Public Documents of Maine:

BEING THE

ANNUAL REPORTS

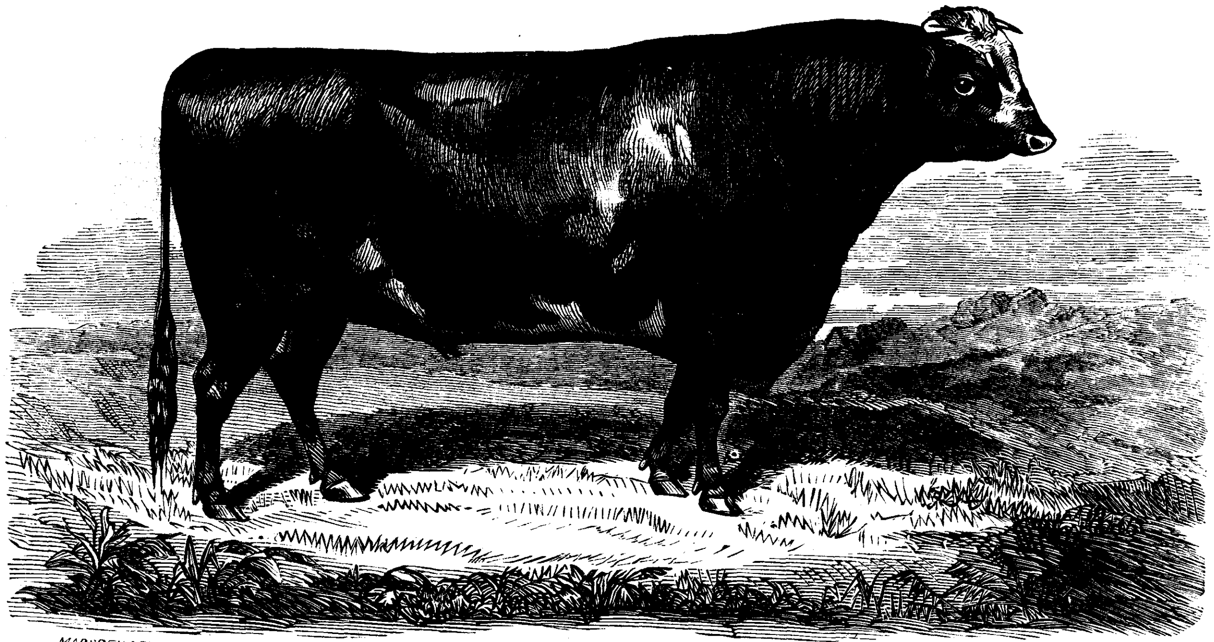
OF VARIOUS

PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEAR

1868-9.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1869.



Ayshire Bull,—"HONEST JOHN." Bred and owned by William Birnie, Springfield, Mass. Dark red and white; calved March, 1864; sire, "John Anderson;" dam, "Daisie 4th."

THIRTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

MAINE BOARD OF AGRICULTURE.

1868.

AUGUSTA:
OWEN & NASH, PRINTERS TO THE STATE.
1868.

BOARD OF AGRICULTURE.

SAMUEL WASSON, President.
RUFUS PRINCE, Vice President.
S. L. GOODALE, Secretary.

(Term Expires January, 1869.)

NAME.	COUNTY.	P. O. ADDRESS.
James M. Carpenter,	Kennebec,	Pittston.
Peter W. Ayer,	Waldo,	Freedom.
William S. Brown,	Lincoln,	Waldoborough.
Rufus Prince,	Androscoggin,	Turner.
Calvin Chamberlain,	State Society,	Foxcroft.

(Term Expires January, 1870.)

S. F. Dike,	Sagadahoc,	Bath.
Seth Scamman,	Cumberland,	Scarborough.
Samuel Holmes,	Oxford,	Peru.
Albert Moore,	Somerset,	North Anson.
S. L. Goodale,	York,	Saco.

(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.

REPORT.

To the Senate and House of Representatives:

On the third Wednesday of January, 1868, the Board of Agriculture convened at the State House in Augusta, and being called to order by the Secretary, James M. Carpenter was chosen Chairman for purposes of organization.

Messrs. Wasson, Prince and Holmes were appointed a Committee on Credentials. They reported a quorum present.

Permanent organization was effected by the unanimous election of

SAMUEL WASSON, *President.*
RUFUS PRINCE, *Vice President.*
STEPHEN L. GOODALE, *Secretary.*

The following Standing Committees were announced by the Chair:

Business Committee—The Secretary, *ex officio*, C. Chamberlain, Dike and Moore.

On Elections—Messrs. Carpenter, Brown and Norton.

On Pay Roll—Messrs. L. Chamberlain, Wilder and Prince.

The Rules and Orders of last year were adopted for use until otherwise ordered.

Mr. Wasson introduced the following preamble and resolution, which was adopted:

WHEREAS, the potato occupies a prominent position among the staple products of Maine; and whereas, the same variety is known in different sections by different names, and also new sorts are constantly being introduced, therefore

Resolved, That the Board of Agriculture hold an exhibition at the Agricultural Room on the third Thursday of January, 1869, at which we trust all the more valuable varieties of the potato in cultivation may be exhibited for comparison, correction of names, and general instruction.

An *ad interim* paper was then read by Mr. Carpenter on mixed husbandry, which gave rise to a somewhat protracted discussion and was finally adopted, as follows:

Report on Mixed Husbandry.

To what extent should mixed husbandry be practiced? Mixed husbandry, as understood by the writer, is a system of farming by which the greatest possible variety of products are raised that may be required for the use of the farmer and his family. Hay and pasturage may form the great foundation of all. Apple orchards and other fruits, the rearing of horses, cattle, sheep, swine and poultry, the production of wheat, corn, barley, oats, potatoes and other vegetables, may be considered an illustration of the *mixed* side of the question. The opposite to this may be classed as *special* husbandry.

The advantages of the former system are that all the products that are needed for home consumption will be where they are required for use, and will not be subject to the cost of transportation. The variety of crops will enable the operator to take advantage of our short seasons for sowing and planting, so as to save time in putting his seed into the ground, and give him a better prospect of a good harvest than could reasonably be expected from the production of one article. And it will also give him the assurance of a fine basis, less subject to ups and downs by reason of fluctuating markets, as often occurs when the sale of one product has to be depended upon as a source of income.

The nation, State, community or farmer that comes the nearest to living within their own resources, will first become independent. You must sell more than you buy, or you will never get rich. One's labor requires to be made productive by intelligent application, in order to be successful.

The extent to which this shall be practiced is the main question. It will be admitted that the best judgment should be exercised in regard to it. Location as to markets, storability of product, soil and climate, should be taken carefully into the calculation. In the exercise of that judgment one would select from the products one or more, that in view of all the circumstances would be the best adapted to his location, soil and market, and bend his extra efforts to the production of those that from experience are found to be the most profitable, looking to a series of years rather than to present profit; as it will be easily seen that from this source, the surplus production, all his means will come to meet his expenses and allow him something if possible for a rainy day.

When nearly all that is required for home consumption is raised on a farm, it will be found that a much smaller surplus will be needed to purchase articles that cannot be produced, than would be the case if only one article was depended upon to meet all demands. It should be recollected that every article consumed on the farm and not produced there must be purchased and brought home, and it must be paid for by something sold from the farm: and that will have to be transported to a market. From these facts it is evident that it would be more advantageous to produce many articles that may be required, even at a cost considerably higher than such articles are quoted at in the market; as two transportations will have to be met by the farmer. And then there is a great satisfaction in consuming one's own productions, especially of all articles of food.

It is from the small, constant, numerous springs that large rivers are formed, rather than from the rapid mountain torrent that soon finds its way to, and is lost in the sea. The great reliable strength of the immense iron bridge cables is owing to the number of separate wires with which they are constructed. It requires a very remarkable musician to play a tune on an instrument with only one string. So in all the affairs of life, especially with those who deal on a comparatively small scale, it is considered more prudent to adopt a middling course than either of the extremes. It may be said that in order to approach perfection in the production of any article or in any pursuit, one should apply himself to one thing at a time. This comes nearer to the facts in mechanical affairs than in agriculture, although to some extent it is true in both. We believe, however, that a man with a farm to cultivate and care for, with the advantages for improvement and information that exist at the present time, may be sufficiently intelligent to do more than one thing. If he has the usual variety of farm stock, he may improve it. If he has an orchard, he may improve that by keeping sheep, even if wool is dull, and both together be made profitable when one alone would result in loss. And so on through the list of products. We recommend this question to the careful consideration of the farmers of our State. It appears by the census returns of 1860 that there were in this State 55,675 farms,—1,719 of ten acres and under; 48,884 of from ten to one hundred acres; and 5,072 of over one hundred acres—about nine-tenths of the whole being in farms of less than one hundred acres. They constitute a large proportion of the taxable property of the State. Let every one review this matter and weigh it in all its bearings. If they find themselves going in a wrong direction, one that is unprofitable, a change can be made. But it is not desirable to change often. A steady, careful, industrious line of action seldom fails of an abundant reward. Success contributes to a general satisfaction. If the farming operations in our State can be made profitable, more will be satisfied to remain and till the soil, and less go to seek their fortunes elsewhere. This is very desirable, and all classes of industry should be encouraged and fostered that one may help the other, and with their united strength build up the State.

J. M. CARPENTER, *Kennebec Co.*

Mr. Holmes of Oxford, submitted a paper being a report on a topic committed to him for investigation at the previous session:

On the Comparative Profit of Cattle and Sheep Husbandry.

"Which is the more profitable, the raising of sheep or cattle?"

When I proposed this question to the Board, I had no doubt but the raising of sheep was much more profitable than that of cattle, and probably this would be the case should we have no reference to the profits of the dairy. If the farmer should calculate nothing but the amount arising from the sales of cattle, throwing out of the account the benefit or profit of the milk from his cows, which is converted into butter and cheese or consumed as food for his children and other uses in his family, and helps to raise and fatten his pork, and should set aside the advantages of the labor of his steers and oxen, and making no account of the greater quantity of manure produced by his cattle, no doubt he would find the raising of sheep more profitable than the raising of cattle. What I shall say on this subject will be mostly from my own experience during the past six or eight years.

I have kept good cows of the breeds common in my vicinity, but no fancy breeds. My sheep are of the common breed also. I have generally selected the largest and strongest sheep to keep, such as would be good breeders, having much regard to their capacity for raising lambs; for I have realized more from the sales of my lambs than I have from wool. On an average my sheep have produced four pounds per head. Some years they have averaged four and a quarter pounds.

In comparing the profits of raising cattle and sheep, I shall estimate the keeping of eight sheep to be equal to the keeping of one cow ; or the keeping of forty sheep as equal to the keeping of five cows. We will now call the expense in stocking a farm either with cows or sheep equal, that is, that five cows will cost the same as forty sheep. Forty dollars for a good cow, in the fall of the year, would be as much as the average price has been for the last eight years; and five dollars per head would buy the best of our common sheep in the same years. We know this comparison of prices will not exactly suit the present state of things, the price of sheep having diminished beyond that of cattle, but I propose to answer this question agreeably to the state of affairs as they existed when the inquiry was made, presuming they may compare for the next decade about the same as in that which has passed. We will next consider the profits of forty sheep. We will calculate the sheep to bring up one good lamb each, which will sell in the fall for three dollars, amounting to one hundred and twenty dollars; and that the sheep will average four pounds of wool per head, giving a yield of one hundred and sixty pounds of wool. I have sold my wool for the last eight years at the average price of fifty-six and one-fourth cents per pound. At this price the wool will bring ninety dollars, which makes two hundred and ten dollars income from the forty sheep. The sheep must be well kept and cared for to produce the above result, and it must be admitted that I have allowed for more than ordinary success in raising lambs.

We will now see what will be the income of five cows. It has been ascertained by actual experiment that one gallon of milk will make a pound of cheese. I think that calculating two and a half gallons of milk per day from each cow for four months, reckoning from the middle of May to the middle of September, would not be too high an estimate. This would give fifteen hundred gallons of milk, which will make fifteen hundred pounds of cheese. I think the average price of good cheese, for the last eight years, has been about sixteen and two-thirds cents per pound. At this price fifteen hundred pounds of cheese would bring two hundred and fifty dollars. One gallon and a half of milk per day for each cow, would not, I think, be a high estimate, from the middle of September to the middle of December, by which we get from the five cows six hundred and seventy-five gallons. Allowing three gallons of milk to make a pound of butter, we get two hundred and twenty-five pounds of butter, after suspending cheese-making. I believe the average price of good butter for the last eight years has been about thirty cents per pound. At this price we get sixty-seven dollars and fifty cents for the butter. Now we will suppose the cows to have a calf each in the month of March, and we will keep them until the middle of May, when they will be from six to eight weeks old, and will sell as per average of past prices for eight dollars each, making forty dollars for the calves. We now have the following results as the gross income of the five cows: Calves, $40; cheese, $250; butter, $67.50—total income, $357.50. We made the income of the sheep, $210, showing a difference in favor of the cows of $147.50.

It may be said that it requires much more labor to take care of the cows, and to manufacture the cheese and butter, than it does to take care of the sheep. This I admit; but sheep need a good deal of care and attention, especially in the spring of the year when they are bringing their lambs, and it requires some labor to wash and shear them, besides more care and pains in fencing, as a general thing, than for cows. From the cows while manufacturing the butter and cheese, we get sour milk and whey, which will do much towards compensating for the labor of attending the dairy. The whey and skim milk will aid much in keeping and fattening hogs, and the hogs will make much valuable manure if properly attended to, by being well supplied with muck, loam, weeds, leaves, &c., so that with the cows and hogs we have a grêater quantity of manure than we can obtain from the sheep; enough perhaps, with the pork from the hogs, to fully compensate for the extra labor of the dairy. It will be seen that by keeping cows we can obtain more manure to enrich our soil, we can raise more corn, potatoes and hay, &c., and keep our farms in a higher state of cultivation.

But we will say nothing of the profits of pork and manure as connected with the dairy, and confine ourselves to the more immediate and direct profit of the two species of stock under consideration. We will suppose it would take a woman one-half of the time for twenty-eight weeks to manufacture and take care of the butter and cheese, and that her labor and board would cost six dollars a week; half this expense would be three dollars a week for twenty-eight weeks, which would be eighty-four dollars. We take this from our former balance of one hundred and forty-seven dollars and fifty cents, and there is still left in favor of cows, a balance of sixty-three dollars and fifty cents. Many farmers believe that a farm stocked wholly with sheep will deteriorate or "run out" sooner than if stocked with cattle. This idea I believe correct. It is certain that we obtain much less manure from them and that they crop the feed much closer than cattle, especially on the high land where the feed is the sweetest, and will not feed on low, swampy land, if they can find green roots of grass on high land.

As to the raising of cattle—steers or heifers, to sell while young for beef or other purposes, I am of the opinion that though the profit may preponderate in favor of sheep, the advantage is not so great as many people suppose, when taking into consideration the extra labor of caring for and attending to the sheep, with the benefit resulting to the farm by keeping cattle instead. The labor of the ox is almost indispensable, and with many farmers the steer, after he becomes two years old, nearly or quite pays for his keeping if properly fed and well treated, without materially injuring his growth. Many do not fully appreciate the useful labor of the ox, and do not sufficiently consider that much of the income of the farm, and even the means to rear and provide for their sheep, is due to the usefulness of this valuable animal, and should be set down as part of the profit of raising him.

I believe the reason why sheep are considered by many the more profitable stock to keep, is because the income of the flock comes in at stated seasons in whole sums, or solid parcels, while that of cows is frittered away in family use, and the ox is only credited for what the butcher may pay for him after his service is rendered. It is the opinion of many of the farmers of Oxford County, that it would be well for them to give more attention to dairy products and the raising of cattle, and less to the raising of sheep, especially to fine wooled sheep, as it is thought we shall be likely to have more competition from the Western States in wool than in dairy products, and in this opinion, after giving the subject some thought and attention, I am led to coincide, and believe that the raising of cattle is more profitable than the raising of sheep.

SAMUEL HOLMES, *Oxford Co.*

Mr. Moore next presented a report on the topic committed to him at the last session, as follows:

Sheep Husbandry in Somerset County.

In treating upon this subject, it is assumed, first, that the best interests of the farmers of Maine demand a system of mixed husbandry—not only of the immediate productions of the soil, but of the live stock raised upon the farm. And second, the consumption, on the farm, of all the crops produced. Any other system would fail of success, under the exhaustive process of taking from, without replenishing the fertility of the soil, except near good markets, where products could be exchanged for fertilizers.

Starting from these premises, the advantages of sheep raising, in connection with other agricultural pursuits, would seem to be the practical question to solve to be of value to the farmers of Maine. Not whether wool and mutton can be produced in Maine cheaper than in Ohio, Texas or California, but does it pay to raise sheep in Maine? for if this point is negatived, further discussion is useless and better be abandoned. On this point, a late number of the *Wool Grower* well says, that "everywhere and anywhere the sheep will live and thrive, and with proper care, pay more for the labor and capital invested, than any other animal or any other system of farming. It is one of the most useful and economical modes which have been given us to convert the vegetation of the farm to money. There is no animal in which there is so little waste or so little loss. For at least seven years of its life, it will give an annual fleece of the value of the carcass, and the yearly increase will be nearly or quite equal to the cost of keeping." The farmers of Maine are coming to appreciate the advantages of wool-growing, so tersely stated in this extract, and we find the flocks increasing on the thousand hills of our rough and mountainous State, from 374,000 in 1860, to 1,041,724 in 1866, as reported in the February number of the report of the Commissioner of agriculture—an increase of 667,724 in six years, and an annual increase of 111,287.

In my county, the county of Somerset, the statistics for the year 1862, show 81,599 sheep, and 1863, 93,119. I have been able to find no county statistics reported since 1863; but taking the statistics of the town of Anson, to which alone I have had access, I find it had in 1862, 8,616 sheep; in 1863, 11,944; 1865, 13,098; 1866, 13,199; 1867, 13,592—an increase in five years of 4,976, average annual increase, 995. The same ratio of increase would give Somerset county in 1867, 128,725, an increase in five years of 47,126, an average annual increase of 9,425—equal now to about one-eight of the whole State. These evidences of the thrift and prosperity of this branch of agriculture seem to furnish an answer to the question, does sheep husbandry pay? But it may be asked, will the figures, which it is said never lie, show a corresponding result? The following statements, of some of the most intelligent and practical sheep-growers in Somerset county, in answer to questions propounded, are to this point:

W. W. Pease of Anson, states: "My sheep number about three hundred; are Spanish Merino, pure and grade; use the best buck I can obtain; lambs come in April and May; flock will produce one-third its number of lambs, besides loss and waste; one hundred sheep will consume eighteen or twenty tons of hay or its equivalent in other feed—my sheep averaged the last year, six pounds of wool a head; think that the flocks through the town will average five pounds per head; one hundred sheep will consume about the same amount of hay as ten cows—average time of feeding, five months."

Major Samuel W. Tinkham of Anson, states: "My flock numbers two hundred and twenty, consisting of grade and pure-blood Merinos; breed from pure American Merino bucks, always obtaining the best I can; my lambs are dropped in May, after the sheep are put to grass, I therefore feed no grain; flock averages six pounds per head; average price of sheep now about $5, though they have been much higher; lambs average $5; twenty tons of hay to one hundred sheep is a fair estimate of feed; consider that ten cows will consume the same amount of hay as one hundred sheep; sold my wool in 1863 for 75 cents; in 1864, for $1; 1865, for 74 cents; 1866, for 70 cents; in 1867, for 46 cents per pound; I think as long as the present tariff exists, wool will bring at least 50 cents per pound. The following is about an average of expenditures and receipts on my flock, per hundred, for the past five years":

EXPENDITURES.		
100 Sheep, valued at $5 each,	$500 00	
20 tons of Hay, average price $12,	240 00	
Pasturing,	40 00	
Washing and Shearing,	15 00	
		$795 00
RECEIPTS.		
600 lbs. of Wool, average 70 cents per lb.,	$420 00	
40 Lambs, more than waste,	200 00	
Flock worth now,	500 00	
		$1,120 00
Profit,		$325 00

Q. P. Wood of Anson, says: "As I have had the benefit of more than thirty years experience in sheep husbandry, I think I can answer the questions proposed with considerably accuracy. One hundred sheep, average live weight ninety pounds, require four tons of hay per month, or twenty tons in five months, which is the usual time for feeding sheep in this locality. Twelve sheep require about the same as a cow. Good English hay placed on clean snow when practicable, with pure water, is the best feed imaginable for sheep in winter. If hay is poor, grain should be fed in sufficient quantity to keep alive the ambition of the sheep—say one gill of corn or beans, or pint of oats per head, per day. I feed as above in spring to sheep while they are in a transition state between hay and grass. Sheep require food nearly in proportion to their weight. I will just mention that I never fed hay under cover that was so good that they did not make orts, or so poor as to cause them to leave it, when placed on snow in open air. I select about one hundred of my best ewes, between the ages of three and five years, from which I raise about eighty-five lambs annually. Never sold a sheep under three years old, sell annually off the other end of the flock. Average price for the last five years preceding 1867, about $6. At shearing, I find quite a large proportion of my flock young and smart, yielding the last five years hardly four pounds, the average of the finest quality Spanish Merino wool, which sells at the top of the market. Sold in 1866 for 67 cents; clip of 1867 yet unsold."

Jabez D. Hill, Esq., of Moscow, furnishes the following: "For several years past I have kept from two hundred to two hundred and fifty sheep. They are now grade Merino—not equal to the crack flocks of Vermont, but very much better than the flock with which I began the business, some half a dozen years ago. I consider it a matter of the first importance in sheep husbandry, that you have a good pasture, so that the flock may come to the barn in the fall, fat. Fat, in the latitude of Somerset county, is the great panacea for warding off sheep disease. A fat sheep, not extremely old, with ordinary treatment, may be warranted to go through a northern winter safely.

And here let me remark, that what follows regarding sheep has reference to flocks where two or three hundred are kept, rather than to those of half a dozen, kept just for a little 'stocking yarn.' A few sheep on a farm will be pretty sure to get a full share of the green herbage and of the dried fodder, and look well. They can run out in the fall till snow comes, and cropping closer than cattle, will find food enough. But with large flocks the case is different. As freezing weather approaches, it is generally found that they have stripped the fields bare, and it will not do to take it for granted that because the ground is uncovered with snow, the sheep are 'doing well enough.' When the ground freezes, if not before, a large flock must be fed partly or wholly at the barn—wholly is the best, unless you are willing to diminish next year's hay crop, by letting the sheep nibble up the grass roots. I put mine in the basement of the barn and in sheds, with a small yard which has running water in one corner, to which they have free access during the day. The lambs are separated from the rest of the flock; old, feeble or otherwise undesirable sheep are sold or killed—we get a pelt if nothing more. We feed four times a day—two feeds for breakfast and two for supper—hay put in the ordinary boxes; don't feed before light nor after dark. Feed twice for breakfast, &c., because the sheep can be made to eat up the fodder with less waste. Make them eat up clean; or if the fodder is too poor for that, clean out the orts before feeding again. When feeding time arrives they are all driven into the yard, and there kept till the boxes or cribs are filled. This passes each animal under your eye frequently, and I believe is also beneficial to the animal as exercise. I have generally fed a little grain—say a gill of oats daily per head—but for two seasons have given the flock one foddering of oats in the straw, daily; like the plan. In this region, large flocks have to be fed twenty-six weeks, and one hundred sheep fed wholly on hay, will eat one ton per week. The present season, began to feed Nov. 5th. Calculate not to have the feeding boxes more than sixteen inches wide, so that sheep may not be induced to chafe off the wool by reaching too far for fodder. According to my observation, sheep want but little salt comparatively, while living on dry food. I keep a box containing a mixture of ashes and salt in the pen.

We lead the bucks into the pen in the morning, and when one has served a sheep once, she is spotted with red paint on the back, and he is tied up for fifty or sixty minutes, and then allowed to serve another ewe. Towards night, if the ewes are coming forward freely, he is allowed to serve one, sometimes two more. The other bucks are managed in a similar manner. Give old bucks two quarts of oats daily, with hay and water, occasionally a mess of potatoes. By turning off the poorest annually, and keeping the best lambs, there is a marked improvement in the flock.

I choose to have the lambs dropped after the grass begins to start; but as I cannot have them all at once, I begin a little before and continue till the 5th or 10th of June. By the custom of the country, am obliged to wash the sheep in running water about the first of June; let them run a week, and then shear.

Previous to turning the sheep to grass in the spring, we 'tag' them—that is we clip off all the wool about the tail and haunches liable to be smeared by the scouring of the animal when first turned to grass. If we find in any case the wool is growing loose on the belly, that is sheared off also. The wethers in addition, have a small portion sheared around the opening of the sheath. A man will 'tag' fifty to seventy-five in a day, the last of April. These taggings are washed, and a small handful tied up with each fleece when put for market. Can shear a grade Merino sheep in about sixty minutes—don't hire many men who will do much better than that, unless they make poorer work than I want done. I want all the sheep's skin left on, and but very little of the wool. This I know will sound small beside the feats of the Buenos Ayres damsels, who, Mr. Carrow informs us, shear from eighty to one hundred each per day. But then, a fourth or a half pound of wool is of but little consequence—won't pay for close shearing—in a country where a pound can be bought for ten or twelve cents. In shearing, I seat the sheep upon her haunches, and holding the upper part of the body between my knees, take hold of the head and shear from the face all around the neck, down to the fore shoulders. This neck fleece is then laid aside; then placing the sheep on her back I stand over her, and taking a leg in one hand, and my foot placed on her neck with sufficient force to keep her from turning over, each leg in succession is sheared up to the body. Then kneeling over the sheep, I shear the belly, commencing at the breast bone and clipping along the centre to the bag. The sheep is then laid on the table and one side sheared round to the back bone, when that portion of the fleece is torn off and laid away. Then the animal is turned over, and the other side sheared. This method was taught me by an old Englishman, brought up near the Romney marshes, who learned the trade of shearing 'at home'—except he dispensed with the table altogether. I have tried other methods, but think I can keep the best portions of the fleece unbroken by the one described, better than by any other.

When the lambs are a few days old, they are marked. At shearing time they are castrated. By this time, thinking I have let blood enough, I frequently let 'docking' go till the next spring, and then tie the stump with a waxed thread. Immediately after the sheep are sheared, the lambs are dipped in a decoction of tobacco, or 'Indian poke,' to kill the ticks. The sheep don't need it—they are clipped close enough to destroy or clear out the vermin. A bushel and a half of 'poke' root boiled in a barrel of water till you get its strength, will answer for fifty lambs. Put the wash in a barrel or large tub; place a piece of wide board so that one end shall rest on an elevation a few inches higher than the tub, and the other on the end of the open tub itself. Take the lamb by the fore legs from the assistant who catches him, and dip him in the moderately warm poke juice, taking care while you settle him in the liquid with one hand, that the other is grasped around his mouth, so that the nose and eyes, may not be immersed. As soon as his wool becomes well saturated, lift him out and place him on the sloping board above the edge of the tub, where he may drain a little, then dismiss him for another. After this operation, the noses of the whole flock are tarred to keep off the fly which produces the grub in the head. This tarring the nose had better be repeated in three or four weeks. When the sheep are turned to pasture, three or four bells to the hundred are hung to their necks; the noise from which serves to scare away many enemies of the sheep-fold. The flock is sheltered as much as possible from the cold rains, spring and fall. Give three quarts of salt to one hundred, once a fortnight in summer. The lambs are weaned about the 1st of September, by putting in a good grass plot, out of hearing of the sheep.

With regard to curing diseases, I have made but little headway. Sometimes the animals I have experimented with have died, sometimes they have in consequence of, or in spite of my treatment, recovered. However, I am satisfied that my attainments in this direction will not warrant me a diploma. The sheep business is, as you are well aware, in a very depressed condition. The low price of wool has induced many, perhaps ruinously, to get rid of their flocks. In large portions of Somerset County, hay and pasturage are the main resources of the farmer; and instead of being sold must be used up on the land, in order to keep up its fertility. Even laying aside the question of fertility, with our lack of home markets and facilities for reaching more distant ones, we should still, in the case of so bulky an article as forage, be compelled to use it up at home. Therefore, the only way to decide whether wool growing is a remunerative business, is to compare it with the raising of cattle and horses. It is true, the prices of cattle have not dropped so ruinously as sheep, and apparently promise a better margin. But in view of the value of sheep as renovators and fertilizers of our mountain pastures, it may be doubted whether many have not moved with a wasteful precipitancy in decimating their flocks. Wool must be had as long as we live in a freezing climate; and probably, taking a series of years into the account, will pay as well as the rearing of cattle. There is no doubt but that for the last fifteen or twenty years, sheep husbandry, when conducted by men of intelligence, energy and ordinary tact, has been as remunerative as any other branch of farming; and I believe that a majority of the old 'standards'—not the 'shifty' ones, who flocked into the business because wool had gone up to war prices, measured in a depleted currency—who have followed their flocks for years, notwithstanding the portentous clouds now seen in the financial sky, still look upon it as holding a similar promise."

Hon. William R. Flint of Anson, furnishes me with the following statement :

"The sales are mostly from records, but numbers of sheep are sometimes estimated, especially the distinction between sheep and lambs when sold.

Years.	No. Sheep.	Average per head.	No. pounds.	Price per pound.	Amount.
1863, . .	400	5 lb. 4 oz.	2100	50 cents.	$1,050 00
1864, . .	400	5 6½	2163	82	1,773 66
1865, . .	390	5 3¾	2100	$1.00	2,100 00
1866, . .	416	5 4½	2184	61 cents.	1,332 24
1867, . . .	400	5 7¼	2180	48	1,046 40
					$7,302 30

Years.	Lambs raised.	Lambs sold.	Price of Lambs.	Sheep sold.	Price of Sheep.	Amount.
1863, . .	140	40	$5 00	80	$6 00	$480 00
1864, . .	136	25	4 00	75	6 00	450 00
1865, . .	146	33	3 50	75	5 00	375 00
1866, . .	133	56	3 00	85	4 00	340 00
1867, . .	136	40	2 50	70	3 50	245 00
						$1,890 00

The sales of sheep and lambs have generally been of inferior sorts.

DR.

Estimate of flock of 100 sheep to keep the flock good in numbers and years, estimated to cost $4 each,	$400 00	
17 tons hay, $10 per ton,	170 00	
Pasturage, 50 cents each,	50 00	
Washing and Shearing, 12 ½ cents each,	12 50	
Allowing 5 per cent. for deaths, accidents, &c.,	20 00	
		$652 00

CR.

100 Fleeces, 5 lbs. each, 70 cents per lb.,	$350 00	
33 Lambs, 15 to sell at $4 each,	60 00	
18 Sheep, $4 each,	72 00	
95 Sheep, value of the flock at $4 each,	380 00	
		$862 00
Profits,		$210 50

Statements received from other prominent sheep-growers show so nearly the same results, that they need not be repeated. The average estimate of these statements show about the following results :

EXPENSES.

Cost of 100 Sheep, $5 each,	$500 00	
20 tons of hay for feed,	240 00	
Pasturing,	40 00	
Washing and Shearing,	15 00	
		$795 00

RECEIPTS.

500 lbs. Wool, average 50 cents per lb.,	$250 00	
35 Lambs more than waste,	175 00	
Value of flock at end of year,	500 00	
		$925 00
Profit,		$130 00

Another source of profit not generally taken into the account, is the value of the sheep as a renovater of exhausted or partially exhausted lands. He is said to be a public benefactor, who makes two spears of grass grow where only one grew before. We do even more when we stock our worn-out pastures with sheep. The sheep indiscriminately crops every weed, shrub or bush—save the Canada thistle, which is rather promoted than retarded in the sheep pasture—these wild bushes soon give place to clover and the finer grasses.

To the question—"What is the best method of reclaiming exhausted lands?" We have in the Agricultural Report of 1857, the answers of five correspondents, all to the same import, which may be summed up in the comprehensive reply of one of them—"turn it out to sheep." On this subject one writer says: "Experience shows that sheep walks instead of becoming exhausted, uniformly grow better and more productive; and one of the most effectual means of destroying the bushes and mosses, and bringing back the sweet grasses to an exhausted pasture, is to turn upon it a flock of sheep."

Another writes: "I have seen pastures that had become almost worthless, but now green and smiling as a lawn, with every inch among the rocks covered with the richest pasture grasses, and not a blackberry vine, wild rose bush, mullen, or other useless plant in sight—all from feeding sheep upon it."

As early as 1850, in the infancy of sheep husbandry in Maine, Hon. Wm. R. Flint of Anson, as reported in the Patent Office Report of 1851, wrote: "Sheep are peculiarly adapted by their habits, to render important services as pioneers to the plow, reducing, in a few seasons, lands that have been mortgaged to weeds and briars, to arable fields, and while doing so, thrive so that their sides will stick out with fatness; or will scale the rough hill-sides, and glean food where the implements of husbandry are useless. They invariably leave a pasture better for having been kept in it. An old sheep pasture that can be plowed may be looked upon as but one step from a well-filled granary."

There seems but one opinion among farmers on this point. All agree that sheep are no mean renovaters of worn-out grounds, and moreover it is believed that a pasture full stocked with cows or other neat cattle, will carry the same number of sheep without detriment to either, and with benefit to the pasture. Sheep-raising for mutton is so little known in the agricultural districts of Maine, that no data exists on which to estimate the profit if any; but our reports all agree that in the vicinity of a good market, mutton-raising pays well. The *United States Economist* says: "In Illinois and other parts of the West, where corn is raised in such quantities that it is at times used for fuel, the Leicester and Cotswold sheep would pay a large profit to the grower, if raised for mutton alone, leaving out of the account the value of the fleece; but the largest profit in growing of sheep in our country, is realised on the clip. It is estimated in all sheep-growing countries that the increase of the flock will fully offset the cost of keeping, so that the clip is clear profit." In Maine, mutton is coming into more general use, and will, as it ought, become *the* meat for family use, at no distant day. It is the most wholesome, nutritious, and cheapest of meats.

The Merino seems to be accepted as the best adapted to wool-growing, while it is conceded that the coarser wool breeds are preferable for mutton. The Genesee *Farmer* speaking of the different breeds, says: "The advantages of the Merino are; 1st, they produce more wool for the food consumed; and 2d, their wool usually commands a much higher price. The advantages of the long-wooled sheep are: 1st, they afford more mutton for the food consumed; and 2d, the mutton usually brings a much higher price. Under ordinary circumstances it is not easy to determine which of these two classes of sheep are, on the whole, most profitable. It depends much on the character of the soil, on the location, the system of agriculture, the proximity to market, and on the taste of the breeder. Other things being equal, sheep undoubtedly consume food in proportion to their live weight; and as long-wooled sheep are nearly double the size of Merinos, and as they do not yield double the amount of wool, it follows that, leaving the mutton out of the question, a pound of wool cannot be produced from the long-wooled sheep as cheaply as from the Merino." There can be no doubt of the truth of this proposition, if it is a fact—which we think will not be denied—that fine-wooled sheep, in proportion to their live weight, produce more wool than the large, long-wooled mutton sheep.

Hon. Wm. R. Flint, when a member of this Board, made a report on sheep, in which he says: "From numerous experiments for a course of years, as well as from more recent inquiries and investigations, they have come to the conclusion that for all purposes of sheep culture and wool growing, the Spanish Merino of the early importations—improved and kept free from all crosses of the Natives, Dishleys, South Downs, Cotswold, French or anything else—possess the most desirable qualities of any sheep in this country. Their herding habits are so fixed that much larger flocks may be kept together than of any other sheep, without degenerating; requiring much less food for summer or winter, and being easily secured in pastures or enclosures. Whatever qualities these sheep possessed when first imported, they have now become thoroughly acclimated; being improved in constitution, in form and size, as well as in weight and fineness of their fleeces. Their wool being more closely packed over the whole body, and furnished with abundant oily secretions, the animal is thoroughly protected from the sudden changes of the weather in our climate, and hence are more healthy."

Mr. Flint also writes to the Commissioner of Patents, December, 1850, that "if the raising of wool be paramount, the Merino is superior to all others introduced among us. They will grow more wool from the same weight of sheep, will eat a greater variety of vegetables, are more peaceable, therefore requiring less watching to keep them within enclosures; and taking all the items of expense and care into consideration, will produce wool as cheap per pound as any of the coarser breeds."

Mr. H. S. Randall of New York, says in a communication to the Commissioner of Patents, that "for wool-growing purposes, there is but one breed in the world entitled to a moment's consideration—this is the Merino."

The care and management of sheep requires special attention; but the practice of sheep-growers is so varied, and in the opinion of each, his own the best way, than any attempt to lay down any fixed rule, would be only an expose of one's own method. There are, however, some general rules that may be considered essential by all—regular feed and plenty of it, warm shelter in storms and cold weather; well ventilated sheep barns or sheds with yards opening to the South, if possible; room for free exercise; plenty of running water and an occasional feed of roots are among the essentials. The matter of feeding differs among farmers—some feeding two, some three, and some four times a day, as by the statements noted above.

A correspondent of the *Maine Farmer*, who signs, "W," gives his method as follows; "Three fodderings a day for sheep is thought to be enough, and some feed only twice. Their lightest meal should be in the morning, and heaviest one at night, when every sheep should be well filled out. Don't feed too early in the morning nor too late at night—they want daylight to eat by."

A Vermont sheep-grower writes to the Genesee *Farmer*: "Some farmers appear to think that a flock of sheep will do better if foddered three times a day. Sheep fed three times a day are not as hearty as if fed only twice; besides they waste a great deal of hay. Sheep should not be disturbed until sunrise on a cold frosty morning, and then fed some good hay and a little grain. Give them all the water they will drink during the day, and feed again at three o'clock in the afternoon. By the time it is dark, they have eaten and drank enough, and are ready to lie down and rest until the next morning."

The feeding crib or sheep-rack in common use in Somerset County, is made by setting uprights of common joist, three feet long, at each corner, giving the desired length, and three feet apart for the width; and if over twelve feet long, one upright between on each side. Nail a six-inch board lengthwise and across the ends of these, the lower edge eight or twelve inches from the lower end of the uprights. Make a bottom for the crib even with the lower edge of this board, four or five inches crowning in the centre; to the top of the uprights nail another six-inch board lengthwise, and across one end if to set against the feeding floor: if not, across both ends. From a line on the bottom nine inches from the outside, nail upright strips seven inches wide and seven inches apart to the top boards on each side and end, and you have a sheep-rack of any designed length, a foot and a half wide on the bottom, and three feet wide at the top, with seven-inch feeding space and seven inches between, and a box or trough outside the upright strips to catch the chaff and seed, and to feed grain and roots.

But plenty of feed is the secret of success after all. Dr. Dadd, in the *Prairie Farmer* says: "The only way to prevent grub in the head of sheep is to put plenty of "grub" into the stomach of the animal; and it is a well-known fact that sheep properly attended to, well fed and housed, are never troubled with the parasite known as the grub." Almost the only sheep disease now known in northern Maine, is the foot-rot. At first this created quite an excitement, and produced great alarm among our flock-masters; but they have got bravely over the panic and now think themselves masters of the situation. After trial of nearly all the remedies recommended in the books, they use simply a solution of spirits turpentine and blue vitrol. As soon as the sheep is discovered to favor the foot, draw a small cord briskly between the hoofs a few times, apply the wash and the thing is done—so say our sheep farmers.

Ventilation is indispensable in the sheep barn. No flock can escape disease and thrive, cooped up in a 7x9 close pen. Exercise is equally indispensable to the health and thrift of the sheep. They are naturally a roaming animal; in native sheep countries, driven over mountains and through valley and plain to grub their subsistence. Want of this or of some kind of exercise, is frequently the cause of diseased flocks. Give the sheep frequent exercise, good clean, airy shelter, plenty of feed and pure running water, and they will look sleek and fat, and pay well for all these.

But the price of wool has ruled so low, and the market so depressed the past year, that there is a strong disposition among farmers to "sell out." Is this good policy? We think not. We believe a comparison, even now, with the price of the products of the diary, will show that the price of wool is as well sustained as these. Let the husbandman bear a steady hand in this as in all other husbandry, and he will ultimately be crowned with success.

ALBERT MOORE, *Somerset Co.*

Mr. Dike of Sagadahoc, presented an *ad interim* report on Bee Culture, which was adopted without dissent—as follows:

Bee Culture.

The honey bee has been known from remote antiquity. It is several times mentioned in the books of the Old Testament. Herodotus mentions the bee. Cicero and Pliny refer to one philosopher who devoted sixty years to the study of the bee. A large number of books have been written to promote the knowledge of the bee, and increase its usefulness to men. Its instincts, its industry and its sweet products, have engaged for it universal attention. The naturalist, the agriculturist and the politician, have been earnest students of its mode of life and habits. The ancient Essenes, a sect of the Jews, the monks of that age of the world, who sought a quiet retreat from the corruptions and conflicts of the world in the solitudes of the western side of the Holy Land, occupied a portion of their time in the delightful employment of cultivating the honey bee. And Virgil devotes a portion of that poem which is the most finished of all his works, the Georgics, to the discussion of the subject of Bee Culture. He shows what place on the farm is most proper for the bee hive, when they gather their honey, how to call them home when they swarm, describes their battles, and their politic administration of affairs, and at last lays down the ancient method of replacing them when the race is destroyed or lost. This account of the generation of bees, is of course exploded in modern discoveries; but it was then the common opinion of learned men—Aristotle and Pliny both refer to it.

What an attractive creature the bee has always been considered. The sweet product of its industry has been sought for and used among all the most cultivated nations. "What is sweeter than honey?" And in Divine Prophecy it is said of Him who was to come into the world for its redemption and salvation, that "butter and honey shall he eat." And when a blessed state of mankind is foretold, it is described under the symbol of "a land flowing with milk and honey." And what a tiny insect it is that collects and stores the sweet honey; and how many practical lessons this little insect will teach us, if we are humble and wise enough to learn them. They live in societies as man does. And what a perfect government is theirs. It is purely a government of love and usefulness. The queen* is the mother of all her people, and her life is devoted to their services; and they show to her a correspondent regard and respect. If the queen be destroyed, and the workers have no prospect of obtaining another, they become inactive and lose their instincts. She appears to be the very soul of all their actions, and the centre of their instincts. When deprived of her, or of the means of replacing her, they lose their activity and pursue no longer their daily labors. In vain the flowers tempt them with their nectar and ambrosial dust; they collect neither, elaborate no wax, build no cells—indeed would soon perish, were not the means of restoring their monarch put within their reach.

The bee is the pattern of diligence. No human society on earth can be found more industrious, than that little organized society in every healthy hive. And then the instinct which guides them—what a wonderful power! a power bespeaking the nearness and constant presence of a power near and over us all. What skill it gives them in the construction of their cells. As these are formed of wax, not easily produced, it is important that as little as possible of such a precious material should be used. So the bees in making their cells, solve the difficult geometrical problem of building cells to use the least quantity of wax, and of a form occupying the least possible space. And every part of the problem is practically solved. If the cells had been cylindrical, a form seemingly so well adapted to the shape of the bee, they would not have economically used the space. If they were square or triangular, a greater quantity of wax would be needed to make

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*The queen was anciently called king, and was supposed to be of the masculine gender. Virgil speaks of the *kings* of colonies of bees.

them. Both of these difficulties are obviated by adopting the form of the hexagon, which is admirably suited to the shape of the insect, and economy of shape and material. It is asked, whence such an instinct, and how they come to have it? I answer, it flows unto them from above; and the activity of that affection, the love of procreating their race, incites in them the activity of their instincts. Their instincts are, in fact, the development of their affection and the means of its accomplishment. We see from the loss of the queen, the source of their instinct while she is with them. The affection of producing their young and providing for them, animates and gives them their instincts to carry it out. They do not, like man, exercise a choice of means, and debate between the best and next best means, for they see only the best. They possess therefore in themselves, resources suited to changes of circumstances; and are thus often led to act as if they had the power of reasoning, but it is only instinct.

A life time may be spent in investigating the mysteries which are hidden in the bee-hive—in studying their marvellous instincts, and the wonderful life they live, and then many of the secrets would still lie undiscovered. We have just above alluded to the wonderful mathematical problem which they solve; but the changes which the honey undergoes is a matter of as great interest to the chemist. Fresh honey is a clear yellow syrup, without a trace of solid sugar; but after it is strained and exposed to the atmosphere, it gradually begins to crystalize—or candies, as people say—and finally becomes a solid lump of sugar. Now it has been lately discovered that this change is due to the action of the sunlight. The same agent which alters the molecular arrangement of the iodide of silver on the excited collodion plate, and determines the formation of crystals of camphor and iodine in a bottle, causes the syrupy honey to assume a crystaline form. M. Scheibler enclosed honey in stoppered flasks, some of which he kept in perfect darkness, while others were exposed to the light. The invariable result has been that the portions exposed to the light rapidly crystalized, while those kept in the dark remained perfectly liquid. Now the bees have to obviate this difficulty, the effect of sunlight on their honey, otherwise it will soon become ruined for their own use or that of their young. The very existence of their young depends on the liquidity of the honey presented to them.* To obviate this difficulty, they work in their

*Honey was anciently called *ærial*, being supposed by Aristotle and others of the ancients, to come from the dews engendered in the air. Hence the term *honey dew*.

hives in perfect darkness. They are obliged to do so. If light were allowed access, the honey would gradually acquire more or less solid consistency, seal up the cells, and in all probability prove fatal to all the inmates of the hive *. So their discoveries in chemistry are equal to those in mathematics. In both, they are guided by the same power from above.

The question must by this time, be forcing itself on our minds, for what is such a wonderful little insect made in our world? Surely it was made to be useful—like all the things which God has made, each one has its use. If we go out into the fields and pastures on a bright summer day, when Nature is clothed in all her beauty, and the flowers are expanding and filling the air with their fragrance, and examine minutely enough these flowers, we shall find a set of vessels have been pouring into the cup or nectary of each one of the millions of flowers which deck the earth, a minute portion of honey. The bee is made to perform the use of collecting this honey and depositing it in the hive, where a portion of it can be taken for the service of men. The honey is made in such minute quantities, that it will hardly seem at first as if it was worth while to collect it. Why not let it spend all its fragrance on the air? Not so thought our good Father above, and so he made the bee to collect it; for he suffers nothing to be wasted in all his vast domain. In this way the honey can be converted into use, and millions on millions of these tiny little insects can enjoy the pleasure and happiness of a brief, but most industrious life. But it was foreseen by the all-wise Father, that the bee could be made to subserve another use in the animal economy while it is on its daily excursions, collecting honey.—Vegetable Physiology teaches us that the stamens and pistils of flowers answer to the different organs of the two sexes in animals. The pistil is connected with the ovaries, the stamens furnish the pollen, which must come in contact with the pistil—in other words it must be impregnated from the dust of the stamens, or no fruit will be produced. A field of wheat produces long, slender stalks, which bend to the influence of the breeze, and one ear shakes its pollen on a neighboring one at some distance. So in a field of corn, the upright stalk bearing the stamens, some feet above the pistils, drops the pollen on the ears below. And the winds come and waft the abundant pollen rods distant from the producing

* See "Chronicle of Optics," in the Quarterly Journal of Science, for the above statement of the reason why bees work in the dark.

stalk, and fertilizes the distant ear, as is proved from the different varieties mixing at so great distances. Now the bees are not wanted in such cases as these. Other agencies can do the work. But the case is different in multitudes of small flowers and vines which trail along the earth. The winds cannot be made to do this work here; but the little bees can do it, in their constant visits, as well as not. So their little bodies are made in such a rough and hairy manner, that when they enter the flower in quest of honey, they cannot help shaking off and carrying away more or less of the pollen, and leaving a portion on the pistil of some distant flower. They want themselves, both the honey and pollen. Each flower secretes but little, just enough for the attraction of the bee. Nothing like a full load is obtained from one flower; were it so, the end would not be answered. A hundred or more flowers are visited in one excursion. The pollen of the first flower visited will fertilize many, previous to the return of the bee to the hive—thus the field of buckwheat is kept in health and vigor by the visits of the bee, and breeding in and in, the farmer's dread is totally prevented. And so needful is the bee among our vines, that it has been inferred by many that if it were not for these visits, the uncertainty of a crop, from non-fertilization, would render the cultivation of them useless.

Have we ever duly considered how useful to us all is the bee, in addition to the value and profit of its products in the hive? I have no doubt that if bee culture were much more general in our State than it is at present, it would add much to our knowledge, pleasure and profit. Among all the stock which we keep on our farms, the honey bee can be kept in the cheapest manner, and yields the most profit in proportion to the expenses of keeping. She works for nothing, and finds herself. All she requires is a proper hive, where she may deposit her precious treasure, and a cheap, comfortable home or shelter in winter, and a little assistance from man to protect her against her enemies. The succession of flowers through the season, affords rich and ample pasturage for the bees. Though the amount of honey in a single flower is very small, yet when the whole product of the season has been gathered, it will be found to be immensely great. Only a small portion of the whole is now saved and stored. Any ordinary sized farm will support several colonies, and in locations where red and white clover, mignionette, buckwheat and other flowers whose yield of honey is large, abound, the stock of bees kept may be increased. I think there is no location in our country which is not capable of supporting a good sized apiary, and if well managed, it will pay the owner a good dividend.

Probably one reason why so few have engaged in keeping bees, has arisen from the prevalent notion that the success and profit are merely a matter of luck or chance. But it is now a well settled conviction among all intelligent apiarians, that success in this, as in every other business, depends chiefly on the proper management of the bees. There will of course, be larger products some seasons than others; it is so with almost every crop we raise on our farms. An extremely wet, or extremely dry season is generally less favorable to the largest field of honey, than one between the two extremes. But a healthy stock of bees will do something for its owner every year; if he takes good care of them, they will repay him. If he attempts the culture of bees and depends entirely upon luck for success, he will be likely to fail. He may be prosperous for one or more seasons, but failure in the end is pretty sure to come. So if he attempts to raise corn, wheat or barley, or any other crop, and depends entirely on luck, he will soon fail in these crops. Wise, careful, proper management, is the only sure road to success. Procure good hives, keep the colonies strong and vigorous, see your bees often, look into the hives, watch for the enemies and destroy them, and you may reasonably expect a large return for your labor. When men have learned to manage the bees aright, and keep them in sufficiently large numbers to collect all the honey which our Maker distributes in the flowers throughout our land, hundreds of pounds will be raised where one is raised now.

Another reason why many are reluctant to keep bees, is on account of the little weapon with which they are armed, and the great freedom with which they use it on most of those who approach them. Now we would not deprive them of their only means of defence, if we could; for if so, a thousand lazy depredators, including men, would prey upon the products of their industry, and leave them to starve; and the whole race of this industrious insect would soon become extinct. The better way to get along with their irritable tempers, is to learn to treat them well. They are like some men in this world—easily managed, when one knows how; but irritable and pugnacious and passionate, and easily provoked to use their means of defence, and exceedingly difficult to live with on peaceable terms, when one does not understand their character or know how to manage them. But it is worth while for us who live in this world, to learn how to get along comfortably with all the varieties of character which we meet. And we can learn a lesson in the treatment of the bee. The less fear we have of them, the better we can deal with them. Then we can be calm and quiet in our motions, and can move among them and soon seem to handle them without provoking or disturbing them at all.

The bee is endowed with the keenest sense of smell, and there are some persons whom they seem to utterly dislike. As soon as such persons approach them, they rush at them and attack them without mercy, and drive them away. I have seen them do this when I was moving among them unnoticed. The breath of a person, especially inside of the hive, is offensive to them. I suppose there is a peculiar odor attendant on every person, and their sense of smell is so keen that they instinctively form their likes and dislikes. I have never seen my horse, when in perspiration from labor in the field, come near the hive without being stung; and when I have come up from the field in a perspiration, I have fancied they did not like me as well as at other times. I have no doubt that the free use of soap and water over the whole person, has something to do with making a man attractive to his bees, as well as to people generally with whom he holds intercourse. I am inclined to think that there are very few, who cannot learn to treat bees so well that they can manage them without any serious difficulty. It is only in and around the hive that we have any difficulty with the irascible tempers of bees. Those who do not like too close personal intercourse with them, and are not ready to put implicit confidence in them, and withal still retain a slight fear of the unmerciful use of their weapon, may easily protect themselves, so that they may visit their hives with entire impunity.

Bees have a great aversion to tobacco smoke. The pipe or cigar is convenient among the bees; but as I do not advise any one to use either, it is better to get a tube eight or ten inches long, and half an inch in diameter, fill this with tobacco and ignite it, and by blowing this you keep the tobacco burning, and throw the smoke from the other end into the hive. Armed with this weapon, any man may subdue the combative propensities of his bees, render them harmless, turn their anger into submission, and do what he pleases in their hives or with their treasures.

I have seen and will here quote a description of another method of protection, adopted by Mr. Bradley, a successful apiarian in Lee, Mass. He makes his protector of common black coarse bobbinet lace, which draws down over the face and neck. Two yards long and three-fourths of a yard wide, is sufficient to make one, the piece being cut in two, and the edges of the two halves or pieces being sewn together in the form of a common grain bag without a bottom. A piece of small twine, a yard long, is then run into one end of this bag-shaped protector, so that it draws up like a lady's work-bag. The crown and rim of the hat will keep the meshes of this lace protector from coming in contact with the face or neck, while the string will close the lower end round the chest. The whole will cost about fifty cents. This is better than the gauze wire protectors. A common pair of leather gloves completes the armament, though Mr. B. "handles them without gloves."

In going about and examining into the condition of his hives, Mr. B. uses a dry piece of rotten hard wood, such as is usually called punk. Punk burns slowly and steadily, without a blaze, but with smoke enough to fumigate a ship. With this little piece in hand, he blows a little smoke into the hive through the entrance. This should always be done in warm weather, before raising the top of the hive to look under, or to examine for moths. It has the effect to frighten the inmates, or at any rate to astonish them so much as to throw them off their guard, so that he can handle or do anything with them with perfect safety, by being gentle and careful. This mode of smoking is always used in removing the honey boxes or surplus honey from the top of the hives. "On all occasions, in fact," says Mr. B., "in your operations with your bees, use this smoke. It is perfectly harmless—a single good smart blowing on the lighted punk, is quite sufficient to prevent all nervousness on the part of the bees, and it is astonishing to see with what perfect freedom they can be handled, and with what affectionate docility they climb and crawl, in great numbers, over the master's hands."

I will here allude to the Italian bees, not for the purpose of expressing any preference for either one over the other, but rather to provoke discussion, and call forth the experience and preference of others. Some are much prejudiced against the Italian bee, and others are as thoroughly in their favor. Mr. B., to whom I have alluded above, has thirty or forty swarms of Italian bees, which he has kept some four years, and considers them superior in several particulars, to our common black bees. In the first place, they are more industrious. In proof of this, he states that, in the spring of 1863, he carried nine swarms of common bees, all strong and healthy, and one small swarm of Italian bees, about twelve miles from his own apiary. It proved a very unfavorable honey season in that location, during the whole summer. The result was, that the nine swarms of common bees made seven boxes of surplus honey, and cast seven young swarms. The swarm of Italians made one box surplus honey, cast one swarm, which filled its hive and one box surplus, and also cast a swarm. All these swarms of Italians wintered well without feeding, while three or four of the common swarms required to be fed, to get them through the winter. In the spring of 1864, he carried two swarms of Italians about three miles from his home apiary, and made them into non-swarming hives. From the two swarms of common bees he took one hundred and six pounds of surplus honey, while from the two swarms of Italians, he took two hundred and three pounds.

In the second place, the pure Italians are less inclined to sting—so much less, that they can be handled almost with impunity, without fear of their sting. The reason why so many bee-keepers are prejudiced against the Italian bees, on account, as they say, of their being so irritable, is that they have got "hybrids," or half-blood queens, which have been sent to them perhaps for *pure* Italians, and they do not answer the recommendations. They consequently discard them without a fair trial. The progeny of these half-blood queens are more irritable than the common bee, though in most other respects they have the characteristics of the pure Italians. In the third place, they are more prolific, and swarm earlier and more frequently. They are stronger, more courageous and active in self defence against other bees, and are seldom robbed; while on the other hand, they are not inclined to rob other swarms.*.

In a letter just received from R. D. Paul, enclosing an advertisement of Italian bees for sale, he says, "after having twenty-five years experience in bee culture, and having proved the superiority

* See Thirteenth Annual Report of the Massachusetts Board of Agriculture for 1865.

of the Italian over the native bee," &c. I do not know how long he has kept the Italian bees, but he seems convinced that they are superior to the common bee. And the experience and testimony of Mr. B. of Lee, Mass, are certainly worthy of serious consideration.

