackberry is delicious, yet it would be better to cultivate some of the more valuable varieties, which produce much finer berries, and destroy the wild plants.

5. Wild Red Raspberry—*Rubus strigosus.* Produces red berries, which "are in the market" a few weeks earlier than those of the blackberry. As a weed, it has a similar character to the preceding plant, though may be not so troublesome, nor so difficult to eradicate.

6. Dewberry—Running Brier—Low Blackberry—*Rubus Canadensis.* "There is scarcely a farmer's boy in Pennsylvania who is not well acquainted with our plant from having encountered its prickly, trailing stems with his naked ankles while heedlessly traversing the old fields where it abounds."—(*Darlington.*) If Dr. Darlington had said *Maine,* instead of Pennsylvania, his statement would have been just as true. If the land were properly cultivated this plant would soon disappear.

7. Sambucus—Common Elderbush—*Sambucus Canadensis.* This shrub is often quite troublesome along fences, &c. It spreads rapidly, and is very tenacious of life. The plant is well known in domestic medicine. "If the bushes are cut early in the summer, and the brush burned upon the stubs, and then all the sprouts pulled up the moment they appear, the roots will soon perish."

8. Sheep Laurel—Lambkill—Dwarf Laurel—*Kalmia angustifolia.* A native evergreen shrub, frequent on rocky hills and pastures, growing to the height of two to three feet. In June it bears a profusion of bright crimson flowers. It can hardly be considered a troublesome plant, but from the fact that it is supposed to be poisonous to sheep we decided to notice it. Two of the popular names—Lambkill and Sheep Laurel—have arisen from the general impression that it possesses deleterious properties. That this plant has ever been injurious to stock has been doubted by good authority. It may be destroyed in the same manner as the *common elderbush.*

9. Common Alder—*Alnus incana* and *serrulata.* Along brooks and streams and around ponds this shrub is most abundant. It is a worthless plant, and its prevalence is a sufficient indication of a slovenly farmer. "If cut closely during the last half of the summer for two or three seasons, they are destroyed."

10. Common Juniper—Ground Hemlock—Round Hemlock—*Juniperus communis.* The more common form of this evergreen shrub is the prostrate, having the long branches extending in every direction, close to the surface of the ground, forming beds five to fifteen feet in diameter. It often grows in the form of a slender pyramid. The leaves are numerous and very sharp pointed. The juniper grows on dry sterile hills, and in sandy fields and pastures, is often quite troublesome.

GLOSSARY

OF THE PRINCIPAL BOTANICAL TERMS EMPLOYED IN THE DESCRIPTIONS.

Acaulescent: having no apparent stem, stemless.

Acerose: narrow and needle-like, as the leaves of firs.

Achenium: a dry seed-like fruit.

Acotyledonous: destitute of seed-leaves.

Acrogenous: growing only from the summit, as in the ferns.

Acuminate: ending in a narrow tapering point.

Acute: ending in a sharp point.

Alternate: not opposite.

Apetalous: having no petals, destitute of a corolla.

Appressed: lying flat against, or close to the stem.

Auriculate: having ear-like lobes at the base.

Awn: a slender bristle-like appendage, like the beard of barley, wheat, &c.

Axil: the angle between the leaf and stem, on the upper side.

Barb: a straight process, armed with one or more teeth pointing backwards.

Beak: a process, like the beak of a bird, terminating the fruit of certain plants.

Biennial: living only two years.

Blade: the *blade* of a leaf.

Bract: a small leaf or scale, from the axil of which a flower or its pedicel arises.

Bristles: short stiff hairs.

Calyx: the exterior leaves of a flower, usually green.

Capitate: collected in a head, or a globular mass.

Capsule: a seed-vessel opening when mature by regular valves.

Carpel: a simple pistil, or one of the parts of a compound one.

Cauline: relating, or belonging to the stem.

Chaff: small membranous scales or bracts on the receptacle of the Asterworts.

Compound flower: a cluster of flowers on a common receptacle, as in the Dandelion and other Asterworts.

Compound leaf: a leaf composed of several leaflets articulated to a common petiole—as the clover.

Cordate: heart-shaped.

Corolla: the inner of the two floral envelopes, generally colored.

Cotyledons: seed-leaves.

Creeping: running on or beneath the ground and putting forth small roots.

Cruciate or *cruciforme:* cross-shaped, like the flowers of the Mustard family.

Culm: a straw, or straw-like stem.

Deciduous: falling at the end of the season.

Decompound: several times compound or divided.

Decurrent: said of a leaf whose base extends downward along the stem.

Depressed: flattened from above.

Dicotyledonous: having two seed-leaves.

Diffuse: much divided and spreading.

Diœcious: staminate and pistillate flowers on separate plants—as in the Sheep-Sorrel.

Downy: clothed with fine hairs.

Echinate: having sharp points, bristled; hedgehog-like.

Elliptic or *Elliptical:* oval, with the two ends narrowing equally.

Endogens: inside growers, increasing by central or internal deposits of new matter.

Exogens: outside growers, increasing by annual additions to the outside.

Fibrous: consisting of fibres.

Frond: the foliage of ferns.

Fusiform: round and tapering to a point.

Gamopetalous: having the petals more or less united.

Gamosepalous: having the sepals more or less united.

Genus: an assemblage of species possessing certain characters in common, by which they are distinguished from all others.

Glabrous: entirely smooth; destitute of any hairiness.

Glumaceous: chaff-like, having chaff or glums.

Habit of plants: their general appearance and mode of growth.

Hirsute: clothed with stiff hairs.

Hispid: bristly, with rigid, spreading hairs.

Incised: divided deeply as if cut.

Indigenous: native, growing originally in a country.

Inflorescence: the arrangement of the flowers on a plant.

Inserted: attached to; growing out of.

Insertion: the place or mode of attachment.

Involucre: a set of bracts or modified leaves surrounding the flower cluster.

Irregular: the component parts differing in size and shape.

Lanceolate: lance-shaped.

Legume: a fruit like that of the pea-pod.

Ligneous: of a firm woody texture.

Ligulate: strap-shaped, as the floret of the dandelion.

Linear: long and narrow, with the two margins parallel.

Lyrate: pinnatified with the upper lobes much larger than the lower.

Maculate: spotted or blotched.

Male flowers: flowers furnished only with stamens.

Metamorphosis: the transformation of one organ into another, as the transformation of the stamens into petals.

Monocotyledonous: having but one cotyledon or seed leaf.

Monœcious: having the staminate and pistillate distinct, but on the same plant.

Monopetalous: having the petals more or less united.

Monosepalous: same as gamosepalous.

Obovate: inversely ovate.

Obovoid: inversely ovoid.

Officinal: applied to plants, &c., used in medicine or the arts.

Ovate: having the outline of a longitudinal section of an egg; broadest near the base.

Ovoid: egg-shaped.

Pannicle: a form of infloresence, in which the cluster is much and irregularly branched, in a branched raceme, as in oats and some of the grasses.

Pappus: the calyx of composites, usually hairy-like or plumose, e. g. thistle-down.

Pedicel: the stalk of a particular flower.

Peduncle: the flower-stalk; also the *common* foot-stalk of a compound inflorescence.

Perennial: lasting for more than two years.

Petal: a leaf of the corolla.

Petiole: the stem or foot-stalk of a leaf.

Pistil: the central organ of a fertile flower.

Pistillate: those flowers which have pistils, but not stamens.

Pollen: the fertilizing powder contained in the anthers.

Punctate: appearing as if perforated with many small holes.

Raceme: a flower-cluster with short and equal lateral one-flowered pedicels, as in the currant.

Rachis: axis of inflorescence.

Radical: belonging to, or growing immediately from, the root.

Receptacle: the end of the flower-stalk, on which the parts of a flower are inserted.

Revolute: rolled backwards.

Rhizoma: a root-like subterraneous stem.

Runcinate: having large teeth pointing backward, as in the dandelion.

Scape: a stalk which arises from the root, supporting flowers and fruit but no leaves, as in the dandelion.

Sepal: the leaflet, or distinct portion of a calyx.

Serrate: notched like the teeth of a saw.

Sessile: inserted directly upon the main stem, without any pedicel or foot-stalk.

Solitary: standing alone.

Species: a group comprising all similar individuals; it is the lowest division of natural objects.

Spike: a prolonged, indefinite infloresence in which the flowers are sessile or nearly so; ex. mullein.

Stamen: thread-like organs situated between the corolla and the pistils.

Staminate: flowers bearing stamens but no pistils.

Stemless: see acaulescent.

Sterile flower: having no pistils.

Stolon: a sucker; a weak trailing stem given off at the summit of the root, and taking root at intervals.

Strap-shaped: see ligulate.

Succulent leaves: juicy; full of juice; or pulpy.

Syngenesious: stamens united by their anthers.

Truncate: terminating abruptly as if cut off.

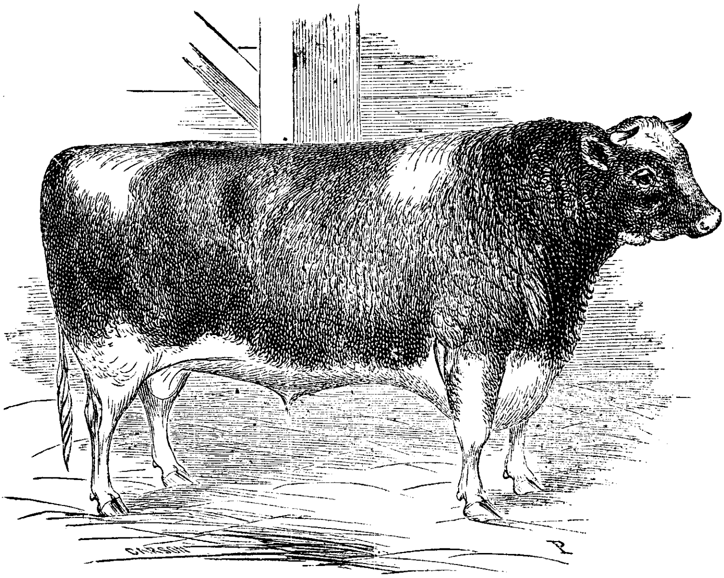
Tuber: a short, thickened underground branch, as the potato or arrow-root.

Tumid: enlarged like a swelling.

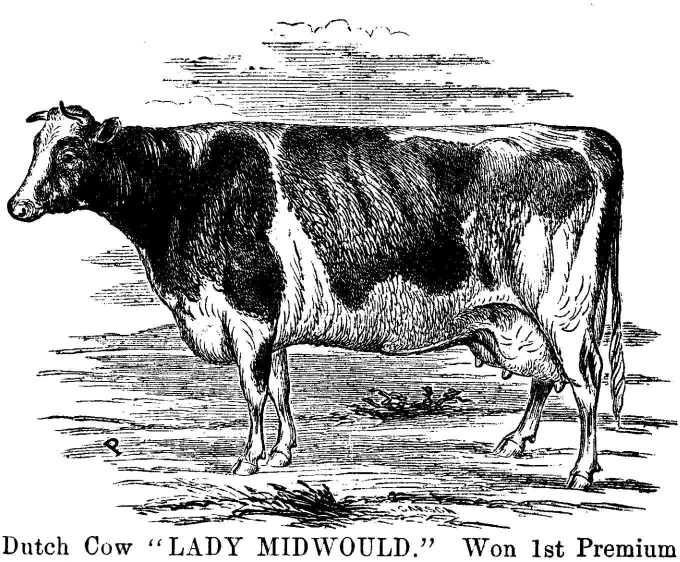
Tussock: a dense tuft formed at the root.

Umbel: a kind of inflorescence in which the flower-stalks diverge from one centre like the sticks of an umbrella; as in the carrot.

Whorl: a set of organs arranged in a circle around an axis, or stem.



Imported Dutch Bull "VAN TROMP," winner of 1st Premium and Diploma at N. E. Fair at Portland, 1869.



Dutch Cow "LADY MIDWOULD." Won 1st Premium and Diploma at N. E. Fair in Portland, 1869. Imported and owned by W. W. Chenery, Esq

HOLSTEIN, OR DUTCH CATTLE.

Comparatively little attention has been paid, either in Great Britain or in the United States, to the breeds of cattle which prevail in Continental Europe, and it is very possible that by this omission merit may have been overlooked. Dutch cattle were imported into New York early in the seventeenth century, and traces of that stock may yet be seen in the pastures of that State. It is very probable that the dairy qualities of the cows had somewhat to do with the early prevalence of dairy husbandry there.

It is claimed that the Holstein, or Improved Dutch Cattle of to-day have been as much improved from those of former years as have the Shorthorns, Devons, Ayrshires, Herefords, or Jerseys of Great Britain; and by the same means, viz., care, skill and good judgment in the selection and coupling of the best specimens to breed from, with a rigorous "weeding out" of inferior ones.

Animals of this improved race were imported by W. W. Chenery, Esq., of Belmont, Mass., some years since, which have increased in numbers, and to a limited extent have become disseminated, yet enough to furnish indications of what may be expected from farther increase. That they possess remarkable dairy qualities is plain enough, and scarcely any more doubt can be entertained that these run in the direction of cheese rather than of butter yielding ;—which may explain what the writer has frequently heard of them : that their calves take on flesh with greater rapidity than those of cows yielding milk richer perhaps in butter but containing less of caseine,—the principal flesh-making or nitrogenous constituent of milk.

It is plain enough that animals of their size, whatever the breed, require a goodly amount of food if the owner would realize profit from them. It is not half so bad policy to run cotton or woollen machinery, or mill saws or grist mills at half speed or capacity, as it is to run cattle organisms (considered in the aspect of machines for the conversion of vegetable into animal products) at such rate. And if what we have heard, from those supposed to be disinterested, proves true generally, these Dutch cattle will pay good returns for an adequate supply of food, especially the grades.

The animals of this breed shown at the N. E. Fair in September at Portland, by Mr. Chenery, attracted much attention, and we are gratified in being able, through his courtesy, to present our readers with portraits of several of them, together with a letter from our well known fellow citizen, Hon. T. S. Lang, a pound of experience being worth more than tons of speculation.

NORTH VASSALBORO', ME., Dec. 23, 1868.

W. W. CHENERY, ESQ.:

Dear Sir,—I must claim your indulgence for not returning an early answer to your inquiries concerning my opinion of the Holstein cattle. ("As I see them.")

I well know you need no endorsement of mine to convince you of the value of this stock to the breeding interests of this country.

When I last saw you, before leaving for Europe, in 1866, I was unwilling to give an opinion formed upon so slight acquaintance as I then had with the stock, but observation since my return and while abroad, makes me feel cheerful to encourage you all I can in the introduction of this breed of cattle. And I feel stronger in this course as, from time to time, I am in receipt of letters from different parts of this State where the half-breed animals from the Dutch bull which I had are located.

Representative animals of this stock are much sought after in this vicinity, which may seem strange, as I am located within six miles of the Shorthorn headquarters, (*if judged by awards of premiums at State Shows.*)

It may not be out of place to remark that when I purchased the Dutch stock, with a view of testing them, it was the subject of much pleasantry on the part of some of my neighbors who were breeders, and one prominent breeder of "Shorthorns" said to me, at Springfield, when he heard what I paid "Mr. Chenery" for them, that I ought to have a guardian if I intended to carry such animals to Maine.

Yet, in spite of those forejudged conclusions, the stock steadily gained ground as it developed itself. For I did not offer it for sale or advertise the services of the bull, or in any way call the attention of breeders to it through the public papers, wishing to see it myself before presuming to decide upon their merits. My regret now is that while in low health, I sold the finest bull that ever came to Maine. I, however, satisfy myself that in due time I shall be again in health, to commence breeding, when I shall certainly buy Dutch stock.

I feel sure that I wish to speak guardedly upon a subject of this kind, and I have endeavored to compare this stock with others with which I have been more or less acquainted.

My father, J. D. Lang, more than twenty years ago, while I lived at home, commenced breeding Shorthorns of the Greene stock of Albany, keeping sometimes forty head. This stock was unfortunate, on account of a constitutional defect, which in the end run the stock down very low. They were not satisfactory as a dairy stock.

Feeling that the trial of Shorthorn stock by my father was unsatisfactory, on account of the peculiar hereditary difficulties attached to that special family, I bought six cows and a bull of Samuel Thorne's splendid stock. They were beautiful animals; some of them had gained a first-class reputation in this country, and in England before they were imported. The progeny of this stock was the finest I have ever seen in Maine of Shorthorned stock. While I had this stock I saw your Dutch cattle at Springfield, and being struck with their peculiar vigor and milking qualifications, so different from the cows which I then had, I desired to buy them as an experiment in crossing with the Shorthorned stock. I had no idea of making a specialty of them, or any other stock, without comparison with other breeds, that I might be able to see for myself what appeared to be best adapted to the wants of Maine.

I do not wish to convey to you the idea that I believe Dutch stock, or any other breed, are suitable to every locality among us. But were I situated upon clay loam soil, or good grass land, I should decidedly choose Dutch and their cross upon Shorthorn cows as the *sine qua non* of my wishes. I do not wish to be understood as encouraging any one to breed them for the special purpose of butter-making, but as a stock uniting a hardy, vigorous constitution—which it proves by developing the most remarkable growth of bone and muscle—with a power to assimulate thereto a more varied and cheap class of food than any other stock that I have ever met. One point which struck me as peculiarly desirable was the distribution of fat through the animal, rather than in lumps or deposits upon the surface.

The half-bloods of this stock are remarkable for their thrift. A few days since I met a butcher who does a large business here, and sends much meat to market; he said it was unfortunate that I had allowed the Dutch bull to go out of Maine, and remarked that he paid from four to five dollars per head more for calves four weeks old from this bull than any other.

I am unwilling to have you think that I underrate Shorthorned stock; on the contrary, I admire them, and in breeding a mixed stock I should certainly aim to select cows of that breed, whenever they could be found prime milkers or feeders, of their progeny. So far as I can judge, the cross of Dutch bulls on Shorthorn cows is admirable.

I am inclined to the opinion, so far as my observation extends in this country and in England, that Shorthorns in the main have been bred to beef and form, without much attempt to develop their milking qualities. And I am fully aware that no one quality can be urged to the utmost without taking from others.

My own experience has taught me that any kind of cattle or horses which assimilate their food to flesh in their own organism, cannot feed or supply the demands of their offspring. And the longer this tendency is bred, the more absolute it qualifies the stock. This is the point I wish to make when I urge the cross of Dutch and Shorthorned stock. The one gives its large, vigorous organism and secretive power, while the other gives symmetry and compact configuration, combined with early maturity.

The secretive power of the Dutch cow is very astonishing in many cases, and in nearly all cases coming under my notice, much greater than in any other stock. Then the peculiar character of the milk to grow calves, just adapted to form bone and muscle while they are growing.

I have been interested in trying experiments in growing calves of milking stock, suitable for butter-making, especially Jerseys, by feeding upon milk of cows which do not make good butter, and the result was quite marked, while no calf makes so good advancement fed upon rich, butter-making milk, as if fed upon a milk adapted to cheese-making. The abundant flow of this kind of milk, from the Dutch cow, insures a rapid development in the progeny, and robust, thrifty physique.

My conviction is, that to institute an experiment of ten or more cows of Dutch and Shorthorn stock under the same feed and circumstances, as far as practicable, and weigh the progeny at six months or two years old, it would be found that the Dutch stock would cost the least per pound.

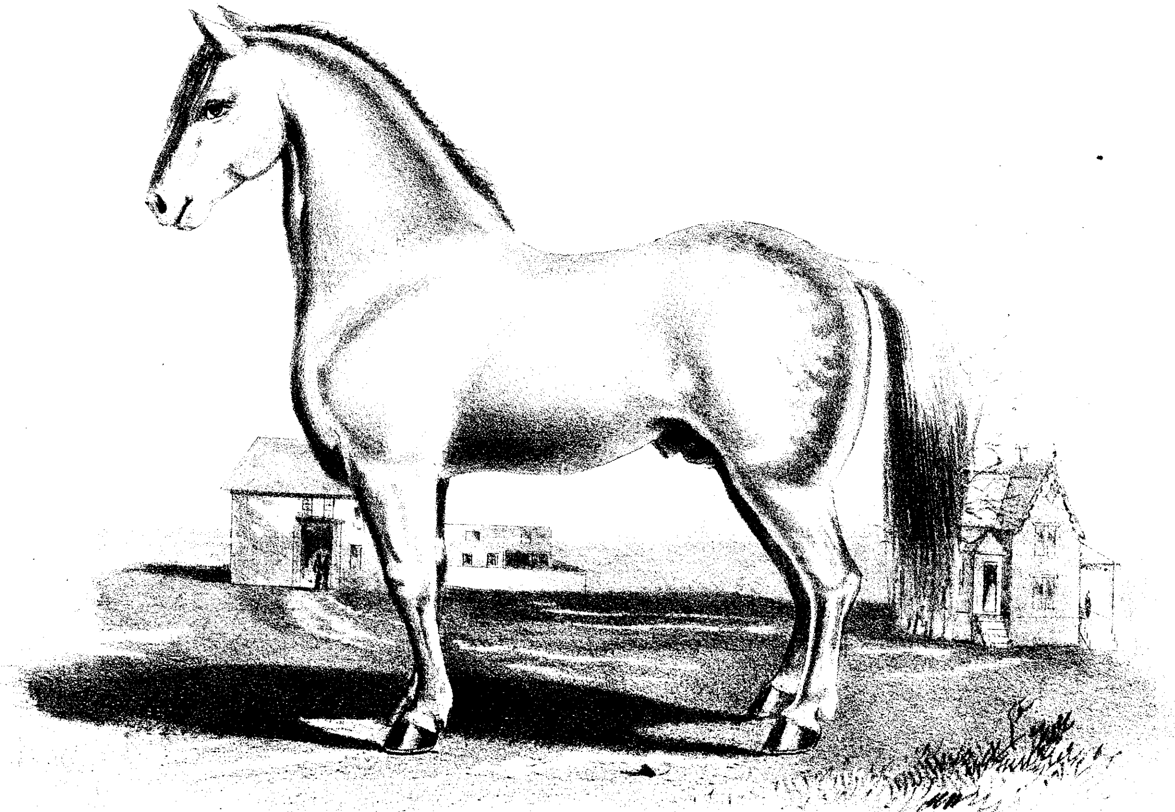
My experiments with the half-bloods were very gratifying, and outstripped all others with same feed.

These experiments were made with some care. I repeatedly received offers of $225 to $250 per yoke for eighteen months steers, which never ate any grain. I sold four to your neighbor, Mr. Munroe, which girted, at eighteen months, six feet seven inches average, and one pair averaged six feet eight inches.

As to the working qualities of Dutch cattle, or their crosses, I am unable to give you any idea from personal knowledge. I questioned the herdsmen in two or three estates in Belgium, where these cattle were kept for cheese-making, and they assured me that they excelled in this particular; one of them, pointing to the intelligent head and eye, and strong, straight, active limbs, saying, "do you doubt it ?"

At all events, when I get ready to breed once more, which I hope will be soon, I shall try the Dutch cattle again, either from your herd or direct from Holland, if the injunction be raised. Truly yours,

T. S. LANG.



IMPORTED PERCHERON STALLION "CONQUEROR."

Owned by HORACE WOODMAN, Saco, Maine.

THE PERCHERON HORSE.

In the breeding of horses, as hitherto pursued in Maine, comparatively little attention has been given to the production of beasts for heavy labor; the fast trotter and the horse of "all work" being the almost universal aim of those engaged in rearing and in the improvement of breeds.

Substitution of the labor of the horse for that of the ox has followed, with even step, the progress of improvement in agriculture in Great Britain, until now the working ox is found only to a very limited extent and in a few sections, as in Devonshire where the breed is better suited for labor than many others.

All are ready to admit the benefits arising from a division of labor in the employments of men. The same principle holds good with regard to the employments and uses of beasts. The only doubt which can be entertained regards the extent to which the division should be carried, or whether that stage of progress has been reached where it may be adopted with advantage.

Believing that the time has arrived when a heavier class of horses than has hitherto been sought may be reared among us advantageously, it is gratifying to notice that attention and effort are thus directed.

Among the larger breeds of Europe none is held in higher esteem for the possession of that combination of good qualities which gives value for farm and draft purposes, than the Percheron.

The introduction of a superior stallion of this breed by Mr. Horace Woodman of Saco, (the first, so far as we know, which has ever been brought into the State,) induces the republication here of a brief paper found in the last report of the Missouri Board of Agriculture, by Jefferson K. Clark, Esq., of St. Louis, who was so pleased with the stock from personal examination and study where they are best known, that he imported two stallions and two mares, involving no small trouble and considerable expense:

"There are few persons in the United States even among those interested in the breeding and management of horses, who are aware of the value and character of that breed known as '*The Percheron.*' The immense power, wonderful endurance and extreme docility of this peculiar animal, will render its introduction into this country an important advance in the art of stock breeding, while to the farmer his usefulness and strength will render him preferred above all others.

During a recent visit to France I was peculiarly struck with the beauty and strength of the Percheron, and made express inquiries concerning them and their management and breeding, and trust the informarion which I received will not be uninteresting to those engaged in agricultural pursuits.

The department of Perche is a small extent of country, about twenty-five leagues in length by twenty in breadth. It is bounded on the north by Normandy, on the south by the Vendomois, on the east by Beauce, including Chartrain and Dunois, and on the west by part of Normandy and Maine. It is in this beautiful country, where agriculture has flourished for years, where the beautiful meadows stretch far and wide, watered by brooks and rivers, and where the climate is remarkable for its salubrity, that the Percheron is found in his glory, and surely a more magnificent animal cannot be imagined than a well-bred Percheron on his native soil. Such were my thoughts in the spring of 1868, as I viewed him in Perche, and determined if possible to introduce the breed into Missouri.

It is not my intention in this brief paper to enter into the genealogy of the Percheron, but from historical deductions it is fair to believe that he is of Arabian origin, modified of course by climatic influence. 'Mon. Eugene Perrault,' says Du Huys, 'one of the most extensive and skillful dealers in fancy horses in all Europe, has frequently remarked to me, that of all the various breeds of horses none were so interesting to him as the Percheron, and judging from his appearance and quality, *he was satisfied* that he was a genuine Arab, modified in form by the climate and rude services to which for years he had been subjected.' There are many interesting historical facts, to prove this hypothesis to be correct, and among others I would allude to the defeat of Abderame on the field of Vouille. In this memorable engagement, it is reported that over 300,000 infidels were slain, and that the horses (all of eastern extraction) which they rode, fell into the hands of the conquerors. These horses, or at least a very large number of them, were divided among the men of La Perche and Normandy, and the country immediately surrounding. Again, excavations made as recently as 1861, revealed carvings and antiques on which, beyond doubt, the horses represented must have been of the Arabian breed.

These horses, then, were gradually modified by the peculiarity of climate, mode of keeping, the labor they were obliged to perform, and especially by the contact with the Britainy race of horses.

It may here be asked, what are the advantages which these horses possess? Allow me to state them as briefly as possible:

1st. STRENGTH. Let any stranger in France, whether he be a breeder of horses, or a student of metaphysics, stand in the streets of Paris, and see the enormous blocks of stone carried along with ease by a single Percheron, which in our country would require a whole team to move, and he will certainly be struck with amazement. Let him observe those omnibuses of immense size, filled to overflowing with people inside and out, moving at a rapid rate, drawn by two of these powerful animals, and he would certainly believe, that either *our* horses have degenerated or that vehicles and people too are not so heavy in France as in this country. It is surprising in the extreme, to observe not only the weight which these horses move, but the apparent ease with which enormous loads are conveyed from place to place, and above all, it is beautiful to witness the docility and kindness of temper with which they bend themselves to their work. Of this subject a distinguished authority says: 'Do you expect also from a horse, a horse derived from English blood, that cool, restrained and ever fresh energy, that courageous patience of which the Percheron every day gives an example in the omnibus in the streets of Paris! Dragging at a trot heavy loads, the weight of which frighten the imagination; stopping short both in ascending and descending; stepping off freely and always without balking; never sulking at his work or food, and fearing neither heat nor cold; this is a specimen of Percheron qualities.' In London a traction of only about 2000 pounds is required of a draft horse. In Paris, the horses harnessed to the heavy stone carts are required to draw as much as 5000 pounds each, and often more. The testimony of Mr. Webb and Mr. Dickenson is to the same effect.

2d. Docility. As a mark of the wonderful kindness of these animals, it may here be mentioned that stallions and mares are frequently worked together, side by side, without any effort on the part of the horse to become unruly or unmanageable. They are free from the usual faults of draft horses, always going 'cheerfully,' (if I may be allowed so to speak) to their work, and performing it with a gentleness that renders them beloved by all who attend them. They have been accustomed to work from the age of five or six months, and are most carefully handled by their masters. Rough usage is comparatively unknown in Perche, and this with the kindness and care of years extended to the breed, they naturally then become animals of great docility.

I have seen in one stable in France as many as eighty horses hitched to a rack, as many mares as stallions, and only a suspended board separating the two lots. This board was only about eighteen inches wide and eight feet long, hung from the ceiling with the two ends fastened with a cord, and clip spring in the rear to loosen easily if a horse should happen to stride it. None of the stables in Europe have stalls for the horses, except those of the royalty. In Paris you constantly see four or five of these magnificent stallions hitched a la tandem, pulling their immense stone carts and often being left standing in the streets entirely alone; frequently one of the leaders will be turned around and two of them standing head and tail, so as to keep the flies from bothering them. And either of my own stallions will allow you to go under them, sit on their hocks, or do anything with them you choose; they neither kick nor bite.

3d. Freedom from Disease. I am about to mention a fact under this head, which I know will be regarded suspiciously by many, yet it is, nevertheless, as true as remarkable. The Percheron is exempt from the hereditary bony defects of the hocks, and where they are raised, spavin, jardon, bone spavin, periodical inflammation, and other dreaded infirmities, are not known *even by name.*

4th. ENDURANCE. As an example of this, I may be permitted to state that a gray Percheron mare started from Bernay, harnessed to a travelling wagon, and made the fifty-five and two-thirds miles, over a bad and hilly road, to Alencon, in four hours and twenty-four minutes; also, that a mare, seven years old, trotted, to a heavy travelling wagon, from Lyons-la-Foret, fifty-eight miles, to Pont Andemer, in four hours, one minute and thirty-five seconds, and returned the following day, making the distance in four hours, one minute and thirty seconds, and the last thirteen and three-fourths miles were made *within one hour.*

5th. SPEED. One of the most noted features of the Percheron is speed. To look at the build of the horse, or to observe him while he is quiet in his stable, one would scarcely imagine him capable of much swiftness. For authority under this head, I am again obliged to consult the valuable work of Mon. Du Huys, 'Mounted Percherons,' and twenty-nine results at one and one-fourth miles. The best race was made by Julie, at Montdoubleau, in 1864; time, 3 minutes and 50 seconds, or her mile in 3:04, and the average time of the twenty-nine was 4 minutes, 12½ seconds.

The best time for two miles was made by Cocotte at Illiers, in 1861, in 6 minutes, 5½ seconds. The average time of forty trials was 7:20.

The best for two and one-half miles was made by Sarah at Langou, in 1865, in 7 minutes and 35 seconds, and the average time of sixty-five trials was 9 minutes and 15 seconds.

6th. ALL-WORK. A horse of all-work is often 'read about,' but rarely seen. The animal we use for draft is not a comfortable horse upon the road. The good 'buggy horse' or 'carriage horse' is not fit for draft. The trotter is too delicate, and the runner is fit for nothing but his appearance on the turf. The Percheron combine qualities which render him a true horse of all work; he will kindly draw immense loads, will get over the road at an excellent rate, will trot from dawn to dark with an ease and grace that surprises, and is most easily kept in excellent condition."

PHENOL, OR CARBOLIC ACID.

ITS USES IN AGRICULTURE.

No feature of the remarkable age in which we live is more noticeable than the wonderful discoveries of science, and their application to useful ends. Among these, the utilization of substances heretofore considered waste, because possessed of unknown properties, figures very largely. In the benefits which have thus accrued, agriculture comes in for a full share. A little more than a quarter of a century will cover the whole term in which manufactured manures have been introduced to the knowledge of the husbandman. The use of bones, guanos and other substances occurring in nature, containing phosphates and soluble nitrogen, which now contribute so largely to the renovation of run-down soils and to the production of abundant crops, has been mainly within the same period. What has been thus far accomplished is, we believe, but as a feeble dawning of what is in store. In thousands of ways at present unknown, scores and hundreds of substances now of no practical utility will doubtless develop into uses in all imaginable and before unthought of directions.

Only a few years ago, the tar, so plentifully produced as a side product of the manufacture of illuminating gas from coal, scarcely possessed any commercial value whatever. Now we have from it not only various benzines, naphthas and oils of various densities and adapted to divers uses, and the asphaltum so widely used for roofs above our heads and for pavements beneath our feet, but other substances also, including the famous aniline colors, blues, purples, mauve, magenta, etc., surpassing in richness of tints any thing the world before knew.

The object of penning this paper is, to bring to the notice of farmers a product from coal tar which promises to render them good service and which is yet very little known. It is commonly called Carbolic Acid, sometimes Cresylic Acid,—Phenol, Cresol, also Phenylic Alcohol and Cresylic Alcohol. Its chemistry is somewhat obscure, but it is more nearly an alcohol than an acid. It very nearly resembles the creosote formerly obtained from wood tar, and which is the active agent of preservation in smoked fish, meats, &c. When separated with care, what is sold for pure carbolic acid is a white crystalline substance, usually with a pale pink fluid, and at present sells for about two dollars per pound. But a much cheaper article, often, but improperly called "Solution of Carbolic Acid," a dark colored fluid, selling at from fifty to seventy-five cents per pound, answers equally well for any uses the farmer may likely need it for. As it comes to be more generally used, the price will grow less, and we may probably find it of more uniform grades of quality than at present. In some cases I have even known what the distillers of coal tar call "dead oil," by which they mean simply that part of the distilled portion which sinks in water, to be called, but very improperly, carbolic acid. This sells for ten to twenty cents per gallon, and contains a portion of the tar alcohols, but so contaminated with tarry and sulphurous substances as to be exceedingly disagreeable; although if used freely, effective enough for disinfecting cattle cars, carcasses, sewers, and perhaps for water closets, garbage receptacles, and stables. It is from this "dead oil" that the so called carbolic acid of commerce is obtained by repeated separating and purifying processes. The value of what passes under the commercial name "carbolic acid," is due to its content of phenol and cresol, or tar alcohols. These seemed to be *endowed with a wonderfully destructive power over all low forms of life,* such as the sporules and germs from which come fermentation, decay, parasitical growths, and infusoria,—*thus destroying the very beginnings of the diseases thence arising* whether in plants or animals, as well as noxious effluvia, etc. It is also an active medicinal agent and an effective protector against insects, vermin, and the like.

In a lecture delivered by Dr. F. Grace Calvert, F. R. S., before the "Society for the Encouragement of National Industry," in France, after giving an account of the progress of its discovery, he says:

"We will rapidly glance at the applications which have been made of this remarkable substance for sanitary purposes, in medicine, agriculture and manufactures.

The disinfecting, or rather antiseptic, properties of carbolic acid are very remarkable. The beautiful researches and discoveries of M. Pasteur have shown that all fermentation and putrefaction is due to the presence of microscopical vegetables or animals, which during their vitality, decompose or change the organic substances, so as to produce the effects which we witness, and as carbolic acid exercises a most powerful destructive action upon these microscopic and primitive sources of life, carbolic acid, therefore, is an antiseptic and disinfectant much more active and much more rational than those generally in use.

It is necessary that I should here make a few remarks, explanatory of the distinctions between *deodorizers*, *disinfectants*, and *antiseptics*.

DEODORIZERS. All substances merely acting as such are neither disinfectants nor antiseptics, as they simply remove the noxious gases emitted from organic matters whilst in a state of decay or putrefaction, without having the property of arresting decomposition or fermentation. For it has been proved that the source of infection or contagion is not due to noxious gases or bad smells, (being merely indicators of its probable existence,) but as we shall see presently, to microscopic spores floating in the atmosphere, and which by their ulterior development and propagation are believed to be the true source of contagion.

DISINFECTANTS. Under this head may be classed bleaching powder, or chloride of lime, sulphurous acid, and permanganate of potash; they first act as deodorizers, and then as disinfectants, but they must be employed in large quantities, to thoroughly oxidize or act upon organic matters, so as to prevent them from again entering into decomposition; but still it is known that if the organic substances so acted upon are exposed to the atmosphere, they will again experience decay and putrefaction; they are, in fact, more destructive agents than disinfectants, and they are never antiseptics.

ANTISEPTICS. Antiseptics, such as corrosive sublimate, arsenious acid, essential oils, carbolic acid, etc., act as such by destroying the sources of decay and decomposition, that is to say, they destroy or prevent the formation of the germs of putrefaction or fermentation, without acting upon the mineral or vegetable matters present. The advantage of their use is, therefore, that they act, when used in small quantities, upon the primary source of all organic matters in a state of decay; further, they are deodorizers, for they prevent the formation of offensive odors, and consequently they are antiseptices, disinfectants, and deodorizers. One great advantage which carbolic acid possesses over other antiseptics is, that it cannot be used for any illegal purpose, as arsenic or corrosive sublimate may.

And allow me further to add that disinfectants, such as chlorine, permanganate of potash, or Condy-fluid, operate by oxidizing not only the gaseus products given off by putrefaction, but all organic matters with which they may come in contact; whilst carbolic acid, on the contrary, merely destroys the causes of putrefaction, without acting on the organic substances. The great difference which therefore distinguishes them is, that the former deals with the effects, the latter with the causes. Again, these small microscopic ferments are always in small quantities as compared to the substances on which they act, consequently a very small quantity of carbolic acid is necessary to prevent the decomposition of substances; therefore its employment is both efficacious and economical. Moreover, carbolic acid is volatile, it meets with and destroys, as Dr. Jules Lemaire says, the germs of sporules which float in the atmosphere and vitiate it; but this cannot be the case with Condy's fluid, chloride of zinc or iron, which are not volatile, and which act only when in solution, and are mere deodorizers. This is why carbolic acid was used with such marked success, and therefore so largely, in England, Belgium and Holland during the prevalence of cholera and of the cattle plague. Mr. W. Crookes, F. R. S., not only states, 'I have not yet met with a single instance in which the plague has spread on a farm where the acid has been freely used,' but he has also proved, by a most interesting series of experiments, that the gases exhaled from the lungs of diseased cattle contained the germs or sporules of the microscopic animals discovered by Mr. Beale in the blood of such animals; for Mr. Crookes having condensed on cotton wood these germs, and having inoculated the blood of healthy cattle with them, they were at once attacked with the disease. As to the value of carbolic acid for preventing the spread of cholera, among many instances which I could cite, allow me to mention two special instances: First, Dr. Ellis says—I have, in many instances, allowed whole families to return to cottages in which persons had died from cholera, after having had the cottages well washed and cleansed with carbolic acid, and in no case were any persons allowed to enter such purified dwellings attacked with the disease. My friend, Professor Chandelon, of Liege, has stated to me, that out of one hundred and thirty-five nurses who were employed to attend upon the cholera patients—and they must have been numerous, for two thousand died—only one nurse died, but the nurses were washed over and their clothing sprinkled with carbolic acid. In fact, the antiseptic properties of carbolic acid are so powerful that 1-1000th, even 1-1500th will prevent the decomposition, fermentation, or putrefaction for months of urine, blood, glue solution, flour paste, etc., etc., and its vapor alone is sufficient to preserve meat in confined spaces for weeks; and even a little vapor of this useful substance will preserve meat for several days in ordinary atmosphere, and prevent its being fly-blown; lastly, 1-10000th has been found sufficient to keep sewage sweet, for Dr. Letheby states, in a letter addressed to me, that through the use of such a quantity of carbolic acid in the sewers of London during the existence of cholera last year, the sewages of the city were nearly deodorized.

Although questions of Public Health are the province of Medicine, still permit me to say a few words on the medicinal properties of carbolic acid. This question deserves to be treated thoroughly, for phenic acid is susceptible of so many applications in this direction, its properties are so marked, so evident, and so remarkable, that they cannot be made too public, and it is rendering a service to mankind to make known some of the employments of so valuable a therapeutic agent.

I wish all who are listening to me were medical men, for I could show, by numerous and undeniable facts, the advantage they might derive from pure carbolic or phenic acid, and if my testimony was not sufficient to convince them, I would invoke the authority of men justly esteemed amongst you. I would recall to you the words of the good and learned Gratiolet, and those of Dr. Lemaire, showing that carbolic acid is the most powerful acknowledged means of contending with contagious and pestilential diseases, such as cholera, typhus fever, small pox, etc. Maladies of this order are very numerous, but in carbolic acid we find one of the most powerful agents for their prevention;

for besides many instances which have been cited to me, I may add that I have often used it in a family in which there were eight or ten children, and that none of the family have suffered from those diseases except those who were attacked previously to the employment of carbolic acid about the dwellings in which such diseases existed.

Besides its antiseptic action, the caustic properties of carbolic acid are found useful; most beneficial effects are obtained from it in the treatment of very dangerous and sometimes mortal complaints, such as carbuncle, quinsy, diptheria, etc., as shown by Dr. Turner, of Manchester; and also in less severe affections, such as hemorrhoids, internal and external fistulas and other similar complaints. But what must be especially mentioned is the employment of carbolic acid in preserving in a healthy state certain fœtid purulent sores, and preventing the repulsive odor which comes from them, an odor which is the symptom of a change in the tissues, and which often presents the greatest danger to the patient. The services which carbolic acid renders to surgery can be judged of by reading several most interesting papers on compound fractures, ulcers, etc., lately published in the *Lancet* by J. Lister, F. R. S.; and allow me to draw your special attention to the following paragraphs which are to be found is a paper published in the journal of the 25th September, 1867: 'The material which I have employed is carbolic or phenic acid, a volatile organic compound, which appears to exercise a peculiar destructive influence upon low forms of life, and hence is the most powerful antiseptic with which we are at present acquainted. The first class of cases to which I applied it, was that of compound fractures, in which the effects of decomposition in the injured part were especially striking and pernicious. The results have been such as to establish conclusively the great principle that all the local inflammatory mischief and febrile disturbance which follow severe injuries are due to the irritating and poisonous influences of decomposing blood or sloughs. These evils are entirely avoided by antiseptics treatment, so that limbs which otherwise would be unhesitatingly condemned to amputation may be retained with confidence of the best result. Since the antiseptic treatment has been brought into full operation, and wounds and absesses no longer poison the atmosphere with putrid exhalations, my wards, though otherwise in precisely the same circumstances as before, have completely changed their character; so that during the last nine months not a single instance of pyæmia, hospital gangrene or erysipelas, has occurred to them.' My hearers can also witness the same remarkable results by visiting the two sick wards of Dr. Maissonneuve, at the Hotel Dieu. Further, I must not overlook the valuable application made of it to gangrene in hospitals by the eminent physician, James Paget, Esq.; and lately it has been used by many of the most eminent medical men with marked success in the scourges of humanity, phthisis and syphilis.

In agriculture our firm has stimulated the employment of carbolic acid for the cure of certain diseases very common to sheep—scab for example. The method of treatment customary in similar cases was very imperfect as well as dangerous, whilst with carbolic acid this malady is cured without danger to the animal by dipping it for a minute, often only for a few seconds, in water containing a small quantity of carbolic acid. For this purpose pure acid would be too expensive and is not used, nor concentrated acid, which ignorant men who have the care of sheep, would not know how to use, but by the help of soap an emulsion of carbolic and cresylic acids is made. After having shorn the sheep it is dipped in this mixture; a single immersion in a bath containing one-sixtieth of it is sufficient to effect a cure. After scab, the foot-rot is one of the worst and most frequent complaints. Carbolic acid is also for that an efficacious remedy. For this a mixture is made of the acid and an adherent and greasy substance capable of forming a plaster, which is made to adhere to the animal's foot, for two or three days preventing the contact of the air, allowing thereby time for the application to have its effect. But if the flock be numerous it would take a long time to dress the four feet of each animal, one after another; so to make it more easy a shallow tray is made of stone; a sort of trough; this is filled with the medicated mixture and the sheep made to pass through it, their feet being thus impregnated with the required substance. Permit me also to state that cattle cease to be annoyed with flies, &c., if washed with this solution or a weak solution of carbolic acid; and a first-rate salve can be prepared by adding 10 per cent. of carbolic acid to lard or any other fatty matters used for such purposes."

It was chiefly because of the uses of carbolic acid *to the farmer* that attention is here called to it. How extensive these may become it is at present impossible to say; but it is safe to assert that for lice, ticks, and other vermin infesting his domestic animals, and for their cutaneous diseases, sores, ulcers and the like, its equal for safety and efficiency has not before been found. Its use in medicine is rapidly extending, being used with great success in burns and scalds, in erysipelas, for preventing and arresting ulceration, and for many other diseases; as well as for the prevention and arrest of epidemics and all diseases of zymotic origin. With the single drawback of its disagreeable odor, its applications and uses in a sanitary point of view are more important and numerous than those of any other known substance whatever—and the odor rapidly becomes less unpleasant to most people who use it, until it ceases to be so at all, and especially as the better qualities are employed.

The best clue to be offered regarding its applications and uses, as well as the best safeguard against its misuse, may be had by remembering a few plain facts. First, that according to the best authorities, all contagious, infectious or epidemic diseases (as well as some others neither infectious nor contagious) are zymotic—that is to say, they are of the character of fermentations; and that these fermentations depend on the presence of various low forms of vegetable and animal life; next, that Phenol and Cresol, or so called Carbolic Acid is anti-zymotic; that is, it is opposed to, and even in very minute quantities fatal to these low forms of life; thus, if used in time, arresting these diseases at the very beginning. Also that the processes of fermentation and decay are zymotic in their nature, and are also quickly arrested by the same agent.

If a pure, or strong although impure article be used, caution is needful, for if applied of full strength to the skin it causes severe irritation, smarting, numbness, and even shrivelling. If this occurs wash it off at once and apply sweet oil or fresh butter. When swallowed in quantity it quickly operates as an irritant poison. In such case administer oil of some kind, preferably sweet oil or linseed oil, and give an emetic as quickly as possible, to be followed with lukewarm water. But with ordinary care in handling there is no need of any trouble from its use.

There are three or four methods of employing it which may be used, as one or other seems most advisable. The first is to mix with oil or lard in proportion of one to twenty, or even fifty or more. This may be used for the feet of animals—for cattle cars or places much exposed to rain, &c. Second, it may be mixed with a dry powder and sprinkled where required. For this purpose dry slacked lime is as good as any; this mixture is sometimes sold as carbolate of lime. A third method is to dissolve in water and use the solution. This is more frequently applicable and to a greater number of uses than any other, the chief drawback being the trifling inconvenience of keeping a quantity on hand. The purest carbolic acid of the shops requires about twenty times its weight of water to dissolve it. When thus made, or if a *saturated* solution of the *impure* article be made, *much further dilution* will be needful for most purposes. In fact no one knows how little will often answer the purpose sufficiently well. Last year the writer found a weak solution effective in immediately arresting mildew on grape vines and on various other plants; also to destroy plant lice. It was intended to repeat experiments in this and similar directions during the present year, but no occasion for its use arose. There is much probability that various plant troubles due to parasitic growths may be controlled in this way, and its trial is advised for this purpose.

The last method named, and it is one adapted to many purposes is, as soap, prepared as follows: slice a quantity of bar soap, set it over the fire in a suitable vessel, after having added just water enough to liquefy it by stirring and warming to less than boiling heat, then take it off and mix thoroughly for each pound of soap employed, from a quarter of an ounce to a whole ounce of carbolic acid, according as it is desired to have it mild or strong; and the quality, both of the soap and of the carbolic acid, may be varied in proportion as the product is desired to be nice and delicate, or cheap and less agreeable. When cool the soap may be cut into cakes and laid by for use, and will keep any length of time. If my own experience is any indication of what will occur with others, occasions to use it will grow more frequent as its fitness for very many uses becomes known. Prepared as stated above it has been found greatly preferable to what is sold in the shops as carbolic soap, unless we except an article sold at a high price for toilet purposes.