Without referring to any of the patent hives, or expressing any preference for one over the other, it may be enough in this paper to say, that it is not difficult for any person to make a hive at a small expense, with a box attached on the top, capable of holding twenty-five pounds or so of honey, which will answer all ordinary purposes for the common farmer. The hive should be neither too large nor too small. A good size is about thirteen inches square by fifteen inches deep. The box may be of the same size of the hive, by about five inches deep, made wholly of wood, or with glass sides, according to the preference of the bee-keeper. Two or three holes, more or less, an inch square, should be made in the top of the hive, and corresponding ones in the box, through which the bees enter to work in the box. If any one desires to have annually a moderate quantity of honey—forty or fifty pounds, with little trouble, and does not care to increase his stock of bees, or to spend much care or thought on the matter, he may build a small house—four feet by six, or such size as he chooses, and place a healthy hive in it, and the chief part of his expense and trouble is done. If this room is kept dark, no swarm will be sent out from year to year; and the number of bees in the hive will continue about the same for a period of several years. I have kept a hive in this manner more than ten years, and the bees still appear to be in a healthy, thriving condition. The last year, they made about thirty pounds of honey; the previous year five pounds. Some seasons they have made less, when the season was unfavorable, and one or more seasons, upwards of a hundred pounds. Of course there is much less profit in keeping non swarming hives. With good success, at the end of ten years, a non swarming hive will be of the same value as at the beginning. The annual produce of honey will be the only profit. While a swarming hive will send forth a new swarm usually every season, sometimes two swarms, at the end of ten years the product arising both from the honey and numerous colonies, will be very much in excess over the non swarmers.

It is coming to be the general opinion among intelligent bee-keepers, that it is better to keep bees during the winter, in a house. The bee is warm blooded, and requires food and air to generate caloric, like the ox, cow and sheep. So the warmer they are kept, the more quiet they are, the less food they consume, and the more healthy they will be in the spring. A dry, dark room, tight and warm, with some means of ventilation, is the best place to winter them. Mr. Quinby recommends placing the hives on shelves, bottom upwards, thus affording the proper ventilation. Mr. Bradley adopts a similar method. His winter apiary is a dark shed, lined on the inside with straw, to which he removes his swarms when winter sets in, and where they are kept till spring. He adds, "it is not desirable to attempt wintering swarms that you do not know to be strong, free from all disease, and have plenty of honey. It is from such swarms that we get our profits, and they require the best care, and will winter under most any circumstances—even in the open air without any protection. So will a strong, healthy cow winter by a hay stack, with nothing more for a protection; but would it not be best, after all, for the hay and cow both, to be in a warm barn? So in regard to bees. They will winter enough better in a room or house prepared for the purpose, to pay all extra expense and trouble, and ten *times* more." Proper care and management bestowed on bees, the highest culture, make them exceedingly profitable. One colony increases in the course of some ten years to about five hundred, where they cast swarms every season. These will produce, say a thousand dollars worth of surplus honey. Is not this a profitable investment? Where can the farmer make a better one? Where else does so small an investment bring such results?

To the lover of Nature, of natural science, natural history, the bee affords an interesting subject of study and investigation, teaches some instructive lessons, and thus furnishes food for thought and gratification for the mind. Our Creator has endowed us with the love of knowing something about his wonderful works that surround us on every side in this world. It is right that we should cultivate this love, and become acquainted, as far as we can, with his marvellous doings, wrought so continually before our eyes. How many wonderful mysteries are concentrated in the little colony of bees. There comes to mind the song of our childhood:

"How doth the little busy bee
Improve each shining hour,
And gather honey all the day
From every opening flower."

Let us learn to imitate the industry of the bee, her carefulness, wonderful skill, forethought, the order and good government over all our concerns, in our higher life, and it will be well with us.

Mr. Wasson presented the following:

The Farmer's Road to Success.

Success is a hard fact. It comes only inch by inch. Untiring labor, prudence and economy are the pillars of its structure. Five in every hundred of those who enter commercial life, and one in every thirty engaged in lumbering may find it, after years of tug and toil. Agriculture presents no such forbidding aspect. It is true, that but few farmers become suddenly rich, and it is also true, that where farming has passed its transition state into that of a well defined system, founded on a basis of correct principles which govern practice, few remain poor; and when the agriculture of the whole State is thus reduced to a system, it will not be classified as an unprofitable occupation. It is an old maxim, that "necessity is the mother of invention." *That* necessity is upon the farmers of Maine. A necessity for a system of farming, or for a bettering of that system, to overcome that *hard fact* of success.

A variety of causes have combined to strike out the wheat crop from the list of our staple products. We turn as naturally to the West for our bread, as toward our houses to find our homes. Each year is increasing the distance to mill. Each year the wheat and corn bin is found another remove nearer the Rocky Mountains. Each year is increasing the cost of transportation in steady ratio, each adding its quota to help swell the cost, until the prices of corn and flour have reached an almost unheard of figure. But a worse feature of the case is, that a review of the market shows no gleam of hope for a reduction of prices in years to come. What a prospect before us! The flour brought from the West is estimated at a cost of $8,557,500; the corn imported, $4,277,500; the butter and cheese at $1,500,000; oats, rye and buckwheat, at $500,000—making a sum total of $14,835,000. We disclaim any intention of piling up extravagant estimates to fortify a position. The truth, pruned to the trunk, is enough. Our freight trains, steamboats, lines of packets and numerous coasters, with their cargoes of corn and flour, plying their vocation with all the industry of the bee or ant, tell enough of stubborn facts, without the aid of fiction.

Has the sterility of our soil, or has the sterility of our culture created this enormous importation? If attributable to the barrenness of our soil, our precepts are proverbs to delude us, our practice examples of probity of conduct, which evince more of sincerity than sanity. Taking it for granted that our system is defective, that we have become blinded to our true interests, we may rid ourselves of this excessive burden by producing what we purchase, and simply by enacting a higher grade of farming. What has been achieved across the water, may in the same way be achieved on this side of the Atlantic.

The soil of England, which had been cultivated for a thousand years or more before Columbus sailed on his voyage of discovery, is now yielding three fold more than at some former periods. The same is true of Saxony, Bavaria and others of the German States. What the hand of man did there, the hand of man may do here. Turn to the Genesee valley—the granary of the West in the days of our boyhood—what the hand of man has done here, has been repeated there; till their handiwork like ours, has plucked the very elements of fertility from the soil, sifted out and sold the ash-constituents of wheat and corn—a process westward in its course, prosecuted with an unsparing hand, till the width of continent is spanned, and standing on the banks of the placid Pacific, we look in vain across its almost illimitable bounds for other virgin soils to rob. Hard facts are these, varnish or gild them as you may. What is to be done? That our soil and climate are as capable of producing wheat and cereals generally as any other part of British America, there can be but little doubt. That success in farming in Maine is as accessible to us as to those States of Europe where shines the same northern sun, or blows the same Arctic winds, science and observation have determined.

The time has come which calls loudly for a reform, Each day's delay augments the necessity. No longer can we put off the hour when we must learn to farm better, or learn to live poorer, when we must measure out more manure to our farms, or measure out less bread to our families. A radical change must arise from the ashes of a consumed conservatism. To inaugurate a reform, we must first stop that culpable waste of our manure heaps, five-sevenths of which may now be shedding its fragrance on the desert air. Farmers may expatiate on the misery which is to follow when thrown on their own resources; but we see no reason why such a course of events must be deprecated—indeed, we fail to see why such a course is not the most to be desired.

In France, from 1820 to 1850, the cultivated area has increased fifty per cent., whilst the produce has doubled itself. In Great Britain, the increase in the average yield of wheat per acre has been forty per cent. in eighty years, or from 1770 to 1850. Subsequent to 1850, the law-makers of England, losing sight of their own dear selves in that of the interests of the country, repealed or modified the corn laws. Would that American legislators, seized with the same kind of infatuation, so far at least as to occasionally remember that their constituents too, have rights, to be regarded and protected. The result of such English legislation was that the average yield per acre, aided by an improved method of farming, extension of drainage and artificial manure, raised it to a higher figure than ever attained before—that of twenty-seven bushels in England, Wales and Scotland, and twenty-five bushels in Ireland. In Switzerland, Holland and Bavaria, where they have learned what we must learn, how to economise resources, the soil is made to double its capacity. The same is true of the older countries, China and Japan. ·The same will be true in Maine, when her farmers revise the order of things—when the making and saving of manure shall become the rule rather than the exception, when instead of preparing the seed-bed and guessing as to the amount of crop, the soil will be stinted and forced up to the limit. English agriculturists to accomplish this, explored the caves of India, the battle-fields of Europe, the coasts of Africa and the islands of the Pacific, for elements of fertility. Let the farmers of Maine emulate the example of their English cousins in this regard, fix the average yield at a high standard, and when the resources of our own farms are exhausted in the trial, call to our aid artificial and commercial fertilizers; not from India, Europe, Africa or the Pacific, but from Cumberland and Hancock, Lubec and Rockland. We can let the world alone, and procure for the wants of our farmers an ample supply of phosphates, guano, gypsum and lime, to meet every exigency in the case.

Is some commercial fertilizer wanted, with its phosphate and nitrogen, to exert a vigorous influence upon the growth of plants, a fertilizer that can be recommended to the farmer who does not wish to spend his money foolishly, who would buy that which is trust worthy, guaranteed by a previous chemical examination? He can buy it of the Cumberland Bone Company. *En passant.*

Should these words of mine ever fall upon the ears of the managers of that establishment, I would say to them, if their purpose is immutably fixed to send out only a pure article, free from worthless adulterations, if what has been put into the market are but samples of that which is to follow, I very much misconceive the shrewdness of our farmers, if they fail to appreciate its value. If a fertilizer is wanted, one exceedingly and quickly efficacious, chiefly ammoniacal, we have it in fish guano, or porgy chum. Have we a soil rich in the insoluble elements of fertility, lime is the agent to liberate and set them free. Is an agent sought to bind and retain the volatile, winged or golden virtues of our manure-heaps, gypsum is that agent, working silently and too often without recognition or commendation.

With such potent auxiliaries at command to strengthen and enliven the home-made food for our plants, with a saving of all the voidings, liquid and solid, in and around our barns and buildings, and a judicious application of them to supply the wants of vegetation, we may defy both exhaustion and starvation, improve and elevate the standard of farming, till every farmer shall have learned that if we would here reap abundantly, we must manure abundantly. This, and this alone, is the farmer's road to success.

Samuel Wasson, *Hancock Co.*

Mr. French, retiring member from Franklin County, contributed the following paper:

The Application of Manure.

Much has been said, and much written upon this subject, and yet the farmer asks, "What is the best method for applying manure—whether on the surface or under the turf, in a green or a rotted state?" It has never been satisfactorily determined in what way precisely manures act in stimulating the growth of plants, and hence agriculturists have differed widely in their methods, the practice of one class being based upon a gaseous theory, which buries the manurial agent deep in the earth, presuming that in process of time its odoriferous particles will be snuffed up by the plant that grows above it, and, as the other extreme, there have been advocates of an entire application on the surface, basing their argument upon what they term the "natural method." We are not going to take issue directly with either of these theories, more than to say we do not think the arguments adduced sustain the premises, but wish to present some thoughts of our own, suggested by observation and experience.

Every farmer has learned by his own experience that old, well rotted manure—and to a certain degree the older the better—is better suited for an immediate crop, than fresh or green manure as it is termed; but observation teaches him that in passing through a state of fermentation, so necessary to prepare it for immediate use, there is a partial loss of some elements esteemed to be of great value among manurial forces. The question naturally arises, shall I wait till my manure is ripe for use and a part of it dissipated in the air, or shall I apply it immediately and let it ripen in the ground with slower results? So far as our experience teaches us, the crops we raise and the ultimate object of our cultivation must determine our method of application. Every farmer or cultivator is presumed to know his own business—what he is to realize immediately, what he is to expect prospectively. We believe it may be safely laid down as a rule, that when manuring for general purposes, the manure should be applied in a fresh state or nearly so, if it is simply manure unmixed with straw or refuse, and thoroughly incorporated with the surface soil. Just here is where the essential part of the process is left out, and because of the difficulty in doing it satisfactorily many plow it under, at once, where a large part of it remains till the next plowing. We are aware there is great difficulty in working in barnyard manure unless it has been allowed to freeze in the winter, but with the coulter harrow and cultivator, and worked on a newly-turned or moist soil, it is soon accomplished and well repays the trouble. We attach a good deal of importance to the advantage that is derived from freezing, and if possible, would have all the manure that is to be used in the spring frozen during the winter. It is not only more easily worked, but is in a better condition to forward the growth of crops, as we have repeatedly proved in the fall preparation of land for sowing—realizing so far as we could observe, very nearly the same advantages where the land was only made ready by splitting open the corn rows and spreading on the manure before winter, as where fully prepared by plowing.

It is objected by those opposed to surface manuring, that what remains unmixed with the soil is dried up by the sun and is useless. We must take issue on this point, and without claiming anything for the argument that surface manuring is the natural method, for nature mulches first, and carries on the manuring process beneath the annual covering of cast-off foliage, we will put forth the opinion or theory for the consideration of our agricultural friends, that the sun, instead of destroying the value of manure that is left or dropped on the surface, seals it up so effectually as to prevent evaporation, while decomposition takes place within the mass. It is by this method, as it seems to us, that the valuable portions of the excrement of our stock while at pasture are preserved, while decomposition takes place preparatory to the solution and distribution of its nutrient properties by agencies that are ever at work. So far as our observation extends, pastures on which the stock is herded as well as pastured, do not run out, but retain their fertility if kept clean and not allowed to be overrun by bushes and brakes. Especially is this true of pastures and even fields on which sheep are kept, but will not of course hold good of those where cows run and are yarded over night.

Lands in pasture may well be said to be in a natural state and fertilized by natural methods, and this too without the advantage of having their manures incorporated with the surface soil ; but if we were to suppose the manure voided by our animals while grazing was immediately buried eight, ten or twelve inches, the question might well be asked, when may an adequate return be expected ?

Great stress of argument by those in favor of plowing under manures, is laid on the escape of ammonia and other volatile parts of manure, and the loss occasioned thereby. When manures are moved in a high state of fermentation, there is loss occasioned by the escape of nitrogen set free in the heated mass ; but this action soon ceases on exposure to the sun, as is evident from the loss of its pungent odor. We do not consider it longer an open question, as to how plant food is assimilated in vegetable growth, as between the two theories, whether in a liquid or a gaseous form ; but that the elements of nutrition are taken up mainly if not entirely, in some form of solution. This principle seems equally applicable to those elements of a gaseous nature as to the more solid forms, inasmuch as they appear more active in a moist atmosphere than on clear, dry days.

We have so much faith in the practical workings of the views herein expressed, that we have our practice conform to them ; and do not hesitate to recommend that in the general system of farming as pursued among us, the bulk of manure be applied in a fresh state on the surface, and be thoroughly incorporated with the surface soil to a depth not exceeding five or six inches, unless a great quantity be hauled on at a time, when a corresponding depth of earth must be stirred. We deem it better that application be made each year that the land is tilled, rather than all at one time; as by so doing it becomes more evenly distributed through the mould. This method of application does not exclude, but rather includes the use of what old manure the farmer has on hand for the benefit of his grain and hoed crops, because of its immediate availability in increasing the growth of these; and if these be his sole dependence, he will, as a matter of economy and profit, use no other.

Our practice has been for twenty years or more, to break up our green sward either fall or spring—generally in the spring just before planting—spread on green manure at the rate of three cords to the acre when using old manure in the hill, and when not, doubling the above amount spread on. The old manure that is carted out of the yard in the fall, together with the dressing from the hog yard, &c., is applied at the rate of four cords to the acre in the hill. In the spring or fall following, again apply a coat of green manure as at the first, and this time plow under with the seed plow, sowing to wheat or barley, and seeding to grass.

In the spring of 1862, we tried an experiment by way of comparing the two methods generally practiced. Part of a three-acre piece that was to be planted to corn was marked out, and manure of like quality and equal quantity with what was used on the rest of the piece, was spread upon the sward and plowed in eight inches deep. In other respects it was treated like the rest of the piece; but when the corn had attained its growth, this plot could be easily traced out by any one standing where he could look over the corn—it was at least three inches less in height than the rest of the corn, and equally wanting in other respects, on comparison with the rest of the piece. At the time of seeding down it was all manured alike; but a like difference was noticable in the growth of the wheat, and has been more plainly seen in the yield of grass.

In 1865 we repeated the experiment in a different form, this time taking two pieces of ground of equal size and lying side by side, on one of which was spread on the sward and plowed in ten inches deep, all the manure that was to be applied in that manner, and on the other piece, half that amount was spread on the furrow before planting, and the other half before sowing. The effect on the crops was even more marked than in the other case, particularly so in the grass—the difference being discernible for more than a half mile. These two experiments are making positive to me by results, what I fully believed before in my theory and practice.

The application of special manures, and their kind, must be determined by the character of the soil and the ability of the farmer to make present outlay. With a view to test this question, a year ago last May we measured off three half-acres on a corn field that had been similarly treated by a top dressing of green manure, and was to be dunged in the hill from the same heap. The first half-acre was simply manured in the hill; the second had in addition a tablespoonful of plaster dropped on top of the manure; the third a teaspoonful of raw-bone super-phosphate. The difference in the appearance of the plots was noted through the season comparatively. On the part where only the old manure was used, the corn made a good growth; on that where the plaster was applied, it was *very* much better; and where the super-phosphate was put, it appeared the first of the season to be of a ranker growth and darker color; but on harvesting could see but little difference between the effect of this and the plaster, while the difference was very manifest between where these two agencies had been used and where neither was applied.

The past season we continued the experiments with plaster and super-phosphate, but in a more definite manner—taking one acre of ground for each. After the usual dressing of green and old manure, nine-tenths of the rows on one acre were treated with plaster at the rate of two hundred pounds to the acre, one-tenth being left with only the old manure in the hill, and like portions of the other acre were treated with raw-bone super-phosphate at the rate of one hundred pounds to the acre, (or it was intended to be so applied, but being absent at the time it was put on, that figure was not quite reached.) The rows left without either plaster or super-phosphate were through the middle of the piece. The effect of the special manures applied was plainly visible through the season, that where the plaster was put on seeming to be of a ranker growth, but on harvesting, that on the super-phosphate appeared to be better filled out; the yield in both cases being at least one-quarter more, and earlier than where only the old manure was used.

After repeating experiments and observations, we are free to say what in our case we deem the best methods of applying manure, viz.: That the bulk of farm yard manure be spread on fresh from the heap and thoroughly mixed with the soil, there to ripen, using the old manure and such special manures as we may choose for hastening the growth of our special crops.

Accepted, with the following resolve attached—(offered by Mr. CARPENTER of Kennebec :)

Resolved, That so much of the conclusions in the report of the ex-member from Franklin as relates to the application of Plaster, be considered as having only a local value.

E. R. FRENCH, *late member from Franklin Co.*

Mr. Chamberlain of the Maine State Society, presented the following report on

Alsike Clover.

Alsike Clover is a species of clover that reached this country ten years ago, or more. Its name is obtained from the parish of Alsike in Upland, (Sweden.) It is found in a wild state through much of Sweden, also in Norway and Finland. In the present century it has been introduced into cultivation through those northern countries, and is now known as Swedish clover, in England, Scotland, Denmark, Germany and France. It was early distributed to different parts of this State by the Secretary of this Board; but I fear it fell generally into the hands of careless men. Unless it has recently spread in Aroostook beyond the neighborhood where it was highly prized some years ago, it has not yet received much attention anywhere in Maine. The few seeds I received, came after my spring seeding, and in looking for a place to plant them, I saw a rough border by the fence, where I had plowed a recently cleared field—having set the fence nearer the wood than I could work the plow. On this spot I scattered the seed, and worked the ground a little with a hoe.

The clover still holds possession of the spot; and as the field has now been mown several years, it has sometimes been cut in with the hay, in other years cut for seed.

As an experiment, while seeding a field to grass, I sowed one square rod in the middle with Alsike clover. I cut it for seed three years in succession, each crop being a luxuriant one. The grasses then worked in, but the Alsike was still there at the last haying—which was I think, the sixth crop.

Last season I had half an acre of clean Alsike, that attracted much attention from farmers, many estimating it at one and a half tons of hay on the half-acre. I cut it for seed, and think it would rather exceed than fall below the estimate. This was on land that never had received any manure, except with the barley crop in 1866, when the clover was sown, and on the clover in 1867, 100 lbs. of Cumberland Super-Phosphate was sown each year. Having had an opportunity of observing this clover in a small way and by noting it carefully as hay and as a forage for soiling, I can only conclude that it is a plant admirably adapted to this State, and one possessing so many excellent qualities as to render it worthy of special effort to extend its cultivation. If anything I should say here, encourages a careless farmer to try the Alsike clover alone for a hay crop, I would have him understand that he had better let it alone, unless he can give his field so smooth a surface that his scythe or machine can cut low; as the clover, if of any great weight, is sure to lodge pretty flat.

Compared with the two other clovers before known to us, the Alsike differs so as to disclose to me the following characteristics:

1st, It is hardy, more permanent than the red clover, and retains its hold many years.

2d, It branches very much—throws out many stalks from one root; thus affording a good crop with thin seeding. Indeed, I think it should be sown thin, that the roots may have room, so as to obtain strength to strike deep into the subsoil.

3d, It bears cropping by cattle well; thus proving its adaptability to pasturage.

4th, It continues longer in condition to be cut as hay than any other forage plant that I know. It throws out a great number of heads from each stalk, coming into bloom successively for a month or more. When the most of the heads are ripe, the stalks and leaves are still in condition to make excellent hay. My seed crop has always made good fodder after the seed has been threshed off.

5th, I believe it to be the best honey-plant in the world. Much attention has been given to the habits of the honey-bee in regard to its choice of flowers, and to quantity and quality of the honey stored in different portions of the season. We often see a new plant recommended for cultivation specially for the bees. I think bee-keepers now generally agree that the surplus honey is all, or very nearly all stored during the bloom of the white clover. From all other flowers including buckwheat, but little more is gathered than is consumed daily. I have for several years had on my place a plat of Alsike clover beside one of the white. I have often called attention of people to the working bees on the plats; and it was always easy to see that the Alsike had the greater attraction. Equal areas usually show twice the number of bees on the Alsike. The blooming season is longer on the Alsike. The heads are also more numerous on that variety. A field of Alsike clover is the best patronized bee-pasture I have ever seen—exceeding that of an orchard in full bloom, I am sure that, in a neighborhood of Alsike clover fields, bee-keepers would not be searching for other plants for their use.

CALVIN CHAMBERLAIN.

Mr. Prince of Androscoggin, presented the following:

Report on Root Crops.

The cultivation of root crops in this State, we believe has not received that attention its importance demands, either from the farmers of our State or by this Board. Indeed, were it not for the potato rot, we should not, from a careful examination of the proceedings of this Board for several years past, even dream that roots were raised in Maine; hence we fear that in undertaking to report upon this topic we are, so far as this Board is concerned, approaching untried waters. We shall not, in this report, treat separately upon all the roots raised in this State, but shall confine our remarks generally to the mangold wurzel, and Swedish or ruta baga turnip, believing these to be the most important roots for field crops (potatoes excepted.)

The great difficulty in raising roots in this State, has been that they have been made a secondary object. Farmers having done the bulk of their planting and sowing, have called their spring's work completed; and it generally has been, unless perchance they had some little spot that was too wet to plant or sow in the ordinary time. In this case they have usually scraped up a little dressing and sowed a few roots. It now being the season for the June drouth, but a small portion of the seeds germinate, and what do bring forth a little plant, that at this season of the year has to struggle with the maggot and drowth, and between the two present a very sickly appearance. The owner becomes discouraged, and unless there is a dull day in haying, they are neglected until it is too late, and the inquiring neighbor is assured that roots are a very uncertain crop. We would not overdraw the picture, but believe the above is the experience of many farmers in this State.

To raise good crops, they must be made of primary importance—put in in good season, and taken the same pains with as other crops; and then we believe they will not only be a sure, but a profitable crop. What farmer is there that cannot with a good degree of certainty raise good crops of turnips, beets or carrots, in his garden? and if in a small bed in his garden, why not his acres in the field?

For neat stock we cannot recommend turnips; but would raise mangold wurzels for milch cows, as they contain a large quantity of sugar. For sheep, we believe there is no crop that equals the turnip. They eat them readily, and we find from experience that nothing is more conducive to the health of the flock. The great portion of the year during which our stock is necessarily fed from the barn, renders it of the greatest importance that we should not only endeavor to keep them alive, but thriving; so that the idea of "spring poor" should become obsolete.

In the culture of mangolds we would use well rotted manure, thoroughly incorporated with the soil. The quantity can hardly be too large. For turnips, green or unfermented manure in the drill, and well covered. The rows should be from twenty-six to twenty-eight inches apart. We would sow either the mangold or Swedish turnip as early as we would plant corn. The plants then take root before the early summer drouth, and usually before the appearance of the fly or maggot. The young plants will usually appear in about a week after sowing, and as soon as they show a pretty strong third leaf the process of hoeing and thinning should commence; for if they obtain too great size before being thinned, they are more liable to be injured in the operation. The young plants should be left a few inches distant at first, and afterwards as they increase in size, should be again thinned to about one foot distant. In this way they will be injured but very little in thinning, and may also be transplanted with the assistance of a trowel without material injury. The transplanting of either mangolds or turnips (especially the former) is not recommended except to fill up any blanks that may occur; then to be done with the utmost care and in favorable weather. Great care should always be observed in the after cultivation of the mangold, as the slightest wound is apt to increase with its growth, and in many cases greatly injures the root; in fact, we know of no other root crop so susceptible to injury of this sort as the different kinds of beet. Some writers recommend removing the lower leaves of turnips and mangolds during the latter part of the summer, and feeding them to stock; but this practice we deem of doubtful expediency.

Our method of harvesting turnips is to use a sharp hoe, and with one clip take off the tops; then strike one corner of the hoe under the turnip, and you can draw it very easily. We take two rows at a time, throwing the roots into the space between those and the next two. In this way we leave room enough between the rows of roots to drive a cart. We let them remain long enough for the outside to become dry, and then drive between the rows and throw them directly into the cart; in this way saving much hard work that is necessary when a basket is used.

Dr. Voelckler says that the mangold is justly esteemed on account of its fattening properties when given to beasts, yet it appears to be about the worst description of roots that can be given to sheep, on account of it laxative qualities. He further says that he has learned that this observation is confirmed by many practical farmers; therefore mangolds ought not to be given to sheep.

The turnip was introduced into England from Sweden about one hundred years since, and has been gradually growing in estimation until at the present time it is considered one of the most important field crops, and is used very extensively in fattening beef and mutton.

We are aware it is often said that the soil and climate of the British Isles are more favorable for the growth of root crops than ours, but we do not think the same remark can be justly made with regard to the Canadas; and to show what is done there in raising these crops, we will make an extract from an address before the New York State Agricultural Society in 1864. "In a match between Hamlinton and Wentworth Agricultural Societies in 1862, there were three entries of carrots averaging nine hundred and twenty-one bushels per acre, and three entries of beets averaging one thousand thirty-one and one-half bushels per acre. In 1864 the agricultural societies of North and South Wentworth had a 'turnip match,' and as the report of judges is very full and instructive I make some extracts from it.

1st. Four and one-half acres Skirving's purple top; soil, light loam; wheat stubble, manured and plowed; two pounds of seed per acre, in drills two feet apart; sown from 26th to 27th of June; thinned and hoed twice; cultivated twice; yield of piece, 835 37-60 bushels per acre.

2d. About eight and one-half acres, principally Matson's and Skirving's; soil, black alluvial, clover sod; manured with twelve loads of barn yard manure to the acre; plowed in the fall and again in the spring; three pounds of seed per acre; sowed June 15th and 16th, in drills twenty-six inches apart; thinned and hoed twice; cultivated three times; yield 558 bushels per acre.

3d. Six and one-half acres oat stubble; manured in fall with sixteen loads barn yard manure per acre, and plowed nine inches deep; plowed again in the spring and cultivated; seed sown 9th, 10th, 11th and 13th of June, with purple top Swede, Matson's, and Skirving's improved; drills twenty-eight inches apart; manured in the drills with three hundred pounds of bone dust per acre; soil, clay loam; yield 633 ½ bushels per acre.

4th. Five acres purple top; soil, clay loam; oat stubble plowed in the fall and spring; manured in the drills with ten loads of farm yard manure and two hundred pounds of Coe's super-phosphate of lime per acre; two pounds seed per acre, sown on the 15th to the 21st of June, in drills twenty-eight inches apart; yield 781⅝ bushels per acre.

5th. Five acres half Laing's, half old purple top; soil, black, alluvial and sandy loam; oat stubble, manured with eighteen loads of farm yard manure per acre; plowed with trench plow in the fall, cultivated, harrowed and plowed; plowed again last of May, harrowed and rolled; three pounds seed per acre, sown 15th to 18th of June, in drills twenty-four inches asunder; seed came up very irregularly at first; horse hoed 12th July; commenced thinning July 20th; plants eight to ten inches asunder; horse-hoed 3d of August and hand hoed again; yield 628 ¼ bushels per acre.

6th. Three and one-half acres King of Swedes; soil, sandy loam; sod plowed in the fall, twice plowed in the spring; manured in drills, fifteen loads farm yard manure to the acre; sowed 15th to 20th of June, in drills thirty inches apart; hand hoed twice; cultivated once; yield 624 bushels per acre.

7th. Five and a half acres King of Swedes and Laing's; soil, sandy loam; oat stubble; plowed in the fall and again in the spring; manured with leached ashes and farm yard manure; sown in drills, twenty-eight inches apart; yield 704 $\frac{2}{3}$ bushels per acre.

The judges in their report state "that they are happy to observe that the increase of breadth sown is very satisfactory, furnishing as it does every evidence that farmers are beginning to appreciate the advantages of this most invaluable crop. That this season has been one of the most unfavorable for the cultivation of the field root crops, which has occurred for many years. They also recommend for heavy upland soils the Skirving's, and Skirving's King of Swede and for alluvial, and lighter and loamy soils, Matson's and Laing's purple top."

With regard to the potato, which has come to be regarded as almost indispensable in every household, we have but a word to say. We would plant good sized tubers, cut or otherwise, in moderately rich, dry soil. We are aware that many believe small potatoes to be equally as good as large ones, but we do not believe that potatoes are an exception to the rule that "like begets like." The distance between the rows should be at least three feet, and the hills not more than one and one-half or two feet. They should be hoed at least twice, and hilled up an inch or two. The last hoeing should be before the blossom appears, for if hilled later the plants will be likely to form a new set of tubers, which will not only fail to reach maturity, but will draw nourishment from the others, thereby injuring the crop.

Potatoes should be exposed to the sun and air as little as possible, as exposure makes them watery and insipid—but as we said before, we propose to say very little with regard to the potato, and this little we will close with an excellent summary of the qualities of this root, taken from an essay by H. C. Worsham, in the Philadelphia Journal of Medical and Physical Sciences. "Having its origin in a warm climate, it was supposed to be intolerant of cold, and on that account incapable of cultivation in a more northern climate; but experience has shown the contrary, and the potato is naturalized in almost every region. It is one of the greatest blessings which the soil produces, forming flour without a mill, and bread without an oven, and at all seasons of the year an agreeable, wholesome dish, without expensive condiments."

RUFUS PRINCE, *Androscoggin Co.*

Mr. Ayer of Waldo, presented the following report:

Increasing the Fertility of our Farms.

"How shall we increase the fertility of our farms?"

I do not attempt an elaborate argument on this most important subject, but shall offer some practical suggestions, hoping thereby to provoke profitable discussion.

In the first place we plow too much; thereby compelling us to spread our manure so thin that we can scarce see it, or its effect on the crops. The average of our farmers, judging from careful conversation with many of them, cultivate in hoed crops and grain about one-fourth of their fields, and by the same means of information, I set the crop of hay to fall short of one ton per acre. Now let us examine a farm having forty acres enclosed in fields, and see how much manure the plowed ground will be likely to get per year, under our wasteful system of keeping the same. A fair estimate, I think, of manure from thirty tons of hay, which is as much as we have harvested, would be about forty loads of three cord feet each. Now suppose one-half of this plowed ground to be in grain; this being five acres, it may possibly produce five tons of straw, which if fed out to cattle and used for bedding in stalls and pig pen, together with roots and grain fed to swine, will perhaps furnish seven or eight loads more; and if we mix the contents of the privy and hen house with two or three loads of muck, which is better than some of us do, so much more is saved, making in all about fifty loads. Now if we dress but once for two crops, which is the more common practice, and take but two crops before seeding down to grass, we have the whole of ten loads per acre; and what does that amount to? The answer is easily found in the crops, of which the grass shows the most decided lack of food, because the preceding crops have almost exhausted the manure, since generally it is mingled with the soil to but a very small depth. But it may be asked, what better can we do? I answer, plow but half as much, and that a great deal deeper, and incorporate the manure more completely with the earth, and see what the results will be. One illustration of this practice I will give. In the spring of 1860 an acquaintance of mine found himself with old manure enough to plant four acres of corn in the usual way, but desiring to raise a large crop, and also try an experiment, he concluded to plant but half that amount, and prepared his ground by spreading about one-third of his manure upon the surface, which he plowed under to the depth of ten or twelve inches, then harrowed and spread another third of the same, plowed about six inches, harrowing again, and again after spreading the last third; then planting in the usual manner except much thicker. We will not doubt this crop was well tended and carefully harvested, the product being eighty-five bushels per acre of shelled corn, by actual measurement. After corn harvest the ground was plowed as deep as the first time and harrowed down, in spring sown with wheat about the first of May, producing thirty bushels per acre. But the best part was yet to come, having yielded from two to three tons of hay per acre ever since in one crop per year; and so well satisfied is he, that he follows about the same course to the present time; and could I give you a detailed history of the farm operations of the the late Horace McKenney of Monroe, in this matter of crops, I think it would be very much like what I have just stated;—having brought his farm in about ten years, immediately preceding his death, from cutting sixty tons of hay to not less than one hundred and sixty.

I know this is describing but one step towards a better husbandry, and will be found very incomplete, unless we take more pains to add to our manure heaps, and save the liquid portions of what we now get. Methods for doing this are so often described that I will content myself here with relating the practice of one who has neither barn cellar nor vaults.

In autumn he takes up the rear planks in the stables and cattle pen, filling under the floor as far as convenient with swamp muck, which he allows to remain one year before disturbing it, then hauls to the corn field for next spring's use, taking care to replace it with muck as before. This muck thus saturated with urine, he finds quite as good for corn as the well rotted solid excrements of cattle or horses. The urine from the house he puts to another purpose, viz., top dressing for plum trees and other small fruits Each morning in summer it finds its way directly to the roots, in winter it is thrown upon a box of ashes to be used in same manner when spring opens. He claims astonishing results for this apparently small saving.

But the fields are not the part of the farm which I think need the most attention at the present time. The condition of our pastures is a matter of more general concern among farmers than anything else, and well may it be, for no uncommon saying among us is that this pasture will not carry half the stock it would fifteen or twenty years ago; yet this complaint never comes from farmers who keep cattle and sheep together in summer, or alternate their feeding ground between the two as often as every four years. I have for some time been convinced that pasturing exclusively with sheep made the richest and fattest of grazing for cattle, while at the same time it became miserably poor for themselves; and I have been strengthened in this opinion with each farm looked over, and every farmer conversed with touching this point. I will give the history of one farm in Kennebec county so far as I know. It was long owned and occupied by John Hunnewell of China. From 1840 to 1862 he was extensively known for his fine herd of Durham stock, and frequently quoted as a model farmer and excellent breeder; but during the latter years of his experience in that branch of husbandry, he found an increasing difficulty in keeping his stock in summer at the desired point of excellence, and somewhere about 1850 or '52, owing to the poverty of his pastures, decided to make a change from cattle to sheep, disposing of all his Durhams and increasing his flock to two hundred or two hundred and fifty sheep, trusting by the experience of others that they might thrive where cattle had but poorly lived. And he was not disappointed; for quite a number of years getting good returns both in lambs and wool, but after some eight or ten years he found a change, his lambs not growing so well and his sheep showing a decided lack of something which has compelled him to hire a large part of his flock pastured away from home for several years past, and has now cut his flock down very much, not for want of hay, for he cuts much more than when he commenced with sheep, but wholly because they have spoiled the pasture for themselves. He now tells me there are but two things he can do with the pastures; one is to plow them up, crop and seed down to grass, or change to cattle again, both of which methods he has commenced.

I will now add my own experience in this direction. I have always kept about sheep enough to eat one third of my hay, that number requiring at least one-half of the pasturing, either keeping them together or changing every few years at least—cattle to sheep and sheep to cattle. And I find my pasture at the present time, with the exception of about ten acres, which are always bare in winter, as good for all purposes as when I first owned them sixteen years ago, having carried as much stock the past two years as ever within my memory, from which I draw the following conclusion, viz., that all our pastures need a judicious stocking with cattle *and* sheep, *alternating every year.*

PETER W. AYER, *Waldo Co.*

Mr. Norton of Franklin Co., presented the following report on

Apple Orchards.

Every attentive and reflecting observer among that portion of our population who are interested in agriculture, has doubtless come to the conclusion that if the natural resources of the State are ever developed, the apple must become a great staple crop. I deem it to be demonstrated that the apple tree is as well adapted to the soil and climate of considerable portions of the State as any indigenous tree whatever. This is shown by the fact that in the older settled portions of the State, apple seeds, by whatever means scattered, by the roadside, in pastures, and about stumps and rocks, have not only germinated, but have successfully competed in growth with the wild cherry, birch, maple and other trees, so that a foreign naturalist might as naturally conclude the apple to be indigenous as either of the others. In fact, on many farms, the apple trees thus planted are nearly all which are to be found on them. We are thus taught two lessons of some importance; first, that many rough and rocky places, unfit for tillage, are well suited for orcharding, as also sometimes, steep banks of gullies and streams; and second, that where the wild cherry and maple can secure a foothold, the apple will do well. Of course if we would have choice fruit and profitable crops in such locations, the trees must be properly cared for.

The number of varieties to be cultivated is a matter of some importance. It is often said that half a dozen sorts are better than a large number. This depends much on the object in view. If it be to send to a distant market, it is undoubtedly true that a small number of the choicest and most productive hardy winter sorts will be more profitable than a large number, which will give greater variety. But we need for home use, and it is the privilege of every farmer to have, if he will, a good supply of choice fruit all the year round; and for this purpose we require, not half a dozen, but half a hundred different varieties. The best of one season cannot be the best at other seasons, and they are also required for different uses and also to suit different tastes. Nobody would think of eating a Baldwin in September, and no one would regard as worth eating a Sopsevine which had chanced to keep into December. A good orchard should have a well selected assortment of varieties ripening in succession, so as to fill the seasons from the earliest to the latest. In the selection of these we must be guided by observation and experience, and by experiment in testing new and promising sorts, so that eventually we shall have fruit books and catalogues exclusively our own. Much work lies before us in the way of careful observation and experiment before we attain the full development of our natural facilities in the culture of apple orchards, or the profits within our reach in this direction, and it is to be hoped that all who can will contribute to this end and give their results for the public benefit.

J. R. NORTON, *Franklin Co.*

Mr. Stackpole of Penobscot, presented the following on the

Culture of Buckwheat.

Buckwheat is grown by nearly all the farmers in the county which I represent, and is becoming (as it should be) one of the staples of our annual farm crops. It has not yet been cultivated there as much as its merits deserve. It is an excellent cleansing crop, where land has become foul with thistles and other troublesome weeds. It grows so rapidly that it gets the start of nearly all other plants, it completely shades the ground, and keeps down every thing that attempts to grow with it. It is well adapted to newly cleared land full of vegetable matter, and a good crop of this grain can be produced on land that is not in a high state of cultivation. Very rich land causes it to grow so large and branch so much, that it will cause it to lodge, and thereby the crop to be destroyed, or very much injured. Fresh manure causes the crop to so run to foliage that it will not fill. The quick and rampant growth of buckwheat makes it of great value for plowing under for manuring purposes. If desired, two crops may be had in one year, of sufficient growth for this purpose; and as the land requires but little preparation to obtain a good crop of this grain, or of the straw for manuring purposes, I think it is worthy of being cultivated more extensively than it now is. When sowed in early spring or early summer, the hot weather which occurs when it is in full bloom, causes numerous clusters of kernels to blight, and much of the crop to be destroyed; for this reason, the seed should be sown so that the hot weather will have passed by the time that it is in full bloom. Cool weather, or at least cool nights, are quite as essential to a good crop of this grain, as hot days and nights are to the growth of Indian corn. The point to be aimed at in sowing this grain in every locality is, to put off the sowing as late as possible, and allow it sufficient time to grow and ripen before an early frost destroys the crop. This period occurs at different times in different localities. In that part of the State in which I reside, it is usually sown from the 20th to the last days of June; in the western part of the State, perhaps a few days later would answer. But it will not be safe to sow it much after that time, on account of its liability to be destroyed by frost. Farmers who cultivate it, prize it highly to sow where other crops have failed, or could not be planted on account of the wetness of the land or the lateness of its preparation. The quantity of seed used is from two to four pecks to the acre, the less quantity being sufficient for land in a good state of cultivation. The crop is ready for the scythe when the earliest seeds are fully ripe, many of the rest being in all stages from the blossom to the nearly ripe grain. Much of the unripe grain will ripen after being cut. It is usually left on the field in small bunches, until it is sufficiently dry to thresh; then it should be carted to the barn and threshed out as soon as possible, for it requires a long time for the straw to dry enough to mow away with safety, as it is liable to become moist, which makes it difficult to thresh so as to save most of the grain.

In harvesting buckwheat, great care should be taken to handle it carefully, as it shells easily, and if roughly handled will leave seed on the ground, that will spring up another year and mix with the following crop. Buckwheat is oftentimes ground into flour, and its excellence depends chiefly on the management of the grain between the time of ripening and grinding. When left in the field for several weeks, (as is often the case) sweet white flour is not to be expected; but when harvested in a proper manner, and taken care of as it should be, it gives fine flour, which makes good bread. The miller is sometimes at fault, but practice soon teaches him that in grinding this grain, it will not answer to run his millstones very near together. The value of the grain for feed is universally recognized by those who raise it, the meal being nearly or quite equal to its weight of Indian meal, for fattening hogs or poultry. I consider buckwheat one of the best grains that I have ever fed to fowl. The straw is not worth much for fodder; it is valuable for bedding, and is esteemed as a mulch for apple, pear and other trees.

E. B. STACKPOLE, *Penobscot Co.*

Mr. Wasson presented the following:

The Ideal Farmer.

"Ideals are the world's masters," says the old proverb. A man's acts tell-tale his thoughts. An opinion is but an ideal, by which, if one trusts his judgment, he is governed, and while he entertains that opinion, it is his master. The Scientist follows—not so much the *real* truth of the science around which his affections cluster, as his conception, his ideal opinion of that truth; and only as his plan of conception is elevated, will he follow its development. Only as the ideal is kept in advance, will he progress.

Among the Greeks, it was more glorious to carry off the palm at the Olympic games, than among the Romans, to obtain the honors of a triumph. The Greek's ideal of honor, was to excel at running or wrestling, not in conquering a nation. The painting of a fish is the Egyptian's ideal of that which is most odious and hateful. The youthful swain's ideal of human perfections, is his betrothed; to him she is the emblem of elegance and purity, though a termagant to all the world beside. Virtue, in the opinion of the Cynics, consisted in renouncing all the conveniences and comfort of life.

How many regard the art of agriculture as the least complex and most simple of all arts—as a resort for fools, an asylum for those deficient in brains, a place to suffer penance in for the crime of having been born without money—that a farm is no place for a person of intelligence and knowledge. The idea of such an one, is that the attempt to find out the nature and mode of the growth of plants and animals he is to have to do with, will only result in a painful search of what he cannot find. In utter contempt he holds "book farming," the almanac, excepted, which occasionally is convenient to tell him when the moon is *magnanimous*, that the pork shrink not in the pot, or the peas shrivel not in the pod. Says Uriel Wright, "if the 'book farmer' has not succeeded, his failure was the result of one or more of three causes: First, the book did not contain the requisite science. Second, if it did, the farmer did not find it out. Third, he had not the practical experience or industry to apply the knowledge the book contained." Books have been, and are, and will be in all coming time, the repository of science. They are the caskets which contain the jewels of the mind, wrought by genius in every age; yet, unlike the caskets, while they collect, they distribute also.

Example begets example in full fruition. The practice of the father is the ideal of the son. He plows around the same rock-heap, and up to the same headland; one furrow beyond would be sacrilege. The manure heaps, the time-honored frontispiece of the view from his parlor, the well at the foot of the hill, evince a civilization which sighs o'er the days lang syne. His ideas of ventilation are expressed in tight school houses and open barns; oxygen is good for cattle, but bad for children. He believes that all is known that can be known, which tends to multiply the fruitfulness of the earth. The results of his farming are reached in two ways—sometimes by blunder, oftener by accident. His theory is, that the business won't pay. With such an idea, he is right for once. His example comports with his precept. The results prove the correctness of his theory, but not of his premises. His farming is muscle without mind, the hand without the head, too much physical and too little intellectual labor. It borrows no light from the past, it reflects no light on the future. "What a man sows, that shall he reap." Every age and generation has had its reformers. Agriculture has its full share, each of whom, inventors of a theory, hold letters patent of success, contingent upon the purchase of their wares.

A person who uses an imperfect theory with the confidence due only to a perfect one, will naturally fall into an abundance of mistakes; his predictions will be crossed by disturbing circumstances. Ptolemy, to explain his theory of astronomy, supposed the planets revolving in small circles called epicycles. In following out his theory, it became necessary to add new epicycles until the system became unwieldy. If the agriculture of this nineteenth century was as prolific of potatoes as of those unwieldy, cumbrous, complicated, epicycle theories, sweet Erin's living generations need fear no famine. It was only after repeated applications of phosphate, gypsum, lime, ashes and other mineral ingredients, that the theory was shown to be erroneous that these constituents were unimportant to plants, or that their existence in them was accidental. A few simple experiments of Prof. Black's, of Edinburg, exploded the long-received theory, that the air was a simple, and the only fluid permanently elastic, although it had received the sanctions of a scientific proposition. All are aware of the principle enunciated by Jethro Tull, a century ago. The great principle of Tull was, that the soil and the air together contained all that was necessary, without the aid of manure. Pulverization of the soil by plows, harrows and rollers, was all that was needed to secure perpetual fertility. The Lois Weedon system is based upon substantially the same theory. As far as the theory enforced importance of pulverizing and of comminuting the soil, so far it worked well ; but when it inferred that the principles were applicable everywhere, it failed. In a soil like that around Naples, or where there is a deep, rich subsoil, this theory would work well for thousands of years; while on a shallow subsoil, like that of New England, the crop can only be recruited by manures—just a shallow lamp must be filled if it has actually burned out. In as far as this theory inculcates the belief that fertility is only contingent upon rendering the soil fine and divisible, that, unobstructed, the rootlets might penetrate and permeate the seed bed, it was not true in fact, because but few, if any plants are cultivated, whose roots in a good soil, do not extend entirely below where the plow ever runs, and because the great end in plowing and stirring the soil is to put it in the best possible condition to receive heat, moisture and atmospheric influences from above, connected with capillary attraction from the subsoil below. This is the principle in under-draining, to extend down into the earth the rays of heat and light in proportion as the water line is lowered. Says a writer, "The sun, the ocean, the winds, the storms, the light and the darkness, the heat and the cold, the air with all its currents and gases above, and the earth will all its fluids and treasures below, all together and alike conspire and co-operate to fertilize the soil."

Thær's theory that the equivalents taken from the soil in the form of crops, must in some manner be returned to the soil again, to preserve its normal fertility, was but the searching out of another of those great principles enfolded within the volume of Nature's laws. It was a denial of the theory of Tüll, which presupposes an inexhaustible supply in the soil, requiring only the intervention of those equivalents, returned by excessive cultivation. "Carrion crows bewail the dead sheep, and then eat them." Thaer's theory bewailed the exhaustion by successive croppings, because the results of life that had been taken from the soil were not restored again, yet could find a healthful nourishment in a supply of humus only, and for a time it was considered as an incontrovertible fact, that the increase or decrease of crops was entirely dependent upon the amount of this material. So afflicted became Thaer with "humus on the brain," that in 1806 he did not estimate bone-dust of any value as a manure, only in proportion to its percentage of gelatin. Even as late as 1830, Sprengel thought bone-dust useless in Germany. Says Stockhardt, "The farmer is quite correct in attributing an especially beneficial influence upon the growth of plants; he must not, however, suppose that this enrichment of the land in humus can be achieved only by directly introducing into the ground in large quantities, such substances (for example, straw manure) as have especially the power to produce humus. This end can be attained, and frequently with greater pecuniary advantage, by a judicious application of guano, bone-dust, etc." Great anxiety on the part of the farmer respecting the supply of humus is uncalled for, from the fact that, Nature herself provides against its removal from the soil when the farmer takes care that it produces an abundant crop of plants. To say the least, Thaer's deductions were irreconcilable with his theory; for all subsequent experience has proved, and continues to prove that all the elements of vegetable structure removed year after year must be returned, or the plants will cease to thrive.

All so-called science is a lie when men throw the facts connected with it out of their legitimate relations to make ideals. The analysis of the soil is a lie when it is regarded as the great disideratum, the "one thing needful," to be able to take a spadeful of earth, and separate the several ingredients of earth, alkalies, salts and gases of which it is composed; to tell to a nicety the per cent. of lime, potash, soda, magnesia, etc.; to figure up, and figure out the exact quantities of lime required to grow a crop of wheat, or of potash for a field of potatoes; to know if the different kinds required for the different kinds of plants are contained in the soil; and if not, what to supply; that the farmer as readily as he could select the sheep from the swine, could say, this field needs lime, and that salt; this needs phosphate, and that nitrogen.

When De Sausure first made known the fact that plants would not grow unless they found in the soil their own proper ash constituents, it was claimed as the greatest triumph of agricultural science. Men had lived in the belief that, the knowledge of the individual constituents was in no respect important, because vegetables possessed the power of converting lime into silica, or silica into lime, just as one or the other might be needed. When De Sausure and other experimenters had shown this belief to be erroneous, the opposite extreme was run into. Plants must needs be analyzed and their demands upon the soil made known; the soils must be analyzed and what they lacked made apparent; the manure must be analyzed so that what was deficient might be added. The theory looked well on paper, but did not pay as it promised. The truth proved to be that, chemical analysis can give, but rarely, a correct standard by which to measure the fertility of different soils, because the substances therein contained, to be really available and effective, must have a certain form and condition which analysis reveals but imperfectly. The analysis of some Vermont soil that yields only meagre crops of buckwheat, gave the same ingredients as the analysis of the soil from Scioto Valley, Ohio, which produced corn abundantly without manure, simply because there were certain conditions involved which analysis did not determine. A soil may abound in all the elements of a fertile one, and yet be barren. The soil of the great Colorado desert in California possesses the elements necessary to high fertility. Yet the theory has more than the semblance of truth. The mistakes and disappointments are chargeable to those who have thrown the facts connected with it out of their legitimate relations. The error was, that chemical analysis in its infancy attempted to fathom a man's labor ere it had reached man's estate.

Another theory which lays its ban on all schemes of improvement which itself does not originate, is the so-called "mineral theory." Some of the most celebrated agricultural chemists of the day at one time held all other theories as unsound, and that on the abundant or scanty supply of inorganic foods depended the fertility or sterility of a soil—that the great care of the farmer need not be to increase the fertility, but to prevent exhaustion.

Says Liebig, "the true art of the farmer consists in rightly discriminating the means which must be applied to make the nutritive elements in his field effective. He must take the greatest care that the physical condition of his ground be such as to permit the smallest rootlets to search those places where nutriment is found." May it not be justly inferred that the opinions of men seem to be inherited like some inveterate disease, when the same writer lays down as a principle, "that the real fertility of a soil is always exactly proportionate to the amount which it contains of mineral constituents." It is explained only when it is remembered that "ideals are the world's masters;" for if chemical analysis has revealed anything, has it not revealed that nine-tenths, at least, of every plant is composed and built up of combustible or atmospheric elements, to obtain which, the soil may have been a medium but not a source, and while the theory that every element of mineral plant-food must be present to insure fertility is true enough, does it follow as a sequence that a soil is fertile because these mineral elements are present? Why those barren hill-tops of the West which contain the same mineral elements as the fertile prairies below? The prairies contain humus says Thaer, the hill-tops do not. If Thaer is right, then Liebig is wrong. Both are riding a horse that throws them. "The very essence of truth," says Milton, "is the plainness and brightness; the darkness and crookedness is our own."

Another matter about which much breath and ink have been spent, is the so-called "Nitrogen theory," and such is the earnestness of the disputants that we fear that the advocates of either aspect of the question seldom admit that their opponents are the friends or promoters of science. After long discussion, of forging and hammering, the question is still agitated. Which is the anvil and which is the hammer, may be seen; but which is to win, or whether both, experience must determine. Says Timothy Titcomb, "if the victory were always with the hammer the French would always be victorious; but the anvil won at Waterloo."

Liebig in this discussion, in his work on "The Natural Laws of Husbandry," says "preconceived ideas will for a time assert their sway, and such is the case with those notions which ascribe to nitrogen a preeminent importance in the cultivation of land." "No one," he goes on to say, "who has an acquaintance with chemistry, has the smallest doubt or uncertainty respecting the origin of nitrogen in the arable land. It is derived either from the air, rain or dew, decayed acumulations," &c. In another place he says, "it is the ammonia of the atmosphere that furnishes nitrogen to plants." Boussingault an agricultural chemist of great celebrity, in his "Rural Economy" advocates the free use of ammonia as a manure, and values manures in proportion to the amount of ammonia in them.

Dr. Stockhardt, in his "Field Lectures," one of the most useful works of that distinguished chemist says, "from the circumstance that plants do not take up the nitrogen of the air as nourishment, we infer their inability to do so. This article must beyond all question, be considered the most valuable element in all substances employed as manure."

Prof. Horsford, a former pupil of Liebig gives the amount of nitrogen in a single fertile acre as being sometimes from 3000 to 8000 pounds and then triumphantly inquires what farmer would ever cart from his manure yard 8000 pounds of ammonia to his fields ?

Copeland in his "Country Life" replies, "that the tables of analysis have shown that in a single fertile acre there may be 145,605 pounds of lime, 54,251 pounds of potash, 17,289 pounds of phosphoric acid." What farmer would ever think of carting such quantities of these salts out of his yards to his land ?

The last item from the budget of modern theories that we shall mention is, that sea dressing and artificial fertilizers exhaust rather than supply strength to the soil.

Says a correspondent of the *N. Y. Turf, Field and Farm*, "too much of Long Island has been drained of its substance by deceiving it with artificial manures, which release the vegetable and mineral matter in the earth, so as to gradually impoverish the soil. Nicoll Neck has been made a receptacle for weeds by constant cropping, aided by sea-weed and artificial manures, which has brought that portion of the Island to the last extreme of poverty, and it will cost more than it is worth to bring it back to its primitive state."

Says a Spanish proverb, "drink no water without looking into it." Say we, accept no theory that may fall and bury us in the debris of its own improbabilities. The assertion that "artificial manures exhaust rather than fertilize," affords more scope for expansion and discussion than the already extended limits of this paper can entertain. It is suggestive of a discussion of what is plant-food, of what is furnished by the soil, of what is supplied by manure, of what *is* manure, of how manures benefit the soil and build up the plant, and, indeed, of the whole question of the application of chemistry to agriculture, a consummation *not* to be wished for. Yet a word here may not be out of place. If we accept as the definition of *manure*, that which our Secretary gives in his late paper on the "chemistry of manures," viz., "any material used for the purpose and with the effect of accelerating vegetation, or by increasing the production of cultivated plants," it would be hard to prove that such manure, whether specific or general, natural or artificial, would *exhaust* land, or make it poorer. The writer of such nonsense should learn, as his first lesson, that it is never manure added to land which exhausts it, but the crops which he takes from it. If the crops have been larger by reason of manures of an ammoniacal character, it shows that these were proper and suitable at the time. It does not at all show that the same would continue to be suitable and proper; and when barrenness follows large crops got by means of ammoniacal manures, the inference is, that something else is needed for manure, and very likely a good deal of the same ash constituents which were carried off in the crops.