There is little doubt that it may be beneficially employed for ridding plants of insects and for both the destruction and prevention of those microscopic fungi which so frequently injure plants by producing rust, mildew, blight, and kindred diseases. It is asserted that when introduced into the soil, insects, worms, and larvæ disappear. Experiments are wanting fully to determine its measure of efficiency in this respect.*

*An "Insect Exterminator and Fertilizer" is latterly puffed and extensively advertised claiming great efficacy by virtue of containing Carbolic Acid, and to be patented for the purpose. Its appearance gives the impression that it is a mixture of coal tar with gas lime (the latter being a complex *refuse* product of the manufacture of gas), and the analysis as stated in the pamphlets accompanying it corroborate this impression. If so, any farmer may mix them for a small fraction of the price charged for the "Exterminator and Fertilizer." Coal tar and gas lime, separately and together, have long been employed for similar uses, sometimes with success, sometimes with injury. That such a mixture would annoy insects is very probable if not certain, that it would contain a little carbolic acid is evident enough, that it would exhibit fertilizing effects is improbable.

BOARD OF AGRICULTURE.

SESSION OF OCTOBER, 1869, AT ORONO AND BANGOR.

The first session of the Board of Agriculture, held under the Statute approved March 1st (see page 237), began at the College of Agriculture and the Mechanic Arts on Tuesday the 19th day of October.

It was gratifying to find a recent accession to the number of students, enlarged means of imparting instruction, an additional Professor at work, and abundant evidence of ability and determination on the part of all connected with the institution to succeed. There were present, also, several members of the Board of Trustees of the College, and the forenoon was chiefly devoted to the usual recitations of the classes, and to remarks by those present, all of whom expressed the highest degree of satisfaction at the thoroughness of the instruction, the progress of the students, and the happy results of the union of labor with study.

Professor Hamlin, of Colby University, one of the newly appointed members at large, said that, in all his experience as a teacher in different institutions, he had never heard better recitations or witnessed greater evidence of thorough, careful work on the part of both pupils and instructors. He alluded to the sympathy and cöoperation which should exist between pupils and teachers as necessary to the best results, and believed it existed in the present institution. He thoroughly believed in the necessity of proper exercise of both mind and body in the system of training young men, and was more convinced of the benefits of this course after having visited and become somewhat familiar with the success of the Michigan Agricultural College, where manual labor had been united with study long enough to demonstrate its usefulness.

Professor Fernald, in reply to an inquiry whether the bodily labor interfered with intellectual progress, replied that so far as he could judge from the working of the system for something more than a year, it did not—but, on the contrary, they were better fitted for study by reason of having engaged in physical labor, and he regarded it as really a benefit. He also stated that those pupils who exhibited the most aptitude at work, were also those most ready at their several studies. Mr. Johnson, the Farm Superintendent, said that the pupils were always ready and willing to work, and to put their hand to whatever they were told to do. Professor Peckham stated that he came to this institution with some prejudice against the system of manual labor, but he was every day gaining confidence in its expediency and usefulness.

Afternoon Session.

The Board met for the transaction of business. The terms of office of the several members at large, appointed by the Governor and Council, was determined by lot, as follows:

M. C. Fernald, one year.
Geo. L. Goodale, one year.
C. E. Hamlin, two years.
C. F. Brackett, three years.
S. F. Peckham, three years.

Messrs. Gilbert, Hobbs and Pulman were appointed a Committee to report on the time and place of next session.

After some discussions upon various incidental matters of interest, the Board adjourned to meet at the City Hall in Bangor, at 9 o'clock A. M. on the following day; after which the members occupied themselves in an examination of the buildings, the farm, and the stock belonging to the institution.

Wednesday, October 20th.

The public session of the Board (in the nature of a Farmer's Convention) was held in the City Hall, Bangor. The opening exercise of the forenoon was a lecture by Prof. George L. Goodale of Bowdoin College, (one of the newly appointed members at large), on

Some of the Conditions of Successful Experimenting.

(Phonographically reported by J. M. W. Yerrington.)

Mr. President and Gentlemen:—College duties, which could not be conveniently assigned to others, have rendered it absolutely impossible for me to prepare a written lecture for the present occasion, therefore the remarks which I have now to offer must be presented in the most informal and familiar manner. The topic, as announced by the President,—"The Conditions of Successful

Experimenting, and of Progress in Agricultural Science,"—is too comprehensive a subject to be brought within the limits of a single hour's familiar talk. In the quiet of one's study, it might be possible to collate and arrange all the facts bearing upon this subject, and to bring out the principles involved in the question; but it is impossible in a single hour of familiar talk to present this whole subject in an exhaustive manner. Therefore I shall confine my remarks to the first portion of the subject, and now invite your attention to some of the conditions of successful experimenting.

This subject has been repeatedly brought before the Board. I would refer particularly to the labors of a gentleman who is now a member of the Board,—Mr. Chamberlain of Foxcroft. It has been very ably treated by him, and by others also, and much that I have to say to-day is but a repetition and amplification of what has been already and ably said.

The subject is a very important one, and I think you realize its importance. The present proud position of agriculture is almost wholly due to successful experiments in collateral sciences and in agriculture itself. I think this must be admitted by every farmer. I say "experiments in collateral sciences and in agriculture." By "collateral sciences" I mean botany, zoölogy, and chemistry; particularly that department of botany bearing upon the physiology of plants, those departments of zoölogy bearing upon the physiology and classification of animals, and those departments of chemistry relating to the analysis of soils and of crops. American agriculture has followed very closely in the footsteps of European agriculture. It has been merely necessary for Americans to modify European agriculture to meet wants existing here—different climatic conditions, and then the great want of all, the want of labor. This last has been met by labor-saving appliances. Whatever has governed the progress of agriculture abroad has governed it in this country. Whatever affects the progress of agriculture abroad affects it in this country.

Now, who are the experimenters abroad, and who are the experimenters in this country? I shall confine myself now to brief allusion to some of those who are to-day experimenting in this country, as introductory to the question of experiments in general. Let us see who are experimenting in the collateral sciences. In Botany, we have Professor Meehan of Philadelphia, editor of "The Gardener's Monthly"—a gentleman who has devoted much time to the elucidation of the laws of plant growth. Now, those laws, as he is bringing them out, we consider contributions directly to botany; but sooner or later they will be incorporated into the very substance of what we call American Agriculture. So it is with Zoölogy. We have very able workers in that department of science. I will mention three, sons of Maine, Prof. Morse and Prof. Packard of the Peabody Academy of Science, at Salem, Mass., and Prof. Verrill of Yale. These gentlemen are studying zoölogy; their contributions are given to zoölogy directly, but indirectly they are to affect the progress of agriculture.

Whatever these gentlemen have done in these collateral sciences, they have done through experiment and observation, and whatever contributions they make to botany and zoölogy must be made through similar means. Prof. Verrill is carefully studying the laws that govern the reproduction of domestic animals; Prof. Packard is studying those insects prejudicial to your crops and those insects beneficial to them; and Prof. Morse is studying certain great laws of classification bearing upon the improvement of varieties, and hence bearing directly upon the improvement of breeds of cattle. In chemistry there are also many able experimenters, as Johnson of Yale, and Lea of Philadelphia.

These are some of our American workers in the collateral sciences. Now if I should ask the question, "Who are experimenting in Agriculture?" I should leave the question for you to answer. There are many who are performing what they call experiments, but to-day we have in this country very few who are able and are willing to devote the time, the money and the labor necessary to thorough agricultural experiments. This is not yet to our discredit, but it soon will be. Thus far we have simply been obliged to modify European agriculture to meet wants existing here, but the day has now dawned when we must begin to experiment for ourselves, and have an independent American agriculture. This can be brought about only through experimenting.

Now, what is an experiment? It is necessary, of course, that we should have this plainly and fairly understood at the very outset. What is an experiment? How much is involved in that word? I know no better definition than one which has been given by a German writer: "An experiment is a question put to nature." An experiment in physiology is a question which you put to nature through physiology; it is a question put by the physiologist. A philosophical experiment is a question put in molar physics by the natural philosopher. A chemical question is a question in chemistry put to nature by the chemist. An agricultural experiment is a question which the farmer puts to nature through agriculture. That is what an experiment is in the broadest sense of the term.

It is obvious that we have two kinds of experiments; that is, we can ask two kinds of questions of nature. First, in regard to nature's laws; and, second, in regard to some particular operation. An experiment in regard to a law is a general experiment; one which is directed to a particular end, we may call a special experiment. So that we have at the outset this broad division into general and special experiments. The subject reads, "The conditions of successful experiments."

This brings me to a portion of the subject which is very important: What is a successful experiment? Now, we must agree upon this. Suppose you wish to experiment with a particular kind of fertilizer, I will say a salt of potash. You want to try the effect of this salt of potash upon a given soil and upon a given crop. I will suppose you find your crop diminished from what it was last year. You call that an unsuccessful experiment, I presume. Your neighbor tries that same fertilizer, upon the same crop, and doubles his. You call his a successful experiment. If you say so, I certainly cannot agree with you. I do not call either of these experiments successful, because we do not know whether nature has answered Yes or No. A successful experiment is an experiment which elicits from nature a direct answer, Yes or No. Now, what sort of an answer have you forced nature to give? It is an equivocal answer; you do not know whether she has answered Yes or No. And it is so with your neighbor. Now, suppose you noted precisely what kind of soil it was, precisely what kind of fertilizer you used, precisely what kind of seed was used, noted the conditions of temperature, and all the climatic conditions of the season, and then noted the time at which the crop was gathered, and the results, there is in your work a valuable contribution to agriculture. Now, suppose your neighbor communicates the results of his experiment, in which his crop was increased, to some agricultural paper, merely saying that the fertilizer doubled his crop, how much information does that statement give you? Very little. Nature has not answered the question Yes or No. His is an unsuccessful experiment, while yours, if fully reported, is a successful experiment; and that is just the difference between the two.

We shall find that almost all the experiments thus far performed in this country, at least most of those communicated to our agricultural papers, have resulted in equivocal answers. You cannot tell whether the answer is yes or no. Without going any further back in your memory than last winter, let me call your attention to the discussion which followed a lecture upon the diseases of plants. The question of fungoid diseases came up—the diseases produced in plants by fungi. It is a well known fact, that the little spores which produce these fungoid diseases are killed at a certain temperature. Soaking the seed in hot water will destroy the vitality of the fungus, but not the vitality of the seed. Then the question was asked, by a gentleman well known to you, "What is the temperature at which the vitality of the seed itself may be destroyed?" Without following the line which was carried out in the discussion then, let me call your attention to one single point which was brought out in regard to the treatment of the fungus on corn. One gentleman said he had always had good corn crops, because he had treated his seed with boiling water, and he thought, also, he was able to harvest his corn a little earlier; or rather, I should say, he was able to get his crop, which was sweet corn, to the corn factories a little earlier than his neighbors. A gentleman who was present said his experience did not agree with that. He said that he tried an experiment like that three or four years ago; he soaked his seed-corn in boiling water, and had been waiting for it to come up ever since. Now, how can you account for these discordant results? Here the corn and the boiling water were the same in both cases; in one case, a large crop had been obtained, but in the other the corn had not come up in three years. The same experiments were made, and the results were discordant. And so it is with nearly all the agricultural experiments in this country, and I do not wonder that farmers are disgusted with most agricultural experiments, as they have been thus far conducted. I have no doubt if I should call upon you for your experiments, you would say the results have been something like this. You found in some agricultural paper, or in the agricultural columns of a political or religious paper, some experiment described in such a graceful and fascinating style that you thought you would like to try it, and you did try it, with conditions the same or nearly the same as were there detailed, and you found your results did not agree with the results reported. Of course, you became dissatisfied, and said something was wrong; the fault was either in your experiment or in the experiment of the writer of the article. If in him, you did not want to follow out any more of his experiments; if in you, you wanted to know what the fault is.

Now, what are the conditions of a successful experiment? what are the conditions that will prevent these discordant results? You do not find chemists, you do not find natural philosophers disagreeing in their experiments; why is it that the results of agricultural experiments are almost always discordant? There is a fault somewhere. Let us see where it is. I have said that an experiment is a question put to nature, and a successful experiment one which elicits an answer Yes or No. Now, the conditions of a successful experiment will obviously be those which will secure that answer, and they will be precisely those which will obtain an answer, yes or no, anywhere. I have no doubt that either of the Professors of the Agricultural College would say that he might ask the best scholar in either of the classes a question, and he would find that the answer would depend upon the way in which he put the question. If you should put a confusing question to the most brilliant scholar, you would get a confused reply; but put the question in a clear, intelligible manner, and you will get a plain, clear answer, yes or no. All lawyers know that it is a very difficult thing to acquire the art of putting clear questions. Some acquire this art, some seem to have it naturally. You as farmers must learn to put a question to nature so that you can get an unequivocal answer. You know, that in order to get a plain, unequivocal answer, you must make your question in the first place, plain, and in the next place you must make it pointed. It is so with experiments. You must make your experiment plain, and you must make that experiment point to some one definite end; then there will be no trouble at all. First make the question plain, have a clear idea of what you want answered in your mind, and then you will have a plain, intelligible answer.

Suppose I should propose this as an experiment to the Board of Agriculture: "What is the effect of phosphate of lime upon the corn crop?" One member might try bone dust, and obtain certain results; another would try superphosphate of lime, and obtain certain results; another might try apatite, mineral phosphate of lime, and he would obtain different results. The results would not agree, and yet you would say that in each case phosphate of lime was used. But the one who used bone dust used bone phosphate, together with gelatine—nitrogenous matter; the one who used superphosphate of lime, used, in all likelihood, nitrogenous matter together with *soluble* phosphate of lime and insoluble phosphate and sulphate of lime; the one who used apatite, used the most insoluble form of phosphate, and with no nitrogenous matter at all, and how could the results agree? If nature had given an answer, yes or no, the same in each case, the answer would have been of no value, because, if you had found the same answer to different questions, you would have thought something was wrong in the manipulations. So, if you want an answer, yes or no, to your question, make it as pointed as you can, eliminate every outside complication; do not let the experiment cover too much ground, but have it directed to a particular point.

Take this subject of potato growing. It is too much to ask one man to experiment in regard to early and late varieties, and in regard to the size or weight of seed, and the distance between the hills, which will produce the best crop. Either of these is enough for one man to study at the same time. It is this very desire to cover too much ground that makes much American experimenting so fallacious. Our experimenters want to do too much. They are not satisfied with taking one point and working it out fairly and faithfully. A long time ago, a German writer said "Experiments it is true, are not easy; still, they are in the power of every thinking husbandman. He who accomplishes but one, of however limited application, and takes care to report it faithfully, advances the science and consequently the practice of agriculture, and acquires thereby a right to the gratitude of his fellows and of those who come after him." "Of however limited application." Note that limiting clause. Make your question pointed; do not ask too much of nature; because, if you ask a complex question and get the answer "Yes," you do not know to which division of that complex question the answer "Yes" applies. Make your question, therefore, pointed.

To put this in other language, in the first place, you must carefully study all the conditions of the experiment. Take, for instance, the first experiment to which I referred—the effect of potash upon a given soil. It makes all the difference in the world to what kind of soil you apply it. That is the very first condition which you must study. Now, in regard to the examination of the soil, you must have a physical inspection of it, I had almost said a geologieo-physical examination, and there must be some rude chemical examination of the soil. We all know that all soil comes from the detritus of the rocks, and we know that these rocks vary in their physical and chemical character. Having instituted such experiments as these, and found out, in the first place, what the nature of the soil is, physically and chemically, in the next place, study the times and seasons. Remember that you may here have certain unforseen circumstances which will be a modifying condition in your experiment. The reason may be short: it may be an early or a late one; it may be a wet season or a very dry one. In making up your account, all these things must be very carefully and correctly observed. Note the quality of the seed employed, and the weight, and make your experiment sufficiently limited, so that, if need be, you can even count the seeds. I hope I shall be able to show you, before I get through, that successful experiments have been a matter of counting and weighing. Therefore study the seed which is put into the ground, study the season which passes over its germination and growth, and then the aggregate of these conditions will form the conditions of the experiment.

In the next place, having accurately observed all these conditions, and studied them very carefully, you are to record them faithfully and truly. And I think, gentlemen, you will agree with me, that it is the failure to do this which has wrought so much mischief in American agriculture,—the failure faithfully and fully to record experiments. I know that a great deal has been said and written about the necessity of keeping farm accounts, but how many farmers are there who as yet keep the accounts of their farms as a merchant keeps his books? This reluctance to keep accurate details of your experiments seems to spring from one characteristic of farmers. You think that what may be of trifling interest to you may not be interesting to others, and you do not want to obtrude yourself upon their attention with your results. You thus become careless about the *little details.* Time passes on, and then you think all at once you would like to note down the exact conditions which existed in the spring; it may now be summer. But remember, that when a single month has passed over your head you will probably be unable to record the exact conditions you found at the outset. Your memory may fail you. No chemist would undertake an analysis, and trust to his memory throughout that analysis. It would be impossible for him to do it, and if he attempted it he would be really trifling with those who employ him. Everything must be labelled, everything must be marked. You must faithfully and accurately record all the conditions and all the results.

Next, you must correctly interpret the results of your experiments. And this is by no means an easy matter. Every now and then it seems as if the natural and physical sciences, and agriculture, and medicine, which depend so largely upon the natural and physical sciences, take a retrograde motion; they seem to move backwards; and whenever that retrograde motion seems to take place, you may depend upon it that the cause lies in the misinterpretation of experiments. We have found it so in chemistry. Experiments that have been carefully conducted and faithfully recorded have been incorrectly interpreted; their meaning was not fully understood. So it is in agricultural experiments. Perhaps in no department of human thought and work have there been grosser misinterpretations than in agriculture. Misinterpretation, then, has retarded agriculture. It is only by experiments accurately conducted, faithfully reported, and correctly interpreted, that we can hope for progress.

It is also necessary to repeat experiments. You will find in all our scientific works statements like this: Mr. So and So found by experiment that a given acid and a given alcohol produced a new ether. Subsequent observers have not been able to confirm his observations. As in chemistry so in agriculture, it is important to have the same experiment repeated many, many times in order to see if there were any errors in the first results.

Have any experiments ever been conducted in this way? More than twenty years ago an English gentleman of wealth, then, and still extensively engaged in the manufacture of superphosphate, marked out for himself a course which his friends must have regarded as exceedingly whimsical. He engaged the services of a chemist, and of chemical assistants besides, and then commenced a course of agricultural experiments. During the first year he devoted himself to the solution of a single question; a question which any American farmer, out of this State, would have decided, very likely, by one season's experiment, in what leisure he could have obtained, and upon some small place on the farm. But the gentleman to whom I refer devoted a large tract to this special experiment; it was accurately conducted, faithfully reported, rightly interpreted, and became incorporated into agricultural science.

That was a valuable contribution to agriculture. During that year he spent in his experiments two thousand pounds. He has carried on these experiments until the present time, spending year after year between two and three thousand pounds sterling in these investigations. He has studied almost everything that goes on to a farm, and almost everything that can be taken off a farm; he has studied the growth of animals, and the laws that govern reproduction; and all these points have been studied as his first experiment was studied, carefully and accurately, and correctly interpreted.

In giving these facts from memory, I may not have given the details in their proper order, but the outline of the experimentation can be found in any of the agricultural cyclopedias. This gentleman, Mr. Lawes, and his associate, Mr. Gilbert, have by their experiments overthrown some of the brilliant but false theories which were brought forward by the great Liebig, who has been obliged to recede from some of the positions taken early in his life. He has been forced to do so in some cases by the results obtained by Messrs. Lawes and Gilbert. Here I will say, that in making a very graceful recantation, Liebig says he is simply moulting his wings for a higher flight. There is no generalizer to whom agriculture is more largely indebted than to Liebig, who gave to organic chemistry methods of organic analysis. Let us hope, however, that the next theories he brings forward will be brought as the result of experiments extending over a long time, and experiments which satisfy the conditions which I have stated.

Now, gentlemen, is it possible for the members of the Board of Agriculture to undertake experiments and conduct them in this manner? I think you would all agree that at present it might be impracticable to undertake such scientific experiments upon a large scale. What may be called *tentative experiments* may however be successfully conducted by every farmer in Maine. By such an experiment I mean a practical trial in order to settle questions upon one's own farm. This subject will be alluded to by Professor Brackett, in his lecture this evening. Such tentative experiments repeated many times with the same results, have almost the same authority as the scientific experiments which I have detailed. You know the subject of an "Experimental Station" has been broached. It has not been met with any opposition, but perhaps at the present time it would be impossible, for lack of means, to establish an experimental station such as is really needed. We have however an Agricultural College, established upon what seems to be a pretty sure foundation. It is meeting, deservedly, with a good deal of favor; and it is to that institution and kindred institutions that we must now look for some contributions to agricultural science. We must now have these scientific experiments conducted so that they will be types of experiments that we can all try. Experiments as to the real value of muck—a question upon which hundreds of experiments have been tried, and concerning which the most diverse opinions prevail among those who have used it; experiments with plaster, so that we can have that question, which is continually coming up, "What is the use of plaster upon soil?" settled. You can think of many questions which can there be clearly and fully settled.

But, gentlemen, you must not expect too much of the Professors of the agricultural college. Their time is very largely occupied in imparting instruction to the students attending. Only fragments of it are at their command which can be devoted to experiments having for their object an increase of the amount of knowledge at present existing. I am in a position to say this. It is also requisite that you give them your hearty coöperation. They need this as much as they need the payment of their salaries. It is indispensable that they have your hearty coöperation and encouragement in their work.

And now, in bringing to a close these remarks, which have necessarily been brief, and fragmentary, I wish to say that one of the Professors has been very well and favorably known to me and to very many in the State; the other comes among you as a stranger. It gives me pleasure at this time to renew an acquaintance with him very pleasantly begun upon the other side of this continent. I had the pleasure of meeting him in California, where he was undertaking a course of experiments under circumstances of exceeding difficulty. You remember the petroleum excitement in California a few years since. You remember that companies were formed, and superintendents were sent out, and chemists to assist those superintendents. Among them, our friend Prof. Peckham went. He was directed to conduct experiments in regard to the California petroleum. What appliances did he find upon that Ojai ranch, a long distance south of San Francisco? He had no appliances within his reach, and was obliged to draw upon the resources of his own ingenuity, and did what every Yankee of equal ability would have done—he made his laboratory, made his apparatus, and conducted those experiments with success, satisfying in those researches precisely the conditions of the experiments to which I have referred as necessary in agricultural experiments. His results are known to technical chemistry wherever chemical journals are read. They have formed a real, substantial contribution to industrial chemistry and to chemical technology. Therefore it is with hope that we now turn to the Agricultural College of Maine for good results in successful experimenting.

In conclusion, allow me to say, that the latter part of this subject, "The Future of Agriculture," will be treated by another member of the Board this evening.

Remarks of Professor Fernald.

Prof. Fernald, of the Agricultural College, was called upon, and said:

I do not know that I have anything to offer in connection with what has been said, other than to acknowledge the very favorable report which Prof. Goodale was pleased to make in regard to the officers of the college, and to assure him and the other gentlemen of the Board that it will be our endeavor, so far as experiments are conducted there, to conduct them faithfully.

I was very glad to hear the several points so clearly brought out by the lecturer in regard to the methods of conducting successful experiments; that all the conditions should be accurately noted when an experiment is made; that it does not answer to note the conditions at a given time during the progress of the experiments, and neglect to note them at other times, which are equally important; but that an experiment, when once undertaken, in order to be successful must be conducted with the utmost care from the beginning to the close of it; and also that other remark, that every experiment which has been faithfully conducted should be as faithfully and accurately reported, that others may have the benefit of what one observing man has been able to accomplish.

I am not prepared to make any special remarks in connection with this topic; but there are around me a large number of men who, I know, are well able to speak upon it, and with your permission I will take the liberty of calling upon Mr. Scamman, who is always ready.

Mr. SETH SCAMMAN. After listening to the very interesting address by Professor Goodale, I have come to the conclusion that we farmers are "left out in the cold," for every one knows, who knows any thing about the matter, that ninety-nine out of a hundred of the farmers of Maine have not the means, in the first place, to go into these exact and elaborate experiments, and, in the next place, they have not the time. We have but a short season in which to put our seed into the ground, to nourish it, and to harvest the crop; we have to work all the time and give our whole attention to this matter, and therefore we have not the time, even if we had the means, to go into experiments, which we have seen here to-day it is useless, perhaps, for us to go into unless we can somewhat in the manner described to us.

But, it may be a long time before we shall be able to realize what the farmer needs to-day, if we wait for the Agricultural College or for anybody else to make these experiments, and the question arises "Can the farmers of Maine do anything towards advancing this very important and essential matter in agriculture?" It strikes me that although we may not be able to add materially to agricultural science, we may still learn something for our own benefit, individually. For instance, we may not be able to go into an elaborate investigation in regard to plaster, yet I believe that the farmers of Maine may, by observation, determine the usefulness of this fertilizer on their own land. A farmer may use plaster on a given soil and find it very beneficial. Now, if he carefully notes the kind of soil upon which it was used, and the circumstances as far as he can, although he may not be able to benefit his neighbors materially, he may perhaps apply plaster on his own farm successfully and beneficially. For instance, take a stiff, heavy, clayey loam. I have had in the course of my life considerable experience in farming; I have had a good deal to do with that kind of soil, and I have found that the use of plaster, as a top-dressing, is advantageous. I have never used it on that kind of soil when it has proved a failure, and therefore I have come to the conclusion, that if I have a stiff, clayey loam, naturally barren and unproductive, if I can throw broadcast on that soil a coat of plaster, I am very sure the succeeding year to harvest a rich, luxuriant crop of clover. I have never known it to fail, and hence I conclude that plaster on that kind of soil is the cheapest fertilizer that I can use.

Then, again, I have used plaster on sandy soil, and I never saw any benefit at all. Therefore I come to the conclusion that plaster on that kind of soil is not beneficial, and I do not use it.

Now, sir, I think that we farmers, while we are waiting for the results of experiments from the professors at the Agricultural College and from other sources, had better be doing a little in this matter. Even if we do not do it so accurately or scientifically as may be desirable, and perhaps add little or nothing to the science of agriculture by doing it, we may perhaps put some money in our pockets. Therefore I suggest to the farmers in this Convention, that we should, with the time and means we have, be doing a little round the edges, if we do not go into the bowels of the matter.

QUESTION. How much plaster do you apply to stiff, heavy soils, and how frequently?

Mr. SCAMMAN. About three bushels to the acre, every third or fourth year.

Hon. HANNIBAL HAMLIN. I listened with very great pleasure to the lecture of Prof. Goodale, and he made me feel most sensibly how little I knew about the subject which has brought us together; and yet it is an art to which I have given attention during my whole life; it is one to which, if I was so situated, I would like to devote my whole time. Agriculture is the most important of all the arts, and it may be truly said, we know scientifically the least of it. I agree with my friend over the way (Mr. Scamman) that we have not the means or the leisure to apply science to agriculture, and get results which are as satisfactory and certain as science, and yet we need it. We must depend, to a very great degree, upon other sources for accurate experiments, which we cannot expect to be performed by common farmers. One of the first things to be done, therefore, is to strengthen and encourage by every means in our power the agricultural institution which we have founded here in our immediate neighborhood.

There are two kinds of experiments which may be most properly made, and each will contribute in aid of the other. Certain scientific experiments, in which all the conditions of the seed, the climate, the soil, and everything which shall make the results as certain as science, are to be made; and then there are to go along in aid of these that which all of us can do to a certain extent—practical experiments, which will not be so accurate as those which will be embraced in the first class, for we can, at best, have but few who will be able to apply scientific principles, in a satisfactory manner, to the problems of agriculture. But to our Agricultural College we may look with much hope for scientific experiments and practical results; and I think, as my friend Scamman has suggested, that there are a great many experiments and observations which we may make by careful annotations of soil, and such other auxiliary means as we may bring to our aid, and we may thus contribute in aid of that which is scientific and fixed.

But there is one great obstacle in the way, which must be removed before either of these things can be done. I wish it did not exist; it surely ought not to exist. How many men have we in our community who avoid a county agricultural association, who are hardly willing to open a book and read the results of agricultural experiments, either scientific or practical? How many men there are in the community who find fault with a man because he is a "fancy farmer," as they choose to call him? Well, sir, if a man be nothing but a "fancy farmer," if he is able to make scientific experiments and produce scientific results, and if he shall give to the community an improved vegetable, or improved stock, which is nothing but the result, if you please, of fanciful experiments, do our people remember how very much good that man may do? Apply that principle to stock raising. How many hundreds of thousands of dollars have gone into the pockets of the farmers of Maine by the efforts of a single man in our State, who within a few years has so much improved the breed of horses? I need not name the man, because every one who hears the suggestion knows to whom I refer. Yet you may say that man is a "horse man," a "fancy horse man," perhaps. Suppose he is a "fancy horse man," if he gives us a breed of horses that are worth twice as much as the animals we have produced heretofore, I ask you if that man is not a public benefactor? Most assuredly he is. And so of experiments in the production of new varieties of vegetables, even though they are not scientific experiments. I am dividing experiments into two kinds, because I am free to admit that we have neither the time, nor the knowledge, nor the means, to make just such experiments as Prof. Goodale has told us are necessary for the advancement of scientific agriculture, and which I know as well as he does are necessary. But outside of these, there is a class of practical experiments which we may make which will aid us along the road of progress in the art, and, I might say, the science of agriculture.

The time ought soon to come when the word "art" shall be dropped, and agriculture be, what it is in truth, a science.

Now, we have all of us got to help. Mind acts upon mind, community acts upon community. We are all interested in this subject, and we should all aid in elevating the minds of our community, to bring them up to any kind of an experiment, whether it be practical or scientific; because it is still said by too many of the good men in our community, "That man is only a book farmer," "That man is only a fancy, experimental farmer." Well, if he be only a "book farmer," if he will apply his book knowledge practically, and will give us better vegetables, better stock, better results from the farm, he is what Dean Swift said, a great many years ago, of the man who made two blades of grass grow where but one grew before—"a public benefactor."

How are we going to do it? We shall do it by coming together, by talking with each other, by creating an interest, by stimulating each other along the path which shall produce those results.

Now, sir, that we want these scientific experiments and results no sensible man can doubt. That we should all give our aid to secure this desirable end, in the best possible way, is equally true. That best way, in my judgment, is to bring to bear the best means we can to sustain our Agricultural College, and trust to them for the scientific results, we to take their science and apply it in practice after they shall have made it plain to us. These are my views, and I shall, in my humble way, contribute in both directions.

S. F. Perley. Hon. S. F. Perley being called upon by the Chair, said:

Mr. Chairman and Gentlemen,—I am not prepared to speak upon this subject, but I can say that the influence of the lecture upon my mind was similar to what it was upon the mind of the gentleman from Cumberland (Mr. Scamman,) that Prof. Goodale had almost shut us farmers out from trying experiments, and for this reason: He says the first thing we require is, to know what the soil is upon which we are to try the experiment. Gentlemen, which one of us who handles the plow can tell what the constitution of the soil is? We have been dosing it with superphosphates, with plaster, with barn manures, and a variety of things, which are all having an effect upon that soil, and how are we to know what our soil is? We scarcely know anything about our soil, and this being so, how can we make scientific experiments?

But as the gentleman from Penobscot (Mr. Hamlin) says, if we cannot make scientific experiments, we may make practical ones, that will be of use to ourselves. If we pursue an experiment upon our own farms, year after year, and find it successful, no matter what the constitution of the soil is, we may venture to say then that we have tried an experiment, and know that nature answers "Yes;" that is to say, if we succeed in raising crops as we hope to raise them. I do not know but it is just as proper, if we fail every time, to say that nature has given us an answer. If we try half a dozen times to raise corn upon a piece of land, and fail, we might as well admit that nature says "No" to that, and try some other spot, or try some other method, or some other manure. I have been rather a dabbler in experiments, and my neighbors have laughed at me sometimes for it. This very summer, they caught me weighing some potatoes. I saw them smile, but I was not at all disturbed, for I ascertained in that way that there was a difference of fifty per cent. in the result of different kinds of manure that I had used upon the same ground. Yet I have thought since that I may have been mistaken in regard to that very experiment. I labored very carefully, and thought I knew everything about it. But I dumped the different manures upon the ground, and, query, did not rain come, and if so, did not the land under these piles of manure get more than its proportion? If not, did my boys spread that manure so that every foot of ground got its due proportion On the whole, I have but little faith in the results of that experiment. I thought I was doing the best I could, but really I don't think it amounts to much. And yet, if I were to pursue that same series of experiments half a dozen years, and the same answers came from the same manures every time, I should believe that the experiments were worth something.

There is a great deal of truth in what has been remarked here, that few of us have the time, few of us have the money that we can afford to spend, and few of us really have the ability to give proper attention, and notice carefully and correctly the answer that is given. I must say with regard to that, that it is very much as it is with stock breeding. A man who does not love an animal is doing a foolish thing if he undertakes to raise stock; and the farmer who undertakes to make experiments must have a love for it, a kind of genius for it, or his experiments will not be worth much to him, or to anybody else. So I do not think it is for all of us to become experimental farmers, to record experiments and make a report of them. That must devolve upon a few. We all know that we now have provision made for some agricultural experiments, and we hope that they will be useful. But so far as we farmers are concerned, I do not think that the man who loves his animals above all things can ever make a good field farmer, or make a good agricultural experimenter. The man who loves his field crops above all things will never make a stock breeder. We have different natural capacities, and we must all devote our efforts to determining which we think will succeed. I would not say to every farmer, "Try experiments, write them down, and record them in the newspapers," but I would say, "Try experiments year after year;" but I do not think it would be well to report them, because they might not be reported accurately. But upon our own premises we can determine what we can do upon the different soils, and what manure will do upon one piece of soil and upon another. We can all of us be our own experimenters after a practical fashion. And yet I wait with a great deal of impatience for the time when reports shall be given to us by scientific men who are competent to examine the soil, and all the conditions, and report them to us.

The reports of Messrs. Lawes and Gilbert have been mentioned. Those reports are intensely interesting and of the highest importance to the farmers of Maine. Although their experiments were made in England, under different conditions of soil and climate, no American farmer can read their reports without being the wiser for it. Those experiments were made by men competent to the work. I wish there were a hundred men in the State of Maine competent to make similar experiments. There may be a dozen, there may be two or three. I hope we shall hear from them in due time.

In regard to our friend the lecturer, I do not want to discourage him at all, but I must say he rather damped my ardor in experimenting. Perhaps what he has said is all true, and it may be that none of us will be discouraged from trying experiments in our own particular locality; but it is certain that none of us will undertake to become scientific analyzers of soils or crops.

Mr. Samuel Taylor. Samuel Taylor of Fairfield was called upon, and said:

I feel altogether unfit to make any remarks which will be edifying or useful. I have been through life what may be called a harum-scarum farmer. I have raised a few potatoes, and some pretty clever animals; I have gone into Knox horses, and into Durham shorthorns, and have raised some pretty good ones; but I feel that any remarks which I might make to this audience would be of very little edification. I must beg to be excused.

Mr. Z. A. Gilbert. I am somewhat surprised that I should so widely differ from some of the gentlemen who have preceded me in the impressions that I received from the lecture to which we have just listened, which has been interesting to all, without doubt, and extremely so to me. Instead of its having the effect to dampen my ardor in the way of experiments, I must say it had the opposite effect. The lecturer pointed out to us the importance of accuracy in experiments, and his remarks coincided with my opinions precisely, and seemed to strengthen me in the conviction that we should all of us improve every opportunity to make experiments, and note all the conditions of those experiments, and their results, that others may have the benefit of them. I know that most of our farmers here in Maine are not scientific men, and that in the Board of Agriculture, until the present time, we have not had a very strong scientific element. We have recently had such an element grafted upon it, and I look forward to some important advantages to be derived from that element. But meanwhile we can work in a practical direction; and I was much pleased with the remarks of Mr. Hamlin upon that point. We should not, because these scientific experiments are called for, and because they are of great importance, cease our experiments in a practical and more humble way. They are of importance still, and if we can unite the two, and have scientific and practical results, we shall gain great advantages therefrom. We are all aware of the truth of the statement of the lecturer, that scientific experiments have not been conducted in America to any great extent, and therefore we are somewhat in ignorance in reference to their results. English and German works have not been brought before the people for study. We have not access to such works, except in the extracts which have been furnished us at times by our secretary. I have felt the need and importance of such works, and hope that in the future we may have access to them, and be benefitted thereby.

Prof. FERNALD. I hope there will be no misinterpretation of the bearing of the lecture that has been presented to us this morning. Prof. Goodale has delineated in a clear manner the method by which experiments can be successfully made. If we are not prepared as farmers to enter upon a course of experiments in the extended and elaborate manner indicated, we can certainly do something that will be a benefit, not only to ourselves, but to all interested in the science or the art of agriculture. We may follow the humbler path alluded to by the lecturer. If we cannot take that which true science points out, each man may experiment for himself, and may let the results of his experiments be known, so that his neighbor may profit by them.

The remark was made by some one, that it was well for a man to experiment, but he should not report what he has accomplished. Why not report it? Why not, if he has found out anything that is useful to himself, let his neighbor have the benefit of it?

Mr. PERLEY. Will the gentleman allow me to interrupt for one moment? I made that remark, and it was with this view. We farmers have not the ability to make correct reports. That is, we cannot accurately state the conditions of our soil; we cannot state all the conditions of the experiment. If we make a report, somebody else may undertake to follow it and be misled.

Prof. FERNALD. If I may judge by the remarks made by the farmers present this morning, it would seem that almost any of them would be able to make a report that would give some pretty clear idea of the result of their experiments. Of course, there would be some conditions that they could not report, and they would be obliged to leave them out. But let them report as fully as they are able what they have done, and they will find, by practical work and observation, that they will be able to observe and report better and better, and their friends and neighbors will have the benefit of what they are able to do.

The point I wish to make, however, is this: that while it is well to conduct experiments scientifically, and while it is well to have tentative experiments, and a great deal may be learned from both, the minds of men should be disabused of the idea that experiments scientifically conducted are not practical. If there is anything in the world that is practical it is high science; and it is only when man goes down into the depths of nature, and fathoms her mysteries, and brings them out to the world, that any advances are made; and when man has done this, we find there is a great overturn of things as they were, and any art or science is advanced thereby. I trust that in the deliberations of this Convention the sentiment may be advanced, and that it may be spread throughout the State and everywhere, that there should be, as there is, no conflict between what we call practical work and scientific work, for they go hand in hand together in all that relates to progress.

SECRETARY GOODALE. If I rightly apprehended the intent of the lecturer, it was not in the least to discourage the practical, every-day experiments which every farmer can and should make, but rather to set forth the conditions which must be complied with to insure success in a more difficult class of experiments. The doing of this substantially aids the farmer in successfully prosecuting his practical experiments; for some of these conditions, and many more than we may at first suppose, are equally applicable to both classes. The commonest of all dangers is, that we attempt to make deductions from too scanty and uncertain data. He told us that the question put to nature should be plain, and that it should be pointed—that is, I suppose, that it should have one point only, and admit of only one answer. Now, for example, take the question, "Is salt good for cattle?" That may appear at first sight to be a plain and pointed question, but in fact it is a very complex and many pointed one, or many questions in one; and we accordingly find a wide diversity of opinions upon it, as the result of imperfect attempts to determine the true answer. One farmer says he would use salt if it cost ten dollars a bushel. Another says he gets little good from it. Let several farmers try to settle the matter by putting the question to nature. One may seek the answer by giving it to young growing cattle, another to mature animals, a third to working cattle, and a fourth to fatting cattle, and all may get different answers. This question has been the subject of careful research at one or more of the German Experimental Stations we have heard of, and it is found that its value differs widely with different conditions of the animals. Again, salt would undoubtedly be found more useful in Aroostook or Piscataquis county, far from sea breezes, than on the shores of Hancock.

The only way to get a satisfactory answer to such a question, seemingly simple but really very complicated, is to divide it up and put it in detail,—with regard to one animal at a time. It is only after obtaining a sufficient number of answers, and carefully noting the conditions under which they were severally given, that we have the data needful for an answer. If we look into this subject a little we shall find that, very often when we imagine we are putting one question to nature, we are in fact putting a good many in that one, and hence the difficulty of rightly interpreting the answer which we get.

The point I desired to make is this: let no farmer be deterred from trying experiments, nor from reporting them, but because the problems with which he deals are, for the most part, complex, let him make his question as single-pointed as possible, and his report to include where, and when, and from what, and how, his answer came, and then that answer will be an actual contribution to knowledge on the subject. Small as the contributions may be individually, yet in the aggregate, when they are brought together and collated, definite and valuable results will be obtained.

D. H. Thing. I was very glad indeed to hear the lecture to which we have listened, and I am sorry if anybody felt that a wet blanket had been thrown upon farmers. I think the gentleman made ample apology for the lecture, when he mentioned the experiments stated last winter in reference to scalding seeds before planting. Many who are present recollect that discussion. We had some eminent men from Massachusetts, Dr. Loring and Ex-Governor Brown, and they disagreed utterly. Mr. Chamberlain, of Foxcroft, also disagreed with Dr. Loring entirely. I thought to myself, "If doctors disagree, how shall we farmers decide? We can only come to the conclusion, that we will not boil our corn before we plant it. We do not know how hot to make the water; we do not know what temperature will kill the fungi without killing the seed, and we know less now than we did before." Now we want somebody to make the experiment, and let us know the circumstances under which it was made. It is rather vexatious to plant corn and wait three or four years for it to come up.

Prof. Goodale. I am very sorry that the remarks I have made should be considered as at all of the nature of a wet blanket, for I certainly did not intend to discourage the farmers present, or in the State of Maine, or in this country, from experimenting, in a practical way, for they have received, year after year, directions how to conduct these experiments in the reports of the Secretary of the Board of Agriculture of this State, and in the reports of similar Boards in other States; but I was endeavoring to show and I hope I did show — in fact, the remarks which have been made satisfy me that at least some impression was made,—I was endeavoring to show, that we need another type of experiment, in which all the conditions will be carefully considered and recorded. For that, we must look to the Agricultural College. But there are experiments which farmers must try upon their own farms. It was chiefly of scientific experimenting that I proposed to speak. Practical experimenting may come more within the scope of Prof. Brackett's lecture this evening.

Adjourned to 2 o'clock, P. M.

Afteroon Session.

The Board met at 2 o'clock, Mr. Scamman, of Cumberland, in the Chair.

The session opened with an essay on Physical Geography, by Mr. Thomas, one of the students of the Agricultural College, which was followed by exercises on the same subject, under the direction of Prof. Fernald, in which the physical characteristics of North and South America and Australia were described and explained by Messrs. George, Gould, Hilliard and Norton. Several questions were put to the students and answered to the satisfaction of the interrogators, and the entire exercises manifestly gave great pleasure to all present.

Evening Session.

The Board met soon after seven o'clock, and the President stated that the topic for consideration was "Progress of Agricultural Science," and introduced Prof. Brackett, of Bowdoin College, as the first speaker.

Lecture by Prof. Brackett.

Phonographically reported by J M. W. Yerrington.

Mr. President and Gentlemen:—It will doubtless seem presumptuous in me to attempt to say anything on a subject as broad as this appears to be in its enunciation. I will disclaim at the outset, being a prophet, or the son of a prophet; I cannot predict what is to be the future of agricultural science, but I am happy to believe that you will be willing with me to resume the subject of the morning, which was so ably treated by my friend Prof. Goodale, and enter into a familiar discussion of it this evening.

We are to discuss the "Progress of Agricultural Science." In briefer language, the subject may be thus enunciated,—"The Future of Agriculture." It is a truism for me to say, that the future of agriculture is involved in the present; and yet, if we understand that idea, and examine it in all its width and depth, we may perhaps get some profit. The future, then, of agriculture is involved in the present. But what is the present? What do we know? What is our condition? Go with me for a few moments, while we take account of stock, and see what we really do know; and then let us answer the inquiry how we came to know what we do; for, seeing first what we have, and secondly, how we came to possess it, we may be better able to devise measures for the future, which measures, put into effect, will determine what that future is to be.

Now I say, the agriculture of the present, and indeed the agriculture of all time, is but natural history applied. Applied to what? To the production of food, to the production of sustenance for man and beast; shall we say, limiting the whole matter there? We shall need to do more than take that view of it. We shall need to look at agriculture in *all* its relations, not simply with reference to the production of our daily bread, which I admit is of primary importance.

If agriculture is natural history applied, let us inquire still further, what is natural history, and how have we come to our present attainments in this department of knowledge? Natural history takes up whatever is found upon the earth, or indeed within the earth, and, in a still broader sense, whatever may be discovered from the earth, and attempts to describe, systematize and classify it. It attempts to do all that. Before I go further in that direction, I beg leave to call your attention to the fact, that in the development of science—(and here allow me a parenthesis: I say what I do now more especially to those members of the Agricultural College whom I see before me, and I hope to be able to fix upon their attention, if I may by a brief word, this idea)—there is a fixed, inevitable order, that cannot be transgressed with success. Let me illustrate what I mean. The very first science that is ever developed in a connected scheme is that of logic, or the science of reasoning. We are so constituted that we cannot help reasoning; one mind reasons as another does under the same conditions. That is, all men's intellects work in precisely the same way, under precisely similar conditions, and when they carry out their legitimate work it becomes logic; and when it is first applied to number, or to reasoning in number, it gives rise to arithmetic; arithmetic applied to reasoning in quantity gives rise to algebra; and this applied to reasoning in space gives rise to geometry; and when geometry has been perfected, and we take the materials thus far secured—namely, arithmetic, algebra and geometry,—and apply those to force, an entirely new conception, we are then able to develop mechanics; and I use that term in its broadest sense, as embracing machines and machinery, astronomy, hydrostatics, hydrodynamics, and everything that pertains to natural philosophy and natural philosophy applied. When this is done we are prepared to advance a step further, and develop chemistry; and when chemistry has been thoroughly perfected, we are prepared to advance a step further still, and develop physiology or the science of life, whether vegetable or animal.

I have followed in this statement of fact the natural order that we should pursue if we were to continue one thing until we had accomplished it before commencing another. It is, however, by no means incumbent upon us to PERFECT any one of these preparatory sciences before we enter upon the succeeding one. For instance, you may do something in chemistry before you have settled everything in natural philosophy; you may do something in natural philosophy before everything in mathematics is settled; but if you were to go clean through everything, and to develop each science in its natural order, you would pursue that which I have given.

Now, have the sciences, as we find them to-day, in a more or less perfect condition, been developed in the order which I have sketched? Have mathematicians seated themselves and patiently toiled through the mazes of their calculations and completed all their labor before they entered upon natural philosophy? Not at all. Did the natural philosopher conclude all his work in physics before he ventured upon chemistry? By no means. Did the chemist complete all his work before the physiologist dared to reason upon organic structures? No; all these pursuits have been going along at the same time, side by side. How has this been done? By the employment of another method, which we will call the empirical method. There is, then, the scientific method, which we might pursue, beginning at the simplest elements and evolving a complete, perfected science; there is, on the other hand, an empirical method, which takes up all the conditions of an experiment in the gross, and evolves results. I will, for the sake of clearness, put it in this way: The one reasons in extension; it takes an involved principle, evolves it, proves it, and then applies it in all possible conditions; it is extending the principle. The other is reasoning in comprehension. We take all the conditions and do with them as a mass whatever we please, and evolve such results as we can. And right here, gentlemen, is the line to be drawn between us as experimental, scientific farmers, and as practical farmers.

Now, I undertake to say that my friend who spoke in the morning (Prof. Goodale) will perfectly agree with me in this. Most farmers will take the great mass of the conditions that are presented to them in the gross, and experiment to good purpose. There is no intention, either on the part of myself or of my friend who spoke before me, "to throw a wet blanket" upon that kind of experiment, or, indeed, upon any which can be undertaken properly. The farmer, then, we say, will always find a field open to him for successful experiments of this sort.

Let me illustrate by an example. I will take the ox. Look at him in a practical way now. An ox is nothing but a machine. He is a machine to accomplish what? The transformation of grass and grain and roots, it may be, into fat and flesh, hides and horns, and all the other available products that you can get from him, and lastly, to give up to you what you cannot use as food, as bone phosphate, etc. You are going to use him as a machine. Now, as a scientific experimenter you would begin and say, "Oxen are composed of so much phosphate of lime, so much hydrogen, a certain amount of oxygen and nitrogen, a little iron, a little chloride of sodium, and several other constituents; I will put these through certain cell processes, by strictly mechanical and chemical laws, and ultimately, if nothing oppose, there will be a perfect ox evolved." As a theorist, you will set yourself to tracing each element that enters into the structure of the ox through all its changes, until it is fixed in the tissues. That, for science, is a very important work, when it can be done. That will enable some one to put his finger upon the seeds of disease and perfect a system of rational medicine. But then, the farmer, and all those dependent on him would starve if everybody went to work in that way. Let us see what else we would do. Somebody noticed that the ox flourished very much better if well fed; and somebody else observed that he flourished much better when sheltered; and therefore the barn was built, and filled with hay and grain, and the ox, with all the conditions to transform grass and hay and grain into flesh was put into it; and the experiment went on there in the gross. That is what I call empirical experimentation. It is scientific. It is exactly the kind of experimentation by which these sciences, about the accuracy of which we prate so much, have been developed. Did men sit down and reason out mathematically all the problems they have presented to us, before they began to experiment in physics? Not at all. They tried experiments with levers, and pullies, and Atwood's machine, and a thousand other contrivances, putting questions to nature through them. We cannot always employ mechanics and mathematics in asking questions. For we do not always desire answers in mechanical or mathematical terms. We get them through massing the conditions; always seeking, however, to put our question pointedly; and when more conditions than one were involved, always knowing the fact, and reasoning correctly as to their importance to the experiment.

Now, then, if there be a fixed order resulting from the interdependence of the sciences, and if that is the order in which they shall be perfectly unfolded, and if they have not yet reached that perfect unfolding, is it not hopeless for any one, no matter who he may be, to attempt to sketch to you a scientific method of agriculture that shall be perfect? I will contrast agriculture with one of the learned professions; and I do that the more readily because I see some of its representatives here, who will bear me witness in what I say. I refer now to medicine. We talk of it often as if it were a science; we dignify it with that high-sounding name,—"the science of medicine." Gentlemen, it is no science at all. On the contrary, it just puts its hand upon this and that and the other science, each imperfect, selects whatever useful facts they may have evolved, and uses them as it best may. Now, what do we do, in general, when we are out of health, when some pestilence comes upon us, or we abuse the laws of nature until we find ourselves suffering from disease? We send for a man who has given himself to the study of these various subsidiary sciences, that make up the collection of facts that we call medicine, and ought, therefore, to be able to cast more light upon our case than we can ourselves. That is what we do, if we are *rational* men,—we send for a physician. But yet there are plenty of people who say, "If I am sick, I don't want any doctor round me. I would rather have the herb teas that my wife can steep for me; or Mrs. So-and-So, who knows all about fevers and all about dysentery; or Mrs. So-and-So, who is very good in sickness."

Yes, there are plenty of men who are ready for any emergency, and they gather at taverns and country stores, and discuss in the most learned way, their theories of cholera and dysentery, and typhoid fever; they know all about diseases, and a physician would be perfectly useless to them. I must object to intelligent farmers proceeding in the same way; for they all laugh at their friends who, when they are sick, take this course.

Now let us see how the case stands with us as farmers. We have the soil to deal with; we have plants to deal with, and they are very complicated things; we have animals to deal with, as complicated in structure, nearly, as we ourselves are. If we do not trust our own knowledge when we are out of order, but send for a physician who is supposed to understand our case, why should we any more trust ourselves, without making some careful and thorough study, in dealing with the nice organism of plants and animals? I take it for granted that there is not a gentleman present, who reasons like these men of whom I have been speaking. You are men accustomed to think—the very fact that you are at this Convention evinces that—and you will not reason in that way; but if your soil is out of order, you will want to send for the soil doctor. But where is he to be found? Where is the physician who understands this diagnosis? We have not seen him in these parts, at any rate. And here let me say, gentlemen, is a point to which I wish careful attention to be given. It is the function of our medical schools to train up men whose business it is to look carefully into anatomy and physiology, the general workings of the human system, and its relations to nature about us. And it is not enough to understand man alone; they must understand every thing about him; they must understand all the climatic and other influences that are brought to bear upon him. It is the aim of our medical schools to give this knowledge, but they do it as I well understand, very imperfectly. It should be the aim of our Agricultural College to do better the same thing for the farmer.

But, you say, the whole community does not go to a medical college to be educated. Very true; we do not want all to go. The whole community will not go to the agricultural college to be educated. Very true; it it not necessary. If the whole community had to go to medical colleges in order to be instructed in the secrets of life, that its members might live, the community would have perished long ago. But a kind Father has so ordered the whole matter, that much as we abuse these systems, widely as we may err of the best way in taking care of them, the human race has gone on very comfortably these many years, and seems likely to be continued for many years to come. But, gentlemen, the "science of medicine" has lengthened human life, and those nations that best understand it have lengthened their days by the greatest number; and as we as a community better understand it, our days shall be lengthened also. And so it will be in the matter of farming. Just in proportion as intelligence is diffused with reference to the principles that underlie it, will be the success of agriculture.

Now, gentlemen, I do not mean to say that every student who graduates from the Agricultural College is to burden his back with his pack, or take his saddle-bags and travel about practising agriculture, exactly as many arrant quacks travel about practising medicine. I do not mean that; nor do I mean that they shall settle in the community exactly on the same terms as physicians, and there hold themselves ready for calls to treat gouty soils, or repair broken implements, or anything of the sort. But, with your patience, I will try to make myself entirely understood. I was happy to notice, this afternoon, in the exhibition of some of the principles of physical geography, an intelligent appreciation of the fact that the earth's structure,—those great natural feature lines which were drawn by the finger of the Almighty in the first place —had something to do with the location of cities, had something to do with the distribution and the pursuits of men upon the earth; that they are determined, primarily, by those facts. Moreover, the physical geography of a country gives rise to its geology; the one is parent of the other. The fact that we have mountain ranges running as ours do, and river systems such as ours, is settling the future geology of this continent. We are having a great delta formed at the mouths of the Mississippi, and there are various changes going on upon the face of the country which will result in a different order of things, some thousands of years in the future. We are learning that the present condition of things is the result of a physical geography very unlike that which now exists, and *that* physical geography determines our geology and determines the character of our soil. These young gentlemen will reason rightly in this matter. The very facts which they are learning of physical geography will enable them to go out upon the soil and by inspection say what its character is, exactly as the physician goes into the sick room and makes his diagnosis. He feels the pulse of the patient, looks at his tongue, asks certain questions as to his descent, &c., and then makes up his mind as to his condition. The patient is the result of circumstances. He receives his constitution from his parents; he has treated it improperly or imprudently, and so has come into his present condition. The physician ascertains these facts, and is able to administer the proper remedies. So the geologist can go on and ascertain facts that will enable him to say what is the general character of the soil and what are its needs.

But, to pursue the illustration still further, the physician in attempting to make up such diagnoses, will sometimes find a case where the general determination does not answer; he is obliged to study it more carefully; he examines every portion of the excreta carefully, microscopically, and brings the latest discoveries of science to his aid; scrutinizes every possible condition about the patient, and finally gets a clue to the difficulty. So our future agriculturist, who shall be educated at the Agricultural College, will be able to go into the community and give general advice, or apply his chemistry in special cases and give particular advice.

I will propose a name now for a class of men who are wanted, but do not yet exist, and that name shall be this, growing out of their function. They shall be called "Consulting Agriculturists." They shall not be arrant quacks, who will analyze a sample of soil for "five dollars," and tell you you can do things which you cannot do; but men who, acquainted with all the facts of science that can possibly be brought to bear, and acquainted also with your empirical experiments, which I have not failed to impress upon you as important, will be able to give you general directions, and specific details when they are necessary. I insist upon it, that the agricultural colleges shall turn out men to whom the community may go with confidence that they understand physical geography, chemistry, and all the collateral sciences, and are competent to apply them to the raising and perfecting of crops; and I propose, I say, that we name them "Consulting Agriculturists."

Now, then, speaking of the Agricultural College, you will not fail to see that the future of agriculture, if my reasoning thus far is correct, is indissolubly bound up with it, or whatever may take its place as a substitute. Some agency like it is needed. Let us inquire, then, what should be taught there, and how it should be taught? We can answer that question by going back to our first inquiry, What is the agriculture of to-day, and what must the agriculture of all time be? It must be, as I have said before, natural history applied. It is natural history applied to definite ends. I now make this point, which I ask you to consider. Agriculture stands related to every other pursuit in life. Let us inquire how it stands related. We can best do that by presenting some of the reasoning we sometimes hear among farmers. The farmer not unfrequently makes this assertion, which seems to him perfectly proper, with reference to manuring his land: "We should never allow our hay crops to be carried away from the farm; the hay should be consumed upon the farm, and only the drain of the live stock allowed from it; the manure should be returned to it." But, gentlemen, you will not fail to see, on a moment's reflection, that large cities, centres of commercial and professional activities, are just as much a part and parcel of the plan of the Almighty on the surface of this earth as agriculture itself, and if we are to have a large city like Bangor, or Boston, or New York, or like the cities of the old world, they must have, as they are at present constituted, at least, a large number of animals, and they must derive their sustenance from the soil. Whether you will or not, your hay will go to those cities. You cannot consume it all at home, because, if you attempt to do that, you fight the Almighty in his plans. Your hay crops will go, in some measure, to the cities. You are then brought seriously to consider the question whether you will attempt to transport back again to the soil whence it came these waste products in the form of manure. Study the problem for one moment. Take London for example: a mighty city; all the soils of the earth, almost, contribute to its sustenance; our own western fields being drained every year to supply a large amount of breadstuffs to that city. Is it possible that the whole can come back to our own land to restore it? Tell me what feats of engineering would be equal to the transference of such immense masses of matter as the sewerage of a city like London back to the soil. We should need all our sciences, mathematics, physics, chemistry,—directed by civil engineering, and applied to their utmost, and should not be able to do it then. That is not all. Take one of our manufacturing towns. Its sewerage inevitably passes, more or less, after all precautions are taken, into the streams, the streams carry it to the ocean, and the ocean finally swallows up these products of the land, we resorting all the while to some temporary expedients to obtain substitutes for that matter.

Now, do we not see that agriculture stands related to all these pursuits? It stands in a peculiar relation to them, and that peculiarity consists in this: that its resources are being exhausted every day. And do we not see, further than that, that political economy lies at the very basis of agriculture, and that we must devise a system that shall not be self-exhausting, and doomed ultimately to perish in the using; but a system that shall be able to give back to the earth what it takes from it. This is one of the things that agricultural progress is to do. It has yet to be settled some way. And when I say that, I say it on this general principle. The fact is recognized as a matter of scientific demonstration that the fertility of our soil is deteriorating every year. The end of that thing will come sooner or later unless properly regulated, as it has come to some of the nations that have already perished from the face of the earth. If we, as wise legislators, (for we are all supposed to have to do with the making of laws,) would have a system of political economy that shall be co-extensive with our wish for prosperity, we must so devise it, in the first place, that it shall not be self-destructive. You will ask me how is that going to be done. I do not know exactly. It is a problem I confess that I cannot solve; I have not the means for its solution. But you may rest assured that in the future, the attention of men must be turned to the application of mathematics, of natural philosophy, of chemistry, and of all those sciences upon which agriculture depends, and which it is made up of; and the science of its relations to other pursuits so as to involve a compensating and self-maturing system. These matters and such as these must be thoroughly studied and mastered at the agricultural colleges of our country.

I know that is not the way men usually reason; men say they want something *practical.* Gentlemen, what is life for? What do you raise your corn and potatoes for, except to live on; and what do you live for except for the future? And if you are going to throw away the future, the very object that makes life worth living, don't raise any more corn or potatoes; let us die now; we might just as well starve here, as live to no good purpose. Now, all these "fine-spun theories," as you may call them, are based in eternal right and justice. So surely as God has planned and made this universe, so surely his laws must be recognized, and we must make the endeavor to carry them out, in dealing with the things which he has put into our hands. This, then, is exactly what I mean by something practical. The engineering of the future must be so perfected and applied that we can carry back to the soil exactly what we take from it, save only these very bodies of ours, which we may permit for a few years to rest in the cemetery, when in due time, they themselves shall go back to the soil. "Dust thou art, and unto dust shalt thou return." They will not rest useless, but in form of ammonia and bone phosphate must go back to the soil, in the same way that we carry back that derived from the slaughtered cattle. "The earth is the Lord's and the fullness thereof," and the system of agriculture that does not strike deep enough to reach that idea does not strike deep enough to prosper for any great length of time. The blasting breath of the Almighty has come down upon those nations which have violated these principles, as witness some of the older nations and some portions of our own land, where negroes and tobacco have been sent off the land until it is comparatively worthless. In the future, therefore, of agriculture, these young men are to take up just such ideas as I am giving you, and become the masters of them ; to become the teachers of the people besides indoctrinating them with the principles of natural history applied to the production of food for useful ends ; namely, raising moral, upright, Christian men and women, so that the life shall not be thrown away after it has succeeded to this inheritance.

Now, gentlemen, I have reached one great practical end, "Utopian" you will say, "looking forward to the millennium, when all things are to be perfect, and there is to be no more trouble?" Not at all, in the sense in which some will derisively speak of it. But I recognize before me intelligent men and women, who are living for a purpose, living for a definite end, clearly marking out for themselves what they will attain to ; and just as soon as they take this matter home to their own firesides and thoughtfully consider it there, every man and woman will say "Right."

Now let us be a little *more* practical about it. In what way can we apply physics to the improvement of the soil, or to bring about these ends? First, let us take mechanics, to illustrate. The soil may be improved by simple tillage. I heard two of these practical common-sense farmers talking this evening, and they said that the more land was plowed the better it was. That is perfectly scientific ; it is perfectly practical. But what are you doing when you plow a field but applying the principles of natural philosophy? That is to say, do not the principles of natural philosophy find their expression in the instrument with which you plow, which has a certain proportion of parts, which has been studied out carefully, on the principles of the inclined plane, the lever or the wedge, so that the soil may be properly turned and broken, and all its parts brought under the chemical influences that best fit it for the crop. Is not that mechanics applied? Who thinks now of inventing a plow without stopping to make it conform to scientific principles? You may take a knot, fasten it to the horns of an ox, drag it across a field, and call it a plowing, but it is not; it is only a very rude experiment. When, however, you apply the natural principles which may be applied by the study of physics to the machine we call a plow, then mechanics may be applied to tillage.

Secondly, hydrodynamics—the science of water in motion or at rest, that is, the power of water,—may be applied to draining the soil. When we come to investigate and understand the whole matter of the laws of drainage, and apply them to the improvement of unproductive soil, we make it bring forth many fold more than it did before. But plain farmers, without studying natural philosophy, do that to a certain extent exactly as I have been telling you. That is one of the empirical experiments which every common-sense man, leaping over all the deductions of logic, arrives at almost intuitively.

We admit that *soils* may be improved by the application of mechanics, and by chemistry. Suppose, on the other hand, we look at the productions of the soil,—how may they be improved? Take plants, for instance. You commence with crossing the different varieties that you may thus experiment with. You take into account the laws of vegetable growth and production; you may make shrewd guesses without studying up all these, and bring about very important changes, and reach very desirable results. You may do much better if you are able to go to your consulting friend and receive the exact hints you want. So also with reference to zoölogy. Any experiments you have to make there, you will be more likely to succeed in if to your own native common sense, sufficient to conduct you aright in ninety-nine cases out of a hundred, you add the simple hint that you can get from a man who has patiently studied the whole matter, both practically, as you have done, and scientifically, as he may do at the Agricultural College.

It was my fortune to be in college at the same time with one of the learned Professors of the Agricultural College. I know very well from the reputation he had then for constant application to study, the position which he took, and the general power that he had over his associates, that he will be one of the men who will always be ready to experiment to bring about these results. Indeed, I have no doubt that the college is intrusted to just the proper hands to receive these results, so far as may be in the present condition of things.

What, then, is to be the future of agriculture? I have told you what we have at present. We have natural history applied,—natural history in its imperfectly developed condition, and the natural sciences in their imperfectly developed condition. In the future, then, of agriculture, if it is to grow out of the present, I think I see something like this: In every community, somebody to whom the great mass of agriculturists may go, who is shedding light upon all these matters. The object of the farmer is to procure food, first, for his own sustenance and that of his animals; secondly, to develop and maintain the proper, honest and just relation of agriculture to these other pursuits, without which he himself will fail; and thirdly, to look beyond his own country, to look abroad into other countries, where his products go, and develop and maintain just, proper, friendly and righteous relations with them; and as primarily the sustenance of man comes from the earth, and as all things go back to it sooner or later, so it seems entirely proper that he should make provision that they should go back in the right places, to be most available to those cities in this country, located as the Almighty has located them, and those towns across the water, located as they are, that all may get their portion in due time.

I see also in the future instead of the bone and muscle that do most of the hard work of farming at the present time, mechanics applied, in the form of labor-saving machines, steam engines, and the like, that will take the place of sweating animals and toiling muscles, and so a great gain of time will be secured, which may be applied to the study of those conditions, a knowledge of which we all feel that we want to-day.

If it has been the pleasure of the Almighty to place us in the condition we now occupy, there is no need our being at all frightened about these conditions being too hard for us. On the contrary, we develop ourselves when we develop the resources of nature. The two things go hand in hand, and the best results are to be secured by that system which is furthest and widest reaching in all its relations.

I do not know that anything practical will come of what I have said; if it shall provoke a little discussion I shall be entirely content. I have not intended to put a wet blanket upon anybody. If I have, let it remain, and the natural heat evolved by discussion will put us into a perfectly calm, equable temperament, and we shall rise to a better appreciation of the whole subject.

Mr. BARTLETT, of Brewer. I am not much of a farmer, and do not know that I should speak here, but I admire to see systematic, good farming; because, as it was observed this forenoon, I think a man, in order to be a good farmer, must be made for a farmer. I hold that God has called people to different occupations. I was brought up with the idea that some men were called to preach the Gospel; I believe it now; and I believe that the same voice that calls some men to preach the Gospel also calls others to be farmers, and traders, and blacksmiths. The call comes by virtue of the capacity to be farmers, traders or blacksmiths. No one can be a successful farmer unless he has that call, any more than he can be a successful physician or preacher without it.

I make these remarks because our friend, the professor, has gone a little into speculation. We have had what seems to me something like the Millerite doctrine in regard to the world. Certain wise individuals have come to the conclusion, from particular Scriptures and from study, that this world is to be destroyed by fire. Our friend here is more logical; he thinks that we shall come to nothing unless we change our mode of farming, for the earth on which we live is being used up as a means of supplying food. It is said that this earth shall be the habitation of the saints; but I think it needs considerable repairing and putting in order before it will be fit for them to dwell in. But the change is going on, the world is being repaired, and the human beings who live on this earth are being prepared to inhabit this regenerated world also.

When our forefathers came to this country, most of them had to use their muscles, and the best they could do was to raise that kind of food that would make muscle; but we find now, as our friend has suggested, that this muscular process is being superseded by mechanical forces. Now, in order to live in this world, in this better condition, we must have different food from what our forefathers did; we need a different product. These changes are going on in the soil to lead us to raise what will supply the wants of the physical system under this new order of things. If we could be driven into raising only Indian corn it would be bad, because we do not need the Indian corn, and the coarser articles of food, so much as our ancestors did; we need a finer product, and we shall have it. I remember when Indian corn was about the only food that was raised in some parts of this State. It was cooked in a variety of ways, and we lived well, because that was all we needed. But now we need something that makes more brain, because we have sharp competition. These young men who attend this college have got to eat something that produces more than muscle, because they go there to sharpen their wits, to exercise those faculties that will enable them to go out into competition in the work of a world that is very different from that of our predecessors.

It is a mistake to argue the necessity of keeping the world in exactly the same position, or reproducing it just as it was in Adam's time. God does not mean you shall do it. He means you shall be better and more intellectual men than Adam was, and therefore he changes the world by taking away the coarser things and giving the finer. We must, therefore, study the relations which we sustain to the world we live in. The time is coming when the coarser foods, that go to make up the muscular system, shall give way to those finer foods that we must have in order to fit ourselves to live in this new earth that is being made. I do not believe, therefore, in the doctrine that our friend has been inculcating, but that we must study into this matter, and prepare ourselves to meet the future, and not look back to old times and mourn about them.

It is often said, if we would only live as our forefathers did, we should have as good health, and as good muscles as they had. We do not want so good muscles; we don't need them. We want as good health as they had; and if we do not have it, the reason is because we use dainties to excess. We are told that if we would only live on bone broth and hominy, as our forefathers did, we should be as healthy. Not at all; we should not be fit to live and do the work we are designed to do. The gentleman himself is a physical manifestation of that fact. You see that his brain is a great deal larger, proportionally, than his muscles, just as it ought to be. If he was designed to do such work as our forefathers did, and nothing else, what would be the use of having such a brain? It would be of no more use than it would be for him to have a hundred pounds of additional muscle, in his present business, which would be only a burden. He wants now a sharp wit. When labor-saving machines shall be put fully into operation, there will be less muscular work required, and if you are not prepared to do the work of planning and contriving, you will be driven to the wall. To do that work you must be prepared by a systematic course of living; not by food that makes muscle only, but by what makes up the whole system.

Mr. Mills, of Bangor. I never felt more highly gratified by anything to which I have listened, than by the remarks of the first speaker this evening—not only by the way in which he claimed that agriculture should be studied, but also by the picture which he drew of the future. I believe that in the future, instead of bone and muscle, we shall be able to get our bread through the agency of machinery; and that the present is as far behind what the future will be, as the present is in advance of the century past. When I look back and see the implements that our grandfathers used, and look at those we use now, I see a progress almost marvellous. The progress that has been made since the war in this direction has been so great that I can carry on my farm almost as well as I could when not more than thirty years old, with all the strength I had then, and all the help I could get. I have sometimes queried whether the improvement in farm implements has not made up for all the destruction caused by the war. It led mechanics to study the wants of the farmer, so that he is now supplied with such implements as he never had before.

Mr. Bartlett. I beg pardon. I supposed that every individual who heard the lecturer was fully competent to appreciate the facts brought out; and I was highly gratified with the systematic way in which he brought them to our attention. I was only combatting the conclusions he seemed to reach in regard to the changing of this world from bad to worse. The suggestions that he made in regard to farming I certainly would not oppose in the least. They were excellent.

Dr. Henry Boynton, of Woodstock, Vt., having been called upon said: I am here at the end of a day and night of travel, to share in the benefits of this occasion, and though somewhat weary with my journey, I cannot but embrace the opportunity to speak for one moment upon this subject, which interests me, and which I have no doubt must interest every gentleman in the hall, after the manner in which it has been presented to us this evening.

The future of agriculture, gentlemen, is a subject which should stir all our minds to their profoundest depths whenever we meet for consultation, as we have here this evening. I am glad to speak for one moment, because I always love to be in an assembly like this. I am just from my farm, from practical and very personal labor. I come from gathering corn and potatoes, and fighting the flood that we have had up among the Green Mountains, to keep it from carrying away the river banks; and I am glad to get down here once more among the farmers of Maine. I feel a good deal as old Anteas is reported to have felt when he got his feet on mother earth, a renewal of his strength. I was at Augusta two or three days last winter, with several gentlemen whom I recognize here this evening, and I got a great deal of strength there. I have felt better for it, and have accomplished more the past year. I have felt myself more of a man, and I have tried to make others about me, engaged in the same occupation, feel more like men; and for that reason I am glad to say a few words here to-night.

I confess that I myself, as well as others in the same business, am very apt to receive suggestions such as has been thrown out here this evening for our benefit, with some incredulity. We are proverbially too critical, too skeptical, too apt to halt whenever suggestions are thrown out to us in reference to what we can accomplish as agriculturists, by way of relieving our muscles from labor and gaining more time for the cultivation of the mind, and bringing ourselves up to such a standard as we have had set before us. Men who see further into the future by reason of the light which science gives them than most of us can, come to us occasionally in a friendly manner and patiently point out to us the course we should pursue in order to attain the desired object, and we, in a doubting, hesitating manner, wait, and question, and doubt, and suggest, and fear, and too often sit down just where we were. But in order to make progress we must, whether we believe it or not, take hold of such principles as have been suggested to us to-night, and apply them to the actualities of our business before we can succeed. Unless we do this we go, as has been said, directly in the face of the plans of the Almighty. We must put ourselves in harmony with the laws and operations of nature in order to advance one single inch in this department of labor, just as men who labor in other departments must bring themselves into harmony with the laws of nature, or the laws of mechanics, or the laws of trade, in order to advance an inch.

What would you do, at this day, if you undertook to market the products of Maine as our grandfathers and grandmothers used to market them,—hanging a goose on one side of a horse and half a bushel of beans on the other, and starting for Hallowell or Portland? Think of the idea! No; science has brought to our relief other means, and we now avail ourselves of them. I have no doubt that many of you to whom I speak now remember very well that when railroads were first talked of many held back strongly and stoutly, and asked, "What will become of all our horses? If our stages and wagons are to be superseded, and we are not going to Boston or Portland by stage, and are not going to send our produce there by wagon and get our freights back in the same way, what is to be done with all the horses we use in that line of business?" Here is a man who tells you that with a few buckets of water and a little wood he will transport three hundred tons to Boston, and you ask, "What is to become of all our horses?" When a principle is brought to us and made clear and plain, we should be the men to walk up and take that principle to the extent of our ability, and apply it to our business, in order that we may advance.

In the olden time, people used to get along pretty well for artificial light by setting fire to a pine stick, and putting it in the chimney. They used to sit down by its light and read and think. Thank God for the men who did that! They and their brains. They wrought out theories, and experimented upon them, and made them practical, and we to-day enjoy the benefit of their thought and labor. But we cannot put up with pine torches now; we turn a little stop-cock, and light the gas, which God locked up, thousands of years ago, in the coal, and which science has distilled out and applied to our uses to-night. Water brought to a city like this from a distant spring on the back of a donkey would be better than no water at all, but you cannot stop for that now. Bring in the aid of science, let the water pipe bring it to your houses, distribute it to all your apartments, and when you want it, turn your faucets, and there is your water. Let us apply principles in this way to the development of the soil, so that labor shall be abbreviated; we shall then understand the necessity of feeding the brain as well as the stomach, (a very beautiful and true idea that is); we shall be relieved from this heavy drudgery of manual labor, and there will be a chance to feed, develop, and enlighten the brain, so that the two things shall be balanced; the muscles will be diminished in size, through this relief from toil, and the brain will be stimulated and developed in proportion, our work will go forward regularly, systematically and harmoniously. I say, then, that every principle that is being brought forward by your scientific school, tested in the soil, tested in mechanics, tested in chemistry, should be accepted by us farmers, and to the extent of our ability, we should follow their teachings.

There is one other thought to which I would allude in connection with this subject, the progress of agriculture. It is this. As farmers, we should endeavor to make a better use of the products of the soil. Expressed differently, I mean this: To our practical education as farmers, we need to add a sort of commercial education, if may use the term in this connection. We should know what to do with the products of our soil after we have them at our hands. If you are as wise as we are in Vermont, you sometimes find that you have sent your potatoes to Boston and sold them for less than you could have got at your own door. You raise cattle, feed them, care for them, and bring them up to maturity, perhaps transport them two or three hundred miles, and then sell them at a discount from the price they would have brought at home. We do all these things in a blind, haphazard way. We need a commercial education sufficient to make us quick, keen and shrewd enough to know where is the best market for our products. You would not consider a merchant very shrewd who should expend $50,000 in freighting a vessel to Australia, and when it got there, sell the cargo at 25 per cent. less than it cost him in Boston. But many a man conducts his farm on pretty much the same principle; and many of us settle down with the idea that that is a part of farming—that it belongs to the "ups-and-downs" of farming. No such thing. It belongs to "ups-and-downs" of a man's brains.

I say, then, to repeat,—let us accept kindly, thankfully, such suggestions as we have heard to-night, and reduce them to practice. I would not be too critical; I would not find fault with farmers too much; I would find no more fault with them than I am willing to have found with me; but as I have listened to the remarks that have been made, an old fable of the Greek mythology occurred to me, which I have thought more than once illustrated the condition of the farmer who manifests the reluctance to which I have referred to accept new truths as they are brought to his mind. It is reported in that old mythology, that when Uranus was the only being in the universe, excepting his little son, after spending millions of years in solitude, he one day concluded to exercise his creative power and he made an oyster; the first thing of life, aside from himself and his little son, that the old universe had ever seen. His little son was so delighted with that new form of organized life, that he besought his father to make something higher and better than the oyster. But the old god looked wise and shook his head and at last concluded it would not do to have anything better than the oyster; so he went on making oysters for ten thousand years. I have thought that as farmers, when improvements are brought to our notice and demonstrated clearly and forcibly, we are too apt to look at them doubtingly, shake our heads, and too many of us go on making oysters for ten thousand years.

Ex-Governor Coburn. I have been very much gratified to-day, and think I can bear witness to the truth of the remarks that have been made. I endorse fully the sentiments of the address of the evening, and I look forward with a good degree of confidence to improvements in agriculture and in every department of industry, in the future. Looking back twenty or thirty years, I can perceive very great improvements in the manner of managing farms, the raising of stock, and all the minutiæ of agriculture. Those of us who have been in the habit of seeing the mode of culture pursued by our neighbors in Canada, even now, and the implements they use, cannot but see that they are far behind us, even as we were thirty years ago. I remember when the first plow, that really was a plow, went over the Chaudière; and I remember perfectly well that for years and years, even those farmers who had good farms would not have a chain to plough with, but hitched their oxen to the plow with elm bark tied to the end of a pole, so that the oxen, when they came round, would have to come round sideways. They had no yoke, but instead there was a pole tied to the horns of the oxen. The doctrine was, and I presume they think to-day it has real force, that by the use of the yoke they lose the strength of that part of the ox that runs through the bow. That idea prevailed through the whole length of the Chaudière valley, which is a very fine agricultural region indeed. It is so with their other implements. It did not take much for them to live on. They were willing to eat what nobody else would, and they sold the best part of their products; the women would go to market with their chickens and bring back the money, and they got along very well.

We are not satisfied with that mode of living. Our people are differently constituted. They will have something better to eat and something better to wear; and the improvements which we have adopted in the last half century warrant them in so doing.

Hence, I say, in looking back a term of years, we see that great improvement has been made in our own State, as well as in every part of the country. A good many are inclined to the belief that our farmers are not making much improvement, and are not up to the times. I can see an immense difference in the position of farmers, so far as I am acquainted with them, from what it was fifteen, twenty-five and thirty years ago. They are really a very independent class of people. They manage their farms remarkably well; not so well as they might, not so well as they will; but if you travel through the State, you will see a marked improvement, which I think has kept pace, if not gone ahead, of any and all other business in the State. I believe that we shall continue to improve; that we shall arrive at a higher state of independence, and support ourselves and families with more ease and with less loss by mistakes, because we shall be governed more by the thinking power, rather than by chance or by routine. I have full faith in the future of agriculture.

Mr. H. C. Burleigh, of Fairfield. I have been pleased by the remarks which have been made in regard to the improvements which are going on in machinery and in the modes of culture of our farms. We can all see a marked difference. I think all who have farms of large size can endorse the remark make this evening, that since the war, a farm can be carried on with one half the labor that it could before the introduction of recent improvements.

It has been suggested that our farms are wearing out by the raising of animals and sending them to the large cities. I hardly think we need have any fears on that ground; but when the farmer raises hay and potatoes and sends them off we have reason to fear. Let every farmer, instead of raising hay and potatoes and corn to sell, put them into neat stock, carefully save every shovelfull of dressing, and return it to the soil, and it will never run out. You can see to-day, in the Kennebec valley, farms that have been used for stock raising for forty years, and they are better now than they were at first. But if you go near the railroads, where they have been raising hay and potatoes to sell, instead of being consumed on the farm, you will find the condition far otherwise. Let us turn our attention to neat stock, or sheep, or horses, and carefully save all the dressing, and no danger need be apprehended.

Prof. PECKHAM. A thought occurred to me during the discussion in reference to experiments which has not been mentioned by other speakers, which, perhaps, if stated, may serve as some encouragement to those present who have been thus engaged.

We very often hear the wonderful progress of chemistry referred to, and the development of agriculture which has been attained in the last twenty-five or thirty years, by means of chemistry. Now, very few persons, not engaged in chemical research, have any idea of the vast number of experiments which prove utterly futile to one which brought about the results anticipated or sought. Every experimenter in chemistry has made hundreds, and the older chemists have made thousands of experiments which gave no results whatever, simply because the experimenter did not have a clear idea, at first, of the object sought. So it is in agricultural experiments. Many of them fail; and if the farmer is discouraged by the failure of his first experiments, and stops there, he will never reach useful results. So, too, if some of the greatest chemists now living had become discouraged at the failure of their first experiments, they would have ended their careers without being heard of, and the results which they have obtained would never have been given to the world, unless obtained by some other person, more courageous, more patient, more persevering.

The statement of this fact may encourage some of those persons engaged in agricultural experiments, who may become faint-hearted because one, two, ten or twenty of their experiments proved useless or futile. You must not be afraid of being "left out in the cold."

Mr. PERLEY. Whether our friend Professor Brackett has put us to bed in a wet sheet, or treated us to a dry blanket, matters little; he has certainly given us a quieting dose, which has relieved our nervousness, and when these meetings are over, we "empirical" farmers can go home and try our experiments, and also learn from the experiments of scientific professors, and become wiser men. Let, then, those who have the ability prosecute their scientific experiments; let them teach us what they can in regard to the processes we should pursue in agriculture; let them make suggestions which it may be prudent for us to follow. We will then try those suggestions and prove what are good. We shall thus work hand-in-hand with those who are leading the way, and all learn something. We shall now go home feeling better.

Prof. BRACKETT. Let me add one word to what I have said. I did not come here as a teacher, by any means. I fully recognize the wisdom of the members of this Board; it must be, in the nature of things, superior, having been tested by the experience of so many years. I am glad, however, that one of the gentlemen lately speaking, recognizes the spirit of harmony and the disposition to work together that should ever exist between scientific experimenters and practical farmers. My object was to say something that should enable the farmer to appreciate his relation to other men, and assist him to understand that there are certain inevitable laws that must be followed in order to succeed in the highest sense of the word. It was not for me to talk to you of the details of farming, which every one of you know better than I about. I purposely avoided that, and endeavored to take a broader view, and show our relations to the rest of the world and to science generally. Now, I know these young men will carry off some ideas, and grow and develop, physically, morally and intellectually into a rounded and complete manhood.

Now, as to a single misapprehension, I tried an experiment this evening and received an answer—shall I say "Yes" or "No?" It will depend upon the interpretation which you put upon my language. I tried the experiment if you would agree with me; and I recognize a president of an agricultural society who disagrees with me. He has failed, permit me to say, (and I only mention him simply as an illustration, of the failure of the experiment,) because he has not appreciated the conditions of the case. Now I will put the question so that he will understand it. He says, "consume your hay upon your farm, and there is no danger of its running out." I say the Almighty has so ordered this universe that it cannot be done. Some of that hay will go into the large cities. It is not safe to reason from a general principle to a specific fact. I do not care whether it is hay, or grain, or potatoes that is taken from a farm, something must replace it or the farm will run down. It has been so in all history, and it will be so here.

Now as to my friend on the other side, [Mr. Bartlett,] who seems to have the impression that I was preaching Millerism, I cannot but recognize the fact, that if we spend our whole time in perfecting our fruits and cattle, we shall be perfected. I do not wish to go back to the earth as the Almighty made it first, for He covered it with the old Silurian seas, and filled those seas with Silurian monsters. We are all going to be perfected, through the perfected products of the earth. I did not think it necessary to carry my idea through every possible ramification.

I find that my experiment failed in one respect; it succeeded, however, in another. It succeeded in bringing us into the relation which I hoped we should come into, perfect harmony. You experiment, I will experiment, let us talk the thing over in a friendly spirit, and we shall all of us get light upon it.

Prof. FERNALD. I have listened with a great deal of interest to the lecture and discussion, and I was particularly interested in that part of the lecture which elaborated somewhat the course of study. That certainly has a very close relation to agricultural pursuits. It so perfectly corresponded with my own views upon the subject, that I wish to thank Prof. Brackett for the very happy and able manner in which he has shown the relation between those studies that the students at the college must necessarily pursue, and the practical pursuits of life that follow, in their relation to agriculture.

Passing from that, I wish to take up a point, that the lecturer of the evening brought out—that a portion of the products of our farms must necessarily go from the farms; for I believe Prof. Brackett is entirely right, that is, taking the broad view, which is the correct view. How are the horses in the cities to be supplied with food? How would the gentleman who has raised a point in opposition have the horses in the cities fed? How would he have the people in those cities fed? He says he would keep his hay at home. Very well, if he keeps his hay and corn and potatoes at home, somebody else must send their hay and corn and potatoes to the market, for the cities are an inevitable necessity. I think it has been shown to-day, and certainly it can be shown, that cities will spring up in certain localities; they are as much a matter of necessity as is the country, in our present state of civilization. We cannot control the matter. God has put his hand upon it, and those cities will exist; we need them, as means of commercial exchange; they are our marts, we need them for manufactures. Implements must be manufactured somewhere; they are not made on the farm; there must be factories, and the operatives must be fed from the farm. If every man keeps all his products on his farm, how can those who are thus engaged live? There must be a complete inter-relation established. The farms must feed them, and in consequence a portion of these products must be taken away from the farms and go to those cities.

Now look at our own State. What is the proportion of population in our cities, compared with the entire population of the State? I do not know precisely what it is. Here is the city of Bangor, with 20,000 population; the city of Portland, with 30,000; and there are six or seven other cities, besides the villages. I suppose I should be safe in setting the population of our cities at 100,000. That is near one-sixth of the population of the State.

Now, unless these cities are to be blotted out, a portion of the products of the farm must go to supply them. Here is an inevitable necessity, and Prof. Brackett is but recognizing facts as they exist, when he says there must be a constant drain from the farm to supply the wants of our cities; and unless some means can be devised by which returns can be made, there is an operation constantly going on that must, in the course of time, tend to run down these farms, unless by superphosphates or other fertilizers, they can be kept in good condition.

Now, how are we succeeding in our agriculture, pure and simple? Going back and taking up more and more land, and so we are able to live. We are wearing out the land in certain places, but taking up more, and so on. Now, when these States come to be so fully populated that there is no more land to be taken, what then! Is not Prof. Brackett right in saying that they must necessarily wear out, unless improvements can be devised by which returns can be made to the soil; if there is to be a constant drain, and that drain must be growing greater and greater, proportionally, from year to year, and from age to age, through these centres of population? And I do not see how we can do otherwise than recognize the great fact, that these centres of population must exist, as a matter of necessity, for all coming ages.

I do not anticipate that the time is ever coming when we shall not be able to raise from the earth all that is necessary for the wants of all who may live upon the earth; but the question is, as Prof. Brackett puts it, how, when a large amount of the products of the farm goes to supply the cities, shall we get back what will make up for this drain upon the soil, so as to keep up the farm? The question is, in what way is that transfer to be effected? No doubt it will be done; but it seems to me it is right, in looking forward to the future, to recognize the fact that this waste must go on, and the question then is, how shall this waste be met?

Prof. PECKHAM. I fully agree with what has been stated by Prof. Brackett and Prof. Fernald, but there are occasionally localities in which the experience of the residents seems to contradict such assumption. I spent last summer in Western Pennsylvania, in Washington county, which is one of the greatest hay growing counties east of the Rocky Mountains—exceeded only by some in California. They have an exceedingly fertile soil, and deride the idea of anybody's undertaking to farm it in New England. They boast of wasting more of the produce of a hundred acres than can be raised on an equal area in New England; and I think they do, from what I saw. They are very slovenly farmers. They raise great quantities of oats, wheat, and hay. The hay is all taken off the farms; not a cent is spent for any foreign fertilizer; some of the best farmers burn a little lime and spread it upon the surface; and yet I was assured that the annual produce of their farms was greater than it was forty years ago; and they have done nothing but carry on what is seemingly an exhaustive process of agriculture from the time the country was settled, eighty or ninety years ago, to the present time; and still they maintain, and I think the testimony was reliable, that their farms improve steadily.

Mr. SAMUEL WASSON. I had occasion recently to estimate the number of producers and non-producers in my own county, (Hancock,) and, if I was correct, forty-two per cent. of the population are producers, and fifty-eight per cent. non-producers. To these forty-two must the one hundred persons look for their bread and butter. That is, the forty-two must supply themselves and the fifty-eight who are not producers.

We often hear the idea advanced, that it is necessary to consume what is grown upon our farms. I know it sounds well to talk about consuming upon the farm what is grown upon it, but we want to discriminate. There are certain products that should not go off the farm, or only as small a proportion as possible. There are other products that may go off the farm. Those who do not produce must have their bread and butter, and their potatoes and beef, and we must furnish them.

Mr. S. F. PERLEY. On this question the middle ground is the safer one. Some farmers may sell their produce, others had better not. Somebody must supply the cities. Their inhabitants must live, and to live they must eat and drink, and have somewhat to wear, and it must be grown on somebody's farm. I never sell a pound of hay nor a bushel of grain of any kind, but if others want to sell, let them sell; or if they prefer to put their produce into sheep and pork and beef, or into blood animals, let them do that. If any farmer has not dressing enough, let him buy Cumberland Superphosphate, or some other if he can find as good, or let him make some himself, out of old bones, if he likes that way. I consider the manufacture of fertilizers as necessary and useful a business as any other. Those engaged in it succeed in producing what enriches our barren fields out of what would otherwise be wasted, or put to no use. They are ransacking the ends of the earth to get materials, and they are not all found yet. We have rocks in our hills with riches in them, and a good many fish in the sea, and a good deal of muck in our swamps not taken out yet. I am not going to worry about future generations starving. Let us furnish the cities with food, reclaim our old fields, catch fish, sow clover, haul muck into our barn-yards, and not fear but that we are making real progress. It will require brain work, and hard work, after all, but it can be done, and the work won't hurt us.

Secretary Goodale. Let me heartily endorse the views of my friend Perley. He has struck the right vein.

With regard to a supply of food for coming generations, my mind is perfectly at ease. Through what agencies it will come, does not yet appear. It may be by feats of engineering, which shall carry back to exhausted lands what has been carried off from them. But this is highly improbable to my mind.

I am a firm believer in the Divine Providence. When wants arise, if we behave as we ought, they will be supplied. They have often been when we behaved otherwise. When the Creator made this earth, He stocked it with food material enough to last for its inhabitants as long it lasts; although a good deal of it was invested in a way that business men might call unproductive capital, or, at least, very tardy in paying dividends. When some of that which is nearest at hand, gets washed through the cities and rivers into the ocean, it is not lost, but only deposited where future generations will find and use it; just as we occupy soils ground up from rocks by the action of glaciers, and washed hither by ocean currents a long time before our day. Meanwhile, we are constantly discovering sources of fertilization hitherto concealed, or unknown. It is but very lately since they began to dig and use the mineral potash deposits of Germany, and the fossil deposits of South Carolina, and the rock guanoes of Sombrero, Navassa, Alta Vela, and numerous other islands of the Carribbean sea, and these are only the faint beginnings of what will yet be found.

Have not real wants always been supplied? Not, perhaps, when we fancied them to be real, but when the time was ripe to have them supplied? When our country was young and dark days had fallen upon it, did not a farmer of Virginia, surnamed George, "receive a call" to lead armies to victory? And only a little while ago, did not a leather dealer of Galena receive a similar call? And you know what came of that. When whales run scarce, petroleum began to spout, and the world is better lighted this evening than when we depended on New Bedford. When our country was ripe for great enterprises and enlarged business, and money was needed for purposes of exchange, the gold of California was seen. It was there before Capt. Sutter's day as much as since; but not while that land was under the heel of a despotic hierarchy—not until the Mexican Jesuit had departed, was it found and used. So on this side of the continent. The scientific mineralogists of South Carolina had collected numerous specimens of the fossil coprolites, abundant near Ashley river, and stored them in their college cabinets years ago; and their scientific chemists had looked at them; and the people had dug them out for road material and for sidewalks, counting them of equal value with salt which had lost its savor, fit neither to put on the land, nor into the compost heap, but only to be trodden under foot. Why was this? Simply because "their eyes were holden." The moment slavery went out and free labor came in, "their eyes were opened." Now, we see clearly that a region large enough for the abode of millions is to be redeemed and made fertile as a garden by their agency.

Such events lead the way for the reception of truth; first, natural truths, then spiritual truths. A few years ago a college Professor of Northern birth was driven out of South Carolina for saying that the real want of that State was "*manure*, not secession." To-day that saying would be deemed the expression of a fact too obvious to need utterance in words.

Adjourned to Thursday morning.

THURSDAY, October 21, 1869.

The Board met at 10 o'clock, the President in the Chair. The Chair announced as first in order, a lecture on "The Valuation of Manures," by the Secretary of the Board.

THE VALUATION OF MANURES.

The changes which have come to pass in the agriculture of Maine during the past ten years are greater by far than those of any previous decade. Nor is this to be wondered at when we consider that it includes that most eventful period whose history is yet to be written, but of which we know, that, besides involving terrible sacrifice of life and happiness; besides calling forth, from deep slumbers, patriotism and allied virtues; besides creating Sanitary and Christian Commissions and giving wings to clouds of Florence Nightingales, sending them on missions of love; besides abolishing slavery and emancipating whites, rich and poor; besides piling up taxes for years to come, it accomplished other things, and very different things as well. It caused many to run to and fro; and knowledge to be increased, and about a great many matters. It shook all classes prodigiously, and the quiet farmer not less than others. When not bodily shaken out of the furrows into the ranks, it shook him out of many old-time notions, and into familiar acquaintance with many facts, both of science and practice, of which he would otherwise have known nothing in a long time. It compelled attention to ways and means to economize human labor; to enable few hands to do the work before done by many.

Witness the harvest of the current year's grass crop; never excelled in value,—and this not nearly so much because of large amount, as because of being harvested near the time when it was in its best estate. Instead of a large proportion being left standing until the gum and sugar, the oil and the starch were converted by the processes of nature into wood and seed, the grass was mostly cut when its nutritious constituents were present in maximum amount.

We thankfully acknowledge the Divine Providence in sending favorable weather, without whose help man's labor would have availed as little in this as in any other direction. But it is also well to consider that this aid would have availed a great deal less, had not the recipients first helped themselves to mowers, and tedders, and rakes, and forks, worked by brute power; thereby quickly accomplishing the work formerly wrought, in a less perfect manner, in a longer time, and by an immense expenditure of human force.

For every mower at work in Maine ten years ago, doubtless twenty, and perhaps fifty, were running in this year's crop. Consequently the product harvested was more nearly *preserved grass*, than the growth of small dry wood which formerly passed, by courtesy, as "late cut" hay.

The war brought with it habits of fast living and fast spending; but these evils were mingled with good, which we may hope will remain after the noxious weeds have been eradicated. It brought habits of spending for the enginery of peace as well as for implements of war; for seeds as well as for bullets; for manure as well as for powder.

We may hope that saltpetre has fulfilled its mission in the way of propelling missiles of death among brethren of our common country. Saltpetre mixed with sulphur and charcoal, and then put to a bad use, makes but a villianous compost. Saltpetre in the hands of the farmer is capable of serving a better use than in those of the soldier.

When saltpetre (known to chemists as potassic nitrate) is burned, as powder, the nitrogen which it contains, (and because of containing it is sometimes called nitre,) is liberated from its combinations and reappears in the gaseous form in which it constitutes four-fifths of the air which we breathe. In this form however, i. e., *uncombined,* (although mixed with other gases,) it is the most inert substance known,—more destitute of active properties than anything else; in fact its very use as a constituent of the atmosphere, regulating and moderating the results of breathing, and of burning, arises very largely from its negative character.

But the nitrogen of saltpetre in gunpowder, when parting from its combination, gives out a great amount of force. This force may be put to a bad use in killing men, or to a good use in blasting ledges. Splitting rocks, however, is not the only good use to which combined nitrogen may be put. The farmer may give saltpetre to his crops; and the plants, slowly, to be sure, and in a very quiet, non-explosive manner, will untie its combination, and will do it just as effectively; and in doing so the plants will receive a propelling power of growth corresponding to that manifested when the same combination is suddenly and explosively dissolved; the difference being, that the force is expended less quickly and in an entirely different direction. The idea of propelling plants into vigorous growth by the use of gunpowder, may be a novel one to most of you, but it is one which may be followed up without harm.

If there be truth in the statement, it follows that saltpetre would prove an effective manure; and the results of its use when given to plants show this to be the fact; and not only because of its combined nitrogen, but also because of its potash, which, so far as its amount serves, is as good as if it were applied in wood ashes.