According to a report by Professor Way of the Royal Agricultural Society of England, estimating corn at 50 bushels to the acre, oats 48 bushels, wheat 28 bushels, a crop of each will remove from an acre annually as follows:

CORN.		STALK.	CORN AND STALK.
Of Phosphoric acid,	21.2 lbs.	10.2 lbs.	31.4 lbs.
" Sulphuric acid,	—— "	6.5 "	6.5 "
" Lime,	0.2 "	13.5 "	13.5 "
" Potash,	11.2 "	43.5 "	56.6 "
WHEAT.		STRAW.	WHEAT AND STRAW.
Of Phosphoric acid,	15.2 lbs.	4.8 lbs.	20.0 lbs.
" Sulphuric acid,	—— "	—— "	—— "
" Lime,	—— "	13.5 "	—— "
" Potash,	9.0 "	14.0 "	23.0 "
OATS.		STRAW.	OATS AND STRAW.
Of Phosphoric acid,	7.1 lbs.	8.7 lbs.	15.8 lbs.
" Sulphuric acid,	0.6 "	2.7 "	3.3 "
" Lime,	3.8 "	13.7 "	17.5 "
" Potash,	9.2 "	27.3 "	36 5 "

In one ton of hay, of phosphoric acid 18.6 lbs., sulphuric acid 7 lbs., lime 18.2, potash 99.4 lbs.

An examination of the above table will show that farm yard manure, which has been called the sheet anchor of farmers, may vary widely from a perfect or complete fertilizer. For it will be admitted that manure contains only the elements of the materials of which it is composed; hence from a crop of wheat where only the straw is returned to the farm, there is a loss per acre of 15.2 lbs. of phosphoric acid, and 9 lbs. of potash; of oats, a loss of 7.1 lbs. of phosphoric acid, of lime 3.8 lbs., of potash 9.2 lbs., which loss is repeated year after year until the soil ceases to yield remunerative crops, unless some of those auxiliary substances suggested by chemistry are applied. And the longer this depleting process has been permitted, the more extensively useful are those specific adjuncts.

The supposition that artificial can supplant natural manures, is simply absurd. Those who have substituted most, have erred most. No less in error are those who rely wholly upon natural manure, for such as are ordinarily used, contain but sparingly such elements as are not usually found in the soil. Says one who is good authority, "as long as the farm has not reached the highest point of cultivation, every means must be pronounced acceptable, which puts the farmer in a position to provide his fields with more liberal dressing than he is able to give from his own supply of home-produced natural manure."

The great error of the unscientific farmer is, that when the assumption of a theory has been proved false, he is apt to confound true science with false theory, and denounce both alike, instead of winnowing out the absurdity and folly, and gratefully accepting the truths. In each ideal or theory of the past, has been embodied the highest conceptions of the age of a perfect agriculture; one as prescriptive as another, and alike protesting against innovations, which must come of necessity, if there be any genuine development and progress of that aggregate of sciences, the science of agriculture. Then if agriculture *is* a progressive science, there is, and there can be, no standard ideal good for ages. As our own comes up to the point of anything like a just ideal, so will that ideal change its relations to many of the *great facts* and practices of agriculture as they are now understood.

To farmers of our own time is committed the responsibility of appreciating the labor of those who successfully investigate nature and discover new truths of practical value; but that responsibility is maintained, not so much in pressing forward the arena of theoretical conflict, as in holding ground already won, strengthening and improving their position on every occasion.

A writer in the Scottish *Journal of Agriculture*, in an article headed "Orthodox Manuring," well says, "as matters at present stand with the farmer, it is only by a liberal supply of manure to land properly kept in heart, that he can expect to rear remunerative crops. He must work and he must weed—he must plow and he must plant, stir, roll and harrow, but unless he put in the manure, he may not be able to calculate on a due reward for his labor. The soil itself soon informs against us, if we seek to abuse it—clover will fail to appear in clover fields, and corn refuse to grow in corn soils, and nature will take immediate revenge for an outrage by some slow but certain access of sterility, not to be warded off by theories, however plausible."

SAMUEL WASSON, *Hancock Co.*

Mr. Dike presented the following report on

The Relationship of the Industrial College to the Common Schools.

"By what practical method, if any, can an effective and useful connection between the Industrial College and common schools be effected?"

Looking at this question more carefully and deliberately, I have been induced to present some thoughts on the distinctive characteristics of the different institutions of education among us, and their relationship to each other, and the part they may each be made to subserve in the great work of the education of our people, the whole people of the State.

These remarks will perhaps be thought to be more theoretical than practical; and the question suggests some practical connection; but I hope they may conduce in some small degree to unite the friends of education ultimately in establishing and maintaining a practical as well as theoretical relationship between these two most important institutions of popular education, the common school, and the Agricultural and Industrial College.

At a late discussion before the Board of Agriculture in Massachusetts, when the Industrial College was under consideration, Prof. Agassiz asked a nearly similar question to the one before us, viz.: "the relation in which the college in Massachusetts would stand to the common school system." No one seemed to apprehend the point of his question, at least with sufficient grasp to attempt an answer to it, and Prof. Agassiz himself is reported to have spoken on the subject as follows:

"The point I wish to reach is to have the large number of people who are now interested in agricultural, scientific, commercial and military education, who are now scattered, pull together a little more than they do. My question was with reference to the possibility of contriving some way by which the efforts of the friends of these various educational institutions, which are now organized in different parts of this State and throughout the country, may be combined, so that they shall help each other. In the Scientific School at Cambridge we are just as much at a loss to know what we should do as you probably are in reference to the future when your pupils shall be increased. Our means are entirely insufficient, and I suppose yours are entirely insufficient, and I think the time has come when we should make it known to the community how in this age,—which is an age in which all education is changing, in which scholastic and monastic education is vanishing, in which even literary education is waning, to make room for more practical, for more active, for more scientific instruction,—I say, I think the time has come when we should make it known to the community how they are to move in that direction. I hold that even our common school education, admirable as it is, tends too much to book learning—just as much to much as our colleges do. The cry against mere book learning in the colleges is already loud enough, but it should not reach the college only; it should reach the common schools also, because there is a great deal of study of things that might be introduced there. If the children of all the common schools could be taught to recognize and know by sight all the stones upon which they tread; if they could be taught to know by sight all the plants and animals which are found in their neighborhood, they would come better prepared to your agricultural school than they do, and they would be equally better prepared to come to our scientific school in Cambridge, or to go anywhere. The foundation would be laid of a better preparation for that practical training which our age demands. I think that agricultural colleges will have somewhat the effect to lead in that direction; and we should, I think, from all sides, press upon the community the need of learning in the direction in which the wants of the active community go, not merely in the direction in which an antiquated practice has led us thus far. I would not lessen in any way the value of scholarly culture. I would not disgrace my mother—and letters have been my mother; I would not disgrace culture in ancient lore even, impractical as it is; but I think in the methods by which these things are taught there are savings to be made in time, which could be applied to things far more useful. When our boys give so many hours to the study of Greek and Latin grammar, I think that that is practically useless, because they could learn a great deal more Greek and Latin, and Greek and Latin in a way which would last better, even, with less of that kind of teaching; and a little more natural history, and a little more of foreign modern languages, would certainly be a very useful substitute. I think that there lies the need of co-operation between all these institutions which have sprung up to meet wants in a direction which schools and colleges, as they have been thus far, have not supplied."

From this report of the remarks of Prof. Agassiz, it will be seen that he desires to see the various educational institutions of his State combine together in the exercise of their power and influence, as well as to have the various subjects taught, and the methods of instruction practiced at these institutions more practical in their character. These certainly are worthy objects of desire, and what the true friends of education everywhere must desire to see realized.

Our system of common schools is designed to educate the children of the State in the elementary branches of study. This amount of education is free to all, Where good High schools can be established, education can be carried somewhat farther with a limited number. But good and well-conducted High schools can flourish only in cities or larger villages. In the more sparsely populated portions of the States, the advantages of popular education are small beyond instruction in the elementary branches of a common school education. Our colleges, which have come down to us from a remote age, are more specially suited to provide an education for those who contemplate entering one of the learned professions. The ancient languages and mathematics, constitute the principal studies. It is true that the classical college is the rich legacy of past generations. It is not the out birth of a single generation, but the joint product of numerous college systems; it is the result of the efforts of the best thinkers and educators in all highly civilized lands, experimenting more than five hundred years, rectifying mistakes, rejecting errors, thus slowly accumulating the wealth of ages of research and investigation. The classical college of to-day is very different from the college of one of the earlier centuries of our era, with its load of Latin and limited mathematics, its astrology and alchemy. Still, the college of to-day bears the marks of a more monastic and scholastic age, and one far less practical, than the age in which we are now living. As Prof. Agassiz says: "we live in an age in which all education is changing, in which monastic and scholastic education is vanishing, in which even literary education is waning, to make room for more practical, more active, more scientific education."

Prof. Agassiz has given a hint at one way in which much time may be saved in acquiring a classical education. He says: "When boys give so much time to the study of Greek and Latin Grammar, I think that is practically useless." Language is one thing, grammar is another. One of the most unpractical of all ways of studying a language, is that of devoting month after month to the study of the grammar. That witty remark of Heine contains also a severe rebuke on the late method of teaching Latin and Greek, in which he says, "How fortunate the Romans were, that they hadn't to learn Latin Grammar; because if they had done so, they never would have had time to conquer the world." Montague long ago told us how much easier it is to learn Latin with very little grammar, when we make use of the language in speaking and writing. And Roger Ascham, Preceptor to Elizabeth, gave us good hints on the study of language.

In mathematics, too, the best method of studying this most important branch of study, has not yet been reached. Mathematical truths are to apt to be substantially committed to memory by the student, not incorporated into his understanding and thoughts. They then remain in his mind but a short time, having exerted little if any influence in really educating his powers and faculties. In some cases the student falls into the opposite extreme, and devotes himself so entirely to mathematics that his very thoughts and turns of mind are all mathematical. He thinks in abstract formulas, and becomes useless except for abstruse calculations. Laplace was such a man. When Napoleon employed him as a minister, he found that he could only transact the business of his office in reference to its differential and integral calculus.

But however well the college course of studies is taught, it is better suited to the preparation of young men for the so-called learned professions, than for the more active business of life. It is now a pretty well settled conviction of the best and most prominent educational men of the day, that the old classical and mathematical course of our colleges, does not meet the wants and demands of by any means all, who desire to become educated men. Our colleges are therefore discussing changes or actually making them. At Cambridge the studies are, to a certain extent, optional with the student, after the first year. The great and rapid advancement of the natural sciences and useful arts, has also led to the establishment of scientific schools. These schools are designed to instruct and train young men to become civil engineers, mining overseers, chemists, geologists, naturalists, architects, &c.; for the age now demands a large body of men to be as well educated as the doctor, the lawyer or clergyman. One of the earliest, if not the earliest school of this character, was founded by the noble-minded Hon. Samuel Van Ransellaer, at Troy, N. Y., about the year 1824. I have from one of its graduates an interesting account of this school. The school was at first established for the purpose of preparing lecturers to go about the State and instruct principally by lectures, the teachers as well as pupils of the public schools, and the people generally in those branches of science which have relation to agriculture and mechanic arts. The Institution was not liberally endowed, and received very little help; but continued a very useful school, devoted to its original purpose, till the year 1849. At that time the name and purpose were changed to a considerable extent, making it a school specially adapted to the preparation of young men to become civil engineers. Its peculiar methods of instruction were continued till 1856, and to some extent till the present time. The lecture system was applied to nearly all subjects of study, and was pursued in the following manner: From twelve to one o'clock a lecture was delivered, of which the students took full notes. At eight o'clock the next morning, the students assembled in the lecture room and were requested to ask questions till all points of the previous lecture were cleared up. This continued about three-quarters of an hour. The Professor then assumed that the pupils could answer any questions he could ask, and he spent the next hour in questioning them. Then the class separated into sections of six, each section taking a room by itself, and being under the general management of one of its members for the day. Then each member delivered the lecture in turn to the other five, who criticised the manner and matter. The Professor was engaged in passing from one room to another, criticising and giving instruction. These section exercises continued till about half-past eleven, from which time till twelve the Professor was putting on the blackboard of the lecture room the syllabus of the next lecture, with diagrams, formulas, &c. These the students copied, and were ready to attend the lecture at twelve o'clock. The afternoon was spent at the students' rooms, writing out the lecture of the previous day, and the evening, in studying the lecture of the day, and consulting works of reference. A lecture course continued generally a fortnight with one subject. Three days after it was finished, the whole course of written lectures was handed to the Professor for examination. After a lecture course, field work or surveying, astronomical observations, or drawing occupied a week, when another course was commenced. As a rule, the students were occupied with but one subject at a time.

There were examinations consisting of calling a student out from the class, assigning a subject, giving him time to put what was necessary for illustration on the board, and he was then to deliver a lecture five minutes long, on the subject; after which he was questioned by the examining committee. Before these examinations, which continued a week, a day was devoted to each subject for a test exercise, which consisted of an examination by the Professor in the particular department. This was counted of more consequence by the students than the public examination.

Daily records were kept of the standing of each student; and each week the class was arranged in the order of success shown by the records to that time. From these daily records, and the results of the test exercise, a student's standing for the year was determined, and if it did not reach the required limit, he was not allowed to go on with the class; he must go over the course again, or leave. The class of 1856 commenced with sixty students, was reduced to twenty-seven the second year, and graduated fifteen.

The Ranselaer Polytechnic Institution, at Troy, has been one of the most useful and best scientific schools in the country and is still a flourishing Institution. It has led forth prominent, able and educated men into the world; opened honorable and useful careers for numbers who had not the time or taste for the old college course. And I have no doubt, scientific schools will increase in numbers, efficiency and usefulness, for they are the outbirth of this new age. And yet the scientific school is truly only one agency in educating a limited number, chiefly for some scientific profession.

Notwithstanding the increasing number of colleges and scientific schools, the question is still a pertinent one, "what shall be done to give a better education to the thousands of young men in our State—the sons of farmers, mechanics, and day laborers?" Congress has indicated the first step to be taken in this work, in providing for the establishment of agricultural colleges or industrial schools in every State in the Union, where young men are to obtain a liberal and practical education. The agricultural college is to take the same class of pupils which fill our common schools, and instruct them still farther in the various branches of useful knowledge. It is not like the college and scientific school, designed to educate persons *out* of their present positions, and make professional men of them, even professional agriculturists, but to educate them *in* their positions and enable them to become wiser, better and happier men. The agricultural college, then, if it subserve these purposes, is not to be an institution where the rich, powerful and influential alone may go, but one where all may enjoy its privileges alike—where the pupils meet together on the common ground of equality, work together, live together, and together are trained for the active labors of future life. It is to provide for all, a practical education, because a vast majority of its pupils are to be practical men, and get as good and thorough an education as possible, that it may lift the whole community up, into a condition where each member of his community shall have greater means of usefulness, more sources of happiness, and be able to discharge better all the duties of a good citizen.

The common schools have ever been the boast of New England. They still furnish our whole population better means of education than any other section of the country or portion of the world. But the age is changing. Science is so rapidly developing that the young men of the future need more education, and a mental training more varied and complete, so as to prepare them for the wider and higher fields of usefulness which are opening, and give them the command of more elevated sources of happiness. And the institutions we need to do this work, are of a similar character, only so to speak, of a higher grade than our common schools. In them, education must be just as free to all, and so far as possible, accessible. And it must be within the means of all to attain it. The institution must not inculcate in its instructions, by precept or example, or in its influences, the idea that labor is servile or degrading; on the other hand it must exalt labor to its true place. It must inculcate this truth by precept and example. Its president, professors, and pupils must not be above work. They should all be men of labor in the true sense of the word.

They must not assume that because they are educated, therefore they must not work, but rather show that they are being so well educated as to be able to work more wisely, more efficiently, and more profitably. If our agricultural college is going to inculcate the idea or exert an influence against labor—healthy work, it better never be established in Maine. It would be an injury rather than a benefit to our State. If our farmers and mechanics suppose that they are going to send their sons to the agricultural college to have them educated so that they will no longer need to work for their living, better that they keep them at their own homes, where they learn to be useful if they do not attain so much knowledge. For we cannot live in this cold climate and on this hard soil without labor. When once we have abandoned the idea of work, we must leave these fields and valleys for some sunnier clime. The cultivated lands of the Penobscot, Kennebec, Androscoggin and Saco, must revert to the primitive forests. To establish an institution that would thus militate against the true interests of our State, never could have been the purpose of those wise men who formed the act of Congress.

I think the general character of this Institution has been plainly pointed out: for it is to "promote the liberal and practical education of the industrial classes." That education alone can be said to be practical, which enables men to work better and more efficiently for having had it in their several vocations in life. The practical knowledge of any truth is such a knowledge of it as will enable us to put it into practice; to work it out in the lowest, ultimate form in which it exists in this matter-of-fact world. The mechanic has attained a practical knowledge of the truths of his profession, when he has so learned them as to have become a more skillful mechanic. The farmer attains a practical knowledge of the truths of agricultural sciences when he so applies them as to conduct his farm in a better and more profitable manner. A practical education is what we all want and what our agricultural college must furnish the young men of our State, if it ever lives in the affections of the people.

Education has been defined to be teaching what it is important for men to know, and disciplining the mind; or so much of what it is important for men to know as they can acquire within the limited time given us in this world to get an education, and at the same time to discipline the mind as much as possible. All knowledge is valuable—there is not any knowledge of any sort of truth that is not worth knowing. But as we can take in only a little from the vast treasury, it becomes a question of serious importance, what sort of knowledge we will have taught in our public institutions which are for the benefit of the whole people.

We live in a world of things, not of names, technicalities or words. The first few years of a child's life, it is true, are employed in learning both words and things, but by far the most of the time is spent in studying the nature and character of the things that meet him on every side, in the world into which he has been ushered. We may well suppose that here is a wise hint, which we may follow, in establishing institutions and places for education. We should teach language, the use of words, but the chief part of the instruction should be common things. It is well of course to know the names of the heart, lungs, liver, &c., of the human system, but it is a great deal more important to know where these organs are seated, the functions they subserve in the animal economy, their uses, offices, &c., than to know their technical names.

But if languages be taught, the question arises, to what extent shall they go? Shall only the English language be taught? Shall the modern European languages be taught? Shall the ancient languages be taught? These are all studies of importance. And yet it is well to bear in mind that the ancient Greeks, whose language has been held up in all ages as a model for felicity of expression, knew no language but their own. The Latins knew the Greek and the Latin, but knew neither half so well as the Greeks knew their language.

Now the course of studies we assign to our students, depends of course on what we wish to make men; but if we wish to make them fit for the business of life, we shall not require them to spend much time on Latin, or Greek, or even modern languages, except in special cases.

But our noble English language, with literature unparalleled in the world, we may study, more than it is yet studied in any of the higher institutions in our State. Our great classical authors—we may read Chaucer, Spencer, and the entire classics—the great dramatists and writers of the reign of Elizabeth and Charles—and our great American writers. Here is an ample field spread out before us.

And yet when we think of the enormous quantity of things that are worth knowing to the world, and well worth knowing, we cannot afford to spend too much time on language, literature, the names, technicalities of science, &c. The boundless fields of nature, the natural sciences are now daily opening up to us, till we are lost amid the immensity of knowledge; chemistry expanding a new world before us, while geology is calling the old world again into existence and enabling us to read its wonderful lessons; and all those other studies, which are the glory and distinction of the time in which we live; these are the studies to which the chief portion of the time of our young men need to be devoted. These are what are engaging the most active and best portion of the world. These are the studies that are looming up higher and higher, every day above the horizon; while the old branches of study, which have so long been pursued at our colleges and institutions of learning, are receding farther and farther into the past. It is scarcely too much to say that at the present time, a man who has usually been accounted well educated, has really but just begun his education. He has been spending his previous years in the mere by-paths of knowledge, and now he must begin to educate himself.

But not only should the studies pursued at our agricultural college be of a practical character, but they should be taught in a practical manner. The instructor should teach by the observation of facts and things, as well as by the statements of theories and of books. The laws of nature should be studied in the facts of nature and by natural objects. Instructor and pupils should together go out into the fields, and study in the open world of nature, and observe and touch the actual things which are the subjects of instruction—the rocks, the soils, the animals, the plants, the fruits and crops, the machines and implements of culture.

It has been asked, in favor of the study of the classics, in preference to the natural sciences, why the pupil may not be as much benefited by knowing the name of Aristides and Socrates, of Cato and Brutus, as by learning to call a certain shell-fish no longer a clam, but a *Mya arenaria?* This is certainly putting the question in a form which, at first light, appears very favorable to the study of the ancient languages. But it is worth while to inquire whether putting the question in this form is quite fair; whether learning to call a certain shell-fish by the name of *Mya arenaria* is studying natural history; whether learning the technical name of the clam is studying its natural history in any broad and true sense. To my mind, there are other facts about this humble shell-fish, more interesting than learning its technical name, facts which are deeply interesting, facts which suggest interesting trains of thought and inquiry.

For instance, the clam lives in a little house of stony hardness, of just the right size and shape, and in every respect suited exactly to its wants. What is this house made of? Where did the clam find the materials out of which to make its house? How came those materials where it finds them? How does it know how to build them into a house?

The little gelatinous speck, floating in the water at its birth, has through some means, obtained one or two ounces of a hard material, in a short time, suitable for its house. It had no means of hammering it out of the limestone cliffs, and quite likely there are no calcareous deposits near its home. It has absorbed or drawn the material for its house from the waters in which it moves. How immense the beds of shell-fish on the shores of the ocean. What a vast concentration of lime once held in solution in the sea, is effected by these puny creatures, and others related to them.

What an interesting field of inquiry is opened by these facts about this little clam! Why the surface of the globe has been altered and modified, in ancient and modern times, by the silent labor of the multitude of these little creatures engaged in the productions of calcareous matter. The whole peninsula of Florida has been manufactured out of sea water (or the substances held in solution in the sea) by the little polyps. Our marble houses, tombstones, mantle-pieces, &c., are the result of their labors. The marble is made up of the relics of these animals. If they are not visible to the eye, the microscope shows them. It is probable that nearly, if not quite all limestone rock, is of animal origin and produced from the water of the sea.

One can scarcely allude to any fact in natural science, so dry and uninteresting, as that of the Latin, technical name of an animal or plant. If the study of the natural sciences is made to consist in knowing the mere Latin technical names of the animals, plants, minerals, &c., about which instruction is given, as has been too much the case in the schools and colleges; then it makes but little difference whether we study languages, literature, history or natural science. For in either case it is the study of mere words, names and technicalities. But the study of botany or zoology is not learning the Latin name by which the genera and species of plants and animals are known in the books. These sciences open fields of far higher and wider range; they lead directly to the study of the works of Him who made the world, and the laws He has put into operation, and the wonderful wisdom He exhibited everywhere around us; and no christian mind can be a sincere student of the works of God, in any department or field of science, without being brought nearer to God, and to know more of him and to love him better for his wisdom and goodness.

If then the studies at our Agricultural College are what they should be, and taught in a practical manner, we must seek to bring the privileges of the institution within the reach of all so far as possible. We must open wide the doors of the college, not only make it accessible, but inviting, and conduct it with such rigid economy that it will be within the means of the poorest. This institution will then bear a resemblance of and relation to the great system of common schools in our State. It will be as free as they are; it will furnish the means to every boy in Maine of prosecuting his education to such an extent as to become a well educated man. It will be, by and by, I trust, the crowning part of the great system of common schools, established so wisely among us, for the common good, the common welfare of us all. It will be the State's own institution, established and conducted exclusively for the benefit of the young men, all the young men of the State. And more and more of these young men will accept the privileges of the college, as the common people are made to realize the benefits of such an institution.

S. F. Dike.

A discussion followed the reading of the report, in which Mr. Goodale said:

I have listened with much pleasure to the reading of the report, and particularly to that portion where allusion is made to the change which is going on in education; from what Prof. Agassiz so aptly terms the 'monastic and scholastic' method, which has come down to us from the dark ages, modified little by little, as it has been compelled to yield to the universal demand for more general education, and for more practical education.

When the act was passed, establishing the State College of Agriculture and the Mechanic Arts, I felt that a most important step had been taken in the right direction—a step which placed Maine in advance of any of her sister States. I felt so because that organic act distinctly shadowed forth an institution quite unlike the 'monastic and scholastic' institutions hitherto known among us as colleges; and indeed unlike (and in my opinion better than) any which had been undertaken by other States under the act of Congress providing for the 'liberal and practical education of the industrial classes.' These last, so far as I am advised, have been either the ancient monastic article with additional modern improvements, (after the manner of new cloth patches upon old garments,) or else they are just scientific schools—nothing more and nothing less. Now no one values these more highly than I do, for the purposes which they were intended to subserve; and these were the training and education of civil engineers, mining engineers, professional chemists, architects, and such like; but they never were intended for the training and education of such young men as propose to be, and to continue to be during life, either farmers, working their own lands, or mechanics, using their own tools. I say that scientific schools were never intended for the 'liberal and practical education of the industrial classes;' they are not adapted to such an end; as a matter of fact they have done no such thing; they never undertook anything of the sort; never promised to do it, and there is no pretence that they have done it.

The act passed by the Legislature of the State of Maine did contemplate (in the language of the act of Congress bestowing lands for their endowment) the 'liberal and practical education of the industrial classes;' but the time and attention of the original Board of Trustees was mainly given to the question of location. For long months this was the all absorbing topic. At length a decision was reached, viz.: to locate at Topsham, from which place liberal proposals had been made; and where there existed, as I then believed and still believe, a most remarkable combination of natural advantages.

Subsequently, proposals came from Orono, and it was strongly urged that the question of location should be re-opened. The chief argument used was that the majority which decided the question lacked one of a majority of the whole Board (not all being present.) Somehow or other, the question was opened, and if my recollection is not at fault, without a majority to that effect; and shortly thereafter it was again decided, and this time to go to

Orono. In that vote several participated who had been elected to fill vacancies only a few days previously, and who had not visited either place. When a suggestion was made to one of these that a few day's delay, spent in personal investigation of the comparative advantages of the the several locations, would do no harm—it being then midwinter—he was understood to respond, that he had all the knowledge which he desired on the subject; and that man's vote turned the scale—so far as it turned at all—for the decision was once more made by a bare majority of those present, and by less than a majority of all the trustees. The arguments so strenuously urged a little while before, at once lost all force and pertinency! The vision of grievous wrong inflicted upon the industrial classes in Maine by such a transaction, as suddenly faded from view!

The former Board, at no time did more than make a beginning towards carrying into effect the provisions of the organic act. I am not sure that they did much beyond deciding one question preliminary to that beginning. It may be doubted if up to their last day there existed any adequate maturity of thought regarding the ways and methods of actually embodying the principles set forth in that organic act.

It was supposed that the incoming Board of Trustees would make it their first business to reach satisfactory conclusions in this regard. Before a tailor cuts a coat he takes the measure of his customer. Even the bee, the beaver and the bird, before they begin construction, have as definite ideas of the life to be led in their several structures, as they have after they move into them—and so they avoid costly blunders; and man, if he has not the instinct of the lower animals, is the possessor of far nobler powers.

There is good authority for the belief that it is poor policy to put new wine into old bottles; and if an educational institution is to be put into practical operation, so widely unlike the scholastic institutions which we have been accustomed hitherto to call colleges, as is the institution contemplated by the act of the Legislature of Maine, it is fair to presume that its requirements in the way of structures and furnishings, would be unlike also.

We may well believe that the new Board would require time to consider thoughtfully the problems involved in the very important trust which they had assumed. These problems were both novel and profound; their solution demanded most careful deliberation and great practical wisdom. Was it too much to expect that, before commencing to build, they would come to satisfactory conclusions, and at the proper time would present them to the public? Indulging such an expectation, I have examined with great interest the document lately placed on our tables—the Annual Report of the Trustees of the State College of Agriculture and the Mechanic Arts, and so far as I am advised the only document issued by the Board, hoping to find those conclusions clearly set forth therein. I am disappointed. There is in it mention of lumber and bricks, of Durham heifers, and underdraining, of hay and barley and beans, and manure, but of education, not one word; and of educational plans, methods and means, not much. I do not say there is no clue to their thought, for I read as follows: 'A part of the Board believed that plain, brick buildings after the old college plan, capable of accommodating either forty-eight or sixty-four students, according to the height, really the most economical. Two such buildings, or at most three, together with a building for the laboratory and lecture room, might accommodate all the students, and in the infancy of the institution, some of the rooms might be used for general purposes. Those in favor of such buildings believed that the materials or style of architecture made use of in building, would not necessarily determine either the course of study to be pursued or the industrial character of the institution.' From this I infer that entire harmony of views had not been attained; also, that by some, old bottles were considered cheaper than new; and that the character of the bottle would not necessarily determine the use to which it might be put. Perhaps a farther clue may be found in the following sentence: 'The dormitory building is now progressing towards completion,' &c. This word 'dormitory,' I have not been accustomed to find often used except in connection with a scholastic college, or a convent, or something else of monastic origin.

And now, Mr. President, with these prefatory remarks, offered with a view to state my ignorance and the scope of the inquiry I would make, I respectfully ask the member from Sagadahoc, who is also a member of the Board of Trustees, to furnish the industrial classes of Maine, through this Board, with such additional light as he may be able to do, upon certain matters of importance not clearly shown in the published report, and in which the farmers and mechanics of the State are most deeply interested.

Mr. DIKE responded as follows: I rise to say a few words, in answer to my friend from York. He asks me to 'furnish such additional light on certain matters of importance, not clearly shown in the published report, as I may be able;' referring, of course, as I understand him, to the vital question of the character of the institution we would build up at Orono. At the time when the report was read over for the approval of the Board of Trustees, I regretted that this question had not been discussed to some extent, at least in this first document issued by the Board; but it was then too late to make much addition, for this was the last meeting of the Board for the year 1867. After some reflection on the matter, I determined to prepare a paper on the subject and present it to this Board. This I have done, and the paper is now before you. It was written at a late day, and is not so full and complete as I could wish. It may, perhaps, convey some idea of my own views of what the future character of our agricultural college should be; what the character of the education it shall furnish, and the method of instruction there to be practiced. I know not whether these views are in accordance with those of the other members of the Board, or not. I do not know whether they have any definite views, or have given much attention to this subject. The question which the gentleman from York alludes to, has been very little discussed thus far, at any of the meetings of the Board; and I presume this is the reason that the report throws no light on the character of the agricultural college—at least throws no light on the important points to which the gentleman refers.

The Board then went into informal session, and John F. Anderson, Esq., in answer to a call upon him by Rev. Mr. Dike, spoke as follows:

Messrs. President and members of the Board of Agriculture:—With a profound sense of my own unworthiness, I acknowledge your great courtesy. Had it not been for the remarks of your Secretary upon the report before you, I might have rested with merely an expression of thanks for the singular consideration shown me by your action and invitation, because it is not in me to speak properly to that very able, interesting and suggestive report upon the connection of the State College of Agriculture and Mechanic Arts with our common school system of education, just rendered by my respected friend, who so competently represents the county of Sagadahoc at this Board. I have not the ability even to criticise or comment upon that paper; much less to add anything to the subject matter of it, or to offer advice thereon of any value whatever. But while I listened to the measured words dropping from the lips of your honored Secretary, I felt that my time and opportunity were indeed before me; and if, in what I am about to say an offensive warmth appears, I crave your charitable indulgence towards one who, unaccustomed to utter his thoughts publicly, has been incited by an honest indignation, to speak from the fulness of his heart, long pent up words.

Mr. President and gentlemen: I feel that I speak to you as a representative farmer of this State, unauthorized to be sure, but nevertheless truly; and the gist of my remarks will lie in these questions: What are the Trustees of the State Industrial College doing for the farmers and mechanics of Maine? what do they propose doing? how do they propose to do it? and when?

Some years ago I had the honor of a place at this Board, as well as a place on the Board of Trustees of the State Agricultural Society; and during that time the donation of land for the fostering of agriculture and the mechanic arts in a collegiate society was granted by the general government to our State. As unworthy President of the two organizations, I was intimately associated with the moving spirits of both—our fatherly friend, the late Dr. Holmes, Secretary of the State Society, and Mr. Goodale, then as now, Secretary of the State Board of Agriculture, besides other honest and disinterested men, prominent among whom were Hon. Samuel F. Perley and Thomas S. Lang, Esq., former Presidents of these organizations. We were associated together in urging this college, which seemed to promise so much for the future of the farmers and mechanics of Maine, into a separate and independent existence. Met at the onset by a formidable array of Presidents and Professors of our scholastic colleges, aided by their hirelings from out as well as inside the State, I, even I, the least of the upright coterie in every respect but honest zeal, was instrumental in bringing to its aid the man of might.

I confess to you that I have been proud of the forethought which prompted me to solicit that learned man, the soundest and most independent and powerful to originate new thoughts among them all—Hon. Phinehas Barnes—into standing forth as the champion of the weak against the strong; of the unlettered poor against the learned rich; of the farmers and mechanics against the Professors and Divines, who, with their corporation Presidents and lawyers were banded together, and for more than two years tried to seize this little possession of ours and divide it among them. Not to lose sight of figures of speech repeated in the hall above by one of these scholastic teachers, our champion uncovered 'the cat which lay hidden in the tub of meal,' and swinging into light the 'axe brought here to grind,' struck them back in confusion. But, gentlemen, I have lost that pride, because I fear that our possession is coming to naught. I was a spectator of the act which, by a majority of one vote or fraction of a vote, consigned this intended State institution to the obscurity of a merely local pile of bricks and mortar, against the solid vote of those men whom you and I, and all the honest farmers and mechanics of Maine recognized then, and still recognize as the portion of that first Board of Trustees of this College of Agriculture and Mechanic Arts, who were sincere and disinterested in their regard for its future.

When the Topsham farm, shown to be incomparably better for the purpose in all respects, and located at the very centre of railroad communication with all parts of the State, and near the seaboard also, was under consideration and by a similar vote accepted, the disinterested friends of the college, who then solidly voted yea, were asked by the other party to be magnanimous, and deem it, for the time, an informal vote. But there was no corresponding offer of magnanimity when these true friends were voted down, and the college was consigned to Orono by a majority vote of one-half of one.

Well, these gentlemen got their college located at Orono. What then did they do? First the President of the Board of Trustees resigned within half an hour of the record of that vote. The location settled in accordance with his behests against the convictions of its true friends, the master spirit of the movement retired from all responsibility and visible direction in its management. Then what was done for a year, a little more or a little less, no matter for a day or two when nothing was accomplished. What did they? As near as I can learn they first employed the landscape engineer Olmstead, of New York, to project a plan of their island farm, bought a pair of horses and—retired, leaving their elephant, about whose sustainment they could devise no ways and means, chained to a stub. Having taken the time named to ascertain that they did not compose the proper body to manage him there, that Board gave it up and resigned.

Another was appointed, and what have they done with the elephant? what do they propose doing? Well, let us look at this their first report. First let us see who compose the Board. Here are the men—President, Abner Coburn of Skowhegan, ex-Governor of Maine, well known all over the State as one of our ablest business men, one who has built up for himself a colossal fortune, and controls the material destiny of an army of laboring men. Trustee, George P. Sewall of Oldtown, eminent as a lawyer, politician and farmer, with brains enough to stock a Legislature, as has been repeatedly demonstrated to his fellow citizens throughout the State. Trustee, N. Wilson of Orono, another lawyer of experience in legal and legislative practices. Trustee, W. P. Wingate of Bangor, formerly Collector of that port, a man of note, accustomed to the management of grave affairs. Trustee, Lyndon Oak of Garland, a tried and faithful legislator, the careful scrutinizer of every enactment, who thus won the implicit confidence of his constituents and all others. Trustee, Samuel F. Dike of Bath, our reverend and respected friend, who has shown us in this report of his, so plainly, what we never questioned—his ability, learned attainments, sagacity, and above all, honest and zealous labor for a future of something besides the bricks and mortar pointed out by your Secretary.

Now for their report. I shall not weary you with it, for 'tis not so long but we can run through it quickly, and it is so clearly printed and withal so simple, that he who runs may read and understand. It begins with mention of Mr. Olmstead's plan of the general location, size and use of the buildings, as an act of courtesy to that eminent man and the preceding Board who employed him. Then of repairs to the Frost and White houses. Then, we are informed, that for knowledge of what should be built, they called to their assistance two practical mechanics of Bangor, and Mr. Stead, an architect of Portland; and because this Portland architect was driven to some weeks' delay in cudgelling his brains to the extraordinary labor of devising what in his opinion, might be the vital principle, the inner and essential constituent, the vivifying soul of their college, and then to design the proper clothing for his precious device, upon him is publicly cast the odium of greatly increased cost over what was estimated. During Stead's delay, we learn that the drouth of summer came the river ran low, and lumber ran up so that an increase of two or three dollars per thousand for about one hundred thousand, increased the cost of the building several thousands of dollars. We have a hint however, that men from Orono and Bangor were 'hired by the day, and were more expensive than if the work had been done by contract.' Then the report gives an account of the brickyard, in nine lines; then of the farm, in six lines; then the crops, the orchard, the stock; then of thoroughbred Durhams, of swine, inventories of property and estimates for the coming year; then the signature of the President, and this is all of it—and with the Treasurer's report annexed. Now I submit whether all you who have thought so well of these Trustees, and have felt you had reason to expect something from them, I ask all men who have sought for and read this report, are you not disappointed? I declare I am.

We had a right to expect in a report from the Trustees of this State College some glimpse of the vital essence which was to shape its future. If the report had contained the paper presented here by the member from Sagadahoc, we should have recognized a soul in that body and a promise of an earnest future life which would have given us a hope. But when the official report of the Trustees presents only a poor body, leaving it for one of them in another capacity as a member of this Board, to present here its soul, we feel as if the two were sundered, and that while we have here the soul without a body, they have down there the body without a soul.

The member from Sagadahoc seemed to hesitate and to be at some loss when he rose to the call made upon him by your Secretary. If he could have given in reply facts which would have redounded to the credit of his associates, do any of us who know him believe he would not have answered with his customary promptness? While he was thus hesitating, that part of the Governor's message occurred to my mind, which informed us that he could not induce, or found it difficult to induce gentlemen most naturally suggested, to accept the position of Trustees. I hoped he might ask back whether he whom the entire people of the State regarded as the proper man to be upon that Board was invited to such position, and if he, as we all believe he must, answer yes, then why did he not accept the trust?

Mr. Scamman remarked:—This matter relating to the Agricultural College, now in the incipient stages of its establisment is one of vast importance, inasmuch as it can be made to subserve the highest good of all our industrial interests, if properly managed. And the paper just read by the gentleman from Sagadahoc, sets forth in clear and distinct terms how this can be effected, and it is an assurance, so far as he is concerned at least, that his utmost efforts will be put forth to secure the desired end.

By the politeness of a friend in Bangor last August, I enjoyed the privilege of a visit to the farm and grounds selected as the site for this Institution, and although the farm is in many respects a good one, and affords some desirable facilities, yet, it looks as though a mistake had been made in its location. How or by what means this has been accomplished, I do not propose to inquire. Enough has been shown to satisfy us that certain influences have been at work that should have been left out of an enterprise so truly looking to the good of our industrial welfare.

Fitness for the particular business or work to be accomplished, has been too often overlooked, or ignored or given away to party purposes in projecting and prosecuting our public enterprises. If we wished to employ a man on our farms, we should not ask him if he had studied Greek or Latin, or was versed in the fine arts, but are you a practical farmer? Do you know how to do all kinds of farm work? So then if the State wishes to erect a public building, or prosecute the Hydrographic survey of the State, or establish a college to aid its agricultural interests, the same rule would prompt us to employ a practical mechanic, or a practical engineer, or men of such broad practical views as would secure the end in view.

Without saying more on the general subject, I wish to call particular attention to the idea advanced by the gentleman of making labor honorable. This is a point of great importance. If you can establish the institution on a basis that will correct the false impressions now prevalent, that labor is menial, degrading, one great point will be attained. When you combine labor with instruction, so as to make one a relief to the other, you develope both the mental and physical systems, while you are impressing upon the pupil that to be able to show by actual application the theories and abstract truths derived from books, is a part of education, and an honorable part. Too many of our young men look upon farm labor as drudgery, and seek some other employment where there is less show of work than on the farm. Now let the projectors and managers of the Agricultural College give prominence and character to labor, to daily labor. Let the boy that is not ashamed to work with his hands, be looked upon and respected as much, to say the least, as the boy who will only study. Give prominence to intelligent labor everywhere. Let every student feel that he has accomplished only one-half of his task, until he can not only tell what kind of manures, and what kind of treatment is necessary for a given crop, but be able himself to do the work. I repeat then, that any course that will raise labor to the dignity its importance demands, is a step, and a very important step, in the right direction.

Mr. Carpenter spoke as follows: *Mr. President:*—In what I have to say at this time on the subject before the Board, it is not my intention or desire to give an opinion as to whether the former Board of Trustees performed their part in the best possible manner, or that the present Board have done their duty, or as to their qualifications for the position they have accepted. If we are to judge from the report of their doings just published, I will say for one I am disappointed. I wish to endorse the report now under discussion made by the member from Sagadahoc on the relationship of the Industrial College to our common schools. We desire to bring the Industrial College and the common school together, nearer than they are at the present time, both by improving the college and the schools, so that our boys when they leave the schools can have the benefit and advantages of the college. Efforts should be made to prepare the pupils both in the common schools and all our colleges, for the business of life; to apply the knowledge so gained to all our affairs, to all kinds of labor. It adds to the capacity of labor, makes it more productive, and gives it a more cheerful aspect. Formerly, if one contemplated a college course, he also looked to one of the learned professions (as they are called.) These persons have an advantage over their fellow men above those less favored. Knowledge is power, and when rightly applied it becomes a mercy and a great benefit to mankind, but when wrongfully used it proves a curse. I desire especially to call attention to that portion of the report which refers to the great amount of time expended in a college course in the study of Greek, Latin, and the higher mathematics. The position is taken I believe, that much valuable time is thus wasted, and the information gained is worthless. I will allow those who have been there to be the best judges of this matter. If they admit it to be correct I see no reason why we who have not been there should dispute it. They ought to know, and as far as I am able to judge of its practical advantages I am inclined to think they are correct. What I desire most of all is, that in the course marked out for the Industrial College all the studies that after a trial of hundreds of years are found to do little or no good will be left out, and those introduced that we have good grounds for belief will prove to be of the greatest practical benefit to mankind. 'That labor may look up here and rejoice in the midst of its toil.'

Mr. Wasson said: *Mr. President:*—The farmers and other friends of the Agricultural College have been watching its progress with a great deal of interest. They have feared that it would be subverted to the base end of a political machine on which, or with which the axes of scheming and designing men were to be ground. Those fears have been somewhat excited, when as appears by the Governor's Address, 'it was found difficult to induce gentlemen most naturally suggested' to accept the appointment of Trustees. It would be a relief to our suspicions did we know that that *difficulty* was not what many have surmised, or what has been hinted. If an appointment is coupled with political services, or if eligibility is to be measured from a partizan stand-point, then may the friends of an Agricultural College despair of ever seeing one in operation in Maine.

I confess to but little confidence in any good which is to come from that so-called Agricultural School. It was so unfortunate in its infancy as to fall not into the hands of good 'Samaritans.' It started wrong, and its managers seem not to be aware of the fact. Yet, sir, in view of all these facts, we still hope better counsels may prevail, that practical farmers may not only be induced, but may be permitted to have a voice and influence in its management.

Wheat Culture.

Mr. Goodale offered the following for adoption:

Voted, "That the several county agricultural societies be and the same are hereby required to offer during the current year, a sum in premiums on wheat culture equal at least to one-third of the amount of the State bounty received during the year."

Mr. G. remarked that action like this was legitimately within the province of the Board. The Legislature seems unwilling to offer any bounty, and it seemed to him that there was need either of some temporary stimulus being applied, or some method being adopted which shall direct public attention more strongly to the needs and capabilities of the State in the matter of bread-stuff. We pay out very large sums for what, in his opinion, to considerable extent, we might produce to advantage at home.

Mr. Dike thought the proposed action of questionable expediency. He had grown wheat for many years with indifferent success, and had come to the conclusion it was not profitable to raise it. His soil was a stiff clay and probably could be better fitted for wheat by under-draining. He thought the general soil of Maine was not well adapted to wheat growing, and believed the indications of past experience showed we could do better by raising other crops that could be grown to better advantage and exchanging them for wheat. We should raise those crops the soil and climate are best adapted to, for they are certainly the most profitable crops.

Mr. Putnam said that in Aroostook county the average yield per acre the past season, was about twenty bushels of good quality. He had known of fifty-four bushels of wheat to the acre being grown. More than double the amount of wheat was sown the past year than has been sown heretofore, and if it is put in early enough to avoid the midge, good crops are almost invariably secured. If the land is very rich so that the straw is apt to lodge, an application of about three barrels of unleached ashes are needed to the acre.

Mr. Carpenter formerly raised winter wheat with very good results, and believed it poor policy in any farmer to dispose of the raw materials of his farm whatever they might be, and his aim should be as far as possible, to raise all he consumed. He thought its culture should be maintained, even if it was not what would be called a paying crop. One farmer in his town raised good wheat every year, at the rate of about twenty-four bushels to the acre.

Mr. Ayer spoke of the impetus given to wheat culture under the State bounty of 1840, and for many years after the bounty was taken off it was continued with good results until the advent of the midge discouraged farmers from growing it. Farmers in his section considered it very essential to lime the soil for a crop of wheat, and if proper exertions were again made by farmers he believed the results would be satisfactory if not surprising.

Mr. Wasson spoke of the great importance of wheat culture to our State, and thought it one which every member of the Board should be ready to offer some facts and suggestions upon. Can wheat be raised in Maine, or must our farmers make dependance to always procure it from beyond our borders? But a few years ago wheat was raised in great quantities in Maine, and even now our soil, our climate and other conditions are all favorable to its growth. The difficulty as to its cultivation he believed to be purely an imaginary one. He believed it was not an exhaustive crop. Every year the distance of the wheat growing sections of our country is becoming farther and farther from us, and in the same ratio the cost of transportation is also increasing. So much so that many of our citizens find it a hard matter to procure this necessary article, and he feared it would not be many years before our people must be obliged to grow it in our own locality or substitute something else for its use. He believed that to-day the average yield of wheat in Maine was larger than that of any other section of New England, and indeed, of some sections formerly called the wheat growing sections of the Middle States. Let the farmers of Maine be made to believe they can grow their own bread, and in less than five years they will do it. But to accomplish this, one thing is needed, our land must be put in better condition.

Alluding to the statement of Mr. Dike that farmers should raise some other crop in exchange for our wheat, Mr. Wasson said "that all other crops grown in our State, whether sold or consumed, would not pay for the flour brought into the State. Our shipping, our lumbering, our fisheries and other commercial pursuits pay for the wheat consumed. We must grow our own wheat in the future or abandon the State. But wheat can be grown, and it must be. We must give less attention to other pursuits and devote more time to real farming and the production of bread. The land must be made rich, and the seed must be put in early. These are the two prime requisites of success in wheat culture."

Mr. Chamberlain of Piscataquis, said that last year the average yield per acre has been from nine to fifteen bushels, but in some instances in very favorable locations double this amount has been obtained. There is no more labor in raising a crop of wheat than a crop of oats, and the former pays double what the latter does. It succeeds best on old mowing fields, with an application of ten loads of manure to the acre, applied upon the surface.

Mr. Hobbs of Knox, had raised from fifteen to twenty bushels of wheat from one bushel of sowing, applying the seed at the rate of one and a half bushels to the acre.

Mr. Brown of Lincoln, said that in his county, winter wheat was more generally sown than spring grain, and the average was about eighteen bushels to the acre, the kernel plump and handsome. Wheat is generally sown upon land previously occupied by potatoes, the soil usually clayey.

Mr. Stackpole of Penobscot, remarked that winter wheat was little sown in the county, and the spring wheat was last year nearly a failure, not averaging more than ten bushels to the acre. In some years previous the average had reached eighteen to twenty bushels. He inquired if an application of lime was necessary to raise wheat.

Messrs. L. Chamberlain and Dike replied to this query showing that the lime formations were the real wheat growing regions. The latter gentleman supposed the object of a bounty on wheat was to induce farmers to increase its culture, but as soon as the bounty was withheld its culture stopped. This he thought showed that our farmers considered wheat raising an unprofitable pursuit, and he regarded the statement of the gentlemen from Hancock as to the cost of the wheat brought into the State, as conclusive evidence in the same direction.

Mr. Prince of Androscoggin believed that with an average of only ten bushels to the acre, wheat growing would pay better than the growing of any other grain crop; but the ravages of the midge had brought about its neglect by the farmers.

The discussion was continued at an informal session, in which several not members participated.

Mr. Poor of Andover, said that previous to the appearance of the midge in 1835 good crops were easily grown. By 1837 the midge was abundant, and the culture of wheat was too generally abandoned. He had found this by preparing the land in the fall and sowing quite early, good crops can still be obtained.

Mr. Jefferds had raised wheat in Piscataquis for many years, and with an average of from nine to eighteen bushels to the acre. He had in one instance raised twenty-four bushels to the acre. He had practiced sowing lime with his wheat, in the proportion of one cask of unslaked lime to two acres of wheat, using a part of it at seeding, and a part after the wheat was up. He hoped the action and suggestions of the Board upon this matter, would be such as would induce farmers to engage more largely in its culture.

Mr. Moore of Somerset, alluded to the culture of wheat in the early settlement of the county, when immense crops were raised, and said that until the advent of the midge it was regarded as a sure crop. During the past few years, our farmers have become aware that the midge is disappearing, and good crops are now obtained. Upon the high lands in his county, from eighteen to thirty bushels are obtained, even where the crop is sown after corn, and with no extra application of manure. He believed the subject a most important one, and one that should be brought to the earnest attention of all farmers throughout the State.

Mr. Fish of Somerset, a former member of the Board, said that for thirty years he had not failed to raise a crop of wheat, except in one year. In one instance during the past year, a farmer in his town had a field of four acres, of which a very large proportion was smutty. It was the only instance of smutty wheat in town for thirty years. The wheat crop with him, has been a very good one, and taking the average of the past thirty years, has amounted to sixteen to eighteen bushels to the acre. Generally sows after corn. Had sometimes sown after potatoes, but had not obtained so good a yield as after corn. His usual practice was to break up sward land, manure and plant to corn and potatoes, and then sow to wheat and seed down. On under-drained land he had received a very heavy yield.

After some discussion as to the local bearings of the proposed action in different sections, the vote was amended by substituting "one fourth" in place of "one third," and in this amended form was passed unanimously.

Trials of Speed.

Mr. Goodale introduced the following:

Resolved, That this Board recommend to the several county agricultural societies that, in future, trials of the speed of horses be conducted one by one, and not by competition with one another.

Resolved, That this Board recommend that the sums offered by county societies for trials of speed of horses should not exceed the sums offered for the culture of breadstuffs.

Mr. Goodale remarked that he introduced this subject chiefly in order to get an expression of opinion whether what he considered the undue prominence given to the trotting of horses could be lessened without crippling the agricultural societies in a pecuniary point of view. He thought the man who had a fast horse had as good a right to exhibit that quality in his horse, as one who had a fine sheep had to exhibit the character of its wool, because speed is an element of value in a horse; still there could be no question but the prominence given to trials of speed of horses at our agricultural exhibitions in the few years past had been productive of evil. The carrying out of the first of the above resolutions might perhaps do away with much of this difficulty.

Mr. Carpenter thought it would be hard work for our societies to get along without trials of speed in competition with one another. They draw a crowd and place the societies on a good financial basis.

Mr. Prince believed that without the horse trot accompaniment at our fairs we should get up but meagre shows. He did not know that they did any good, and was not sure that they did any hurt.

Mr. L. Chamberlain spoke of the management of the agricultural societies in his county, and said there were two sides to this question of horse trotting. In their society they could not get along without it, but as soon as he was shown a better way to get along and take the place of it, he would be ready to adopt it.

Mr. Wilder remarked that he was no horse-man, but did not see how, in the management of our societies, we could get along without trials of speed at our fairs, for he believed horse-men were as entitled to show the speed of their animals, as others were to show the good qualities of their animals, or articles of a different nature. He admitted it to be objectionable but could hardly see how we could get along without it, much as it was to be desired.

Mr. Ayer would like to see the resolutions adopted by the Board. Croakers we would have, let the matter remain as it was or be changed. Some men will find fault, let the management of societies be what it may, and we could diminish some of the evils by compelling the trials to be made separately.

Mr. Wasson remarked that the question of horse-trotting in his county had for years been a troublesome one. He presented some figures in regard to the receipts of the Hancock Society, which showed that for the first day of the exhibition in 1866, the receipts were $30; the second day, $125; and the third day—the day of trials of speed of horses—$850. In 1867, the receipts were for the first day, $127; the second day, $433; and the third day $435—the trotting being divided between the two last days. In his county the society could not live a year without the receipts obtained from this source. The plan of agricultural discussions in various towns in the county—under the auspices of the society—had been attempted and proved of wonderful efficacy in creating an interest in the society and contributing greatly to the success of the annual fairs.

Mr. Scamman believed the subject of trotting horses at Fairs had received an undue prominence, but he still believed it to be as legitimate a business as for a man to show the strength of an ox. The great difficulty was to keep it under proper control, and he thought there might be some way in which it could be done.

Mr. Moore thought if his society should be prohibited from offering premiums for speed of horses, it could be sustained but a very little time.

Mr. Putnam remarked that should the plan recommended in the first resolution be put in operation, it would take several days for his society to hold their exhibition, as the horse interest in his county (Aroostook) was an important one, and many horses of different classes were examined which took a great deal of time.

After some farther remarks the resolutions were indefinitely postponed.

Change of Climate.

At one of the informal meetings the following topic was the subject of discussion:

"Has any considerable change taken place in our climate in the last fifty years; and if so, to what cause or causes is it to be attributed? What are the evidences?"

Mr. Stackpole said he had lived in Penobscot county thirty-five years, and he had noticed as the land became cleared the streams produced a much less volume of water. When he first moved into the county there were several mills in the village that could run six or eight months in the year. Now they lie idle most of the time, with the exception of the grist-mill. The snow storms were not so severe as twenty or twenty-five years ago, and he had noticed of late years, that in the West there were heavy snow storms when ours here are light. The present winter, so far, had been a very cold one. During thirteen days in December the mercury was down to and below zero, while in the same month in 1866 it was down to or below zero only seven times. In 1866 the lowest temperature was seven degrees, and this year, thus far twenty-seven degrees. He thought the forests in his section had diminished in extent, one-half during the last fifteen years, a part of which was due to heavy and destructive fires in the forests. Fire wood is now becoming an object, and it is hauled fifteen miles to market. Fifteen years ago the soft, seasoned growth was worth but a trifle, and now it is worth $4 per thousand for shingles and staves.

Mr. Wasson said: We have no forests in Hancock county. The growth of small, light wood we have is rapidly disappearing and the stave mills and hoop manufacturers are cutting off all that is growing, and if this work goes on for a few years to come to the extent it has in those that are past it will be but few years before we shall have no pine, no spruce, no birch and no poplar. Many families in the town in which I reside—Surry—have not a single stick of wood growing upon their farms, and large numbers have been dependent for years for their fuel, upon the drift wood that comes down Union river. The change of climate in our section is for the worse. There are occasionally seen by the sites of some of the older dwellings, apple trees of great age and size, but in late years it is impossible for newly set apple trees to be made to live more than six or seven years. The springs that were years ago regarded as living springs have in late years dried up and failed completely. The storms of snow you have in this section of the State, are usually rain with us on the coast, and we have but little snow during the winters generally. The change in our climate is very marked. We have now no spring as formerly. April and May seem crowded into June, and October is crowded back into September. Our section also suffers greatly from drouths, and for the last four years—preceding the last—we have raised hardly any crops for want of rain.

Mr. Wilder remarked that during the past thirty years he had observed a marked change in the seasons in his section. Thirty years ago his county—Washington—was largely covered with forest. Thirty-eight years ago the iron works in Pembroke were started, and an overshot wheel was put in to carry their machinery. Some six or eight years ago this wheel was taken out, there not being water enough to carry it, and during a part of each summer the works have remained idle for want of water. During the past twelve or fifteen years the water in the river has been growing less and less every year, and there is now not three-fourths the volume of water in the river there was thirty years ago, and the clearing up of the land had undoubtedly caused more of the rain to evaporate. Many of the trout streams of twenty-five and even twenty years ago were now completely dry. A stream ran across his farm that did not now have more than one-half or two-thirds the water in it, that it did twenty-eight years ago. He believed there were not so many snow storms in the winter as formerly, but on the contrary, there were more thaws and more rains. The soil, he thought, did not produce so well as twenty or twenty-five years ago. He spoke of the importance of our forests, and thought farmers paid too little attention to the raising of a growth of wood. Every farmer should set off a part of his farm to grow up to wood. Sheep and cattle should be kept out from an acre or two of pasturing, that the hard wood growth might live, as it was known that cattle and sheep would feed off all hard wood growth in pastures, and soon unless they were kept out from a portion of the pastures, no growth but a black or soft growth would appear.

Mr. L. Chamberlain said that in his section, Piscataquis county, corn was planted in 1830, in April, but since then it had not been planted so early by about two weeks. The trout streams of twenty years ago were now nearly dry, and he believed there was not two-thirds the water in Piscataquis river there was twenty or thirty years since. In 1840, two feet of snow fell on the 2d of November, but of late years our first snows did not fall until about the last of December. He thought the seasons shorter now than twenty years ago, and the springs were colder and shorter. The corn crop in his section is a safe one, and some kinds ripen in ninety days. There is now less snow in winter, less rain in summer and more rain in winter than formerly.

Mr. Dunning of Charleston, of the House of Representatives, regarded the change in the seasons during the past fifty years as a very marked one, as there was now fewer blocking storms in winter, and less rain in summer, than at that time. He also believed the weather was not so cold, and that the winters were warmer. It was true old people were apt to think the summers not so warm as years ago, for as they take less exercise than formerly, they feel the effects of the sun's heat much less. He said there was often a difference of several degrees of temperature within four or five miles, and the locality or other circumstances must have some influence upon it. Thirty or forty years ago the corn crop was very uncertain ; now it is regarded as one of the surest crops grown. This fact led him to believe there was a marked changed in the character of the seasons.

Hon. Dennis Moore of Anson, remarked that about forty-two years ago, when the Dead River settlement in Somerset county was being opened, the first settlers could raise nothing but wheat and oats, and never attempted to plant corn. In Anson, from 1812 to 1830, corn was regarded as an uncertain crop, but it has not been injured by early frosts in the last twenty-five years. The snow storms we have now are not so heavy as those of twenty-five years ago. As to the drying up of streams by the clearing of land, he believed that streams having their heads in low, wet lands would be dried up somewhat in a few years by the process, but thought it could not be true of those streams rising in highland springs and among mountains.

Mr. Putnam of Aroostook, said he moved into that county in 1831, and at that time corn was planted but little, and wheat, if sown late, was often killed by the frost. The county was subject to very early frosts at that time. In 1831 he planted a little corn the 2d of June, and it was nearly all destroyed by frost August 18th. The greatest expectation he entertained in regard to growing corn when he first went into the county, was that he could get it fit to eat green—as boiled and roasted. Now corn is regarded as almost a sure crop if planted early, and it does not fail oftener than once in eight or ten years. It is usually planted from the 15th to the 20th of May. In consequence of the clearing up of the forests there was not so much rain as there was thirty years ago. Neither were the snows as deep for the ten or twelve years last past, as for the same number of years before that period. Thought the thermometer usually did not go so low as it did thirty years ago. The county did not, as a general thing suffer from drouth, and he believed that should the forests be cleared for twenty years to come to the extent they had for twenty years past, there would still be no injury from drouth. The past season, which in many parts of the State was unusually wet, was not so in his county. He thought there was not so much water in the streams as formerly, and that the changes in temperature were more sudden. He did not remember that the thermometer had ranged so low for thirty years, as during the past season.

Mr. Holmes said that he had resided in Kennebec county thirty years, and in Oxford county,—his present residence—thirty years. He believed in late years the seasons were shorter and colder, especially in spring. There was less time to get in seed. In 1816 corn was killed by frost in Kennebec county, but with this exception the crop has usually ripened. He thought the county of Oxford more subject to early frosts than the county of Kennebec."

Lecture by Mr. Chamberlain.

By request, Mr. Calvin Chamberlain repeated before the Board a lecture, prepared for and first delivered before the Library Association of Dover and Foxcroft, a few weeks previously. The thanks of the Board were voted to Mr. Chamberlain, and a copy requested for publication; which was furnished; as follows:

It has been announced that one among you—usually a silent individual—will lecture on

"Man a Destructive Power."

Any subject of much less moment than an error of his, wide-spread as civilization—a mistake as broad and deep as humanity itself—a subject of universal interest, to which every intelligent mind cannot too soon devote earnest thought—would have failed to tempt me to assume a position so opposite to my habit and taste.

I propose to speak of man as a destroyer, avoiding the well explored fields of his geological and theological status. The present train of thought is not affected by the inquiry whether man has existed on this planet six or sixty thousand years. The diligent student may go on reading human foot prints in the old volume of nature, and examining facts as they are recorded in books,—which he usually finds outside of small, carefully selected libraries—touching this interesting inquiry. With his conclusions we have nothing to do. Neither shall I wander, in the present hour into the mazy fields of fact and fiction touching man's mental obliquity, the ways and means by and through which he is to be rejuvenated and his existence perpetuated.

If life is a blessing, if the laws governing our existence here are beneficent, if we are placed here to exercise our faculties in providing physical comforts for ourselves and our successors, then it becomes a duty to so treat mother earth that she may be able to bestow like favors on future man till the laws governing planetary worlds shall be repealed.

The leading pursuit of civilized man is agriculture. Of necessity it fixes his habitation. From permanent homes naturally come social order, laws, love of country, record of history, the accumulations of progress, durable architecture, mental growth, nationality. No roving race built the stupendous monuments that outlive all history and tradition.

But as we read man's history in his footprints, we see on every hand that his ways and methods of deriving his sustenance from the fields of his occupancy are not compensating ones. Every crop taken from the soil diminishes its capacity to produce another. The necessary elements and conditions of vegetation must be replaced, or the day of exhaustion will surely come—a day of ruin and desolation. It is a precept enjoined on agriculture, that whatever is taken from the soil by the harvest must be returned to it again. The violation of this precept inflicts an injury upon a country and does injustice to the race—tends to its extinction, or to force it back to barbarism. To destroy the productiveness of the soil, is to destroy the hopes of civilized humanity, and rob posterity of its just birthright to a career of progress.

What right have we, the transitory tenants of a fair and fertile world, to despoil it of that without which human advancement is impossible, and turn the fair heritage over, sterile and impoverished, to the generations we summon into being? Shall we, the creatures of a day, be held guiltless for our thoughtless waste inflicted on *one* country, in view of the infinitude of ages that this earth has been preparing for the habitation of man!

By intense heat, by icy cold, by lava torrents, and grinding glaciers, by earthquake and volcano, the upheaval of mountains, the ocean's deluge, the river's flood, by the tempest, by the sun's rays through eternity of day and night and the revolving seasons, by the kingdoms of vegetable and animal life, whose multitudes and tribes are extinct, air and water have been purified, the solid rocks have crumbled, the fragments sorted, washed and mingled, the flow and distribution of water fixed, and temperature toned to suit the home of man. Through all mutations the minerals of the harvest have been borne and safely treasured in the fruitful soil. To take this precious dust from the earth and not return it, is to imperil the existence of the race.

My subject unfolds into the inquiry as to the evidences of the effects of man's labors on the physical condition of those portions of the earth's surface where the greatest numbers have had an existence. In other words, what effect has man's operations on physical conditions?

A few moments spent here in considering what Physical Geography is, and what are some of its lessons, may be profitable to young minds, to the better understanding of what may follow. One compiler in this field of science,* opens his work by defining Physical Geography to be "a description of the general features of the earth's surface, the organized beings placed upon it, and the operations of the atmosphere by which it is universally surrounded. It relates to the earth as it exists in a state of nature, without regard to political or arbitrary divisions, or to any of those changes or improvements in the world which have been effected by man."

The last clause of this definition seems to be a wrong position. I will not object to excluding the "*improvements*," but where the "changes" wrought are of a negative character and of vast magnitude, a mere definition of a science ought not to lend a barrier to their just criticism. Some fields of man's greatest efforts, as indicated by the ruins of his works, are now laid in barren wastes.

How are we now to study such regions as they might be pursented to us, if the harmony of nature had not been disturbed by man? Or if this expression is a seeming "begging the question,"—how are we now to study them as they were when giving sustenance to a thousand times their present population?

Another school of Geographers present the science as "the general phenomana of the present life of the globe;" including the inquiry,—how far external physical conditions have influenced the social life and social progress of man.

"It was a narrow view of geography which confined that science to delineation of terrestrial surface and outline, and to description of the relative position and magnitude of land and water. In its improved form, it embraces not only the globe itself, but the living things which vegetate or move upon it, the varied influences they exert upon each other, the reciprocal action and reaction between them and the earth they inhabit. Even if the end of geographical studies were only to obtain a knowledge of the external forms of the mineral and fluid masses which constitute the globe, it would still be necessary to take into account the element of life;

* George W. Fitch.

for every plant, every animal, is a geographical agency, man a destructive, vegetables, and even wild beasts, restorative powers.

Whenever man has transported a plant from its native habitat to a new soil, he has introduced a new geographical force to act upon it, and this generally at the expense of some indigenous growth which the foreign vegetable has supplanted."

Physical Geography teaches that the earth is surrounded with a transparent and highly elastic fluid, called the atmosphere. It is indispensable to all living creatures. The atmosphere is mainly composed of two gases called oxygen and nitrogen, in the proportion of 21 parts of oxygen to 79 of nitrogen. It usually contains about 14 parts in a thousand of water in the form of vapor. The property of elasticity in the atmosphere admits of its expanding and becoming much lighter by heat. A portion of atmosphere becoming lighter than neighboring portions, rises to a higher region; when the more dense surrounding air rushes in and restores the balance.

The sun's rays always falling directly on the surface of the earth at its central zone, and more obliquely towards the poles, the atmosphere is at all times receiving more heat in one part than in others. Hence atmospheric currents or winds may be formed by the power of the sun's rays alone. The direction and force of the wind is very regular in the central and warmest zone, and is a leading power in the formation and continuance of ocean currents.

The direction of winds on the oceans, is changed, and their force and character disturbed by the continents lying in their course. The atmosphere becomes more heated over land than over water. Ocean currents of large volume, ever moving from warm to colder regions, and the reverse, have a great effect on the temperature and humidity of the adjacent atmosphere. Mountain chains interpose a barrier to winds. These and other secondary influences cause the regularity of the winds in the equatorial regions to disappear by degrees as we advance into the temperate zones, where they sweep in all directions.

Winds carry with them the temperature and the moisture of the places whence they come. A sea breeze highly charged with moisture, passing to a colder region where it becomes condensed, must part with a portion of that moisture, which forms clouds, and falls in rain. Moist winds, when they encounter an elevated obstacle, like a chain of mountains, are forced to ascend their slope into a colder air, where their vapors are condensed, and the rain flows down their slope. The wind may pass over the mountain, but it arrives on the other side dry and cold. Thus the wind that brings rain on one side of a mountain range, brings fair weather on the other. The quantity of water that falls from the atmosphere in the tropical regions is very great—being estimated on the eastern continent at 77 inches annually, and in America at 115 inches. But some localities, under the influence of certain circumstances, receive much more.

The mean quantity of rain-fall in the temperate zone of the eastern continent is estimated at 34 inches, and temperate America 39 inches. But these fruitful showers are better distributed through the year, than are the more prodigal ones of the tropics; and are more advantageous to vegetable and animal life.

The revolutions of the seasons, the climates of the different zones, and the general condition and movements of the atmosphere and the seas, depend upon laws beyond our control. "The elevation, configuration, and composition of the great masses of terrestrial surface, and the relative extent and distribution of land and water, are determined by geological influences equally remote from our jurisdiction. It would hence seem that the physical adaptation of different portions of the earth to the use and enjoyment of man is a matter so strictly belonging to mightier than human powers, that we can only accept geographical nature as we find her, and be content with such soils and such skies as she spontaneously offers." "But it is certain that man has done much to mould the form of the earth's surface, though it is not always easy to distinguish between the results of his action and the effects of purely geological causes. The destruction of the forests, the drainage of lakes and marshes, and the operations of rural husbandry and industrial art, have tended to produce great changes in the condition of the atmosphere, though we are not able to measure the force of the different elements of disturbance, or to say how far they have been compensated by one another or by still obscure influences; and finally the myriad forms of animal and vegetable life, which covered the earth when man entered upon the theatre of a nature whose harmonies he was destined to derange, have been, through his actions, greatly changed in numerical proportion, sometimes much modified in form and product, and sometimes entirely extirpated."

The physical revolutions wrought by man have not all been destructive to human interests. Northern and central Europe, since the days of Roman rule, has, under the sway of intelligent industry, vastly improved in its physical condition in many respects, and has attained to a material wealth and variety of product that with all their natural advantages, the granaries of the ancient world hardly enjoyed. While man has improved his physical condition in one direction, the reverse had a constant growth in another.

The man of western Asia, the restless, progressive man, whose "march of empire" has been westward, whose high mission has been to subdue the earth, and subject the elements of nature to his purposes for the ultimate good of his ever increasing numbers, has left his foot prints by the way; and it is our privilege this evening, as the younger members of the family, to look back over these foot prints, and read as best we may, of his successes and his failures. Man seems to have forgotten that the earth was given him for use alone, not for consumption, still less for profligate waste. Nature has provided against the absolute destruction of her elementary matter. But she has left it within the power of man to so far derange the combinations of inorganic matter and of organic life, that practically, in an extended sense, the law becomes a nullity. Before the advent of man, the organic and the inorganic world were bound together by such mutual relations and adaptations as secured the permanence of both, and admitted of very slow and gradual succession of changes in those conditions. "But man is everywhere a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discords. The proportions and accommodations which ensured the stability of existing arrangements are overthrown. Indigenous vegetable and animal species are extirpated, and supplanted by others of foreign origin; spontaneous production is forbidden or restricted, and the face of the earth is either laid bare or covered with a new and reluctant growth of vegetable forms, and with alien tribes of animal life.

These intentional changes and substitutions constitute, indeed, great revolutions; but vast as is their magnitude and importance, they are insignificant in comparison with the contingent and unsought results which have flowed from them."

The earth was not, in its natural condition, completely adapted to the use of man, but only to the sustenance of wild animals and wild vegetation. But man, the animals that serve him, the products that supply him, cannot subsist and rise to the full development of their higher properties, unless brute and unconscious nature be effectually combatted, and to a degree vanquished by human art. Hence a certain measure of transformation of terrestrial surface, of suppression of natural, and stimulation of artificially modified productivity becomes necessary. This measure man has unfortunately exceeded. "He has felled the forest whose net-work of fibrous roots bound the mould to the rocky skeleton of the earth ; but had he allowed here and there a belt of woodland to reproduce itself by spontaneous propagation, most of the mischiefs which his reckless destruction of the natural protection of the soil has occasioned would have been averted. He has broken up the mountain reservoirs, the percolation of whose waters through unseen channels supplied the fountains that refreshed his cattle and fertilized his fields ; but he has neglected to maintain the cisterns and the canals of irrigation which a wise antiquity had constructed to neutralize the consequences of its own imprudence. He has stripped the clothing from extensive plains, and has failed to reclothe them with artificially propagated vegetation; thus leaving them a barren waste of drifting sands. He has warred on all the tribes of animated nature whose spoils he could convert to his uses, and he has not protected the birds which prey on the insects most destructive to his own harvests. His destructive agency becomes more and more energetic and unsparing as he advances in civilization, until the impoverishment, with which his exhaustion of the material resources of the soil is threatening him, at last awakens him to the necessity of preserving what is left." Without multiplying charges here, let us return to the foot prints. The progressive man, descending from upper Armenia, becomes a vast multitude upon the arable plains watered by the Euphrates and the Tigris, is organized into a vast empire and spreads a civilization westward, covering the peninsula of Arabia, Syria, Armenia, Asia Minor, Greece, Sicily, Northern Africa, Italy, Spain, and leaving its traces as far north as Switzerland, and Denmark. This wave of civilization was succeeded by one of obliteration, leaving in the East the debris of cities as extensive and grand as Paris and London,—in the West, human remains, mingled with works of art and the bones of extinct races of animals, to interest modern scientific explorers. Onward in the course of time, man's recuperative energy repeopled all the vast area of western Asia, and united it successively in the Assyrian, Babylonian, and Persian empires. Coming thus down to the historic period of the Caucasian man, we are presented with other evidences touching population and consequently the physical condition of the country. The direct testimony of history to the ancient fertility of these regions, "the multitude and extent of yet remaining architectural ruins, and of decayed works of internal improvement, show that at former epochs a dense population inhabited those now lonely districts. Such a populalation could have been sustained only by a productiveness of soil of which we at present discover but slender traces." The abundance derived from that fertility alone can explain how large armies, like those of the Persians—in one instance, says the historian, the army, including camp followers, numbered five millions—and of the Crusaders and the Tartars in later ages, could, without an organized commissariat, secure adequate supplies in long marches through territories which, at present, would scarcely afford forage for a single regiment.

It appears that the fairest and most fruitful provinces of the Roman Empire, that portion of terrestrial surface which, at the commencement of the Christian era, "was endowed with the greatest superiority of soil, climate and position, which had been carried to the highest pitch of physical improvement, and which thus combined the natural and artificial conditions best fitting it for the habitation of a dense and highly refined and cultivated population, is now completely exhausted of its fertility, or so diminished in productiveness, as, with the exceptions of a few favored oases that have escaped the general ruin, to be no longer capable of affording sustenance to civilized man." Add to this realm of desolation, the now wasted and solitary soils of Persia and the remoter East, that once fed their millions with milk and honey, and we have a territory larger than all Europe, the abundance of which once sustained a population equal to that of the whole christian world at the present day. All this is withdrawn from human use—thinly inhabited by slender tribes—poor in products—"too little advanced in culture and the social arts to contribute anything to the general moral or material interests of the great commonwealth of man." Thus man through his ceaseless acts of aggression, by the constancy of his outrageous attacks on the fair domain of nature, is at last forced to relax his grasp on her choicest field, and concentrate his forces at another centre, for further operations.

A little removed from the the theatre of his tremendous exploits, out of the range of the arid winds which circulate from central Africa to northern Asia, more under the influence of the humidity of the Atlantic, on the soil of Europe, which, with long enduring patience of thousands of years, essays to reproduce her vegetable covering as often as it is removed,—here rests for a time the seat of empire. Here taking an advanced stand-point we may overlook the never-ending conflict as it intensifies in interest. The man of the Old World, on his way from the highlands of Asia, as he has descended from station to station, has marked each of his footsteps by a new civilization superior to the preceding, by a greater power of development. Arrived at the Atlantic, he pauses on the shore of an unknown ocean.

In the language of Guyot—"Under the influence of the soil of Europe, so richly organized, he works out slowly the numerous germs wherewith he is endowed. After a long and teeming repose, his faculties are reawakened, he is reanimated. At the close of the fifteenth century, an unaccustomed movement agitates and vexes him from one end of the continent to the other. He has tilled the impoverished soil, and yet the number of his offspring increases. He turns his looks at once towards the east and the west, and sets out in search of new countries. His horizon enlarges ; his activity preys upon him ; he breaks his bounds."

The discovery of America and the islands of every sea, have served to widen the circle of civilization and the range of improvement. Europe, through a fortunate train of circumstances, now presents the spectacle of a family of States drawn together by material ties and spiritual bonds. Old ideas have become common property ; new ideas spread through space almost with the rapidity of thought, and reach the understanding of all. The special gifts of nations all blending together, form a rich organic unity, with a regular and healthy growth, exalting the powers of man to a degree hitherto unknown. While industry, commerce, and agriculture employ the activity of Europe, another feature of her society is *the desire to know*—reflection—science—activity in the intellectual world as well as in the material. The European man treats high philosophical questions, works out a thousand ideas in all the branches of science. "He is the man of ripened age who reflects upon men and things, analyzes the causes, and seeks to understand the lessons of the spectacle the world presents." In the last three centuries, Europeans have given much attention to the subject of physical deterioration. The literature of the forest, which in England is not yet come to be any considerable branch of authorship, and still less in America, now counts by thousands its volumes in Germany, France, and Italy. Sylviculture has become a distinct science of the schools. Fortunately for our country, we can now avail ourselves, before utter ruin overtakes us, of the knowledge there gained, of the philosophical discussions as well as the presentation of the subject in an economical aspect. Facts collected from observation and record running through several centuries, so far as they reach us in our own language, are intensely interesting and conclusive.*

Thus man "accepts the situation;" but whether he is to become master of it, remains to be seen. At present there are some slight indications that he may. His maturer mentality grasps the perils, and measures the defences of the field of present conflict. He sees and understands the causes of previous disastrous defeats. But he still loses.

Should I here leave this part of my subject—treated in a general way—I might fail to impress you with my own convictions of its

* As a matter of curiosity, showing the amount of labor and thought expended in this direction, I have collected the captions of books, essays, or chapters, devoted to this subject, to the number of over fifty. To repeat them here may be suggestive of further thought in like channels: Causes of physical decay, are—"a due allowance for geological causes"—"Direct violence of human force"—"The result of man's ignorant disregard of the laws of nature"—"The incidental consequences of war, tyranny, and misrule." "Transfer of vegetable life." "Extirpation of vegetables." "Organic life as a geological and geographical agency." "Domestic animals eminent destructive agents in the garden of nature." "Extirpation of quadrupeds." "Diminution and extirpation of birds destructive to insects." "Introduction of insects." "Destruction of reptiles, such as feed upon insects." "Destruction of fish." "Extirpation of aquatic animals." "The habitable earth originally wooded." "First removal of the woods." "Effects of fire on forest soil." "Effects of the destruction of the forest." "Electrical influence of trees." "Chemical influence of the forest." "Influence of the forest, considered as inorganic matter, on temperature." "Trees as a shelter to grounds to the leeward of them." "Trees as a protection against malaria." "Influence of forests on the humidity of the air and the earth—on temperature and precipitation—on the humidity of the soil." "Its influence on the flow of springs." "General consequences of the destruction of the woods." "Literature and condition of the forest in different countries," "The influence of the forest on inundations." "Destructive action of torrents." "Mountain slides." "Protection against the fall of rocks and avalanches by trees." "Principal causes of the destruction of the forest." "Special causes of the destruction of European woods." "Royal forests and game laws." "Small forest plants." "Utility of the forest." "The forests of Europe." "The economy of the forest" "Sylviculture." "Lands artificially won from the waters." "Exclusion of the sea by diking." "Drainage of lakes and marshes." "Geographical influences of such operations." "Climatic effects of draining lakes and marshes." "Geographical and climatic effects of aqueducts, reservoirs, and canals." "Surface and under-draining, and their climatic and geographical effects." "Subterranean waters." "Artesian wells." "Artificial springs," &c.

vast importance to us. I can make the character and magnitude of the evils in question better understood by presenting in detail some facts of actual occurrence. I have only time to select a few.*

In the southeastern provinces of France—Dauphiny, Avignon, and Province—recent deterioration has been watched by very competent observers. These provinces comprise a territory of fourteen or fifteen thousand square miles, or one half the size of Maine. The surface is generally hilly and mountainous. Here was Roman civilization. Here the orange, lemon, date, the vine, and fig flourished. Later than the Roman rule, the Crusaders brought home from Palestine the knowledge gathered from the wiser Moslems, the art of securing the hillsides, and making them productive by terracing and irrigation. The forests that covered the mountains secured an abundant flow of springs, and the process of clearing the soil went on so slowly that, for centuries, neither the want of timber and fuel, nor the other evils about to be named, were seriously felt. Through the Middle Ages, these provinces were well wooded, and famous for the fertility and abundance, not only of the low grounds, but of the hills. Such was the state of things in the year 1600. The statistics of the next century show an increase of prosperity and population in the lower portion of these provinces, while there is an alarming decrease in the wealth and in the population of Upper Province and Dauphiny, although by the clearing of the forests, a great extent of plow-land and pasturage had been added to the soil before reduced to cultivation. "It was found, in fact, that the augmented violence of the torrents had swept away, or buried in sand and gravel, more land than had been reclaimed by clearing." From official documents is seen, that at dates running through the eighteenth century, one commune, town, or village after another were laid waste and deserted. In 1776, Viscount Puget reported: "The mere asnect of Upper Province is calculated to appal the patriotic magistrate. One sees only lofty mountains, deep vallies, rivers with broad beds and little water, impetuous torrents, which in floods lay waste the cultivated land upon their banks and roll huge rocks along their channels; steep and parched hillsides, the melancholy consequences of indiscriminate clearing; villages whose inhabitants, finding no longer the means of subsistence, are

* The inquirer may find an extended article on this subject in 10th vol. of Maine Agriculture—1865.

emigrating day by day; houses dilapidated to huts, and but a miserable remnant of population." Another administrator of the province writes in 1792, "The washing down of the mountains is to be ascribed to the clearings and the practice of burning them over." During the French Revolution the most of the remaining trees were destroyed, and the desolation before described has since advanced with still swifter steps. Blanqui, spoken of as the eminent political economist, in a memoir read before the Academy of Moral and Political Science, 1843, says: "Important as are the causes of impoverishment already described, they are not to be compared to the consequences which have followed from the two inveterate evils of the Alpine provinces of France, the extension of clearing and the ravages of torrents. The most important result of this destruction is this: that the agricultural capital, or rather the ground itself—which, in a rapidly increasing degree, is swept away by the waters—is totally lost. Signs of unparalled destitution are visible in all the mountain zone, and the solitudes of those districts are assuming an indescribable character of sterility and desolation. The gradual destruction of the woods has, in a thousand localities, annihilated at once the springs and the fuel." It is worthy of special notice, that the district here referred to, though now among the most hopelessly waste in France, was very productive down to so late a period as 1789. Arthur Young, who visited France at that date, says: "About Barcelonette and in the highest parts of the mountains, the hill pastures feed a million sheep, besides large herds of other cattle;" and he adds: "With such a soil, and in such a climate we are not to suppose a country barren because it is mountainous. The vallies I have visited are, in general, beautiful." In 1853, ten years after the date of Blanqui's memoir, M. de Bonville in his report to the government says: "It is certain that the productive mould of the Alps is daily diminishing with fearful rapidity. All our Alps are wholly, or in large proportion, bared of wood." "I will not dwell upon the effects of the torrents. For sixty years they have been too often depicted to require to be further discussed." "An indirect proof of the diminution of the soil is to be found in the depopulation of the country."

Mirabeau estimated the forests of France in 1750 at 42,000,000 acres—about 32 per cent. of the whole country. In 1860 they were reduced to 19,769,000 acres. In a country and a climate where the conservative influences of the forest are so necessary as in France, trees must cover a large surface and be grouped in large masses, in order to discharge to the best advantage the various functions assigned to them by nature. The consumption of wood is rapidly increasing in that empire; and it is probable that Mirabeau's estimate of the proportion of forests in 1750, was not too great for permanent maintenance. The Germans have estimated the proper proportion of wood land to entire surface at 23 per cent., for the interior of Germany. The due proportion in France would considerably exceed that for the German States, because France has relatively more surface unfit for any growth but that of wood, because the form and geological character of her mountains expose her territory to much injury from torrents, and because at least her southern provinces are more frequently visited both by extreme drouth and by deluging rains. During the period in question, "France neither exported manufactured wood or rough timber, nor derived important collateral advantages of any sort from the destruction of her forests. She is consequently crippled to the extent of the difference between what she actually possesses of wooded surface and what she ought to have retained." "Italy and Spain are bared of trees in a greater degree than France; and even Russia, which we habitually consider as substantially a forest country, is beginning to suffer seriously for want of wood." Every district in Russia deplores the ravages of man or of fire; and clear-sighted men already foresee a crisis which will become terrible. "Hohenstein, who was long professionally employed as a forester in Russia, describes the consequences of the general war upon the woods in that country as already most disastrous, and as threatening still more ruinous evils. The river Volga, the life artery of Russian internal commerce, is drying up from this cause, and the great Muscovite plains are fast advancing to a desolation like that of Persia." In Bavaria and Austria is seen the same improvidence which marks the rural economy of Switzerland, Italy, and France, and the effects are hardly less disastrous. Nearly every island of the seas where European colonies are established for the production of articles which enter into commerce, are reported as suffering materially through causes proceeding from the destruction of woods. The Cape de Verds, some of you will recollect, not many years ago were suffering from famine, and an appeal was made to this country for food. At that time the population was reduced thirty thousand by starvation—one third of the whole. Their forests were destroyed and rain ceased to fall.

There is a partial reverse to this dreary picture. Enlightened individuals in most European States, governments in some, have made extensive plantations of wood. The objects of the restoration are as multifarious as the motives that have led to their destruction, and as the evils which that destruction has occasioned. I have thus tarried as long as time permits, in looking over the course of instruction in the only school with extensive appointments, where we can look for that practical knowledge which shall be a safe guide to us, to a wise administration of the affairs of so important a part of the physical world as is committed to our keeping. We can make an application of the facts there deducible, so far as they apply to these States situated under similar physical conditions. We have noted that rain-fall is about the same here as there. Temperature there at any given point can find its parallel here. Both are open to Arctic winds—unprotected by any high mountain range. The States east of the Mississippi have the warm, humid winds from the Gulf of Mexico, not very unlike the effects of the Atlantic on Europe. In the time remaining to us, I shall only try to consider man's destructive agency on physical nature, so far as it applies to American forests.

Four centuries ago, America lay unworked and solitary, glutted with its vegetable wealth. Its soil waited the hand of man to work out that wealth. The primitive owner was incapable of the work.

The European established himself little by little upon this new land. His footing once secured, the colonies were reinforced and strengthened day by day. This was not a new civilization, but the transfer of one already made. The man of the Old World, whose education had been there completed, appeared here upon a larger theatre—a scene worthy of his activity. Here the different peoples of Europe have met, with room enough to move in, and have mingled their efforts and their gifts. Having measurably exhausted Europe, his first appointed task was to subdue and fashion a savage nature to his pleasure. He has worked out the task with a *firey* activity. The nations of Enrope have in the mean time enriched themselves from the products of these forests. Has the task been done wisely? Has not man already overstepped the proper bounds to the domain of nature? or if not, is he not likely to do so in the immediate future? These are important questions, and they seek a speedy solution. The statistics from one decade to another, of the number of farms in these States, the number of acres added to improved lands, the proportion of improved lands to unimproved in the several States, the amount of marketed lumber of all kinds, the increase of population, the rapid increase of home consumption of wood for the innumerable purposes to which it is applied, all together present a mass of facts, that by their magnitude alone, cannot fail to arrest the attention of every thinker. With these statistics in mind, the observing traveller as he passes from Maine to Kansas, from New Hampshire to Georgia, will prepare himself to listen to almost any one who may take the stand and plead for the trees. Look where you will upon the operations of civilized man, the application of wood to his purposes is on a scale so collossal, that, it seems to me, we cannot lose sight of this grave matter, when the attention is once directed to it.

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 whe 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 then take into the account that all this wood is destined to decay and compel renewal in twenty-five years—fix all this in mind, and we have made one point in illustration. The destruction of buildings by fire in these States, is no inconsiderable item in this view of consumption. The evils of past destruction are now experienced in all our cities and large towns, in the great increase of cost of fuel, and in the price of lumber and timber. High rate 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 2500 ties or sleepers to the 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 trees—for a tree generally make but one sleeper. 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 1 $\frac{3}{4}$ cords of wood for every 25 miles. This gives a daily consumption of wood for this purpose alone, of 21,560 cords, or 6½ millions cords annually. Telegraph poles are a recent item in demand for trees. The sixty thousand miles of lines, at forty poles to the mile, is 2,400,000 poles—representing so many trees now recently cut. These also decay rapidly, and soon require renewal. The mechanical industry of the country demands much wood and lumber. About half a million of artizans, enumerated in near a hundred trades or callings, work wholly in wood. The late civil war caused the destruction of much wood. It has been cut for fuel, for fortifications, to hinder the movements of opposing forces, and to open the country for military movements. Sleepers from torn-up railroads, costly bridges and buildings have been burned; and the relaying and rebuilding all these, demands a new supply.

Native Virginians are removing from some of the finest parts of the State, because of the destruction of the timber; and for the same reason, emigrants decline to go there. In their haste to get their land under cultivation, men cut and burn large tracts of magnificent forest, 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 fine 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 secured a permanent value of one hundred dollars per acre. On every hand the waste of the forest goes on with a constant acceleration of speed. "The cunning foresight of the Yankee seems to desert him when he takes the axe in hand."

When we think of the increase of population, and look forward to the time when the number will be one hundred millions, then two hundred millions, try and think what will be their condition. What proportion of all that host will be poor? and what will be *their* condition? What will life be to them, cast in a country such as our acts now promise to bequeath to them?

We need not go far, nor peer into the future to see the beginning of the end of all this. The increased price of fuel diminishes the comforts of the industrious poor, injuriously exposes their health, confines them to a mere defence of life, by consuming a large share of their earnings, which else could have been used for education, for personal comforts, or the purchase of a home. A great increase in the price of lumber hinders the erection of dwellings. The poor man labors years longer to obtain the means to build a house. The growth of cities is retarded by it. Small and uncomfortable tenements are built. Rents are higher. The high price of lumber adds to the expense of furniture.

A wise and good man of France, Bernard Pallissy, three hundred years ago, in expressing his indignation at the folly of men in destroying the woods, said: "I cannot enough detest this thing, and I call it not a *error, but a curse and a calamity to all France*; for when forests shall be cut, all arts shall cease, and they who practice them shall be driven out to eat grass with Nebuchadnezzar and the beasts of the field. I have divers times thought to set down in writing the arts which shall perish when there shall be no more wood; but when I had written down a great number, I did perceive that there could be no end to my writing, and having diligently considered, I found there *was not any* which could be followed without wood."

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 many purposes, so far as I know, are not equaled by any timber elsewhere.

In California the miner can find no wood for a lever or a pick-handle, better than a pine limb. The western half of our country produces no timber suitable to make a carriage, a wheelbarrow or any kind of farm implements. All these are now supplied from the East. American farm implements are in great request all over Europe. Germany in particular, buys all that reach there, as soon as they are landed, and is ever calling for more. The superiority of our tools and machines, which is everywhere admitted, over those made in Europe, is mainly in the better quality of the timber that enters into their construction. For handles to rakes, hoes, shovels, for scythe-snaths, for shafts and poles to carriages and harvesting machines, there is no other wood, that in the qualities of elasticity and strength, is equal to the American ash.

Taking a general view of American forests, we shall see our whole country west of the Mississippi, with perhaps an exception of a part of Texas, with no trees to spare for the further extension of tillage alone. As population spreads over the arable portions of those vast regions, and the railroads are built through them, the one great check to business and to prosperity, will be the lack of timber. East of the Mississippi are the prairie States, and now other considerable portions of country, with no wood to spare. The available forests now remaining, to furnish all the wood that is seen to enter into home and foreign commerce, are embraced within a few of the States. These forests are cut away at the rate of three millions of acres annually, equal to one sixth the area of Maine. The country cannot many years longer rest in blissful ignorance of her impending fate. Let the present reckless habit continue, and before the present age of our nation shall be doubled, millions of the poor will be found burrowing in the ground and burning peat.

Another consideration, second only in importance to the one already noted, is that of *climate*, as affected by the removal of forests. The physical elevation and configuration of our country, to which I have briefly alluded, subjects it to great vicissitudes of climate. I have not time to examine this in a general way, but must come at once to Maine. Here we may speak of what we know, though there may be many things that we now fail to comprehend sufficiently to reason from them. We think we see changes going on in our climate. We who can speak from personal observation of the same locality through a period of fifty years or more, may be allowed to utter our convictions, that extremes of temperature now more rapidly alternate—hot and cold approach each other with more sharply defined lines and angles, than formerly. If we are not certain that rainfall has tended to greater irregularity, we are certain that snow covers and protects the ground with less regularity.

The first settlers in Piscataquis were obliged to wait a month or more after winter had set in here and sledding become good, before they could go to market at Bangor. Then in spring the snow would fail there a month or more before it did here. Now, when the woods are removed from nearly every hill-top between this valley and the ocean, the south winds reach here about as readily as they touch at Bangor; and it is a common occurrence for a loaded team to leave here for Bangor on a snow that scarcely covers the ground and return with the report, that there was more snow there than here.

The proof that the warm winds sweep over the State with greater freedom and force as the forests disappear, is proof that the cold winds become intensified also. But, it may be asked, what obstacle do trees present to the motion of the atmosphere, which is several miles in height or thickness? The atmosphere, movable as are its particles, and light and elastic as are its masses, is yet held together as a continuous whole by the law of attraction between its atoms, and therefore, an obstruction which mechanically impedes the movement of a given stratum of air, will retard the passage of the strata above and below it.

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 are cited in the old countries, as well as by observations in our own, all concurring to show that it is an important element in local climate. I will introduce one statement to this 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." Statements parallel with this from Belgium, may be gathered from all parts of Europe. Sunny France, where we have looked at another result from man's operations in a mountainous country, has lost most of her semi-tropical fruits, and only sees them restored as they are provided with shelter. Cortes, the Spanish conquerer of Mexico, left by his will, sugar plantations in the valley of the city, where now, owing, it is supposed, to the cutting down of the trees, the cold is too great for sugar cane or any other tropical production to thrive.

"At Worcester, Mass., careful observers attribute the greater difficulty now experienced in the cultivation of the more delicate fruits in that town, to the fact, that the encircling hills, formerly covered with trees, are now, to a considerable degree, laid bare."

"The laws of the motion of the atmosphere are similar to those of water. A bare hill gives no protection. The wind pours over it as water pours over a dam. But if the hill be capped with trees, the windy cascade will be broken into spray. Its violence will be sensibly diminished."* A forest near the coast, in any part of New England, protects those farther inland from the chilling east winds; and while such winds prevail, a person passing towards the sea, experiences a marked change of temperature upon crossing the last wood and especially the last wood-covered hill. A garden surrounded by tall trees admits the cultivation, even in our severe climate, of plants from a much warmer zone.

The first settlers in the counties of Kennebec and Oxford, raised good peaches in abundance. This fruit retired gradually from Maine, quit southern New Hampshire, lingered for a time in Massachusetts, and has finally been driven from all New England, except some favored spots where shelter has been provided; and that luscious fruit is still retiring southward, under protest, and seems unable to give assurance of making a stand north of Mason and Dixon's line. The same causes materially affect the more hardy apple. Trees are longer in coming to the bearing state. The general crop of the State has greatly fallen off. Orchards with the bleakest aspect, produce the least. In the last season, I have seen apple trees in this vicinity, under perfect shelter, loaded with fruit, while on the bleak hills, acres of orchard failed to yield a supply for one family.

But time passes, and the task grows under my hand. As I have jotted down on these leaves the words to be offered you as food for thought, as I have turned leaf after leaf to the pile, I have held in reserve the home points for a final appeal in behalf of the trees. But I must relinquish my purpose for this evening—and in doing so, will indicate in part, what was my design.

I designed to speak of the already destitute condition of some neighborhoods on the coast-line of our State, in regard to timber and fuel—where all the farmers in the present generation were cutting off their wood for the Boston market—all have now reached their last tree, and are bringing wood for their own fires from distant points on the coast. Now these same farms have nearly ceased to produce aught for man or beast, and domestic

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* George B. Emerson—"Forests of Massachusetts." 1845.

animals have nearly been banished from them. I designed to call your attention to the general condition of the towns here about us, as they are, sixty years removed from man's first destructive onset. I designed an attempt to reconcile you to the wise plan of nature, by which you are placed on the immediate border of lands not suitable for farms, where you may go a little time longer, for your timber and your fuel. I designed to show you, that without this arrangement, of which you sometimes complain, this river's channel would be dry with each summer's drouth; and at some winter's rain, when the the naked hills and valleys should be deep frozen, the swift-retiring waters would sweep all your mills and bridges into the ocean. I intended to offer you, in imagination, a sleigh ride, on such a day as oft occurred in the last month, up this river valley, passing over the open country, mile after mile, in the teeth of a brisk nor' wester, and talk to you by the way, of the beauties of American landscape; or taking a wider circuit, count the proportional number of homes—one in a thousand possibly—where the owner, by a wise forecast, has nestled it in the lee of a wooded hill, where the benumbed traveler can take breath as he rides past it, and for the moment join the domestic scene, and participate in the pleasures which the clear, midday sunshine imparts to the herd of domestic animals. I had projected a tour with you to the mountains near Sebec Lake, and the higher points around, to look at the giant pines with up-turned roots, as they lie decaying on those hundreds of acres of now bare granite rock, to show you the wasting effects of fire on the borders of civilization. I designed to go on a tour of inspection, to see the location of the wood-lots that are to stand for your use after the lapse of the next twenty years, when, with your railroad and the promised increase of your village, 500 acres of wood will be required annually, instead of 150 acres as now. I wanted to talk in solemn words to the remnant of those vandals who still hang on the skirts of society, living upon the woods—rioting on the proceeds of cedar shingles!

I wanted to gather here the chums of my boyhood, and speak of the oar-makers, who long ago cut all the large ash trees in these towns. But those boys are not here. They have gone to distant States, or passed on to fairer climes, where, under the higher law, man's destructive power avails naught. It would avail nothing to lecture to the men who have, since the crusade of the oar-makers, overrun the county and nearly exhausted the younger ash trees for shovel handles and other purposes. But I would like to whisper in the ear of that woods-man, who, a few days since, cut a fine, young ash, to skid his road and guide his sled from a stone,—when he could have cut an alder as well,—that just such trees are worth one almighty dollar each, standing within ten miles of anywhere. I intended to go to the hills and talk with the owners of them, of the mistakes made in cutting away the wood where the soil was so thin that it has already gone down to the valleys, leaving the naked rock above;—and of the ways and means by which they should, at no distant day, be re-clothed in green. I wanted to advise land owners, while they planted fruit trees, to plant at the same time a forest screen to the windward of them, and advise with them as to the mode of doing it. I wanted to give the assurance, that in planting a belt of trees, first with our hardy evergreens on the cold side, our deciduous trees next, then on the warm side, the oak, hickory, chestnut and black walnut will succeed and grow here with nearly the rapidity they do in their native latitude. But I have already indicated a wider range of thought than should be compressed in one lecture. My purpose has been more to direct your attention to a subject of vital importance, than to attempt any solutions of its intricate problems.

While my subject has been in process of taking form, in the odd hours of the last few days, the exercise has not been to me one of unmixed play.* The whole subject matter is yet fragmentary, and scattered wide over the domain of physical nature. With my every effort to gather of these fragments and compress them into a unity, they have tended off in tangents, with a seeming affinity for each other in groups, looking here and there very like series of lectures waiting for curious hands, scintillating in the dreamy distance and eluding my present grasp of thought.

There is one consideration to which I failed to allude in the proper place—the opportunity that will be afforded for the formation and growth of taste and character in connection with arboriculture and sylviculture as they must soon be studied and practiced. Our surroundings as we make them, are but the outgrowth of our interior selves. As adding to the beauty of a

* The previous lecture of this course, was on the subject "Work and Play."

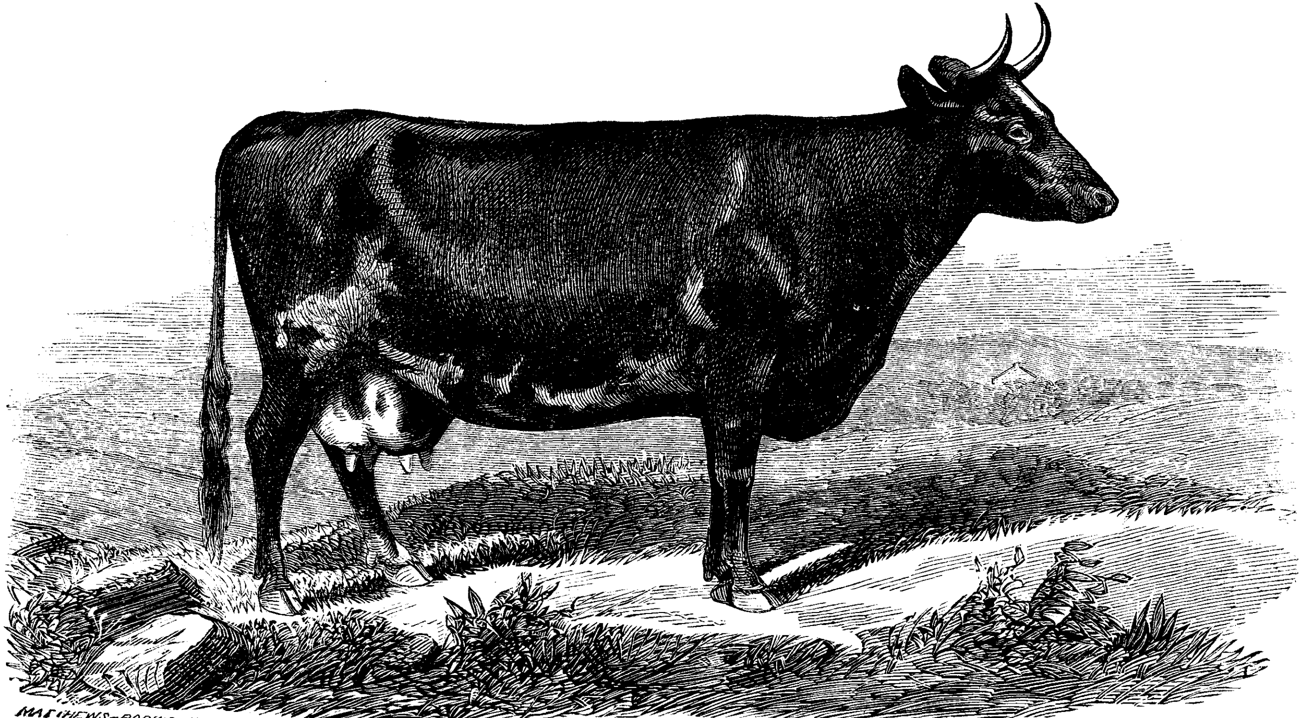
country, the forests are of the utmost importance; and no element of beauty is so completely manageable as trees.

One practical fact I think you will have learned before you get far on your way in improving your lands by sheltering them—that is, that two thirds of your present area, well sheltered, will produce as much as the whole now does. *Sufficient shelter*, is so much as will save the snows of winter from being blown off the fields. A barrier to winds is found to act effectually over a space equal to ten or twelve times its own height.

There are some things that I would like to say in this connection, not exactly relevant to my subject. But when one finds it hard to "get the floor" in the world's great debating society, the speaker must make the most of his opportunity to reach the public ear, without any nice inquiry as to being "in order."

During these years, I have toiled as you have, for my bread and butter. While I have done so, I have not been unmindful that to my keeping was intrusted a section of that green fringe which I hope you may ever see as a border to your pleasant village. In an extended sense you all are joint owners with me in it. You all enjoy a seat or a walk under its dear, old trees as I do. While I have tilled it, I have not been unmindful of that part of it which still stands as nature clothed it. While I have tried to make the place a pleasant, green spot in spring-time, I have studied to so order it that much of the same light and shade should be continued through summer's drouth and winter's cold. While I have labored to preserve trees or to plant them for their shade and their fruits, I have talked with you of trees and of fruits as we have met day by day; and I here thank you for the degree of interest with which you have listened to me. And I have often thought to say to you, my neighbors, that the most of you will live to see the spot I have cared for these few years, pass to other hands. When it does pass, I hope it may be to one whose taste and habit may dictate a tender care of its trees.

From the character of our government—National and State—and the fact that the most of our land property is held by individuals in small parcels, it is pretty certain that when the evils of which I have spoken shall be stayed, it must come through individual effort—just as the character, habit, and prosperity of the nation at any time is but an aggregate of individuals in those particulars. As action is the expression of the highest intelligence of the individual, so all general reform comes through the dissemination of higher light. As you farther examine the subject to which I have in so brief and imperfect a manner directed your attention, as your acts—the exponents of your convictions—shall take higher rank, worthy of the place you occupy as integrants of a great nation, in degree as you shall advance to the full discharge of your duty in this impending crisis, in the same amount and degree, shall be my reward for this effort.



Ayshire Cow,—"FLORA."—Owned by William Birnie, Springfield, Mass. Dark red and white; calved March, 1857; bred by George Richmond; imported from Scotland in 1859.

WHEAT CULTURE IN MAINE.

No other cereal furnishes so perfect a food as wheat. No admixture of other grain is requisite in order to make the best bread—the best single article of human food—best, because it furnishes in fitting proportions and palatable form, those flesh-forming, heat-supporting and force-yielding constituents needful to sustain life and vigorous strength.

No other cereal can wholly fill its place, hence it is recognized as one of the first necessaries of life in all civilized communities. Except for its perishable character, and its bulk and weight, it would be a more perfect standard of value than either gold or silver.

But the importance of wheat is too well appreciated generally to render necessary any extended remarks on this point, and hence I proceed to remark :

That the perfect culture of wheat requires the highest exercise of skill on the part of the agriculturist. This is true notwithstanding the fact that thousands of acres yielding plentifully are annually grown under the culture of ignorance. But this occurs only on the rich prairies of the West, or upon other virgin soils where nature's processes of storing up elements of fertility have been going on during periods of great and indefinite length. Upon such soils, as well as upon these of less natural wealth, it is simply a question of time how long such culture will be followed by remunerating returns.

Wheat culture in the United States, from the beginning, has been mainly an exhaustive culture. It has been the fashion to take as much as could be got from the soil without making much returns to it, and fast enough to suit the views of the croppers; and when returns came too slowly and too meagrely, to move on and ravish other virgin soils in like manner. It is too much as if their motto had been "After me the deluge"; utterly thoughtless of the needs of posterity, and ignoring their duty to leave the world better than they found it,—physically as well as morally.

The result of this course is, that the granery of New England has been receding for many years,—it is now a good while ago that it passed her own borders, although many, and not very old men either, can remember when we only "went to New York to mill," and with no misgiving that the famed "Genessee country" might not be able to furnish all which might be wanted, and more cheaply than we could grow it at home; and yet the fact is that now the mills at Rochester do not depend mainly on wheat grown in the Genessee Valley, and not a little of the flour used on the Atlantic coast comes from the uttermost shores of this Western continent!

It is asserted upon good authority that "from Illinois, on an average, it costs the farmer three bushels of corn to get the fourth to market in New York; from all the Lake States it costs one half of all the wheat and flour to the farmer to get the rest to the markets of the world." If such be the fact it is obvious that the obstacles which intervene, notwithstanding the immense facilities for transportation which modern science and energy have achieved, are equivalent to a protective tariff of one hundred per cent. and upwards upon Western breadstuffs, which is paid by the consumer here.

It would seem that this must be abundantly ample to compensate for any disadvantages under which we may labor and to make its production here a paying business. Botanically speaking, wheat is a grass, or a member of the family of grasses, and its requirements, in regard to soil and food, do not differ materially from those of other nutritious grasses. Especially is this the case if we suppose the grass to be an annual variety and grown for its seed rather than for forage. In this connexion I am reminded of a conversation held some years ago with one of the most intelligent Scottish farmers I have ever met, in which I remarked that Maine produced very largely of hay with comparatively little grain; that our farmers generally thought the former could be grown to much better advantage than the latter. His reply was "If you can grow hay *to advantage*, surely you can grow wheat enough for home consumption;" to which I felt constrained to say, that our style of producing the hay was not probably such as he would consider *advantageous*, for much the greater portion of it was from large breadths which gave but a scanty yield—somewhat less than a ton per acre.

If we compare the acreage products of Maine with those of other sections, we find that our product of hay—the crop which is grown here more extensively than any other,—is considerably less *per acre* than the yield of hay in other sections where wheat is known to be extensively grown; while at the same time, these wheat producing sections are content with an average yield of ten to twelve bushels per acre, an amount which would be deemed unsatisfactory here. I have freqently asked myself why is this so? and without becoming fully satisfied with any answer which has suggested itself. A plausible supposition would be, that Maine farmers had been taught by experience that the climatic and other conditions which prevail were more favorable to hay than to wheat; and also that they were content with altogether too low farming.

The time was when Maine grew her own breadstuffs, but for many years the complaint has been general, that "old land wont produce wheat as it used to grow on new land;" and so its culture gradually declined; the declension being greatly hastened, and with many reaching total abandonment, by reason of the advent of the midge.

Having already treated of the midge at considerable length in a former report,* in a paper devoted to "Obstacles to Wheat Culture," it may suffice here to offer two remarks merely; first, that this obstacle was never any more formidable here than it has been where wheat culture was more extensive, and notwithstanding the midge, was extensively continued up to the present time; and ought not to have caused an abandonment; and secondly, that there is now reason to hope that new natural enemies to the midge have been raised up or by some means introduced, which may hereafter lessen its rapid increase, as they have been known to do in Europe, whence the midge was brought to this country (probably in straw used for packing crates of crockery) but without the importation, at the same time, of the parasitic destroyer which there holds it in tolerably effective check. It is undoubtedly true that old land will not produce wheat with the same facility and abundance and the same lack of manure and skillful management as new land, but the time has come when it must be grown on old land or not at all, whether in Maine or in the other States of New England or in New York or in Ohio; and the same will be true of lands still farther West before very long.

And this can be done. It has been done for centuries in other and older countries. In England by improved methods of cul-

*Report for 1858, pages 125 to 150.

ture, better management, and especially by the aid of commercial manures the average yield has been raised within forty years from fifteen bushels or less to near thirty bushels per acre.

As the case stands now, there are farmers in Maine who tell me they have not failed to reap a fair crop of wheat in any season during a term of twenty, and some say, thirty years past. In some seasons the midge or the rust or mildew or other cause has prevented a large crop, but on the whole, the return has been as satisfactory as from other leading crops. It is an undoubted fact, and one which should never be lost sight of, that all commonly complained of hindrances fall with comparative lightness whereever good cultivation prevails. It is chiefly where, from any cause, be it lack of skillful culture, lack of food or any other lack, plants (forming any crop) are afflicted with feebleness, hunger and general debility, that they invite the attack of diseases and calamitous visitations of all sorts, and fall a ready prey to them. Over the fence, under better treatment, in similar soil, the same kind of plants, healthy and robust, successfully resist the adverse influences which were fatal to the others.

Soil.—In considering the subject of soil, for wheat or for any other plant, two aspects present themselves; first as a home for the plant, and thus chiefly of its mechanical character; and secondly, as furnishing the needful food to sustain vigorous growth of the plant; this involves its chemical composition. Wheat loves best a firm soil for its home, and for food, its requirements, (aside from those constituents which are usually found in sufficient quantity naturally,) are chiefly phosphoric acid, potash and nitrogen. The best soil for wheat is good, strong loam, containing clay enough to give it due consistence; in other words such a soil as you would prefer, if you could have choice of all, to grow grass upon. Stiff clays, *when well underdrained,* not only succeed well, but will sustain a growth of wheat during a longer term (other things being equal) than most other soils. Limestone and slate soils, such as prevail extensively in Aroostook county, are excellent. Sandy soils, although to a greater or less degree generally deficient in the qualities which fit it for a home for the plant and also in food constituents, sometimes succeed pretty well, especially if well fed.

For the successful growth of wheat and particularly for winter grain, it is absolutely essential that the land be *well underdrained* unless it be underlaid by a subsoil porous enough to allow the free descent of surplus water, so that none remain in it for any length of time except so much as is held by capillary attraction.

Upon any soil of Maine having a fair degree of natural adaptation to the crop, by means of underdraining where needful, and judicious manuring and suitable culture, our belief is that a profitable crop of wheat may be grown in nine years out of ten.

MANURES.—Among the manures most frequently mentioned in connexion with the growth of wheat is lime. Wheat contains some lime—but only a very little—much less than is generally supposed—not more than one ounce in a bushel of grain, (and a little more in the straw,) while it contains rather more of soda than of lime, about four times as much magnesia, nearly nine times as much potash, and more than thirteen times as much phosphoric acid*.

It may not be safe to assert that soils are nowhere to be found so completely destitute of lime as to be incapable of furnishing the small quantity required as food for the wheat plant, but such cases must be comparatively rare. Nevertheless the application of lime is frequently of immense advantage in promoting the growth of wheat, especially on clayey soils. If we call lime a good manure for wheat, it is because the term manure is understood to embrace not only those substances which supply plant food, but also all such as may be used for the purpose and with the effect of accelerating vegetation, or of increasing the production of cultivated plants. During the early part of the present century the great topic of discussion among both practical and scientific farmers was the part which lime played in relation to the soil and to the crops benefitted by it. Some contended that it furnished food to the plant; some that it improved the texture of the soil; some that it converted inert matter into assimilable food. Modern science shows that these were, so far, *all* right. It is pretty certain, however, that the precise way or methods in which lime accomplishes all its beneficial results are not yet fully understood, although the researches of Profs. Johnston and Way and others have thrown some light on the subject. For instance, we know that clayey soils are rendered more friable and mellow by the action of lime; and also that some constituents of plant food in soil may, by its application, be liberated from insoluble conditions to one more available to the plants. Prof. Way says "If a plain practical far-

*Calculated from the reported mean results of thirty-two analyses by Profs. Way and Ogston.

mer is asked the reason why he lays lime on his fields he will at once point to the practical results by way of answer—thicker, more luxuriant and sweeter grass, larger and more equal and firmer turnips, bulkier and more abundant crops of barley and wheat, and above all the almost total disappearance of couch grass and other weeds. The clay-land farmer uses lime as a chemical agent, either to afford food directly to his crops, or to bring other substances into a condition in which they may act as such ; and not only does he find that his crops are heavier, but he also discovers that the mechanical condition of the soil is altered. It has become softer, more easily plowed and harrowed and it carries a mellower surface. The light land farmer is also benefitted, for while the use of lime may act in some degree injuriously on the texture of his soil by increasing its looseness, still this evil, which can only be called such as regards the growth of wheat, is more than counterbalanced by its greater cleanliness, the ease with which it can be kept clean, and the increase obtained in the crops of grass, turnips and barley which are the special and natural products of such soils.