But it happens that the commercial value of saltpetre, for the manufacture of gunpowder, of nitric acid, and for other uses in the arts, is greater than its agricultural value. It follows, therefore, that it cannot be economically employed as a manure.

This suggests a train of thought, which may be followed to advantage with regard to various substances and compounds, which are every year coming into more general use for fertilizing purposes, and which may be grouped together under the term, Commercial Manures. Can they all, or any of them, or which of them, be employed with actual gain to the farmer who applies them to his crops?

The agricultural value of any substance used for manure is in proportion to its fertilizing efficacy, and determines what the farmer can afford to pay for it. It does not necessarily conform, in any measure, to the price which the article commands in market. Nor is it, when ascertained, a fixed amount. It is a variable quantity, less here and more there; one amount in this field and another in the next; more on one kind of soil and less on another, or on the same if it has been differently treated or cropped. In some cases, the application of a bushel of gypsum is followed by a return worth two, or three, or five dollars. This furnishes no reason why a dollar per bushel should be paid for plaster, when it can be had for a half, or a quarter of a dollar. Upon other soils the application of gypsum is attended with no benefit whatever; and this, on the other hand, is no reason why the dealer should sell gypsum below cost, for he may sell to those who do find it profitable to apply to land, or he may sell to those who require it for other purposes.

In one sense it may be said that all manurial agents are alike valuable, because all are indispensible to the healthy growth of plants. We find that the absence of any one constituent of plant food is attended with serious consequences, even though every other one needful be present in abundant quantity. Thus, a deficiency of lime is attended with as much injury as a deficiency of phosphoric acid.. In this sense, therefore, lime is as valuable as phosphoric acid. But it is also true that lime is generally present in quantity sufficient for plant food, and when deficient it can be supplied in burnt limestone, or oyster or clam shells, or by means of marl, at small money cost, while to supply phosphoric acid involves a much greater outlay. In an equally true sense, therefore, the different constituents also possess different values.

The commercial value of any manure, like that of every other article of commerce, is the price which it commands in market. This depends on a variety of circumstances, such as the ease or difficulty, the certainty or uncertainty, with which a supply can be procured; and the variety of uses to which the article may be put besides that for which the farmer would buy it. In other words, the laws of demand and supply regulate the price.

It will simplify and facilitate our present undertaking to consider that, although many elements go to make up the constituents of plant-food, such as carbon, oxygen, hydrogen, nitrogen, lime, magnesia, phosphorus, silica, etc., and although these occur in numberless combinations in substances found in nature, there are yet only three for which the farmer can afford to pay a price exceeding one cent per pound. This is the fact, no matter what name the manure bears—or what its form, or bulk, or weight—whether barn manure or seaweed, guano or superphosphate, salt or plaster, whether poudrette, or lime, or fish, or whatever be its name.

If he buys salt, or gypsum, or lime, he takes care to pay less than a cent per pound. If he buys superphosphate, or ashes, or fish refuse, or dung, or guano, he buys them because they contain more or less of one, or two, or all three of the substances to which I have referred. These are, 1st, potash, 2d, phosphoric acid, 3d, soluble nitrogen; and by soluble nitrogen is meant nitrogen in any combination from which plants can readily take it. Inasmuch as this is most commonly as ammonia it has come to be common usage to employ the terms "ammoniacal" and "nitrogenous" in agricultural parlance as convertable terms, or nearly so. Ammonia consists of 14 parts of nitrogen, by weight, combined with 3 of hydrogen. Thus 14-17 of the weight of ammonia is nitrogen.

When the phrase "nitrogen equivalent to ammonia" is employed in expressing the results of analysis of a manure, it is for the purpose of saying that the amount of nitrogen in it is capable of producing so much ammonia, and the latter is, of course, 3-14ths more than the weight of the nitrogen.

When a farmer buys stable manure, three-fourths or more of the weight of his purchase consists of water and woody fibre. If sawdust has been freely used as bedding, perhaps as much as nine-tenths. Now, water is good, nay it is indispensable for vegetation, but no farmer can afford to transport it by team for the use of his crops; still less to pay money for it. The vegetable matter is good to improve the mechanical condition, the texture, of heavy soils, rendering them more friable, and more permeable to roots and air and rain, and to some extent it may serve other useful ends; but the farmer would not carry far, nor pay dear for manure which consisted of vegetable matter only. He wants mineral matter more.

When he buys stable manure, he does so because it contains a small percentage of the most valuable mineral fertilizers. It contains potash and phosphoric acid and nitrogen, and these constitute by far the greater part of its value. There may be from twenty to forty pounds of all three together in a ton of it. If these were separated they would form a highly concentrated manure, and in many localities would be cheap at ten to fifteen cents per pound, or perhaps even more. And it would be none the worse for having no weed-seeds nor water with it. It is because stable manure contains all three of the constituents named, (together with others also, of less commercial value) that it forms a general manure, and is, as we say, suited to all soils and all crops; and although this may not be strictly accurate, yet the language would hardly be misunderstood. At least it is safe to say, that farm manure very seldom comes amiss.

It frequently happens that not all of these are equally demanded by the crops which we propose to grow, nor equally lacking in the soil. Consequently it is not always needful to apply all of them. Experience has shown that an addition of phosphate alone is often sufficent to insure a bountiful crop of turnips, or of clover; and an application of nitrogenous manure may be all that is required to insure a heavy growth of grass, or of grain, and so in other cases.

Let me repeat, that potash, phosphoric acid and nitrogen, are the scarce fertilizing substances. They are those which are most frequenty lacking in soils, and yet, equally with others, they must be supplied if we would have healthy, vigorous plants and abundant harvests. It has been found by ample experience that when one or all of these are wanting in a soil, they can be supplied profitably, at the usual market rates, in a great majority of instances, because, climate and other conditions being favorable, their addition ensures good crops in place of what would otherwise be meagre, sickly and unprofitable crops.

The rapid and continued increase in the employment of commercial manures, by a class of men so careful and cautious as farmers, is held to demonstrate beyond all cavil that, on the whole, they have been profitably employed at the prices which have been paid; and this notwithstanding the numerous and gross frauds which have been practiced. Much greater, therefore, would have been the profit from their use had no frauds been committed.

The employment of commercial manures is rapidly extending at the present time in this State, more than twenty times as much being now annually bought as ten years ago. Their manufacture and sale give large opportunity for fraud, and dishonest men have frequently taken advantage of this fact. It is true, that in general their quality has very much improved during a few years past, and this will be found to be still more the case as the manufacture and sale falls into the hands of those who believe that honesty is better practice than fraud, or of those who have reputation and capital at stake and so cannot afford to cheat.

"The introduction of these new and important aids to fertility has not only in some degree changed the style of cultivation, but it has put the farmer in a new position. It has not only opened up a wide field of inquiry into the use of manures, but it induces vigilance in order to make sure that what he buys really possesses the qualities that he is endeavoring to obtain.

The commercial manures sold possess an exceedingly variable composition, and one not directly within the control of the farmer. Too often it happens that when any particular manure has given satisfactory results the farmer does not feel sure that what he buys again under the same name is identical with that from which his experience was derived.

Herein lies one marked difference between these manures and that to which he has been accustomed. Farmyard manure can always be recognized and its quality and condition tolerably well ascertained by occular inspection ; but with all other manures the external appearance is no criterion of their quality, and it is possible to imitate their characters so that the worst may appear equal to the best.

The farmer is therefore compelled to call to his assistance the chemist, and then he meets new difficulties. A reliable analysis is costly, and its results must be expressed in the language of chemistry, and with this language he is not familiar." Not one farmer in a hundred can determine anything satisfactory regarding the value of a manure from a statement of the results of analysis furnished him by ever so good a chemist. It would not be very difficult for him to obtain sufficient empirical knowledge to read an analysis understandingly if all chemists used the same methods in expressing results, but this is not the case. Some for instance will state the percentage of "soluble phosphate," others of "bi-phosphate," and others still of "phosphoric acid," using, and justly too, in each case very different figures, and yet all conveying the same information to those who are able to read them understandingly, but only confused and uncertain meaning to others.

What is much worse than this, because dishonest, is the fact that some chemists in the pay of manufacturers, or for a "consideration" from a transient customer, have, sometimes, and apparently with purpose, expressed the results of analysis in such a way as is liable to mislead any but those pretty well acquainted with chemistry; at the same time usually keeping within the limits of technical accuracy, or avoiding demonstrable error.

There is another phase of this subject to which reference may not be out of place here, since it sometimes occurs with respect to fertilizers. I refer to those analyses which occasionally appear as advertisements in the public prints and which are expressed in such terms, and accompanied with such remarks, as to impress a hasty or unprofessional reader with an idea of considerable value, or of some noteworthy merit, when a closer examination shows it equally capable of bearing a different construction, or what is more probable, to be elaborately empty of any important information; in other words, a mere puff of the "spread-eagle", "highfalutin" order, masked in professional language.

It was with a view to meet the wants of farmers, so far as could be accomplished by legislation, and in response to urgent calls from various sections of the State for some adequate means of security against fraud, that a statute was enacted in this State last winter to take effect in July following, and is consequently now in force.

It is entitled "An Act to prevent fraud in the sale of commercial manures."

The first section provides that, "Commercial manures sold or kept for sale in this State shall have affixed to every barrel, bag or parcel thereof which may contain fifty pounds or upwards, a printed label, which shall specify the name of the manufacturer or seller, his place of business and the per centage which it contains of the following constituents, to wit: of soluble phosphoric acid, of insoluble phosphoric acid, and of ammonia."

The second section provides that, "Whoever sells or keeps for sale commercial manures not labelled in accordance with the provisions of the first section of this act, or who shall affix thereto labels specifying a larger per centage of the constituents mentioned in said first section, or either of them, than is contained therein, shall be punished by a fine of ten dollars for the first, and twenty dollars for the second and each subsequent offence; to be recovered on complaint before any tribunal of competent jurisdiction."

The third section provides that, "Any purchaser of commercial manures bearing label, as provided for by the first section of this act, and which contains less than the percentage stated in said label, may recover from the seller, in an action for debt, twenty-five cents for every pound of soluble phosphoric acid; six cents for every pound of insoluble phosphoric acid, and thirty-five cents for every pound of ammonia deficient therein."

The fourth section provides that, "By the term soluble phosphoric acid, wherever used in this act, is meant phosphoric acid in any form or combination readily soluble in pure water; and by the term insoluble phosphoric acid, is meant phosphoric acid in any combination which requires the action of acid upon it to cause the same to become readily soluble in pure water."

The fifth section exempts from the provisions of the statute porgy chum and any manures "prepared exclusively from fish and sold as such," and also any other commercial manures sold at a price not exceeding one cent per pound.

I propose now to offer some remarks with intent to show how this law may work good to the farmer; why it should be enforced and also to state some of the facts and principles which governed in adopting its provisions.

The aim of the law is three-fold—

1st. To introduce into general use the system of selling commercial manures by "guarantied analysis"—the method which has been found by experience abroad to be more effective in preventing fraud than any other.

2d. To a limited, but perhaps to a sufficient extent, it prescribes *one* method of stating the results of analysis, thereby rendering it much easier for farmers to understand the statements, and to compare them one with another.

3d. It fixes a definite rate at which an injured buyer can claim redress.

To obtain its benefits, all which is necessary is to enforce it. In the first place, let every farmer see to it, if he is offered any packages without the prescribed label affixed, that the vender suffers the penalty. It is not enough that *a* label be affixed, but *such an one* as the law prescribes. It will not answer the law to have one stating that Prof. Such-an-one "guaranties the standard," or that a professor, or anybody else "will know" that it contains such or such proportions. It must be the statement of the vender that it *does contain* what he alleges, and a statement for the truth of which he is responsible.

In the next place, when the farmer purchases with the label affixed, let him take from each barrel or bag a sample to be carefully labelled and retained for examination, if need arise. A pound or two will be an ample quantity; and if he buys several packages, let a sample consist of a little from each one. After due trial in the field, if he be dissatisfied with the results, and has not reason to believe that the failure is due to some peculiarities of the season, nor of the soil, nor of injudicious mode of application, but that it is probably owing to want of value in the manure,—to its not being what it was represented to be, he will do well to have the sample, retained for the purpose, analyzed by one of the State Assayers, or some other competent chemist. There is this advantage in submitting it to a State Assayer, that by virtue of his commission his testimony is admitted in a court of justice as that of an acknowledged expert; and no pains need be taken to show that he is competent to perform the analysis. If the analysis shows that the manure was deficient in the stated content of valuable constituents, the alleged presence of which was the consideration for which he paid the price, let him recover damages.

It is assumed, as a matter of course, that the buyer will be careful that the label represents the presence of a satisfactory amount of the more valuable constituents.

To show how easy is the calculation, let me say that, it is only needful to multiply the stated percentage, that is to say, the number of pounds contained in one hundred pounds, by twenty, which is the number of hundreds in a ton, and this by the legal price for each pound. Do this for each constituent and add them together.

For instance, if the label says that the manure contains 6 per cent. soluble phosphoric acid, multiply 6 by 20, making 120, and this by 25 cents (the price for each pound) the result is 3000 cents, or $30. If it says 8 per cent. of insoluble phosphoric acid, multiply 8 by 20, making 160, and this by 6 cents, the result is 960 cents—$9.60. If it says 2.5 per cent. ammonia, multiply 2½ by 20, making 50, and this by 35 cents, the result is 1750 cents, or $17.50. Now add these together, and you have the sum of $57.10, which is the amount for which manufacturer and vender are responsible.

A method shorter still answers equally well. Multiply the per centage by double the number of cents for each pound; add these together, and you have the number of dimes which a ton amounts to. Place at the right hand one cypher, and point off two figures, and you have the sum in dollars and cents. Thus, in the case just supposed, you say 6 times 50 are 300; 8 times 12 are 96, and 2½ times 70 are 175; add these together and you have 571; place to this one cypher, 5710, point off two figures, you have $57.10. Any lad in the common schools familiar with addition, multiplication and decimals, can readily solve any problem which may arise in this connection in a few minutes.

Whenever any manure is offered for which more than one cent per pound is demanded, refuse it, unless it contains a due per centage either of potash, or of phosphoric acid, or of nitrogen.

The efficacy of these in the production of crops is assured beyond doubt, not that all three are equally useful on all soils, or for all crops, but each is very good when and where needed. It would be going quite out of our path to attempt showing here when and how and why one, or another, or all should be employed. Our present purpose is simply to determine their commercial value.

The fertilizing efficacy, or agricultural value of any substance being assured, and its degree or amount where it is contemplated to apply it being estimated with such approximation as the nature admits, the question next in order is, what ought the farmer to pay for it?—and the answer plainly is, as little as he can buy it for; and not then unless its agricultural value exceeds its commercial value; and by enough to offer reasonable probability of a handsome profit. If he makes no profit by its use, he would better let it alone. I think he should reasonably expect not 7 3-10 per cent., but rather 73 per cent. and upwards; for experience shows that when judiciously employed, several times its cost is frequently realized.

It is certain that he cannot afford to pay the price demanded for chemically pure potash, nor for pure phosphoric acid, nor for pure ammonia. But he is not shut up to these resources, for he can find them constituting a part of various substances occuring in nature, as for instance, potash in wood ashes, phosphoric acid in bones and minerals, and nitrogen in organic substances. Wood ashes will give up its potash to plants without difficulty, for it exists in them in a readily soluble condition, very unlike the condition in which it exists in feldspar, or granite. Bones require, at least, to be finely ground before plants can get good of the phosphoric acid which they contain; and if they be dissolved in acid so much the better. Mineral and fossil phosphates must be both finely ground and also chemically treated before they will yield up their virtues, and some organic substances may be improved by either mechanical or chemical treatment.

To the celebrated Saxon chemist, Dr. Stockhardt we are indebted for the earliest suggestions whereby approximately to determine the money value of commercial manures. He reasons as follows:

"The inquiry, what is the money value of manures? is one of great moment to the farmer, especially in times when he is in danger of buying a manure for twice, nay three or four times as much as, compared with others, it is actually worth. How then is the farmer to protect himself against losses of this description? We answer, by interrogating chemistry. In deciding upon the value of artificial manures, external signs and evidences are wholly insufficient and insecure; they must be subjected to a keener and more thorough scrutiny; to wit, a chemical analysis. * * *

The chief difficulty consists in finding a trustworthy and accurate criterion by which the price of the *individual* chemical substances that form the constituents of manures may be determined. Many of these substances (for example nitrogen) are not met with as articles of commerce and have, accordingly no definite market value. Other substances (for example potash, soda, sulphuric acid, etc.) occur, indeed, in commerce, but only in the more or less purified state in which they are used in the arts. The commercial value they possess, when so refined, cannot be assumed as a basis of our calculations, inasmuch as it would be greatly too high. Finally, most substances, recognized as manuring agents, even when they form an article of trade, are commonly united with each other, whence a distribution of the money value between two, three or more elements, for which no sure foundation is possessed, becomes absolutely necessary.

In want of certain principles for guidance, I have sought to gain assistance by proposing the question : How could the ingredients of the manure whose value is to be determined, have been procured most cheaply in another way? Hence I have looked around for such materials as are met with in abundant quantities upon the earth, and by means of which one or another of the manuring constituents could be furnished at the lowest possible cost. From the market value of these materials, the price to be placed upon the individual ingredients was then ascertained; but this in many cases, must again be modified, for if it is taken as the groundwork for calculating the worth of those manures that are actually met with in commerce and possess a fixed market value, a disproportionate price, differing widely from the assumed commercial value, is established. A perfect unison between the actual and theoretical price cannot therefore be always obtained by this mode of computation; nevertheless I maintain that the differences which will occur in calculations made with care are of such a character, that the theoretical price, obtained by the method of reckoning which I recommend, is entitled to be regarded as *more accurate* than that actually exhibited in the present state of trade."

Dr. Stockhardt then goes on to say: "It is impossible to specify the reasons in detail which have induced me to increase the price of one substance and to reduce that of others, because the entire valuation depends in general more upon a reciprocal comparison, a counterbalancing, experimenting, and practical knowledge, than upon fixed principles. If the prices specified are shown upon examination to be untenable, they must be altered. In any case they cannot lay claim to permanent weight, *inasmuch as they are subject to the same fluctuations* as those of any other articles of trade."

Since Dr. Stockhardt, many eminent agricultural chemists, both in Europe and America, have contributed efforts towards determining a schedule of prices for the ingredients which constitute manures. Among these may be mentioned Prof. Anderson, chemist to the Highland and Agricultural Society of Scotland, Professors Way and Voelcker of the Royal Agricultural Society of England, and Prof. S. W. Johnson of the Sheffield Scientific School at New Haven.

From the nature of the case it could hardly be expected that different chemists would come to precisely the same conclusions, but we find so near substantial agreement as to give confidence of near approximation to accuracy at the times they were made, or, at least, from their point of observation.* But prices have changed,

*It may be remarked here, that the values set by scientific men upon the several constituents *in a manufactured article* have frequently fallen below a fair price by reason of more or less since the latest schedule of prices, adopted by competent authorities, was published. At least, none have fallen under my observation made within ten years or more, with the exception that Prof. Johnson in a recent report uses the prices adopted by him in 1857–8, with the remark that they will serve to *compare* the worth of various fertilizers now in the market *one with another*, and by adding the difference between gold and currency will not be far from present values. But while it is a fact that the commercial value of insoluble phosphoric acid has remained nearly stationary (allowance being made for variations in currency), that of soluble phosphoric acid has advanced somewhat, and that of ammonia or soluble nitrogen, has advanced still more.

Having conferred with the committee which reported the bill which has now become a law in this State, I may speak with confidence so far as this: that it was their intention to place the values as a whole, at figures which would fully cover the actual commercial values at the time of the enactment, and at the same time would make a close approach thereto. How nearly this purpose was accomplished we may briefly consider.

With regard to a valuation for potash I will only remark, that in the form of wood ashes it commands a much higher price than formerly, and that its agricultural value is so generally understood and appreciated, that the limited supply is quickly taken up in every neighborhood where it is produced, so that it cannot be considered an article of commerce. Neither am I aware of any form in which potash occurs in commerce where the price which it brings for other uses is not greater than Maine farmers can afford to pay. For this reason, and also because it is not mentioned in the law we are considering, no attempt will be made here to affix a price.*

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their lack of familiarity with business operations, and consequent failure to include the expenses attending them. They are not the men likely to consider that purchases and manufacture must go on the year round while sales are confined to a brief period in each year, thus involving the employment of many times more capital to do a given amount of business than in one where sales are frequent and quickly follow production; nor the expenses attending sales and collections, storage of large amounts, heavy transportation, insurance, taxes, losses, depreciation of buildings and machinery, and the numerous other items which must be incurred. These all form as legitimate a part of a fair selling price as the cost of raw materials and labor.

* J. Lawrence Smith, United States Commissioner to the Paris Exposition of 1867, says in his Report: "In 1862 the chloride of potassium (its cheapest form in commerce, and containing forty-six per cent.) averaged a little over $100 per ton, making real

The attempt to fix a precise value upon any manurial constituent is hedged about with practical difficulties.

In regard to the next one to be considered, viz., insoluble phosphoric acid, it is comparatively easy to set a price upon phosphate of lime in raw bone, and just as easy upon the phosphoric acid which constitutes less than half of the phosphate; but this is not the only source from which it is derived. In fact, only a very small proportion indeed of the insoluble phosphoric acid of commerce comes from raw bone. Moreover, the cost of phosphate of lime in most other substances is less than in bone, and less in some of them than in others; and not only is the price less but the agricultural value is less also, and varies more or less in all.

This variation is due to the greater or less degree of solubility of the phosphate as it exists in one or another of the substances containing it. In raw bone, when finely ground, although not immediately soluble in pure water, and therefore technically called insoluble, it can be appropriated by growing plants during the

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potash cost nine and a half cents a pound, while in American ash it costs thirteen and a half cents per pound."

There is a loss or drain of potash from our farms hardly thought of hitherto, and even more seldom utilized, in a peculiar excretion of sheep. The following is quoted from the report above named:

"It is well known that sheep draw from the land on which they graze a considerable quantity of potash, which, after circulating in their blood, is excreted from the skin with the sweat, in combination with which it is deposited in the wool. Chevroul pointed out that this peculiar compound, called by the French 'Suint,' forms no less than a third of the weight of raw merino wool, from which it may be readily dissolved out by simple immersion in cold water. In coarser wools it is less abundant, and according to M. M. Maumene and Rogelet, potassic sudorate, or suint, of ordinary wools forms, on the average, about fifteen per cent. of the raw fleece. This compound was formerly regarded as a soap, doubtless because wool contains, besides the suint, a considerable amount (about 8½ per cent.) of greasy matter. This grease, however, is, in fact, combined with earthy matter, chiefly lime, as an insoluble soap. The soluble sudorate is a neutral salt, resulting from the combination of potash with a peculiar animal acid, of which little is known beyond the fact that it contains nitrogen.

At the great seats of the woollen manufacture in France, as at Rheims, Elbœuf and Fourmies, the new industry of M. M. Maumene and Rogelet is either established or in course of establishment. * * * An ordinary fleece weighing about four kilos, contains about 600 grams (above 20 ounces) of sudorate of potassium, or suint. This contains about one-third of its weight of pure potash," (say seven ounces.)

The manufacturers of the three above named places wash the fleeces of 6,750,000 sheep, and it is computed that these are about one-seventh of all in France; also that if all the potash from this source was saved France would derive from it all the potash she requires. It is to be hoped that, either by the efforts of farmers or of wool manufacturers, this source of fertilization may not be longer overlooked.

season when it is applied. This is due to the fact, that in the organized structure of bone, every molecule of phosphate, infinitesimally small, is separated from the next by animal matter subject to decay, and as it decomposes they fall apart.

If bone be charred to "bone coal," or burned to "ash" before being ground and applied to the soil, it is less soluble than if unburned, and unless treated with acid, and thus first converted into soluble phosphate, it requires much longer for plants to appropriate it to their needs. Bone ash is imported from South America. Bones are burned in close retorts to furnish bone charcoal, which is largely used by sugar refiners to decolorize their syrups; and after it will no longer serve their purpose, is sold for the manufacture of superphosphates. Rock guanoes, and other phosphatic guanoes of varying grades of quality, are also extensively used for the same purpose. In some of them, the phosphate is in a state of tolerably minute division; and just in proportion to the fineness of its particles is the ease with which it is taken up by plants. Apatite, or mineral phosphate, found in Upper Canada, is also employed. Some of this is very rich in phosphoric acid, but so insoluble that unless treated with acid it would remain for years in the soil as inert as so much sand, even although made small "as the fine dust of the balance."

Latterly, a new and very extensive source of phosphatic material has been discovered in South Carolina, where exist fossil deposits, of obscure origin, immense in amount, but less rich in phosphoric acid than the substances above named. With proper treatment and suitable additions, these South Carolina coprolites are capable of producing a commercial manure which will do good service, as far as it goes, but will not make a highly concentrated manure, and consequently should be sold at a moderate price.

The abundance of these deposits, and the ease with which they are mined, will serve beyond doubt to work a wonderful change in the agriculture of the Southern States, feeding their impoverished soils with what they lack, and thus restoring fertility to numberless acres abandoned because of the exhaustive culture usually accompanying slave labor.

The very lack of a large per centage of phosphate in these deposits is destined to work good to the South; for were they much richer they would undoubtedly be largely exported to Europe which stands ready to buy all which comes up to their standard of desirable quality. As it is, they will be chiefly used at home, and within distances requiring but moderate expense for transportation.

In the light of such facts you will easily perceive the difficulty of fixing a definite price upon an article, which, although always the same substance, is yet found in forms and with accompaniments which affect its value to a very considerable degree. The best which can be done in fixing a legal rate is to settle upon what may be a fair average.

In 1858, Prof. S. W. Johnson decided upon four and a half cents per pound for insoluble phosphoric acid. This corresponds very nearly with the valuation of most European chemists. Since that time the increased supply has kept so even pace with the increased demand that the market value of substances containing it, (excepting raw bone,) have changed very little, if at all, except for the difference between gold and currency. Consequently, if we add to Prof. Johnson's price of 4½ cents, say one-third, for the premium on gold, we have six cents per pound—and this is considered a fair price at the present time, and is that named in the statute.

Let us next inquire what is a fair valuation of soluble phosphoric acid. Soluble phosphoric acid, whether designed for manure or for other uses, is always obtained by the action of sulphuric acid upon ordinary phosphates. Phosphate of lime (which is the phosphate most frequently met with in nature, and which commonly goes under the name of "bone earth," no matter whether actually obtained from bone, or from minerals, or from fossils), consists of one part of phosphoric acid combined with three parts of lime. This is insoluble. But another combination of the same constituents exists, which is very easily soluble, and this consists of one part of each. The method uniformly practiced to obtain this soluble phosphate is, to add to ordinary phosphate sufficient sulphuric acid (oil of vitriol, as it is commonly called), to take away from the phosphoric acid two of its three parts of lime—leaving the phosphoric acid combined with one part of lime. This is readily effected, inasmuch as the sulphuric acid has a stronger affinity (to use the common term), for the lime than phosphoric acid has. When thus treated we have a mixture of sulphate of lime and soluble phosphate as the product.

It follows, therefore, that the cost of manufacturing soluble phosphoric acid depends largely on the price of sulphuric acid, and as the sulphur, the nitre, the labor and the apparatus, which go to make up the cost of oil of vitriol are, all of them, dearer than ten or twelve years ago, it also follows that the expense of converting insoluble into soluble phosphate is greater than it was then.

The commercial value of soluble phosphoric acid in 1857–8 was estimated by Prof. S. W. Johnson at twelve and a half cents per pound. So far as I am aware this is the lowest price which has ever been affixed by any scientific authority. It is the same as that arrived at by Dr. Voelcker of England and by Dr. Stockhardt of Germany about the same time. Prof. Johnson seems to have adopted their conclusions as correct, on theoretical grounds, and added nothing for the higher price of oil of vitriol in the United States above what it commands in England and on the continent. In 1856, Prof. Way, chemist to the Royal Agricultural Society of England, adopted sixteen cents as its just commercial value. In 1860, Dr. Anderson, chemist to the Highland and Agricultural Society of Scotland, after careful investigation decided upon fourteen and a half cents per pound, as the price at which to estimate it in commercial manures.

Now if we take the average of these three appraisals, and add a third for difference between gold and currency, we have upwards of nineteen cents, currency, and if to this we add a proper amount for the greater cost* of oil of vitriol here above its cost abroad, we bring it up to, if not beyond, twenty-five cents per pound. At present prices of materials, labor and incidental outlays, and with gold bearing twenty to thirty per cent. premium, a valuation of soluble phosphoric acid at twenty-five cents per pound is probably as near a fair one to be paid by the consumer to the dealer (including a small profit to the latter) as is likely to be reached. The manufacturer will not reap a profit beyond, if as large as, what is usually obtained on manufactured goods, while the purchaser will get it cheaper than it could be made on a small scale.

We come next to ammonia, to decide the value of which in a satisfactory manner is more difficult than either soluble or insoluble phosphoric acid. This is owing in part to the variable character of the substances we buy it in, and their fluctuating and on the whole rapidly increasing prices during ten years past. It is

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*How much higher it is, I am not able to state with precision; probably fifty per cent., perhaps more.

J. Lawrence Smith, in his recent report as United States Commissioner to the late Paris Exposition, comparing its price in this country with that in France and England, says that owing to ill advised legislation, it is "*much higher and fluctuating.*"

also partly due to the fact, that we sometimes buy it as actual or ready formed ammonia, and sometimes as potential ammonia; that is to say, we sometimes buy a nitrogeneous substance containing no actual ammonia, but certain nitrogeneous compounds, which, while decomposing in the soil, yield as much ammonia as the nitrogen in them is capable of forming. The animal portion of raw bone is such a substance, so are dried blood, horn, hair, hoof, flesh and fish; so are woolen rags and refuse leather, but the latter decay so slowly that they possess less value as manure than if they decomposed with greater rapidity.

Formerly the cheapest source of supply was in Peruvian Guano and the valuation of ammonia was obtained from its cost in that form. Fifteen or twenty years ago it yielded from 16 to 19 per cent., but latterly much less, while the price is 40 per cent. higher than then. These considerations make a very wide difference in the price to be set upon it. Besides, the Chincha Island furnishes a very limited supply at present, and are nearly exhausted; and what is coming forward from Guanape is much inferior containing only about 8 or 9 per cent. and the price $60 per ton (gold). Fifteen to twenty years ago ammonia was estimated by some chemists as low as 14 cts. and even 12½ cts. per pound, now it appears that double this price (in currency) falls short of wholesale rates. Even then Dr. Stockhardt maintained that its value was not less than 25 cents, and says that, "although this price may appear high he believed it would bear a further addition rather than any reduction."

At the present time we have a source of supply then unknown, in fish guano; but this as found in our markets is exceedingly variable in quality, sometimes containing not more than one or two per cent. and from that up to seven or eight. Its quality, its price and the supply are all so uncertain as to furnish at present no satisfactory data by which to determine a standard of value.

Sulphate of ammonia is another form in which it may be bought, and which is largely employed in agriculture. The price of this article has rapidly and largely advanced, in consequence of its extensive employment for the growth of the beet root for sugar on the continent of Europe. An inquiry lately addressed to a large dealer in New York for the lowest price at which fifty tons could be furnished for cash, brought an answer by which it appeared that ammonia in this form commanded thirty cents per pound in large quantities.

In nitrate of soda we have a desirable form in which to supply plants with soluble nitrogen; but at the present time, the equivalent of a given amount of ammonia costs about a third more than it does in sulphate. This is due partly to the enlarged demand both for agricultural uses, and for the manufacture of oil of vitriol, and other uses in the arts, and partly to the serious injury to the port of shipment in South America by reason of earthquakes. The unusual price which nitrate of soda now commands, may not continue many years, but there is small likelihood that it will recede to former rates.

Taking all the facts bearing on the question into consideration, the conclusion is reached, that if the farmer can buy ammonia or its equivalent, at the present time, in a well prepared manure, near home and in quantities to suit, at thirty-five cents per pound, he may be well satisfied.

Let us now apply this scale of values to the commercial manures sold in New England, and endeavor thereby to ascertain how they compare with the prices usually paid. For this purpose we cannot otherwise do so well as to quote freely from a recent report made by Prof. S. W. Johnson to the Connecticut State Agricultural Society, dated April, 1869, and published in their volume lately issued.

At the instance of the Connecticut State Society, Prof. Johnson analyzed the various fertilizers offered in the markets of that State. The samples were obtained by the secretary of the society, who visited the dealers in various towns and took them from the barrels and bags as sold. To each he affixed a number only, and sent them thus to the chemist; retaining however the number in a memorandum with the name of the article, the name of the dealer, and the selling price. After the analyses were made and reported to the secretary, the latter added to the numbers the corresponding items of information, thus making the report complete. It is not easy to say how a better arrangement could be made to arrive at the facts in the case; nor how we could better obtain reliable data for the purpose now in hand.

These analyses embraced one sample of fish guano which proved to be good and cheap; one of "Lodi poudrette," and one of "Lodi double refined poudrette," neither of which proved much better than common farm manure, and not worth a very long cartage; one of "saltpetre waste," one of "castor pomace," one "bone fertilizer," (Baugh's); one "tobacco grower," (Wilson's); and nine so called "superphosphates." Sixteen manures were analyzed, and in each case the analysis was duplicated in order to verify the results.

To avoid complications we will examine only the nine so called superphosphates; and from these I propose to throw out three. First, the "home made," furnished by Mr. Plumb, partly because of its inferiority, being worth by our scale of prices less than $18 per ton; that is to say, less than a cent per pound, and partly because no price was affixed to it. Secondly, we throw out Baugh's, for the reason that it contained no *soluble* phosphoric acid at all, and therefore is not entitled to the name, because soluble phosphoric acid is *the distinguishing feature* of any and all superphosphates, properly so called. Lastly, we throw out "Russell Coe's ammoniated superphosphate," for a very different reason, namely, that it is too good for the money. The price named is cheaper than that of any other, while its value as shown by the analysis, and the scale here adopted, is fifty per cent. higher than any other; eighty per cent. better than Atwood's, and more than a hundred per cent. better than Bradley's. It is safe to say, that it could not be made and sold, in the usual course of business, at the price given, without loss. Hence we infer, either that the sample was an exceptional one, not fairly representing the bulk sold; or else that it was got up with a view to win a reputation upon which, by and by, to sell a more cheaply made article.

We have, then, six remaining on the list, the names, prices and composition of which are as follows:

	The price of which is per ton.	Containing per cent. of soluble phosphoric acid.	Per cent. of insoluble phosphoric acid.	Nitrogen equivalent to ammonia.
Lloyds'	$60	.30	15.95	2.59
Bradley's	70	1.38	13.16	3.28
Stagg's	65	3.19	16.16	2.43
Mapes'	60	3.93	8.64	3.52
Atwood's	70	5.75	10.38	2.04
E. F. Coe's	60	7.91	4.96	2.80

Estimating the value of these severally, according to the scale of prices named in the statute, to wit, six cents per pound for insoluble phosphoric acid, twenty-five cents for soluble, and thirty-five cents for ammonia, we find them as follows:

Lloyds'	$38.77	per ton.	Mapes'	$54.66	per ton.
Bradley's	45.66	"	Atwood's	55.49	"
Stagg's	52.35	"	E. F. Coe's	64.10	"

To these amounts should be added the value of the minor constituents, which although not adding largely to the sum total, really add something; as for instance, the sulphate of lime, of which there must necessarily be rather more than twice as much as there is of soluble phosphoric acid, and if the phosphatic material used contains carbonate of lime, as most frequently occurs, there will be more. This being formed and precipitated in the process of manufacture, is in a state of very minute division, and therefore more readily soluble than the mineral gypsum commonly sold. So, too, there is usually present more or less of alkaline salts of variable composition and value.

We see, therefore, that one of the superphosphates exceeds in value (estimated by our scale) the selling price, and several others make a close approach to it.

We might with propriety have included among the superphosphates Wilson's "tobacco grower," since it is neither more nor less than a superphosphate, except that it contained between three and four per cent. of potash. Estimating the soluble and insoluble phosphoric acid and ammonia, by our scale of prices, and leaving out of account the 71 pounds of potash contained in one ton, it would come to $35.30. It may appear strange that an article bearing so good a reputation as that does should show so small a value, but it may be accounted for by the fact that it is mainly a by product of another manufacture, namely Horsford's phosphatic bread preparation, and by reason of this its mechanical and molecular condition is remarkably good, and thus manifests greater immediate efficacy than would naturally be expected from a bare statement of its contents as the result of analysis.

This brings to view a thought which was presented at some length on a former occasion, namely, that it cannot be justly claimed that analysis will reveal all which is desirable to be known about a manure. It will show with certainty what is in it, but not so certainly about the combinations, or chemical, or mechanical condition in which the constituents exist in it, and this is sometimes a matter of importance, for even with regard to mechanical condition, which one might suppose could be determined with sufficient accuracy by sight and touch, there may really be a very wide difference between two articles which appear equally well to ordinary inspection.

Nor is it claimed that the scale of values here adopted is all that is to be desired. From the nature of the case no absolute standard of the sort can be set up. But it is believed to represent more nearly than any other which has fallen within my observation, the actual commercial values of the more important constituents of manures at the present time.

It is further believed, that if buyers will enforce the law, and will refuse to buy unless the contents stated, and by responsible parties, too, show a fair approach to the price demanded, everything like *serious* fraud, or imposition in the sale of commercial manures may be wholly banished from the State.

Mr. TAYLOR. I have used these superphosphates some, and have compared the different kinds. I would like to make a single inquiry of Mr. Goodale. Bradley's "XL.," as it is termed, has been used pretty freely in the neighborhood where I live, and I believe the testimony respecting it is pretty uniform: that applied to corn, it produces a healthy, vigorous growth of stalk, and a wide, dark-colored leaf, but seems to lose its strength just about the time the ear sets. We get a great growth of stalk, but a small ear, in proportion. What I want to ask is, what is the deficiency which causes it to fail before the ear is formed?

Mr. GOODALE. Assuming that the fact stated is uniformly observed, which may be doubted, for I have heard favorable opinions expressed in regard to the earing of corn manured by Bradley's phosphate,—assuming the fact to be as the gentleman has stated, with this or any other manure, it may be accounted for in this way: Perhaps you noticed the remark in the lecture that in my opinion the function of nitrogen in manure is to supply force rather than to feed. In common language, it stimulates growth. If you apply a manure containing a large per centage of ammonia to any grass (for corn is a grass, a large species to be sure, and having a very different seed from others, but it belongs to that family, and in regard to its wants there are decided points of similarity,) if, I say, you apply to corn a sufficient amount of nitrogenous manure, you get a very vigorous growth of stalk and leaf, but unless the plant can get, at the same time, mineral constituents to help fill out the ears and mature the seed, you will find a deficiency in the ear at harvest time; so that, if a manure produces the effect which the gentleman says is produced by Bradley's XL., the fact would indicate that it contained a sufficient amount of ammonia, with too small a proportion of phosphate, or else that the phosphate was in an insoluble condition, which would be equivalent to the same thing. What is needed in manure is something that supplies all which is required; gives an active, vigorous, healthy growth, and at the same time yields the food which it wants to complete and fill out all its tissues.

Mr. MARTIN MOORES, of Bangor, was called upon and said: I will not take up much of your time. This is a wide field, and much might be said; for three years, commencing in 1849, I gave some attention to this subject and made up my mind decidedly that more might be made in farming by knowledge than had been made by labor, and I wanted to get along in an easier way. I took Mapes' "Working Farmer," from the first number, during three years. I read Dr. Johnson's "Agricultural Chemistry;" if that could have been abridged one half, I should have liked it better. I had also "Bommer's Method," and from that something was to be learned. I think I have learned enough from Johnson and others to understand what has been advanced here, and, so far as I know it is all true. You have had the science of agriculture; now the great thing is to have the practice.

In regard to this question of manures, it is the barn yard, to which we must always look for our main supply. The decomposed rejections of what the animal eats furnishes the general manure; and where that can be supplied to the soil, with the addition of any special manure that may be wanted, we shall realize greater benefit even than has been represented here. When your farm is in balance, a general manure is exactly what you want. But if some of the elements which are absolutely necessary to produce a given crop are deficient, it cannot yield its maximum product unless those elements are furnished in sufficient quantity. Whenever phosphate, or potash, or nitrogen is wanted, we need mercantile manures in addition to what is furnished by our animals.

I experimented a good deal during three years. Following out Bommer's method, my first object was to increase the amount of manure. These commercial manures must not be the main dependence of the farm. We cannot expect to make three hundred acres rich by buying manures; we must depend mainly upon the barn-yard, and by attending to it understandingly, we can furnish them in our composts, as I have practised. In one instance, following out the Bommer method of fermentation, I decomposed six horses, with other things, in six weeks, or all but the hair and bone; and I actually decomposed the bone in the course of one or two years.

There is one point which I wish everybody understood, and that is the great value of the liquid manure from stock. This, if properly saved and applied,—and it is very easy to save it by means of a barn cellar and plenty of muck,—will make a valuable compost, and furnish much nitrogen.

There are certain principles which you may reduce to practice. What we want is for the farmer to double the amount of his manure. We certainly now have more than four times the amount of manure on our farm that we had under our former practice. We save all our urine, and add as much muck as we contemplate making solid manure. The muck thus treated is worth as much as solid manure, and the urine is all saved.

Mr. Thing. I thought, when the lecturer was speaking about shooting growth into plants, that if he could go a little further and shoot his ideas into the minds of the people, he would accomplish a great work. This discussion, like every other to which I have listened, has more and more impressed me with the great necessity we have for this agricultural college which has been established. Mr. Goodale says that a chemical analysis will inform us just what a certain manure contains; but it will not tell with certainty what we can get out of that manure, or what results will surely follow its application. Now, if we get this agricultural college established on a firm basis, and in successful operation, we may make its influence felt throughout the length and breadth of the State. We hope they may tell us what our different soils need; what manures to apply, so that we may know not only what their market value is, but what their value will be to us. I hope those who are here to-day will remember, when they return to their homes, the necessity there is for encouraging and sustaining this college.

The Michigan Agricultural College.

The President. The chair will state that a gentleman is present from one of the Western States, who is under the necessity of leaving early in the afternoon. It will interest all to hear from him, either upon the question now under discussion, or upon matters in the State in which he lives, I therefore call upon President Abbott, of the Michigan Agricultural College.

Address of President Abbott.

Gentlemen of the Board,—I feel very deeply this compliment to the Michigan Agricultural College, for it is certainly paid to the college, and not to me. I came to see the Agricultural College of

Maine at Orono, and I find it mostly here at Bangor. I feel deep interes in this college; and we all at the Michigan college feel a very deep interest in all the other agricultural colleges in the country, and that they must act together, and must know each other's plans and methods. Everybody says that we are experimenting, and so we are; and we must have all the wisdom we can get from the experiments, the trials, successes and failures that we make among ourselves. For that reason, I was anxious to come here and see what you were doing. I have another interest in Maine, inasmuch as I was born in Vassalboro', and brought up in Augusta, and never left the State until I went to Michigan, and was there but a short time before I went, some eleven years ago, to the Michigan State Agricultural College; so that all the homes I have in the world are Maine and the Michigan State Agricultural College.

We are trying to do something there in the way of experiments with fertilizers, but you must not expect too speedy results from such efforts. It has been one difficulty with us, that the farmers of the State expected that in one year we should be able to tell them, from the results of a single year's experiments, what to do. Now, for my part, I cannot say that farmers are entirely to blame, for the feeling of distrust which has generally prevailed in reference to "book farming," as it is called. I will not say that they are not to blame for it, in part, but I will say, that in part the educated and scientific men have also been to blame. The impression you would get from the earlier writings of Liebig would certainly be this: that if you analyzed the soil and analyzed the plant, you could tell what manure to use to make that plant grow; but when you come to try the experiment, you find that you cannot tell. There may be conditions in the soil which prevent the fertilizers from acting as it was expected to act, and there may be all the elements in the soil that that plant uses, and yet the plant will not grow. We cannot tell. Book learning and theories, especially theories in agricultural science, are too vague, they are not yet established by weight and measure; certainties are too far in the future, to enable an agricultural school, either here or elsewhere, to tell you, in a few years, just what to do, and just how to fertilize.

There comes in,—and it is recognized now by scientific men much more than it was when agricultural chemistry began to be preached about,—the necessity of union and sympathy between farmers themselves and those who make laboratory work and careful experimenting their business; they must all pull together. Your college cannot sit there at Orono and tell you how to farm without your assistance; it cannot tell you exactly what manures to use, or anything of the sort. There must be a working together; for you cannot yet tell with agriculture, as you can with mechanics; it will not come into mathematics; it is not sure without experiment. It is an experimental science, as yet in its infancy. So, I say, do not expect too much from the Agricultural College, in that particular line. Help it forward, so that it can make experiments and analyses as fast as you can. Money expended there, in my opinion, (but I belong to an agricultural college) is a good investment; but do not expect that its value is to be found in the development at once of particular rules, as to what you are to do.

Your meeting here to-day is exceedingly agreeable to me, and it will be a pleasant memory to take home. We are situated somewhat differently in Michigan from what you are here. The State Board of Agriculture has no existence there save in the law organizing the College. The College was first, and the Board came afterwards, as a Board of Control.

I was asked by friend Taylor yesterday, if the College was successful, and I answered that I was an officer of that College. If I were in Michigan, I should say it was. If I went into some corner of Michigan where they hated to pay taxes, I should say it was, because I should add, "You are up to Lansing often, and you can come and see." But I cannot say to you, "Come and see," and I would like to be a little more modest about it. But if we have been successful, we have had, for the past few years, a pretty good chance. The Legislature has, without hesitation, given us what we asked. For five or six years, they have granted us $20,000 a year for current expenses. The Faculty are all hard-working men. They are all interested in their departments, and a perfect unit in the work. They are all men who have come since I went there; I knew them all before they came; and they are there, hard at work; if they were not competent to instruct when they came there, (I mean in the hidden things that were not then much studied,) they are certainly fast preparing themselves.

Our Board is small, only six or eight, and almost every member is present at the meetings. I have been either a member of the Board *ex-officio*, or been summoned to attend their meetings from the first, about twelve years ago, and I have not seen any dissension, nothing but harmony and friendship; so much so that their families, although residing in different parts of the State, frequently interchange visits.

Our College is conducted, I think, much like yours. We have there a Professor of Agricultural Chemistry, one of Botany and Horticulture, one of Animal Physiology and Practical Agriculture, one of Etomology and Zoology, one of English Literature, and myself. There is a large University in Michigan, at Ann Arbor, of 1300 to 1400 students, and about 30 Professors. The feeling has prevailed to some extent amongst the educated men of the State, that it is impossible to make a scientific course of instruction give the same power or discipline of mind as a classical course. I will not undertake to say that it can be done or is done in the case of graduates of our college, but I think it comes pretty near. My own impression is this, that a year's study of the sciences may be made as disciplinary as a year's study in any other branch of education. Most Agricultural Colleges, however, admit their students with a year, or a year and a half less previous preparation than is required at other colleges. I have studied this question with care and had it constantly in view; for when I went to the Ann Arbor University, the Professors there said to me, "Let us see if you can make discipline go with scientific studies. We have a scientific department and a classical department, and most of the students who excel in ability prefer to change from the scientific to the classical department, because they find it to their account. Can you do any better?" I say I believe that a year's study of chemistry (and we require a year's study of chemisty, with three hours work a day in the laboratory by every student for half a year,) is equal to a year in Latin or a year in Greek; and I believe I shall be borne out in this statement by the professors of other colleges, for I have consulted those at Harvard and at Yale on the subject, and they agree with me. And if you will add to scientific studies such others as will enable the students to impart their knowledge, and express themselves with method and clearness, I do not see why agricultural colleges cannot place their students on a par with those of the old colleges. It remains to be seen, it is an experiment.

The Agricultural College of Michigan is really educating farmers. It was said that we could not send three per cent. of the young men back to the farm. I have repeatedly opened our catalogues, with persons who asked the question, and shown them that over sixty per cent. of our students went back upon farms, or into horticultural pursuits. That is the difference between the prediction and the result. I think this result is due to the fact, that they keep up their habits of labor during the whole four years; and they labor cheerfully, because their labor is all connected with their class instruction. Our students frequently go out into the barnyard, or into the garden, or into the green-house, and receive their lecture there. But we do not allow them to depend upon lectures entirely; they use text-books also, where suitable ones can be obtained, and we oblige them to study and recite. In practical agriculture we do not use text-books, but depend upon lectures, with practice.

Now, if all the farmers who come to a convention like this were able to follow a lecture like that we heard this morning, and seize upon and hold the scientific names of substances, and if they knew their relations to each other and their action, how exceedingly interesting and profitable a meeting like this, anywhere, would be to the common run of farmers. There is too commonly a lack of the elementary knowledge among farmers that would enable them properly to take hold of these things and profit by them as they should.

But the Agricultural Colleges are exerting a general influence in favor of scientific studies, and as this influence spreads we shall have, by-and-by, this elementary education widely diffused, and people will be better able to read books and newspapers, and to discuss matters of this sort intelligently; the education of the world will be more practical, and just as beneficial, just as disciplinary, and just as much calculated to elevate and make noble the man.

QUESTION. How many students have you at the college?

Pres. ABBOTT. About 80. We have but one building for students, which would not hold near that number, but our students have been willing to room four in a room, if they could get two beds in; and we have been for the last three or four years crowded all the time. Last winter the Legislature made an appropriation of $30,000 for a new building; the college added about $5,000 more, so that, at the opening of the next spring term, we hope to be able to accommodate nearly 200 students. Whether we shall have 200 I do not know, but we have had hitherto more applications than we could entertain, and of course there have not been so many applicants as there will be when it is known that we have enlarged accommodations.

QUESTION. Is it desirable to have a very large number of students?

Pres. ABBOTT. Our board say they do not desire for some years, at any rate, for more than 300 or 350; and it has not been considered a matter of very great regret that our numbers were small, excepting in this one particular—that taxes are heavy. The people pay the taxes, and they want a large number educated, and all very right, too. It has been an experiment; we have had to feel our way. We were put in the wilderness, there were no other schools whose experience we could profit by, and I suppose that three or four hundred students would not really have been so good for the institution as eighty during these years of trial.

There is another thing to be considered also. It is not possible, I think, for an officer to do well with more than forty students, unless they are so well disciplined, so far advanced, that they can get from a simple lecture, all the good which they ought to get from a class-room exercise. If they are not well-disciplined minds, (and very few of our students get so well disciplined when they graduate), a course of lectures merely is not what they need, but lectures upon which they are examined, and of which they have to make notes, connected with text-book instruction if a suitable one can be had. That is the kind of instruction which they get and which they need. Now I say that a class of forty is as much as one person can manage, who has to superintend and look after the progress of every individual; and a professor who will not do that, ought not to be professor at all. If he will not interest himself in the progress of every individual, he is not fit to be a professor; and if he does that, and has a class of forty, and an hour a day to examine them in, it is all he can do; and it will suffice to give each a chance to acquire that discipline which comes from raising and answering questions, and so imparting to others what he has had imparted to him.

QUESTION. I would inquire whether manual labor forms part of your system, and if so, what has been its effect?

Pres. ABBOTT. Manual labor was introduced the first day, and has been there ever since. We do what we can to make it easy to the students. That is to say, we require no labor in the forenoon, so that they may have the time when they are the brightest, for books, lectures and study. We require no labor on Saturday. We put it all into the afternoon, as early as we think the laws of health will admit, so that, if they need rest after the three hours' labor, they can get it before tea, and be refreshed for their evening tasks; for if you take growing boys into the lecture room after they have been laboring three hours, they are apt to be sleepy, whether they have had their dinner or not, and especially if they have. They are young and growing, and if you take them directly in, after three hours' work, they are not in a condition to receive that benefit from the lecture or the class-room exercises that they otherwise would. They go out at half-past one, and remain until half-past four.

QUESTION. Does it interfere with their intellectual advancement, as compared with other colleges where the system is not introduced?

Pres. ABBOTT. I cannot tell. If a person merely wished intellectual advancement, he might get the same benefit to his physical system by gymnastic exercise. If he were compelled to take it, or took it voluntarily, he *might* do better than if he worked in the field; but I think three hours' labor a day is vastly better for the boys than the no-labor system which is adopted by nearly two-thirds of the boys who go to college. If I were asked for the best possible system to save time, I should say voluntary exercise in the gynasium, under instruction. Our system does not interfere with the advancement of the students so much as the method of taking exercise or not, as it happens.

Our boys work cheerfully; we have no trouble about that at all. They are all required to work; it is in the law of the State, and consequently nobody asks exemption from the rule. As to the value of their labor, I think the farm, taken as a farm simply, could be run more cheaply without their labor than with it. And yet the boys work well; but they labor only three hours. It is a set time, and when the bell strikes, it is necessary for them to stop; they leave the work where it is, unless in case of necessity. Our boys are always ready to finish a job if they are asked, but we do not ask it unless the case is one of real necessity, for the time is theirs, and they need it; consequently, at the end of the set time they drop whatever they have been at work upon, and one or two hired men have to come in and take it up where they leave it, and put things to rights. Then we are obliged to send skilled men into the field with them to make their labor profitable to them. If you send out a parcel of boys together, they may work well, but if you wish to make their work really educational, you must send one with them who knows just how to do that work, who can tell them about it, and answer questions; consequently the system is not a money saving system. Although the boys work well, and do their work well, and do a great many kinds of work that ordinary hired hands could not do, nevertheless, it is not a money saving system to our institution, the way it has been managed since I have had the control of the college. It was before I took charge of the institution, but it was not so educational. I made the change, and stated to a committee of the legislature, why I made it, and that it made the institution more costly than before. They were satisfied, and presented the matter to the legislature, and that body was satisfied, and increased the appropriation which was given to us.

Sec. GOODALE. What influence, in your opinion, does their labor at the college have upon their subsequent pursuits in life? If they got what physical exercise they needed at the gymnasium, would the proportion of those who returned to industrial pursuits be what it is now?

Pres. ABBOTT. That is a question which a man may answer from his opinion, or from a basis of facts. The facts are few, as yet; they have not been examined; but I will tell you how it is with us. As I have said, more than sixty per cent. of our graduates have gone into the pursuits of agriculture and horticulture. The University of Ann Arbor graduated thirty-seven this last commencement, and out of those thirty-seven only *two* were intending to become farmers. The State Agricultural College of Wisconsin is united with the University of Wisconsin at Madison. It is a fine college, and in a beautiful place, and they have one of the finest men for president that I ever knew—Paul A. Chadbourne, formerly of Williams College, Mass., and of Bowdoin College in this State, and a Maine man. Prof. Chadbourne stated before a committee of the legislature, or before the legislature itself, I am not certain which, that he had carefully inquired of all the students at the college, some four or five hundred, and he could not find any who had made up their minds to be farmers, or to till the soil, after they left.

Now, as a matter of opinion, I think this system of labor has everything to do with the subsequent choice of employment. A boy at our college begins with a course of lectures on agriculture, extending over half a year, with geometry and algebra. The next half year he has trigonometry, and after trigonometry, surveying; and our students are sent for far and wide, to run lines and settlé boundary questions. The next year they go into chemistry and botany; and after going through with the text-book in botany, they continue the study through lectures and investigations into all the more important plants, stopping a good while upon the grass family. All this time they are also at work. Then they have horticulture, and have two or three books for reference; and they see the operations, and they perform them. When they come into the Junior class, they have entomology and zoölogy; and in the Senior class, before they graduate, they have another course in agriculture, more advanced than the first. They attend lectures during the whole time, and when they get through and go home, it is natural to suppose that more of these boys, farmers' sons, so educated and so trained, with physical strength and habits of labor, will go into agricultural pursuits, than would do so if they went to a college where the whole current of feeling was different. I do not see how it could possibly be otherwise. But then, the facts are the things to look after, and I gather them up as I happen to see them. If I had my notes here I could give several important, though not a very large number of facts; but they all point the same way.

Question. Have the students the privilege of choosing their work?

Pres. Abbott. They have not, as yet; if the college was further advanced so that we could, my own impression is, that it would be better, after the first year, to let the student choose his labor, and study to correspond. That would make him more perfect in some line when he graduates. For instance, if he chooses chemistry, let him displace some other studies, and become more advanced in that; so too, if he chooses horticulture, or stock breeding. My own impression is, that a school more advanced than ours might give them that choice, but we have not done it.

Our method is simply this: The horticultural department, embracing gardens, lawns, the green-house, orchards, and the like, is under the Professor of Botany, not under the Professor of Agriculture, and we give him one-third of the students; that third always embracing the Sophomore class. We give the farm the other two-thirds, and that must always embrace the entire Junior class. This we do so that the Sophomores, under the Professor of Botany and Horticulture, may be with him the whole year, and if he wishes to pursue any special system of instruction, they may see the thing from the beginning to the end of the year, in the green-houses in the horticultural department, or anywhere else. And we have an arrangement by which the Seniors are changed back and forth from an alphabetical list, as it is necessary to make up this two-thirds and one-third; which change occurs every fortnight.

Adjourned to two o'clock, P. M.

Afternoon Session.

The Convention reassembled at two o'clock, Hon. Lyndon Oak of Garland in the chair.

An exceedingly interesting exercise in the application of natural philosophy to agricultural operations was given by the students of the Agricultural College, under direction of Prof. Fernald, the principles enunciated being very clearly illustrated by diagrams on the blackboard.

At the close of this exercise, which occupied about two hours, the Chair called upon Dr. Boynton of Vermont to address the Convention.

Dr. Boynton. *Mr. President and Gentlemen:*—I do not accept the invitation to speak for a few moments for the purpose of expanding the thoughts that have been brought before you by this exercise, but rather, in the first place, to express my personal satisfaction with the manner in which these subjects have been presented. We have had here, if I may so express myself, some of the first fruits of your college at Orono, a foreshadowing of the good things to come. Personally, I have been highly pleased with the manner in which these illustrations have been brought before us, and with the evident understanding there is of the principles by those who have exhibited them. I have been forcibly reminded, while listening to these demonstrations, of the old method of instruction no longer ago than when I myself was a boy. We were arranged on the recitation seats, these subjects were brought up; for instance, the teacher asked a question, and the pupil answered it if he could; if he could not, it went to the next; and so the thing went on from day to day. But here we have these young gentlemen coming forward, each with his topic assigned, which he takes up, illustrates, discusses. We have had it abundantly demonstrated here this afternoon that they understand what they are studying; it is not a routine business with them; it is not memorizing. The knowledge thus acquired is incorporated into their own being; or, in other words, it is assimilated to and becomes a part of themselves. It will not go away, it will stay, and in their future lives will become practical. As they go out into life, it will be valuable, either through their own labor or through the assistance and direction they can give to others.

And here let me say, that a very important point is gained by the manner in which this instruction is imparted. They not only acquire this knowledge, but at the same time they are enabled to communicate that knowledge to others, which is far better. The difference is that between gold locked up in the earth, and gold brought out, minted, and put into the circulation of the world. In the one case it is dead knowledge, locked up and accomplishing little; in the other, it is coined and stamped, and put into the circulation of the practical thought and labor of the world. That is what we shall have, and what I trust will be perfected and carried forward in this school which you have founded, and to which, I trust, you will give your warm personal sympathy, and, better than that, your substantial support.

But some may say, "It is all very well, these diagrams, with A, B, and C, and the pullies, and cords, and angles, and parallelograms,—it does for the school-room, it does for Professors to talk about, it answers as a means for students to exhibit themselves before the public, but we do not quite see the connection between this and farming; we do not quite understand what this has to do with the building of walls, the ploughing of fields, the carting of manures, and all the practical work of the farm." But, gentlemen, it does have much to do with all your practical operations in life, because these illustrations that have been brought out here are but an exemplification of the universal laws of nature, under which we all literally "live and move and have our being." Some may think that this demonstration in regard to leverage, for instance, is not of very much practical importance, but the moment you reflect upon it, you will find it is, inasmuch as the principles which have been stated are the fundamental principles of all motion of which you can form a conception. The very wave of air that reaches your ear from the word formed by my vocal organs moves forward in accordance with the same laws which we have had demonstrated here. The law of fluids is the same which is illustrated every moment of your life in the flow of the current of blood through your system. Go outside of yourselves, into practical life, and what do you find? You cannot take up a hoe, a shovel, a crowbar, or an axe, you cannot harness your horse or yoke your ox, you cannot do anything except by the application of those principles that have been exemplified here this afternoon. Wheeling a barrow, lifting a basket of potatoes or a bushel of corn, whatever motion is produced is the result of those same laws, of which we have had these illustrations so clearly and beautifully given to us this afternoon.

You may say, "All this may be true, but still I do not see the application quite yet." The application will come in this way: A school of this character, founded, made permanent, and perfected, will be a means for the diffusion of that element in labor for which now the soul of the farmer "groans and travails in pain," and that element is intelligence. How often do we hire a man and send him into the field to do the work of our farm, paying him a dollar or a dollar and a half a day, and find that half his labor, and sometimes more, has been wasted, for want of just this practical knowledge, —for the want of the application of established law to the common operations of life, and for no other reason in the world. Half his strength in wielding the axe is lost; 75 or 95 per cent. of it many times lost in the use of the crowbar! How often do you see a great lubberly man, with 180 or 200 pounds of human flesh, trying to move a rock! He gets the crowbar under it, and wriggles, and lifts, and prys, and finally gives it up, having spent two or three hours, for which you pay him twenty cents an hour. It is all lost. Another man, boasting only 115 pounds of muscle, comes along, takes up the crowbar, puts in at just the right place, and over goes the rock. It is intelligent labor applied to the rock; that is all.

So, I say, this kind of education, instilled into the minds of young men, when perfected and brought to maturity, will be made available, through them, in the community, wherever they may go. It will be so much of the leaven which we hope will be diffused into the common mass of humanity, by which the whole may be leavened, and brought up, by-and-by, to the standard of intelligent labor, so that intelligent labor shall be made to match the mechanical instruments we now have, by which to abbreviate the hours of our labor and lighten the severity of our toil. In this way these principles may be made applicable, and valuable, and effective. I admit that the end to be attained is not within our reach. You cannot quite see it to-day. It will not be available for the harvests of this year, or next year, or the year after that; but one thing we may be certain of, that investments made in this way are sure to pay in the future; they are sure to pay to you personally, sure to pay in your communities, and in fourfold measure, ay, a hundred fold, are they sure to pay you as a State. The maturing and perfecting of this kind of education, which shall go out into our masses, will be one of the ways in which the question shall be answered which was brought up for your consideration last evening, and which was so well carried out by the admirable lecture to which we listened this forenoon; one of the ways in which the question shall be answered, "How shall we sustain a multiplying population, a population year by year growing more dense upon our soil, while out of this soil, from which we already draw our sustenance, a continual drain is going on, every year, into the sea?" It will be by the elevation of this class of labor into an intelligent position, so that in any given circumstances we can secure the highest available results out of any condition whatever which may hereafter overtake us. It is not an idle dream, nor a Utopian theory to talk of, or to hope for, this idea of intelligent labor which we hope to have in the community. I hope to live to see a day of great advancement myself, when through its agency we shall make a better use of the earth than the best of us make now. With all our advantages, with all our perfection of machinery, with all our skill and intelligence in agricultural pursuits, we have not yet begun to ascertain what one acre of the soil of this earth will give us in return for skillful and intelligent labor. I believe firmly in the truth of all God's laws, and of God's laws applied everywhere; and I believe that beautiful promise of the Gospel, "Ask and it shall be given unto you, good measure, pressed down and running over, shall the *earth*" (to substitute a word) "give unto your bosoms." You will find it true here, when you feed the earth with what it needs, as we were told this forenoon; and when, in addition to that, in the application of that food, and in taking from the earth the products thereof, you apply a skilled labor, you will find the one will increase in manifold degree and perfection the fruitfulness and final result of the other.

How miserably, how shamefully, how cruelly, the best of us treat this kind old mother Earth, after all! With what rudeness we scratch over her fair fields, with what greedy clutches, with what avaricious grasp we tear off the leafy garlands that she hangs over her rough places, and leave them to dry and blast and parch in the sun, and ultimately die and become worthless! It is an abuse, an outrage,—our treatment of this earth. We ought to be ashamed of it. Let such suggestions as we have had brought before us this afternoon, stimulate us to qualify ourselves to give it, hereafter, a better treatment.

Prof. PECKHAM, of the Agricultural College, was then introduced, who occupied the remainder of the afternoon with an account of his recent journey and stay in California, giving a very vivid and interesting description of that country, whose agricultural and other peculiarities are so remarkable. The address was highly gratifying and instructive, and elicited warm commendation.

Adjourned to 7½ o'clock.

EVENING SESSION.

The Board again met at 7½ o'clock, the Vice President in the chair.

Dr. BOYNTON, of Vermont, was announced as the first speaker of the evening, who gave the following lecture on

THE INFLUENCE OF CLIMATE.

Mr. President, Ladies and Gentlemen:—I propose to invite your attention to some thoughts relative to the

INFLUENCE OF CLIMATE UPON MAN.

It may be necessary for me to state at the outset, that I understand climate to include all those conditions, both physical and artificial, external to man, to which he is obliged to conform his actions. Among the former, may be mentioned heat and cold, land elevation, proximity to lakes and large bodies of water, the nature of the soil and its productions. Among the latter, which may be termed the secondary influences of climate, are to be included such pursuits as are prescribed for man by the primary climatic elements—or such branches of human industry as spring up in given localities, dependent upon the pre-existing conditions of nature. And as his pursuits constitute a powerful agency in moulding the character of the man, it need occasion no surprise if due investigation should show us that not only physically, but intellectually and morally as well, we are acted upon, controlled and moulded by those conditions of nature external to ourselves, which we denominate climate.

A momentary glance at some of the well established facts illustrative of the operations of climatic influence in the other kingdoms of nature, will enable us the more clearly to recognize the workings of this influence in the higher realms of human life.

The influence of climate upon plant and animal life, has long been noticed and carefully studied. The outlines of geology are as familiar to the popular mind as nursery rhymes, and we have long since ceased to wonder that thousands of species of plants and animals should have been swept from the face of the globe in consequence of changes in their natural conditions which they were not able to withstand. It was not possible, for instance, for primeval vegetation to exist subsequent to the coal period, nor could warm blooded animals have lived prior to that time. Whenever a change in the conditions necessary to the life of any species of plants or animals has been so sudden and violent that they could not bring themselves into harmony with the new and discordant elements, it has become extinct. But if the rate of change has been sufficiently gradual to allow the organism to fit itself to its new surroundings, then life has continued, but under a modified type.

In that far remote time when a uniform tropical climate obtained over all of what was then the western hemisphere—when no change of seasons marked the round of the year—when an unending summer reigned over all—a tropical vegetation flourished from the shores of the Mexican gulf to the Arctic ocean. Along the slopes of our New England mountains the palm tree lifted its coronet of leaves into a torrid air, and these very hillsides were bedecked with the rich garniture of tropical flowers. The huge mastedon roamed in lordly pride through these valleys, and found a congenial home on what are now the shores of Hudson's bay.

But at length a change came. By slow and almost imperceptible degrees winter commenced its reign at the pole, and the temperature went down over all the continent. In process of time there was, in these northern latitudes, no more life for stately palm or lordly mastedon. In their places, the spruce and the pine put on their robes of living green, and the polar bear came out upon the northern snow. So through these long geologic epochs, one form of life has followed another, as the changes in the surface of our globe have demanded, till nearly five hundred thousand species of animals have become extinct, and of plants not less than fifty thousand.

Looking back through these periods of the earth's unwritten history, we see how hopelessly these forms of life have struggled against those disturbing forces which have altered the conditions necessary to their existence. Variation in the development of the surface of the earth necessitated a corresponding variation in organic life. As the natural surroundings were favorable, one group after another flourished and culminated, and as these became less and less fitted to its wants, it gradually declined and finally disappeared.

It should here be remembered that we are not endeavoring to show how far an organic type can change, but only to inquire if it can change at all. If any modification can be demonstrated, the extent of that modification will depend upon the power of the modifying agent, and the nature of the circumstances under which it is brought to act upon the organization.

In the vegetable kingdom, the history of many of our cultivated plants will afford us forcible illustrations upon this point. Of those, perhaps none is more noticable than corn. Originally a tropical grass, its disposition to yield to climate influence is very elastic. In acceptable spots in southern latitudes, it attains a height of from twelve to eighteen feet; in a colder climate belt, only two or three.

In southern latitudes six or seven months are needed to bring it to maturity, while in colder climates it ripens in ninety days. When cultivated for a series of years in a high and steady temperature, it tends to revert to its original form of a succulent grass. Its greatest productive value is on the Atlantic slope, in about the latitude of 42°, while on the Pacific it seems disinclined to mature its seed, though showing an average growth of stalk; thus exhibiting a wide contrast to wheat, which there attains its maximum value. These are but a few of the many facts presented by the wonderful flexibility of this plant under the modifying agency of different climates.

Wheat, though not so flexible in its disposition as corn, yet shows a wide range of modification. The winter and spring varieties are mutually convertible in three years successive planting. Coming to us from its ancient Asiatic home through Europe, it brings with it the climate impress of that country, hence our Pacific coast suits it better than the Atlantic, California producing the finest variety in the world. Barley, near its northern limit of production, will run the cycle of its life in ninety days; in other localities it will consume as many as one hundred and sixty in coming to maturity. Cotton vibrates from a perennial tree in its tropical home, to an annual-herbaceous plant along the extreme northern line of its growth. The world renowned sea-island staple can only be produced when a given amount of heat and moisture can be uniformly provided. We have the highest authority informing us that in no two districts of England do the same varieties of ornamental flowers attain an equal degree of excellence, although each may be receiving the attention of the most skillful cultivators. Wines from particular localities in the south of Europe, possess a flavor attainable no where else, and no distiller is expert enough to coax from wheat, barley and corn, a liquid possessing the combined life and richness of that which these grains yield when grown in the Blue-grass soil of Kentucky.

If curiosity prompts, you may follow the workings of this influence of climate even to the fibre and chemical qualities of the plant. The wood of the locust so valuable with us, is nearly worthless grown in England. Our New England forest king, the white oak, when grown at the Cape of Good Hope, loses all its tenacity and strength. The heat, humid atmosphere, and soil of Florida will convert the apple tree into a growth hardly recognizable to eyes only familiar to it in its northern home, the pliancy of its branches, and the form of its leaves making a close approximation to those of our common water willow.

On the plains of India, hemp yields a plentiful harvest of seed, but the fibre is brittle and worthless, while in England it gives a valuable fibre, but none of that resinous substance so extensively used in India as an intoxicating drug.

A synoptical view of the globe would reveal facts to our eyes bearing upon the same point, on a far grander scale than those found in such details. We should find, within certain isothermal lines, zones of vegetable productions, belting the entire globe, gradually shading off on either border of the zone into such varieties as flourish best in a higher or a lower temperature, and that as a whole, vegetation shades off by a gradual incline, from the Equator to the poles. From the leafy coronal, which nods above the stately trunk of the monarch of the tropics, we come down through groves where the orange and myrtle flourish ; then to the oak and chestnut, onward to pines and firs, birches, alders, stunted spruces, and thence onward to the humble reindeer-moss, growing underneath the northern snow. Each variety of plant life we here meet with, attains its full perfection only in a limited zone, and all yield to such modifications as are imposed upon them by a greater or less amount of heat and cold.

On the sides of mountains the same gradation is noticeable. On their warm and sunny slopes, a luxuriant vegetation abounds, but as we ascend to a cooler belt of air, and a poorer soil, a new flora presents itself. This again quickly gives place to another of diminished life and vigor, as we continue the upward journey, till we arrive at the bald and barren summit. Thus in the changing form, fibre, texture, fruit, chemical qualities, and general distribution in the vegetable world, do we trace the workings of this all-embracing and irresistible law. So vast, and yet so minute are the changes which are being continually wrought by climate influence in the leafy kingdom of life. Like the waters of the ocean, with which winds and tempests sport, this sea of vegetable life ebbs and flows over the face of the globe, in strict obedience to subtle forces of nature, whose power they cannot resist.

However fruitful the field for observing the operations of the same laws, presented by the animal kingdom, our subject does not demand that we linger long upon it; for it is not my purpose to discuss how far structural changes in the animal organization are dependent upon inherited variation, (themselves the result of accumulated, methodical selection); as contrasted with such changes as are traceable directly to the action of physical conditions. However great and important the former may be, the law of the latter will always prove the stronger.

The marvellous improvements in our domestic animals, wrought by modern skill, can only be maintained up to a high level by a constant and unremitted application of that intelligent culture which perfected them, and even then, in process of time, the more powerful influence of climate will assert its demands, and, in spite of man's best endeavors, impress its own type upon the animal. In proof of this we have only to look at some of the breeds of cattle early imported into this country, and placed in circumstances so uncongenial that the most skillful care could not long maintain the high state of development attained in their former homes. The climate of the Kennebec valley makes one type of Durhams, the Connecticut valley in Massachusetts another, and the Winnepiseogee region still another.

On the other hand, it should be noticed that whenever we are careful to have our efforts in this department of labor coincide with the laws of climate, we find nature ready to aid us. The Spanish Merino found its New England home quite as congenial as the one it left in old Spain, and consequently the improved type of that animal now known among us yields a fleece three times as heavy as that produced by its best Spanish progenitor.

It is the opinion of the great naturalist, Darwin, that the heavy breeds of cattle and sheep now known in England could never have been formed on mountainous pastures, nor could dray-horses have been raised on barren and inhospitable islands. The short pastures and humid climate of the Falkland Islands will in a few generations convert the stout horse into a diminutive pony. The European dog, transported to India, becomes changed, not only in structure, but in his instinct even. Within so narrow territorial limits as England a difference in the quality of the wool has been noticed when the same flock of sheep have been pastured in different localities. At Angora, nature clothes not only the goat but the cat and the dog even in fine fleecy hair; and we have it on good authority, that horses kept for a series of years in the deep coal mines of Belgium become covered with velvety hair like the mole.

Thus the organic history of the past, not less than scientific observations of the present, teach that forms in both vegetable and animal organizations are dependent upon the material conditions under which they live, and that any change in these environments imprints a corresponding change upon their form and structure. In the one, whether living or dead, we read unerringly the variations of the other, and hence we arrive at the important conclusion that, in order to secure permanency to any typical form, we must first ensure invariability to the physical conditions in which it exists. Thus we learn that in ages far remote, leaf and flower, beast and bird, quietly laid down their lives in obedience to laws whose demands they could not meet, faithfully imprinting their perishing forms upon the plastic materials of earth—a truthful history of the orderly procedure of nature.

Answering to the voice of the same great power which bade the old depart, new forms of life have come forth to find a congenial home in each new epoch of the earth's development. We are told that "If some grains of sand lie scattered on a drum head or some other elastic surface, whenever a suitable sound is made the grains start up, and entering on a choral dance, arrange themselves in symmetrical and exquisitely perfect geometrical figures. If disturbed by another sound, they forthwith re-arrange themselves in some other equally beautiful figure, and answering to the voice that speaks to them, form after form in wonderful perfection comes forth." Thus do organic beings answer the voice of nature, sympathetically responding to her call.

It now becomes us to inquire whether *man* forms an exception to this law of the control of physical agencies over organic forms? Can it be that man to whom alone is given the control of nature's forces, is, at the same time, their servant? Can it be that he who can temper the seasons in any part of the globe, soften the rigor of a northern winter, and dissipate the long darkness of its night, create commerce, and feed himself, if need be, from distant continents,—can it be that such a being must bow in obedience to the same laws that work such transformations in his corn and wheat, his cattle and horses? It may be, and yet he be called upon to lay aside no part of the glory that pertains to him as the rightful lord of this lower world.

In looking for evidences of the operations of the same influences upon the human organization, that have now been noticed in the other realms of nature, the first and most obvious climatic change in man is found in the varied complexion the same race exhibits in different localities. The most satisfactory illustrations upon this point are furnished by the Jews, because of the almost universal opinion regarding the unity of their origin. To assume the existence of two distinct Hebrew tribes, as some writers have done, the one auburn, the other black-haired, will not explain the facts presented by the widely differing hues of these Hebrew children now scattered throughout the civilized world, for on the ground of a common origin, whence the two distinct branches? The Jew of northern Europe is fair in complexion, with blue eyes and sandy beard. The Palestine Jew is tawny. As we travel towards the equator the tint deepens; and in Malabar we find him almost black. The Indo-European family, derived beyond intelligent questioning from a common center, present all shades of color, from the fairest blonde to the deepest brown. Travellers, in passing from south-eastern Europe to southern India, say that in crossing elevated regions, the deepening tint is broken through and a fairer complexion comes out, when the temperature is lower than in the valleys, thus exhibiting a strict correspondence to the plant-zones already referred to on the sides of mountains. On the slopes of the Himalaya mountains, the people are brown or olive-colored, with black hair and eyes; but as we ascend towards the more elevated districts these disappear, and in their stead come out the fair skin, blue eyes and auburn hair. Traders from the gold coast of Africa, inform us that natives come down to the sea from the distant interior having a light complexion, hazel eyes and red hair, though possessing all the features of the real Guinea negro. From such information as can be gleaned from them, it is inferred that they inhabit elevated districts far inland.

At the two extremes of the western hemisphere are found the light-tinted representatives of the human family, but as we approach the equator the tint deepens. Along the line of the Andes there are special local illustrations of the same fact, the dwellers on the elevated plateaux being lighter-hued than those inhabiting the valleys, or on the same parallel nearer the Atlantic border. In the light of such facts, no one can, therefore, safely question the conclusion that man, after a long residence in a locality having a high temperature, will become dark-hued, but if subjected to the climate influence of a low temperature for successive generations, his complexion will take on a lighter tint. It must also be conceded that these changes are alone tracable to the workings of the same influences which, in form, color and texture, alters the leaves of the tree transplanted from the soil of New England to the sands of Florida. The details by which this modification is produced belong to physiological science, and cannot be crowded into this brief page.

Still again, should the question here arise, Why has not the western hemisphere in its tropical climate produced the negro-type of humanity? the answer will be found briefly in the fact that in the central portion of our hemisphere there is not sufficient topographical expansion for the indigenous production of the negro. The negro zone in Central America is barely fifty miles wide, while in Africa it is more than four thousand.

Were the task as short as it would be easy, many facts could be adduced to show that not only in this superficial manner, but in a much more profound degree, the structure and constitution of man are changed by the climate in which he makes his permanent home. One of the greatest living thinkers* in England maintains that the effects of the definite action of external physical conditions are tracable even to the tissues and fibres of the animal structure. If, then, it be remembered that with a modified physi-

* Herbert Spencer.

cal organization there must necessarily come a corresponding modification in the mental organization, we may the better be prepared for the results which legitimately follow from such fundamental principles; such, for instance, as the fact that the southern hemisphere has not yet produced a single man who has left his impress upon the race, or in any way permanently affected its destiny.

Extending now our view to the whole population of the earth, the fact will be revealed that every well defined geographical locality, will have its corresponding type of humanity. Nature's unvarying laws mould men into zone-belts, as they determine for each geographical zone its peculiar type of vegetation. Emerson says, "The extremes of divergence in one race of men, are as unlike as the wolf and the lap-dog."

If then, any population be allowed to remain long enough in a locality of marked physical characteristics, to come into physiological accordance with nature, and establish a well settled equilibrium with all its climate elements, heat, cold, rain, snow, frost, tempest, winds and floods,—not less also with its changing seasons and the productions of its soil,—there will result a type of humanity which cannot be found or produced in a different climate anywhere on the face of the globe beside. And when men thus situated shall have attained the point of structural acclimatization, and shall have given themselves for successive generations to such pursuits as have been predetermined by the climate, there will also result, coincidently, a peculiar type of mentality, the like of which no other people will manifest, unless surrounded by similar physical conditions.

Any section of the earth's surface which is individualized by well defined physical peculiarities, is like a founder's mould. Pour a portion of our plastic humanity into it, and allow it to stand long enough, and it will *set*. Having become physically stereotyped by the primary, and mentally by the secondary influences of climate, the successive casts which this mould will produce will be precisely alike. Generations of men will follow each other for centuries, manifesting no more signs of change in their modes of life or modes of thought than do the trees in the form of their leaves or the time of fruiting. Among the many specimens of workmanship into which climate moulds humanity that might be related for examination, perhaps those upon the Asiatic continent and the valley of the Nile are among the most notable.

On the supposition that the human races originated in a common centre, the early migrating columns which spread over Asia, must have been full of that youthful vigor and energy which impelled them to leave an overcrowded centre of life and seek new homes in new lands. In pre-historic times this country must have presented scenes of stupendous human activity. Before these early populations settled down into a physiological harmony with the many well defined geographical areas which distinguish that continent, and into which these people were cast, they were the authors of inventions which have placed all subsequent civilization under obligations to them. The clock, and the sun-dial, cotton, linen, silk, sugar, tea and coffee, with the cup, saucer, and tray in which they are served, this ancient population first gave to the world. In some of the useful arts they have not yet been overtaken by modern civilization. Who can produce steel that will match the old "Damascus blade?" or where shall we find modern hydraulic constructions in magnitude equal to the Chinese canals, or defences on a scale as gigantic as the Chinese wall?

But the scenes of active industry of which their works give evidence ceased long years ago. Each tribe soon learned to subsist within itself, and manifesting no energy to overcome the natural barriers (whether of mountain ridges or barren tracts of territory) to intercommunication with neighboring tribes, new dialects and differing languages made the work of isolation complete, and that ancient people, after the lapse of many generations, came into a state of physiological accordance with such external conditions as each fragment of the original stock found around itself. Each successive chieftain in time established his own form of government, and this, with tribal forms and customs, all aided the climate in securing a definite result, for each tribe the same pursuits of life and the same modes of thought.

The Asiatic populations have therefore been for generations in a state of hopeless stagnation. Hundreds of thousands of these people never move from the spot where they were born. Travel is regarded unholy by them. Myriads, born on the bamboo boats that float in countless numbers on the rivers of that almost measureless empire, never set foot on land. Everything remains as it was years ago. No changes in clothing, none in their houses, no bettering of food, no improvements in social life or customs. So unchanged have all things remained, that could Abraham revisit the scenes of his boyhood he might suppose he had only been asleep for a single night. Everywhere the traveller of to-day finds the life of the past. He sees the patriarchal customs of by-gone centuries, the shepherd's tents and the flocks on the hillsides, the crowd of travellers hurrying within the city walls at sunset, and the scribe with his ancient ink-horn lingering near the city gate. At the wayside well he finds women filling their water pitchers, and thinks of the marvellous story in the Gospel. He listens to the same minstrelsy that charmed the ear of David, and hears again the love songs that won the hearts of the ancient Jewish maidens. The patient camel kneels every morning to receive his burden, and at nightfall the hoary caravansari receives its dusty travellers, just as in the days of Abraham.

Such is the work which climate has wrought with a purely homogenous stream of population, taking the whole mass, alive with the freshness and vigor of youth, breaking it up into fragments, bringing each individual fragment into accordant harmony with its own conditions, and then through the agency of its secondary influences stereotyping the whole heterogenous mass, so completely that centuries have made no change in the cut of a garment or the make of a wagon. What has been may be, and under like circumstances these scenes may all be repeated within the borders of our own country.

Dr. Draper, in speaking of climate, says: "In our Pacific region there is an American Arabia, Palestine and Tartary. For millions of square miles the aspect of the country is altogether Asiatic, and then on the coast it abruptly approximates Europe. Europe and Asia are here pressed into contact. Man in these varied abodes will undergo modifications, and the ideas of the old world will reappear in the new. The arts of Eastern life, the picturesque Orientalism of Arabia, will be reproduced in our interior sandy desert, the love songs of Persia in the dells and glades of Sonora, and the religious aspirations of Palestine in the similar scenery of New Mexico." This of course is under the supposition that no greater disturbing force should ever agitate these future populations than have come upon those of Asia.

Egypt is another of nature's workshops that demands a moment's attention. This country was hoary and venerable with the blight of ages, when first historically known to the rest of the world. "The monumental achievements of its ancient kings were already five hundred years old, when the southern cross sank below the horizon of the Baltic, and the Pole Star itself was a new comer to them." On a strip of land averaging seven miles in width, and a few hundred miles long, there once lived seven millions of human beings. They subsisted without the aid of any foreign commerce, as the outside world was more ridgidly excluded than it has ever been from China or Japan. The Nile was the one source whence these swarming millions had their bread. That mysterious river, mysterious now no longer, ensured their harvests by its annual overflow, and as these supplied all their wants, they were not compelled to give attention to any other pursuits, hence they were strictly an agricultural people. Improving upon the natural conditions of the soil and the river, by a system of dykes and flood-gates, canals and other hydraulic apparatus, they easily controlled the volume of water, retaining and dispensing it where most needed. The Nileometer gave the rise of the river, and the husbandman could predict with unerring certainty the amount of the coming harvest. For once in the history of the world, agriculture became a reliable art. The results of each year could be calculated with mathematical certainty. That they should meet the wants of the next year, this people had only to do what they did the last, and the desired end would be accomplished. As a natural consequence, as soon as the first inhabitants of this valley came into full harmony with these physical environments, there resulted of necessity a common bond of interest, a uniformity of thought, wishes, plans and purposes, and coincidently, a sameness of intellectual pursuits. The civil and ecclesiastical powers were united in one head, and thence followed a political system precluding the very idea of change, and a consolidated form of government which laid a strong hand upon the only treasure-house, the Nile, from whence the millions could be fed. The priest stood with his hand on the lever of the flood-gate, and the fate of millions hung upon its movement. Their monotony of social life, their stereotyped political and ecclesiastical condition, which knew no change for many centuries, was as legitimately a product of their all-bountiful river, with its concomitant climate influences, as were the harvests which annually waved upon its banks. Under such circumstances, what possibility could there be for a change? What could stimulate thought, or what disturb the unbroken repose of centuries? Under this uniform climate, with this sameness of employments, with the coincident and consequent result, of like modes of thought, the Egyptian generations followed each other for more than forty centuries, each one as much like its predecessor as though the last was only a previous one born over again. And to-day the thoroughbred Egyptian uses the same kind of hydraulic machinery to lift the water of the Nile into the troughs which conduct it to his garden that Abraham saw when he and Sarah made their visit to that country twenty centuries before the Christian era. Within the sound of the modern railway engine's whistle the old Shadoof—the same used in the days of Sesostris—lifting its single bucket of water at a sweep, sends out its monotonous creak upon the morning air, and the basket of palm leaves still performs its ancient hydraulic duties.

The critic, who may admit the power of climate in thus moulding a people into one homogenous mass, should not demand that we account for all the political and social changes that may have occurred among such a people, as the results of the local operations of the same natural laws.

The great invasion of the ancient Asiatic shepherd kings who overthrew the old empire and introduced the monotheistic ideas of the east to Egyptian religion, or the still greater movement, under the leadership of Psamoneticus, by which the ports of Egypt were thrown open to the commerce of the Mediteranean, and the intellectual wealth of the country allowed to flow out to fertilize and energize the nations living to the north of that midland sea, if analyzed from another stand-point, may be found to have owed no small portion of their momentum to the same great laws of nature. An examination of the ancient Aztec and Peruvian civilizations on our western hemisphere would furnish ample proof in support of our theory, but I wish to make some more special observations upon that isothemeal zone into which our own country falls. For this purpose it will be sufficient to consider the United States under two general divisions. The northern section is characterized by extremes of heat and cold, having in many places a range in temperature of 140°. Much of it is ridged by high mountains and covered by deep valleys. Its coast line is indented by deep bays and bold harbors. Its summer is short, and weather so uncertain as to render harvests doubtful. The winters are long, stormy, and inclement.

The southern half of the United States is favored with a genial, uniform climate. Along its southern border the difference between its summer and winter mean temperature in scarcely 15°. The seasons glide so imperceptibly into each other there is no dividing line to mark when the one ends or the other begins.

Along its northern border the country is but lightly broken by mountainous ridges, and on its southern not at all. Primarily its soil was very fertile, and eminently adapted to the production of the great staple of cotton.

Knowing these primary facts, it would require no prophetic vision to pronounce, that a people inhabiting a country of such striking diversities of climate, would naturally and necessarily give themselves to such pursuits as had been predetermined by the physical conditions of the various localities. Those dwelling along the sea-border would build ships, and sail them across the ocean. Those peopling the inland districts, would till the soil, carve the timber, and hew the rocks, as the one or the other would yield the better return. Wherever any one branch of industry could be made largely more profitable than others, a large majority of the population would follow it. These facts are so obvious as to seem like truisms, but they cannot be overlooked, inasmuch as through their agency as secondary causes, many significant results are produced. Modes of thought, not less than peculiarities in customs and language, take direction from our pursuits. With a diversity of employments, there will always be found a corresponding diversity of mentality. The law that *like produces like,* is not confined in its operations to any one realm in nature. A cause which brings forth its direct and immediate results in its own plane of existence, produces at the same time corresponding results in higher orders of life connected therewith.

It is not too much to expect, that by the aid of the future perfected development of the science of physiology, and the broader and more comprehensive science of comparative history, the dawn of which we only now begin to see, we may be able to trace the intellectual and moral effects of all our external conditions, not only the more marked and demonstrative elements of nature, as cold and heat, sunshine and tempest, but also the more subtile influences of changing seasons, genial skies, and fruitful fields, down through all the human devices of clothing, shelter, food and fire, not less readily than we now trace the effects of a long continued, high temperature upon the human complexion. Indeed, analogy would lead us to infer that it is the more impressible part of man's physical nature that feels the first impress of the altered conditions of his human abode, and that long before such changes as we are now able to detect have been wrought by climate, other and profounder changes have taken place in his nervous system, indelibly stamping predetermined characteristics upon his mentality, and coloring for all subsequent time his moral nature. The leading facts in the civil, political and religious histories of the United States are but reproductions on a larger scale of what has transpired on the continent of Europe. The trial by jury was known in the old German forests in the time of Julius Cæsar. In their political conceptions, the Teutonic nations of Europe have always been inclined to the representative system of government, and the Puritan, who was driven out from England, as soon as he had his feet safely planted on the shore of Massachusetts bay, himself persecuted and expelled the first man of his number who insisted on the right of private judgment.

In northern lands men have always found themselves face to face with forces of nature they could not control. With them the year is divided into a short and uncertain summer and a long and rigorous winter. The limited season for out-door labor imposed upon them distinct and definite duties. The work of to-day could not be deferred till to-morrow. A harvest in autumn could only follow days of industrious activity in the spring. Under this imperious law of the climate they become industrious, and acquire habits of exact and methodical labor. Disappointed in many expectations by the fickle and changing seasons, they become prudent and cautious, looking well to the end, even from the beginning, hence slow and considerate. Taking the ready suggestion from falling water, they put it to turning a wheel, and this is the foundation of that mechanical and inventive genius which has always characterized northern nations. The cold of winter which drives the northern man from field labor, brings with it abundant opportunity for reflection and forethought. The cheerless and desolate aspect of nature teach him the value of his home and his family, and herein is laid the foundation of his love for fixed institutions, established laws, and orderly society. Compelled to make all his labor result in practical advantage, the northern man of all ages has been noted for his perseverance. Slow to act, deliberate in purpose, an enterprise once undertaken, he holds to it with an inexorable tenacity. And so it comes to pass that for his habits of industry, his foresightedness, his inventive genius, his cool, calculating method of reasoning, his matchless power of continuous mental application, his love of home, his regard for law and fixed institutions—for all these qualities the dwellers in northern countries are indebted to climate influence.

In contrast with these results, place now those of a genial climate, which never knew the rigors of a northern winter. In a country where common field work may be done throughout the year, there comes no necessity that specific duties should be done at a given time. The maxim is, "Never do to-day what can be put off till to-morrow." Hence under the influence of such a climate man becomes indolent and careless, and cultivates no systematic and well regulated habits of labor. Nature feeds him with a lavish hand, and thus relieves him of the necessity of prudent forethought, and so he comes to act from momentary impulse rather than from reason. The conditions of the climate being such that much of his life can be passed under the open heavens, he receives an infinite variety of impressions from external nature, but none leave any permanent mark upon his brain, as compared with the results which, in the seclusion of his winter home, the northern man deduces from his observations of nature. Inclined to indulge in endless speculations, where he can enjoy in a life of ease and inactivity, man will deal superficially with them all, and follow none to its logical conclusions. Quick in his perceptions, volatile, unreflective, he becomes disinclined to form habits of continuous mental application. When a tree will afford ample shelter at night for the man who may roam all day, he will form slender attachments to the hearth-stone and the family, so dear to man in his well-anchored home in the colder north, hence he will manifest but little regard for fixed laws and well established forms of government.

Admitting that the type of the northern man known as the Yankee has proved himself proverbially a wanderer, he has not found the globe large enough to allow him to travel so far as to snap the cord that binds him to the spot of his birth.

Cold has produced a singleness of heart in Teutonic which contrasts markedly with the character of the Latin races. Exact, punctual, precise in dealings, lovers of truth, sparing in promises, the nations of northern Europe have ever been distinguished from those in the southern half of that country, which have proved themselves more polite than true. Madame de Stael says the English imitated Napoleon because they found out how to unite success with honesty.

Like the luxuriance of their semi-tropical vegetation, the language of a people in a warm climate will always be found to be extravagantly redundant, and if their country be a level one, their tone will be soft and musical, but monotonous, seldom enlivened by that swelling intonation and well modulated harmony which is heard in northern dialects. Their utterance will be uncertain and indistinct, either from a careless sluggishness or a tripping, volatile precipitancy. They make promises they never expect to keep, and indulge much in use of the superlative degree. The English say one cannot speak in the French language without lying. They are fruitful in assertions, but reluctant to reason. Bring them to a point by your questions, and they grow heated and passionate. They resort much to falsities and make-believes.

Under the late regime in our own country, the oft-repeated boast about the magnificent advantages of southern over northern life and the transcendent superiority of southern character, was the most stupendous sham the world ever saw; and the climax of that self-deception was, that our southern friends, in entering the late civil strife, based their hopes of success not so much upon their own intrinsic strength as upon the baseness of northern character.

If, then, to the natural facilities for a life of present gratification afforded by a genial climate you can add an adaptation of the soil to some general agricultural pursuit, such as will absorb a large part of the attention of the people, and still more, if to this you can add the element of compulsory labor, you will always have resulting the social, political and religious phenomena which has been witnessed in the southern half of the United States. From one general employment came a common interest, binding all in a common bond of union. Cotton supplied their every want, the slave raised the cotton, and hence when the north laid its hand on the negro it took away the foundation of southern life. Thus the cultivation of cotton and the system of compulsory labor were both powerful concomitant circumstances which intensified the physiological distinctions that climate primarily was effecting in southern communities. They came to think and act as one man. In the late civil strife eight millions of people were wielded like a single regiment on the field of battle. The free thought and individual judgment of the north found little favor in the cotton States. Legislation repelled northern immigration. Year by year intercommunication between different sections of the south became less, and society was fast tending to the same stereotyped condition which has been found in Asia.

The antagonism between the two sections of our country was as natural in its development as the growth of sugar cane in Louisiana or barley in New York. Could our country have been blessed with a legislation founded upon a knowledge of the influence of these laws of nature, the sad culmination of these antagonisms would have been averted, and American history would not have made so fearfully true the saying of Quetelet, that "Society prepares the crime, the culprit only executes it." While therefore the fickle and changeful climate of the north, with its consequent diversified employments for man, was deepening and intensifying the ideas under whose impetus northern immigration was at first commenced, the genial and uniform climate of the south, aided by the almost universal attention of her people to the cultivation of cotton—and by compulsory labor—was working out a far different type of humanity. We would not forget that the zone in which our southern States fall, is favorable to the development of the highest intellectual qualities of man. Every race that has figured upon it for the past three thousand years attests the truth of this statement. On the eastern continent, it has produced the most eminent writers upon law, mathematics, theology, and astronomy. Among soldiers it produced Hannibal, and Carthage alone could dispute with Rome the empire of the world. But when we seek for the moral qualities this zone has developed in man, our task is not attended with results as pleasant. If we are warranted in our conclusion, that with a change in the physical constitution of man there come coincidently a corresponding modification of his intellectual organization, analogy, not less than a long catalogue of facts, would lead us to expect, also, like changes in his moral qualities. In this zone society has always resolved itself into two classes; one has sought to command, the other has been obliged to obey. Hence the latter have never had "any rights which the former was bound to respect." It has manifested but little regard for the sacredness of human life. Here war has exhibited its most pitiless and revolting aspect. In the old Carthagenian contests, 40,000 captives were massacred in a single day. In our own times, in the same country, fugitive enemies have been suffocated by fires at the mouths of caves whither they had fled for safety. Sad, but truthful antetypes of scenes lately enacted within our own borders! This dwarfing and blunting of the higher moral qualities, has rested like a deep shadow upon southern character, as known in our own land. The only moral laws in which our representative man of this type believes, are such as support the vagaries of his own brain.