These remarks apply, however, to their full extent, only to land that has been well drained, or is dry from natural causes ; for although even undrained or wet land may, in some notable degree, be improved by liming, it is only on a deep staple of dry earth that the action of lime reaches its maximum effect, or continues to exercise a permanent influence. Much money was at one time wasted in liming imperfectly drained land, and there is still very considerable scope for amendment in this respect. Drain first, and (when necessary) lime afterwards, is an agricultural axiom that should form the motto of every farmer who would wish to derive the full advantage of his outlay."

As above remarked, wheat requires about nine times as much potash as it does of lime ; hence we see the value of an application of ashes which directly supplies this constituent of plant-food. Late investigations render it probable that potash may be indirectly furnished to plants by methods hitherto unthought of. Prof. Horsford has recently stated that an incidental effect of an application to the soil of superphosphate, that is to say, of a true acid phosphate, *is the liberation of potash from its insoluble connection with silica,* the condition in which it occurs in feldspar, and the forming of a soluble phosphate of potash. Since almost all the soils of Maine have originated in part from granitic or other feldspathic rocks, there is every reason to believe that our soils contain potash in sufficient quantity to supply many successive crops of plants, *provided* it could be unlocked and set free, or induced to form soluble combinations from which plants could appropriate so much as their needs demand. This explains in part the remarkable results attending the application of a well made superphosphate. But it explains them only in part, for as above shown, phosphoric acid is a necessary constituent of wheat, to an extent greater than that of any other inorganic or mineral substance; about thirteen times as much being required as of lime. Phosphoric acid is a constituent of all soils not absolutely barren, but it usually exists in so small proportions (at least in such condition that plants can appropriate it,) that in order to grow fair crops it oftener needs to be added than any other single constituent of plant food.

It is usually applied in one of four ways; first in farm-yard dung, which when made from nutritious food may contain nearly one-half of one per cent. say ten pounds to the ton. Secondly, in wood ashes, leached or unleached. These contains a proportion varying with the kind of wood burned, from one and a half to four per cent. In wood ashes it exists in a form not at once wholly available to plants, but given up gradually upon weathering in the soil. Thirdly, in ground bones; these if pure, contain nearly twenty-five per cent., and in condition available to the plants proportionate to its fineness and the rapidity of decay of the animal matter which holds together the atoms of phosphate of lime. Fourth, in commercial phosphatic manures, such as guanoes, superphosphates, poudrette, &c. These vary widely, both as to the proportion they contain, and the degree of solubility of the combinations in which it exists. They may contain from three to thirty per cent., and the degree of solubility may vary as widely as the proportions.

A good superphosphate is now generally acknowledged to be the most efficient and economical means of supplying phosphoric acid. Speaking of the value of bones, Todd in his "Wheat Culturist" says, "If there is any one practice among American farmers for which they deserve sharp rebuke, it is for permitting such immense quantities of bones to be exported for the improvement of the agriculture of foreign nations. Thousands of tons of bones are collected annually in Chicago, Buffalo, New York and other populous cities and shipped to European countries, to fertilize the land for raising turnips, wheat, fat cattle and sheep. And yet American farmers, in stupid quietude look on and say, 'It don't pay to collect bones and apply them to the soil.'

It will pay. They have not tested the application of ground bone. There is not a meadow, nor a pasture in the land—with very few exceptions—that will not be greatly benefitted by a dressing of raw bone. Thousands of acres of the best farming land in New England are in a low state of impoverishment for the want of a liberal dressing of raw ground bone. Such fertilizing matter is the very life of the soil. European farmers understand and appreciate this fact. They know it pays to ship bones from America to enrich their farms. The value of every ship-load of bones that is picked from our land cannot readily be computed in dollars and cents, to the agriculture of our country. England delights in her own fatness produced on the choice cheese of American dairies, while we mutter and grumble over a pot of the whey. Europeans rejoice over the rich, sweet American butter, while we are so unaccountably stupid as to be satisfied with the butter-milk. Our farmers dig and delve, and rake and scrape their grain fields, meadows and pastures to get phosphatic fertilizies to send to Europe to produce big crops of turnips, and then grumble and denounce their own land as good for nothing, because their turnips refuse to grow as they do in Eastern countries. The truth on this point is American farmers must save and apply more manure to their impoverished land; especially must they save bones for growing a crop of turnips. As soon as we can produce a bountiful crop of turnips, we can grow wheat. Wheat and turnips in England go hand in hand. And when the wheat soils of America are rendered sufficiently fertile to produce a crop of turnips, we may have the eminent satisfaction of seeing bountiful crops of choice wheat, where now the yield will scarcely defray the expenses of harvesting and threshing the crop."

"No bone dust, no turnips; no turnips no wheat;
No wheat and no turnips, no cattle no meat;
No turnips, no cattle, nor manure in the yard,
Makes bills for the doctors, and farming go hard."

In addition to the mineral elements required, wheat demands a larger supply of nitrogen for vigorous growth than almost any other crop. It cannot obtain this from the air, although four-fifths of the atmosphere consists of nitrogen. The supply of nitrogen to the wheat plant must be furnished through the soil, and hence the universal testimony as to the efficacy of ammoniacal* manures. The experiments of Messrs. Lawes and Gilbert showed that, where every mineral element was present in the soil in quantity sufficient for a maximum crop of wheat, the crop was doubled by an application of 200 lbs. of sulphate of ammonia per acre.

Now since neither the straw nor grain of wheat, (nor rye, barley nor the so-called English grasses,) contain as much nitrogen as do clover or peas, (which grow well without ammoniacal manures,) it seems reasonable to conclude, as is generally held, that the grains and grasses, especially wheat, not only take up, but also pass off, during their period of growth, in some unknown form, a considerable amount of nitrogen. However this may be, sure it is that, a supply of nitrogen, in some available form is an indispensable requisite for the successful growth of wheat. And this brings us to the question, whether there is any way to supply this indispensable requisite otherwise than by farm-yard dung, of which the farmer always has too little, and cannot buy, or by ammoniacal salts, which he could buy if he had pecuniary ability, but which he also lacks?

If the experience of others, elsewhere, furnishes safe data as to what may be anticipated in Maine, this question can be answered in the affirmative. Other plants can be made to furnish it. Es-

*Nitrogen is the distinguishing element of organized substances. Compared with other elements, its affinities are very feeble. Its most characteristic feature is its indifference or reluctance to enter into combinations. When it does so it is usually in some roundabout way, and, as it were, temporarily and under protest, determined to escape as soon as possible. It is well for us that it is so, for if the oxygen and nitrogen of which the air is composed were to *unite* chemically, (forming nitric acid or aqua fortis) instead of remaining as they do, in the state of *mixture*, neither vegetable nor animal life could survive an hour. Explosive mixtures mostly owe their efficiency to the fact of their containing nitrogen which is ready to let go its partnership with other elements immediately upon being struck or touched by a spark. If it were not for nitrogen there would be little in the world of gunpowder, or gun-cotton, or percussion caps, or nitro-glycerine, or fulminating powders. Everybody knows the facility with which animal and vegetable substances pass into decay when life departs from them. During this decay the nitrogen quits its combinations; and usually leaves in company with hydrogen—in the form of ammonia. Ammonia is a combination of fourteen parts (by weight) of nitrogen with three of hydrogen. In the urine and solid excrements of animals as voided there is no ammonia—any more than in fish or flesh, but as these decompose and decay ammonia is evolved, *being formed during the changes going on*—and is readily recognized by its pungent odor. Ammonia readily parts with its nitrogen to plants, and hence the universally acknowledged value of ammoniacal salts as manures. Hence, too, the reader will see how the terms "nitrogenous" and "ammoniacal" come to be used as almost synonymous. It is simply because ammonia readily furnishes nitrogen to plants, and plants can get nitrogen readily from ammonia when they would not get it from the air which contains it in abundance, but in an unavailable form.

pecially and to great advantage can it be supplied through the agency of clover.

The wheat soils of Maine can be made to grow clover with ease. In some sections an application of a bushel or two of plaster (gypsum) per acre, will cause a plentiful growth. Leached ashes are excellent for the same purpose, and where these fail, superphosphate will serve to effect vigorous growth. Mineral manures will suffice. Ammoniacal manures are not requisite to, nor do they help materially, the growth of clover. Clover has the power to obtain nitrogen, somehow or other, nobody knows how or from whence, but it is generally supposed from the subsoil by its long tap roots, and it stores up this nitrogen in the plant.

By virtue of the nitrogenous constituents it possesses, clover hay is supposed to go farther in repairing the waste of the system, and in forming muscle, or lean meat, (but less of fat,) than herdsgrass, red-top or any of the proper grasses. The manure from animals fed upon clover, is certainly much richer in nitrogenous constituents than that from the grasses. It is true that farmers frequently get very little benefit from this superior richness of the manures from clover, but it is the fault of the management and not of the excrements. The richness is largely in the urine and this is too often lost entirely, and the solid parts are too often leached and its soluble portions lost to the owner's benefit. As Mr. Harris pithily remarked once, "a ton of such stuff as farmers call manure wouldn't furnish ammonia enough for a lady's smelling bottle." But it can be saved, and it ought to be saved. Careful calculations show that the nitrogen voided in both liquid and solid form, from the consumption of a ton of clover hay is worth a fraction over nine dollars, (and besides the nitrogen it has other constituents of value,) which is about half as much as is yielded by the consumption of linseed oil cake which is extensively used in England for combined feeding and manuring purposes, and which always bears a high price.

I am aware that many farmers have more or less prejudice against clover for feeding purposes, but I could never discover sufficient ground for it. As an agency for enriching and sustaining our lands, I am confident it deserves a great deal more attention than has been given to it. Its beneficial effects where extensively used, as in western New York, in some localities from twenty to forty years, are beyond all question. We can grow clover with greater ease and with fewer drawbacks than do the farmers of England where they often complain that the land becomes "clover sick" and refuses to produce a crop.

Some diversity of opinion exists whether the better policy be to plow in the crop, or to harvest and feed it to stock, applying the excreta to the land. From such investigations as I have been able to bestow upon this point, and it is one of importance, the conclusion has been reached that, *provided* the liquid and solid excreta be fully preserved, it is much preferable to pass the larger part of the clover grown through the stomachs of animals. But if the saving of the excreta is to be after the style usually practiced by a numerical majority of farmers, I hold it better to plow the crop in, as more economical both in regard to labor and manure.

Another mooted point is the proper stage of ripeness at which the crop should be turned under. It is generally agreed that clover will furnish the greatest amount of nutriment for animals if cut when the earlier blossoms begin to turn, but if plowed in at this stage there is liability of too rapid fermentation to ensure beneficial results. Sometimes actual injury ensues. A very intelligent farmer, in the vicinity where I reside, informed me of an instance in his experience where he had a very heavy crop of clover so badly lodged that he thought it would furnish him an excellent opportunity to try the alleged benefits of green manuring, and he accordingly plowed it under. The result was that violent fermentation ensued, the weather and soil being warm, the land was "soured" as he termed it, and the fertility of his soil was very seriously injured for a term of years, in place of receiving benefit from its heavy manuring. Had the crop been allowed to remain on the surface until farther decayed, and then nearly dried before turning in, the result would undoubtedly have been widely different.

It does not follow that to plow in crops when they are in the best condition to cut as the food of animals, will result in the greatest benefit to the land. Practices which would be judicious in a climate so unlike ours as that of England may not be equally useful here. I have now lying before me a prize essay on green manuring, published in a recent number of the journal of the Royal Agricultural Society, in which the writer says, "it ought if possible to be plowed in either while it is passing into flower or is in actual bloom, for it then possesses its maximum of easily soluble and alimentary matter." Again he says, "the ground to be benefitted by the plowing in of green crops should be capable of bringing them forth, if not luxuriantly, at least with such abundance as to furnish complete shade during their growth, and sufficient vegetative matters to occasion a rapid fermentation when buried." I do not say that this would not be good advice to follow in England, with tares, rape, buckwheat or mustard, the crops usually grown there for green manuring; but as at present advised I cannot recommend the plowing under of crops in Maine, until they be past bloom and partially dried. The result in such case will be a slower but equally effective decay, attended with a return to the soil of all the enriching matter which the plants had obtained from any and all sources, and without loss or injury by reason of the generation of noxious gases, which in our climate are sometimes at least, found to attend a too rapid fermentation. This I find, so far as my inquiries have reached, to be the general experience and testimony of practical men who have tested the matter under the conditions which prevail among us.*

Nor does it follow from the fact that the clover plant furnishes a particularly valuable agency towards the production of wheat, that the best place for wheat in the rotation is next after clover. It may be in some cases and not in others. Experience in divers places indicate this to be the fact. Even in Onondaga Co., N. Y., where as Mr. Geddes says, "The agriculture of this county is based on the clover plant. It is used for pasture, for hay and for manure. Strike this plant out of existence, and a revolution would

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Since the above was written an article appeared in the American Agriculturist from the pen of Joseph Harris, in which he quotes Mr. Geddes as recommending the plowing in of clover "when it is at full growth." To quote more fully, he says: "A few weeks ago an Ohio subscriber of the Agriculturist wrote me in regard to the best time to plow under clover for manure. I wrote him that I had little practical experience in the matter, but theoretically the best time was a week or ten days earlier than it should be cut for hay. Dr. Voelcker's investigations [Journal of the Royal Agricultural Society, Vol. 3, Part 1, 1867,] indicate that when clover bursts into flower there is no further accumulation of nitrogen, but that, on the other hand, there is a rapid formation of sugar and other nutritious carbonaceous substances. To cut clover for hay, therefore, as soon as it bursts into flower, would be a wasteful practice, but it is just the time to plow it under. We get no more nitrogen by allowing it to grow longer; and the more succulent it is, the more rapidly will it ferment and decay in the ground. I wrote to Mr. Geddes, one of the earliest and most enthusiastic advocates of clover, requesting his opinion on the point. In reply he said: 'Plow under the clover when it is at full growth. But your question can much better be answered at the end of a long free talk, which can best be had here. I have many times asked you to come here, not to see fine farming, for we have none to show, but to see land that has been used to test the effects of clover for nearly 70 years. On the ground, I could talk to a willing auditor long, if not wisely. I am getting tired of being misunderstood, and of having my statements doubted when I talk about clover as the great renovator of land. You preach agricultural truth, and the facts you would gather in this neighborhood are worth your follow that would make it necessary for us to learn every thing anew in regard to cultivating our lands." He says, on a subsequent page of his admirable "Survey," "the most common and approved rotation is, first year, clover sod plowed in the spring and planted to Indian corn.

Second year, oats or barley.

Third year, winter wheat,† sown on the stubble of the oats or barley, timothy grass seed, at the rate of four or six quarts to the acre being sown, either with a machine attached to the drill, or by hand; if by hand, immediately after the wheat is covered. In the following spring, red clover seed at the rate of eight quarts per acre.

Fourth year, a crop of (clover) hay and another for seed.

Fifth year, pasture."

Here we find one crop of Indian corn and one of smaller grain to intervene between the turning under of the pasture sod filled clover roots, and the crop of wheat. Mr. Geddes goes on to say that "in the south parts of the county spring wheat is sown extensively, and the rotation differs somewhat from that given. Much more land is there devoted to grazing, consequently there is less plowing and re-seeding for grass. The rotation given is most common in all parts of the county where grain is extensively grown." We could wish that Mr. Geddes had been somewhat more explicit regarding the longer rotation which prevails in those

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knowing, and worth giving to the world. So come here and gather some facts about clover. All that I shall try to prove to you is, that the fact that clover and plaster are by far the cheapest manures that can be had for our lands has been demonstrated by many farmers beyond a doubt—so much cheaper than barn-yard manure, that the mere loading of and spreading it, costs more than the plaster and clover. Do not quote me as saying this, but come and see the farms hereabouts and talk with our farmers.'

Of course I went, and had a capital time. Mr. Geddes has a magnificent farm of about 400 acres, some four miles from Syracuse. It is in high condition, and is continually improving, and this is due to growing large and frequent crops of clover, and *to good, deep plowing, and clean and thorough culture.*

We drove round among the farmers. 'Here is a man,' said Mr. G., 'who run in debt $45 per acre for his farm. He has educated his family, paid off his debt, and reports his net profits at from $2,000 to $2,500 a year on a farm of 90 acres; and this is due to clover. You see he is building a new barn, and that does not look as though his land was running down under the system.' The next farmer we came to was also putting up a new barn, and another farmer was enlarging an old one. 'Now, these farmers have never paid a dollar for manure of any kind except plaster, and their lands certainly do not deteriorate.'"

* This he elsewhere informs us is manured with about a gill of gypsum to each hill after it has come up.

† Manured with "nearly rotted manure" harrowed in.

sections where grazing is most extensively pursued, inasmuch as it would more likely furnish suggestions by which we might profit, than a rotation in which hay and pasture occupied the land only two-fifths of the time.

Another rotation which is highly approved in some parts of New York is as follows :

First year, corn on sod.

Second year, barley, followed by clover not cut, nor pastured, but allowed to rot down.

Third year, clover plowed under after attaining full growth, and afterwards sowing with wheat.

Fourth year, wheat.

Fifth year, clover and timothy for hay.

Sixth year, pasture.

Few questions meet the farmer which require for their satisfactory solution more experience and brains than the one "what is the best rotation for me to adopt?" No general answer can be given, because so much depends on the character of the soil, and subsoil, and climate, and other general conditions, as well as on the crop which is deemed the most important to favor.

If wheat is to be grown on strong clayey soils, and these *if properly drained and enriched* certainly possess advantages over others, (and we have a great deal of them along the coast line of the State,) I see not why the summer fallow may not be advantageously introduced. It would go far towards suitably mellowing, cleansing and thoroughly preparing the soil, with the additional advantage of permitting winter grain to be sown *in good season,* and this is a matter of no mean importance, since one of the most frequent causes of the failure of winter wheat in Maine has been too late sowing.

Considerable diversity of opinion prevails regarding the expediency of pasturing clover. Some maintain strongly, as the result of experience and careful observation, that land is left in better condition for subsequent grain crops, where the clover is cut and carried off, leaving the roots alone to fertilize the soil, than it is where the same clover is fed off by animals who in consuming it return to the land a considerable portion of what is thus eaten. A recent editorial article in the Mark Lane Express, acknowledging the fact to be of frequent occurrence, explains it as follows :

" There are few questions connected with agricultural practice, which give rise to more interesting research than the peculiarity so frequently observed respecting the growth of a second cutting of clover, and its influence upon the succeeding grain crop. The speculations which have been advanced, and the explanations which have from time to time been given, appear to contradict so many well established opinions, which have generally been accepted as undeniable, that the question still appears shrouded in mysterious doubt. It is held, and we see no reason to deny its accuracy, that any crop grown upon the land, which may be cut and carried away, must of necessity have a tendency to impoverish the soil from which it is produced. It is true, that if such produce be removed to the homestead or fed off, upon other land, the farm remains uninjured; for this process then simply resolves itself into a transfer from one part of the farm to some other portion, of a bulk of vegetable matter, which being consumed by stock, is partially appropriated by the animals feeding thereon, and the residue again reaches the soil as manure. The peculiarity so frequently noticed in the growth of clover chiefly consists in the fact that land from which a second crop of clover has been cut and carted away, is in better condition for the growth of wheat, than when the same clover is consumed upon the field on which it is grown. Indeed, we may go so far as to say that even when such clover has been allowed to stand for seed, it is not uncommon for the same result to be observable.

This, we readily acknowledge, conflicts sadly with many established rules of agriculture; but these facts are none the less correct on that account. It is placed beyond all doubt, that the removal of a crop of clover—and still more so with a crop of clover-seed—must of necessity withdraw from the land much valuable fertilizing matter; and it follows as a natural consequence that the soil cannot be as rich in fertilizing ingredients as it was prior to its growth. And yet we have the paradox existing in the shape of an improvement in the crop of grain upon that portion which has had the clover taken away, as compared with that part on which the clover was fed on the land; or in other words a diminished degree of fertility is attended by an increase in the crop of grain.

It is clear that there must be some compensating influence to explain this result. It has been maintained by many that when the land is depastured, there is a considerable exposure of the soil to the scorching influence of the sun, and thereby the nature of the soil is said to be drawn out and its quality injured. We have little opportunity of knowing what is really intended by this explanation, and, indeed, it can only be received as exceedingly indefinite. It is easy for any one to understand that manure exposed to the sun may lose some portion of its volatile constituents; but we have no corresponding loss taking place by the action of the sun upon the soil—so far, at least, as any trust-worthy researches have hitherto led us to believe.

We must rather seek for an explanation from some other influence more definite in its character, and more capable of accurate proof. In the luxuriant growth of clover we have one of the best illustrations known, in the entire scope of agricultural practice, of a crop gathering nutriment both from the soil and from that which is the common property of all—the atmosphere above it. Its roots penetrate into and through the soil, gathering therefrom the nutriment the crop requires, moulding it into new forms, and preparing it for being assimilated in the growth of the crop. This vigorous growth below the surface is accompanied by an equally luxuriant development of foliage above, which very powerfully co-operates in promoting the general increase of the crop; the activity of the roots has a fitting counterpart in the vigorous action of the leaves, which abstract from the atmosphere much valuable fertilizing matter; and thus, by the co-operation established, we have an accumulation of a rich mass of vegetation, valuable either as food or as manure, but its growth has been the result of an active development both above and beneath the soil. Any circumstances favorable for promoting vegetable growth would in such a case act favorably; and on the other hand, any condition unfavorable thereto must tend to diminish the produce.

If we now notice the growth of a crop of clover which is being depastured, we shall observe that many of the conditions of luxuriant growth are wanting; and as a consequence, we cannot have an equally extensive formation of vegetable matter. The irregular manner in which such clover is eaten not only destroys much valuable food which has been produced, but by the sheep eating into the centre of the plant its further growth is frequently effectually stopped, and thus much of the clover perishes, and leaves the soil exposed and in an unproductive condition. Further than this, the crop has no opportunity of making a bulky growth, the practice being generally to eat it as it is growing, rather than let the crop advance towards maturity, and then be fed off.

It is in the latter stages of growth that the two practices offer the greatest contrast. When a moderate growth has been secured, the one portion may be set aside for feeding, and the other part reserved for mowing; but from this moment, the one is subjected to a process of a destructive character and the other is permitted to accumulate, with a constantly increasing force, vegetable matter of the richest character. Instead of the plant being plucked in its point of growth, the development goes on uninterruptedly; the soil, instead of being scorched by the rays of the sun, is kept moist by the overshadowing leaves of the clover crop, and thus the growth of the crop is encouraged. The growth, and consequent accumulation of rich vegetable matter, goes on until the period of full growth has arrived, and then the whole is cut down and removed. In the one case, the growth is interrupted during its most important stages; and, in the other instance, it is encouraged with its fullest luxuriance.

It is perfectly clear that by such luxuriant growth the demands upon the soil have been very greatly in advance of that removed from the soil by the portion fed upon the land; but we must not lose sight of the fact that the growth above the ground has been proportionate with the growth of the roots in the soil, and that a luxuriant crop of clover leaves such a rich legacy for the succeeding crop in the accumulations of vegetable matter produced by the decay of the clover roots. When the crop has been fed upon the land, the growth of the clover root has been impeded, and consequently the land is far from being in equally good condition for the growth of grain. True, we have removed from the land a considerable quantity of valuable fertilizing matter in the clover taken from the field; and yet, by the course of management pursued, there remain behind in the soil, accumulations of fertilizing matter of a different nature, but most valuable for the succeeding grain crop, which more than compensate for the loss. The advantages appear all on one side, for most remains where most has been removed; but, in the one case we have secured an uninterrupted and luxuriant growth, whereas by the process of feeding the clover, we have kept its growth impeded, and consumed it in such a manner that the land could not receive those stores of rich nitrogenized matter which the clover extracts from the air and adds to the land.

It must be admitted that there are exceptional cases to the more general rule we have referred to; but those variations may generally be shown to be traceable to other causes, and not in any way to interfere with the rule. If, for example, the plant is weakly in its character and habit, or has partially failed upon the land, the difference in favor of cutting will be less evident; the closer and more abundant the crop may be, the more fully will the result be in favor of mowing as compared with feeding; and conversely, when the crop gives no evidence of growth, we ought not to look for results of as favorable a character as we should otherwise expect. The secret of the entire difference lies in the fact of an uninterrupted growth being encouraged until the fitting time arrives for its prompt removal."

Among the conditions which elsewhere attend the successful culture of wheat upon soils long cultivated, we find a due degree of fertilization of the soil to be an indispensable requisite. We all know how inadequate are the resources of the barn-yard of the Maine farmer to supply the means for directly manuring a sufficient breadth of land. We know also that his pecuniary resources are inadequate fully to supply the want by means of commercial manures. Doubtless he may purchase advantageously to the extent of his ability, *and the increase of crops thus effected add, year by year, to his barn-yard supply, and so every purchase may increase his ability to supply himself in the future.*

We have just seen that indirect manuring, through the agency of ameliorating crops, and a judicious rotation, may contribute materially to the due degree of fertilization which is required. Are these all the helps which are available to us? We think not. A careful study of the lessons taught by the enlightened and extended experience of old-land farmers in England, cannot fail to impress upon the mind as a point of great practical importance the connection which exists between the successful culture of wheat and sheep husbandry, together with root culture, and especially the culture of the Swedish turnip.

Hitherto, in Maine, sheep husbandry has been governed principally by considerations relative to the production, quality, and price of wool, and as a necessary consequence the numbers of sheep kept have been subject to great fluctuations. This is not the view which true policy would dictate. For the production of wool other States and and other countries possess natural advantages which we do not enjoy. These are so great that with all the help obtainable from high tariffs and greater nearness to the centres of woolen manufacture, we still labor under very considerable disadvantages. But no such disadvantages here attach to the cultivation of sheep considered as an agency for the production of meat and manure; decidedly the contrary is true. Meat is worth more, and manure is worth more, by a great deal than they are where the greater natural advantages above referred to, for the production of wool, are enjoyed. And this fact of to-day is growing bigger and more intense ever year. Good mutton is constantly appreciating in public estimation as an article of food. It has yet to advance a great deal more in the same direction, for the common estimate has been formed in large measure upon sheep meat of inferior quality; some of it very sheepy and very mean. Mutton is like Jeremiah's figs, the good very good and the bad very bad. It is doubtful if one in five of our population ever tasted first-rate mutton. It is doubtful if as large a proportion of our farmers give the sheep due credit for his usefulness as a manufacturer of manure, and as an improver of poor pastures.

No question at the present time receives more attention among the best agriculturists of Great Britain, than "how can I enrich my farm at the least cost?" The conclusions arrived at may be gathered from the enormous purchases of superphosphates, guano and the like, and also in the immense importations of food made expressly in expectation, (an expectation founded upon experience,) of receiving back a considerable proportion of their cost in the manure yielded from their consumption. That both methods pay well is entirely certain, but which pays best is not settled and probably never will be, because by reason of varying circumstances and conditions the replies given by results of experience are not uniformly in favor of one over the other. This is a matter for each to settle for himself.

Without doubt much remains for the Maine farmer to learn regarding the connection between root culture and wheat culture. The former may be made to serve a most important purpose toward such improvement of culture, and greater enrichment of the soil, as will contribute greatly to the success of the latter. Our climate may be deemed somewhat less favorable for the culture of roots than that of England. Still we grow better crops of potatoes than most other States, and wherever due culture and proper fertilizing additions are bestowed, we grow good crops of mangolds, carrots and turnips, and crops which are profitably grown also. It is not probable that the culture of roots in Maine will ever attain that degree of prominence which it holds in England. There turnips are fed to stock as a principal article of diet. To fatting bullocks two hundred pounds daily is not considered too much. When fed to such an extent the returns are chiefly from the nutritive value of the root, and the manure yielded. But if given in much smaller amounts, say one tenth or one eighth as much, a very marked additional benefit is obtained in the alterative effect of the roots keeping the bowels open and the system in better health, and by the aid furnished toward the better digestion and assimilation of the drier food which constitutes their chief subsistence. For this reason roots deserve a great deal more attention than they receive.

But it is chiefly by reason of their influence as an ameliorating crop, by helping to improve and enrich the soil itself, that they deserve to be carefully considered in this connection. The manurial demands of the turnip are sufficiently met by the use of a good super-phosphate alone;—for if the plants are furnished with phosphoric acid in a soluble form, they seem to be able, in most soils, to obtain whatever else they require, and thus attain vigorous growth. In doing this, they undoubtedly draw very largely upon the atmosphere, while at the same time they obtain from the soil and subsoil, elements needful to the growth of wheat, but which the wheat plant seems unable to get directly from the same soil. When these are returned to the soil together with what is obtained from atmospheric sources, through the manure yielded from the consumption of the roots, the land is found to be enriched and adapted to the needs of the wheat plant to a degree far beyond what it would have been by merely adding the manure which served the requirements of the turnip.

Among the causes which contributed to the decline and fall of wheat culture in Maine were several which may be obviated by better practice. Especially is this true of the alleged degeneracy of the several varieties of grain which were from time to time introduced and cultivated. It is undoubtedly true that they became poorer and poorer, year by year, (as a general rule,) and finally so far run out that they were abandoned for others or for none at all. And why this result?—For the same reason that the domestic animals, the horned cattle, the sheep and the horses would have "run out" had as little pains been taken to improve the seed and the culture. Upon the latter, care and skill and expense have been bestowed, and the result is great improvement; but had they been as ill-bred, ill-fed and ill cared for, as the wheat plants were, they would have been as steadily running out.

Some years ago this subject was investigated both theoretically and practically by Frederick F. Hallett and the results arrived at were given to the public in an essay, the object of which was "to show that the wheat plant from its nature *requires a mode of culture which permits its perfect growth,* and that when so cultivated by the repeated selection of the seed, of which, as in breeding animals the record is a pedigree, we can gradually increase the contents of the ears without in the slightest degree diminishing their number."

From his essay we quote as follows: "It has for the past twelve years been my conviction that a good pedigree is as valuable in plants as in animals, and that in the careful rearing of seed which has this qualification lies our only means of materially increasing the produce of our cereals. Amongst animals whether horses, cattle, sheep or pigs the importance of "pedigree" is fully recognized, as also even in reference to *some* of our agricultural *plants;* for if a farmer wants a good cabbage, mangold, turnip, or carrot, he selects the seed from a good *parent,* but the moment he deals with the cereals he almost ignores the great principle of like producing like, which he admits, in the foregoing cases, to be not only a right one, but so important as to deserve much attention, and repay much outlay.

Yet the minutest characteristics of a plant of wheat will be reproduced in its descendants, so much so, that we can not only perpetuate the advantages presented to us in an individual ear, but *by the accumulation of selection* make further advances in any desired direction; the union of good qualities imparting a cumulative force, and their successive renewals and establishment conferring, as in animals a "fixity of type." To me it has always appeared that, while offering an earnest of what a better system would effect, the mode in which the best varieties of our cereals have been raised (that of starting with *accidentally* fine ears, and simply keeping the produce unmixed without any *further* selection,) is a very imperfect one, and that its attainments are perhaps of less value than the earnest which it offers of future success under a more complete system. For such beginning (and *ending* so far as selection is concerned) with an accidentally fine ear, is a very different thing from starting annually with one of a known lineage. Look at the almost parallel case of two heifers, identical in every respect but that of "pedigree;" the one what she is by accident, the other by design; the one worth £25—the other

£300; from the one you may obtain any imaginable kind of progeny, from the other only a good kind.

The formation of a race of high-bred cereals, in many respects, admits of more rapid, complete, and satisfactory development than that of animals, first, because they are far more prolific, which gives much greater choice in each renewed selection (besides favoring a rapid extension of the improved breed;) and next, because instead of that "delicacy of constitution" often found in high-bred animals, the very opposite character will prevail in the pedigree plant, which is descended from a line of ancestors, *each of which was the most vigorous of its year*, and possesses, in combination, those various good properties by which they, more successfully than others, withstood the vicissitudes of season experienced during the years of selection.

In illustration of these principles of selection, I now give the following results, due to their influence alone,—as the kind of seed, the land, and the culture employed were precisely the same for every plant for four consecutive years; neither was any manure used, nor any artificial means of fostering the plants resorted to:

Year.		Length, in inches.	Containing grains.	No. ears on finest stool.
1857.	Original ear, . . .	$4\frac{3}{8}$	47	
1858.	Finest ear, ...	$6\frac{1}{4}$	79	10
1859.	Finest ear, ...	$7\frac{3}{4}$	91	22
1860.	Ears imperfect from wet season,	–	–	39
1861.	Finest ear, ...	$8\frac{3}{4}$	123	52

Thus by means of repeated selection *alone*, the length of the ears has been doubled, their contents nearly trebled, and the "tillering" power of the seed increased five fold."

Mr. Hallett's essay comprises many very interesting details which our limits forbid giving in full, but the following is added: "Before explaining the method of procedure adopted in the above selection, I will briefly state why I commenced with so small an original ear. I had for several years previously experimented on *accidentally* large ears, irrespective of the quality of the grain they contained; the invariable result was a sample so coarse as to be almost unsaleable. Convinced that this did not naturally result from the attainment of a perfect growth in the plant, but rather arose from the fact that the large parent ears, from some peculiarity of their growth, themselves contained coarse grain, I determined to commence with a fine *quality* of grain irrespective of the size of the ear, trusting to pedigree for the gradual attainment of fine ears. I therefore started with the 'Nursery' wheat as the finest quality of red wheat known, as I have since done with several kinds of white wheat, such as 'Bellevue Talavera,' (kindly sent me for the purpose, by Colonel LeCouteur,*) 'Hunters White,' and several kinds of Australian white wheat which were all fixed upon on account of their quality alone.

The plan of selection pursued above is as follows:—A grain produces a 'stool' consisting of many ears. I plant the grains from these ears in such a manner that each ear occupies a row by itself, each of its grains occupying a hole in this row; the holes being twelve inches apart every way. At harvest, after the most careful study and comparison of the stools from all these grains, I select the finest *one* which I accept as a proof that its parent grain was the best of all, under the peculiar circumstances of that season. This process is repeated annually, starting every year with the *proved* best grain, although the verification of this superiority is not obtained until the following harvest.

During these investigations no single circumstance has struck me as more forcibly illustrating the necessity for repeated selection, than the fact, that *of the grains in the same ear one is found greatly to excel all the others in vital power.*

Thus, my original two ears together contained 87 grains. These were all planted singly. One of them produced ten ears containing 688 grains, and not only could the produce of no other single grain compare with them, but the finest ten ears which could be collected from the produce of the whole of the other 86 grains contained only 598 grains; yet supposing that this superior grain grew in the smaller of the two original ears, and that this contained but 40 grains, there must still have been 39 of these 86 grains which grew in the same ear. So far as regards *contents* of ears.

Again, this year (1861) the grains from the largest ear of the finest stool of last year were planted singly, 12 inches apart, in a continuous row; one of them produced a stool consisting of 52 ears; those next to and on either side of it of 29 and 17 ears re-

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*This was originally raised by Colonel Le Couteur from a single grain. The ears and grains sent me by the Colonel in 1860 are absolutely identical in character with specimens grown in 1841, and now in the collection of the Royal Agricultural Society, showing how the influence of the original selection has been maintained for nearly twenty years.

spectively; and the finest of all the other stools consisted of only 40 ears.

By planting grains so as to form a plan of the position occupied by each when in the ear, I have endeavored to ascertain whether this superior grain grows in any fixed place, but hitherto these endeavors have not proved successful."

The suggestions of Mr. Hallett, it will be seen, open up a wide and highly interesting field for research and experiment, and I confidently believe that judicious labors in the direction indicated would achieve exceedingly fruitful results. The comparatively brief number of years; that is to say, compared with those required to effect corresponding results with domestic animals, should encourage many to enter this field who might distrust their ability for the patient waiting requisite for the building up of improved breeds of cattle, sheep or horses.

Another of the contributing causes of the decline of wheat culture in Maine was the exceedingly variable degrees of success attending the culture of winter grain. Many of the best crops ever harvested in the State were autumn sown, and so also were some of the most complete failures. A full statement of the various conditions which attended these successes and failures would form an interesting and exceedingly valuable chapter in the history of agriculture in Maine. I much regret having been unable to obtain sufficient data to furnish it. Some facts however have been gathered which may serve to throw a degree of light upon the subject.

It appears that many if not most of the successes have been upon lands which, either because of overlying a porous subsoil or from being filled with the roots and vegetable matter of a recent forest growth, or by artificial drainage, readily parted with any redundancy of water; and the converse is equally true, viz., many of the failures have been upon lands, which by reason of retentive subsoils *and lack of drainage,* retained a surplus of water. The facts regarding this point are such as to warrant the conclusion that it is inexpedient to attempt the culture of winter wheat except upon surfaces which are well drained,—either naturally or artificially. It may not be saying too much, that the same is also true of spring wheat, so great and manifold are the advantages of sufficient drainage upon any good wheat soils.

Regarding the effect of a continuous covering of snow in winter—so likely to occur in some parts of the interior, and so unlikely upon portions of the coast line, there is more obscurity. Such a covering has been sometimes followed by what appeared to be a smothering of the young plants, and it has also been frequently followed bv the best results.

It is evident enough that a fruitful cause of ill success has been *too late sowing.* From a comparison of all the facts which have been gathered on this point, it would seem that sowing during the last week in August has been followed by the best results, and that whenever deferred much beyond this, the chances of success were *greatly lessened.*

From the best information I have been able to gather, much the greater number of failures may be attributed to one of the two causes above alluded to, either lack of proper drainage in the soil, or too late seeding, and I am persuaded that the culture of winter wheat deserves much more attention than it receives from the farmers of Maine.

This persuasion has been confirmed by what I learn of the success attending its culture in New Hampshire, and I am very happy to be able to give the following valuable communication from a veteran agriculturist of that State, Levi Bartlett, Esq., of Warner, N. H., already well known to many of our farmers as a frequent contributor to the agricultural periodical literature of the country :

S. L. Goodale, Esq. : Your letter of 20th ult., soliciting notes of my experience in wheat growing was duly received. It affords me much pleasure to comply with your wishes in this matter. For some ten or more years I have had experience in growing winter wheat. I was induced to attempt this from the uncertainty of growing spring sown wheat on my low-lying farm. If sown early, the midge was pretty sure to greatly injure it, sometimes nearly ruining the crops. If sown late the rust was very sure to greatly injure it. Similar results followed its culture on all low-lying farms, so much so, that wheat growing was given up, except on the hill-farms, where, from a drier atmosphere and a free circulation of air, taking a series of years together, tolerably fair crops have been grown, ever since the midge first made its appearance here, over thirty years ago. However, for the past few years the midge has done but little injury to spring sown wheat, and many farmers are again cultivating it, that for a number of years gave it up. The above remarks apply to spring sown wheat.

Some fifteen years ago, the son of a farmer in this town was in western New York, during the harvesting of winter wheat. He brought home fourteen quarts, all his valise would hold. This was sown early in September, on one-third of an acre of light, dry land, from which a crop of oats had been harvested. The ground was manured before being plowed. The wheat was sown and well harrowed in. Next spring the plants came out bright and green, none being winter-killed, and no injury from midge or rust. The season being favorable, the yield was sixteen bushels, being at the rate of forty-eight bushels per acre.

This small patch of winter wheat, and its great yield created quite an excitement among our farmers. Scores of them had never before seen a field of fall-sown wheat. All this farmer could spare, was readily sold at three dollars per bushel for seed. The results of the experiments in growing winter wheat, by different farmers, were, as might have been expected, "good, bad, and indifferent." Those sowing early in September, on well prepared and suitable soil, realized a yield of sixteen or more bushels, for the bushel of seed sown; while others that delayed sowing till after their corn was harvested, (sometime in October) generally reaped light crops, suffering badly by midge, rust, and winter-killing. Most of these farmers decided at once, that fall sown wheat could not be grown here. But the failure was not in our soil or climate, but the result of their inexperience and lack of knowledge in the proper culture of winter wheat.

I procured a bushel of the wheat above alluded to, and sowed it about the 20th of September (three weeks too late,) on one hundred rods of light, sandy land, from which a few days previously, a fair crop of white beans had been harvested. I applied 125 lbs. Peruvian guano, which was worked in by the use of the cultivator—the land not being plowed after the beans were harvested—some small patches, deeply covered by snow-drifts, were smothered. The yield however, was about ten bushels, most of which I sold at three dollars per bushel for seed.

For ten succeeding years, I grew more or less winter wheat—with the exception of two years I grew good crops. The two seasons in which I failed of growing paying crops, were occasioned by the disappearance of the snow, in March and April. The frequent freezings and thawings of the ground threw out the plants, so that I obtained but a few bushels per acre; but late in the season I mowed a fair crop of grass.

Most of the land upon which I have grown winter wheat has been inverted sod. Plowed from middle to last of August, applying a fair dressing of manure or guano. I have grown it on alluvial soil, on sandy, gravelly, and on deep loamy soil, as also, on good, rocky upland. On this, from being badly plowed, the grass sprang up, lessening the yield. I have grown it on inverted timothy sod, on a clover ley, and after oats, and wheat after wheat—always manuring after the land was plowed; freely using the cultivator or harrow before sowing the grain. Sowing from 25th of August to 10th of September. I have tried all of the above named ways, and kinds of soil, for the purpose (in part) of ascertaining the adaptation of our different soils and climate for raising winter wheat, and have come to the conclusion that fall sown wheat, is as sure a crop in New Hampshire, as it is in any other of the States of the Union.

I have experimented with a great variety of wheats—received from the Agricultural Department of the Patent Office, many of which were of foreign growth, being fine samples. But nearly all I experimented with proved too tender to withstand our northern winters. I have grown the early May from Kentucky, and a similar variety from Virginia, maturing some ten days earlier than the White Flint and similar sorts. But the yield has been light—still, they might be worth cultivating where there is danger from midge and rust. I have successfully grown Early Flint, Michigan Tuscan, White Blue Stem, Early Noe, from France, and several other similar varieties; all of which were white, bald or beardless wheats—making, first-rate, white flour, and generally, giving satisfactory returns.

It is said, by some experienced wheat growers, that the red-chaffed wheats are hardier and more productive than the finer, white sorts, and that the bearded varieties are less subject to injury from the midge, &c., than the beardless varieties.

In August 1860, I forwarded to Col. Boyd of Hancock, Maryland, five varieties of my winter wheat. The next August, he wrote to me, as follows: "All the varieties of the wheat you sent to me last fall, I observe are smooth, (bald.) There is a prejudice against smooth wheats, and I am beginning to be of the opinion, that it is not without substantial reasons. Certain it is that our smooth varieties are more subject to the ravages of the fly and other insects, and to the elemental diseases incident to the wheat crop, and yield little or nothing, whilst the bearded varieties, with but few exceptions, escape the insect and these diseases, and yield remunerative crops."

All the varieties, with one exception, that I have experimented with, in field culture, have been white, bald varieties, and in favorable seasons the yield has been from ten to sixteen bushels for the bushel of seed sown, from which it seems that the finer varieties of white wheats have yielded better in New Hampshire than they have in Maryland, and I have no doubt the white, bald wheats, would do as well in the State of Maine, as they have in the Granite State. But still, the red chaffed, bearded wheats might be less subject to injury from the midge, rust, &c., than the white, bald wheats.

In 1865, A. Bean, a farmer in this town, harvested forty-five bushels of prime, red chaffed bearded, winter wheat from three bushels of seed sown. In 1866, harvested thirty-five bushels, from two and one-half bushels sown. Another farmer grew about the same from an equal amount of seed—of the same variety. These, I think were the only fields of red wheat, that I have ever seen in this section.

In 1861, Col. Boyd of Maryland forwarded to me per mail a small package, of what is known there, as the "*Lancaster wheat*" He wrote, "The Lancaster wheat I forwarded, is the earliest of our wheats, and is in considerable demand with us for seed. It is somewhat singular in appearance when ripening, presenting the appearance of rust."

The envelope enclosing the wheat sent to me by Col. Boyd, in some way got rent, and a portion of the seed lost. There was just one ounce saved. This was sown in drills 1st of September 1861, harvested in July 1862. Have grown it till I have enough to seed half an acre or more this fall. I now think very favorably of it.

In looking over the "Monthly Report of the Department of Agriculture, for January, 1868," (which contains brief notices of farming operations in a number of the States,) I find these entries. The reports from New York say, "By far the greater part of the returns indicate the Mediterranean varieties of wheat as preferred, on account of hardiness, and greater exemption from insect attacks."

Returns from New Jersey say, "Mediterranean wheat, chiefly red, is almost entirely grown, being considerably less apt to be affected by rust and insects."

Report from Pennsylvania says, "Mediterranean wheat has generally been preferred, as being less affected by the frost, and the fly and other insects. Though within a few years the Tappahannock wheat has been cultivated, with success in some sections, ripening from one to two weeks earlier than other varieties—while in other localities it is pronounced a failure. Between the red and white Mediterranean wheat, the former meets with most favor, as it withstands the ravages of the fly more certainly, and uniformly yields better than most other varieties. In Lancaster, they have an improvement upon the Mediterranean, called "Lancaster wheat," which is in general use in this and adjoining counties, and valued for its early ripening qualities. * * Some spring wheat is grown in the northwestern counties, but it is an uncertain crop and not profitable, and its cultivation is being abandoned."

The report from Delaware says, "In Newcastle county, the old bearded Mediterranean wheat is cultivated, preferred chiefly from its supposed greater immunity from attack of the Hessian fly and less liability to rust, it being ten days earlier in ripening than other varieties. In some other counties, several kinds of white wheats have been grown—the red Mediterranean gaining favor, on account of its early ripening and freedom from rust, though the yield is not large."

Now, friend Goodale, can you, or any one else assign any valid reason, why the Mediterranean, or other early and hardy varieties of winter wheat cannot be as successfully grown in Maine, as in any of the States from which I have quoted? I know it can be done in New Hampshire—and profitably too. My friend Bean, who grew forty-five bushels of red, bearded, winter wheat from three bushels sowing, sold a large portion of it, at $3.50 per bushel—in greenbacks.

In September 1863, Joseph Harris, then editor of Genessee *Farmer*, delivered an address at the Fair of the Monroe Co. Agricultural Society, N. Y., in course of which he said, "As good wheat can be raised in New England to-day as when the first Pilgrim landed on Plymouth Rock. I have within the past two or three years, seen as good wheat raised in Connecticut and New Hampshire as I ever saw in this State. But it won't pay! Wheat can be brought from the West cheaper than it can be raised in the East." It may be so, but still, there may be a difference of opinion upon this point. I think it was in 1862, I fowarded to Mr. Harris several varieties of winter wheat I grew that year. The cleaned grain was forwarded in glass vials,—fair averages of the different kinds—also, sent sample heads—three or four of which were so nice, that he had engravings taken and inserted in the *Farmer*. He pronounced the samples of wheat sent, as good as the wheats grown in the Genessee Valley. But he says "they can raise wheat there cheaper than we can here in the East," and I have no doubt they can. But when flour of good quality is worth $18 per barrel, it must be a poor crop of wheat that "won't pay."

I presume there are thousands of farmers in Maine, who understand the growing of wheat, both fall and spring sown, as well, or better than I do, and doubtless there are others, who have not had much practical experience in its culture. For the benefit of such, I offer a few suggestions: In growing winter wheat, on a clover ley, or sward land, plow the ground sometime in August, completely inverting the sod; press down the furrow slices with a heavy roller, apply a fair dressing of well rotted manure, or compost. I find it better to spread the manure from the cart or wagon, by so doing, it can be more evenly distributed over the ground, than if first laid on the land in heaps. Then thoroughly work the ground with the cultivator or harrow. Sow the wheat by the first of September. Some farmers sow one and a half bushels per acre; others, two bushels. I have usually sown one bushel to an hundred rods of land. After the wheat is harrowed, in sow herdsgrass seed. Then pass the roller over the land. I think I get a better catch of grass in this way, than by sowing the grass seed with the wheat. By harrowing the ground after the grass seed is sown, much of it gets buried so deep that it fails to come up. In the following March or April, sow clover seed. Where I have pursued the above described course, I have seldom failed in obtaining fair crops of wheat, followed with good crops of hay. I have sometimes grown a crop of oats, after corn; manured the oat stubble, plowed the ground and sown wheat and grass seed. In one or two instances, the oats sprang up and retarded the autumn growth of the wheat and grass. Twice, wheat has followed wheat; but I think, I shall not repeat the process. I have never sown winter wheat after corn, because I could not remove the corn in season to sow as early as I wished.

Good, well preserved, farm-yard manure, doubtless, contains all the necessary constituents for the wheat crop. But in this section, most farmers think all their manure must be used for their corn and other hoed crops, and have none for winter wheat.

When good Peruvian guano could be had at $60 per ton, its purchase for growing wheat, was generally found a good investment. It is now quoted in the Boston price current at $100 per ton. I do not think it would pay to purchase at that price, with freight added, for either wheat or corn.

Mr. Lawes of England, by his experiments in wheat culture, on the strong soil he cultivates, and by his method of culture, does not find super-phosphate of lime, and other, so-called mineral manures, applied, either in large or small quantities, to add but about two bushels of wheat per acre, over unmanured land of the same quality. The unmanured, for a long series of years, averaging over sixteen bushels. The mineral manured plots yielding about eighteen bushels per acre, while those plots using, annually, about 320 lbs. of muriate and sulphate of ammonia, gave an annual return of over thirty bushels per acre. Ammonia seems to be the one thing needful on Mr. Lawes' soil to insure large yields of wheat. Over twenty years careful experimenting establishes that fact.

But on the other hand, there are well established facts, that prove beyond all cavil, that on other soils in England, the application of six hundred pounds of super-phosphate of lime, per acre, has increased the yield of wheat, twenty-four bushels,—even on a soil so fertile that it produced twenty-nine bushels of wheat per acre, without manure—while an adjoining acre that received 600 lbs. of super-phosphate of lime gave a yield of fifty-three bushels.

To account for these apparent discrepencies in the action of these manures, Mr. Lawes published a letter in the London Agricultural *Gazette*, explaining to my view, in a plain common sense manner, the causes of these different results, in the favorable action of super-phosphate on Mr. Leigh's soil, and its nearly non-effect on his, and also why the ammoniacal manures on his soil exhibited such marked results over mineral manures.

In view of the above, I think it would be for the interests of the farmers in Maine, and elsewhere, to experiment with super-phosphate on their wheat. They need not experiment very largely. If the wheat crop is not benefitted by its use, the phosphate will not be lost, for it will not be worked out of the soil—and it will come into requisition, sooner or later, in subsequent crops of clover or other leguminous crops.

Judging from Mr. Lawes' experiments, and numerous other recorded facts in wheat culture, I think the importance of a free use of nitrogenous manure in growing wheat is not fully understood by the great mass of our farmers. From the fair per centage of nitrogen in a good "porgy chum" (capable of yielding ammonia,) and the phosphates contained in the bones, theory would say "it was the manure for the growing of wheat," and I believe practice would confirm it. The British farmers in past years have expended millions of dollars in the purchase of guanoes for increasing their yield of wheat. Guano is *digested fish*, in a more concentrated form, to be sure, than "porgy chum;" but its fertilizing constituents are the same, though less in amount, in a given weight.

There has never been any of this fish guano used by the farmers in this section so far as I am aware. A few weeks since, I was in Danvers, near Salem, Mass., and learned that the farmers there had been purchasing largely of "fish guano;" from which fact I infer they find it a cheap and efficient manure.

One of the great drawbacks on successful farming in New England is a deficiency of manure. If our farmers could have a full supply of this, for their hoed and grain crops, and for top dressing their pastures and mowing fields, there would be a much less number of our people emigrating to the fertile soils of the far West. Too many of our farmers never think of looking beyond the limits of their barn-yards for manurial resources, but plod on, year after year, in the old beaten track, complaining of high taxes, light crops, and the small profits of farming.

There are large farming sections in this country, where heavy crops of corn, wheat, oats, barley and hay, have been grown for a long series of years, without the use of animal manures; and still the fertility of those soils has been kept up. This, has been accomplished, by the use of clover, lime, and gypsum. Now what has been so successfully enacted in New York, Pennsylvania and many other States, can also be enacted in the Pine Tree State, and in the Granite State, and at a much cheaper rate, than it can be done in the purchase of stable, or any of the commercial manures in the market; though, doubtless, a judicious use of some of these, in connection with the clover, might be profitable.

I do not *know* but the farmers of Maine are in the practice of largely growing clover for enriching their lands, preparatory to raising corn, wheat, oats, barley, &c. But I *do know*, that such a course is not practiced to any great extent, any where in this section of New Hampshire. The reason why such a system is not practiced by our farmers, I presume, is because they are ignorant of the advantages of such a course. And perhaps, this may be the case with farmers in some portions of Maine. If there are such, I will try to enlighten them on this important point.

Some ten years ago the Hon. George Geddes of Onondaga county, N. Y., ex-President of the New York State Agricultural Society, and one of the best practical farmers of that State, made a thorough geological, topographical and agricultural survey of Onondaga county. His survey is published in the Society's transactions 1859. In chapter sixth treating upon "Practical Agriculture," he says: "The agriculture of Onondaga county is based on the CLOVER plant, *Trifolium pratense*. It is used for pasture, for hay, and for manure. Strike this plant out of existence, and a revolution would follow, that would make it necessary for us to learn everything anew in regard to cultivating our lands. What their value would be without clover, we will not attempt to conjecture. We have this most valuable treasure, and appreciate it. Its influence and importance to us demands an extended account.

"There are two varieties of red clover, known among the farmers as the large and small—the smaller variety is generally preferred, as the large yields but a single crop of hay in a season. Clover seed is usually sown on winter wheat, in March or April, in quantities varying from two to ten quarts per acre—eight quarts is generally sown by the best farmers.

"Gypsum, at the rate of a bushel or more, is sown on an acre after the ground is settled, and the crop has commenced growing. Sometimes the sowing of the gypsum is deferred until the wheat is harvested, and then sown on the stubble as soon as convenient. If the season is wet, and therefore a growing one, the small kind of clover will be in full bloom before the frosts of autumn kill the plants.

"It is common to pasture this young clover moderately in the fall, and opinions are somewhat divided as to whether this injures the future growth of the crop.

"In the following spring, gypsum should be again sown on the clover, at the rate of a bushel to the acre. By the 25th of June, or the 1st of July, the small variety is ready for making into hay, and should yield a ton and a half to the acre. The general practice is to cut the clover for hay, when in full bloom, or as soon as the earliest heads show signs of ripening. The process of curing varies with the weather and different farmers; the general plan, however, is to handle it as little as possible, and to cure mostly in the cocks. As soon as the hay is drawn away, gypsum, at the rate of a bushel to the acre should be sown. By about the first of October, the second crop will be ready to cut for seed. * * After the seed crop is removed from the ground, there is a considerable part of the crop of hay left, particularly if it was cut high, as it should be. This stubble is usually pastured to some extent.

"In the spring following, the ground is plowed, unless wanted for pasture. If plowed, corn, oats, barley or spring wheat is sown, and a good crop is confidently expected. The roots run deep into the soil, and thus pulverize it, so that a single perfect plowing brings it into a most satisfactory condition. Some of our best farmers plow their fields deep once in a few years, and then shallower plowing of this clover sod will show the long tap roots, that have been pulled up from the subsoil by the plow, projecting above the surface all over the field, looking like dead weeds. *These roots, have transferred the fertilizing matters of the lower soil to the surface.* * * The oftener we can fill the soil with roots, and then plow them under, and thus allow them to rot, the sooner we expect to get our land in condition to crop with grain. Clover is a bienmial, and two years is all that one seeding should stand.

"A very considerable part of the cultivated land of this county has never had other manuring than this clover and gypsum, and its fertility is not diminishing. These fields are not cropped with grain as often as those that have the benefit of barn-yard manure, but they are manured at much less expense.