A firm believer in the Old Testament, he does not care to turn the first leaf of that gospel which brings good tidings to the poor—and the Providence in whom he believes will exercise great caution before he interferes with anything belonging to a southern gentleman.

Granting, then, all that may be fairly claimed for the fact that the two immigrating columns which originally settled the territory of the United States were representatives of different social grades in their common English homes, and admitting the difference in the motives which animated them—the one being material interests, the other an idea—we see that under the influences of two parallel climate zones, the descendants of a common lineage have been converted into distinctly different types of men, and without at least a very wide departure from truth we may conclude that the separation, alienation, and political antagonisms which have been developed among the American people, are the legitimate results of the climate influences of this country. Cold and heat have resolved the original settlers into two typical forms, intensifying the Teutonic traits of the one, and developing the same qualities in the other that have been seen in ancient people inhabiting the same climate zone on the eastern hemisphere.

If, then, we arrive at the conclusion that, like all other forms of organic life, man must yield to the control of nature's laws, it may well be asked if there be no remedy by which he can avert or neutralize their unwelcome and disastrous social and political consequences. Among the more obvious agencies which may be employed for this end, is the use of the various appliances of modern civilization by which an artificial climate is produced. Man can shield himself against the discomforts of cold with better success than against the annoyances of heat. A cold climate may, therefore, by artificial means be made to approximate the natural temperature of a warmer one. The artificial climate of our northern cities, at least to all such persons as can command the requisite means, is but a little lower than the mean temperature of Savannah. As our civilization is developed the results in this direction will be increased till the wide climate differences of our country will be made to approach a mean condition. With this will also come the consequent change in our physical and intellectual organization, and ultimately the future populations of this country may attain political unity.

In the opinion of Prof. Draper, the answer to the question forced upon us by this subject lies in two words—Education and Intercommunication. He says, "While legislation has been brought to bear in all directions upon the former, the latter has been almost entirely neglected in a national point of view. It is not enough that there should be a free movement of thought, a free movement of the people is of equal importance. Travel increases as its cost diminishes. Whatever therefore operates as a tax on locomotion, is inconsistent with the highest principles of State policy. Let the State assume the proprietorship of all our great highways of travel, reducing the rates to a minimum, and the social and political results would be beyond computation."

But while nature compels us to yield obedience to one class of her forces, she places within our reach other agencies by which we can prevail over them, and hold their influences in check. It is steam, as applied to the purposes of locomotion, that will accomplish the much needed social and political revolution in our country and avert the evil consequences of climate influence. It is by our knowledge of nature alone that we can come into harmony with her laws.

In the light of this truth modern civilization is being evolved, and in proportion as we apply this fact to practical life will that evolution be carried forward. Steam, electricity and sunlight were as abundant in the days of Abraham as now; yet these mighty forces have been patiently waiting through these many centuries, mutely looking man in the face, longing to be invited to do his work, to go on his errands, and to adorn his dwelling. As soon as we say to the lightning "Go," it goeth. Just as speedily, when we say to it "Do this," will it do our bidding.

Nature waiting to be our servant! The thought commends itself to the intellect. A glimpse of this truth should call from our souls a cry of exultation and joy. What man once seeing this can lose it from his thoughts, or be satisfied with meaner things! Surely, in more than the common acceptation are the words of Paul truthful, when in prophetic vision, having caught a glimpse of the day when man, delivered from the thraldom of sin and ignorance, should come into the full enjoyment of the noontide glory of science, he said: "For the earnest expectation of the whole creation waiteth for the manifestation of the sons of God; because *nature itself* shall also be delivered into the glorious liberty of the children of God; for the whole creation groaneth and travaileth in pain together until *that day.*" When, therefore, man shall match the forces of nature by his knowledge, thereby proving himself their rightful lord and master, shall he put on his coronation robes and go out to universal power.

> "Largely gifted, largely blest,
> Of the world and sky possessed,
> He shall be great nature's heir,
> Lord of earth and sea and air;
> Like a benediction dwell,
> Doing all things wise and well."

Mr. Bartlett, of Brewer. I have been very much gratified, as I presume the audience generally have, in listening to the very excellent lecture which has been delivered on the subject of man and his relations; and I would not make any criticism to disturb the pleasant course of thought suggested, but it occurred to me, that the people who preceded us on this continent do not seem to have been governed so much by climate, or not in the same way, as we who are interlopers have been, according to the statements made. If I am rightly informed, the southern Indians are more industrious, and more attentive to agriculture, than the northern Indians. If it was the climate that had this effect, would it not have been the same in both cases? And in regard to color, I believe the northern Indian is about as dark as the southern. The Indian on the Penobscot is as dark as the Indian at the mouth of the Mississippi. Now, why is this? Are there exceptions to a law of nature? How can we account for this seeming contradiction of what is laid down as a natural fact? We may have to give some credit to the speculations of those who say that we have a different origin. I am aware that Mr. Sumner believes in the unity of the human race, but Prof. Agassiz maintains the opposite doctrine. These things are matters of speculation, simply, and perhaps they afford to us no practical results in our struggle for life, or for distinction, or riches. We come here as practical farmers, to see what we can do in diffusing the light of knowledge into the minds of each other, as to how, in this cold region, we can best develop ourselves, and make our lives a success where we live. This lecture excites thought; it gives us an opportunity to reflect in regard to the human race; and the criticism that I make is one that I hope may simply excite the minds of individuals still further, and make them indisposed to call any man "Master" in regard to this, any more than in regard to anything else. The one grand fact in regard to man is, that he is striving to attain an independent position, such an one that he need not look to the doctor to save his body, nor to the lawyer to save his civil rights, nor to the minister to save his soul, but work out his own salvation in every respect. One grand object for which we come here is, that we may be taught to think, to reflect, and that nothing, however brilliantly set forth, nor whether it come from the President of a college, or a professor, or a farmer, or a half farmer, or a quarter farmer, as I am,—that nothing that may be uttered shall be accepted as Gospel by me or by you, unless it has the "Thus saith the Lord" in it,—unless we see it clearly from our our own reflection; and if I have not brains enough to see it, I will go home and study into it, but still keep my independence in regard to thinking and accepting what is offered.

SAM'L TAYLOR. I listened to the lecture with great delight, but there were some statements in it that my own observation lead me to call in question. What was said with regard to the influence of climate may all be true as respects the white race, but as the last speaker has said, it certainly has not had that influence upon the aborigines of this country. I have, in the course of my life, visited most of the tribes west of the Mississippi river, (not the far west, but west of what were then the States and new territories of the United States,) from Minnesota to Texas, and it was a fact, conceded on all hands, that as we approached the south, the Indians became more intelligent. There never was an Indian tribe that invented a language except the Cherokees. I visited twenty different tribes, and if I had capacity to judge, the further I travelled south the more intelligent were the Indians. I believe it is universally conceded that the Mexican Indians, at the time that country was invaded by Cortez, were by far the most intelligent tribe ever found in this country. They live in a warm climate, and as we approach the north, the Indians decrease in intelligence, until we come to the Esquimaux, who are elevated but a little above the brute. The influence of climate may be different upon a white, but such is the fact in regard to the Indian. In my travels at the south, I never observed that the educated men there differed much from the educated men of the north. Some of our greatest statesmen and most profound thinkers lived at the south. Chief Justice Marshall was as sound a jurist, and Thomas Jefferson, James Madison, and other southern men whom I might name, as profound thinkers as we have had in the north. I do not believe that the theory presented to us in regard to the influence of climate upon white men or upon the Indian is entirely accurate.

Dr. BOYNTON. I do not rise for the purpose of defending any position taken in what I said this evening. I am very happy indeed to see that my views call forth criticism. If you had received what I stated without any comment, I should have been forced into one of two conclusions, either that it was not considered worth noticing, or that it was so wild that it was not best to notice it.

In regard to the point brought forward, to suppose that the influences which I have hinted may be traceable directly to climate, should have the same effect upon the Caucasian who came to this country and upon the aborigines who were found here, necessitates a supposition antecedent to that, which is, that they should each be susceptible to the same impressions and to the same modifications; a position which I think the gentleman would be unwilling to take. There was a different antecedent condition. The capacities of the two people for impressions were vastly different, and consequently widely different results followed.

As regards the effect on complexion, the difference in latitude between the Penobscot river and the mouth of the Mississippi is hardly wide enough to afford the necessary data to decide whether the Indian found at the mouth of the Mississippi river should be darker than the one found on the Penobscot. But if you will take a wider range, and go north of Hudson's bay, and compare the complexion of the Esquimaux with what you will find near the equator, you will have a range of latitude wide enough to test this question. The general fact is, that the complexion deepens as you approach the equator.

In reference to the other point advanced, in regard to the general intelligence found among the Indian tribes as you approach the borders of the Mexican Gulf, being greater than that found among the more northern tribes, and that the southern Indians have left evidences of a stage of civilization in advance of the northern tribes, that, also, involves another important question, and that is, whether the aborigines as found through the northern section of what we now know as the United States, descended from a common origin with those which Cortez found in Mexico. I believe it is now considered a pretty well settled fact by ethnologists, that whether we believe in the unity of the race, or that mankind had several centres of origin, the people found upon the soil of Mexico, who lived there for ages of which we have no history, the people who built those monuments and mounds, had a different origin from the tribes which inhabit the more northern parts of our country. If that be true, the fact stated by the gentleman will be accounted for. All that he has stated may be true, but we cannot assume that all the people who dwelt from the British Provinces to Central America had a common origin.

I do not claim that we are to attribute to the influence of climate all the changes that have occurred in our own people, or in the different peoples, as we find them in the different countries of the earth; but I do say, that it seems to me a pretty well established fact, that there are in these general laws facts which we are not to overlook, and to which we should yield and must yield; and our duty as intelligent American citizens is to recognize these facts, and shape our future course, politically, with reference to them.

One other point I wish to notice, and that is what has been said with reference to the intelligence found in the southern States. If any gentleman has understood me as calling in question in the least the intelligence of the people who have originated there, I have been entirely misunderstood. I have not called in question intelligence; that is not the question at all. You may grant any degree of intellectual development or intelligence simply you please, but that intellectual development must itself come into obedience to the same law. Take the same isothermal zone of our southern States as you find it on the eastern hemisphere—the section to which I referred—and there history tells us that very many of the most eminent men and women, in intelligence and culture, that this world has ever known, originated. It is not a question of intelligence—grant all you please; but it will inevitably be consolidated together, intensified, and directed into one channel, as it was in the southern half of our country. It may be great and brilliant; we may be under obligations to it, as we were in very many respects; but nevertheless, the greater law will hold good.

Adjourned to Friday, at ten o'clock A. M.

The Board met at the hour appointed. The President announced as the topic in order for the day,

THE POTATO, ITS CULTURE AND VARIETIES.

The tables were laden with a very large assortment, prominent among which was the very extensive collection grown by Mr. H. S. Goodale of Massachusetts, and shown by him at the Exhibition of the New England Agricultural Society, at Portland, embracing 140 varieties. Mr. Goodale kindly consented to its doing service at this session in the way of comparison and instruction, and has furnished the following statement of his method and results. The fact of their having been grown at a considerable elevation above the ocean level, brings them nearly into conditions similar to those grown in this State, farther north but at lower elevation.

Sky Farm, Mt. Washington, Mass., Oct. 1869.

Dear Sir:—I send you with this a statement of the results of an experiment the present season with, I think, most of the potatoes now in general use, including several of the best English varieties, several seedlings of the late Rev. Mr. Goodrich which have never been "brought out," and three or four promising seedlings of the Early Rose, the qualities of which are not yet fully developed. I consider the record of the time of blooming and of the vines dying, of the different varieties, as of no great value in this trial, in determining their comparative earliness, because not sufficiently exact, and because the dry weather in August seemed to ripen many kinds prematurely; but it is certainly interesting and instructive to note the wide difference, both in the yield and health, of our different potatoes under nearly the same conditions of soil and culture. With perhaps now and then a marked exception, varieties which have distinguished themselves on this mountain land—the natural home of the potato—under this treatment, will, I believe, do correspondingly well in other localities at the North; and those which have here a poor record—save undeveloped seedlings—will probably show a poorer if given less favorable soil and culture.

Varieties originated abroad, I have found, are generally poor yielders and much inclined to rot. As regards quality I think we may say that, as a rule, the potatoes which so delight us with their magnificent yield at harvest, need not be expected to give us quite that same glow of satisfaction when they appear at table. In a scale of 10, counting 10 perfection, upon which number, for instance, the Worcester, and Strawberry and well-grown Peachblow might be securely placed, some of these new, high-priced, and on the whole really valuable seedlings, could not at present be marked so *very* high, though several will vary in quality from 8 to 9, with varying soil and weather. Even the Early Rose, beautiful and bountiful as it is, will hardly need the cipher in this scale to express its table merits, yet it will not fall far short of this, and if it only proves hardy—its weak point, I fear—it will have and deserve a yet higher reputation.

I will add that many varieties in this list, are known under several names, and quite possibly some of them are identical.

With but few exceptions the potatoes here shown were planted on the 7th of May, 1869, in a small side-hill lot of one and one-half acres, the soil of which—a gravelly loam—was quite uniform in quality. It had been in potatoes for several successive years. In 1868 about twenty loads of well-rotted barnyard manure was applied in furrows—Early Goodrich potatoes planted, and after harvesting them, buckwheat sown and turned under in blossom. The potatoes in this experiment were all cut to the single eye, planted in drills three feet apart, one foot apart in drill, with no manure applied save equal quantities of guano and charcoal dust, at the rate of 500 pounds per acre, with a slight dusting of bone dust and ashes on the vines one month from planting. All had throughout precisely the same treatment. Level cultivation was practiced. A horse hoe was once run between the rows, and afterwards hand hoes were used to keep down weeds. The soil is naturally drained. Crop suffered somewhat from drouth the last fortnight in August. One rod of drill of each variety was dug and product carefully weighed on September 1st and 2nd, at which time the vines, save of some half a dozen kinds, were dying or dead. All tubers smaller than a small hen's egg, classed as unmerchantable, or small.

It may be stated, that the yield of some of these varieties was nearly twice as great in richer soils, but in this little trial plot, each potato, famous or obscure, was allowed to develop under fair conditions—neither pampered nor neglected. It will be noted that very few kinds entirely escaped disease, and probably many will show further unsoundness as the season advances:

No.	Variety.	Time of Blooming.	Vines Dying.	Yield, pounds.		
				Large.	Small.	Rotten
1	Early Rose	June 30	July 25	21½	1	¼
2	Vanderveer	July 10	" 30	7	1	
3	Early Goodrich	" 5	" 30	14	3	¼
4	Early Sebec	" 5	" 30	9	2½	1
5	Gleason	" 25	Sept. 1	17½	1¼	
6	Harrison	" 30		20	3	⅛
7	Cuzco	" 30		22½	2	¼
8	California	" 15	" 1	16½	1	⅛
9	Pinkeye Rustycoat	" 30	" 1	13	1¼	¼
10	Peachblow	Aug. 1		8	2	1
11	Prince Albert	" 30		8	2	1
12	Worcester Seedling	July 25	" 1	12	2	⅛
13	Calico	" 25	" 1	10¼	4	
14	Garnet Chili	" 25	" 1	13	1	
15	W. Red or Bermuda	" 10	Aug. 25	6	½	
16	London White	" 5	Sept. 1	3	2	¼
17	Rock	" 15	Aug. 25	11	3	¼
18	Albert	" 15	" 25	7½	1½	6
19	Victoria	" 10	" 20	1¾	2	2
20	Economist	" 10	" 20	4	1¼	⅛
21	Scotch Blue	" 15	" 20	3	1½	½
22	Regent	" 15	" 25	2	1½	¾
23	Colebrook's Seedling	" 15	Sept. 1	10	3	1
24	Hobson's Choice	" 15	Aug. 25	6	2½	¼
25	Early June	" 5	" 10	7	2	1½
26	Dover	" 10	" 20	10	1	1
27	Black Diamond	" 25	Sept. 1	12	1	
28	Pale Blush Pinkeye	Aug. 1	" 1	7½	1	
29	Patterson's Irish Blue	" 10	" 1	9	1¼	
30	Utica Pinkeye	" 10	Aug. 25	8	3	
31	Cinnamon Garnet	July 20	" 15	11	¾	¾
32	Early Hansworth	" 5	" 15	13	1	
33	Mona's Pride	" 5	" 10	2	1½	1½
34	Early Wendell	" 5	" 25	1¼	1	
35	Pigeoneye	" 15	" 25	9	1	⅛
36	New Kidney	" 10	" 25	2	1	7
37	Early Peachblow	" 5	" 15	9	2	
38	White Rock	" 10	" 25	10	1	1
39	Davis' Seedling	" 15	" 20	8	3	
40	Union	" 10	" 20	10	1	
41	Black Mercer	Aug. 1	Sept. 1	4	1	½
42	Shaw	July 15	" 1	6	1	
43	Holbrook	" 15	" 1	4	2	3
44	Early Stevens	" 15	Aug. 15	10	2	1
45	Extra Early White	" 15	" 10	5	1	3
46	Rough and Ready	" 20	" 25	4½	2	1
47	White Mountain	" 20	" 25	9	2	1½
48	Early Minnesota	" 15	" 15	5	1	⅓
49	Prairie Seedling	" 15	" 25	9	½	3
50	Dyright	" 5	" 15	5	2	2
51	Andes	Aug. 25		9	2	
52	Jones' Seedling	" 10		7	¾	
53	Skerry Blue	July 15	" 25	6	5	¼
54	Early York	" 10	" 10	3	1	1
55	Shaker Fancy	" 10	" 20	9½	1	3
56	Black Kidney	" 10	" 15	3	1	
57	Snowball	" 10	" 10	3½	2	½
58	Napoleon	Sept. 1		3	2	
59	Dykeman	July 5	" 15	5	2	2½
60	Dover Seedling	" 15	Sept. 1	14	3	¼
61	No-blow		Aug. 25	3½	2	¼
62	Monitor	" 15	" 20	8½	3	2
63	Dagger	" 10	" 10	5	3	⅛

No.	Variety.	Time of Blooming.	Vines Dying.	Yield, pounds.		
				Large.	Small.	Rotten
64	Delmahoy	July 20	Aug. 20	2½	4	1
65	Alexandria	Aug. 20		6	2½	
66	Coppermine	July 25	Sept. 1	8½	4	
67	Sutton's Racehorse	June 25	July 25	2	3	
68	Scotch Apple	July 20	Aug. 20	2	2½	
69	Mercer Seedling	" 10	" 10	1	½	3
70	Dana's Seedling	" 15	" 25	7	1½	
71	Patterson's Blue	" 15	" 15	15	2½	
72	Forfarshire Red	" 20	" 25	7	3	¼
73	Shaker Russet	" 10	" 20	8	1½	2
74	Early Cottage	" 15	" 20	3	2	¼
75	White Sprout	" 10	" 20	4	1	3
76	Strawberry	" 10	" 20	4½	2	2
77	Early Sovereign	" 10	" 10	5¼	2	½
78	Frankfort	" 20	" 25	1	2	
79	Callao	" 30	Sept. 1	14	2¾	
80	Titicaca	Aug. 5	" 1	9	2	
81	Lapstone Kidney	July 15	Aug. 20	9	2½	
82	Buckeye	" 10	" 15	8	3	3
83	Kearsarge	" 10	" 10	2	2	
84	Chenango	" 10	" 15		½	2
85	Patterson's Regent	" 10	" 25	2	3	
86	Central City	Aug. 1	Sept. 1	8	2	¾
87	Scotch Blue	" 1	" 1	2½	2½	
88	Rock Seedling	" 1	" 1	9	5	
89	New Hartford		Aug. 25	5	2	
90	Chili, No 2	" 1	" 20	3	1	
91	Great Western		" 25	3	1½	
92	King of Potatoes	July 15	" 25	3	2½	2
93	British Queen	" 5	" 15	7	3	½
94	Prairie Flower	" 5	" 15	6	2½	1
95	Ashleaf Kidney	" 10	" 15	1	1	3
96	White Chili	Aug. 25		8	3	
97	Chenery	" 20		11	4	1
98	Amazon	" 20		18	5	
99	Six Weeks	July 25	Sept. 1	4	1½	
100	Patterson's Early White	" 15	Aug. 15	1	2	
101	Carter's Early Forcing	" 10	" 10	7	2	3
102	Lone Star	" 15	" 25	3	3	¼
103	Rochester Seedling	" 10	" 20	3	3	½
104	Prince of Wales	" 10	" 25	2½	½	½
105	Wheeler's Milky White	" 10	Sept. 1	2	1	½
106	Concord		Aug. 25	9	1	⅛
107	Climax	" 10	" 15	12	1	½
108	Heffron's 27		" 25	6	1	
109	Early Prince		" 20	6	½	
110	Orono	" 20	" 25	8	1	
111	Excelsior	" 15	" 25	12	1½	
112	Philbrick's Early White	" 10	" 15	9½	1	3
113	Western Chief	" 10	" 20	5½	1	5
114	Willard Seedling	" 10	" 10	11	3	
115	Early Henry		" 20	8	2½	1¼
116	Pride of Duchess	" 15	" 25	9	½	
117	Hollenbeck Seedling	" 25	Sept. 1	2	1	2
118	Hillhouse	" 25	" 1	3	½	
119	Brezee's Prolific		" 1	17	2	⅛
120	Goodrich Seedling, No. 18	" 30	" 1	14	1	
121	Goodrich Seedling, V	Aug. 1	" 1	4	2	
122	Goodrich Seedling, W	" 1	" 1	6	½	
123	Goodrich Seedling, X	July 25	" 1	8	2	
124	Goodrich Seedling, Y	" 25	" 1	15	3	½
125	Goodrich Seedling, Z.	Aug. 1	" 1	5	1	
126	Cuzco Seedling		" 1	1	1½	

No	Variety.	Time of Blooming.	Vines Dying.	Yield, pounds. Large.	Small.	Rotten
127	Cowhorn Seedling, No. 1			7	1	1
128	Cowhorn Seedling, No. 2			16	4	
129	Seedling of G Chili		Aug. 10	16	4	
130	Early Rose Seedling, No. 1	July 5	" 5	9	1	
131	Early Rose Seedling, No. 2	" 15	" 15	2	3	1
132	Early Rose Seedling, No. 3	" 15	" 15	4	1	$\frac{1}{8}$
133	Early Rose Seedling, No. 4	" 15	" 15		$\frac{1}{4}$	
134	Mercer Seedling			4	1	$\frac{1}{2}$
135	Early Golden		" 20	6	1	$\frac{1}{2}$
136	Green Seedling	Aug. 1	Sept. 1	$6\frac{1}{2}$	3	$1\frac{1}{4}$
137	Jackson White	" 1	" 1	8	2	$\frac{1}{8}$
138	Buckley Seedling	July 25	Aug. 25	9	$\frac{1}{2}$	
139	Fluke	" 20	" 25	$6\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$
140	King of the Earlies		" 10	17	$2\frac{1}{2}$	

Nos. 137–140, inclusive, were planted May 20th.

Mr. Collins of Harmony, sent for exhibition a seedling grown by him from the "Early Blue," six years ago, and which he calls the "Down Easter." He also furnished the following statement of comparative yield and quality of several varieties—rating the Orono, as the standard, at 100, together with the percentage of rotton:

	Yield.	Quality.	Percentage rotten.
Orono	100	100	30
Down Easter	200	140	00
Grant	140	100	4
Early Rose	175	125	00
Early Blue	60	130	5
Early Goodrich	140	75	10
Jackson	80	120	40
Harrison	150	80	15
Gleason	125	85	5
White Mountain	110	100	10
Old White	50	75	50
Peachblow	50	75	50
Garnet Chili	180	90	00
Sebec Early	130	130	00
St. Helena	70	65	10
Early Champion	95	130	00
Christie	85	90	25

Other exhibitors presented specimens, among whom were—Albert Noyes, 13 varieties; E. B. Stackpole, Kenduskeag, 47 varieties; H. Luce, Bangor, 7 varieties; D. H. Thing, Mt. Vernon, 8 varieties; C. Chamberlain, Foxcroft, 6 varieties; Luther Chamberlain, Atkinson, seedling; J. V. Putnam, Houlton, 2 varieties; Geo. Stetson, Bangor, 3 varieties; H. Hamlin, Bangor, 1 variety; Abijah Dunbar, Bangor, 3 varieties.

Mr. Z. A. Gilbert delivered the following lecture on

The Culture of the Potato.

The potato is of great importance to the State of Maine. It is found upon the tables alike of the rich and of the poor, during the entire year; it forms a considerable portion of the food of swine; large quantities are annually fed to cattle and sheep; in many sections extensive starch factories work up thousands of bushels; and in addition to all these uses, and greater than all, it forms our chief article of export. The annual product is measured by millions of bushels, and the value is reckoned by millions of dollars. Strike it at once from our list of farm products, and our system of farming would be extensively altered, the diet of our people and the food of our stock would be radically changed, and the plethoric pockets of the producers would no longer cash sight drafts on presentation. Yet, notwithstanding the important position it maintains, until quite recently it has received but little attention from the agricultural writers of the State. Our agricultural journals have seldom contained an article upon the potato; the Board of Agriculture, if I mistake not, have never brought their combined wisdom to bear upon the humble subject. The Secretary, until last year, has not seen fit particularly to invite the attention of the readers of his reports to it, either by selections or original matter. Thus the potato has remained in humble obscurity, so far as printer's ink was concerned, till some one—it must have been an ingenious Yankee—was possessed of the idea that there might be a speculation in varieties of potatoes as well as in Merino sheep. Since that time varieties have been discussed in almost every issue of every agricultural journal throughout the northern States. I say varieties have been discussed, but seldom culture. My theme is the "Culture of the Potato," and after this prelude I will take up the subject somewhat in the order that farmers handle it every recurring season.

1. *What we want.*

We want a *good potato* for table use, and for the market; for stock a productive potato is sought for, without much regard to its quality. A potato of fair quality we will have if the season will produce it. What is a good table potato? It is desirable that the color should be white, although that is not absolutely demanded, and, other qualities being satisfactory, a colored skin will be not acceptible, but excusable, provided the potato cooks white. White is most desirable, but a colored skin and a slight tinge of the exterior of the potato after the skin is removed, will not condemn it. In shape it should be round or oblong, never "prongy;" smooth, eyes not deeply sunk, skin smooth, thick, and tough, that it will not be easily rubbed off in handling, and may be easily removed when cooked. Size uniform, medium to large. When cooked it should be mealy, not too dry, nor should it on the other hand be waxy, but just in that condition between the two which renders it mealy, yet allows it to adhere together—fine grained, compact, flavor pleasant, that is, it should have like pure water, no striking characteristic of taste. It should be free from all rank or strong flavor. It should cook readily, and completely through without leaving a hard core.

2. *What varieties shall we plant?*

The selection of varieties is an important matter to the producer of potatoes, for not unfrequently profit or loss depends upon this alone. It is best that but few varieties be planted by any one farmer, except by way of experiment,—say about three,—one very early, for summer use; another a little later, if you desire it, for fall and early winter use; and still another for spring and early summer use. This becomes necessary from the fact that very early potatoes are not generally the most productive, and hence are not profitable for extensive culture, and the best kinds for fall and early winter use are not the best for late spring and summer.

It would be the height of egotism in me to select from this display of varieties before us one, two, or three kinds as the best for general cultivation. In fact, no one kind is best for all. Soil and situation must influence the decision. Some varieties produce abundantly potatoes of the best quality on high, dry land, while the product would not be at all satisfactory either in quantity or quality if grown upon low, wet lands. Upon the high land the potatoes will be large, smooth, and handsome every way, upon the low land small, knobby, and every way imperfect. The Jackson and the Orono, which have given, and are now giving so good satisfaction in this section of the State, when planted upon my soil produce scarcely any potatoes suitable for table use. Every one then should experiment for himself. The experiments of a Vermont originator, of a New York dealer, of a Marblehead seedsman, of your own townsmen even, are of little value to you. Soil and situation have so great influence that we should trust alone to our own experiments. These conclusions are the result of my own experience in field culture, and have not been derived from experiments in propagating in the hot-bed or garden.

If a farmer has a variety which is productive, and the product is of good quality, he should plant it for his main crop, and meantime experiment in a small way, side by side with his main crop, with some other promising varieties; and when one is found which he wishes to substitute for the kind which he has been planting, do so, and go on with his experiments. In this way there will be little loss if some of his experiments be failures, as doubtless they will be, and the knowledge acquired be negative instead of positive. Farmers often learn what to do by first learning what not to do. That there are valuable varieties among the large number now being advertised to the attention of farmers, is without question, and there are also valuable seedlings among us here in our own State which have not been generally introduced, and which are deserving of public favor. Farmers will probably realize as much satisfaction in the test culture of these as they will by purchasing expensive kinds from abroad, and do it too at much less cost; while the chances are quite as good that they will find among them a kind worthy of extensive culture.

3. *Preparation of the Soil, and Manures.*

The land should be carefully plowed in the fall of the year, and before planting should be worked into a thoroughly mellow condition. While enriching it this fact should always be borne in mind: that the *potato does not require, and will not bear highly charged nitrogenous manures.* Such manures may be used to force a quick growth on early potatoes designed for use as soon as grown, but cannot be recommended for general field culture. When barn manure is applied it should be as an ingredient of a mild, thoroughly decomposed compost. Muck is an excellent ingredient, and is very profitable to use in this way. When the compost is applied to dry lands it should be spread broadcast and worked into the soil when it is being prepared for planting, or better, in the fall of the year. Heavy manuring, and extremely rich soils should always be avoided for the potato. When wet, cold lands—and all wet lands are cold—are to be planted, the best results are often attained by applying the compost in the hill, or drill. The potatoes are more liable to rot, but it is better to lose some by the rot and have a reasonable quantity of good ones left, than it is to realize only a small crop of inferior potatoes. On such lands if the seed is dropped directly into the soil, it finds a cold, lifeless bed, and consequently is a long time starting, and grows feebly and slowly all summer. The harvest is a small crop of small potatoes. If manured in the hill, the compost holds the seed above the cold clammy soil, and forms a warm mellow bed, wherein it starts into a vigorous, healthy growth, and maintains it throughout the season. But barn manure is not in all cases necessary, nor is it always desirable in the cultivation of the potato. Wood ashes or some of the commercial fertilizers in the market may be used with good results. In many cases the *most profitable* crops may be grown without the application of barn manure, by the use of some one or other of these fertilizers, with the addition perhaps of a little plaster. Ashes are the cheapest application in proportion to the benefit derived. Perhaps, however, an exception to that statement should be made, for on some soils an application of plaster at a very trifling cost produces very marked results. If I were to select a piece of land with a view to growing the most profitable crop of potatoes, taking into consideration the cost of cultivation, expense of fertilizers used, and quality of product, I would select a moderately dry, loamy piece of land, which had been in pasture for a considerable number of years, prepare it in the best manner, and apply liberal quantities of wood ashes mixed with plaster, and no other fertilizer. The crop would not probably be large, neither would the debit side of the account be large; hence when the account was closed, the balance would show a good profit.

4. *Planting.*

In order to act intelligently in the selection and preparation of the seed for planting, it will be well to consider a few facts which, though not conceded by all, are sufficiently well established to be set down as facts. If the seed end of a potato be planted, the result is a good yield of small potatoes. If the butt be planted, the result is a smaller yield of nearly all large potatoes. If very small potatoes are used for seed, a small yield of small potatoes is the result. If large potatoes are used in liberal quantity, the result will be a large yield of good potatoes. I am aware the statements here made and set down as facts will be stoutly denied by some who are listening to me. They are, nevertheless, well established, and deviations from them are exceptions which can be traced to causes outside the usual course of cultivation. In a large majority of the comparative experiments reported—in nearly all of them in fact—the best yield per acre, other things being equal, has been obtained by planting large potatoes whole, or their equivalent in weight if cut. It makes no difference with the result, whether the seed be whole when planted or whether equal weights which have been cut from larger potatoes be substituted. The seed planted gives strength and sustenance to the plant till such time as the roots of the plant have expanded and extended into the surrounding soil, and are henceforth enabled to sustain their growth from that source alone, when the seed decays. The larger the potato which a given number of stalks have to feed upon, if the expression be allowed, the more vigorous and healthy the growth, and the better the yield at harvest. I am aware that the present method of multiplying choice kinds, by cutting the seed planted into very small fragments, by dividing the eyes, by cutting off slips, &c., gives a seeming fallacy to such a theory. It is, however, only a *seeming fallacy*. These skillful practitioners substitute, through the agency of high cultivation and liberal manuring, an art which they well understand, artificial sustenance to the young plant, in place of that supplied in a natural way in our common field cultivation. The plant therefore grows, and vigorously, too, notwithstanding its slender support from the seed, while under ordinary cultivation it would hardly hold life enough to sustain existence.

The course pursued by professional propagators with high priced new varieties is of very questionable utility. Is there not danger that the vitality, the vigor, the constitution of the kind be greatly impaired, if not quite destroyed, by the present methods of propagation practiced by them, before they are generally disseminated, and the world lose what otherwise would have been a healthy, vigorous and valuable potato? The connection between the plant and the potato from which it was produced is so slight, that though the variety be reproduced, the vitality may be impaired. Experience has proved this to be true of other plants, why may it not be so of the potato? May not the tendency to rot, so manifest in some of these celebrated kinds, be attributed to these causes? The point is certainly worthy of consideration.

But let us, after this slight digression, return to the planting.

For planting, then, fully developed, healthy, good sized potatoes should be selected and planted whole, or if too large cut to the proper size. The practice of cutting potatoes into small pieces and putting two or three crumbs in a hill is a relic of ignorance and superstition, worthy only of being classed with such foolishness as planting peas on the full of the moon, and castrating young animals according to the signs of the zodiac, and cannot too soon be done away with. Let the crumbs remain in one piece, and at least you will save the time of cutting. The rows should be at sufficient distance apart to allow the horse and cultivator to work freely between them—three and a half feet will be found the proper distance. Comparative experiments have proved that the best yield per acre is obtained when planted twelve to eighteen inches apart in the rows. There are probably more planted in this State at a distance of two and a half feet than there are at a distance of one and a half feet, but experience proves that there is little if any difference in the yield per hill, while the yield per acre is increased in proportion to the increase in the number of hills. The furrows for planting should be opened but slightly, unless manure is to be applied to the hill, and the covering should be carefully and evenly done.

5. *After Culture.*

Clean culture should be practiced by every one who grows a hill of potatoes. There is no crop grown that better repays the grower for unremitted efforts for the extermination of all weeds, than will the potato; and there is none grown which a rank growth of weeds will injure more. As soon as the plants are up the cultivator should be run between the rows, and the soil around the hills stirred with the hand-hoe. It is not necessary that the earth be hilled up any around the plant at this hoeing. Indeed if it be done as soon as it ought, the plants will not be large enough to admit of it. This stirring of the soil kills all the young weeds which have started into life and leaves the ground clean and mellow. The field should now remain till the weeds again show themselves, or till the plants are large enough for a second hoeing. At this second hoeing the plants should be moderately hilled up, and the whole surface left light, mellow and free from weeds. If any further hoeing is found necessary, it should be done by cutting the weeds near the surface without stirring the soil around the hill to any considerable depth.

The practice so extensively prevailing in some parts of the State, of excessively hilling the plants by the repeated use of the "Horse Hoe," is highly objectionable from two points of view:

The excessive hilling is not only useless, but is highly injurious to the plant; and, the horse-hoe does not pulverize any of the soil only that which it draws around the hill. The soil should be thoroughly stirred up and mellowed, not only around the hill, but which is equally as important, between the rows. If the soil around the hill only is mellow, and between the rows is hard and impenetrable, the plant is dwarfed; the roots do not extend out into the surrounding soil, drought affects it. Very good work may be done by thoroughly stirring the soil with a common horse cultivator and then drawing the necessary portion of it around the hills by the use of the horse-hoe. But would not the work be more quickly and cheaply done by the use of an implement, if such could be found, that will perform both operations at once.

The practice of thinning the plants to the proper number of stalks to the hill, by pulling out with the hand all superfluous ones, is now practiced by many of the most successful cultivators. It has long been noticed that an excess of seed, as it is termed, has a tendency to increase the preponderance of small potatoes. This tendency is more marked in some varieties than it is in others. It is strikingly perceptible in the Jackson and Orono. Hence farmers who have been raising these varieties, have from year to year, cut the seed smaller and smaller, and have by this practice avoided the evil. But they have done it at the expense of the crop. They have not put this question to nature in the right way. They have asked, Does the amount of seed to the hill affect the size of the product? while the question should have been put, Does the number of stalks to the hill, other things being equal, affect the size of the product? The answer from nature would have then been decisive and prompt—Yes! A large number of stalks has a tendency to produce an undue preponderence of small potatoes. Farmers will do well to give this subject careful attention, and see that all unnecessary stalks are thinned out. Four stalks are enough to stand in any hill, and if they are planted thick, three, and even two will give the best results.

6. *Harvesting.*

Early harvesting is being more generally practiced from year to year. Potatoes on wet lands at least, should be harvested the last days of September, and all should be housed before the tenth of October. They should be thoroughly dried, and deposited in a cool, dry, well ventilated cellar. It would seem that so simple an operation as digging potatoes could be mostly performed by horse power. Implements have been constructed for this purpose, but have performed their work quite imperfectly, and have proved of little if any advantage over the process of hand power digging.

7. *Marketing.*

The subject of marketing the crop after it has been secured, is one worthy of considerable thought. The questions how to market, when to market, and where to market, must be carefully considered. Is it best to market in the fall, or keep till spring? Shall we sell here, or shall we consign them to the commission merchant? How much advance should we receive on the fall price, if we keep them over till spring? Potatoes are selling to-day in this market for sixty-two cents per bushel. How much should they bring next spring and summer, in order that the holder meet with no loss in the operation? These are some of the questions which present themselves for consideration under this head; but I leave them with only the mentioning, hoping others will take them up, and discuss them in detail.

8. *Conclusion.*

The present practice of growing large quantities of potatoes for export, which prevails to such an extent in some parts of our State, is in a high degree objectionable, and is working deleterious results which only an improved system of agriculture, conducted through a series of years, can efface. The practice followed out year after year of throwing the principal energy—nearly or quite all the manure—of the farm into the potato crop, to be carried from the State, is exhausting many a productive field, and reducing many a farm to a low state of cultivation. The very fact that this product can be grown, nay, that it must be grown, without high cultivation and heavy manuring, renders the growing of it more objectionable than it would be if other conditions were required. If the growing of the potato required liberal manuring and the best possible cultivation to secure fair returns, the soil would be left in a better condition for succeeding crops. Treated in any way, however, the potato is an exhausting crop, and the land is left in comparatively poor condition for succeeding crops, whatever they may be. Taking into consideration the excessive draught which a succession of crops of so exhausting a nature makes upon the soil, and considering that the crop is all removed and nothing from it returned to the soil, you must see the force of the objections which I have enumerated.

We know that non-producers must be supplied with potatoes, and if the growing and exporting of them is working such results, the question naturally arises, what shall be done in the premises? I answer, withhold growing them till the price which can be obtained be sufficient to enable you to bring back upon your fields those elements of fertility which have been drawn slowly and imperceptibly from them by the system you are pursuing. This must be done, or sooner or later you will awaken to the unpleasant fact that you have sent your farm to Boston in a potato sack.

Mr. Bartlett. The gentleman says that the "Orono" and "Jackson" potatoes have flourished here in Penobscot, but not with him. I would inquire what varieties he has found successful, and what soil he plants on.

Mr. Gilbert. Several years ago, when the Jackson and Orono first came into general cultivation, I obtained them. I gave what I term a good chance, in comparison with other potatoes. The result was not satisfactory. Indeed, it was in the highest degree objectionable. I obtained scarcely any potatoes suitable for table use or for the market. The yield was very light, and the potatoes mostly small. Whether there were four stalks in the hill or but one, it made no difference. I became perfectly satisfied at that trial in reference to these varieties, on my soil, but this spring, on selecting my seed, I found a few of these potatoes in my cellar, and they looked so handsome that I could not resist the temptation to try them once more. I planted them, and the result was precisely the same as before; I obtained hardly a single potato suitable for table or market. Taking all my experience into consideration, I shall not plant them again unless I do it by mistake.

I attribute my want of success to the soil, which is a fine, dark, deep, moist loam; high land and free from rocks, excepting granite boulders. It is mellow and rich. I manured with a mild muck-compost, the same as I manure all my potatoes, and the results I have stated.

Question. What would the gentleman recommend as to measuring potatoes?

Mr. Gilbert. I believe the law requires sixty pounds to the bushel; and if the seller must furnish five pecks for sixty pounds, I should say, by all means have them weighed. I am aware that most varieties of potatoes will fall a little short of sixty pounds per measured bushel. There is, however, quite a difference in varieties, and a difference, also, in the season of the year in which they are weighed. The potato is heavier in the fall than it is in spring, as all who have weighed them well know. There are but few varieties cultivated which weigh more than sixty pounds to the measured bushel. The "Jacksons" and "Oronos" will not, as a general thing, quite come up to the standard; but they will come very nearly to it in the fall of the year; in the spring they will fall short about three pounds to the bushel. Consequently, the practice, if it be one, of requiring five pecks for a bushel, is demanding too much of the seller.

Mr. Ingalls of Bangor. Our city is getting a bad name in this matter, and I suppose there are some who would be glad to say something upon it, when it is in order; I suppose it would hardly be in order now.

Mr. Bartlett. Our friend says that we must put in a whole potato, or seed heavily, because the strength of the seed potatoes supports the plant. When potatoes are worth a dollar and a half a bushel, that is a very expensive sort of manure. I will give you one fact that has come under my observation. Mr. T. R. Shaw, of Exeter, who died a year ago, generally had a very good crop of potatoes. He only deposited one eye in each hill. He often cut a large potato into twenty pieces. I observed that his potatoes were uniform in size. There were scarcely any very large, but were all of good size, smooth, and excellent in appearance. Mr. Shaw's successor planted the same kind of potatoes, on the same soil, and in the same way, except that he seeded heavier. The result was that there were a great many small ones, and the yield was not as good.

Mr. H. C. Burleigh, of Fairfield. I must take one or two exceptions to the rules of culture just presented to us. I have experimented enough the last eight or ten years with potatoes to understand a little about raising them. I raise only about three varieties, as the gentleman recommended. I have tried a good many of the new kinds that are advertised in the papers; some I have found worthless, others have proved excellent. I never put in a whole potato. If it is the size of a hen's egg (and if I could have my choice I would have all of that size,) I cut in two, and never put but one piece in a hill; the hills eighteen inches apart. If the potato is large, I cut into four, six or eight pieces. I cannot accept the theory in regard to putting but one eye in a hill. I tried it this year with the "Early Rose," and got a great yield from the amount of seed; but when we take into account the land planted, the yield would not be so great. I raised at the rate of 166 pounds from one, with one eye in each hill, using no other manure but that most excellent superphosphate which we get from Portland, the "Cumberland," which has proved of great value to me, not only for potatoes, but for turnips and corn.

My yield of potatoes has been, for the last six or eight years, with one exception, and that was on pasture land, 200 bushels and upwards to the acre. This year I raised "Sebecs," at the rate of 280 bushels to the acre. These I manured with half a shovel full of stable manure to the hill. I raised last year of the "Goodrich," at the rate of 325 bushels to the acre; and so precious did they seem to me at the time of digging that I kept them to sell for seed; but this spring nobody wanted them. I shall not plant them any more.

It seems to me that the gentleman's idea that the seed end of the potato produces only small ones is certainly a mistake. I have taken the "Early Sebecs," "Jackson Whites," and "Oronos," divided them in the middle, and planted in rows side by side, and the seed end always came up first, and was always ahead of the others; and in the fall I could not see but I got as many potatoes in weight or measure, if not more, perhaps not quite as large, and about a fortnight ahead of the others.

Mr. Wasson. The potato crop is the leading crop, hay excepted, in the State of Maine, especially in the valley of the Penobscot. It is a crop that is cultivated by more men than any other crop grown in the State of Maine, and it is every year receiving large accessions to the number of its producers. It is now more than a hundred years since the potato has been grown as a field crop, and yet, if we compare certain facts known to those who grew the potato a hundred years ago, and arrange them side by side with certain facts claimed to have been ascertained by those who grow the potato to-day, we should all be surprised to find that we are so little in advance of that period.

Now, the primary object of this exhibition and discussion is, that we may bring out facts and settle principles. Let us look over the ground a little. Shall we select a potato of large size or small, as the better seed? Shall we select the seed end or the butt end as preferable? Shall we plant two feet apart or three? Shall we put the rows three feet apart or three-and-a-half? Shall we plant the seed with the flesh side up or down? Shall we cover to the depth of six, four, or two inches? Shall we plant upon greensward or upon old ground? Shall we put them upon well rotted manure or upon fresh manure, or upon commercial fertilizers? Shall we hill up, or use surface culture? Shall we hoe once, twice, or three times? Let me put any of these questions, and I should receive, in all probability, to each and every one, almost as great a variety of answers as there are gentlemen present. Then what have we learned during the hundred years that we have been cultivating the potato as a field crop? These are some of the questions which I hope during this discussion may be determined. I hope that facts may be ascertained, so that another year when we go into the field to plant, we shall know more about its culture than we knew this year. These are important questions, and should be taken up carefully, considered fairly, and so far as possible decided.

Mr. Henry Little. I wish to add one more question to the list, and that is, whether it is advisable to plant potatoes year after year on the same soil. Will Mr. Burleigh answer?

Mr. Burleigh. I would not recommend planting potatoes for more than one year on the same lot, although I have done it and raised good crops, for two years in succession. Still, I believe it is injurious to our fields.

Mr. Ephraim Goodale of Orrington. No sensible farmer would plant potatoes on the same land for more than two years. I have raised very good potatoes for two years, but beyond that they always deteriorate; the tubers grow small, but the vines grow large. I knew a gardener who raised potatoes on the same land for several years, and was surprised that the vines should be so large and the potatoes so small. I told him, "You have got all the potato out of the soil." I should never plant more than one year, under ordinary circumstances.

Mr. Moore. The suggestion in relation to the effects of the potato on the soil startles me. It is a common remark, that it is an exhausting crop, but that point I should like to have discussed here. We find by analysis that the potato requires a large amount of certain constituents; potash, for one; but by comparing the potato with turnips, beets, rutabagas, carrots and other roots, I have supposed that it was not a very exhausting crop. From our farm is sold milk. We sell no potatoes, meaning not to carry off much of the inorganic elements of the soil. By converting them into milk, we carry away less than we otherwise should. We must carry something to market, and what shall it be? My practice now is, to raise potatoes, follow with a crop of barley, and seed down. This is a question of vital importance to this section of the State, where we raise so many potatoes for market. If it is going to use up our farms in a few years, we want to know it.

Hon. Hannibal Hamlin. I have raised all the potatoes for my family for the last thirty years, and have never raised a single tuber that I have not tried to watch very carefully its progress from planting to maturity; and, so far as I could, the effect of different soils, although I have been confined almost wholly to a clay loam. I listened with great pleasure to the lecture on the potato given us by Mr. Gilbert, and I think that, in the main, his experience is my own. In some particulars, however, I certainly disagree with him. I have finally, from experimenting in all ways that I could, come to adopt this system, and I stick to it, because it is a practical one, and profitable. I plant my potatoes upon a greensward. I spread a moderate dressing of stable manure upon it, and turn the furrow over. I then thoroughly harrow it with a very heavy harrow. I then plant very nearly upon the top of the ground. In digging potatoes, I have found that wherever the hills were sunken, so that the water could not drain away from them, if they rot at all, they always rot excessively. I have therefore come to the conclusion that it is better to have the hills so that the water will drain away from them in wet seasons. I am very sure that this has preserved my potatoes when some of my neighbors have lost theirs.

I believe in cutting potatoes, having tested that for more than ten years. I do not believe that the nutriment in a full-sized tuber is worth one fig for the nourishment of the plant. I do not believe it, because when we find a tuber which has not decayed, we always find a host of little potatoes in the hill.

I run my horse-hoe at intervals of three and a half feet, as lightly as possible, and put the rows three feet apart. Then I apply one part gypsum, one part air-slacked lime, and three parts wood ashes. Or, in other words, to about one acre of land, I apply two bushels of gypsum, two bushels of air-slacked lime, and six bushels of ashes. That gives me a moderate handful to throw in with the seed. I never plant in hills. I cut my potatoes so that in no case shall a piece have more than two eyes,—one is better,—and plant them from eight to ten inches apart, in drills. The yield averages about five to a stalk, and they are all of a size. I raised at the rate of nearly 400 bushels to the acre by this method.

Undoubtedly, the gentleman is right in what he says with regard to the number of stalks in the hill. You may plant a whole potato, if you please; and then, if you will go over the field and destroy all but one, two or three of the stalks, you will get large-sized potatoes; but my experience has been, that you may just as well cut your potato, and save seed and save the trouble of going over the field to thin out the plants.

It is not wise to plant potatoes upon land the second year. They are much more likely to rot, although you may raise good potatoes. I planted the "Jackson" potato for a number of years, and found them very small, until I resorted to the plan of allowing but one or two plants to a hill. I raised 70 odd bushels on less than a third of an acre, and I think out of the whole, we selected but five bushels as small. The rest were all sufficiently large for cooking.

I come, therefore, to the conclusion that green sward is the better soil on which to plant potatoes; that you want to plant them very near the surface, and give an ample width to the hill, so that the roots shall not run out and deposit the tuber too near the edge, and have it sufficiently high, so that it will easily drain in wet weather; apply your ashes, your lime and your plaster, and they will preserve it in almost all years from the rot.

Mr. Warren Percival, of Vassalboro'. Perhaps my experience may assist some gentlemen. There is, however, such a variety of soils, such a variety of culture, and such a variety of seed, that it is impossible, in my opinion, to establish any fixed rules to govern us in this matter. But there are some general rules we may follow with success. In the first place, I believe that every farmer should understand the nature of his soil, and in order to do that, we must have the aid of the Agricultural College. I have strong faith in that institution.

I have been trying, in my limited way, to cultivate the soil for thirty-five years or more. I have not raised potatoes very extensively, for I believe that, as a general thing, they are an exhausting crop to raise. We hear a great deal about the difference in yield of the different varieties. I do not attribute it so much to the varieties, as to the change of seed. When I was a boy, my father brought home, at a certain time, some potatoes, (precisely the same as we cultivated,) that had been raised on a clay loam, our farm being a rocky, red loam. We had a piece of land, which was all ploughed and treated precisely alike, and planted one half with our own potatoes, and the other half with the potatoes raised upon a clay loam; and the latter yielded more than double what our own potatoes did. Since then, I have changed my seed as often as once in five years. I believe that the great success that many people meet with in raising new varieties is owing to a change of climate and change of soil; and almost invariably, if a man buys a pound of potatoes, and pays a dollar a pound, he will give those potatoes better cultivation than he gives his old varieties.

Years ago, I tried this experiment. I took my potatoes, which were about the size of a hen's egg, cut them in two, and planted in one row the seed ends, and in another row beside it the butt ends. The soil and cultivation were precisely alike. When I came to measure my potatoes in the fall, I got just about the same number of bushels from each row, but the potatoes from the butts were much larger and handsomer. I attributed that result to the fact that there were too many stalks where we put the seed ends. I am in favor of having but two or three stalks in a hill, and for that reason I cut my potatoes.

I think if you analyze the potato you will find that there is but a very small amount of fertilizing material in it. There is a certain amount of moisture, and when the potato decays, if the season is very dry, that moisture may assist the plant somewhat; hence it may be advantageous in some instances to plant a large potato for the moisture, but not for its fertilizing properties. I always cut my potatoes, and put two pieces in a hill, the hills being two feet apart. I plant upon pasture land, invariably, and never put any manure in the hill except phosphates.

I never plant potatoes the second year upon the same soil, for I believe we get the potato all out the first year; and so with other crops. Hence I go in for rotation of crops.

Now, as to the after culture. I never hill my potatoes. I prefer level culture upon all crops. But there is such a variety of soil, such a variety of seed, and such a variety of after culture, it is impossible to lay down any fixed rules. A man must be his own judge. Barn-yard manure is the best fertilizer, and when you have not got that use commercial manures. But the best of all is brains.

Mr. Comins, of Eddington. I have listened with much attention to the discussion this morning, and must say that I differ from some of the gentlemen. First, in regard to planting whole potatoes. I think we cannot afford it when potatoes are a dollar a bushel. I have practised for a great many years cutting my potatoes, and I prefer a potato larger than a hen's egg. I would rather have a large potato cut into four pieces than one the size of a hen's egg cut in two.

But I wish to say a word in regard to the argument of the gentleman who spoke in reference to planting the flesh side of the potato down. That is contrary to my rule entirely. I always place the cut side up, and my reason is, that thirty years ago I planted a piece of potatoes, dropping them one side up or the other, as it happened. A severe rain storm came on the day after planting, and a portion of the ground was so wet that the water literally stood on it for several days. The consequence was, much of the seed rotted. When the water subsided, I dug into the hills, and found that in about every instance where the cut side laid down the seed was rotten, but where the cut side laid up it lived through the wet weather, and commenced growing. As to the objection that the sprout has to crook round to get up, I don't think that takes much time, and the fine roots that start with the sprout have a better chance to get hold of the fertilizer or the fertilizing qualities in the soil, if they are at the bottom. But my main object is to prevent the seed from rotting in case of a heavy rain storm.

Mr. Marcellus Emery, of Bangor. In common with the audience generally, I have been deeply interested in the lecture by the gentleman from Androscoggin [Mr. Gilbert], and this because from my boyhood I have been more or less among potato vines. My experience in the cultivation of the potato has been very much that of Mr. Hamlin, and if the audience will indulge me, I will give the result of my observation in regard to the amount of seed.

A few years ago I visited the cellar of one of the most successful potato growers of this county, and he told me that the year before he had commenced planting small seed, and the result was a good crop of large potatoes. Acting upon that hint, the next spring I took up half an acre of greensward, and planted it with small potatoes. The result was, a good crop of large potatoes. The next year I selected the smallest of the potatoes grown on this half acre for seed, and planted about an acre and a half. The result was a failure. Thinking of the subject, I came to the conclusion that farmers generally had been over-seeding, and my friend here in Penobscot had partly remedied the evil by planting small potatoes. He would have remedied it completely had he taken his largest potatoes and cut them into small pieces. In the growing of stock, we take our fairest and largest for breeding. So it should be with the potato.

Last spring I had sent me three of the "Early Rose" potatoes, very large and fair, with instructions to cut and plant an eye in a hill. On the three potatoes there were thirty-six eyes. I planted them as directed, on a half rod of ground. The result was a yield of two bushels of excellent quality; at the rate of over six hundred bushels to the acre. The conclusion to which I arrived is this: select your largest and healthiest tubers, and seed one eye, or at most, two eyes in a hill.

One word in regard to fertilizers. I this year took up six acres of ground, in a field that had been utterly exhausted by twenty-five years of mowing, without the return of a particle of manure of any kind to it. It was so utterly exhausted that I think the last year it was mowed it did not give more than three hundred pounds of hay to the acre. In planting, I used the compost of which Mr. Hamlin has spoken,—ten bushels of ashes, six of plaster, two of salt, and two of lime, composted with half a cord of loam, to the acre. I also used Bradley's superphosphate and the Cumberland superphosphate.

A fortnight ago, I visited the field, where the harvesters were at work. Of course, the soil being so very poor, I could but expect the lightest yield. Where the compost of lime, salt, plaster and ashes was used, the yield was very light. Side by side were the phosphates. The harvesters saw no difference between the Cumberland and the Bradley, but the yield was as three to one in favor of the phosphates.

On a patch in the same field, where barnyard manure was applied, some California potatoes were planted. These rotted very badly. But where the phosphates and the compost were used, not a single rotten potato was found.

Mr. D. H. Thing, of Mt. Vernon. In planting my potatoes this year I have been governed in a great measure by the results of the experiments published in the last report of the Secretary of this Board, and with the best results. I rejected everything smaller than a turkey's egg, and put one in a hill; no cutting except a very few of the largest, which I cut in two and put one piece in a hill. Rows three feet apart, hills twenty inches. I planted a bushel of Oronos, through the middle of the piece, about the size of a small pullet's egg, which produced less in quantity and certainly four times as many small ones. No possible difference except in the seed. When I manure in the hill, I draw a shoal furrow; when I spread the dressing, I draw a chain to mark the rows.

The remark of Mr. Hamlin, that "potatoes planted where the water does not readily drain off are liable to rot," has always proved true in my experience. If the ground is tolerably free from stone, I prefer Chandler's horse-hoe to the hand-hoe, always taking care to use the cultivator till the earth is well pulverized, whether I have to go one time or four in a row. I believe the sooner they are dug after the top show signs of rust the better. By signs of rust I mean when the very topmost leaf of the vine begins to wilt. This year the first great rain came on just when my potatoes should have been dug. The ground being wet, I had to wait several days, and when I commenced the tops were quite black. I found but very few affected potatoes, but as soon as they were put in the cellar they commenced to rot, and now two-thirds of my crop are black. When I dig my potatoes, I have each man take one row; all work facing the field to be digged. The man who has the forward row in all cases keeping ahead; then as each man pulls his tops, lay them down between himself and his row, and cover them up completely, together with all the weeds, grass, and every green thing. For doing this, I get my pay three times. First, the land is in better condition for a crop next year, as there are no sods or potato tops in the way. Second, the ground is enriched by the tops enough to pay for all trouble; and, third, I get amply repaid in looking back over the piece. If farmers who do not practice this method will try it carefully, I believe they will see cause to stick to it.

Adjourned to two o'clock P. M.

Afternoon Session.

The Convention met at two o'clock. Mr. Thing of Mt. Vernon, called the meeting to order, and stated that the subject for discussion was

The Varieties of the Potato.

Mr. Wasson. If I have read the history of the potato correctly, the original tuber presented but two varieties—two in color, in texture, and in form; and each was uniform in color—it was either white of skin and white of flesh, or it was yellow of skin and yellow of flesh. The same was true of the blossom, one was white, the other yellow. At the present time the blossom of the potato presents every variety of hue, and the same is true of the tuber; and we have an intermixing of colors in the skin and in the flesh.

If we come to the number of varieties, we have here upon our table 140 kinds from one exhibitor, and I believe there have been catalogued more than 500 varieties; and the prospect is that we shall soon have an indefinite number of varieties.

This being true, if we started in the first place with two varieties, one a pure white, the other a little tinged with yellow, and we have after two or three centuries more than 500 kinds, presenting every variety of form and color, and quality, we may continue to do this; and here arises an inquiry into the origin or cause of this difference, and to me it is an interesting part of the subject. I remember the old "Chenango,"—a better potato we never had, and probably never shall. It succeeded well for a series of years, but finally disappeared.

In many sections of the State the "Orono" is coming to be regarded as having had its day, also; as being now valueless, compared with former years. Many are abandoning it, and there is a call for a new potato to take its place; and owing to certain causes or agencies, no matter what, we have before us a great many new varieties; and we want to be able to say to our brother farmers when we return whether there is, of the many varieties before us, new or old, one that is better than all the rest, or as good as the "Orono" in all respects, and if so, which it is. That is the question we want to answer. I have answered it for myself, so far as the results of one year can answer it. I have cultivated this year, with a great deal of care, seventy-three varieties, in the same soil, and applied the same manure and the same culture precisely. The results in product I cannot tell, for we are suffering severely in our section of the State this year from the potato rot, as badly as in any year within the ten years last past; but in two of the seventy-three varieties that I have cultivated, I have not seen a single one diseased. Growing in the same row, and side by side with others that rotted badly, they have grown and ripened, as potatoes did thirty years ago. I do not know that they will do it next year; they did it this, they did it last year. One of these varieties is the "Bermuda," the other is the "Gleason.;" one white the other red.

One point more and I close. When we come to speak of varieties, we are met with another difficulty, a troublesome one. Some years ago, I wrote to a member of this Board, and asked him to send me several varieties, naming to him those I cultivated. He sent some, and I exchanged the same number with him. Out of the six sent me, five were kinds grown by me, known to him by other names; and of the number I sent him, every one had been grown by him under other names. This causes a great deal of difficulty and a great deal of confusion, and we ought to do all we can to remedy the evil.

Mr. Comins, of Eddington. At the meeting of this Board last January, I was presented with a potato called the "Lowell," also with one "Early Rose," and one "Prince Albert." Last spring I cut the three potatoes to one eye on a piece, and planted in rows three feet apart, one eye in a place, eighteen inches distant in the rows. The "Early Rose" was dug September 15th, 84 square feet of ground produced 51 pounds, at the rate of 440 bushels per acre. The "Prince Albert," dug October 10th, produced on 66 square feet of ground, 38⅛ pounds, or at the rate of 418 bushels per acre. The "Lowell," dug at the same time, produced on 87 square feet of ground, 27¾ pounds, or at the rate of 212 bushels per acre. The "Early Rose" were much the largest, and three weeks the earliest, and probably attained their full growth before the drought of the last of August, which was severe. They are inclined to rot since they were dug. The "Lowell" had a few defective ones. The "Prince Albert" show no signs of decay at all. They are all very good potatoes.

Mr. Ingalls, of Bangor. In reaching a decision upon this point, the object for which the potato is grown must be taken into consideration. My early life was spent in growing potatoes; the latter part of it, twenty-five years or more, has been spent in the purchase and sale of them. I apprehend that the sale of the potato for export will continue to be the important object of the farmer in this State, and that the question resolves itself into this: "Which is the best variety to grow for export?" I know that one of the points at issue is, whether it is good policy to grow them for export; but inasmuch as that will undoubtedly continue to be a main object, a variety should be sought that possesses the characteristics of good quality and appearance, good size, and durability.

The sale of potatoes from Maine, as I happen to know, is large. The average annual sale from this city, for the last fifteen years, has been 300,000 bushels. Maine has had a wonderful reputation for the quality of her potatoes. That was earned by the "Jackson", and the "Orono" has come to take its place, because persons abroad are hardly able to distinguish between the two, and the Orono yields more. All the orders that come to purchasers contain this phrase, underscored—"A cargo of *Jackson Whites*." It is not only the white skin that is wanted, but the white flesh.

It is surely important to secure a variety or varieties (they should be few) which will give the best quality, of course, whether to use at home or for sale abroad, the best yield, and be durable; and I believe that this multiplication of kinds is going to be a very great drawback upon the farmers of Maine, if they continue to grow potatoes for export. We want to retain the reputation we have for quality and color, and then our sales can be very largely and advantageously increased. There is a large amount of money brought into our State through the sale of potatoes, and there will continue to be, I have no question at all, if we shall be able to continue the "Jackson" or the "Orono," or something which will be like them.

ABIJAH DUNBAR, of Bangor. I have a potato which I think will compete with the "Orono," or any other. It is the "Prince Albert." Three years ago I brought from New Hampshire one potato, that they said was very nice, and planted it the 26th day of June. It yielded forty-three. The next year I planted forty, and got two bushels. I brought them here to the exhibition of the Horticultural Society, and they gave me the first premium—five dollars. I sold last year two pecks to a man in Newburg. I saw him this week, and he told me that he planted them by the side of other potatoes, using them just as he did the others, and got thirty bushels. All the potatoes I plant to sell or eat will be that kind. They are not exactly white, like the "Orono," neither are they much colored, and are very good to eat.

In regard to the "Orono," one of my neighbors had five acres that he plowed last fall, and planted without putting on any manure. When he dug his potatoes this fall he found eighty bushels of rotten ones. If we cannot have something better than the "Orono" to plant, I do not think we shall make much by raising potatoes. I have not seen a rotten one among the "Prince Alberts" in three years.

Mr. INGALLS. I am unwilling to hear a potato slandered that has done so good service as the "Orono." If any one here has a potato that will take the place of that, he will find no one to oppose him. But, sir, let me say to this Board, and to all present, it will take at least ten years to substitute another potato for the

"Orono." Go into Market square, if you please, and see the noble loads of the "Orono" brought in; and there are any number of orders for cargoes of the "Jackson Whites," as the "Oronos" are called. I do not object to your praising other varieties; but mark you, sir, it will only prove an injury to the farmers of Maine, and especially to the farmers of Penobscot, if the result be only to increase the number of new varieties. "Speak well of the bridge that carries you safely over," says the adage. If the "Orono" was a failure, if the farmers get no crops, then we might well deliberate about what we should substitute in its place. But is it true? Go to the farmers' cellars and see the well-stored bins of potatoes. And what are they? "Oronos." It is common all over this ridge of land to hear of farmers raising 1,500 bushels of potatoes. What kind? "Oronos." We have built a railroad to bring in "Oronos," and we shall have them by the car load; there is no doubt about it.

Secretary GOODALE. I wish to endorse fully what has been said regarding the great importance of a standard potato,—one which is known to be satisfactory to both the farmer and his consumers; and also regarding the bad policy of growing other kinds *except on a limited scale,* and only for purposes of trial and for home use; perhaps also for the few fancy customers, but not for export. But it is a fact that the experience of Penobscot is not the experience of all other parts of the State. A somewhat extended observation has convinced me that both the "Jackson" and "Orono" have seen their best days, even in Penobscot. In other sections they have shown signs of failing for some time, and some farmers hereabouts testify somewhat of the same. If worth while to relate personal experience, I might say that for purposes of comparison I planted half a bushel last spring, and although some hills yielded from 40 to 50 by actual count, there was not in the whole product (eleven bushels) one bushel which Mr. Ingalls would buy at any price, unless for pigs. Almost every other sort planted in the same lot distanced it out of sight. Would the gentleman advise me to hold on longer?

Because it is so serious an undertaking to substitute another staple potato in place of one which has done so good service, is a very strong reason why Penobscot should be moving to ascertain what younger variety is qualified to take the place of one which begins to show signs of decrepitude at home—where it has usually been happier than elsewhere,—and which shows its feebleness much more when away from home. I believe such a potato exists, or will soon, though I cannot call it by name. I look for it with more confidence among Maine seedlings than among those of Vermont or New York, even though less attention be given here to raising seedlings. If the one shown here by Mr. Hamlin, as a seedling grown by the late Mr. Chamberlain of Carmel, proves equal elsewhere to what he relates of its hardiness, quality and yield with him, what more could be asked for? Probably there are other candidates for the position, and what is needed is, to *test*, widely and thoroughly, their qualifications before electing one.

H. Luce, of Bangor. The "Chamberlain" potato is so near like the Orono that neither Mr. Ingalls or his customers can tell the difference.

Mr. L. Chamberlain, of Atkinson. I am satisfied that in some parts of Piscataquis, the day of the "Orono" is past. This year, in a large portion of the towns, two-thirds of the crops were perfect failures—entirely rotten at digging time, the middle of September. I am satisfied of another thing—that you cannot induce a man to buy a colored potato if he wants a white one. We must get a new variety, as near like the "Orono" as possible in shape, color, and table qualities.

About five years ago, I commenced raising potatoes from seed of the "Orono." This year I raised forty-eight bushels. From the same number of rows planted with "Oronos," side by side, I raised twenty-two bushels; and from the same number of rows of the "Early Goodrich," I got twenty-eight bushels. I call this new variety the "Orono Seedling." I have half a dozen of them on exhibition here. I do not care about selling, but if I do I shall sell them for a dollar a bushel. I shall get them planted where I can. My neighbors will take them. I can sell them here next year for "Oronos," and nobody will know the difference. I have never known them to rot.

Mr. Ingalls. I fear my zeal caused me to be misunderstood. I only took up the matter because by friend [Mr. Dunbar] rather slandered the "Orono." I do not wish it to be understood for a moment that I object at all to this multiplying of varieties. My friend over there [Mr. L. Chamberlain] has hit it. If he shall be able to furnish a substitute for the "Orono," so near like it that he can sell it to me for the "Orono," that is just what we want.

Mr. Wasson. I am requested to call the attention of the Convention to a potato that was said last winter, at the Convention in Augusta, to be destined to take the place of the "Orono" in the Penobscot valley—the "Harrison." I should like to know what the experience of another year shows about it.

Mr. Harley. I planted a peck last spring, and raised fifteen bushels. There were not ten rotten or defective ones among them. I like it very much. They are perfectly white and mealy. Later than any other I planted.

Question. Did they blossom?

Mr. Harley. They did, but not so much as some others.

Mr. L. Chamberlain. I took one potato home from Augusta last winter, and planted it in eight hills, and got two sound potatoes. I want no more of it.

Mr. Wasson. That is far from my experience. I planted half an acre, and found it exceedingly prolific, and have never yet seen a diseased potato. It requires from two to three weeks longer than the "Orono," the "Goodrich," or the "Gleason." I hear it stated as an objection that it does not come in eating until about the first of January, and some say that it has a disagreeable taste. I do not know whether that is so or not. I only know these two facts, that it is a great yielder, and that I have never yet seen one rot. It blossomed very sparingly.

Sec. Goodale. I planted one-half bushel of the Harrison early last spring, and found it to yield well, comparing favorably with Gleason and Garnet Chili. Twelve hills weighed forty-six pounds. No appearance of rot.

Mr. Griffin. I never raised the "Harrison" potato until this year. I planted an acre with the same treatment as the "Oronos." They did not yield so well, nor were they so sizable, but were generally sound. My "Oronos" were also very sound. I don't think there was a barrelfull of rotten ones in 500 bushels. The yield of the "Harrisons" was about two-thirds that of the "Orono."

Mr. Gilbert. I have planted the "Harrison" only this past season, and the result has not been highly satisfactory. I cannot say they are exempt from liability to rot, for I found a very few rotton ones; but they have one good property, and that is, they are as white as white can be, outside and in. Their quality as a table potato at the present time is not very satisfactory; what it may be later in the season I do not know. I have found that very frequently the best potatoes for spring use are not the best in the fall of the year.

In reference to its productiveness, it stands very well indeed, although this season, particularly in our part of the State, has not been a good one to test a late variety, from the fact that we had a very severe drought at the time the potato was setting, and the rains did not come on early enough to give the growth that we obtained from the early varieties. I think there is no doubt but what it will be a very productive potato, but I fear that, notwithstanding it is a large sort, there will be many small ones.

QUESTION. Did yours blossom?

Mr. GILBERT. They did, but not very fully. In fact, that was the case this year with most kinds of potatoes.

Mr. ———. My "Oronos" were white for three weeks.

Sec. GOODALE. I know of no potato that is making more stir than the "Early Rose." It is generally admitted to be productive and of good quality. I have heard, only occasionally, with regard to its freedom from, or liability to rot. If there are any here who can give us information upon that point, I would be glad to hear it.

Mr. COMINS. I will state my experience. At the time of digging, I found but one rotten potato. They were put in a dry cellar, with good ventilation. After they had been there two weeks, I found they were going to decay fast. I picked out three very large potatoes decayed from a basket, and I formed the opinion that if I had a hundred bushels in the bin, and they had commenced to rot in the manner that this basket had, they would very soon all rot.

The president of our agricultural society brought a few to the county show, and told me that from three potatoes he obtained about 120 pounds, "but," said he, "I had to pick over nearly all to get these samples," which were about a peck.

Mr. KING. A neighbor procured one pound of "Early Rose" last spring. I saw them growing, and saw them dug. He said he obtained 204 pounds, the greatest yield I ever heard of. There were some rotten at digging time. He dug quite early, intending to carry a portion of them to the State Fair; but before Fair time arrived, the rot had got into them so that he was discouraged from taking them.

Mr. NORTON, of Franklin. I procured an "Early Rose" potato last fall, and planted it this spring, without any dressing, on land that had not been dressed for three years. From that potato I

29

obtained fifty pounds, and they are all sound and fit for the table now. They are of even size, not over-large nor very small.

Mr. EMERY, of Bangor. As I stated this morning, I planted three "Early Rose" potatoes, and raised two bushels. They were planted about the first of June, and harvested the third of September, entirely ripe. There was no appearance of rot then. They were immediately put into a barrel, in the cellar. I saw them last a fortnight ago to-day. I did not turn them out, but there was no appearance of rot on the surface. A few of the Early Rose were planted later, and not dug until after the rains and excessive heat, and these showed signs of rot when dug.

Mr. COMINS. Excessively hot weather induces rot, whether they are dug or not; that is, if they are dug and put into cellars, and not protected from the heat. If they lie in a pile they will heat, and that induces the rot.

J. P. PUTNAM, of Houlton. I would like to inquire of Mr. Comins if he has ever covered his potatoes with dry sand to keep them from rotting?

Mr. COMINS. I never have. I have sprinkled air-slacked lime between them, but I have never tried dry sand.

Mr. PUTNAM. When I put my beets, carrots, turnips, and potatoes in the cellar in the fall, for table use, I put them in barrels, and fill the barrels with dry sand. I kept turnips this fall, into September, and they were so handsome that when I carried some to the hotel they thought I had just dug them.

Secretary GOODALE. There was a potato exhibited at the last session of the Board at Augusta, which excited considerable attention, called the "General Grant." I had a few, and planted them side by side with the "Early Rose," with the same soil, manure, and treatment, as nearly as possible. I could detect no difference in the earliness between that and the "Early Rose," although they were very different in appearance. I could hardly tell which to choose for quality; they were both first rate. I see what I suppose to be the same potato on the table, under different names. Some have it marked "Early," some without a name; others have it "Vermont Early." I have seen no one who has raised it who does not speak in the highest terms of its quality; and I would be glad to know what is its true history and proper name, and anything else of interest connected with it.

Mr. COMINS. It has been cultivated in my vicinity for seven or eight years. A brother of mine brought it from Vermont, because it was recommended very highly as an early potato. From that seed they have been propagated extensively through my vicinity under the name of "Vermont Early." It is a little earlier than the old "Early Blues" were when we could raise them; and they are good, I may say first rate, for eating, and as soon as they get a tolerably fair growth; you do not have to wait, as you do with some other varieties, for them to ripen. But they yield rather moderately.

Secretary GOODALE. Is that the same potato as the "General Grant?"

Mr. COMINS. I am not sufficiently versed in potatoölogy to determine; but if I had found that potato among my "Vermont Earlies" I should have had no hesitation is saying that it belonged there.

The PRESIDENT. What is their liability to rot?

Mr. COMINS. I have not noticed a rotton one among mine this year. I raise but few, supposing they would not go well as a shipping potato, and they are not so prolific as some others. I raise them only for early use, but some raise them to eat during the winter.

The PRESIDENT. It might be well to discuss farther the best method of preserving potatoes.

Hon. J. H. RICE, of Bangor. I know well the importance of this question to the people of Maine, and wish it were in my power to say something that might throw light upon it. I rise simply to repeat a brief conversation I had a few moments ago with Mr. G. P. Sewall, of Oldtown, touching this point. He said, "For the last ten years I have not had a peck of rotten potatoes in my cellar." His method is this: he digs his potatoes at the usual time, say the last of September, and deposits them in rows about twenty feet long, piling them up like an inverted V, and covering them with earth. He puts first the vines, and then boards upon them, not to keep the rain out, for he says the wet is no injury, but simply to keep the rain from washing the earth off. He lets them remain there until the ground crusts over with frost—say until the 10th or 15th of November,—then breaks the frozen crust, and takes out the potatoes. They come out in fine order, and if there is a rotten potato among them it is very easy to detect it; he then puts them in the cellar, and never has any rot after that. This is the method of preserving sweet potatoes at the south. They never put them in a cellar. They do not cover them very deeply, because the frosts are not severe.

Mr. COMINS. No doubt, that will preserve potatoes, or any other kind of roots; but the question is, can we afford to dig them twice? One year, after I got all my potatoes into my bin, I covered them with turf, and let it remain there until spring. My potatoes were first-rate, just as good in the spring as when first dug in the fall.

Mr. GILBERT. One or two points were raised this forenoon to which I wish briefly to refer. One was, the quantity of seed. Almost every gentleman who spoke thought he was disagreeing with me very widely, while I thought he was coming quite near to my ideas. I stated some general facts in reference to the potato, and I believe if you pursue the subjeet, you will admit them to be facts. Those general facts were, that the seed end of a potato was liable to produce more small potatoes than the butt end, and that a small potato was liable to produce a small crop of small potatoes. These, I say, are established facts; and my reason for saying so is, that all the comparative experiments made and reported to this Board for several years past, as well as experiments reported through the public journals, have proved the same thing in reference to seed, and that is, that a large amount of seed, other things being equal, will produce the best crop per acre, over and above the amount of seed used. But there should not be any larger number of stalks in the hill than there would be if a small amount of seed was used; or, at least, there should be no more than the desirable number.

With regard to another point. As a matter of theory, I expressed the opinion that there was a certain amount of nutriment obtained by the young plant from the parent seed. That was stoutly disputed by some. Now, in order to obtain striking results, we should experiment in widely different directions. If you wish to test that point, try this experiment: After the potato has sprouted, and the plant begun to grow, separate that plant from the parent seed with a penknife, being careful to preserve all the roots, set it out in a good field, and treat it in the ordinary manner of common field culture, and see what the result will be. The fact is, it will hardly have life enough to grow. What is the reason? Because it does not receive any support from the parent seed. If the plant is set in a hot bed or rich garden, as is the practice with the celebrated propagators to whom I referred, it will grow and produce a large yield; but put it into our fields, under ordinary culture, and it will hardly sustain itself through the season.

Mr. LUCE. The gentleman says that by using a large amount of seed you will get an increased yield, more than enough to pay for the expense of the seed. I wish to ask him this question: Shall we get enough more to pay for the extra amount of seed, and for the labor in thinning the stalks down to two, three or four?

Mr. GILBERT. I think so, decidedly, but my answer is only a matter of judgment. It is not exactly established just how much you would receive.

Secretary GOODALE. A good deal having been said on light or heavy seeding, both pro and con, I would like to add a word. It might be expected from analogy that the tubers would yield, not what may be so properly called fertilizing matter, as valuable nourishment to the young plants; and furnish it too at that period of its life when it would accomplish the best and largest results; that is, before it is strong enough to forage upon the soil for its own support. We know that milk is provided by nature for the wants of the young of all mammiferous animals, and that sugar is an important nutritive constituent of the milk. We know also, that a great many kinds of young plants are nursed on sugar contained in the seeds, or, if not on ready formed sugar, yet upon sugar furnished by the conversion of starch into sugar, which change always takes place in the process of germination. It is the same change which takes place in the process of malting barley. In this case it is effected by subjecting the grain to the combined action of heat and moisture, causing growth to begin, and then nipping that growth as soon as the change is effected. The sugar thus made is "switched off" from the young barley plants and run into beer barrels, or into whiskey. Now, in every seed containing starch, and I am not sure that any are wholly destitute, and some, like the grains and horse-chestnuts, contain a good deal, this change takes place at the commencement of growth. The starch of the potato, when growth begins, undergoes the same conversion into sugar, and it serves the same function; it *nurses* the young plant. If you please, you may induce the same conversion into sugar by artificial means, and when obtained you may induce farther changes and convert the sugar first into whiskey and next into vinegar. You are all familiar with the fact of this change taking place, whether all apprehend the scientific nature of that change or not. Who has not observed, that towards spring the potato loses "mealiness," and gains in "waxiness" of texture and sweetness of taste? This is entirely due to the beginning of the chemical change in its constituents referred to. How much potato starch one can economically give, to be thus converted into nursery pap for the young plants, is one of those problems of practice so frequently arising in the farmer's path, which must be variably answered, according to circumstances. You can afford more when potatoes bring half a dollar, than when they command a dollar a bushel.

But when I look over the results of that very elaborate and extensive series of experiments conducted by Mr. George Maw, and republished in our report for last year, and find them pointing with such uniformity and emphasis in one direction, and when I find that these results are precisely what analogy teaches us to expect, I can hardly more doubt the usefulness of the tuber as a nurse to the young plant, than I can doubt regarding a mathematical certainty. It "stands to reason," as we say, that a well nursed infant is more likely to thrive than one whose needs are only partially supplied; and the same is equally true of a young potato plant.

The debate here terminated, and Hon. James Dunning, of Bangor, moved a vote of thanks to the Board of Agriculture.

Col. Henry Little, of Bangor. Before putting the question on the motion, I desire to say that I have been very much interested in these discussions, and although eighty-one years old, I have got some new ideas. I recollect well how we lived and what implements we used, seventy years ago and upwards. They were very rude. The shovels were of wood, lined with a little iron. The scythes were hammered out by the blacksmith. The hay forks and the scythe snaths were cut in the woods; and everything else was of a similar character. I recollect too, when there was not a grafted orchard much nearer than Boston. There were then no horticultural or agricultural societies. How different it is now! I see great advances made even within the limited period of twelve years, which have elapsed since I had the honor of being a member of this Board. I thank the Lord that I have lived to see these improvements.

The question was then put on the motion for a vote of thanks to the Board, and it was carried.

The President of the Board, Mr. Wasson, then made the closing remarks, as follows:

Gentlemen of the Board of Agriculture and of the Farmers' Convention—Our labors for this session have now closed, and as the mouth-piece of the Board of Agriculture, permit me to say, in response to the vote of thanks which has been tendered us, that it is something new in the history of the Board of Agriculture.

For eleven years it has been my fortune to be a member of this Board. There are but two upon it whose term of office has exceeded my own. I look back and see how it was when our labors had closed—labors of love, for they were performed, as they are still, without remuneration. I feel that the vote just passed is an incentive to labor such as we have not before had. I see other changes. I remember when our lectures and discussions were first compiled by the Secretary, and being published by the State were placed in our hands for gratuitous distribution, that we almost had to coax some farmers to take the volumes and read them. But now, although printed in larger numbers, the demand is greatly beyond the supply. This shows that there has been awakened among the farmers of Maine, whether we have been instrumental in it or not, a spirit of inquiry that did not before exist, and we believe that spirit of inquiry to be growing, and will grow more and more every year. We came together to meet the farmers of the State, not to talk *to* them, but to talk *with* them; to take up questions of importance, and advise with them and they with us, how best we might improve the agriculture of our State, and advance the interests of our farmers. Let me, as the presiding officer of this Board, tender to those gentlemen who have met us our most hearty thanks. Their simple presence, whether they have participated in the discussions or not, has been a great encouragement. We believe that the more a man knows, the more he can do. The more we can educate the farmer and induce him to put mind into his work, the more successful will he be. This is the primary work of the Board. In closing, then, I would say, in behalf of the Board, to those who have met with us, we tender you our hearty thanks.

The Board then finally adjourned.

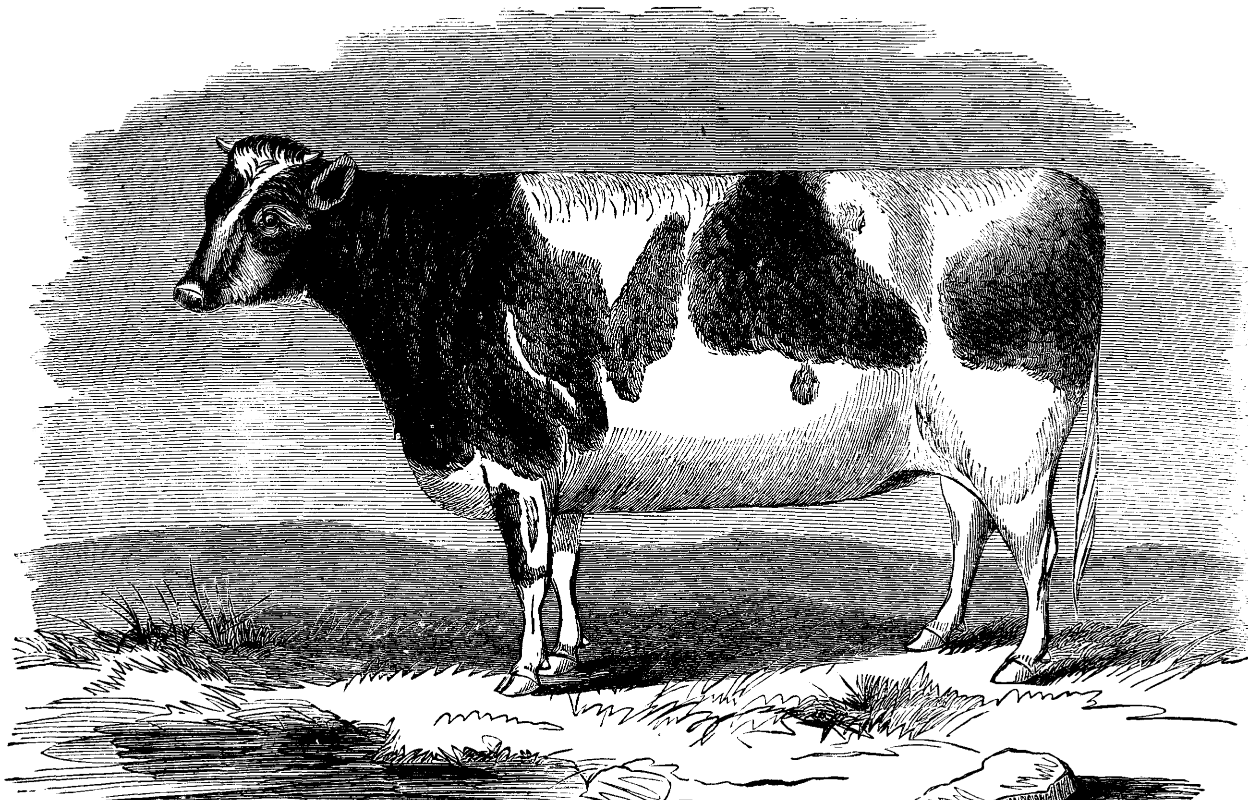
CLOVER AS A FERTILIZER.

Notwithstanding the present report is already larger than usual, I do not feel warranted in delaying for a year to present to the farmers of Maine the important information contained in the following paper from the Journal of the Royal Agricultural Society of England.

If it be a demonstrated fact, as appears from the results of Dr. Voelcker's investigations, that we have at command a fertilizing agency so cheap and easy as the culture of clover, whereby we can supply our soils, to a good extent, with what has hitherto been the scarcest and dearest of manurial elements, (namely, available nitrogen,) the importance of the fact can scarcely be over-estimated; and its extensive introduction *for this purpose* may mark an important era in the history of agriculture in our State.

The use of clover as a fertilizing agency is no novelty. It has been long and successfully employed not only in foreign lands but in our own country, especially in Onondaga county, N. Y. (See last years' report, page 132, 153.) But the results have often been attributed to some peculiar fitness for particular soils where success attends its use. I deem Dr. Voelcker's investigations especially valuable because they enable us to see, by the light of science, and thus to comprehend and to realize how and to what degree, and without limitation to special localities, this agency may be usefully employed by ourselves on our own farms.

There is no doubt that clover has been, unintentionally, used as a fertilizing agency by the farmers of Maine to an extent which themselves are quite unconscious of. In the progress of agriculture it is a common occurrence for practice to be ahead of science in point of time. The experiments and observation of practical men often enable them to adopt methods which may be, properly enough, called empirical, but which, at the same time, are based on facts of nature, on true principles, and are, therefore, excellent and successful methods. And the farmer does well to follow such methods, although science may not be able to explain the principles which govern the results. But when, at length, science grasps the facts, and can explain and set forth the principles, *she*



Holstein or Dutch Heifer "OPPERDOES 3d." Bred by W. W. Chenery, Belmont, Mass. Won Sweepstakes Premium at N. E. Fair.

is able also to show how the same principles may guide in other paths, and to other methods, with equal safety and equal success.

No practice is more universal among us than the sowing of clover with grass seeds. It came to be extensively adopted because it was found to be successful practice. It was not done because of a general conviction that the clover manured the grass. But a failure to comprehend the reason did not affect the result. Without the knowledge of the farmer, the clover does, in fact, so enrich the soil that he obtains larger crops of Timothy and red top than he could get without it, and the clover fodder besides.

The requirements of grass, so far as manure is concerned, are so nearly identical with those of wheat, that if a farmer has land capable of yielding good crops of grass, he may be almost as sure, other conditions being equally favorable, of being able to harvest from it good crops of wheat.

On the Causes of the Benefits of Clover as a Preparatory Crop for Wheat. By Dr. Augustus Voelcker, Chemist to the Royal Agricultural Society of England.*

Agricultural chemists inform us, that in order to maintain the productive powers of the land unimpaired, we must restore to it the phosphoric acid, potash, nitrogen, and other substances which enter into the composition of our farm-crops; the constant removal of organic and inorganic soil-constituents by the crops usually sold off the farm leading, as is well known, to more or less rapid deterioration and gradual exhaustion of the land. Even the best wheat-soils of this and other countries become more and more impoverished, and sustain a loss of wheat-yielding power, when corn crops are grown in too rapid succession without manure. Hence the universal practice of manuring, and that also of consuming oil-cake, corn, and similar purchased food on land naturally poor, or partially exhausted by previous cropping.

Whilst, however, it holds good as a general rule that no soil can be cropped for any length of time without gradually becoming more and more infertile, if no manure be applied to it, or if the fertilizing elements removed by the crops grown thereon be not by some means or other restored, it is nevertheless a fact that after a heavy crop of clover carried off as hay, the land, far from being less fertile than before, is peculiarly well adapted, even

* It may be proper to say that, having noticed several errors in the paper as originally published in England, a doubt arose whether other errors, not so readily detected, might not also have escaped the notice of the proof-reader. This doubt was confirmed by a reply to a note addressed to Dr. Voelcker, who kindly furnished all the corrections necessary, and which are here incorporated into the text. S. L. G.

without the addition of manure, to bear a good crop of wheat in the following year, provided the season be favorable to its growth. This fact, indeed, is so well known that many farmers justly regard the growth of clover as one of the best preparatory operations which the land can undergo in order to its producing an abundant crop of wheat in the following year. It has further been noticed that clover mown twice leaves the land in a better condition, as regards its wheat-producing capabilities, than when mown once only for hay, and the second crop fed off on the land by sheep; for notwithstanding that in the latter instance the fertilizing elements in the clover crop are in part restored in the sheep excrements, yet contrary to expectation, this partial restoration of the elements of fertility to the land has not the effect of producing more or better wheat in the following year than is reaped on land from off which the whole clover crop has been carried, and to which no manure whatever has been applied.

Again, in the opinion of several good practical agriculturists with whom I have conversed on the subject, land whereon clover has been grown for seed in the preceding year yields a better crop of wheat than it does when the clover is mown twice for hay, or even only once, and afterwards fed off by sheep. Most crops left for seed, I need hardly observe, exhaust the land far more than they do when they are cut down at an earlier stage of their growth; hence the binding clauses in most farm leases which compel the tenant not to grow corn crops more frequently nor to a greater extent than stipulated. However, in the case of clover grown for seed we have, according to the testimony of trustworthy witnesses, an exception to a law generally applicable to most other crops.

Whatever may be the true explanation of the apparent anomalies connected with the growth and chemical history of the clover plant, the facts just mentioned having been noticed not once or twice only, or by a solitary observer, but repeatedly, and by numbers of intelligent farmers, are certainly entitled to credit; and little wisdom, as it strikes me, is displayed by calling them into question, because they happen to contradict the prevailing theory, according to which a soil is said to become more or less impoverished in proportion to the large or small amount of organic and mineral soil-constituents carried off in the produce.

Agricultural experiences contradicting prevailing, and it may be, generally current theories, are, unless I am much mistaken, of far more common occurrence than may be known to those who are either naturally unobservant or unacquainted with many of the details of farming operations. Indeed, an interesting and instructive treatise might be written on the apparent anomalies in agriculture, and a collection of trustworthy facts of the kind alluded to would afford valuable hints to intelligent farmers, and suggest matter for inquiry to chemists and others engaged in scientific pursuits.

To me it seems inconsistent with the exercise of common sense, and opposed alike to the whole tenor of a well-regulated mind and the progress of scientific agriculture, to discuss agricultural matters in the dogmatic spirit too often so painfully observable when people meet together for the discussion of subjects relating to farm practice ; but still more painful is the spirit which pervades the writings of certain scientific men who are bold enough from isolated, or even a number of analogous facts, to frame general and invariable laws, in accordance with which they propose to regulate the profession of agriculture. That there are certain fixed laws which determine the growth of the meanest herb and the mightiest forest tree, no one can gainsay, but it may well be doubted whether our corn or forage crops would remain as flourishing as they at present are, if, in reference to some pretty theory, the farmers of England suddenly threw aside their past experience, and endeavored to grow corn in accordance with a mathematical formula which men may fancy they have discovered, and by which they may suppose the development of our corn crops to be governed. Even great men, by taking too general, or as it is often erringly termed, a comprehensive view of agricultural matters, sometimes totally misrepresent the very law they are endeavoring to establish.

The patient investigation of many of the details, with which those only are perfectly familiar whose daily occupation is in the field or in the feeding-stall, is, however, often rewarded by success. Mysteries which puzzle the minds of intelligent farmers are cleared up, the influences which modify a general rule or practice in farming operations are clearly recognized, and by degrees principles are established, which, assigning the benefits or disadvantages of a certain course of proceeding to their real cause, must ever tend to confirm the experienced in good practice, and afford valuable hints in guiding those inexperienced in farm management.

In the course of a long residence in a purely agricultural district I have often been struck with the remarkably healthy appearance and good yield of wheat on land from which a heavy crop of clover hay was obtained in the preceding year. I have likewise had frequent opportunities of observing that, as a rule, wheat grown on part of a field whereon clover has been twice mown for hay is better than the produce of that on the part of the same field on which the clover has been mown only once for hay, and afterwards fed off by sheep. These observations, extending over a number of years, led me to inquire into the reasons why clover is specially well fitted to prepare land for wheat, and in the paper which I have now the pleasure of laying before the readers of the Journal, I shall endeavor, as the result of my experiments on the subject, to give an intelligible explanation of the fact that clover is so excellent a preparatory crop for wheat as it is practically known to be.

By those taking a superficial view of the subject, it may be suggested that any injury likely to be caused by the removal of a certain amount of fertilizing matter is altogether insignificant, and more than compensated for by the benefit which results from the abundant growth of clover roots and the physical improvement in the soil which takes place in their decomposition. Looking, however, more closely into the matter, it will be found that in a good crop of clover hay a very considerable amount of both mineral and organic substances is carried off the land, and that if the total amount of such constituents in a crop had to be regarded exclusively as the measure for determining the relative degrees in which different farm crops exhaust the land, clover would have to be described as about the most exhausting crop in the entire rotation.

Clover hay, on an average, and in round numbers, contains in 100 parts—

Water	17.0
*Nitrogenous substances (flesh-forming matters)	15.6
Non-nitrogenous compounds	59.9
Mineral matter (ash)	7.5
	100.0
* Containing nitrogren	2.5

The mineral portion or ash in 100 parts of clover hay consists of—

Phosphoric acid	7.5
Sulphuric acid	4.3

Carbonic acid	18 0
Silica	3.0
Lime	30.0
Magnesia	8.5
Potash	20.0
Soda, chloride of sodium, oxide of iron, sand, loss, &c.	8.7
	100.0

Let us suppose the land to have yielded four tons of clover hay per acre. According to the preceding data we find that such a crop includes 224 lbs. of nitrogen, equal to 272 lbs. of ammonia, and 672 lbs. of mineral matter or ash constituents.

In 672 lbs. of clover ash we find—

Phosphoric acid	51½	lbs.
Sulphuric acid	29	"
Carbonic acid	121	"
Silica	20	"
Lime	201	"
Magnesia	57	"
Potash	134½	"
Soda, chloride of sodium, oxide of iron, sand, &c.	58	"
	672	lbs.

Four tons of clover hay, the produce of one acre, thus contain a large amount of nitrogen, and remove from the soil an enormous quantity of mineral matters, abounding in lime and potash, and containing also a good deal of phosphoric acid.

Leaving for a moment the question untouched whether the nitrogen contained in the clover is derived from the soil or from the atmosphere, or partly from the one and partly from the other, no question can arise as to the original source from which the mineral matters in the clover produce is derived. In relation, therefore, to the ash constituents, clover must be regarded as one of the most exhausting crops usually cultivated in this country. This appears strikingly to be the case when we compare the preceding figures with the quantity of mineral matters which an average crop of wheat removes from an acre of land.