"The cost of a fourth of bushel clover seed, at $6 is	1.50
do. sowing, is about " "	8
do. 3 bushels of gypsum at the mills, is	24
do. drawing the same,	12
do. sowing at three different times,	38
Total cost of manuring one acre,	$2.32

I had copied thus far from Mr. Geddes' Report, when it occurred to me, that I had two letters received from him several years ago, containing, as I think, valuable practical information for the farmers of New England. Portions of these letters I copy.

In December 1860, I wrote an article on green manuring, which was published in the "Country Gentlemen," of December 20. In that article I stated that "I had never seen a crop of clover plowed in for manuring in this section." A few days after, I received a letter from Mr. Geddes on the subject. I wrote to him, asking leave to forward the letter to the editor of the Country Gentleman, for publication in that paper. A few days later I received an answer complying with my request. This explains the matter respecting these letters.

The first one is dated Fairmount, Onondaga County, N. Y., December 24th, 1860.

L. Bartlett—*Sir*: I have read with some interest your article in the Country Gentleman of the 20th inst., and am surprised to learn that you have never seen a crop of clover plowed in for manuring. When I wrote my chapter on practical agriculture, I was under the impression that I was saying very little that would be new to any of my readers. From my earliest recollections this plowing under clover has been the common practice with our best farmers. I have not yet seen as many winters as you have, but I am past life's summit—and cannot remember far enough back, to find the time when clover was not used for manure on the farm where I was born, and where I now live. You will see on page 109 of my Report, Prof. Norton's anyalyses of some soil and underlying rocks of a field that has been treated with clover and gypsum and no other manure forfifty years. This is land my father bought of the State in the last century, taking the first crop of wheat off it in 1799. This year wheat was taken from this field—a good crop, say 25 bushels to the acre after barley last year. Great care is taken not to manure this field with anything but clover and gypsum, as it is intended to see how long this plan of fertilizing will continue to improve the crops, under our system of rotation.

When our lands were first cleared, they are not thought to be as good for corn as they are after they have been cultivated some years. Our green or gypseous shales are deficient in vegetable matter when new, and this is given by means of clover. In fact, I have never raised a large crop of Indian corn—that is to say, never over about 80 bushels to the acre, measured when fit to sell—and I do not call this a remarkable corn country, but we can average 50 bushels per acre.

Our crop of corn this year was on a 33 acre field, the yield was 67½ bushels to the acre, (135 bushels of ears) besides our seed which is traced up and not measured.

This field last year (1859) was mowed late in June and early in July, and was intended for seed, but the grasshoppers so injured the crop, that only about 8 acres was cut for seed, the rest was tangled and tramped down by the cattle late in the fall. Last spring the clover started early, and we turned on the field 107 ewes, and pastured them until the sixth day of May. The field was plowed in a single land with care, and harrowed well, and worked both ways, the rows 3 by 3 feet apart, from 5 to 7 stalks were suffered to grow in each hill. The kind of corn was "8 rowed, yellow large." By the eighth of October the field was all harvested.

But an important point, and a new thing with us, was, there was no hand hoeing, except two or three rows around the outside, that could not be fully cultivated with the horse. We used cultivators made here with five steel teeth, sharp and thin shanks, that the soil might fall nearly in the place where it was found. The field, at the time of cutting up the corn was *remarkably free from weeds.* Had this field been manured with barn yard manure, this mode of cultivation could not have been adopted. The year 1859, we had ten acres of corn land manured from the barn-yard, and though twice hoed by hand, and clean on the first day of July, it had more weeds on it at the cutting up of the crop—more on one acre—than our 33 acres had on the whole field this year. The yields were about alike per acre. This point is important. Clover plowed under does not seed the land with weeds.

To show you further how we use clover, I give the case of 20 acres of pasture. In the year 1859, we took 28 bushels of wheat to the acre, and pastured it in the fall. On the 6th day of May, this year, we put 107 ewes on the 20 acres, and 18 cows, &c., and kept them on until time to wash the sheep ; the clover growing faster than all these animals consumed it. When the sheep left the pasture to the cattle, the increase of clover was rapid, so that 5 or 6 acres were mowed by some of our men who had cows to winter. In August and the first days of September, we plowed under all we could of the clover, harrowed and sowed to wheat, and expect a first rate crop if the season is favorable, in fact we never had 20 acres of wheat that looked better than this at this time of year. * * I have made these statements, not for publication, but to cause you to think fully on what appears a new thing to you. I cannot say that your lands can be managed as ours are with profit—for I know nothing of your processes, except what may be learned from reading, *but I do think it is time to try manuring with clover with you.* Let me suggest:—Be careful to get good clean seed. We raise our own, and find it a profitable crop, "You will excuse the liberty taken by an entire stranger in addressing this letter to you—and please not forget that it is not intended for publication—I should be quite unwilling to talk so much of my own affairs in public. * * *

Most respectfully, &c.,

George Geddes."

As already stated, I wrote to Mr. G. for leave to have a copy of his letter published. Here follows his answer: "January 4th, 1861. *My Dear Sir:* Your esteemed favor of 29th ult. is received. I really did not write to you, in the expectation that my letter was to be published—but with a view to give you more facts in regard to using clover as a manure, than I had put into my Report. Of course I have no desire to limit the information to you, but on the contrary, you are just *right* in supposing that my desire to see agriculture prosperous is by no means limited to my *parish.* But I wrote in haste, and used my own affairs to convey my ideas—and I am not without fears that my letter would look crude and egotistical in print. But after all, I shall leave the matter, of how you shall dispose of it, to your own judgement.

I think I did not say in my letter, that last year was a very rainy and growing one. This may be important to show why our clover pasture produced so largely. Please remember this point, as otherwise false impressions might be made.

Perhaps I should further say that our 33 acres of corn, was the best field, considering its size, uniformity and every thing, that was ever raised on the farm—*and at the least cost.*

Many years since I received the award for the best farm in the State ; (this did not prove any thing, except as against my competitors,) and out of this grew a discussion as to manure,—that has caused me to say many things in regard to CLOVER and gypsum for manure, that I suppose were not always credited by men living on other soils—but time is gradually bringing farmers to think—and sooner or later, it will appear, and be acknowledged that on *our* soils, there is no way of constantly increasing fertility equal to a free use of clover seed.

I *think,* that *wherever* clover can be made to grow well, this will be true—but my knowledge only extends on this subject, to our soils.

Yours, &c.,

George Geddes."

Mr. Harris in his address, (at Rochester, N. Y.,) referred to some pages back, said, "There has been much said about the exhaustion of our soils, *but this one thing is certain:* as long as we can grow good crops of clover, the soil is capable of growing, so far as the constituents of the plant are concerned, *good crops of wheat,*" and I am inclined to think Mr. Harris is right.

Now, friend Goodale, there is another "thing that is certain," viz.: We can, and do grow as "good crops of clover," in New Hampshire and Maine, as they can in other States. Then as far "as the soil constituents of thewheat plant are concerned," *we are all right.*

The orange-colored midge, that pest of our wheat crop, has never injured my winter wheat to any considerable amount. If the farmer sows chess and other vile seeds with his winter wheat, he will be pretty sure to reap the "likes of them"—so if he sows smutty wheat, he will be pretty sure to harvest smutty wheat. As regards spring sown wheat after a corn crop, it is my opinion the land should be plowed in the autumn, and left in the furrow to be acted upon by the frosts of winter, and prepared for the reception of the seed wholly by the use of the cultivator or harrow. After the wheat is harrowed sufficiently—sow the grass seed and finish off with a heavy roller. If the land is dry, there is no danger of its getting pressed down too solid.

Within the past few months I have received two or more letters from Henry Poor, Esq., now resident in New York. He formerly was engaged in farming in Andover, Mass., and was widely known for his success in the cultivation of winter wheat, and for his frequent and ably written articles in the agricultural journals on the importance of wheat growing in New England. Last fall he was in correspondence with the Governor of the State of Maine, upon this important question. But from the great length of this paper, I cannot here go into a review of his letters—any farther than to quote some of his statistics. He founds his estimates upon the presumption, that there is one barrel of flour required "for each person, which is a fair estimate." He says:

"Estimated cost for flour," based upon the population of the several States:

Massachusetts, 1,300,000 people. Flour at eighteen dollars per barrel, ... 22 millions.
Maine, 700,000, ... 12 "

Vermont, 350,000,	6	millions.
New Hampshire, 350,000,	6	"
Connecticut, 600,000,	10½	"
Rhode Island, 200,000,	3½	"
Total,	60	millions

is a fair estimate at $18 per barrel for flour per annum." The above figures look large. How far they are correct, I have no means of judging. But Mr. Poor seems firm in the faith, that if our farmers would bestir themselves in the right direction, New England could furnish its own wheaten bread.

Some of our "old fogies," (to which fraternity I belong,) are strong in the belief, that if the managers of some of our Agricultural Societies would offer much larger premiums for the increased production of bread crops, and smaller premiums for horse racing and trotting, it would be better both for the morals and the mouths of our people.

LEVI BARTLETT.

WARNER, N. H., March, 1868.

ON SOME POINTS IN POTATO CULTURE.

The potato is the staple export crop of Maine. We sell some hay to go out of the State, but more potatoes; and since, on the whole, this export has steadily increased, while their culture in other States, lags behind the demand, there seems to be a probability that the breath devoted to their culture in Maine may continue to increase.

Upon the visitation of the "potato rot," their culture greatly declined, but as this plague wore away, attention was newly directed and occupied with many points connected with the history, constitution and propagation of the plant, and with the comparative productiveness, hardiness and freedom from disease of different varieties. All these points, together with many others, including the production of new varieties from seed, became matters of careful investigation and experiment with hundreds of cultivators in various parts of the country. Among these we may mention Chauncey E. Goodrich, of Utica. N. Y., whose labors were especially successful in the production of new varieties which have already displaced the sorts formerly cultivated to a great degree, and promise to accomplish still more in the same direction.

Notwithstanding the length of time, and the breadth of surface, over which the culture of the potato has been extended, there still exists a wide diversity of opinion in regard to many of the more important points of practice. Men, who would as soon cut off a right hand as utter known untruth, have assured me that planting small potatoes and few of them is followed by as good crops, and the growth of as large tubers, as if large potatoes and more of them had been planted; and that this conviction is the result of twenty or more years of experience and careful observation. Others, fully as truthful, are equally certain that the potato forms no exception to the law that "Whatsoever a man soweth that shall he also reap," and that careful observation of results during many years has taught them, beyond all doubt, that the planting of small tubers, or cut tubers, and few of them, as a general rule, will be followed by a meagre crop. Equal diversity of opinion prevails upon other points.

Nothing is more certain than that unaccountable results do sometimes, and not very unfrequently, follow all tillage operations. But this ought not to quench our thirst for knowledge. Nothing is more certain than that the laws of nature are fixed and sure, and that similar conditions will be followed by similar results. The difficulty is that we are not always able to perceive all the circumstances and conditions which contribute to bring about a given result.

It is only by deductions cautiously drawn from a very large number of carefully conducted experiments, eliminating, so far as possible, all sources of error, and excluding from the data upon which our generalizations are founded, the apparently anomalous results sometimes met with, that we can arrive at conclusions which may be acted upon with confidence in practice.

By far the most valuable contribution which has come to my knowledge, towards so desirable an end, is furnished by a series of experiments conducted by George Maw, in 1865, and reported in a prize essay, lately published in the journal of the Royal Agricultural Society of England. Had the same experiments been made with a dozen of the best American varieties in place of foreign ones, the results would possess additional value for us; nevertheless, there is small reason to doubt that the general tenor of the results would have been much the same in either case. It is greatly to be hoped that similar investigations may be made by those among us, if such there be, who have the ability and the leisure to conduct them to successful issues.

The reproduction of this essay in our pages will, I am sure, be heartily welcomed and carefully perused by every grower of this very important crop among our readers.

"The striking evidence obtained from a few experiments made during the year 1864 with the object of ascertaining the sized potato-set most profitable to plant, induced me during the past year to carry out a more extensive series on a systematic scheme; a brief report upon which I beg to lay before the Royal Agricultural Society of England.

The 129 trial plots, described in the accompanying tabular statement of general results (at pp. 174–179,) were arranged with special reference to the following questions, which I propose to consider under separate heads.

Firstly. As to the influence of the size of the set on the economic results of the crop ; *i. e.*, whether any increase, and to what extent, is obtained over and above the extra weight of the set, in the planting of large in lieu of small sets.

Secondly. As to the influence on the crop of the distance at which the sets are planted ; or the results of close and wide planting of various sized potatoes.

Thirdly. As to the comparative results from planting similar weights of large and of small potatoes per acre.

Fourthly. As to the relative advantages of cut and whole sets.

Fifthly. As to the influence of thick and thin planting, and of the size of the set, on the proportion borne between the weights of the sets and the weight of the crop, and the rate of increase under various conditions.

Sixthly. As to the relative productiveness of different varieties of potato.

Much diversity of opinion seems to prevail on these points, which are of economical importance in relation to both the Farm and Garden cultivation of the crop.

The selection of the potato-sets appears commonly to be more a matter of present expediency than prospective profit. The general course is to appropriate the largest for use, the very smallest for pig-feeding, the tubers of intermediate size being preserved for replanting ; this method of assortment results in the use of sets of from two to three ounces in weight, and a set of less than two ounces is as often planted as one exceeding three or four ounces.

Our primary question is whether an increase in the size of the set will produce an excess above the extra weight of the sets planted ; such extra weight going to increase the strength of the individual sets without increasing their number ?

The unequivocal results in favor of large sets, obtained from my experiments carried out in 1864, and recorded in the 'Gardener's Chronicle,' as well as from those which form the subject of this report, induce me to describe carefully the conditions under which the experiments were conducted.

Every precaution was taken to insure the most perfect uniformity in the conditions under which the various experiments were made. The manure was separately weighed out, and distributed on each 20 superficial feet of ground. The distance—2 feet—between the rows was the same throughout the trial ground ; and to counteract the influence of any slight variations in the character of the soil, the particular experiments that would be brought into immediate comparison were placed as nearly as possible in juxtaposition. External rows were rejected for the experiments, and planted with part of the ordinary crop; and every individual set was separately weighed and selected to the specified size, and planted to measure, at precise distances.

Notwithstanding these precautions, there was a want of correspondence in many of the individual results, which I would notice as a warning against depending on the evidence of single experiments; for instance, in plots planted under precisely the same conditions, and with no apparent difference in the appearance of the crops, the produce varied to the extent of several tons per acre. Similar inequalities, apparently unaccountable, will be found in all agricultural crops, and in the conduct of experiments every care should be taken that they are fully recognized in the calculation of results.

Under the head of "Accidental Variations of Result" at the end of the report, I shall consider this subject more in detail, and endeavor to show the extent to which these adventitious irregularities affect the general tenor of the experiments.

It remains now to consider separately the various points to which the experiments relate.

It will be found that I have in no case relied on isolated results, but drawn the conclusions from the general bearing of the series. Throughout the report the term "Gross Crop" will apply to the whole weight of potatoes produced per acre, and "Net Crop" to the balance of produce after deducting the weight of the sets from which it was grown.

Firstly. The influence of the size of the set on the economic results of the crop; or whether any increase, and to what extent, is obtained over and above the increased weight of the set in the planting of large in the lieu of small sets.

Several separate series of experiments may be cited in evidence of the influence of the weight of the set on the produce of the crop. An average of from ten to thirteen experiments with different varieties, planted one foot apart in the rows, gave the following results:—

Gross Returns per Acre.

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 13 varieties, 1 oz. sets	10	19	3	17	or	17.65	per set.
" 13 " 2 oz. sets	12	15	2	14	or	21.03	"
" 12 " 4 oz. sets	15	17	2	15½	or	25.39	"
" 9 " 6 oz. sets	20	6	1	9	or	33.44	"
" 6 " 8 oz. sets	23	8	1	14	or	38.67	"

After deducting the weight of the sets, the net balances of produce per acre will stand as follows :—

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 13 varieties, 1 oz. sets . .	9	17	3	0	or	16.65	per set.
" 13 " 2 oz. sets . .	11	11	1	7½	or	19.03	"
" 12 " 4 oz. sets . .	13	9	0	2½	or	21.39	"
" 9 " 6 oz. sets . .	16	13	1	16½	or	27.44	"
" 6 " 8 oz. sets . .	18	11	0	16	or	30.67	"

The following are the amounts of *net* profit per acre for *each oz.* in the increase in the weight of the sets, from 1 oz. up to 8 ozs. (each oz. in the weight of the set occupying 2 square feet, being equivalent to 12 cwts. 17¼ lbs. per acre) of seed.

	tons.	cwts.	qrs.	lbs.
From 1 to 2 ozs.	1	13	2	7½
" 2 to 4 ozs., for each extra oz. . . .	0	18	3	14
" 4 to 6 ozs.	1	12	0	21
" 6 to 8 ozs.	0	18	3	14

The average of a number of experiments with different varieties planted 9 inches apart in the rows, gave very similar results as follows :—

Gross Returns per Acre.

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties, 1 oz. sets .	10	12	0	23	or	14.21	per set.
" 12 " 2 oz. sets .	15	2	2	11	or	18.45	"
" 6 " 4 oz. sets .	17	17	3	12	or	21.99	"

After deducting the weight of the sets, the net balances of produce per acre stand thus :—

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties, 1 oz. sets .	9	16	0	0	or	13.21	per set.
" 12 " 2 oz. sets .	13	10	0	21	or	16.45	"
" 6 " 4 oz. sets .	14	13	0	4	or	17.99	"

The average produce of a number of varieties planted at intervals of 6 inches in the row, also exhibited similar advantages in favor of the larger sets, viz :—

Gross Returns per Acre.

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties, 1 oz. sets .	13	4	1	20	or	10.85	per set.
" 10 " 2 oz. sets .	15	19	0	12	or	13.15	"
" 3 " 4 oz. sets .	22	0	2	3	or	18.11	"

After deducting the weight of the sets the net balances of produce per acre stand thus :—

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties, 1 oz. sets .	12	0	0	13½	or	9.85	per set.
" 10 " 2 oz. sets .	13	10	1	27	or	11.15	"
" 3 " 4 oz. sets .	17	3	1	5	or	14.11	"

Every step in each of these three series of experiments gives, without an exception, unequivocal evidence that each increase in the weight of the set produces more than a corresponding increase in the weight of the crop. The following statement will, however, shew that the advantage in the employment of large sets is much less striking in the early than in the late varieties; out of the examples before given the produce of the early varieties, planted one foot apart in the row, exhibit the following result :—

	Gross Crop.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
Average of 7 early varieties 1 oz. sets	9	3	3	26	8	11	3	8¾
" 7 " 2 oz. sets	10	14	2	17	9	10	1	10½
" 6 " 4 oz. sets	13	19	0	7½	11	10	1	22½
" 6 " 6 oz. sets	15	6	0	22	11	13	1	2½
" 2 " 8 oz. sets	7	17	0	21	2	19	3	23

Although there is throughout an increase over and above the extra weight of the sets, the advance between the larger sizes is not very marked, and is much below that wherein the early and late sets are averaged together. There is even a falling off in the produce of the 8 oz. sets, in comparison with those weighing 6 ozs.; but this is partly from accidental circumstances; the 8 oz. sets, being much sprouted before planting, indeed all the larger sets of the early varieties were much more advanced than those of smaller size. After separating the early sorts from the general average results of early and late, the average produce of the late varieties, taken separately, will stand as follows :—

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
Average of 6 late varieties, 1 oz. sets	12	0	0	15	11	7	3	26
" 6 " 2 oz. sets	15	3	1	19	13	19	0	13
" 6 " 4 oz. sets	17	16	0	24	15	7	2	11
" 3 " 6 oz. sets	30	6	2	11	26	13	2	19
" 4 " 8 oz. sets	31	3	3	24	26	6	2	26

Secondly. As to the influence on the crop of the distance at which the sets are planted; or the results of close and wide planting of various sized sets.

To establish this point, I shall compare, *separately*, each series of experiments on potatoes *of the same weight*, planted at different distances :—

Averages of 1 *oz. Sets.*

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
13 varieties, planted 1 foot apart	10	9	3	17	9	17	3	0
11 " 9 inches apart	10	12	0	23	9	16	0	0
11 " 6 inches apart	13	4	1	20	12	0	0	13

Averages of 2 oz. Sets.

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
13 varieties, planted 1 foot apart .	12	15	2	4	11	11	1	7
12 " 9 inches apart	15	15	2	11	13	10	0	21
10 " 6 inches apart	15	19	.0	12	13	10	1	27

Averages of 4 oz. Sets.

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
12 varieties, planted 1 foot apart .	15	17	2	15½	13	9	0	2½
6 " 9 inches apart	17	17	3	12	14	13	0	4
3 " 6 inches apart	22	0	2	3	17	3	1	5

Averages of 4 oz. Sets (similar varieties.)

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
3 varieties, planted 1 foot apart .	15	8	3	24	13	0	1	11
3 " 9 inches apart	15	19	2	14	12	14	3	6
3 " 6 inches apart	22	0	2	3	17	3	1	5

These comparisons all shew an advantage in planting the smaller sets at intervals closer than 12 inches in the rows; but the results are not very decided, and in one or two cases the gain in the gross crop does not make up for the extra weight of the sets planted.

The following comparisons refer to the effect of planting the sets more than a foot apart in the rows.

Three experiments averaged together, viz :—

8 oz. "Flukes," 6 oz. "Flukes," and 4 oz. "Late Red," gave a gross crop of 23 tons, 16 cwts., 1 qr., 8 lbs., and a net average of 20 tons, 3 cwts., 1 qr., 17 lbs. The same sizes and varieties, planted at intervals in the rows of 1 foot 3 inches, produced a gross crop of 18 tons, 13 cwts., 1 qr., 2 lbs., and a net crop of 15 tons, 14 cwts., 3 qrs., 20 lbs.—a falling off of 4 tons, 8 cwts., 1 qr., 25 lbs. per acre. Indeed the produce of each set was, as nearly as possible, the same, whether planted a foot apart or 15 inches, so that the additional distance was so much loss to the crop. The average produce of 6 oz. and 8 oz. Flukes shews a similar falling off when planted more than a foot apart in the rows :—

	tons.	cwts.	qrs.	lbs.	
Flukes, at 1 foot, the net average produce was .	17	10	1	25	per acre
Flukes, at 1 foot 3 inches . " . .	15	8	2	6½	"
Flukes, at 1 foot 6 inches . " . .	12	16	0	5	"

This diminution of the crop, through reducing the number of the sets per acre, is remarkably uniform, and as nearly as possible proportionate to the distance at which the sets are planted.

The general tenor of these experiments points to an interval of 10 or 12 inches in the rows, as being the most profitable distance at which to plant large full-sized potatoes, of from 4 to 8 ozs. in weight. A moderate increase in the net-crop may be expected from still further diminishing the distance when the sets are below 4 ozs. in weight; but this point will be again referred to in considering

Thirdly. The comparative results obtained from planting equal weights of large and small potatoes respectively.

In the previous series of comparisons (1) the advantage of large over small sets, placed at similar distances, was very striking, large sets producing a much greater crop than an equal *number* of small sets on the same area, and the crop bearing a very regular proportion to the weight of the individual sets. We have now to ascertain whether by diminishing the distance and increasing the number of small sets an equivalent can be obtained for the increased individual productiveness of larger sets.

1 ton, 4 cwts., 1 qr., 6 lbs. of sets per acre, planted as—

	Per Acre. tons.	cwts.	qrs.	lbs.
2 oz. sets, 1 foot apart, gave, on a number of experiments, a net average produce of	11	11	1	7
And as 1 oz. sets, 6 inches apart	12	0	0	13
Balance in favor of small sets at close intervals of	0	8	3	6

2 tons, 8 cwts., 2 qrs., 13 lbs. weight of sets per acre, averaging a number of experiments, planted—

	Per Acre. tons.	cwts.	qrs.	lbs.
As 4 oz. sets, 1 foot apart, produced a net return of	13	9	0	2½
As 2 oz. sets, 6 inches apart	13	10	1	27
Balance in favor of small sets at close intervals of	0	1	1	24½

4 tons, 17 cwts., 26 lbs. planted—

	Per Acre. tons.	cwts.	qrs.	lbs.
As 8 oz. sets, 1 foot apart, produced a net return of	18	11	0	16
As 4 oz. sets, 6 inches apart	17	3	1	5
Balance in favor of large sets at wide intervals of	1	7	3	11

3 tons, 4 cwts., 3 qrs., 8 lbs. weight of Fluke sets per acre, planted—

	Per Acre. tons.	cwts.	qrs.	lbs.
As 8 oz. sets, 1 foot 6 inches apart, produced a net return of	12	3	0	9
As 4 oz. sets, 9 inches apart	13	4	2	6
Balance in favor of small sets at close intervals of	1	1	1	25

These balances are so small, that they can scarcely be relied on as indicating any decided advantage in either direction; but the nearly equal results of the experiments point conclusively to the fact of the very regular ratio borne between the weights of the crop and the weights per acre of the sets, a ton of sets, whether planted as large or small potatoes, producing the same weight of crop per acre. It must, however, be observed that *practically*, the principle is only of limited application. Taking 1 foot as the maximum, and 6 inches as the minimum distance between the sets in the rows, it will be easily understood that a weight of small sets, say of 1 or 2 ozs., equivalent to large sets of 6 or 8 ozs., could not be got into the ground, therefore the general principle, that the crop varies as the weight of the sets, weight for weight, is not practically applicable where the sets differ in weight beyond the proportion of 1 to 2. Small sets, therefore, of 1 to 3 ozs., can, under no arrangement, produce as much per acre as sets of from 4 to 8 ozs.

Fourthly. As to the relative advantages of cut and whole sets.

A comparison may be instituted between the average results of five experiments with sets formed by dividing large potatoes, and five experiments with whole potatoes weighing the same as the cut half sets.

Cut Potatoes.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
Flukes, 4 ozs., cut out of 8 oz. potatoes, 1 foot apart, produced	12	2	0	23
Flukes, 4 ozs., cut out of 8 oz. potatoes, 9 inches apart, produced	14	10	2	4
Flukes, 2 ozs., cut out of 4 oz. potatoes, 1 foot apart, produced	10	4	0	21
Flukes, 2 ozs., cut out of 4 oz. potatoes, 9 inches apart, produced	11	13	1	12
Flukes, 2 ozs., cut out of 4 oz. potatoes, 6 inches apart, produced	8	6	2	1
Late Red, 2 ozs., cut out of 4 oz. potatoes, 1 foot apart, produced	23	7	1	0
Aggregate on six acres of	80	4	0	5
Average per acre	13	7	1	10

Whole Potatoes.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
Flukes, 4 oz. sets, 1 foot apart, produced	13	3	3	23
Flukes, 4 oz. sets, 9 inches apart, produced	13	4	2	6
Flukes, 2 oz. sets, 1 foot apart, produced	7	5	0	27
Flukes, 2 oz. sets, 9 inches apart, produced	5	12	3	17

	Net Balances. tons.	cwts.	qrs.	lbs.
Flukes, 2 oz. sets, 6 inches apart, produced	7	10	2	23
Late Red, 2 oz. sets, 1 foot apart, produced	30	15	2	26½
Aggregate on six acres of	77	13	0	10½
Average per acre	12	18	3	11

Showing an average balance in favor of the cut sets over an equal weight per acre of whole sets of about 8½ cwts. per acre.

In another instance.

	tons.	cwts.	qrs.	lbs.
Flukes, 3 oz. sets, cut out of 6 oz. sets, 9 inches apart, gave	14	8	1	23
And Flukes, 6 oz., uncut, planted 1 foot 6 inches apart	13	9	0	1
Showing a net balance in favor of the cut sets of	0	19	1	22

Both these comparative series indicate a slight advantage in favor of the cut sets; but since the individual experiments do not all point in the same direction, the result of the series cannot be looked upon as at all decisive; but it rather tends to the conclusion previously indicated, that the *weight per acre* of the sets planted has more to do with the produce of the crop than any other circumstance.

Fifthly. As to the influence of thick and thin planting, and of the size of the set on the proportion borne between the weight of the sets and their individual produce, and the rate of increase under various conditions.

This subject presents itself under yet another aspect, which interests the physiologist rather than the farmer, viz., the proportion borne between the weight of the sets and the weight of the crop, or, in other words, the rate of increase. This rate, as was to be expected, is larger as the sets are smaller and as the distance is greater, up to 1 foot apart, beyond which space no perceptible change takes place.

On the general average of these experiments—

The 1 oz. sets increased	14.24 fold
The 2 oz. "	8.77 "
The 4 oz. "	5.87 "
The 6 oz. "	5.81 "
The 8 oz. "	4.83 "

At 1 foot interval, the 1 oz., 2 oz., and 4 oz. sets increased	11.50 fold
At 9 inches " " "	9.64 "
At 6 inches " " "	7.73 "

The rate of progression was found to be very regular, both in individual experiments, and in average results.

Sixthly. As to the relative productiveness of different varieties of the Potato.

To avoid undue complication, the varieties employed in these experiments have been rather limited, and the question of their relative productiveness has only been a matter of secondary importance. As, however, several of the varieties are very generally cultivated, it may be well briefly to state the results.

The average produce of 1 oz., 2 oz., and 4 oz. sets planted 1 foot apart in the rows was as follows on the gross crop per acre :—

	tons.	cwts.	qrs.	lbs.
Late Red	27	10	3	8½
Spencer's King of Flukes . .	19	13	2	17
Second's Kidney	16	0	3	12
Daintree's Seeding . . .	15	8	1	25
Queen of Flukes	15	3	0	7
Flour-ball	14	2	1	23
"Vite-lots" (French Kidney) . .	13	6	3	19
Flukes	10	0	1	19
Early Handsworth . . .	6	18	1	23
Early Prolific Kidney . . .	4	14	1	18

The average produce of four series of experiments, viz., 1 oz. and 2 oz. planted at 9 inch intervals, and 1 oz. and 2 oz. at 6 inch intervals, stand in the following order :—

	tons.	cwts.	qrs.	lbs.
Late Red	27	9	1	20½
Spencer's King of Flukes . .	24	4	2	24
Daintree's Seedling . . .	15	13	0	0
Flour-ball	14	18	3	20
Queen of Flukes . . .	14	15	3	11½
Second's Kidney . . .	14	9	3	3
Lapstones	11	4	3	5
Early Handsworth . . .	7	14	2	17
Flukes	7	6	0	3
Lemon Kidney	7	4	1	20
Early Prolific Kidney . . .	6	12	2	18

The crops produced from 6 oz. sets planted 1 foot apart, stand in the following order of productiveness :—

	tons.	cwts.	qrs.	lbs.
Late Red . . .	37	18	3	0
Spencer's King of Flukes . .	30	19	3	12
Second's Kidney . . .	26	8	2	22
Daintree's Seedling . . .	25	16	2	5
Flukes	22	1	0	21
Early Handsworth . . .	13	16	2	0
"Vite-lots" (French Kidney) . .	13	8	1	8
Lapstones	11	19	0	3
Early Prolific Kidney . .	7	9	3	17

Of "The Queen of Flukes" and "Flour-ball," there were no experiments with 6 oz. sets.

The relative productiveness of the several varieties grown from 8 oz. sets, planted at intervals of 12 inches, stand thus :—

	tons.	cwts.	qrs.	lbs.
Late Red, ...	38	19	2	25
Spencer's King of Flukes, ...	34	0	2	14
Queen of Flukes, ...	30	5	2	9
Flukes, ...	21	9	3	19
Lapstones, ...	4	17	0	26
Early Prolific Kidney, ...	3	15	1	11

The above four series of comparisons are tolerably uniform, as expressing the relative productiveness of the varieties they include. The actual order of precedence of some of the individual varieties, that do not differ much in their produce, varies a little; but the relative positions are, in general, uniform; the late red in each set of experiments produced the heaviest crop; and the Early Prolific Kidney appears in every case at the bottom of the list.

Of the three varieties of Fluke, the greater productiveness of both Spencer's King and the Queen of Flukes, than that of the ordinary variety, is very noticeable; Spencer's King especially, throughout the series, producing from half as much more, to twice as much as the Common Fluke, not only in the general averages, but in all the individual experiments.

Seventhly. Accidental variations of Result.

It has been necessary, in drawing our conclusions, to altogether avoid relying on the results of isolated experiments. Whatever precautions may be taken to ensure uniformity in the conditions under which agricultural experiments are conducted, unaccountable anomalies in the result will be found to occur; variations which affect all agricultural crops, and which should be fully recognized and guarded against when inferences are drawn from experiments.

The only way to remove such sources of error is to throw together the average results of a number of independent experiments, so that the irregularities tending in either direction may neutralize each other. I would cite, by way of illustration, the individual trials making up the average results given under the first head.

At page 164 it was stated that the *average* balance on 13 experiments, in favor of 2 oz. over 1 oz. sets, was 1 ton, 13 cwt., 2 qrs., 7½ lbs. per acre; but if we come to details, it appears that, out of these 13 experiments, 5 show a result in favor of the 1 oz. sets, and 8 in favor of the 2 oz. This proportion, 8 to 5, taken by itself, is not very striking, and might be accidental; but when the sum of the weights of the gains in favor of the larger sets is placed against that in favor of the smaller sets, the proportion is increased to 25 to 5.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The gains per acre on 8 experiments, in favor of 2 oz. sets over 1 oz. sets, is	27	8	3	22½
Whilst the gain on 5 experiments, in favor of 1 oz. sets, is but	5	12	2	6¼
Leaving a balance in favor of 2 oz. over 1 oz. of or 1 ton 13 cwt. 2 qrs. 7½ lbs. per acre.	21	16	1	16¼

Even this result taken singly might be merely accidental; but when the other steps in the same series show precisely similar tendencies, the general tenor must be accepted as confirming the indications given by the majority of the individual experiments.

In comparing the produce of 2 oz. and 4 oz. sets, out of 12 experiments, the net results of 8 are in favor of the 4 oz. sets, and 4 in favor of the 2 oz.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The gains per acre on the 8 experiments, in favor of the 4 oz. sets, amount to	28	19	3	2½
And those on the 4 experiments, in favor of the 2 oz. sets, ...	9	15	2	11½
Leaving a balance in favor of the 4 oz. over the 2 oz. sets of	19	4	0	19

or 1 ton, 12 cwts., 0 qrs., 1½ lbs. per acre.

In comparing the produce of 4 oz. and 6 oz. sets, out of 9 experiments, 7 are in favor of the larger sets, and 2 of the smaller.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The gains per acre on the 7 experiments, in favor of the 6 oz. sets, amounted to	30	0	2	15½
Those on the 2 experiments, in favor of the 4 oz. sets, to	12	12	2	10½
Leaving a balance in favor of the 6 oz. over the 4 oz. sets, of	17	8	0	5

averaging 1 ton, 18 cwts., 2 qrs., 19 lbs. per acre net.

Advancing from 6 to 8 oz. sets, out of 5 experiments 2 are in favor of 8 oz., and 3 in favor of 6 oz. sets.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The sum of the gains per acre on 2 experiments, in favor of 8 oz. sets, amounted to	7	13	3	22
And those on 3 experiments, in favor of 6 oz. sets, amounted to	6	17	2	27
Leaving a net balance in favor of 8 oz. over 6 oz. sets, of	0	16	0	23

on 5 experiments, averaging 3 cwts., 0 qrs., 27 lbs. per acre.

Of the whole series of 39 experiments, 25 were in favor of large sets, and 14 showed an opposite tendency; but the proportion borne between these numbers does not fully represent the actual result, which is more fairly stated by the weights of the balances on either side ; for whilst the gains on the 25 (acres) experiments calculated per acre amounted to 94 tons, 3 cwt., 1 qr., 6½ lbs. in favor of large sets, the gain (14 acres) on the 14 experiments favorable to the smaller sets amounted to only 34 tons, 17 cwt., 1 qr., 27½ lbs., leaving (after setting the gains against the losses) an average net balance, on the 39 comparisons, of more than 1 ton, 10 cwt. in favor of the larger sets on each advance, namely, from 1 to 2 ozs., from 2 to 4 ozs., from 4 to 6 ozs., and from 6 to 8 ozs. I have been particular in noticing these exceptional irregularities, and their general bearing on the tenor of the experiments, as an element inseparable from agricultural experiments, and as requiring the fullest recognition in the estimation of results.

It now only remains briefly to recapitulate the general bearing of the experiments, the results of which have been described in detail.

Firstly. Every increase in the size of the set, from 1 oz. up to 8 ozs. in weight, produces an increase in the crop much greater than the additional weight of the set planted. *The net profit* over and above the extra weight of the sets in planting 4 oz. sets in lieu of 1 oz. sets, amounted on the whole series of experiments to between 3 and 4 tons per acre; and the further *profit* on the increase of the size of the set from 4 ozs. to 8 ozs., averaged about 5 tons an acre ; all the intermediate steps partaking proportionately of the increase.

Secondly. The advantages in favor of the large sets is more marked in the late than in the early varieties.

Thirdly. In the use of small sets of from 1 oz. to 3 ozs. in weight, a larger balance over and above the weight of the sets was obtained by planting from 6 to 9 inches apart in the rows than at wider intervals.

Fourthly. Increasing the intervals at which the sets are planted, even of the largest size, in the rows to more than 12 inches, diminishes the crop, and the wider intervals induce no increase in the weight of the produce of the individual sets.

Fifthly. It may be broadly stated that the weight of the crop is proportionate to the weight per acre of the sets, and that small sets will produce the same crop as an *equal weight per acre* of large sets. The fact is, however, of limited application, as a weight of very small sets equal to a weight of full-sized potatoes

TABLE 1.—RESULTS of EXPERIMENTS on the POTATO CROP,

No	Variety of Potato.	When Planted.	Manure and Remarks.	Distance in the Row. ft.	in.
1	Early Prolific .	March 2	20 tons of stable manure per acre . .	1	0
2	Early Prolific .	" 2	Ditto ditto . .	0	9
3	Early Prolific .	" 2	Ditto ditto . .	0	6
4	Early Prolific .	" 1	Ditto ditto . .	1	0
5	Early Prolific .	" 2	Ditto ditto . .	0	9
6	Early Prolific .	" 2	Ditto ditto . .	0	6
7	Early Prolific .	" 1	Ditto ditto . .	1	0
8	Early Prolific .	" 1	Ditto ditto . .	0	9
9	Early Prolific .	" 1	Ditto ditto . .	0	6
10	Early Prolific .	" 1	Ditto, sets much sprouted . .	1	0
11	Early Prolific .	" 1	Ditto, sets much sprouted . .	1	0
12	Flukes	" 8	20 tons of stable manure per acre . .	1	0
13	Flukes	" 8	Ditto ditto . .	0	9
14	Flukes	" 7	Ditto ditto . .	0	6
15	Flukes	" 8	Ditto ditto . .	1	0
16	Flukes	" 7	Ditto ditto . .	0	9
17	Flukes	" 7	Ditto ditto . .	0	6
18	Flukes	" 7	Ditto ditto . .	1	0
19	Flukes	" 7	Ditto ditto . .	0	9
20	Flukes	" 9	Ditto ditto . .	0	6
21	Flukes	" 7	Ditto, and 4 cwts. dried blood . .	1	0
22	Flukes	" 9	Ditto, and 4 cwts. muriate of potash .	1	0
23	Flukes	" 8	Ditto, and 4 cwts. guano . .	1	0
24	Flukes	" 8	Ditto, and 4 cwts. mineral superphosphate	1	0
25	Flukes	" 9	Ditto, and 4 cwts. sulphate of ammonia	1	0
26	Flukes	" 7	20 tons of stable manure per acre	1	0
27	Flukes	" 9	Ditto, and 4 cwts. dried blood	1	0
28	Flukes	" 9	Ditto, and 4 cwts. muriate of potash	1	0
29	Flukes	" 8	Ditto, and 4 cwts. guano	1	0
30	Flukes	" 8	Ditto, and 4 cwts. mineral superphosphate	1	0
31	Flukes	" 8	Ditto, and 4 cwts. sulphate of ammonia	1	0
32	Flukes	" 7	20 tons of stable manure per acre . .	1	0
33	Flukes	" 7	Ditto ditto . .	1	3
34	Flukes	" 7	Ditto ditto . .	1	6
35	Flukes	" 7	Ditto ditto . .	1	3
36	Flukes	" 7	Ditto ditto . .	1	6
37	Flukes cut out of 8 oz. sets .	" 7	Ditto ditto . .	1	0
38	Flukes cut out of 8 oz. sets .	" 7	Ditto ditto . .	0	9
39	Flukes cut out of 6 oz. sets .	" 7	Ditto ditto . .	0	9
40	Flukes cut out of 4 oz. sets .	" 7	Ditto ditto . .	1	0
41	Flukes cut out of 4 oz. sets .	" 7	Ditto ditto . .	0	9
42	Flukes cut out of 4 oz. sets .	" 7	Ditto ditto . .	0	6
43	Spencer's King .	" 7	Ditto ditto . .	1	0
44	Spencer's King .	" 7	Ditto ditto . .	0	9
45	Spencer's King .	" 7	Ditto ditto . .	0	6
46	Spencer's King .	" 7	Ditto ditto . .	1	0

made at Benthall, near Broseley, in 1865—rows all 2 feet apart.

No	Number of sets per acre.	Weight of Sets per acre.				Gross produce per Acre.				Net produce per Acre after deducting weight of Sets.				Produce per set stated in ozs.	Increase of crop in proport'n to the weight of of sets.
		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		fold.
1	21,780	0	12	0	17¼	4	6	0	1	3	13	3	12	7.07	7.07
2	29,040	0	16	0	23	6	8	1	15½	5	12	0	20	9.30	9.30
3	43,560	1	4	1	6	5	19	3	16	4	15	2	10	4.92	4.92
4	21,780	1	4	1	6	4	12	2	25	3	8	1	19	7.62	3.81
5	29,040	1	12	1	18	5	14	1	0	4	1	3	10	7.05	3.52
6	43,560	2	8	2	13	8	8	0	12	5	19	1	27	7.21	3.56
7	21,780	2	8	2	13	5	4	2	2	2	13	3	17	8.57	2.14
8	29,040	3	4	3	8	9	13	0	13	6	8	1	5	11.91	2.97
9	43,560	4	17	0	26	13	17	3	5	9	0	2	7	11.42	2.85
10	21,780	3	12	3	19½	7	9	3	17	3	16	3	23½	12.33	2.05
11	21,780	4	17	0	26	3	15	1	11		.	.		6.20	0.77
12	21,780	0	12	0	17½	5	19	0	12	5	6	3	23	9.80	9.80
13	29,040	0	16	0	23	5	12	2	5	4	16	1	10	7.00	7.00
14	43,560	1	4	1	6	6	16	3	20	5	12	2	4	5.63	5.63
15	21,780	1	4	1	6	8	9	2	5	7	5	0	27	13.95	6.97
16	29,040	1	12	1	18	6	15	1	7	5	12	3	17	8.35	4.17
17	43,560	2	8	2	13	9	19	1	8	7	10	2	23	8.20	4.10
18	21,780	2	8	2	13	15	12	2	12	13	3	3	27	25.72	6.43
19	29,040	3	4	3	8	16	9	1	14	13	4	2	6	20.32	5.03
20	43,560	4	17	0	26	21	18	0	24	17	0	3	2	18.02	4 50
21	21,780	2	8	2	13	11	1	3	22	8	13	1	9	18.26	5.65
22	21,780	2	8	2	13	15	17	1	3	13	8	2	18	26.58	6.64
23	21,780	2	8	2	13	7	12	3	13	5	4	1	0	12.57	3.14
24	21,780	2	8	2	13	12	3	1	11	9	14	2	26	18.88	4.72
25	21,780	2	8	2	13	11	8	2	15	9	0	0	2	18.81	4.71
26	21,780	3	12	3	20	22	1	0	21	18	8	1	1	36.80	6 05
27	21,780	3	12	3	20	12	6	0	13	8	13	0	21	20.25	3.37
28	21,780	3	12	3	20	15	8	1	17	11	15	1	25	25.37	4.22
29	21,780	3	12	3	20	12	7	1	2	8	14	1	10	20.34	3.32
30	21,780	3	12	3	20	14	2	2	9	10	9	2	17	23.25	3.87
31	21,780	3	12	3	20	15	16	2	1	12	3	2	9	26.04	4.34
32	21,780	4	17	0	26	21	9	3	19	16	12	2	21	36.20	4.52
33	17,424	3	17	3	4	20	10	3	6	16	13	0	2	42.25	5.28
34	14,520	3	4	3	8	15	7	3	17	12	3	0	9	38.00	4.75
35	17,424	2	18	1	10	17	2	1	21	14	4	0	11	35.21	5.86
36	14,520	2	8	2	13	15	17	2	14	13	9	0	1	39.21	6.53
37	21,780	2	8	2	13	14	10	3	8	12	2	0	23	23.92	5.98
38	29,040	3	4	3	8	17	15	1	12	14	10	2	4	21.92	5.48
39	29,040	2	8	2	13	16	17	0	8	14	8	1	23	20.80	6.93
40	21,780	1	4	1	6	11	8	1	27	10	4	0	21	18.80	9.40
41	29,040	1	12	1	18	13	5	3	2	11	13	1	12	16.40	8.20
42	43,560	2	8	2	13	10	15	0	14	8	6	2	1	13.85	6.92
43	21,780	0	12	0	17	15	16	1	3	15	4	0	14	26.00	18.74
44	29,040	0	16	0	23	19	4	0	7	18	7	3	12	23.70	23.70
45	43,560	1	4	1	6	20	19	1	7	19	15	0	0	17.25	17.25
46	21,780	1	4	1	6	17	14	3	16	16	10	2	9	29.20	14.50

TABLE 1.—RESULTS of EXPERIMENTS on the POTATO-CROP, made at

No	Variety of Potato.	When Planted.	Manure and Remarks.	Distance in the Row.	
				ft.	in.
47	Spencer's King .	March 7	20 tons of stable manure per acre . .	0	9
48	Spencer's King .	" 7	Ditto ditto . .	0	6
49	Spencer's King .	" 7	Ditto ditto . .	1	0
50	Spencer's King .	" 7	Ditto ditto . .	0	9
51	Spencer's King .	" 7	Ditto ditto . .	0	6
52	Spencer's King .	" 6	Ditto ditto . .	1	0
53	Spencer's King .	" 6	Ditto ditto . .	1	0
54	Queen of Flukes	" 6	Ditto ditto . .	1	0
55	Queen of Flukes	" 6	Ditto ditto . .	0	9
56	Queen of Flukes	" 6	Ditto ditto . .	0	6
57	Queen of Flukes	" 6	Ditto ditto . .	1	0
58	Queen of Flukes	" 6	Ditto ditto . .	0	9
59	Queen of Flukes	" 6	Ditto ditto . .	0	6
60	Queen of Flukes	" 6	Ditto ditto . .	1	0
61	Queen of Flukes	" 6	Ditto ditto . .	0	9
62	Queen of Flukes	" 6	Ditto ditto . .	1	0
63	Flour Ball . .	" 6	Ditto ditto . .	1	0
64	Flour Ball . .	" 6	Ditto ditto . .	0	9
65	Flour Ball . .	" 6	Ditto ditto . .	0	6
66	Flour Ball . .	" 6	Ditto ditto . .	1	0
67	Flour Ball . .	" 6	Ditto ditto . .	0	9
68	Flour Ball . .	" 6	Ditto ditto . .	0	6
69	Flour Ball . .	" 6	Ditto ditto . .	1	0
70	Second Kidney .	" 4	Ditto ditto . .	1	0
71	Second Kidney .	" 4	Ditto ditto . .	0	9
72	Second Kidney .	" 4	Ditto ditto . .	0	6
73	Second Kidney .	" 4	Ditto ditto . .	1	0
74	Second Kidney .	" 4	Ditto ditto . .	0	9
75	Second Kidney .	" 4	Ditto ditto . .	0	6
76	Second Kidney .	" 4	Ditto ditto . .	1	0
77	Second Kidney .	" 4	Ditto ditto . .	1	0
78	Daintree's Seedling	" 3	Ditto ditto . .	1	0
79	Daintree's Seedling	" 3	Ditto ditto . .	0	9
80	Daintree's Seedling	" 3	Ditto ditto . .	0	6
81	Daintree's Seedling	" 3	Ditto ditto . .	1	0
82	Daintree's Seedling	" 3	Ditto ditto . .	0	9
83	Daintree's Seedling	" 3	Ditto ditto . .	0	6
84	Daintree's Seedling	" 3	Ditto ditto . .	1	0
85	Daintree's Seedling	" 3	Ditto ditto . .	1	0
86	Early Handsworth	" 3	Ditto ditto . .	1	0
87	Early Handsworth	" 3	Ditto ditto . .	0	9
88	Early Handsworth	" 3	Ditto ditto . .	0	6
89	Early Handsworth	" 3	Ditto ditto . .	1	0
90	Early Handsworth	" 3	Ditto ditto . .	0	9
91	Early Handsworth	" 3	Ditto ditto . .	1	0
92	Early Handsworth	" 3	Ditto ditto . .	1	0
93	Lemon Kidney .	" 3	Ditto ditto . .	1	0
94	Lemon Kidney .	" 3	Ditto ditto . .	0	9
95	Lemon Kidney .	" 3	Ditto ditto . .	0	6
96	Lemon Kidney .	" 3	Ditto ditto . .	1	0
97	Lemon Kidney .	" 3	Ditto ditto . .	0	9
98	Lemon Kidney .	" 3	Ditto ditto . .	0	6

Benthall, near Broseley, in 1865—rows all 2 feet apart—*continued.*

No	Number of Sets per Acre.	Weight of Sets per Acre.				Gross produce per Acre.				Net produce per Acre after deducting weight of Sets.				Produce per set stated in ozs.	Increase of crop in proport'n to the weight of sets.
		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		fold.
47	29,040	1	12	1	18	35	8	0	19	33	15	3	1	43.70	21.85
48	43,560	2	8	2	13	21	7	1	9	18	18	2	24	17.58	8.79
49	21,780	2	8	2	13	25	9	3	3	23	1	0	18	44.00	11.00
50	29,040	3	4	3	8	21	16	1	15	18	11	2	7	27.00	6.73
51	43,560	4	17	0	26	30	5	2	9	25	8	1	11	24.91	6.25
52	21,780	3	12	3	19	30	19	3	12	27	6	3	20	51.00	8.50
53	21,780	4	17	0	26	34	0	2	14	29	3	1	16	56.00	7.00
54	21,780	0	12	0	18	14	6	2	6	13	14	1	17	24.40	24.40
55	29,040	0	16	0	23	10	14	2	24	9	18	2	1	13.25	13.25
56	43,560	1	4	1	6½	15	16	0	0½	14	11	2	22	13.40	13.00
57	21,780	1	4	1	6½	14	4	3	0	13	0	1	21	23.42	11.74
58	29,040	1	12	1	18	14	19	1	1	13	6	3	11	15.80	9.56
59	43,560	2	8	2	13	17	13	1	21	15	4	3	8	14.54	7.27
60	21,780	2	8	2	13	16	17	3	15	14	9	1	2	17.80	6.95
61	29,040	3	4	3	8	19	6	3	2	16	1	3	22	23.87	5.96
62	21,780	4	17	0	26	30	5	2	9	25	8	1	11	49.83	6.22
63	21,780	0	12	0	17	10	12	2	21	10	0	2	4	17.50	17.50
64	29,040	0	16	0	23	6	8	2	0	5	12	1	5	18.80	18.80
65	43,560	1	4	1	6½	15	19	3	6	14	15	1	27½	13.15	13.15
66	21,780	1	4	1	6½	14	13	2	2	13	9	0	23	24.15	12.07
67	29,040	1	12	1	18	16	12	0	23	14	19	3	5	20.50	10.25
68	43,560	2	8	2	13	20	15	0	24	18	6	2	11	17.08	8.54
69	21,780	2	8	2	13	17	1	0	20	14	12	2	7	28.00	7.01
70	21,780	0	12	0	17	9	15	1	2	9	3	0	13	16.07	16.06
71	29,040	0	16	0	23	12	13	2	12	11	17	1	17	15.65	15.65
72	43,560	1	4	1	6½	13	13	2	21	12	9	1	14½	11.26	11.26
73	21,780	1	4	1	6½	18	6	1	21	17	2	0	14½	30.15	15.07
74	29,040	1	12	1	18	17	9	3	10	15	17	1	20	21.58	10.79
75	43,560	2	8	2	13	14	1	3	25	11	13	1	12	11.60	5.80
76	21,780	2	8	2	13	20	0	3	12	17	12	0	27	32.10	8.02
77	21,780	3	12	3	19½	26	8	2	22	22	15	3	2½	43.50	7.20
78	21,780	0	12	0	17	11	8	3	16	10	16	2	27	18.83	18.88
79	29,040	0	16	0	23	13	2	2	3	12	6	1	8	16.20	16.25
80	43,560	1	4	1	6½	14	4	2	17	13	0	1	10½	10.68	10.63
81	21,780	1	4	1	6½	14	4	1	17	13	0	0	10½	23.40	11.70
82	29,040	1	12	1	18	16	3	0	3	14	10	2	12	19.93	9.96
83	43,560	2	8	2	13	19	1	3	7	16	13	0	22	15 70	7.85
84	21,780	2	8	2	13	20	12	0	14	18	3	2	1	33.90	8.47
85	21,780	3	12	3	19½	25	16	2	5	22	3	2	13	42 15	7.08
86	21,780	0	12	0	17¼	4	12	1	13½	4	0	0	24¼	7.60	7.60
87	29,040	0	16	0	23	7	16	1	15	7	0	0	20	9.65	9.65
88	43,560	1	4	1	6½	8	17	0	3	7	12	2	24½	7.65	7.65
89	21,780	1	4	1	6½	4	18	0	18	3	13	3	11½	8.07	4.04
90	29,040	1	12	1	18	6	10	2	5	4	18	0	15	8.05	4.02
91	21,780	2	8	2	13	11	4	3	11	8	16	0	26	17.66	4.62
92	21,780	3	12	3	19½	13	16	2	0	10	3	2	8½	22.75	3.79
93	21,780	0	12	0	17¼	6	19	2	27	6	7	2	10	11.50	11.50
94	29,040	0	16	0	23	7	18	0	0	7	1	3	5	9.75	9.75
95	43,560	1	4	1	6½	7	7	0	7	6	2	3	0½	6 05	6.05
96	21,780	1	4	1	6½	6	17	2	27½	5	13	1	21	11.33	5.66
97	29,040	1	12	1	18	8	11	3	3	6	19	1	13	10.60	5.30
98	43,560	2	8	2	13	5	0	3	14⅜	2	12	1	1⅜	4.15	2.07

TABLE 1.—RESULTS of EXPERIMENTS on the POTATO-CROP, made at

No	Variety of Potato.	When Planted.	Manure and Remarks.		Distance in the Row.	
					ft.	in.
99	Lapstone . .	March 4	20 tons of stable manure per acre . .		1	0
100	Lapstone . .	" 4	Ditto	ditto . .	0	9
101	Lapstone . .	" 4	Ditto	ditto . .	0	6
102	Lapstone . .	" 4	Ditto	ditto . .	1	0
103	Lapstone . .	" 4	Ditto	ditto . .	0	9
104	Lapstone . .	" 4	Ditto	ditto . .	0	6
105	Lapstone . .	" 4	Ditto	ditto . .	1	0
106	Lapstone . .	" 4	Ditto	ditto . .	0	9
107	Lapatone . .	" 4	Ditto	ditto . .	1	3
108	Lapstone . .	" 4	Ditto	ditto . .	1	0
109	Lapstone . .	" 4	Ditto	ditto . .	1	0
110	French Red Kidney	" 6	Ditto	ditto . .	1	0
111	French Red Kidney	" 6	Ditto	ditto . .	1	0
112	French Red Kidney	" 6	Ditto	ditto . .	1	0
113	French Red Kidney	" 6	Ditto	ditto . .	1	0
114	Blues . . .	" 8	Ditto	ditto . .	1	0
115	Blues . . .	" 8	Ditto	ditto . .	1	0
116	Blues . . .	" 8	Ditto	ditto . .	0	9
117	Blues . . .	" 8	Ditto	ditto . .	1	0
118	Late Red . .	" 8	Ditto	ditto . .	1	0
119	Late Red . .	" 8	Ditto	ditto . .	0	9
120	Late Red . .	" 8	Ditto	ditto . .	0	6
121	Late Red . .	" 8	Ditto	ditto . .	1	0
122	Late Red . .	" 8	Ditto	ditto . .	0	9
123	Late Red . .	" 8	Ditto	ditto . .	0	6
124	Late Red . .	" 8	Ditto	ditto . .	1	0
125	Late Red . .	" 8	Ditto	ditto . .	0	9
126	Late Red . .	" 8	Ditto	ditto . .	1	3
127	Late Red . .	" 8	Ditto	ditto . .	1	0
128	Late Red . .	" 8	Ditto	ditto . .	1	0
129	Late Red cut out of 4 oz. sets	" 8	Ditto	ditto . .	1	0

TABLE 2.—RESULTS of EXPERIMENTS on the

No	W'ght of Sets.	Name of Potato.	When Planted.	Distance in the Rows.		Number of sets per Acre.	Weight of Sets per Acre.				Produce per set in ozs.
				ft.	in.		tons.	cwts.	qrs.	lbs	
1	8 ozs.	Early Prolific Kidney	Feb. 16	1	0	21,780	4	17	0	26	28.17
2	4 "	Early Prolific Kidney	"	1	0	21,780	2	8	2	13	23.21
3	2 "	Early Prolific Kidney	"	1	0	21,780	1	4	1	6	17.07
4	4 "	Seconds Kidney .	March 31	1	0	21,780	2	8	2	13	13.95
5	2 "	Seconds Kidney .	"	1	0	21,780	1	4	1	6	13.55
6	1 "	Seconds Kidney .	"	1	0	21,780	0	12	0	17½	12.45
	8 "	Flukes . .	"	1	3	17,424	3	17	3	4	30.79
8	4 "	Flukes . .	"	1	0	21,780	2	8	2	13	15.0
9	2 "	Flukes . .	"	1	0	21,780	1	4	1	6	12.0
10	1 "	Flukes . .	"	1	0	21,780	0	12	0	17½	12.10

Benthall, near Broseley, in 1865—rows all 2 feet apart—*continued.*

No	Number of sets per Acre.	Weight of sets per Acre.				Gross produce per Acre.				Net produce per Acre after deducting weight of sets.				Produce per set stated in ozs.	Increase of crop in proport'n to the weight of sets.
		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		fold.
99	21,780	0	12	0	17¼	14	15	3	22½	14	3	3	5	24.35	24.35
100	29,040	0	16	0	23	7	14	1	27	6	18	1	4	9.53	9.53
101	43,560	1	4	1	6½	14	16	0	13	13	11	2	6½	12.18	12.18
102	21,780	1	4	1	6½	11	15	1	24	10	11	0	17½	19.30	9.65
103	29,040	1	12	1	18	14	1	3	35	12	9	2	7	17.40	8.70
104	43,560	2	8	2	13	8	6	2	13½	5	18	0	0½	6.85	3.42
105	21,780	2	8	2	13	13	8	2	11	12	16	1	22	22.10	5.52
106	29,040	3	4	3	8	17	18	3	9	14	14	0	1	22.14	5.53
107	17,424	1	18	3	16	10	19	2	27	9	0	3	11	22.60	5.66
108	21,780	4	17	0	26	11	19	0	3	7	1	3	5	19.60	2.45
109	21,780	3	12	3	19½	4	17	0	26	1	4	1	6½	8.00	1.33
110	21,780	0	12	0	17¼	12	9	2	18	11	17	2	1	20.54	20.54
111	21,780	1	4	1	6½	14	7	2	16¼	13	3	1	10	23.66	11.83
112	21,780	2	8	2	13	13	3	1	24	10	15	3	11	22.50	5.62
113	21,780	3	12	3	19½	13	8	1	8	9	15	1	16	22.07	3.67
114	21,780	0	12	0	17¼	2	11	2	14	1	19	1	24	8.36	8 36
115	21,780	1	4	1	6½	3	17	3	4	2	13	1	25½	6.40	3.20
116	29,040	1	12	1	18	4	2	2	16½	2	10	0	26½	5.10	2.55
117	21,780	2	8	2	13	3	17	3	26	1	9	1	13	6.41	1.60
118	21,780	0	12	0	17¼	22	14	2	6¾	22	2	1	17½	37.40	37.40
119	29,040	0	16	0	23	19	0	3	8½	18	4	2	13½	23.50	23.50
120	43,560	1	4	1	6½	20	18	1	1	19	13	3	22½	17.20	17.20
121	21,780	1	4	1	6½	32	0	0	5	30	15	2	26½	52.66	26.33
122	29,040	1	12	1	18	35	2	0	26	33	9	3	8	43.33	21.66
123	43,560	2	8	2	13	34	16	1	19	32	7	3	6	28.65	14.32
124	21,780	2	8	2	13	27	17	3	13½	25	9	1	0½	45.90	11.47
125	29,040	3	4	3	8	21	12	2	20½	18	7	3	12½	26.70	6.67
126	17,424	1	18	3	16	18	6	2	7	16	7	2	19	37.70	9.42
127	21,780	4	17	0	26	38	19	2	25	34	2	1	27	64.15	8.01
128	21,780	3	12	3	19½	37	18	3	0	34	5	3	8	62.42	10.40
129	21,780	1	4	1	6½	24	11	2	7	23	7	1	0½	40.44	20.22

Potato Crop, made at Benthall, near Broseley, in 1864.