The grain and straw of wheat contain, in round numbers, in 100 parts:

	Grain of Wheat.	Straw.
Water	15.0	16.0
*Nitrogenous substances (flesh-forming matters)	11.1	4.0
Non-nitrogenous substances	72 2	74.9
Mineral matter (ash)	1.7	5.1
	100.0	100.0
* Containing nitrogen	1.78	.64

The ash of wheat contains in 100 parts:

	Grain.	Straw.
Phosphoric acid	50.0	5.0
Sulphuric acid	0.5	2.7
Carbonic acid	0.0	0.0
Silica	2.5	67.0
Lime	3.5	5.5
Magnesia	11.5	2.0
Potash	30.0	13.0
Soda, chloride of sodium, oxide of iron, sand, &c.	2.0	4.8
	100.0	100.0

The mean produce of wheat per acre may be estimated at 25 bushels, which, at 60 lbs. per bushel, gives 1,500 lbs.; and as the weight of the straw is generally twice that of the grain, its produce will be 3,000 lbs. According, therefore, to the preceding data, there will be carried away from the soil:

In 1,500 lbs of the grain	25 lbs.	of mineral food (in round numbers)
In 3,000 lbs. of the straw	150	" " " "
Total	175 lbs.	

On the average of the analyses, it will be found that the composition of these 175 lbs. is as follows:

	In the grain.	In the straw.	Total.
Phosphoric acid	12.5 lbs.	7.5 lbs.	20.0 lbs.
Sulphuric acid	0.1 "	4.0 "	4.1 "
Carbonic acid	0.0 "	0.0 "	0.0 "
Silica	0.6 "	100.5 "	101.1 "
Lime	0.9 "	8.2 "	9.1 "
Magnesia	2.9 "	3.0 "	5.9 "
Potash	7.5 "	19.5 "	27.0 "
Soda, chloride of sodium, oxide of iron, sand, &c.	0.5 "	7.3 "	7.8 "
	25 lbs.	150 lbs.	175 lbs.

The total quantity of ash constituents carried off the land in an average crop of wheat thus amounts to only 175 lbs. per acre, whilst a good crop of clover removes as much as 672 lbs.

Nearly two-thirds of the total amount of mineral in the grain and straw of one acre of wheat consists of silica, of which there is an ample supply in almost every soil. The restoration of silica, therefore, need not trouble us in any way, especially as there is not a single instance on record proving that silica, even in a soluble condition, has ever been applied to land with the slightest advantage to corn or grass crops, which are rich in silica, and which, for this reason, may be assumed to be particularly grateful for a supply of it in a soluble state. Silica, indeed, if at all capable of producing a beneficial effect, ought to be useful to these crops, either by strengthening the straw or stems of graminaceous plants, or otherwise benefiting them; but after deducting the amount of silica from the total amount of mineral matters in the wheat produce from one acre, only a trifling quantity of other and more valuable fertilizing ash-constituent of plants will be left. On comparing the relative amounts of phosphoric acid and potash in an average crop of wheat and a good crop of clover hay, it will be seen that one acre of clover hay contains as much phosphoric acid as two and a half acres of wheat, and as much potash as the produce from five acres of the same crop. Clover thus unquestionably removes from the land very much more mineral matter than is done by wheat; clover carries off the land at least three times as much of the more valuable mineral constituents as that abstracted by the wheat. Wheat notwithstanding succeeds remarkably well after clover.

Four tons of clover hay, or the produce of an acre, contains as already stated, 224 pounds of nitrogen, or calculated as ammonia, 272 pounds.

Assuming the grain of wheat to furnish 1.78 per cent. of nitrogen, and wheat straw .64 per cent., and assuming also that 1500 pounds of corn and 3000 pounds of straw represent the average produce per acre, there will be in the grain of wheat per acre 26.7 pounds of nitrogen, and in the straw 19.2 pounds, or in both together 46 pounds of nitrogen; in round numbers, equal to about 55 pounds of ammonia, which is only about one-fifth the quantity of nitrogen in the produce of an acre of clover. Wheat, it is well known, is specially benefited by the application of nitrogenous manures, and as clover carries off so large a quantity of nitrogen, it is natural to expect the yield of wheat after clover to fall short of what the land might be presumed to produce without manure before a crop of clover was taken from it. Experience, however, has proved the fallacy of this presumption, for the result is exactly the opposite, inasmuch as a better and heavier crop of wheat is produced than without the intercalation of clover. What, it may be asked, is the explanation of this apparent anomaly?

In taking up this inquiry I was led to pass in review the celebrated and highly important experiments undertaken by Mr. Lawes and Dr. Gilbert, on the continued growth of wheat on the same soil for a long succession of years, and to examine likewise carefully many points to which attention is drawn by the same authors in their memoirs on the growth of red clover by different manures, and on the Lois Weedon plan of growing wheat. Abundant and most convincing evidence is supplied by these indefatigable experimenters that the wheat-producing powers of a soil are not increased in any sensible degree by the liberal supply of all the mineral matters which enter into the composition of the ash of wheat, and that the abstraction of these mineral matters from the soil, in very much larger proportions than possibly can take place under ordinary cultivation, in no wise affects the yield of wheat, provided there be at the same time a liberal supply of available nitrogen within the soil itself. The amount of the latter, therefore, is regarded by Messrs. Lawes and Gilbert as the measure of the increased produce of grain which a soil furnishes.

In conformity with these views the farmer, when he wishes to increase the yield of his wheat, finds it to his advantage to have recourse to ammoniacal or other nitrogenous manures, and depends more or less entirely upon the soil for the supply of the necessary mineral or ash-constituents of wheat, having found such a supply to be amply sufficient for his requirements. As far, therefore, as the removal from the soil of a large amount of mineral soil constituents by the clover crop is concerned, the fact viewed in the light of the Rothamsted experiments, becomes at once intelligible; for notwithstanding the abstraction of over 600 pounds of mineral matter by a crop of clover, the succeeding wheat crop does not suffer. Inasmuch, however, as we have seen that not only much mineral matter is carried off the land in a crop of clover, but also much nitrogen, we might, in the absence of direct evidence to the contrary, be led to suspect that wheat after clover would not be a good crop; whereas the result is exactly the reverse.

It is worthy of notice, that nitrogenous manures which have such a marked and beneficial effect upon wheat do no good, but in certain combinations, in some seasons, do positive harm to clover. Thus Messrs. Lawes and Gilbert, in a series of experiments on the growth of red clover by different manures, obtained 14 tons of fresh green produce, equal to about 3¾ tons of clover hay from the unmanured portion of the experimental field; and where sulphates of potash, soda, and magnesia, or sulphate of potash and superphosphate of lime were employed, 17 to 18 tons (equal to from about 4½ to nearly 5 tons of hay) were obtained. When salts of ammonia were added to the mineral manures, the produce of clover hay was, upon the whole, less than where the mineral manures were used alone. The wheat grown after the clover on the unmanured plot gave, however, 29½ bushels of corn, whilst in the adjoining field, where wheat was grown after wheat without manure, only 15½ bushels of corn per acre were obtained. Messrs. Lawes and Gilbert notice especially that in the clover crop of the preceding year very much larger quantities both of mineral matters and of nitrogen, were taken from the land than were removed in the unmanured wheat crop in the same year, in the adjoining field. Notwithstanding this, the soil from which the clover had been taken was in a condition to yield 14 bushels more wheat per acre than that upon which wheat had been previously grown; the yield of wheat after clover, in these experiments, being fully equal to that in another field, where very large quantities of manure were used.

Taking all these circumstances into account, is there not presumptive evidence that notwithstanding the removal of a large amount of nitrogen in the clover hay, an abundant store of available nitrogen is left in the soil, and also that in its relations towards nitrogen in the soil clover differs essentially from wheat? The results of our experience in the growth of the two crops appear to indicate that whereas the growth of the wheat rapidly exhausts the land of its available nitrogen, that of clover, on the contrary, tends somehow or other to accumulate nitrogen within the soil itself. If this can be shown to be the case, an intelligible explanation of the fact that clover is so useful as a preparatory crop for wheat will be found in the circumstance that during the growth of clover, nitrogenous food, for which wheat is particularly grateful, is either stored up or rendered available in the soil.

An explanation, however plausible, can hardly be accepted as correct, if based mainly on data which, although highly probable, are not proved to be based on fact. In chemical inquiries especially, nothing must be taken for granted that has not been proved by direct experiment. The following questions naturally suggest themselves in reference to this subject: What is the amount of nitrogen in soils of different characters? What is the amount, more particularly after a good and after an indifferent crop of clover? Why is the amount of nitrogen in soils larger after clover than after wheat and other crops? Is the nitrogen present in a condition in which it is available and useful to wheat? and lastly, Are there any other circumstances, apart from the supply of nitrogenous matter in the soil, which help to account for the beneficial effects of clover as a preparatory crop for wheat?

In order to throw some light on these questions, and, if possible, to give distinct answers to at least some of them, I, years ago, when residing at Cirencester, began a series of experiments, and more recently I have been fortunate enough to obtain the co-operation of Mr. Robert Vallentine, of Leighton Buzzard, who kindly undertook to supply me with materials for my analyses.

My first experiments were made on a thin calcareous clay soil, resting on oolitic limestone, and producing generally a fair crop of red clover. The clover-field formed the slope of a rather steep hillock, and varied much in depth. At the top of the hill the soil became very stony at a depth of four inches, so that it could only with difficulty be excavated to a depth of six inches, when the bare limestone rock made its appearance. At the bottom of the field the soil was much deeper, and the clover stronger than at the upper part. On the brow of the hill, where the clover appeared to be strong, a square yard was measured out; and at a little distance off, where the clover was very bad, a second square yard was measured; in both plots the soil being taken up to a depth of six inches. The soil where the clover was good may be distinguished from the other by being marked as No. 1, and that where it was bad as No. 2.

Clover Soil No. 1, (*Good Clover.*)

The roots having first been shaken out to free them as much as possible from soil, were then washed once or twice with cold distilled water, and after having been dried for a little while in the sun, were weighed, when the square yard produced 1 lb. 10½ oz. of cleaned clover roots in an air-dry state; an acre of land, or 4840 square yards, accordingly yielded, in a depth of six inches, 3.44 tons, or 3½ tons in round numbers, of clover roots.

Fully dried in a water-bath, the roots were found to contain altogether 44.67 per cent. of water, and on being burnt in a platinum capsule yielded 6.089 of ash. A portion of the dried, finely powdered, and well-mixed roots was burned with soda-lime in a combustion-tube, and the nitrogen contained in the roots otherwise determined in the usual way. Accordingly, the following is the general composition of the roots from soil No. 1:

Water	44.675
*Organic matter	49.236
Mineral matter	6.089
	100.000
*Containing nitrogen	1.297
Equal to ammonia	1.575

Assuming the whole field to have produced 3½ tons of clover-roots per acre, there will be 99.636 pounds, or in round numbers 100 pounds of nitrogen in the clover roots from one acre; or about twice as much nitrogen as is present in the average produce of an acre of wheat.

The soil which had been separated from the roots was passed through a sieve to deprive it of any stones it might contain. It was then partially dried, and the nitrogen in it determined in the usual manner by combustion with soda-lime, when it yielded .313 per cent. of nitrogen, equal to .38 of ammonia, in one combustion; and .373 per cent. of nitrogen, equal to .46 of ammonia, in a second determination.

That the reader may have some idea of the character of this soil, it may be stated that it was further submitted to a general analysis, according to which it was found to have the following composition:

General Composition of Soil No. I, (Good Clover.)

Moisture	18.73
*Organic matter	9.72
Oxides of iron and alumina	13.24
Carbonate of lime	8.82
Magnesia, alkalies, &c	1.72
Insoluble siliceous matter (chiefly clay)	47.77
	100.00
*Containing nitrogen	.313
Equal to ammonia	.380

The second square yard from the brow of the soil where the clover was bad produced 13 ounces of air-dry and partially clean roots, or 1.75 tons per acre. On analysis they were found to have the following composition:

Clover roots, No. II, (Bad Clover.)

Water	55.732
*Organic matter	39.408
Mineral matter (ash)	4.860
	100.000
*Containing nitrogen	.792
Equal to ammonia	.901

The roots on the spot where the clover was very bad, yielded only 31 pounds of nitrogen per acre, or scarcely one-third of the quantity which was obtained from the roots where the clover was good.

The soil from the second square yard on analysis was found, when freed from stones by sifting, to contain in 100 parts:

Composition of Soil, No. II, (Bad Clover.)

Water	17.24	
*Organic matter	9.64	
Oxides of iron and alumina	11.89	
Carbonate of lime	14.50	
Magnesia, alkalies, &c	1.53	
Insoluble siliceous matter	45.20	
	100.00	
		2nd determination.
*Containing nitrogen	.306	.380
Equal to ammonia	.370	.470

Both portions of the clover soil thus contained about the same percentage of organic matter, and yielded nearly the same amount of nitrogen.

In addition, however, to the nitrogen in the clover roots, a good deal of nitrogen, in the shape of root-fibres, decayed leaves, and similar organic matters, was disseminated throughout the fine soil in which it occurred, and from which it could not be separated; but unfortunately I neglected to weigh the soil from a square yard, and am therefore unable to state how much nitrogen per acre was present in the shape of small root-fibres and other organic matters. Approximately, the quantity might be obtained by calculation; but as the actual weight of cultivated soils varies greatly, I abstain from making such a calculation, even though it might be done with propriety, as I took care in the following season to weigh the soil different parts of the same field.

Before mentioning the details of the experiments made in the next season, I will here give the composition of the ash of the partially cleaned clover roots:

Composition of Ash of Clover-roots (partially cleaned.)

Oxide of iron and alumina	11.73
Lime	18.49
Magnesia	3.03
Potash	6.88
Soda	1.93
Phosphoric acid	3.61
Sulphuric acid	2.24
Soluble silica	19.01
Insoluble siliceous matter	24.83
Carbonic acid, chlorine, and loss	8.25
	100.00

This ash was obtained from clover roots, which yielded when perfectly dry, in round numbers, 8 per cent. of ash. Clover roots washed quite clean, and separated from all soil, yield about 5 per cent. of ash; but it is extremely difficult to clean a large quantity of fibrous roots from all dirt, and the preceding analysis distinctly shows that the ash of the clover roots analyzed by me was mechanically mixed with a good deal of fine soil, for oxide of iron and alumina and insoluble siliceous matter in any quantity are not normal constituents of plant ashes. Making allowance for soil contamination, the ash of clover roots, it will be noticed, contains much lime and potash, as well as an appreciable amount of phosphoric and sulphuric acid. On the decay of the clover roots, these and other mineral fertilizing matters are left in the surface-soil in a readily available condition and in considerable proportions when the clover stands well. Although a crop of clover removes much mineral matter from the soil, it must be borne in mind that its roots extract from the land soluble mineral fertilizing matters, which, on the decay of the roots, remain in the land in a prepared and more readily available form than that in which they originally occur. The benefits arising to wheat from the growth of clover may thus be due partly to this preparation and concentration of mineral food in the surface-soil.

The clover on the hill-side field on the whole turned out a very good crop; and as the plant stood the winter well, and this field was left another season in clover without being plowed up, I availed myself of the opportunity of making, during the following season, a number of experiments similar to those of the preceding year. This time, however, I selected for examination a square yard of soil from a spot on the brow of the hill where the clover was thin and the soil itself stony at a depth of four inches; and another plot of one square yard at the bottom of the hill, from a place where the clover was stronger than that on the brow of the hill, and the soil at a depth of six inches contained no large stones.

Soil No. 1 (Clover thin), on the Brow of the Hill.

The roots in a square yard, six inches deep, when picked out by hand and cleaned as much as possible, weighed in their natural state 2 lbs. 11 oz.; and when dried on the top of a water-bath, for the purpose of getting them brittle and fit for reduction into fine powder, 1 lb. 12 oz. 31 grains. In this state they were submitted as before to analysis, when they yielded in 100 parts:

Composition of Clover Roots, No. I, (from brow of the hill.)

Moisture	4.34
*Organic matter	26.53
Mineral matter	69.13
	100.00
*Containing nitrogen	.816
Equal to ammonia	.991

According to these data an acre of land will yield 3 tons 12 cwts. of nearly dry clover roots, and in this quantity there will be about 66 lbs. of nitrogen.

The whole of the soil from which the roots had been picked out was passed through a half-inch sieve. The stones left in the sieve weighed 141 lbs. ; the soil which passed through weighing 218 lbs.

The soil was next dried by artificial heat, when the 218 lbs. became reduced to 185.487 lbs.

In this partially dried state it contained:

Moisture	4.21
*Organic matter	9.78
†Mineral matter	86.01
	100.00
*Containing nitrogen	.391
Equal to ammonia	.
†Including phosphoric acid	.264

I also determined the phosphoric acid in the ash of the clover roots. Calculated for the roots in a nearly dry state, the phosphoric acid amounts to .287 per cent.

An acre of soil, according to the data furnished by the six inches on the spot where the clover was thin, produced the following quantity of nitrogen:

	Ton.	cwts.	lbs.
In the fine soil	1	11	33
In the clover roots	0	0	66
Total quantity of nitrogen per acre	1	11	99

The organic matter in an acre of this soil, which cannot be picked out by hand, it will be seen, contains an enormous quantity of nitrogen; and although probably the greater part of the roots and other remains from the clover crop may not be decomposed so thoroughly as to yield nitrogenous food to the succeeding wheat crop, it can scarcely be doubted that a considerable quantity of nitrogen will become available by the time the wheat is sown, and that one of the chief reasons why clover benefits the succeeding wheat crop is to be found in the abundant supply of available nitrogenous food furnished by the decaying clover roots and leaves.

Clover Soil No. 2, from the Bottom of the Hill, (Good Clover.)

A square yard of the soil from the bottom of the hill, where the clover was stronger than on the brow of the hill, produced 2 lbs. 8 oz. of fresh clover roots, or 1 lb. 11 oz. 47 grains of partially dried roots, 61 lbs. 9 oz. of limestones, and 239.96 lbs. of nearly dry soil.

The partially dried roots contained:

Moisture	5.06
*Organic matter	31.94
Mineral matter	63.00
	100.00
*Containing nitrogen	.804

An acre of this soil, six inches deep, produced 3 tons 7 cwts. 65 lbs. of clover roots, containing 61 lbs. of nitrogen; that is, there was very nearly the same quantity of roots and nitrogen in them as that furnished in the soil from the brow of the hill.

The roots, moreover, yielded .365 per cent. of phosphoric acid, or, calculated per acre, 27 lbs.

In the partially dried soil I found:

Moisture	4.70
*Organic matter	10.87
†Mineral matter	84.43
	100.00
*Containing nitrogen	.405
Equal to ammonia	.491
†Including phosphoric acid	.321

According to these determinations an acre of the soil from the bottom of the hill contains—

	Tons.	cwts.	lbs.
Nitrogen in the organic matter of the soil	2	2	0
" " clover roots of the soil	0	0	61
Total amount of nitrogen per acre	2	2	61

Compared with the amount of nitrogen in the soil from the brow of the hill, about 11 cwt. more nitrogen was obtained in the soil and roots from the bottom of the hill where the clover was more luxuriant.

The increased amount of nitrogen occurred in fine root-fibres and other organic matters of the soil, and not in the coarser bits of roots which were picked out by the hand. It may be assumed that the finer particles of organic matter are more readily decomposed than the coarser roots; and as there was a larger amount of nitrogen in this than in the preceding soil, it may be expected that the land at the bottom of the hill, after the removal of the clover, was in a better agricultural condition for wheat than that on the brow of the hill.

Experiments on Clover Soils from Burcott Lodge Farm, Leighton-Buzzard.

The soils for the next experiments were kindly supplied to me in 1866 by Mr. Robert Vallentine, of Burcott Lodge, who also sent me some notes respecting the growth and yield of clover hay and seed on this soil.

Foreign seed, at the rate of 12 pounds per acre, was sown with a crop of wheat which yielded 5 quarters per acre the previous year.

The first crop of clover was cut down on the 25th of June, 1866, and carried on June 30th. The weather was very warm from the time of cutting till the clover was carted, the thermometer standing at 80° Fahr. every day. The clover was turned in the swarth on the second day after it was cut; on the fourth day it was turned over and put into small heaps of about 10 pounds each; and on the fifth day these were collected into larger cocks and then stacked.

The best part of an 11-acre field produced nearly three tons of clover hay, sun-dried, per acre; the whole field yielding on an average 2½ tons per acre. This result was obtained by weighing the stack three months after the clover was carted. The second crop was cut on the 21st of August and carried on the 27th, the weight being nearly 30 cwts. of hay per acre. Thus the two cuttings produced just about four tons of clover hay per acre.

The 11 acres were divided into two parts. About one-half was mown for hay a second time, and the other part left for seed. The produce of the second half of the 11-acre field was cut on the 8th of October, and carried on the 10th. It yielded in round numbers three cwts. of clover seed per acre, the season being very unfavorable for clover seed. The second crop of clover mown for hay was rather too ripe and just beginning to show seed.

A square foot of soil, 18 inches deep, was dug from the second portion of the land which produced the clover hay and clover seed.

Soil from part of 11-*acre Field twice mown for Hay.*

The upper six inches of soil, one foot square, contained all the main roots of 18 strong plants; the next six inches only small root-fibres; and in the third section a 6-inch slice cut down at a depth of 12 inches from the surface, no distinct fibres could be found. The soil was almost completely saturated with rain when it was dug up on the 13th of September, 1866:

	lbs.
The upper 6 inches of soil 1 foot square weighed	60
The second 6 " " " "	61
The third 6 " " " "	63

These three portions of one foot of soil, 18 inches deep, were dried nearly completely, and weighed again; when the first six inches weighed 51¼ pounds; the second six inches, 51 lbs. 5 oz.; and the third section, 54 lbs. 2 oz.

The first six inches contained three pounds of siliceous stones (flints), which were rejected in preparing a sample for analysis; in the two remaining sections there were no large-sized stones. The soils were pounded down and passed through a wire sieve.

The three layers of soil, dried and reduced to powder, were mixed together, and a prepared average sample, when submitted to analysis, yielded the following results:

Composition of Clover Soil, 18 inches deep, from part of 11-acre field twice mown for hay.

Soluble in Hydrochloric Acid.		
Organic matter		5.86
Oxides of iron		6.83
Alumina		7.12
Carbonate of lime		2.13
Magnesia		2 01
Potash		.67
Soda		.08
Chloride of sodium		.02
Phosphoric acid		.18
Sulphuric acid		.17
Insoluble in Acid.		
Insoluble siliceous matter	74.61	
Consisting of:—Alumina		4.37
Lime (in a state of silicate)		4.07
Magnesia		.46
Potash		.19
Soda		.23
Silica		65.29
		99.68

This soil, it will be seen, contained in appreciable quantities not only potash and phosphoric acid, but all the elements of fertility which enter into the composition of good arable land. It may be briefly described as a stiff clay-soil, containing a sufficiency of lime, potash, and phosphoric acid to meet all the requirements of the clover crop. Originally rather unproductive, it has been much improved by deep culture; by being smashed up into rough clods early in autumn, and by being exposed in this state to the crumbling effects of the air, it now yields good corn and forage crops.

In separate portions of the three layers of soil, the proportions of nitrogen and phosphoric acid contained in each layer of six inches were determined and found to be as follows:

	Soil dried at 212° Fahr.		
	1st, 6 inches.	2d, 6 inches.	3d, 6 inches.
Percentage of phosphoric acid	.249	.134	.172
Nitrogen	.162	.092	.064
Equal to ammonia	.198	.112	.078

In the upper six inches, as will be seen, the percentage of both phosphoric acid and nitrogen was larger than in the two following layers; while the proportion of nitrogen in the six inches of surface soil was much larger than in the next six inches; and in the third section, containing no visible particles of root-fibres, only very little nitrogen occurred.

In their natural state the three layers of soil contained—

	1st, 6 inches.	2d, 6 inches.	3d, 6 inches.
Moisture	17.16	18.24	16.62
Phosphoric acid	.198	.109	.143
Nitrogen	.134	.075	.053
Equal to ammonia	.162	.091	.064
	lbs.	lbs.	lbs.
Weight of 1 foot square of soil	60	61	63

Calculated per acre, the absolute weight of 1 acre of this land, 6 inches deep, weighs:

	lbs.
1st, 6 inches	2,613,600
2d, "	2,657,160
3d, "	2,746,280

No great error, therefore, will be made if we assume in the subsequent calculations that 6 inches of this soil weigh $2\frac{1}{2}$ millions of pounds per acre.

An acre of land, according to the preceding determinations, contains:

	1st, 6 inches.	2d, 6 inches.	3d, 6 inches.
	lbs.	lbs.	lbs.
Phosphoric acid	4,950	2,725	3,575
Nitrogen	3,350	1,875	1,325
Equal to ammonia	4,050	2,275	1,600

The proportion of phosphoric acid in six inches of surface soil, it will be seen, amounted to about two-tenths per cent.; a proportion of the whole soil, so small that it may appear insufficient for the production of a good corn crop. However, when calculated to the acre, we find that six inches of surface soil, in an acre of land actually contains over two tons of phosphoric acid. An average crop of wheat, assumed to be 25 bushels of grain, at 60 pounds per bushel, and 3000 pounds of straw, removes from the land on which it is grown 20 pounds of phosphoric acid. The clover soil, analyzed by me, consequently contains an amount of phosphoric acid in a depth of only six inches, which is equal to that present in 247½ average crops of wheat; or supposing that by good cultivation, and in favorable seasons, the average yield of wheat could be doubled, and 50 bushels of grain at 60 pounds a bushel and 6000 pounds of straw could be raised, 124 of such heavy wheat crops would contain no more phosphoric acid than actually occurred in six inches of this clover soil per acre.

The mere presence of such an amount of phosphoric acid in a soil, however, by no means proves its sufficiency for the production of so many crops of wheat; for, in the first place, it cannot be shown that the whole of the phosphoric acid found by analysis occurs in the soil in a readily available combination: and, in the second place, it is quite certain that the root-fibres of the wheat-plant cannot reach and pick up, so to speak, every particle of phosphoric acid, even supposing it to occur in the soil in a form most conducive to "ready assimilation by the plant."

The calculation is not given in proof of a conclusion which would be manifestly absurd, but simply as an illustration of the enormous quantity, in an acre of soil six inches deep, of a constituent of which only a fractional part of a per cent. is found in the soil. This fractional percentage of phosphoric acid in an acre of land six inches deep amounts to a very large quantity which may be rendered available for the use of plants.

We have here an indication which clearly points out the propriety of rendering available to plants the natural resources of the soil in plant-food; to draw, in fact, up the mineral wealth of the soil by thoroughly working the land, and not leaving it unutilized as so much dead capital.

The exact determination of phosphoric acid in a soil, it may be observed in passing, is attended with no difficulty, if certain precautions, which it is feared are sometimes neglected by chemists, be taken. I will, therefore, give a brief outline of the plan—commonly known to chemists as the Molybdic acid plan of determining phosphoric acid—which yields accurate results.

Not less than 100 grains, or better 200 grains, of the dried and finely-powdered soil are digested for an hour or thereabouts with three or four ounces of moderately strong nitric acid. The acid solution is then passed through a filter, and together with the washings from the insoluble portion of the soil left on the filter is evaporated to a small bulk; thus getting rid of the greater part of the acid employed for effecting the solution. During evaporation a large excess of molybdate of ammonia is added to the solution, care being taken to keep it strongly acid.

If there be much phosphoric acid in the soil, a bright yellow precipitate, consisting of molybdic and phosphoric acid, makes its appearance at once; if traces only be present, the yellow precipitate appears only on the concentration of the liquid, after the great excess of nitric acid has been expelled by evaporation. The yellow precipitate containing the whole of the phosphoric acid present in the soil, molybdic acid, together with a little silica, and frequently some oxide of iron, is thrown on a filter and washed with a solution of molybdate of ammonia rendered strongly acid by nitric acid, until a drop of the washings passing through the filter ceases to show a reaction of iron with yellow prussiate of potash solution. It is then dissolved on the filter in an excess of ammonia, and the ammoniacal liquid precipitated with an ammoniacal solution of sulphate of magnesia, which throws down the phosphoric acid as phosphate of magnesia and ammonia. After standing at rest for about twelve hours, the magnesia precipitate is collected on a small filter and washed clean with strong ammonia-water. Together with the phosphoric acid, traces of silica, and generally also traces of oxide of iron, are thrown down with the magnesia precipitate. In order to separate these impurities the precipitate is dissolved in a few drops of hydrochloric acid, and the acid solution carefully evaporated to complete dryness. The hard, dried residue is again made acid with muriatic acid, a little water is then added, and the liquid passed through a small filter, on which are left insoluble traces of the silica originally thrown down with magnesia. A few drops of citric acid having been added to the acid solution, with a view of keeping any traces of iron in solution, strong ammonia is finally added, which throws down a second time phosphate of magnesia and ammonia, now free from silica and oxide of iron. The precipitate is collected, washed with ammonia water, dried, burned in a platinum crucible or capsule, weighed, and the phosphoric acid calculated from the weight of the tri-basic phosphate of magnesia left on burning.

Following this plan and the precautions here indicated, the smallest amount of phosphoric acid in a soil can be determined with great precision. If the magnesia precipitate be not redissolved and freed from silica, as pointed out, a higher percentage of phosphoric acid necessarily is obtained than the actual quantity which the soil contains.

Clover Roots. The roots from one square foot of soil were cleaned as much as possible, dried completely at 212°, and in that state weighed 240 grains. An acre consequently contained 1493½ lbs. of dried clover roots.

The clover roots contained :	Dried at 212° Fahr.
*Organic matter	81.33
†Mineral matter (ash)	18.67
	100.00
*Yielding nitrogen	1.635
Equal to ammonia	1.985
†Including insoluble siliceous matter (clay and sand)	11.67

Accordingly the clover roots, in an acre of land, furnished 24½ lbs. of nitrogen. We have thus:

	Lbs. of Nitrogen.
In the 6 inches of surface soil	3350
In large clover roots	24½
In second inches of soil	1875
Total amount of nitrogen in 1 acre of soil 12 inches deep	5249½
Equal to ammonia	6374½

Or in round numbers, 2 tons 6 cwts. of nitrogen per acre, an enormous quantity, which must have a powerful influence in encouraging the luxuriant development of the succeeding wheat crop, although only a fraction of the total amount of nitrogen in the clover-remains may become sufficiently decomposed in time to be available to the young wheat plants.

Clover Soil from part of 11-*acre Field of Burcott Lodge Farm, Leighton Buzzard, once mown for Hay, and left afterwards for Seed.*

Produce 2½ tons of clover hay and 3 cwts. of seed per acre.

This soil was obtained within a distance of five yards from the part of the field where the soil was dug up after the two cuttings of hay. After the seed there was some difficulty in finding a square foot containing the same number of large clover roots as that on the part of the field twice mown; however, at last, in the beginning of November, a square foot containing exactly 18 strong roots was found and dug up to a depth of 18 inches. The soil dug after the seed was much drier than that dug after the two cuttings of hay:

	lbs.
The upper, 6 inches deep 1 foot square, weighed	56
The next " " " "	58
The third " " " "	60

After drying by exposure to hot air, the three layers of soil weighed:

	lbs.
The upper, 6 inches 1 foot square	49¾
The next " " "	50½
The 3d " " "	51¼

Equal portions of the dried soil from each six-inch section were mixed together and reduced to a fine powder. An average sample thus prepared on analysis was found to have the following composition:

Composition of Clover Soil once mown for Hay, and afterwards left for Seed.

Soluble in Hydrochloric Acid.		Dried at 212° Fahr.
Organic matter		5.34
Oxides of iron		6.07
Alumina		4.51
Carbonate of lime		7.51
Magnesia		1.27
Potash		.52
Soda		.16
Chloride of sodium		.03
Phosphoric acid		.15
Sulphuric acid		.19
Insoluble in Acid.		
Insoluble siliceous matter	73.84	
Consisting of:—Alumina		4.14
Lime (in a state of silicate)		2.69
Magnesia		.68
Potash		.24
Soda		.21
Silica		65.88
		99.59

This soil, it will be seen, in general character resembles the preceding sample; it contains a good deal of potash and phosphoric acid, and may be presumed to be well suited to the growth of clover. It contains more carbonate of lime, and is somewhat lighter than the sample from the part of the field twice mown for hay, and may be termed heavy calcareous clay.

An acre of this land, 18 inches deep, weighed when very nearly dry :

	lbs.
Surface, 6 inches	2,407,900
Next "	2,444,200
3d "	2,480,500

Or in round numbers, every six inches of soil weighed per acre 2½ millions of pounds, which agrees tolerably well with the actual weight per acre of the preceding soil.

The amount of phosphoric acid and nitrogen in each six-inch layer was determined separately as before, when the following results were obtained :

	In Dried Soil.		
	1st, 6 inches	2d, 6 inches.	3d, 6 inches.
Percentage of phosphoric acid	.159	.166	.140
Nitrogen	.189	.134	.089
Equal to ammonia	229	.162	.108

An acre, according to these determinations, contains in the three separate sections :

	1st, 6 inches.	2d, 6 inches.	3d, 6 inches.
	lbs.	lbs.	lbs.
Phosphoric acid	3975	4150	3500
Nitrogen	4725	3350	2225
Equal to ammonia	5725	4050	2700

Here again, as might naturally be expected, the proportion of nitrogen is largest in the surface where all the decaying leaves dropped during the growth of the clover for seed are found, and wherein root-fibres are more abundant than in the lower strata. The first six inches of soil, it will be seen, contained in round numbers 2½ tons of nitrogen per acre, that is, considerably more than was found in the same section of the soil where the clover was mown twice for hay ; showing plainly that during the ripening of the clover seed the surface is much enriched by the nitrogenous matter in the dropping leaves of the clover plant.

Clover Roots. The roots from one square foot of this soil, freed as much as possible from adhering soil, were dried at 212°, and when weighed and reduced to a fine powder, gave on analysis the following results :

*Organic matter	64.76
†Mineral matter	35.24
	100.00
*Containing nitrogen	1.702
Equal to ammonia	2.066
†Including clay and sand (insoluble siliceous matter)	26.04

A square foot of this soil produced 582 grains of dried clover roots, consequently an acre yielded 3,622 lbs. of roots, or more than twice the weight of roots obtained from the soil of the same field where the clover was twice mown for hay.

In round numbers, the 3,622 lbs. of clover roots from the land mown once, and afterwards left for seed, contained 51½ lbs. of nitrogen.

The roots from the soil after clover seed, it will be noticed, were not so clean as the preceding sample, nevertheless, they yielded more nitrogen. In 64.76 of organic matter we have here 1.702 of nitrogen, whereas in the case of the roots from the part of the field where the clover was twice mown for hay, we have in 81.33 parts—that is, much more organic matter, and 1.635, or rather less of nitrogen. It is evident, therefore, that the organic matter in the soil after clover seed occurs in a more advanced stage of decomposition than found in the clover roots from the part of the field twice mown. In the manure in which the decay of such and similar organic remains proceeds, much of the non-nitrogenous or carbonaceous matters of which these remains chiefly, though not entirely consist, is transformed into gaseous carbonic acid, and what remains behind becomes richer in nitrogen and mineral matters. A parallel case, showing the dissipation of carbonaceous matter, and the increase in the percentage of nitrogen and mineral matter in what is left behind, is presented to us in fresh and rotten dung; in long or fresh dung the percentage of organic matter, consisting chiefly of very imperfectly decomposed straw, being larger, and that of nitrogen and mineral matter smaller, than in well-rotted dung.

The roots from the field after clover seed, it will be borne in mind, were dug up in November, whilst those obtained from the land twice mown were dug up in September; the former, therefore, may be expected to be in a more advanced state of decay than the latter, and richer in nitrogen.

In an acre of soil after clover seed, we have—

Nitrogen in 1st 6 inches of soil	4725 lbs.
Nitrogen in roots	51½
Nitrogen in 2d 6 inches of soil	3350
Total amount of nitrogen per acre in 12 inches of soil	8126½
Equal to ammonia	9867

or in round numbers, 3 tons and 12½ cwts. of nitrogen per acre, equal to 4 tons and 8 cwts. of ammonia.

This is a very much larger amount of nitrogen than occurred in the other soil, and shows plainly that the total amount of nitrogen accumulates, especially in the surface soil, when clover is grown for seeds; thus explaining intelligibly, as it appears to me, why wheat, as stated by many practical men, succeeds better on land where clover is grown for seed than where it is mown for hay.

All the three layers of the soil after clover seed are richer in nitrogen than the same sections of the soil where the clover was twice mown, as will be seen by the following comparative statement of results.

	I. Clover-soil twice Mown.			II. Clover-soil once Mown, and then left for seed.		
	Upper 6 inches.	2d 6 inches.	3d 6 inches.	Upper 6 inches.	Next 6 inches.	Lowest 6 inches.
Percentage of nitrogen in dried soil	.168	.092	.064	.189	.134	.089
Equal to ammonia	.198	.112	.078	.229	.162	108

This difference in the amount of accumulated nitrogen in clover land appears still more strikingly on comparing the total amounts of nitrogen per acre in the different sections of the two portions of the 11-acre fields:

Per centage of nitrogen per acre:	1st 6 inches. lbs.	2d 6 inches. lbs.	3d 6 inches. lbs.
*I. In soil, clover twice mown	3350	1875	1325
†I. In soil, clover once mown and seeded afterwards	4725	3350	2225
Equal to ammonia:			
*I. Clover twice mown	4050	2275	1600
†II. Clover seeded	5725	4050	2700
I. Nitrogen in roots of clover twice mown	24½		
II. Nitrogen in clover, once mown and grown for seed afterwards	51½		
1. Weight of dry roots per acre from Soil I.	1493½		
II. Weight of dry roots per acre from Soil 11.	3622		
*Total amount of nitrogen in 1 acre 12 inches deep of Soil I	5249½		
†Total amount of nitrogen in 1 acre 12 inches deep of Soil II	8126½		
*Equal to ammonia	6374½		
†Equal to ammonia	9867		

31

Per centage of nitrogen per acre:	1st 6 inches. lbs.	2d 6 inches. lbs.	3d 6 inches. lbs.
Excess of nitrogen in an acre of soil 12 inches deep calculated as ammonia in part of field mown once and then seeded..............	3592½		

It will be seen, that not only was the amount of large clover roots greater in the part where clover was grown for seed, but that likewise the different layers of soil were in every instance richer in nitrogen after clover seed than after clover mown twice for hay ; or as it may be expressed : In one acre of soil there were 3592 pounds more of ammonia in the land where clover seed was grown than where other clover was made entirely into hay ; or the former part of the same field produced rather more than one-half more of the total quantity of nitrogen yielded by the latter.

Reasons are given in the beginning of this paper which it is hoped will have convinced the reader that the fertility of land is not so much measured by the amount of ash-constituents of plants which it contains, as by the amount of nitrogen which, together with an excess of such ash-constituents, it contains in an available form. It has been shown likewise that the removal from the soil of a large amount of mineral matter in a good clover crop, in conformity with many direct field experiments, is not likely in any degree to affect the wheat crop, and that the yield of wheat on soils under ordinary cultivation, according to the experience of many farmers, and the direct and numerous experiments of Messrs. Lawes and Gilbert, rises or falls, other circumstances being equal, with the supply of available nitrogenous food which is given to the wheat. This being the case, we cannot doubt that the benefits arising from the growth of clover to the succeeding wheat are mainly due to the fact that an immense amount of nitrogenous food accumulates in the soil during the growth of clover.

This accumulation of nitrogenous plant-food, specially useful to cereal crops, is, as shown in the preceding experiments, much greater when clover is grown for seed than when it is made into hay. This affords an intelligible explanation of a fact long observed by good practical men, although denied by others who decline to accept their experience as resting on trustworthy evidence, because as they say, land cannot become more fertile when a crop is grown upon it for seed which is carried off, than when that crop is cut down and the produce consumed on the land. The chemical points brought forward in the course of this inquiry show plainly that mere speculations as to what can take place in a soil and what not, do not much advance the true theory of certain agricultural practices. It is only by carefully investigating subjects like the one under consideration, that positive proofs are given showing the correctness of intelligent observers in the fields. Many years ago I made a great many experiments relative to the chemistry of farmyard manure, and then showed, amongst other particulars, that manure spread at once on the land, need not there and then be plowed in, inasmuch as neither a broiling sun nor a sweeping and drying wind will cause the slightest loss of ammonia, and that, therefore, the old-fashioned farmer who carts his manure on the land as soon as he can, and spreads it at once, but who plows it in at his convenience, acts in perfect accordance with correct chemical principles involved in the management of farmyard manure. On the present occasion my main object has been to show, not merely by reasoning on the subject, but by actual experiments, that the larger the amounts of nitrogen, potash, soda, lime, phosphoric acid, &c., which are removed from the land in a clover crop, the better it is, nevertheless, made thereby, for producing in the succeeding year an abundant crop of wheat, other circumstances being favorable to its growth.

Indeed no kind of manure can be compared in point of efficacy for wheat to the manuring which the land gets in a really good crop of clover. The farmer who wishes to derive the full benefit from his clover-lay, should plow it up for wheat as soon as possible in the autumn, and leave it in a rough state as long as is admissable in order that the air may find free access into the land, and the organic remains left in so much abundance in a good crop of clover be changed into plant-food; more especially, in other words, in order that the crude nitrogenous organic matter in the clover roots and decaying leaves may have time to become transformed into ammoniacal compounds, and these in the course of time into nitrates, which I am strongly inclined to think is the form in which nitrogen is assimilated, par excellence, by cereal crops, and in which, at all events, it is more efficacious than in any other state of combination wherein it may be used as a fertilizer.

When the clover-lay is plowed up early, the decay of the clover is sufficiently advanced by the time the young wheat-plant stands in need of readily available nitrogenous food, and this being uniformly distributed through the whole of the cultivated soil, is ready to benefit every single plant. This equal and abundant distribution of food, peculiarly valuable to cereals, is a great advantage, and speaks strongly in favor of clover as a preparatory crop for wheat.

Nitrate of soda, an excellent spring top-dressing for wheat and cereals in general, in some seasons fails to produce as good an effect as in others. In very dry springs the rainfall is not sufficient to wash it properly into the soil and to distribute it equally, and in very wet seasons it is apt to be washed either into the drains or into a stratum of the soil not accessible to the roots of the young wheat. As therefore the character of the approaching season cannot usually be predicted, the application of nitrate of soda to wheat is always attended with more or less uncertainty.

The case is different when a good crop of clover hay has been obtained from the land on which wheat is intended to be grown afterwards. An enormous quantity of nitrogenous organic matter, as we have seen, is left in the land after the removal of the clover crop; and these remains gradually decay and furnish ammonia, which at first and during the colder months of the year is retained by the well known absorbing properties which all good wheat soils possess. In spring, when warmer weather sets in, and the wheat begins to make a push, these ammonia compounds in the soil are by degrees oxidized into nitrates; and as this change into food, peculiarly favorable to young cereal plants, proceeds slowly but steadily, we have in the soil itself, after clover, a source from which nitrates are continuously produced; so that it does not much affect the final yield of wheat whether heavy rains remove some or all of the nitrate present in the soil. The clover-remains thus afford a more continuous source from which nitrates are produced, and greater certainty for a good crop of wheat than when recourse is had to nitrogenous top-dressings in the spring.

The remarks respecting the formation of nitrates in soils upon which clover has been grown, it should be stated, do not emanate from mere speculations, but are based on actual observations.

I have not only been able to show the existence of nitrates in clover soils, but have made a number of actual determinations of the amount of nitric acid in different layers of soils on which clover had been grown; but as this paper has grown already to greater dimensions than perhaps desirable, I reserve any further remarks on the important subject of nitrification in soils for a future communication.

SUMMARY.

The following are some of the chief points of interest which I have endeavored fully to develop in the preceding pages:

1. A good crop of clover removes from the soil more potash, phosphoric acid, lime, and other mineral matters, which enter into the composition of the ashes of our cultivated crops, than any other crop usually grown in this country.

2. There is fully three times as much nitrogen in a crop of clover as in the average produce of the grain and straw of wheat per acre.

3. Notwithstanding the large amount of nitrogenous matter and of ash-constituents of plants in the produce of an acre, clover is an excellent preparatory crop for wheat.

4. During the growth of clover a large amount of nitrogenous matter accumulates in the soil.

5. This accumulation, which is greatest in the surface-soil, is due to decaying leaves dropped during the growth of clover, and to an abundance of roots, containing when dry from 1¾ to 2 per cent. of nitrogen.

6. The clover roots are stronger and more numerous, and more leaves fall on the ground when clover is grown for seed, than when it is mown for hay; in consequence more nitrogen is left after clover seed than after hay, which accounts for wheat yielding a better crop after clover seed than after hay.

7. The development of roots being checked when the produce, in a green condition, is fed off by sheep, in all probability leaves still less nitrogenous matter in the soil than when clover is allowed to get riper and is mown for hay; thus, no doubt, accounting for the observation made by practical men that, notwithstanding the return of the produce in the sheep excrements, wheat is generally stronger and yields better after clover mown for hay than when the clover is fed off green by sheep.

8. The nitrogenous matters in the clover-remains on their gradual decay are finally transformed into nitrates, thus affording a continuous source of food, on which cereal crops specially delight to grow.

9. There is strong presumptive evidence that the nitrogen which exists in the air in the shape of ammonia and nitric acid, and that which descends in these combinations with the rain which falls on the ground, satisfies, under ordinary circumstances, the require-

ments of the clover crop. This crop causes a large accumulation of nitrogenous matters, which are gradually changed in the soil into nitrates. The atmosphere thus furnishes nitrogenous food to the succeeding wheat indirectly, and, so to say, gratis.

10. Clover not only provides abundance of nitrogenous food, but delivers this food in a readily available form (as nitrates) more gradually and continuously, and consequently with more certainty of a good result, than such food can be applied to the land in the shape of nitrogenous spring top-dressings.

CONCLUSION.

Several papers which it was proposed to include in this report are omitted, and among them one on Farmers' Clubs. Present appearances indicate that the action of the Board of Agriculture at its session in January last, requiring County Societies to encourage the formation of these simple and effective aids to progress, will accomplish great good.

The benefits arising from these are many and varied. Farmers are, necessarily, more isolated than those engaged in other industrial callings. Hence whatever furnishes to them, even in limited measure, the advantages of coöperation must be of great service. These Clubs bring them together and afford rare facilities for exchange of the results of experience and observation. They awaken desires for careful experience and closer observation; for increase of practical and scientific knowledge. They educate, in the true sense of the term—drawing forth, developing and nourishing the faculties of those who participate. The social element is encouraged; and, look at them in whatever aspect we may, their usefulness is apparent. At the same time they operate effectually toward supporting and strengthening the higher and more comprehensive organizations for the promotion of agriculture.

It is not too much to say that these Clubs sustain a relation to, and perform a function for agriculture among us similar to that of the primary town meetings for the government of our country.

I beg leave to suggest the need of a revision of the law under which State bounty is distributed to the several agricultural societies. When chapter 137 of the laws of 1862 was enacted, its provisions sufficed to meet all cases then existing, as well as those which arose during some years subsequently; and its provisions were applied without difficulty. Such is not the case now. The twelfth section reads as follows:

SECT. 12. The treasurer of the state is hereby authorized and directed to pay to the treasurer of any incorporated agricultural or horticultural society, in case he shall apply for the same on or before the first Wednesday of December, in any year in conformity with the conditions hereinafter specified, a sum equal to that raised by such society within the year next preceding such application. *Provided*, that such sum or sums shall not exceed one cent to each inhabitant of said county, upon the basis of the last previous national census, nor more than four hundred dollars to any one county; and if there be more than one such society in any county, and if the sums so applied for exceed in the aggregate the limits above named, then a sum equal to one cent for each inhabitant of said county, and not exceeding four hundred dollars, shall be divided and paid to the respective treasurers in proportion to the amounts expended by the several societies in accordance with the provisions of section fourteen; *provided also*, that the Penobscot and Aroostook Union Agricultural Society may receive irrespective of population, as much as is raised by it not exceeding one hundred dollars.

Last winter a society was incorporated embracing portions of two counties, (Penobscot and Waldo,) and it does not readily appear how a society so formed can receive bounty under the act.

Other cases have arisen, where, owing to the incorporation of special features, not anticipated when the law was framed, differences of opinion have arisen as to the amount properly due; the letter of the statute indicating one method of division between the several societies in a county, while its general scope and evident intent pointed to a different method.

S. L. GOODALE,
Secretary of the Board of Agriculture.

JANUARY, 1870.

INDEX.