Gross produce per Acre.				Net produce per Acre after deducting weight of sets.				Rate of Increase.	Manure and Remarks. 20 Tons of Stable Manure used per Acre.
tons	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		
17	2	1	21	12	5	1	23	3.52	Single rows, 2 feet apart.
14	2	0	14	11	13	2	1	5 80	Single rows, 2 feet apart.
10	6	1	6	9	2	0	0	8.53	Single rows, 2 feet apart.
9	6	3	14	6	18	1	1	3.48	Single rows, 2 feet apart.
7	17	2	22	6	13	1	16	6.77	Single rows, 2 feet apart.
7	11	1	8	6	19	0	18½	12.45	Single rows, 2 feet apart.
14	19	1	1	11	1	1	25	3.84	Single rows, 2 feet apart.
9	2	1	6½	6	13	2	21½	3.75	Single rows, 2 feet apart.
7	5	3	5	6	1	1	27	6.0	Single rows, 2 feet apart.
7	7	0	7	6	14	3	17½	12.10	Single rows, 2 feet apart.

could not be got into the ground, except by planting them so close as to be prejudical to the crop. The advantage, therefore, of large sets remains practically unimpaired.

Sixthly. Weight for weight cut sets produce, as nearly as possible, the same weight per acre as whole potatoes; but for the reasons given above, the weight of the sets should not be reduced by subdivision.

Seventhly. Smaller sets give a larger produce in proportion to their weight than the larger sets.

Eighthly. When the intervals between the sets in the rows are diminished to less than a foot, the produce of *each individual set* is proportionately diminished. Though this is not necessarily accompanied by a diminution of the weight of the crop, no increase in the produce of each individual set is caused by placing the sets at intervals wider than a foot.

Ninthly. With reference to the relative produce of different varieties, a *Late Red* sort takes the precedence throughout the experiments; and of the several varieties of Fluke, "Spencer's King of Flukes" and "The Queen of Flukes" are much more prolific than the ordinary variety.

RINDERPEST.

All immediate alarm lest this terrible scourge should be introduced to our shores having subsided, it seems a favorable time to gather what lessons we may from the experience of Great Britain for use in the possible contingency of its future introduction into this country. Such an event, however much to be deplored, cannot be deemed more improbable to-day, than was its introduction into England considered to be, by those best qualified to judge, a dozen years ago. In 1856, Prof. Simonds was sent to the continent by the three great Agricultural Societies of England, Ireland and Scotland, to investigate and report upon the disease as manifested in the outbreak then prevalent over a large tract of country. One of the conclusions to which he arrived was expressed in his report as follows: "That no fear need be entertained that this destructive pest will reach our shores." But it did reach them, and caused awful havoc, probably a thousand times more than would have occurred, had they promptly adopted judicious and efficient measures to arrest its progress; such measures as they have been taught by late and costly experience.

If these lessons are rightly apprehended, the first is, *that the immediate slaughter of all diseased animals and of all which have been exposed to infection, is not only the most effective remedy, but it is the cheapest also, provided it be adopted at the outset or early enough to give reasonable hope of success.* At the same time a rigid cordon should be placed around the infected district at a distance sufficient to include all which may have been exposed, and so, by perfect isolation, secure *an impassible barrier to its extension.* There should be also the adoption of all other precautionary measures, such as the burning, burial or thorough disinfection of whatever may communicate the germs of disease, and the administration of of prophylactics to the well.

But if the disease attains strong headway, and occupies various centres from which to extend, at considerable distances from each other, before energetic measures are instituted, there is reason to believe that a policy different in one respect may be better—to wit:—the substitution of treatment for the sick in place of the knife. Let all such as show the slightest symptoms of disease be gathered into quarters set apart for hospital uses: let a rigid quarantine be enforced, let all the apparently well which by any possibility may have been exposed to infection, be frequently and critically examined, in a word, let all possible precaution be taken to prevent the spread of the disease. But let the sick die if they must, and get well if they can with the help of nature alone or with that of man added.

Rinderpest is believed to be a zymotic disease—i. e. one in which the germs of disease when once received into the system act like a ferment—like yeast in dough they leaven the whole lump, and convert the animal organism into a mass of disease. One of the alleged triumphs of modern medicine is the discovery that sulphurous acid (not sulphur*ic*) and also the alkaline sulphites (not sulph*ates*) these being combinations of sulphurous acid with soda, potass, &c., forming sulphite of soda and sulphite of potash, &c., will arrest this action in the living system as effectually as they will arrest fermentation in fermenting matters out of the body.

If such be really the case, and numerous observations and experiments tend strongly to indicate that it is, it follows that, if a solution of sulphite of soda (perfectly harmless) be given to a well beast, and it be then exposed in a way to receive the germs of rinderpest, *these could not begin to develope* so long as the system retains any portion of the sulphite. And there is reason to believe, that if the germs of disease had been recived into the system and had not made progress in development beyond a certain point or degree, their further action would be arrested, and the powers of nature suffice to elminate and throw off what had been received, and thus the beast get well.

From the time when the seeds of rinderpest enter the system until external symptoms of disease are manifested, is probably about one week. From the time when the animal first shows its sickness, the progress of the disease is generally very rapid; but it is important to know that several days before any symptoms are developed which are likely to be recognized by an ordinary observer, the existence of the disease may be ascertained by critical examination with the aid of the thermometer. If the disease exists there will be an abnormal degree of internal heat, and if the bulb of a thermometer be introduced into the rectum or vulva, instead of finding the heat to that of health—say from 98° to 100°

Fahrenheit, it will be found several degrees higher—say 102° or from 102° to 105°, and sometimes even as high as 107°.

There is great reason to believe that during the incubative stage, that is to say, during the term while the poison is spreading through the system and before external symptoms manifest themselves, remedial treatment may be effectual. This should be antidotal in its character,—destructive to the life of the germs of the disease. But if suitable measures be not put into operation before external symptoms force themselves upon observation, at which period the decomposition and degeneration of the blood has made great headway, the chances of success, are very greatly lessened—still they are supposed to be worth trying for.

I had proposed to myself to prepare a tolerably full account of the history of rinderpest as developed in the last few years in Great Britain and on the continent of Europe, with a statement of the symptoms and morbid anatomy of the disease and of the treatment pursued, but I find the work already done in a report from the pen of Hon. A. B. Conger to the State Agricultural Society of New York, lately published, far better than I could do it, and filling an octavo volume, illustrated with colored engravings. From this we give the copious extracts following, and which comprise a considerable share of what will prove most interesting to the non-professional reader. I do this with the more pleasure because they will be found to embrace matters of general interest to the farmers of the State, especially in the prevalent absence of familiarity with veterinary science, aside from its special reference to the subject in hand.

Before doing so I desire to add a word of caution. If we ever should be visited by so dire a calamity as the coming of rinderpest into our midst, or the coming of any fatal contagious disease among cattle, special care should be taken to *avoid a panic.* Since the importation of pleuro pneumonia into Massachusetts some years ago, we have had in this State, as we also had before not less, occasional cases of disease among cattle, sometimes taking a large part of a herd. Of many of these cases I have been officially notified, and I have visited nearly all, in fact every one where there seemed a possibility for any occasion to do so. In only one was found reasonable cause for alarm lest the disease prove contagious, and so to involve the public interest, although calamitous to the owners of the beasts. In the single case above referred to I found no panic, but, happily, a due degree of caution and good judgment exercised by the town authorities. In a majority of the others, alarm prevailed greatly disproportioned to any occasion for it. And we may expect in proportion as panic prevails, usurping the place of due caution and sober judgment, that suitable measures will be neglected, and injudicious methods may be adopted:

"Diseases of animals are either epizoötic or enzoötic. This classification corresponds to that of the maladies which affect the human race, epidemic and endemic.

The former of each class have been defined as *dependent upon* or *originating in* some particular condition of the atmosphere, and as *attacking a number* of individuals at the same time. Thus they differ from the latter of each class, which are described as of purely local origin, at least in the first instance, and as comparatively limited or isolated in their development.

Diseases, however, that are at first endemic or enzoötic, may break out at a time when their diffusion is favored by currents of the atmosphere; when its condition by lowering the tone increases the susceptibility of the patient; or when chemical or other changes affect its normal constitution, and so develope fresh food for the local malaria. Then, these diseases become epidemic or epizoötic.

Most of such diseases exhibit this further peculiarity of developing in their course a malignant virus or miasm (perchance infinitesimal germs, with all the subtle rancor and prolific power of a fungous growth,) which spread through or float on the atmosphere, intensifying the original power of the "*materies morbi*," whether originally local or not, and thus these maladies are *infectious*. But frequently it happens that the poison may be propagated by touch or direct application to absorbent surfaces, by inoculation or the like, and thus the disease may be not only infectious, but *contagious* also.

We do not present this distinction as disposed to cope with any of the vexed questions in the schools, but simply (as the sequel will show the Rinderpest to be capable of propagation by both methods) to guard, in the case of this disease at least, against the erroneous impression that it must be communicable, if at all, in one way or the other, and cannot be by both. Before, however, demonstrating that the great variety of observed facts do not sustain any such delusive view, it is desirable to trace the pest from its earliest appearance to its present formidable development in Great Britain.

History.—The Rinderpest had its origin on the Asiatic part of the steppes of Russia, more, it is said, than one thousand years ago, and in the times of Charles the Great. These steppes (from the Russian word "step," signifying a desert or dry plain) are natural feeding grounds, not unlike the lands of Guienne in France, the heaths of Northern Germany, and in many respects like the prairies of the Great West. In these steppes are now roving from eight to ten millions of cattle, more than half being reserved for market as fat cattle. Though the greater part of these immense ranges is more or less arid, that portion of the Asiatic steppe between the rivers Volga and Don is marshy and generally accounted to be the local source of the infection. Be this as it may, no part of the steppes, or it is said of Southern Russia (and the same may be affirmed of the Hungarian steppes, stretching from Vienna east of Pesth) is wholly free at any time from this noxious distemper, although there are long periods when it is measurably kept in abeyance. * * * Professor Renault, president of the veterinary school of Alfort, in his memoir to the French minister of agriculture, has, after a thorough investigation, established the fact that this steppe-murrain never broke out spontaneously (*i. e.* as an enzoötic) in any country or locality but that of the Russian steppes, and, as we have before intimated, in the Asiatic part thereof.

He also asserts that its transmission to other parts of the civilized world has been directly by cattle contaminated with the poison when they left their native pastures; poison, as we may suppose, if not already brought in contact with the blood-corpuscles, at least lying ensconced in hair or on hoof, furtively awaiting the fatal lick or smell that ensures its absorption by the system. It is very easy to imagine how a virus of this sort might, on this theory, work out all the terrible ravages that have actually resulted, when we understand that these cattle are moved from their pastures in immense droves, sometimes numbering one hundred thousand, and how, as they migrate towards the southern and western borders of Russia, developing and leaving behind them poisonous excretions, they thus distribute the plague throughout Poland, Galicia and Hungary. Thence the passage to Western Europe is comparatively easy, unless the cordon has been tightly drawn or the pole-axe vigorously swung. Thanks to such methods established by decrees at Berlin during the present century, the disease has never, when it has broken out in Poland, and sometimes appeared in Posen, Silesia and East Prussia, advanced since 1815 as far west as Brandenburgh.

In 1841 it penetrated into Egypt by cattle bought by the Pacha from Annatolia and Karamania, resulting in the desolating loss to that country of 350,000 cattle. During the Crimean war, and by the infection brought by Russian cattle into the Crimea, it was there fully developed; the French losing at Samsoun 8,000 out of 17,500 beasts, and the English 4,000 out of 10,000, a loss ranging from 40 to 45 per cent. The mortality in some parts of Europe has risen to 94 per cent., and in some localities not a single animal was saved.*

As the present apprehension of the outbreak of this plague in this country has arisen from its recent spread in England and Scotland, we will now present an outline of its rise and propagation in those kingdoms.

It is generally known in this country that the farmers of Great Britain do not raise food enough for its population. But it may surprise many to learn that the animal value of produce imported, to supply this deficiency, is estimated on very accurate data, at upwards of forty millions of pounds sterling. It is believed that the prominent items in this extraordinary expenditure consist of cattle, meat, butter, poultry, &c. Most of the beef class of imports come through Holland and Belgium. Prior to 1865 but one importation direct from Russia is known to have been made into any port of Great Britain, and this into that of London on 4th July, 1860. But indirectly large numbers of Hungarian and Galician cattle have been brought to English markets; more of late years, as the completion of two great lines of railroads, which traverse Central and Southern Germany, and connect Hamburg and Rotterdam with Vienna and Lemburg, furnish quick transit for these supplies. The immunity which England has enjoyed,

* The number attacked in the Austrian dominions was 296,000, of which 152,000 died. In 1863 it again invaded Galicia (in which country Prof. SIMONDS first saw the disease in 1857), Hungary and its dependencies, fourteen per cent. of all the cattle in those countries taking the infection, and the average mortality as given in Schmidt's Jahrbuch for 1865 was as follows: Hungary, 65 per cent.; East Galicia, 77 per cent.; Croatia and Slavonia, 81.6 per cent.; Military Frontier, 83 per cent.; Moravia, 88 per cent.; Lower Austria, 92 per cent.; West Galicia, 94 per cent.; Burowina and Styria (in which but a comparatively small number were attacked), 100 per cent.

prior to 1865, in such importations, is traceable to the rigorous police measures established in Western Europe, and to the fact that the incubative stage of the Rinderpest rarely extends beyond a week.

But it seems that two importers of cattle, Messrs. Honck and Baker, were induced by the representations of a Mr. Burchell, who subsequently acted as their agent, and, in expectation of a profit of one hundred per cent. to make a contract with the Esthonian Agricultural Society for a large number of sheep and cattle; the latter to weigh at least one thousand pounds each, and to be delivered at Revel after the ice had broken up in the Baltic. As some of the beeves offered did not come up to the contract weight, forty-six were sent down from the neighborhood of St. Petersburg, from which the agent was to choose. These being on their arrival much bruised, having been transported in four-horse wagons, and deemed by him not fit for the London market, three experts or judges were appointed by the local magistrates to say how many were in a suitable condition to take; and thirteen were adjudged. These, with the Esthonian cattle which passed muster, made in all three hundred and twenty-two; but as one died in the yard before shipment, only three hundred and twenty-one sailed from Revel, on the 22d day of May, 1865, in the 'Tonning.' This steam vessel landed at Copenhagen to await orders whether, in view of the state of the markets, the owners desired her to proceed to London, Hull, or any other ports, and in obedience to instructions she put in for Hull; at which place she discharged, on the 28th day of May, three hundred and twenty cattle seemingly sound, and one which had sickened on the passage. One hundred and forty-six of this number were sold for immediate slaughter at three different market towns, from none of which has any disease been traced; twenty were picked out by Mr. Baker to go to Gosport for like use and with a like result. The remaining one hundred and fifty-five arrived at London on 29th or 30th day of May, were placed in Mr. Honck's lairs and sold in the Metropolitan market on 1st of June. On inquiries addressed by the Royal Commission to the purchasers of these animals, they were all sound beef when slaughtered, as far as appearances could lead such judges to determine the fact.

We turn for a moment to another lot of cattle which have been supposed to have had considerable agency in disseminating the contagion throughout England. Twenty-three head of fat cattle were sent from Schiedam, in Holland, by a Mr. Defries to his son, a salesman in the Metropolitan market, which were sent into the market on 22d, 26th and 29th days of June, twelve of them thrice, the remaining eleven only twice. The markets of June being unusually dull, more animals than was customary were left unsold at the close of markets, and sent back to the yards where they lodged, which generally have sheddings attached, and are called *lairs*. This lot of twenty-three were placed in the lairs of a Mrs. Nichols of Islington, which adjoin the cattle yards used by many drovers bringing stock to the Metropolitan markets. As the prices offered for this lot of Dutch cattle were not satisfactory, they were, on the 2d day of July, reëxported to Holland.

On the 27th day of June, a cow belonging to Mrs. Nichols (who had at this date a herd of ninety-three, which, with sixteen or seventeen more purchased subsequently, were all destroyed by Rinderpest), sickened and died, as was supposed by the owner from poison. Two cows which on the 19th of June* were purchased in the Metropolitan market by a Mr. Baldwin, of Hackney, died of the same disease, one on the 29th of June, and within twenty-four hours after she was observed to be ailing; and the other on the 5th day of July. These three cases were attended by Mr. Priestman, a veterinary surgeon, who with a son of Mrs. Nichols brought the stomach and intestines of a cow of the latter to Prof. Simonds at the college, on the 4th of July, for examination. The Professor was also requested to inspect the herd and the premises, which he did with great care; had another animal killed, and took its stomach and appendages and some water from a well recently opened, to the college for examination. On the 9th day of July he was fully satisfied that these animals and others reported at that date had died of the same disease which he had observed in Galicia in 1857.

Twenty-one of the Defries cattle died shortly after their arrival at Schiedam, it having been observed before their departure that they were out of health. Moreover the plague was communicated to the stock of a Mr. Vandervelden, grazing in a pasture adjoining† that in which the Defries cattle had been placed; and the

* Prof. GAMGEE states that the running from the eyes and nose, and the drooping and other primary symptoms, were observed in the market as early as the 14th of June, and gives the history of two Dutch cows bought there on the 19th, which went to Lambeth Walk, and communicated the disease in that neighborhood, one of them sickening shortly after the purchase.

† Prof. GERLACH states that this pasture was full one thousand paces from that in which the Defries cattle were placed.

owner of the stock contaminated in this wise had, in utter ignorance thereof, sold upwards of twenty, which were exported to Norfolk.

To return to Mr. Baldwin's stock. In twelve days after his first loss his herd of twenty animals was reduced to ten, his saving up to that time of fifty per cent. being attributable to the immediate slaughter of each animal on showing the first symptoms of the pest.

In a brief review of these statements (as it is impossible in this sketch, to give all the particulars which go to confirm the conclusion) the only animals which could have conveyed Rinderpest directly to English stock were brought into the Metropolitan market; from which those that developed the contagion earliest were sent to three places, two in England and one in Holland, where it was definitely recognized. And although an interval of nineteen days has to be accounted for, there seems to be little difficulty in accepting the theory of Prof. Simonds, that the pestilence was in its state of incubation in one or more of the thirteen animals sent down from St. Petersburg to fill out the contract of the Esthonian Society; that it was developed in the lot brought to the Metropolitan market; thence spread to Mrs. Nichols' lairs at Islington, and to Mr. Baldwin's farm at Hackney, on or before the 20th of June, and through the Dutch cattle into Norfolk early in July. Even if the impression, as communicated by the English Consul-General at Hamburg, and based upon the opinion of Mr. Schrader, a veterinary in the special employ of the Hamburg government, be correct, that the Rinderpest was developed by Hungarian cattle sent from Vienna to Utrecht early in May; this would require proof of the transmission of some of these cattle, or of others infected by them, to the Metropolitan market in order to account for the earliest observed outbreaks of the plague which we have given. If true, this theory would only show a double source of infection concentrating at a common point and thence to be diffused. Suffice it to say, that in a very short space of time from its outbreak in Islington, the Rinderpest appeared in Suffolk and Shropshire. Before the end of July it had invaded Scotland,* and by the 14th of October it had extended into twenty-nine

* Prof. Dick says that the infection in Edinburgh came from a herd of Dutch cattle brought down from London, two of which were bought by a cow-feeder named Ogg, and lodged in his byres; and that these developed the disease on the 8th of August, all the animals Ogg had dying except the *two foreign cattle*, which *recovered*.

counties in England, two in Wales and sixteen in Scotland, and resulted in six months in a loss of two hundred thousand animals, and within nine months of three hundred thousand at the lowest calculation; an enormous havoc, resulting mainly from a neglect to establish, as has been shown in the preliminary report, efficient sanitary cordons.

It is conceded that it is by no means an easy task to trace with exactitude the subtle course of a pestilence which thus dashed with rapid and fatal strides through the herds of Great Britain as it had previously held on in its mad career on the Continent. Nor less difficult does it seem to arrange and classify the various statements given as to the mediate instrumentalities of its spread. Too much concurrent testimony exists, however, of the poison being carried on the persons and clothes of attendants, diffused by excretions from the mucous surface, the skin and the bowels of diseased subjects; sometimes caught upon the wings of birds or clinging to their claws, so that falling plumes or alighting tracks might contaminate green pastures or farmsteads kept scrupulously clean—to cast a prudent doubt upon what would seem to partake only of the marvelous and fanciful. Proof may be deficient to show that in many cases the pest has been communicated, as some have affirmed, through the antennæ of flies crowding together on the glairy mucus exuding from eyes, nostrils or vagina; or conveyed on the hair or feet of horses, cattle or dogs beyond the limits of developed contagion; or by like secondary agencies, and to a looality sufficiently remote, for its spread by gradual or ordinary diffusion. Yet it is asserted on evidence seemingly beyond impeachment, to wit, on the statement of the Governor of Silesia to Prof. Simonds, that the outbreak in that province occurred in consequence of a carpenter's passing surreptitiously the frontier cordon from Galicia, in order to visit his father, and incautiously mending a manger in the cow sheds; thus communicating the seeds of the disease, which in a few days broke out in what had been prior to that time a perfectly healthy district.

Also, it is gravely stated in a communication on the nature of this disease, transmitted to Lord Bloomfield, and by him to the Home Government, that with a straw from an infected stable, half a dozen healthy stables could be infected. All such statements may be grouped together as sufficient, if not incontestable, testimony of the ready communicability of this poison by contact, and other instrumentalities of contagion proper.

But when we learn that it is also conveyed by currents of the atmosphere, as in instances where, for a distance of three miles, it was carried by a strong prevailing wind (the air being charged with much moisture) from byres where the disease existed, to perfectly healthy herds; or where, from the same causes, it has overleaped all quarantine regulations, we have sufficient evidence of its dissemination by currents of the atmosphere, and thus being propagated in accordance with the laws of infection proper. * * *

Pathology.—This branch of our subject we propose to consider under the ordinary classification of Descriptive and General, designing further to subdivide the former by treating first of the *symptoms*, or descriptive appearance of the disease as it is manifested in the infected animal before recovery or death, and next of the *morbid anatomy*, or description of the lessons revealed by *post mortem* dissections. In a few cases, taken from Jessen's Report, on the results of the inoculative methods, we have for convenience given the symptoms and *post mortem* revelations conjointly. Further historical reference to other murrains, and the consideration of their destructive characteristics as compared with the pest, will be reserved for the general discussion.

As we derive our knowledge of the symptoms and morbid anatomy of this distemper from authorities recognized as such in England and on the continent, of whom we may enumerate Smart, Wood, Simmonds, A. & J. Gamgee, Simon, Pope, Gerlach, Egan and Jessen; where there are conflicting or independent statements, we will subjoin to such the name of each authority.

Incubation.—From the time of the first introduction of the poison into the system, until the development of the external symptoms, a period elapses of several days, which is known as the *incubative stage* of the disease. The time assigned by different authorities varies considerably, though there is but little doubt that we may fix this period in the majority of cases as one of six days. This is the time assigned by Smart and Wood. Egan states it from four to eight days.

The period of incubation varies according to the mode of the introduction of the poison; where the disease is inoculated, I believe it is four or five days; but where it is caught in the usual manner, from eight to ten days. (J. Simon.)

In the inoculation cases which I have had, it has usually averaged from six to eight days, and not beyond that. It cannot be longer than ten days, if ever so long. (J. Gamgee.)

It is seldom less than seven days, and it may be extended to fourteen or fifteen days, or perhaps to a longer period than that. (Simonds.)

The period of incubation is generally from five to seven days, through in in rare cases it may be more. (Gerlach, from personal observation.)

The evidence as to the internal development of this disease in its primary stage, is drawn principally from post-mortem observations of animals slaughtered soon after exposure to the contagion, and attests the fearful rapidity with which it is absorbed. And first it is stated that within thirty-six or forty-eight hours after inoculation, the blood is so thoroughly contaminated that a single drop is sufficient to develop the disease in all its malignity when employed as an inoculative medium, though Gerlach states that blood is rarely, if ever used, as the secretions of the eyes, nose and mouth are, in the remedial agency of inoculation.

Invariably, in the early stage, even before the vulva and mouth have become affected, the lining membrane of the fourth stomach, and of the whole intestinal canal from that stomach downwards, shows appearance of disease. This is indicated by what is at first a mere blush of redness on the surface of the lining membrane, quite appreciable, however, when compared with the pale, fawn-colored appearance found in the healthy state. (Wood.)

The other stomachs soon sympathize with the condition of the fourth; the rumen or paunch, and second stomach or reticulum, are loaded with undigested food, and the third or many-plies is impacted with a mass which assumes the form of a large, round ball, and becomes, as the disease advances, a hard, dry mass.

External Symptoms. As the incubative period declines, the primary symptoms visible to the eye occur in the following order:

Loss of appetite, exhibited first in aversion to all sorts of green food, and on the following day in indifference to food of any kind. At first the animal leaves a portion of its food, and then refuses it altogether.

Rumination. The animal now ceases to *chew its cud*, and then there is manifest

Constipation in its gradual development. The dung is of a dark color, sometimes covered with slime on its surface. [Many show signs of bellyache, by frequently looking round towards the tail and bending up the back. (Egan.)

Diminution of the flow of *milk* (much greater than in pleuro-pneumonia. Priestman.)

External appearances are, first,

1. *Depression* in looks, standing in the same posture, with drooping head and reclining ears. These, with the horns and other extremities, show a loss of natural heat.

2. The first striking signs are manifest in a change of manner. Most commonly the beast is remarkably heavy and dull, hangs its head, lowers its

ears, stays behind the herd, and when in the stable *keeps away from the crib.* (Egan.) Sometimes there is a shaking of the head to and fro. If you lift it up, *it goes down again like a dead weight.* (Ernes.)

3. Sometimes an animal will be *excited*, uneasy, shaking its head, stamping with its feet, lowing frequently, butting with its horns, and running away from the herd. If tied up in the stable, it tears away from its chain and rope, and continually endeavors to go elsewhere. (Egan.)

4. *Trembling motions* now occur of the head and neck; the hairs bristle up, especially on the back and towards the shoulders; the insertions of the horns and ears are sometimes cold, sometimes warm; the palate is dry; the eyes shining, &c. (Egan.) In the cases first observed in England by Professor SIMONDS, there were not the same nervous twitchings about them that had been observed in Galicia.

Respiration is slightly quickened, the expiration or *outbreath* is prolonged, and the pulse rises a few beats. (Smart.) Joined with a striking motion of the flanks and low groans, sometimes a short, dry cough supervenes, which is the cause of much uneasiness to the animal. (Egan.) In most cases a cough with great difficulty in breathing exists, the animal making more noise on expiration than in pleuro-pneumonia. (Gooch's account of symptoms of Dutch bullocks in Norfolk, communicated to Prof. Simonds.)

The *Vulva*, (the external opening of the vagina or passage leading to the womb) assumes a *reddish* tinge (with generally a few bluish streaks—Wood), and the color deepens as the disease advances, these appearances furnishing in females the *most reliable* and distinctive external characteristics of the disease. (Smart and Wood.)

The *Mouth* shows a faint, *red* or *purple* line on the under gum along the roots of the teeth, closing up the column of primary symptoms within forty-eight hours. (Smart.) The buccal membrane, particularly at the junction of the interior of the lips with the gums, becomes abraded or excoriated—the membrane peels off in little irregularly shaped spots, presenting a mouse-eaten or mouse-gnawed appearance. The papillæ of the tongue and cheeks are enlarged. (Per Barron, V. S., Sequel, &c.)

In the vulva and mouth we have the distinctive sign of the Rinderpest; and in the latter the appearance can be readily distinguished from that observed in epizoötic eczema or mouth and foot disease.

THE PERIOD OF CONGESTION.—This is the stage of the disease when the congestion, which has exhibited its earliest outbreak in the epithelial membranes covering the mucous surfaces of the fourth stomach and in part of the bowels, and then shown itself in the vulva and mouth, becomes active and pervades the entire system, showing in the first place a largely quickened action of the

Pulse. The number of pulsations in health may be rated at 40 to 45 per minute in the field, and 50 to 60 in the byre. The pulse now *mounts up* to

80, 90 and even 100 beats per minute (Wood); 60 to 110 (Smart.) Thirst and loss of appetite become more marked.

Respiration becomes *hurried*, and frequently labored and noisy, instead of from 18 to 20 per minute as in health, the inspirations range each minute from 40 to 60 and considerably higher (Wood); 36 to 70 (Smart.) The respirations numbered 96 in an animal which recovered, and are often *jerking* in their character. (Pope.)

Temperature of the body (externally) is *lowered* and deficient, requiring the use of blanketing, and that the temperature of the byre should be raised to 70° Fahr. (Smart.)

Vital depression is characteristic of this disease throughout its entire progress, and becomes manifest as the congestion is extending over the internal organs.

Exudations from the eyes (viscid, slimy tears—Egan), nose, mouth and vulva, form with rapidity, consisting of a glairy, ropy mucus, and indicating the extended congestion of the external membranes of these organs; those of the mouth and vagina exhibiting *apthæ*. The conjunctivæ are congested, becoming, as the disease progresses, perfectly turgid; large plugs of dense ropy mucus being occasionally passed. The alæ are more swollen and injected on their internal surface; externally copper-colored and livid looking patches are observable, about the fifth or sixth day, and in many instances a little earlier; the discharges become purulent alike from the canthi, the nostrils and the vagina. (Pope.)

An abundant yellow or bloody, stringy discharge comes from the nostrils, which gradually becomes white and fetid, and a tough viscid slime flows from the corners of the mouth, and at the same time there are found on the mucus membrane of the mouth, especially between the under lip and gums, small blisters which often cover the whole inside of the mouth; the sick beast grinds its teeth, which are now very loose. (Egan.)

The *anus* is frequently very highly *congested*, presenting the appearance of hemorrhoidal congestions.

The *urine* is now not unfrequently *loaded with blood*, and is passed with considerable pain and difficulty. (Pope.)

THE PERIOD OF RESOLUTION.—The congestion is frequently favorably resolved by nursing and judicious treatment; by the strength of natural constitution, overcoming easily at the outset the diffusion of the virus, and effecting what commonly passes for a light attack of the disease; or, as frequently happens in a pregnant cow, by the concentration of the disease, in the fœtus and uterine membranes, and consequent abortion.

In all such cases the animal begins to look cheery, carries its ears forward, begins to take food and chew the cud. The milk returns and gradually assumes its natural appearance. The distinctive appearances on the vulva and the inside of the mouth disappear very slowly. (Wood.)

The attacks (of pain, &c.) gradually subside, the skin becomes warm and remains so, appetite and rumination return, looseness diminishes, &c.

In convalescence, a scabby eruption very often appears on the skin, accompanied by itching, especially on the nape of the neck or the sides of the neck, and on the back. (Egan.) This scabby eruption, sometimes also seen on the nostrils, and frequently met in other parts of the country, has *not* been seen in more than a dozen cases that have been *treated homœopathically* in this neighborhood. (Pope.)

If, however, from the virulence of the attack, or the lack of sufficient constitutional power to resist the disease, or from neglect and injudicious treatment, the period of congestion is not relieved by any favorable indications, then follow the symptoms which result in death.

Sometimes in the natural course of the disease, more frequently perhaps from the injudicious use of irritant purgatives, the constipated state of the bowels is changed to a diarrhœic condition. The dung becomes soft and pappy, and at length liquid, not unfrequently covered with blood; it is usually voided with little effort in small and frequent passages. (Egan.) "Diarrhœa, often dysenteric in its character, or thin, watery and offensive in the highest degree, sets in, and exhaustion, accompanied by intense restlessness, follows, and death takes place from simple exhaustion. Sometimes where symptoms seem to have improved, the animal becomes suddenly more dull; the head drops, the eyes look heavier, the conjunctivæ are almost livid, the teeth are ground, the animal butts at everything within reach, oftentimes becoming furious, and suddenly dies." (Pope.)

Again; diarrhœa might set in on the second or third day, and about the fifth day it is generally fatal; but it begins by nervous symptoms, and these are so strong at times that a cow might be found dead in the morning without having been suspected to be ill at all. (Simonds.)

On the other hand, constipation is attended not unfrequently with great distention of the abdomen, becomes obstinate and aggravates all the other symptoms. Respiration is now slow, very laborious, moaning or grunting, and the pulse slow and small. The superficial membrane of the mouth peels off from the gums and lips, leaving the surface raw. A similar action occasionally takes place in the intestinal canal, resulting in a desquamation of its mucous surface in casts. In one case the entire epithelial lining of the small intestine, in a perfect tube, was passed from the bowel and has been preserved. (Smart.) The general weakness and leanness (of the body) makes rapid progress, the eyes sink in, the sight is weak, air tumors rise in the back under the skin, groans and difficulty of breath become continually more violent, the ichorous discharge from the open fundament flows involuntarily, and finally the beast cannot stand any longer, but lies on its side with its head turned, until at once, generally, between the fifth and ninth day (in very bad cases between the third and fourth) death comes on with convulsions. (Egan.)

The staring hide and and arched back are not characteristic of the Rinderpest, but of pleuro-pneumonia; but they occasionally make their appearance when the *pest* is *complicated* with the latter disease. (Smart.)

On looking at the carcass the hair is seen bristling; a whitish slime appears at the corners of the eyes and nostrils, partly dried to a bark; the hind quarters are much swollen; the mucous membrane of the bowels projecting through the fundament is of a bluish red color, &c. (Egan.)

* * * (Here follow several pages occupied with the symptoms of divers animals related in detail, which we omit.)

MORBID ANATOMY.—On the dissection of the carcass, which is considerably distended with gases, a foul smell is experienced, which has a *peculiar* odor, and which is more intensely *disgusting* as the autopsy is extended into the abdominal cavity. It is highly *characteristic,* because if once experienced it cannot be mistaken for the exhalations consequent upon the examination of animals dying from any other disease. The pathological appearances which follow are principally those obtained by Dr. Smart from dissections made at the Edinburgh Sanatorium and at Tyne Castle, of over one hundred animals. Wherever other authorities differ from Smart, we shall, under each head, note the discrepant statements, as these clearly reveal modifications of the disease as observed by Smart, depending upon differences of nervous susceptibility of constitution, perhaps of climatic influences; different habits in regard to food, diet; previous or concurrent lesions of other diseases, &c.

MOUTH, PHARYNX AND GULLET. The gums, lips, hard and soft palates, the under surface and root of the upper surface of the tongue, the upper surface of the epiglottis, as also its membranous folds and the pharynx, are marked, to a greater or less extent, by an *aphthous* eruption, which is *not ulcerous*, as the subjacent membrane is entire.* The roughened and granulated aspect, as presented to the eye, is readily scraped off and consists of *accumulated epithelium*, collecting on the surface of the membrane *around the orifices* of the follicles, and thus giving a punctated or *honeycomb appearance* resembling minute ulcers. The lesion does not extend beyond the pharynx (back mouth), into the gullet. * * *

At the fauces, there is intense inflammation with an *effusion of lymph*, the parts being dotted over with a yellowish-white pigment. (From observations in Galicia, by Prof. Simonds, in 1857.)

The buccal membrane around the teeth is ulcerated looking, and stretching between each tooth is a kind of white secretion, which is easily removed and very fetid.

THE STOMACHS. The first and second stomachs are generally loaded and distended with food, a circumstance which indicates their suspended functional activity. No change of structure is observed in either organ, and their lining

* A like eruption equally characteristic of the disease is found at the external opening (vulva) of the vagina.

membranes are not reddened or congested. *Per contra*, their membranes are friable, *infiltrated and blood spotted* here and there. (Egan.)

The third stomach or omasum, exhibits, after careful search of its folds and in about *one-half* of the dissections, irregular circular patches from the size of a pin's head to that of a twenty-five cent piece, which have bright red or scarlet margins, and in the larger patches inclose a central portion of a dirty yellow color and gangrenous appearance. This portion is slightly depressed, friable, quite bloodless, and the papillæ on its surface shrunken, especially towards the middle, but there is not any breach of substance.

The third stomach is usually full to swelling; it is sometimes firm and sometimes soft to the touch, and in accordance therewith the contents are sometimes solid and dry (often so much so as to be capable of being rubbed to powder), in cake-shaped layers, squeezed together between the compartments, and sometimes merely damp, pappy fodder.

The third stomach is affected with inflammation in patches. This inflammatory action often going on to a degree of intensity as ultimately to end in ulceration. (Simonds.) In most of the cases observed by J. Simon, there was considerably more affection of the third stomach than appears to be general, according to the German reports. The claret-colored patches and eventually sloughs were more frequent in England.

The abomasum, or fourth stomach, is reddened in the earlier stages of the disease only a little more than in health, but the color deepens as the malady progresses, and becomes dusky red with interspersed claret-colored patches. Its lining membrane * exhibits the following deviations from a healthy state: 1st. Its attachment to the muscular coat is generally loosened, and at many points destroyed. 2d. It is soft, easily breaks down under pressure, and where the change is furthest advanced, peels off as if cohering mechanically to its sub-mucous connections. 3d. Its epithelium is imperfect, and at many points quite absent, thus forming cracks on its surface. 4th. The high color of the tissue, as microscopically determined, is due, not as has been stated, to sub-mucous or intra-mucous extravasation, but to *vascular congestion* in its most extreme form; the vessels being distended to their limits, but without rupture or dispersion of their contents unless artificially produced. 5th. In some instances, generally in cases examined a few hours after death, some small ulcer-like depressed abrasions have been found. These are not true ulcers, and do not penetrate beyond the epithelium. In other instances black spots, without breach of surface and evidently due to pigmentation, were met with. (Smart.)

In simple cases, the fourth stomach is the principal seat of disease; the natural yellow or brown color of it is changed to a dark or mulberry shade; the

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* This is swollen, especially near the pylorus, and there is a singular *mottled aspect*, when closely observed, from the grayish epithelial deposit in the glandular openings. Erosions and ulceration are not uncommon. Dr. MURCHISON says: "The membrane is studded with numerous minute superficial ulcers like those erosions which are so common in the ordinary catarrhal inflammation of the human stomach." (Gamgee's Cattle Plague.)

lining membrane is *thickened* and *corrugated*, and in cases which have been long suffering, there are often patches resembling ulceration. A careful examination of this stomach proves the morbid condition not to be the result of inflammation, but depending entirely on an intense capillary congestion of the mucous coat, which is found *raised and separated* from the muscular one beneath; . . . the peritoneal covering of the stomach is generally healthy, proving the non-existence of inflammation. (Pallin.)

The rennet stomach and the thin guts always exhibit the most striking change; on the outer surface they are more or less discolored, covered with livid spots and bare places, and when cut up the mucous membrane appears dark red, and covered with a tough adhesive slimy fluid, discolored, frequently of a greenish black. (Egan.)

In the fourth stomach there is intense inflammation of the villous membranes in patches, and every now and then you see spots of ulceration. (Simonds.)

The Intestines. These show a like congestive vascularity, resembling the phenomena of muco-enteritis. Dr. Murchison's observations, however, make the inflammation of the small intestines usually most intense about the middle. The minuter vessels of the small intestines are completely injected, and can be seen by the naked eye in the arborescent forms of their intricate reticulations. When the capillary congestion is complete and is passing into the stage of destructive disorganization, there is shown a very characteristic mahogany appearance. In the large intestines the principal blood vessels of the mucous folds (rugæ) are mainly and in a higher degree affected, which gives to the gut a peculiarly striped aspect.

In the duodenum we also find similar (inflammatory and ulcerous) indications of disease as well as in the other small intestines, particularly in patches; we observe now and then a tendency to ulceration or that there is *ulceration* of Peyer's glands; but it does not appear to be an *essential* of the disease in its early stages. In the larger intestines are seen similar lesions to those in the smaller, and more frequently ulceration in the apex of the cæcum. The rectum may or may not be inflamed. (Simonds.)

The vascular engorgement increases towards the terminal portion of the canal and the mucous folds of the rectum exhibit the tumid and deeply purple appearance of internal hæmorrhoids.

The entire canal of the intestines is more or less filled with fetid gases. (Egan.)

The ileum is affected similarly to the pyloric end of the stomach, thickened, &c. That intensity of these appearances recurs in the cæcum. Here the red patches are visible, varying in intensity along the course of the large intestines until they reach the rectum, which is evidently another favorite abode of the disease, which is thickened, discolored and ulcerated, in advanced stages. (Pallin.)

The whole mucous lining of the bowels is unduly soft and its epithelium imperfect. There are no true ulcerations as in the ulcerative typhoid of man. Not unfrequently a viscid fetid mucus covers the membranous surface. The bowel is usually empty or its contents are fluid and slimy. The discharges contain bile, and are sometimes tinged with blood. Occasionally they resemble the *rice-water stools* of cholera. The feculent matter contained in the intestines (Mrs. Nichols' cow) was fluid, stinking, and of a dirty white color. (Simonds.) The ileo-cæcal valve is, as regards function, healthy, but its lining membrane, as also that of the cæcal appendage, is involved in the general hypervascularity.

There is no sloughing or invagination of the bowels, nor any desquamation of its mucous surface in the form of casts. The intestinal glands do not share to any marked extent in the altered condition of the membrane, except that they are obscured by its discoloration. They are never ulcerated, but exhibit the chronic tuberculous condition frequently met with in healthy animals. The mesenteric glands show no lesion of structure, but are bloodless and shrunken, and their lacteal vessels are generally empty.

KIDNEYS, BLADDER, UTERUS, &c. The pyramids of the kidneys are usually congested; the cortex is pale, but the structure entire. The lining membranes of the bladder and uretha, never seriously involved, present only the appearances when the organs are congested. The uterus exhibits no peculiar feature; the state of the vagina, and especially of the vulva, being *highly characteristic*, the aphthous eruption, as observed in the mouth, being apparent at the junction of the mucous membrane of the vulva with the integument.*

The labia superiorly are dry and corrugated, inferiorly coated with discharges thick and putrid, which, when removed, shows the papillary eruption of an aphthous nature. (Pallin.)

HEART, LIVER, SPLEEN. The condition of the heart is not peculiar, but such as is ordinarily induced by many exhausting diseases. Its muscular substance is relaxed and flabby; there is no valvular lesion or structural change. Ecchymosed patches are sometimes seen on the exterior of the ventcicles. On the inner part of the heart, and on the left side in particular, petechiæ were present. (Simonds.) The large vessels and their lining membranes are healthy. The liver is of natural size, pale in color, but sound in structure. [The liver is generally friable and of a clay yellow. Egan.] The gall bladder is usually filled with bile, which is thin and of a light green color, and rarely patchy discolorations are found on its lining membrane. [It is much distended with thin, yellowish gall. Egan.] In *one or two instances* in Galicia we found ulceration of the mucous membrane of the gall bladder, and effusion of lymph into the gall ducts. (Simonds.)

The spleen is too pulpy, and breaks down under slight pressure. The pulp is composed of broken down tissue and blood cells of a very dark color. It exhibits the same condition as in exhausting fever. The spleen is generally unchanged. (Egan.)

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* The mucous membrane of the organs of generation is always red, tumefied, and the epithelium undergoing changes as seen on the mucous surface of the organs of respiration and digestion. (Gamgee, &c.)

WINDPIPE, LARYNX, LUNGS AND THORACIC CAVITY. The entire mucous membrane lining the respiratory passages is reddened and highly vascular, as in the earlier stages of acute bronchial catarrh. It is sometimes nearly dry, but more frequently, especially in the smaller tubes, there is an abundance of frothy mucus, (purulent—Egan) often of a slightly red color or tinged with blood. [It often appears to be free from inflammatory action, but is covered over with layers of lymph, frequently as thin as a sheet of paper. Simonds.] The membrane is entirely free of aphthous eruption, and there are but rarely indications of an effusive or depositive inflammatory condition. Exceptional cases have been observed in Vienna, and by Prof. Gamgee, where a considerable deposit was observed in the trachea. Only one case is to be found in all the museums of Europe where there has been, as in the exudation of croup, a solid fibrinous deposit in the trachea. The air cells of the lungs in *uncomplicated* cases are healthy; any emphysematous condition being chronic and not superinduced by the disease. The lungs appear shriveled, pale or discolored, and sometimes much swollen. (Egan.) The serous membrane of the chest, as a rule, is likewise free from disease. (Simonds.)

FEET. The lining membrane* of the cleft of the hoof is very highly congested, with desquamation, &c., similar to the other external lesions of the mouth and vulva.

FLESH. This possesses a mulberry or dark claret color, with the remarkable quality of irridescence or of changing color. The color of the fat is of a dark and dusky yellow, becoming more marked after exposure to light and air. Both muscles and fat exhibit an unusual degree of shrinkage. The muscle, however, after a period of exposure, loses the first characteristic distinction from healthy beef, and the mulberry hue is insensibly changed for a reddened tint, still with an element of brown, which imparts a peculiar duskiness to it. If the animal is slaughtered early in the development of disease, there cannot be detected any alteration in the carcass. (Higgins, 1st Rep.) Prof. Brucke, of Vienna, stated that during a recent epidemic of steppe murrain, in Bohemia, the authorities, according to their practice, had the diseased beasts slaughtered and buried; but that the populace dug the carcasses up and ate them without any injury.† Similar accounts of plenty of cases are given in Levy's Traite Hygiene. (J. Simon.) * * *

GENERAL PATHOLOGY.

(Under this head the reporter first expresses his dissent from the generally received opinion that the Rinderpest is identical with the epizoötics which have visited Europe for ages past, and after presenting his views at considerable length, goes on as follows:)

* The great capacity of this membrane for the diseased condition, naturally leads to the inference that it is highly capable of absorbing the virus from urine, dung and other exuviæ of Rinderpest subjects, with which it may be brought in contact.

† It is to be hoped that the food thus eaten was thoroughly cooked, so as to destroy the entozoa, which have almost invariably been found in animals dying of the cattle plague, and in much larger numbers than in the cases of healthy animals.

But to proceed with the more positive share of our task. We have seen that the eruptions noticed on the flank and udder are papular, not pustular, and that in a majority of cases they appear as indications of convalescence or resolution effected through the functions of the skin; so that it is quite impossible to trace any parallel between the Pest and small pox, unless it be urged for the most fatal cases, where coma and death follow closely upon the first intimations of ailment, and the type of the former be sought in that most malignant form of the latter, known as *Variola sine eruptione*. All methods then, designed to ward off or mitigate an attack of the Pest by inoculation with variolous matter from the human subject, would, on grounds of similarity as to type between these diseases, and viewed theoretically, be condemned as empirical; a conclusion amply confirmed by many abortive trials to prove it otherwise. So too, we must treat as fanciful the opinion lately advanced, that this epizoötic should be regarded as an acute internal scarlatina; the reddened appearance of the mucous surfaces, unaccompanied by the rash, as in the human subject, presenting the only common symptom. Yet we are happy to record the fact, that no attempt has been made, either for prophylactic or curative ends, to transfer the poison of Scarlatina, into the veins of a Rinderpest subject.

Except in a few cases where vaccination may have introduced, in addition to the specific virus of the Pest, some typhoid germs, the inner surfaces of the viscera do not exhibit evidences of the degeneration peculiar to typhoid fevers, or observable in the muco-enteritis of cattle; nor do the respiratory organs reveal serious effusion, as in typhoid pleuro-pneumonia. Dr. Tucker in his report to the Lord Lieutenant of Ireland, while repudiating any theory of identity, says: 'The purple gum, the black, saltless blood, and some other symptoms of the *African* typhus, may be recognized in the Rinderpest.' Why might not a parallel be drawn also with cholera, and influenza? The answer to this and the refutation of all the fanciful conceptions to which we have alluded, is given by science, which has very recently exploded the old classification of diseases, and has grouped those which we have mentioned, with many others,* in one leading class of zymotic diseases (order, miasmatic).

* Such as chicken-pox, measles, quinsy and diptheria, croup and hooping cough, ague, remittent, continued and yellow fevers, ophthalmia, erysipelas, hospital gangrene and childbed fever, plague and carbuncle, dysentery and diarrhœa, &c.

The word *Zymotic* is derived from the Greek of *ferment*, and was first suggested by Dr. Wm. Farr to indicate that diseases, so named, manifest in their course a destructive influence on the circulating medium, approaching as near as may be to fermentation, and due to the action of specific poisons of organic origin. These, like inorganic poisons introduced into the system, are found to obey certain general laws ; first, that each has a specific action, and secondly, lies latent in the system a certain though varying period of time, before its specific action is evinced ; and thirdly, that the phenomena resulting from such action vary with the amount of poisonous matter taken into the system, and the receptivity of the patient.

The miasmatic order of this class, as applied to the diseases of cattle, may be understood to embrace all diseases which are commonly ascribed to *paludal or animal malaria,* all due to *specific disease poisons,* capable of propagation from one animal to another, and *communicable* either by *direct contact* or indirectly through various channels of intercourse.

It is frankly admitted that this or any classification would be valueless in the investigation of the Rinderpest, unless it be conceded that this epizoötic is wholly distinct from others, not only in its leading characteristics, but in its source or origin as a blood-poison. And it is principally in this latter sense, that we can pronounce it a disease '*sui generis,*' developed through the agency of a poisonous germ, which breeds after its own type, and multiplies 'after its own kind,' and by a process as regular and uniform as that (to use the emphatic though homely language of John Simon, medical officer of the Privy Council in his sixth report) 'by which dog breeds dog, and cat breeds cat, and as exclusive as that by which dog never breeds cat, nor cat dog.'

The seminal principle or germ of the Pest being considered then as *one* and distinct from that of other epizoötics, its varying manifestations remain to be accounted for. Its development as to time and potency is dependent upon certain spheric conditions, and the different susceptibility of races and individuals. Prof. Röll states that for many years the cattle plague hung upon the Polish frontier without entering Austria, until certain other diseases appeared among cattle and men, and then it became a general pestilence. As far as the historical records of other desolations among the lower orders of creation bear reliable testimony, this view is corroborated. It is also confirmed by the cyclical periods which, as is claimed, mark the devastation of this plague in its native steppes.

Again, it has been too frequently observed to admit of denial, that its fatality has been less marked with those cattle, of whom it may be said that the Pest is to their manor born, than among other races. Devons taken to Russia, after thriving admirably for a time, when brought within range of this distemper, yielded under its most frightful manifestations, and in droves.

So among the cattle first seen by Prof. Simonds in quarantine at Kamienica, a neighborhood which had then been free from the plague for eleven years, were four steppe oxen, three of which recovered, one having never sickened; while of the native cattle, with whom these and six other steppe oxen were housed at this and an adjoining village, in sheds belonging to the same proprietor; thirty-one, being the whole herd in one place, died within nineteen days after the steppe oxen arrived; and of the other lot, which included the four first mentioned, twenty-eight in all; thirteen died and eleven were slaughtered.*

The power of contagion being limited or increased by the operation of certain conditions in nature which it may be difficult to define, or by varying developments of constitutional vigor (which may be equally vague in statement, though undeniable in fact) we are prepared to understand why in different climates and with different races of cattle, the symptoms and the morbid anatomy may seem doubtful or conflicting in particulars, and yet center in a common type, to mark the specific action of a specific virus.

Thus, where from any predisposing or dominant cause the force of the disease in its early incubation is expended on the membranes investing the brain (cerebellum, principally) or the spinal cord, we should expect the twitchings, nervous rigors and fury, and the consequent effusions in those regions observed in Hungary and Galicia by Egan and Simonds.

Where, again, as in the few cases referred to by Prof. Gamgee, the concentrated action of the poison is seen in the trachea and its bronchial branches, we could hardly imagine relief from this obstruction of the respiratory functions in time for any reaction on the intestinal canal. And where, lastly, the grand onslaught

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* Perhaps a more marked case is given by Dr. Weber, as occurring at Kamionka Woloska (Galicia), where 101 oxen, which were brought from Bessarabia, developed the contagion in the farmsteads in the village, so that 158 animals were attacked, of which 93 died; only *one* of the imported oxen suffered.

of the distemper was in the latter direction, we might reasonably look for lesions so much more distinctly pronounced, that what seemed only aphthous appearances in other cases might in these be imagined to be ulcerations; and glands which, in a vast majority of cases, seemed untouched, might give signs of purulent destruction. Making every reasonable allowance for different manifestations in cases such as those we have given from Jessen, where the disease was induced by inoculation; or for a predisposing tendency to the typoid state, muco-enteritis, pleuro-pneumonia and the like; we are still able to group together all the seemingly conflicting indications, and define the general scope of this disease by its *congestion of the mucous tissues*, more or less diffused, and that congestion as mainly *destructive* of the epithelial covering of these tissues.

In the incubative stage, marked changes manifest themselves in the condition of the blood, and the commencement of feverish action. We have seen that when the virus has once been absorbed, it permeates within a few hours every portion of the blood, rendering each drop a fresh medium for inoculating the healthy animal with the Pest. It would almost seem credible, that the poison is a vital germ, feeding upon the germ cells of the blood, appropriating its serous and driving off its saline constituents; and propagating its kind until the red corpuscles become amorphous and shrivelled. Gamgee, however, did not in his microscopic investigations, observe the serrated condition of the corpuscles noticed by Dr. Smart. In some cases he found "a great excess of white corpuscles, and in others delicate needle-shaped crystals, which are probably hæmato-crystalline,* form in the blood *after* this fluid has been drawn from the body."

The moment that the normal balance in the blood constituents is disturbed, feverish action, which escapes notice by ordinary means of observation, is truly established. Gamgee, reviving the use of the thermometer,† first proposed in 1754 by De Haen, a celebrated Clinical teacher in the Hospital of Vienna, as the best aid in the diagnosis of pyrexia; institued a series of remarkable experiments

* These crystals may be regarded as evidence mostly of the decomposition which the blood undergoes, and of abnormal chemical combinations of its saline constituents. They resemble closely in form and appearance those recently obtained by WORMLEY in the methods proposed by him for the discovery of poisons when found in human tissues in minute quantities.

† Also tried by Dr. SANDERSON.

in the use of one of Casella's registering thermometers. He discovered an elevation of temperature in the earliest stage of the disease, varying from one to four degrees, Fahr., "*preceding the acceleration of the pulse* and *every other symptom.*"

He inserted the bulb and about two inches of the stem of the thermometer within the vagina or rectum, and kept it in place a couple of minutes. To prevent error in the use of the instrument, he adopted the precaution, between each observation, of dipping it in water (90° Fahr.) and used a few drops of Condy's disinfecting fluid for cleansing purposes. He found the temperature of these parts, when the animals were in a healthy condition, and the females not in the period of œstrum or sexual excitement, varying from 100° to 101°, rising occasionally to 102°, and perchance, in a hot day or when driven from their pastures, "one or two-tenths more" than usual. He visited, on the 17th of November, a stock of Ayrshires, at Corehouse, near Lanark, where a cow seized on the 9th had died on the 14th, a second case occurred on the 15th, a third on the 16th; and where, on cursory examination, he found six more ill. On the 18th he examined forty-two cows with a thermometer dipped in water 100° Fahr., before each observation, inserting the instrument in the rectum up to that portion of the stem marked 80°. Of this entire lot, one or two had slight discharge from the eyes; one gave more marked indications in rapid respiration, one in urine of dark brown color, and a half dozen in scanty supply of milk. The rest were eating and ruminating, giving full quantity of milk, &c.; none had diarrhœa. "The temperature was recorded at 102° in one case; at 104°.1– in another; at 104°.8– in two; from 105° to 106° in ten; from 106° to 107° in seventeen; in the rest from 107° to 107°.8–. Twenty-five succumbed by the 22d inst., and only five were living on the 25th, "in spite of careful nursing and the best medical treatment." Gamgee observed variations in the frequency of the pulse and temperature during the course of the disease, as Jessen did between the pulse and respirations; also a sudden lowering of temperature with increased frequency of pulse from 120 upwards, a few hours before death. A *gradual* decrease of temperature until it reaches the normal standard prognosticates recovery.

It seems a matter of regret that Dr. Gamgee, who has evinced in all his researches, skill and learning of the highest order, should have felt such utter hopelessness of the efficacy of remedial treatment *in posse* if not *in esse.* Otherwise we think he might have gained another laurel to his veterinary prowess. Nothing seems to be clearer than this proposition, that if the pest is to be properly regarded as a zymotic disease whether developing its fatal germs in the blood, on and in which they feed and multiply; or by an action analogous to ferment, or that chemico-physiological action which Liebig has denominated catalysis, producing abnormal changes in the circulating medium; before the disintegration of structures (the principal test of infection in disease) is manifested: or to take a more palpable illustration, to be viewed as poison from a venomous bite, which must be instantly neutralized, or whose absorption and propagation must be arrested without loss of time that life may be saved; the treatment must be antidotal or destructive of the foreign germ-life, and attempted before the processes of decomposition in the blood have gained much headway. And to this end the use of the thermometer as afresh proposed by Gamgee is indispensable. But it is unnecessary further to foreshadow the use to which we propose to put this method in the treatment we may recommend. * * *

The science of pathology which has made such mighty strides during the last half century, has yet to search out the nature and perchance figure the form of those poisonous germs which develop zymotic disease; to give them distinctiveness by due classification and to separate or identify their action on and power over the animal economy, with those of the well known poisons of the *mineral* or *vegetable* world, especially, perhaps, of the sporules of the various tribes of fungi. The work though vast, is not beyond present hope. It has now all the preparation needed to justify the loftiest claim, and maintain the highest attitude of expectancy. The microscope which has depictured and classified the various forms of spermatozoids constituting the generative power of the divers species of the animal kingdom; which has counted the number of the dust sporules * which feed upon vegetable products useful to man and beast, and which, as we have seen, reveals to the eye the various shapes of blood corpuscles when invaded by various parasites of variant diseases, may yet so group its subtle lenses and direct their ken into such unexplored hiding places, and triumphantly parade the tiniest instruments of torture which the com-

* The sporule of the Uredo segetum, one of the most minute of the coniomycetous fungi which attack gramineous plants, has been decyphered as equal in sixe to 1-7,860,-000th part of an *inch square.*

mon enemy of all things living employs.* While we await with becoming patience, such wondrous revelations, we are not without the analogies of nature in disease to assist and advance our investigations

Dr. Salisbury, of Ohio, in the presence of an alarming epidemic of scarlatina, inoculated himself and family with the smut of Indian corn, produced an eruption and fever similar to that of the prevailing distemper, and effectually warded off the contagion. Had he gone a step further, and ingrafted the poisonous fluid developed by this coniomycete upon a healthy structure, he would have identified or shown the disparate action of the inoculate and natural forms of the scarlet infection. We know that a pregnant heifer may, by ergotized grain, or grasses infested with fungoid growth, suddenly abort, and unless removed from her associates of the byre, the poisonous exudations from the vulva will produce like disaster upon the entire pregnant stable ; leaving in the future for all such aborting from the contagious matter, less chance of carrying their next fœtal burdens to full development, than in the case of the one which miscarried under the action of the vegetable poison. So that there may be in nature a general law by which certain poisons, vegetable as well as mineral, may become potentized in their victims, and taking to themselves a more deadly virus, spread the most virulent infection. Strange as the announcement of such a doctrine, mysterious as the conversion or coöperation of such agencies may be ; they do not afford so great a puzzle to the understanding, as that by which we are called upon to account for the first developed case of any contagion, whether of small pox or cholera in the human race, or of any of the deadly murrains in the bovine.

We state the difficulty which is experienced in the scientific world, without insisting upon any theory, conjectural or imaginary. It is enough to dispel existing delusions which trace the sources of contagion solely to malarious vapors or atmospherical degenerations, or again, to active animal or vegetable parasites, or to any other source than that of poisonous vitalized germs.

It is impossible to deny the vitality of pus corpuscles in ophthal-

* The most serious difficulty in the present extension of microscopic vision, which has revealed the multiplication of bacteria and low animal and vegetable organisms by powers estimated at 3,000 diameters, does not seem to lie in a further extension of micrometric power, but in the *transparency* of these infinitesimal germs; a difficulty which may soon be remedied by the ingenious adaptations of enthusiastic observers.

mia, in the public nurseries or hospitals provided for children; or of their minute offsets (revealed with wondrous power of subdivision under the microscope), as they are transported through the air, remain dormant on clothes, communicated by towels, until they reach the conjunctiva, prepared, in under-tone or by morbid process, for the supply of nutrient matter for these putrid germs. The statistics of surgical cases in our armies during the late war confirm the observations made elsewhere, that pus globules invade the system of one recovering from the primary effects of wounds or amputation, and carry him off with pyæmia.

Like observations as to syphilitic or gonorrhœal pus, the poisonous matter of puerpeal fever, or the more familiar illustration of vaccine lymph, give confirmation suited to the general mind of the theoretic views we have advanced, and which are so thoroughly supported by the researches of Prof. Boeck.

But the nature of this exotic germ-life which, when introduced into the vital economy, is the harbinger of pestilence, is not to be explained by (as the morbid germs themselves are not to be confounded with) the animalculæ observed in the dying organism. The bacteria which have been revealed by the microscope, prove only the previous destruction of tissue and its *advanced* state of decomposition; such relation being reversed, however, in the case of parasitical growths.

Should we pass over, although not precisely relevant in this connection, another condition, under which this morbid germ-life may be sustained, we should be guilty of a neglect which might result in great practical injury.

It may not be easy to prove that the germ cells of the Pest or other infectious disease can multiply in excrementitious matter as in the living body. But it would be unsafe to consider the exuviæ when kept moist and of a moderate degree of heat,* as incapable of furnishing the media for such propogation, unless we had reason to conclude that the matters thrown off by the bowels or otherwise, contained none of the nutrient matter, on which these germs of pestilence might feed, or the enveloping substances in which they might lie dormant and be preserved. For all practical pur-

* Prof. Hertwig stated at the First International Veterinary Congress, a case where dung of diseased animals, even after it had lain in a *frozen* state for four weeks, was known to have transmitted infection. Even the water in which Rinderpest flesh (whether previously salted or not) has been washed, if drank by cattle otherwise untainted, will produce an outbreak; as will the hawking about of the flesh.

poses, and as the first law of hygiene applicable to such cases, all matters thrown off from the organism that is contending with the Pest, should be regarded as a fresh nidus of infection; unless thoroughly disinfected by chlorine, carbolic or sulphurous acids or the like. * * *

But let us bring this extended pathological summary to a close; and claim, without any further attempt to substantiate the thesis; that it is necessary, in order to embrace the various cases set forth in our earlier tracings of symptoms and morbid anatomy, and to bring unity out of their apparent diversity, to propound the following classification for the main varieties or stages of the Pest.

1. The *Congestive* or *Catarrhal Stage*, presenting the disease in its simple and uncomplicated forms, where the lesions do not extend deeper than the epithelial coat of the mucous membrane wherever affected.

2. The *Emulsive* or *Hyperœmic Stage* in which the mucous membrane is softened (more so in all probability by its own ejections lying in the concave folds of the intestine, &c.); pours forth mucin in thin form, and is sometimes in parts completely degenerated, losing its hold on the muscular coat.

3. The *Exudative Stage*, where the separation of lymph proceeds, and croupous casts or diphtheritic deposits are formed or poured out (like polypus).

4. The *Suppurative Stage*, when the follicular growth takes on a pyoid form, and granulations are attended with purulent destruction.

It is only necessary to add that it is highly probable, giving due weight and place to the evidence adduced by different observers, in various climes, and in successive outbreaks, touching the inoculative as well as natural forms of the Pest, that the largest number of cases would be found occurring and terminating either favorably or fatally in the first stage; and that the residue would be ratably proportioned among the other stages, in a ratio, declining with the advanced complications which they respectively portray.

Treatment. The treatment of a distemper so insidious in its attack, subtle and masked in its incubative stage, and if left unchecked, so fearfully fatal in its development, demands a method that shall be prompt and resolute, and based upon the calmest conclusions of science. All empirical modes should meet with a sturdy rejection. *Blood-letting*, and the vulgar *nostrums* of farriery, should be *discarded*. The veterinary who has not thoroughly grasped by careful study the scope and action of this zymotic, should be denied a consultation or a fee. It would be better to trust to nursing and to nature than to him. For his professional blunders might, by the myriads of germs of pestilence created and diffused under his unskilful eye, add to the dumb creature his bungling destroys, holocausts of sacrifices to his quackery. It would be otherwise with the instructed and intelligent expert.

Veterinary science is now invoking to its aid the most eminent pathologists and therapeutists of the age, in order to secure the mastery of this disease. And this should not only be a cause of gratulation to all agriculturists of whatever nation or clime, and a source of hope for the future ; but it should inspire all further investigation, and the handling of every case, wherever and whenever it may occur, with the same feeling. We do not hesitate then to say, terrible as the pictures of such desolations as have been wrought in Great Britain may be, that the treatment of this pestilence in any new country it may visit, should, from its first onset, be courageous and hopeful. The arm of science thus nerved strikes always for victory. And with the facts fresh in our recollection that the Eczema which broke out in England in 1839, and the typhoid or exudative pneumonia which followed in 1841, have lost all their terrors, and can only be found in a few sporadic cases in enzoötic form ; we rejoice that the Edinburgh Committee, through Dr. Wood, their chairman, have proclaimed their faith that this epizoötic is to become milder in its type, and that its fatal ravages will be notably diminished.

Should this disease ever hold an extended reign in this country, not the knife but scientific treatment will check and overturn its empire. If the farming population, and those to whom cattle are a necessity, not only for milk, but for the purposes of labor and breeding, can be duly advised of the latter method, they will not be compelled to resort too unfrequently to the former. But it is not meant by this that science is indifferent to those wise measures of precaution embodied in salutary enactments by the legislative authority. Isolation and quarantine are an essential part of scientific treatment, and unless these can be secured, and, with other approved remedial agencies, applied skillfully and opportunely as to time ; destruction and instant burial with the use of disinfectants are the only alternatives left to incaution and ignorance.

As science cannot accept the rude instruments with which fear always urges ignorance to arm itself, so the common sense of practical men soon revolts from their long continued employment.

The proprietors and tenant farmers of Kincardshire, by memorial addressed in February, 1866, to the Privy Council, stated that until a then recent period, they were of opinion with a great majority of her Majesty's subjects—

"That stamping out by slaughtering all diseased animals, and those in immediate contact with them, was the only remedy; but that within the last few weeks a great change had taken place in your memorialists' opinions regarding this matter, in consequence of the successful treatment of the Plague in the parishes with which your memorialists are connected. . . . . &c."

After stating that on certain farms eighty cattle had been cured and only one died, and their belief that by pursuing such treatment, ninety per cent. at least might be safely brought through the dreadful Plague: they besought the Honorable Council to act under a proviso for such purpose, expressed in the Cattle Plague Act of 29 Vict., Chap. 2, and to exempt from its operation (*i. e.*, the slaughter of infected animals) for a *period of two weeks*, all cattle coming under the immediate care of the Inspector whose treatment of the disease had been so successful; to the end that if the experimental trial thus to be sanctioned should have a successful result, a like measure of relief might be extended to other districts. Strange to say, the Council refused to give a beneficent and liberal interpretation to the clause referred to, fell back upon the alleged original understanding of its purport by both Houses of Parliament; confined its interpretation to experimental cases under the direct charge of the Cattle Plague Commissioners, and refused the prayer of the memorialists. We pause a moment to remind the reader that more benign and less ambiguous provisions mark the enactments of law adopted by the State of New York on the recommendation of its Agricultural Society.

The "stamping out" process it is conceded, may effect the end it proposes within certain limits, provided these are sufficiently extended to comprehend all infected cases. But if the quarantine prove to be an imaginary one, or if the pestilence has broken out through atmospheric agencies and has extended itself beyond the limits of frontier or local cordons, then when the maladroitness of fancied security has been foiled, and all the allied antagonists to scientific methods are prostrated, this *brutum fulmen* recoils upon its abettors; and the appeal that then comes to the skill they despised loses the full measure of benefit to have been secured at the outset, had better, not baser agencies been employed.

These are the plain practical lessons which the histories of all epidemics in the human family, and of all plagues among the brute races, clearly and invariably teach. They mark the bold uprising and clamor of empiricism, and in its successive overthrows by the strides of pestilence they point to the modest but masterly persuasions and trials of science for true and enduring relief. And if we seem to dwell upon such teachings, it is because we are conscious that as "the still small voice" followed the tempest, the earthquake and the fire, and the preparations for it was not until these fearful manifestations had awed the querulous, and doubting prophet; so it always is in the face of mortal pestilences that the howlings of terror, the onslaught of savage phrenzy and the fierce desolations of misguided zeal, precede the calm and benign intuitions of mercy and judgment, which make up what we call science, and give to it the radiance of a divine vision.

Happy are those who are saved from the period of agitation, tumult and dismay, to witness the return of serene and successful counsels and procedures. Most fortunate is the people who, anticipating this as the natural order of events wherever prejudice and passion hold their course, use all their energy and wisdom to cut short or forestall their sway, and hasten to usher in the reign of order and method.

As above intimated, we have to propose, before we conclude this branch of our subject, a method of treatment to be approved by the Society, and as we hope, also by minds versed in or attracted by scientific investigations. But before we proceed to so responsible a venture, we will pass in review the various methods pursued by the different schools in medicine, and by distinguished veterinarians and practitioners of the medical Art; and to avoid repetition, such as contribute to the scheme we may propose will not be particularly dwelt upon in this general review.

The different schools have been fertile in their inventions and modifications of the treatment pursued, whether prophylactic, hygienic or curative. Of these, the Allopathic, as the older and with a larger discipleship, is first in the order of our sketch, and of this school in Great Britain, Smart and Gamgee may be ranked as the leading authorities. In connection with the former, the Edinburgh Committee, made up of highly distinguished physicians and veterinarians, &c., deserve marked attention.

Dr. Smart, who claims to have had considerable success in the treatment of the Pest, a *summary* of which we quote from his Report to the Lord Provost and magistrates of the city of Edinburgh *in extenso*; has, after insisting upon careful and assiduous nursing, proposed three kinds of drugs as all he found requisite to employ, to wit: **Laxative*, with diuretic action—†*Stimulant* (also possessing diuretic and diaphoretic properties); and as *Tonic*, one and a half ounces of powdered cinchona bark of the best quality, to be used when convalescence is fully established. This last is given in the early period of conv lescence in combination with the stimulant, and at a later period with a quart of good sweet ale, given once daily and at night. He recommends, also, that two table-spoonfuls of laudanum be added to any of the mixtures prescribed, or combined with its food, to control excessive diarrhœa, or obviate straining.

His plan of diet requires the use of simple food, and until decided convalescence, well cooked, and given in small portions at regular hours. The *full* diet, (devised, according to Gamgee, by one of the best managers of cows he ever knew, who was in attendance at Smart's experimental byres) is composed of—

"Four handsful each of bran and brewer's draff; one pound of pease-meal; two pounds of mashed turnip (well boiled), not too thick, and given *night* and *morning*. At *mid-day* a gruel is given, of two pounds of oatmeal, well boiled in six quarts of water. In addition to these, some raw turnips (two pounds, for example, of greentops), and one pound of hay, may be allowed in small quantities during the twenty-four hours. To allay thirst, three to four quarts of water, previously boiled and allowed to cool, are given in mouthfuls during the day.‡ This constitutes the full diet of a decided convalescent. *Half* of this diet is, in most instances, during the acute course of the disease, *too much*. In all cases the same kind of food and periods of giving it are followed. There are some animals that for a time refuse all food, not excepting gruel. In such cases the gruel is administered by the bottle thrice daily, along with or after the medicine. The animal should get a little mash so soon as it takes it voluntarily. It is often expedient to miss a meal, especially whenever symptoms of an unfavorable indication appear. These are not of unfrequent oc-

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* Laxative. Nitrate of Potash, Powdered Ginger, of each 1 ounce; Powder of sublimed sulphur, 2 ounces; Treacle, 1 pound; Water to make a quart, and well mixed.

† Stimulant. Carbonate of Ammonia, ¾ of an ounce; Sweet spirits of nitre, Spirit of Mindererus, of each 1½ ounces; Cold water, 9 ounces. Mix.

‡ Many of the diseased animals evince a remarkable predilection for charred wood; and as carbon is an excellent antiseptic, it is only obeying a natural indication to supply materials to satisfy this craving. To do so, charred wood may be boiled with the water, and a few small charred branches of trees placed in the stall.

currence during the course of treatment. Grass is given, and the quantity of hay and turnip increased as there is progress toward more perfect recovery."

His summary of treatment is as follows:

1. The animal is at once taken from its ordinary food and separated from the rest.

2. It is to be placed in a well-aired byre or house free from draughts, and the temperature of which is maintained at 70° Fahr. or 75° Fahr.

3. It is to be well rubbed down, and thoroughly cleaned and covered with a good rug.

4. If there be constipation, begin with the laxa ive and continue night and morning, or if required, oftener, until there is f. .e scouring.

5. Let there be no delay in giving the stimulant, and, if needful, combine it with the laxative.

6. Defer gi"ing ale and bark until convalescense appears.

7. To obviate straining or excessive purging, two tablespoonfuls of laudanum, night and morning, may be added to other medicine.

8. Be careful to avoid overfeeding, as an error in diet may prove fatal.

9. See that the cow is well milked night and morning (even when there is no yield), during the course of the disease.

10. All the droppings should be at once disinfected by solution of chloride of lime, and quickly removed.

11. The affected animals should be frequently and closely observed, and threatening indications treated as they occur.

We give also in a note,* several examples of successful treatment, which may serve as a guide as well as encouragement to the uninitiated.

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* *First case.*—A cow from an infected byre in the Canongate, admitted on the *21st September;* was very weak, and expected to die the same night; the breathing was labored and sighing, and the animal was cold all over. Had taken no food for five days previously; the milk and cudding quite absent during that period; put under treatment next day, when it was thoroughly rubbed down and covered with double rugs. As there was already scouring, it was ordered stimulants three times a day, and to be fed entirely on gruel. It got worse apparently for two days; scouring became excessive, and mixed with blood. *On the 25th* the cow was so well as to be allowed a little mash. The temperature was good, scouring less, and there was an abundance of healthy urine. *On the 26th and 27th* there was no apparent progress; the breathing was very oppressed; pulse 100 per minute; not strength to rise; breathless and exhausted after every effort. *On the 28th* it was decidedly better; warmer, more animated, looked eagerly for the gruel; urine abundant; the dung more natural. Bottle of ale and stimulant mixture twice daily. *On the 29th* the cow eat too freely of hay; relapse of twenty-four hours, accompanied by much diarrhœa and straining; corrected by a tablespoonful of laudanum night and morning. During the next few days some progress toward recovery was made. Had stimulant twice and sometimes thrice a day, and in the evening ale with tonic powder. *On the 4th October* the pulse was 72, and getting stronger, and the respirations were 36 per minute; food consisted chiefly of gruel. Convalescence now appeared, and became decided. The cow was more lively—no scouring. Temperature good; the hide over the

The Edinburgh Committee, in their Interim Report, made up in a week after their appointment, "deprecate and strongly protest against the system of indiscriminate slaughter," &c., and regarding Rinderpest as evidently a disease of a low type, and the tendency to death to be by exhaustion, conclude that violent and lowering treatment is wholly inadmissible, &c. So also with strong saline and gastric purgatives, in the place of which Professor Dick, one of the committee, takes *linseed oil* in doses of sixteen ounces, to which is added half a mutchin (*Ang:* pint) of *whisky*. For the relief of scouring, he recommends the use of *lime water* in quart doses, to which laudanum, from one-half ounce to an ounce, is to be added. These remedies were to be followed by a *stimulant* treatment, (or it might be simultaneously administered), to wit, *carbonate of ammonia* in six drachm doses, three times a day. The tonics promotive of convalescence are, *sulphate of iron* in half ounce doses, twice a day, or the powdered *bark* recommended by Dr. Smart.

In a subsequent paper, the committee classify their treatment under four heads:

a. Diaphoretic and Stimulant.
b. Acid Treatment.
c. Restorative Treatment without drugs.
d. Prophylactic Treatment.

Under the first, a *vapor bath* is administered once or twice a day, and for successive days, according to circumstances; the animal

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back and on both sides of the neck was puffed up with air under it (generally emphysema of the cellular tissue); when struck emitted a drummy sound. *On the 5th*, unequivocal sign of advanced convalescence evinced—cudding. Two small mashes with a little turnip and grass, the stimulant mixture twice, and at evening the bark in warm ale and gruel, constitute the daily food and medicine of the animal. Milk returning; pulse and breathing natural; the cow quite recovered. Puffiness of the skin every day getting less.

Second Case.—A cow from an infected byre; put under treatment *on the 28th September;* had taken no food, nor been seen cudding for two days previously; pulse, 96; constipation and loaded paunch; vagina shewed the characteristic color; treated with laxative mixture night and morning. *On the 1st October* the pulse 96, weak; respiration 72 and oppressed. Free scouring, lasts all next day; moderated by a tablespoonful of laudanum night and morning, along with the stimulant. *On the 2d*, signs of convalescence; takes a little mash night and morning, but mostly gruel; scouring abated. *On the 4th*, convalescence more marked; pulse, breathing and temperature more natural; milk returning. *October* 7, all signs of returning health now present; takes small mash night and morning, with a little turnip, hay and grass. The milk is returning rapidly; breathing tranquil.

Third Case.—Cow from an infected byre. Admitted on the *29th September;* all the marks of the disease present; pulse 100, and weak; breathing oppressed; no appetite; very depressed and thirsty; reddened vagina and gums—constipation. Had laxative being placed in a box or stall whose sides are an inch or so higher than the patient, covered with a tarpaulin thrown over the box so as to tightly enclose the animal except his head, and the hot vapor being kept up by throwing red hot bricks into a tub of hot water, first placed in the box below the level of the floor, and so as to be easily accessible to the operator.

The avowed object of this bath is "to promote the circulation at the surface, to relieve the congestion of the mucous membranes, and to eliminate the poison from the system."

To aid which desired results, and as not incompatible, stimulants are given:

1. *Oil of Turpentine*, four table spoonfuls in a chopin-bottle full of gruel, well shaken, and given twice a day—increasing the perspiratory effort, and superceding the use of a laxative.

2. *Infusion of Coffee*, obtained by digesting two ounces of coffee roasted and ground, in a bottleful of boiling water, for fifteen minutes, and when sufficiently cool given every six hours.

3. *Carbonate of ammonia*, administered three times a day in half-ounce doses, in a bottlefull of gruel, to which may be added three drachms of nitre.

The Acid Treatment is suggested in consequence of the alkaline state of the secretions, and consists of:

1. *Dilute muriatic acid*, three drachms, twice a day, in a bottlefull of gruel.

2. *Vinegar*, also in the gruel, two ounces, given four times a day.

The Restorative Treatment demands full accord with

1. *The general sanitary instructions* of the commission as to cleanliness,

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mixture, and freely scoured by a single bottle. To have stimulant mixture three times a day; remains in an undecided state during the next *three* days, refusing food except gruel and a little thin mash. *October* 3, the pulse 60, and respiration 48. The cow is more lively; eats a little better; same treatment; to have a tonic powder and ale at night. *October* 6, pulse still high—80; the respiration 48; the breathing oppressed; otherwise, not markedly changed. *October* 9, signs of convalescence quite decided; appetite restored, takes full meal of a convalescent quite greedily. The milk increased in quantity; improving in quality; pulse and breathing still a little too high. This arises from a slight attack of pleurisy, caught since admission to the byre.

Fourth Case.—From an infected byre. Admitted *26th September;* taken no food for two days; dull; losing milk; oppressed in breathing; pulse 100; signs present, reddened vagina and gums. Laxative mixture given; free scouring next day; stimulant treatment; small mashes twice a day; gruel at mid-day. *On the* 1*st October*, the pulse was 96; respirations 48; temperature natural; animal dull; no appetite. *On the 2d*, improvement; stimulant twice a day, and ale and bark at night. *On the 9th*, convalescent; milk increased in quantity, improving in quality; gets full diet; takes it eagerly.

Fifth Case.—Cow from an infected byre, where ten had previously died. Admitted 1*st October.* Had all distinctive marks; treated on similar principles. *For three days*, pulse 95;, and respiration 102; nothing specially to be noted in treatment. After seven days illness, convalescent, giving full milk, chewing cud and taking full diet.

use of disinfectants, regulating the temperature of the byre so as to keep it up to 65° Fahr., or 60° Fahr. at least; the banishment of hay, straw and all kinds of fodder from the stall, as well as manger, &c.

2. *The regulation of the diet*, so as only to give oat meal or barley meal gruel, or linseed, hay and bran teas, to which, in the earlier stages of convalescence, well boiled turnips or carrots may be added; not even a handfull of hay being permitted until rumination is re-established, and that first dampened with *water* which has been *salted*.

3. *The keeping of the animal warm*, by rugs or other appliances.

4. *The use of good, sweet ale*, at the rate of two chopin bottles three or four times a day.

The Prophylactic Treatment, recommended with a view of preventing the development of the disease, or of modifying the intensity of its symptoms. &c., consists of:

1. *Sulphite of Soda*, one ounce in a bucketfull of water, and given morning and evening.

2. *McDougall's solution*, a wine glass in a bucketfull of water, twice a day.

3. *The sulphite and solution* combined, to wit, a half ounce of the first, and two tablespoonfuls of the second, given as above. * * * *

Attention was first attracted in Great Britain to the successful cure of the Rinderpest by Homœopathic remedies, through the Report made on the Cattle Plague in Belgium, by M. Barron, Her Majesty's Secretary of Legation at Brussels, to Lord Howard de Walden. In this Report, after a review of the recent outbreak in Belgium (not theretofore visited by the scourge since 1814), and which, principally from the vigorous system of quarantine noticed in our first Report, was comparatively light, the successful cures of Messrs. Seutin and Gaudy in Holland were brought to the notice of the English Government, with a strong recommendation that these gentlemen, one a chemist and the other an Ex-Professor in a Veterinary College, should be permitted to verify their practice in England. Despite the alleged malevolence of the Dutch Veterinary Corps, the carelessness of the farmers whose cattle were under treatment, and the absence of proper assistance, a large per centage (from 70 to 80) of cures was gained; the results of the practice being *officially* certified in one commune, that of Mathenesse, as of forty-six cures in sixty-three cases. The proposition of these experts being based on an indemnity moderate in amount, to cover expenses and remuneration, was not accepted by the British Government, and no opportunity was afforded for a direct inspection and test of the practice. But as appears from an address of Lord Bury, Treasurer of the Household, &c., before the General Committee of the Norfolk Cattle Plague Insurance Association, the friends of Homœopathy requested Dr. Hamilton to go to Holland to investigate and report upon the treatment pursued by both schools. The Doctor was furnished with suitable credentials from Earl Russell to that Government. He found the Allopathic practice mostly confined to the use of *dilute muriatic acid* (in doses of one or one and a half drachms), combined in linseed tea, given four or five times a day, sometimes with *gentian, tormentilla,* and *ginger;* occasionally recourse was had to dilute *sulphuric acid* combined with *sulphate of quinine* in equal parts. By the use of these remedies, and with the external use of *carbolic acid* in proportion of eighteen drachms of acid to forty quarts of water, or of *vinegar* and tepid water, used four or five times a day, there had been a saving of 45 per cent. The Homœopathic treatment at Matterness, within a mile of Kethel, in the very center of what had come to be styled the "black district," as reported by Dr. Hamilton, is also given by his Lordship, coupled with the allegation that the Royal Commission had refused to examine the Doctor as a witness, and the assertion of the consequent duty incumbent on the orator in common with every individual, to give as much publicity as possible to this fact.

The Homœopaths commenced their method of treatment on the 22d day of September, 1865, when eighty beasts sick with Rinderpest, as first vouched for by the certificate of veterinary surgeons, were put under their care; of which number sixty recovered. Besides these, two hundred and thirty beasts were put under Homœopathic prophylactic treatment, twenty-five showing the outbreak of the distemper before the preventive treatment had time to work; but up to the fourth week no other case had occurred, and on the 21st day of October, the commune was pronounced free from disease; the remedies employed being *Arsenicum, Phosphorus, Phosphoric Acid, Rhus Toxicodendron* and *Sulphur.*

Another able exposition of this method of treatment is given by Dr. Pope, from whose well digested review of the symptoms of the Pest as they passed under his own eye we have elsewhere quoted. His observations were gleaned from over one hundred and seventy cases which had occurred in his immediate neighborhood. Accepting Smart's view of the morbid anatomy of the Pest, he adopts his system of diet and care, and finds that—

"Certain features of the Rinderpest are very like those of scarlet fever. Its toxæmic character, the congested state of the mucous surfaces, and the extensive desquamation of epithelium are resemblances of some importance."

And it is doubtless because of this similarity, that Dr. Pope seems to rely on Belladonna as of prime value; an instance being given of its efficacy, in the hands of Mr. George Hope, a much respected citizen of York, who was determined to use his best efforts, and as we judge, without any pecuniary reward, to mitigate the losses of his neighbors.

"An animal . . . . was so far advanced in the disease, that on Mr. Hope's visiting her, he found that the Inspector had been sent for, to give an order for her shooting and burial. It was late at night and as the order could not be carried into effect until the following morning, the owner was persuaded to allow medicine and gruel to be administered during the night. *Belladona* was the medicine given, and by the morning the animal had so far rallied that all thoughts of destroying her were abandoned, and she made a complete recovery."

Another exceptional case of recovery in a late stage of the disease is given, in which

"the cow was completely despaired of, when first seen, and though she suffered to a very great extent from emphysema of the subcutaneous cellular tissue of the trunk, completely recovered."

Dr. Pope very wisely recommends Belladonna, in tincture, two to five drops to be administered every two, three, or four hours. He says:

"1st, 2d and 3d dilutions were tried in our early cases, but they were by no means so satisfactory in their action as the pure tincture."

The other remedies advised by Dr. Pope with their corresponding indications we will give in his own words; remarking that they substantially correspond with those recommended by The Association for the trial of the Preventive and Curative Treatment in the Cattle Plague, &c., &c., of which His Grace, the Duke of Marlborough is announced as Chairman:

"*Arsenic* has been useful chiefly in meeting the prostration about the fifth or sixth day. As a prophylactic I question its value. If it have any, it is not in the sense that vaccination is prophylactic to small pox; but it simply acts by keeping the animals in good condition, and so enables them the better to resist the contagion, giving rise to the disease.

"*Rhus tox.*—The chief indication for this remedy has been found in the muscular twitchings which characterize the disease in some of its stages.

"*Mercurius sol.* has been found valuable when the mouth has been long congested, and the patches of desquamation are general.

"*Ammonium caust.*, 1st dec., is of service where there is much abdominal distention, with heavy breathing and painful moaning.

"*Turpentine*, 1st dec., has been of signal service in checking hæmaturia, a symptom which did not yield to Cantharis at all.

"*Secale cor.*, tinc., Mr. Emerton thought useful in one case of subcutaneous emphysema, and its proving shows that it deserves attention in this condition.

"*Phosphoric acid*, 1st dec., *Mercurius sol.* and *Arsenic* have appeared to control the diarrhæa more than any other remedies; but they have not proved altogether satisfactory. In any future case I should be disposed to try Muriatic acid or China. It has been a more difficult symptom to meet than any other.

"*Mercurius cor.* 1, has checked several cases of dysentery in very marked manner.

"In one case of apparently impending metastasis, the acetate of copper, in grain doses of the first trituration, appeared to prevent its development; but it was the only case in which it was resorted to, and therefore much additional experience is required before its value here can be estimated correctly.

"In addition to medicines, much good has accrued from exposing the animal's muzzle to steam from boiling water or scalded bran. The nasal discharge is thus promoted, and large lumps of coagulated mucus are passed, to the great relief of the patient."

In brief review of this method of treatment, it is to be observed in all frankness, that inasmuch as the present foundation of the Homœopathic system lies in its Symptomatology, no little difficulty must be experienced in applying it to the dumb creation. Besides, the drug-provings which have been made on the human race, cannot with any certainty, or in some cases, even of probability be transferred to the brute races. This is more especially true of the ruminant orders, whose complex arrangement of the digestive organs would render the disparity of symptoms relating to the functions of assimilation, and of the reflex action upon the brain and cord from the direct influence of drugs acting upon the stomachic apparatus, more than probable. No such result might however be expected, when once the influence of the drug was felt, after it had been absorbed and entered into the blood circulation. Besides, as in this disease the function of the first and second stomachs is quite suspended, and medicines carelessly administered (especially in large quantities) and thrown into the paunch, are as inert as if lying in their original packages; so it might happen in the administration of different drugs to obtain their provings, that different results would follow if these were thrown into the first or fourth stomach. And after all, what could we know of their symptomatic indications so pregnant of suggestion in the various morbid states of the human subject, derived from provings on a nervous expanse, not only so delicate as to register at once every, the most trivial departure from the normal state, but so secure and protected in such registry as to confirm it by an unequivocal and audible tell-tale;—what could we know except by the loosest inference, when we seek the same intelligence from those to whom nature denies the power of speech. Hence, we are thrown upon the more tardy method of watching our provings of medicaments introduced into the system of any animal, by experiments on those doomed to slaughter, or massing the drugs, and leaving the proving to go on until death supervenes. So that not only as Dr. Pope remarks—

> "Any nicety in the selection of a medicine to meet a particular case, seems well nigh impossible."

—but all our reliable knowledge of the various scope of drugs irritative or destructive of nerve or tissue, alterative of the blood structures for a brief period, or exerting power until the full measure of poisonous disintegration is established, must be principally gained from *post mortem* observations.

We are not to be understood, however, as holding the view that in drug-provings on the lower races, there can be no symptomatology. We only insist that in the case before us, that of the ruminant tribes, it must be extremely limited, and that before such knowledge can be extended, a very elaborate system of drug-provings upon these tribes should be first instituted. * * *

We have yet in reserve, as before announced, the consideration of those remedies, for which it has been claimed that they severally exercise a specific influence in arresting the peculiar ferment of the Pest. Incongruous as the list may seem, they admit of an easy and scientific classification, and may be arranged in three classes:

1st. Those which are essential or concomitant elements of blood-food, and which may be exhibited to supply the waste of these elements during the progress of the distemper; these as opposing forces may be regarded as anti-catalytic.

2d. Those which may be supposed to set up a new ferment supplanting the morbid one, and thus act as apo-catalytics.

3d. Those generally known as antiseptics, which arrest the putrefactive process, by rendering the fluid or tissues, in and on which the ferment is operating, incapable of putrescence—or even of fermentation; and are thus a-catalytic.

In the first class, as it is not our purpose to refer to those which are ordinarily embraced under the head of hygienic preparations; further than to say that Dr. Smart's method of preparing and exhibiting food for the sick animal meets every contingency which the most skillful and assiduous nursing could provide against; we will note a few instances, of which the most important is the *Chloride of Sodium*, or common salt. This chloride is found in the blood, gastric juice, urine, bone, cartilage, &c. It exists also as a necessary element of vegetable food; seeds and grain containing the smallest amount, while green vegetables and meadow grasses (especially *Lolium perenne*, or common rye grass) hold it in largest proportion. The common experience, of those who are engaged in the rearing of domestic animals, is familiar with the necessity of an artificial supply of this element of the blood, in order to obtain their highest perfection, to secure thrift in growth, or even the appearance of health. Boussingault's experiments are very happy and instructive. He took six oxen and divided them into two lots;—to the one he gave salt at stated intervals, while he entirely refused it to the other. No perceptible difference in the appearance of these lots was, on the most careful scrutiny, manifest at the end of fourteen days; but at the close of the month it was revealed to the most unpracticed eye. In both lots the skin under touch was sound and fine; the hair of those, to whom salt had been supplied, was smooth and shining; of the others dull and staring. At the end of a year the hair of the second lot was matted, or *in places* had fallen out, and the animals were listless and inanimate, while the first lot had the sleek and fine coat of stall-fed beasts, and proved their high condition in frisky and rampant attitudes. It seems strange on first thought to learn besides, that the supply of salt had exercised no influence on the quantity of flesh fat, or, again in other trials, of milk obtained; but the marvel disappears when we understand that salt plays no part in the flesh forming economy, but, according to Liebig, merely neutralizes

"the injurious action of the conditions which must be united in the unnatural state of animals fed or fattened in order to produce flesh."

A clearer statement is, that

"salt serves in the organism to assist and promote the general changes with out taking a share by its elements in the formative process."

It appears that a chemical action takes place in the system, by which chlorine (not found in chemical combination in any organized part or tissue, but ever present in every fluid of the body) leaves its base (sodium) in the common salt supplied to the animal, and unites with potash forming the chloride of potassium; the soda set free uniting with carbonic acid, and forming the carbonate of soda.*

Time will not suffice to follow these changes as far as chemical and physiological research has carried them; it may suffice to add that the chlorine derived from salt, and uniting with the salts of potash, is found as a principle inorganic constituent of the muscles; that the soda as an oxide is found in the secretions of the liver; as a carbonate in the blood of the herbivora (although the ashes of their food yields hardly a trace of it), twice or thrice in excess of the carbonate of potash;† while all excess of salt furnished is carried off rapidly in the secretion of the kidneys. It is important to note that the carbonate of soda (found also in the saliva) imparts to it as well as the blood their alkaline properties; that the tendency of this carbonate (as also that of potash) is to maintain the fluidity of the fibrine and albumen of the blood, that it assists in preserving the form and consistence of the blood corpuscles; and also performs an analogous function with reference to the other semi-solids of the body.‡

When we consider that all vital phenomena, or manifestations of those actions which take place in the body in a condition of health; though they may be said to be primarily dependent upon the organic nitrogenized elements of the tissues or fluids for the power of appropriating materials for their nourishment, or of self-regeneration to repair waste; are still, if secondarily, yet as essentially dependent upon the inorganic constituents of such tissues and fluids in order to keep up their play, and so maintain health and life; we find but little difficulty in concluding, that when any of the proximate principles, or elementary constituents, organic or inorganic, are in excess, or in deficient supply, their harmonious motions are disturbed, and the charm of vital play and healthy action is broken. The elements, which by too large supply in the

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* Soda unites also with Oleic and Margaric Acids (the acids found in fat), forming the Oleate and Margarate of Soda, which are found in minute quantities in the blood, bile and urine—and with Pneumic Acid (the acid found in the lungs) forming Pneumate of Soda, which is not discharged from the body.

† In the milk of cows four and a half times (according to Berzelius), and six times (Pfaff and Schwartz) more than in human milk.

‡ Flint's Physiology, pp. 36 and 44; supporting Liebig's view, *ut sup.* p. 426.

first instance, or by the deficiency of their coördinates, and in the effort of nature to maintain a just equilibrium become so, must remain as clogs upon vital action, until they are thrown off, or agencies employed to restore the balance. And it is in this view that Liebig, in commenting on the condition of those animals which in the experiments of Boussingault were deprived of salt for a twelvemonth, is both convincing and eloquent, when he says that their bodies were

"in regard to disease, like a fireplace, heaped with most inflammable fuel, which only requires a spark in order to burst into flame and be consumed."

If the inquiry should now be deemed useless or visionary, whether those animals who succumbed so easily to the Pest had been denied or not a proper modicum of salt; or whether this agent was of any specific worth in the treatment of the murrians of the 17th and 18th centuries; one conclusion will not be gainsaid, that in all future prophylactic and remedial treatment of the Pest, salt should be largely supplied in the food, and in the absence of other remedies might be relied upon as palliative if not curative.† * * *

It is our purpose to treat in the second class only of *yeast*, which has been said to have been successfully tried as a remedy for the Pest; and our view of it as a remedy will be chiefly by way of comparison.

Yeast deports itself in the presence of many agents and reagents, as the ferments of zymotic disease are believed to do, and may in this respect be regarded as their type. As familiar as the common mind is with this substance, its scientific definition may not find such ready discernment. It is a compound of nitrogen in the state of putrefaction or eremacausis (slow combustion or decay), possessing the power of causing fermentation in sugar or non-nitrogenized organic bodies, of which sugar and starch are the commonest instances, and carbon the chief constituent. The presence of water is necessary to sustain its power of exciting ferment, and this is lost under pressure, or when the yeast is desiccated and dried.

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† As illustrative of the frequent agreement of the tentative experiences of instinct in our race, and the deliberate conclusions of men of science it is not improper here to notice the fact that the Indians of this Continent, whose nomad life impelled them to the chase for the sustenance of life, and limited their supply of food to that mostly deficient in salt, should have used salt successfully as a cure for the bite of the rattlesnake.

It is alone its soluble part, however, that possesses the property of inducing fermentation, and this only after it has received oxygen from the atmosphere to which it must be first exposed. It then developes in its mass carbonic acid. Like vaccine or purulent matter—if not kept dry too long, and under attendant circumstances which ensure its own decomposition—when again moistened, it starts afresh on its destructive mission.

The fermenting process is easily carried forward to putrefaction in bodies containing nitrogen, of which, in the animal organism, blood is the *primum mobile*. And as nitrogen has so low an affinity for the simple bodies, that it is said to be in a state of indifference to them, its evolution is always attended with an easy transposition of atoms. When acted on by alkalies, by acids, or increase of temperature, organic compounds, containing nitrogen in the presence of water, throw off all that element in the form of nitrates; but if the azotised animal matter first moistened, be exposed to the action of the oxygen in the atmosphere, then in the form of ammonia. When gluten, the vegetable equivalent of albumen, is subjected to the putrefactive process, after the evolution of carbonic acid and hydrogen commences, the ammonia takes on its forms of phosphate, acetate, caseate and lactate, which are produced in large quantities; so that for the time being the decomposition of the gluten ceases. But if water is freshly added, the process is renewed, and then in addition to the products just mentioned, we have carbonate and hydrosulphate of ammonia and a mucilaginous substance coagulable by chlorine, &c. Those who desire to follow the labyrinthine changes of which nitrogen is capable, will find that subject elaborately treated by Liebig, from whom we have freely taken the views above expressed. We must turn, however, to the brief consideration of the agencies by which fermentation is arrested.

These are embraced in a long catalogue known as antiseptics, of which we may mention the most important; to wit, boiling water, alcohol, salt, an excess of sugar, the mercurial salts, nitrate of silver, volatile oils; the mineral, pyroligneous, sulphurous and carbolic acids.

"Alcohol and common salt, in certain proportions, check also all putrefaction, and conseqently all processes of fermentation; because by these means the putrefying body is deprived of a certain condition of its decomposition, namely, the presence of a certain quantity of water."

The action of these antiseptics, in arresting yeast ferment, and also the putrefactive process in animal substances, is of the highest interest in the pathology and treatment of zymotic disease, and will readily furnish to the enthusiastic student of medicine most valuable suggestions. His aim in their applications in medical and veterinary practice, will be to select such as will produce the least disturbance, transient or permanent, on the vital force. We will only add, from the similarity of the action, while in the state of propagation, of yeast and morbid poisons, and the identity of the means by which it may be arrested, that it is not improbable that yeast may exert a curative action in the Pest; though even such probability requires that more numerous trials should be successfully instituted than those previously noted.

The old school of medicine has long since exhausted its ingenuity in the use of mercurial salts and the like, in the treatment of epidemics, and has passed from the general use of the mineral acids; and the present school rejoices in the discovery of the efficacy of those last named in our list, to wit, sulphurous and carbolic acids.

This brings us to the consideration of two of the most valuable antiseptic remedies; which are embraced in our third division of specific agencies.

The farmer has long been familiar with the fact, that if he burns a little sulphur in a barrel which has been rinsed out with water, and confines the fumes produced, so that they are absorbed by the wet surface of the staves, the cider he may subsequently pour into the vessel, will remain sweet for a long period and will not undergo the fermentation ordinarily induced. This preserving power is one of the attributes of the *sulphurous* (not sulphuric) *acid* generated in the combustion of sulphur, and has been taken as the starting point for some exceedingly ingenious researches by Dr. A. Polli, of Milan. This learned professor adopted the catalytic theory of disease, as applicable to those maladies in which the blood having absorbed some poisonous morbific germs, undergoes marked constitutional changes; and though he was met at the threshold of his investigation by the dogmatic assertion of the celebrated Bernard, that any substance capable of destroying a catalytic poison in the blood, would so affect that fluid, that it would be thereafter incapable of vital function; persisted in his inquiries, until he satisfied himself that not only did sulphurous acid possess this power, but that its compounds with soda, lime, or magnesia whether hyposulphites, simple sulphites, or bi-sulphites also exercised the same function, and could be exhibited in large doses and with perfect impunity. Two animals of the same kind, size, and condition, and fed alike for a few days, except that one received a certain amount of a sulphite in his food, were slaughtered; when it was discovered that the latter gave evidence of the existence of the drug in every tissue, organ, and secretion; and furthermore, remained perfectly fresh though the weather was that of summer in a tropical clime; while the former, to which no sulphite had been given, rapidly passed after death into an advanced stage of decomposition. This experiment being confirmed by many others equally satisfactory, the deduction naturally followed, that as no fermentation could exist in the presence of a sulphite, and as this remedy could be administered without any injury to the vital function, and permeate every part of the living structure, that it was only necessary to saturate the systen with a sulphite, in order, either to prevent, or arrest the catalytic action in all zymotic maladies.

But further to establish this deduction by facts, the Professor next selected two dogs of equal size and weight, and in perfect health; fed and treated them alike for four or five days, except that to one was administered a certain quantity of the bi-sulphite of soda. Some very fœtid pus obtained from an ill-conditioned ulcer was then injected into the femoral veins of each dog (about a drachm to each), the experiment being repeated on the next day. After the first operation, both laid down, refused food, and remained prostrated for twenty-four hours. The effect of the second injection was more marked. They were seized with stupor, their pulses were rapid and feeble, and their respiration greatly accelerated; when made to rise they tottered and reeled across the room. The one to whom the bi-sulphite had not been given grew worse, his wound in the thigh became gangrenous, and in ten days he died with all the symptoms of typhus; while by that time the other, receiving his daily dose, and having regained in four days his appetite, was entirely well.

Like experiments have been conducted in a vast number of cases by the Professor and his compeer, Dr. De Ricci; sanious matter from ill-conditioned and phagedenic sores,—defibrinated blood exposed to the air until it has become putrid—the discharge from the nostrils of glandered horses—have been employed, and in all cases proved fatal without—and wholly innocuous with— the concomitant use of the sulphites. Conversely De Ricci has exhibited the bi-sulphite in an alarming case of septicæmia, produced by a lady's kissing the lips and face of a dear friend who had died very suddenly; giving nearly twenty grains of the bi-sulphite in infusion of quassia, &c., every half hour at first, and then every hour; and with the most perfect success. Since that time the use of the sulphites has been extended to cases of scarlatina; measles; phlebitis, originating from the stinging of the back of the hand by the spines of a cactus; the malignant epidemics of the Northern Coast of Africa; puerperal fevers, &c. *

In most if not all these diseases, the administration of the sulphites has also proved *prophylactic.*

When the fermenting process is arrested by sulphurous acid, the rationale of such action, according to Liebig, is, that atoms of oxygen are taken up from the liquor of ferment, and combining with those of the sulphurous acid, form *Sulphuric Acid.* If this transposition in inorganic, is also realized in organic fluids, and takes place during the administration of the sulphites in zymotic diseases, the resultant acid being formed in very minute quantities and generally distributed throughout the circulating media, could not exert its ordinary local effects, which are primarily escharotic and destructive of the tissues. Indeed, Pereira's statements in regard to the constitutional action of all mineral acids may be adopted here, that they become neutralized by combination with bases (of salts), and are not absorbed as free acids which operate topically only. In this view we may be spared any extended discussion of the constitutional disturbances produced by the use of sulphuric acid; and for the further reason that its lesions do not correspond with those of the Pest.

The Sulphite of Potassium develops in the treatment of zymotics, action equally beneficial with that of the like salt of soda. It is more expensive, and for that reason not so well fitted for general use. Nevertheless, it should be employed as we may recommend in experimental trials; and in all desperate and long neglected cases, where it is probable that the salts of potash have begun to leave the circulation.

* Dublin Quart. Journal, August, 1864; Glasgow Medical Journal, October, 1865.

Carbolic Acid sometimes called *Phenic Acid,* but chemically, *Phenic Alcohol,* or *Phenol,* is said to occur as a natural product in the secretion of the beaver, *castoreum,* whose peculiar odor is that of this acid ; it is also found in the oil of *coal-tar.* Its aqueous solution has an acrid taste, and an odor like that of wood smoke or creosote, of which last it is probably a homologue.* As it is highly poisonous, it is to be administered with discretion, and largely diluted with water. In this form it is very valuable as an application to the skin, where wounds and sores reach a putrescent stage,† and like the sulphite of soda, thus dissolved, is readily absorbed. The latter so diluted and applied with a wet bandage, we have known to discuss the formation of ordinary boils; the former of erysipelatous swellings. Whether this acid will act as readily or more effectually in arresting the Pest-ferment than Sulphurous acid, in its administration through the sulphites, time and experimental trials will best determine. * * * *

As a guide to the unskillful—a hand-book also to the learned—we will indicate our proposed method of treatment in a series of rules.

RULE I.—In apprehension or in the presence of an outbreak of the pest,

a. Apply the thermometer (see p. 205) to the vulva or rectum ; and if the heat of the parts (the females not being in a state of sexual excitement, and none over-heated by driving, &c.) rises to 102 deg. Fahr.; or—

b. If no such instrument can be readily had or reliably used ; observe the appearances of the inner mouth. If to the eye or by the aid of a magnifying glass there appear small round nodules (knobs) no larger than a millet seed, red at the point or head, or some of them broken and discharging a yellowish or yellowish-grey matter, and the thin membrane which covered the swelling and those adjoining peeled or rolling off: ‡

All animals exhibiting these signs are at once to be put under treatment as in Rules II, &c.

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* Silliman's Chemistry (Organic by Hunt), § 789.

† Also in the treatment of compound fractures of bones and in burns, as recommended by Prof. Lister ; and in the treatment of burns of the first and second degree, by Prof. Pirrie, &c.

‡ Those who apply the thermometer in time will SAVE THE WHOLE PERIOD OF INCUBATION, or or least *five days of burrowing* of the pest-germs through the membranous tissues, and of their ferment in the fluids of the body. Those who watch the first signs in the mouth may save from *two* to *four* days. Those who are so indolent or inobservant, as to wait until they find the disease in full blow, should "go farther and fare worse." Let them hunt up other indications which may serve to alarm them. We have no patience for such a task.

RULE II.—*a.* Let all such animals be *separated* at once from the herd, and placed in an out-building which is to be used as a *hospital*—in suitable stalls or boxes—from which all hay, grass, straw, litter, loose dirt, cobwebs, &c., are to be removed. Sawdust, tan bark, or dry sand is to be their bed.

b. Dissolve 2 oz. of *Sulphite* (not sulphate, which is Glauber's Salts) of *Soda*, or 1 oz. of the *Bi-sulphite*, in 12 quarts of pure spring or clear rain water.

(If the treatment of the case has been long deferred, or the outbreak be deemed an alarming one, double the quantity of the salt may be employed, not otherwise). Administer 1 pint of this solution every hour (or half hour), after Gamgee's plan.* A tin twisted cup in the shape of a horn, with its mouth well rounded off, is to be employed to the *exclusion* of glass bottles. "The operator should go up to the right side of the animal, pass his hand over the face into the angle of the mouth in the left side. The head is bent round, not elevated, except to a slight extent; . . . . the person giving the draught to plant his feet well on the ground, with his back against the animal's shoulder, ... and holding the horn in his right hand, pour its contents by degrees into the animal's mouth."

c. Take one-half (6 qts.) of the solution as above, and add to it 12 qts. of warm water (120 deg.. Fahr.), so that the mixture when used may be at least ten degrees above blood heat.† Take a coarse cotton sheet, folded to four thicknesses, and wetting it with this warm solution, (wringing the edges of the folds so that the water will not drip), lay it on the middle of a coarse woollen blanket (previously fitted as to size, and with straps to fasten it, &c.); then apply to the abdomen and fasten the blanket over the back. (Apertures may be made in the blanket if long enough, so that the hind as well as the fore legs may not be restricted in their motions, and so as to protect the chest and buttocks from the air).‡

d. If no Sulphite or Bi-Sulphite of Soda can be procured, *or more than one* animal is to be treated, use *Carbolic Acid*, 4 drachms to 12 quarts, pursuing the same method of internal as well as external treatment as in (*b* and *c*).

e. For *like* reasons as in last rule, employ 1 oz. of *Aqua Ammonia* to 12 quarts of water, as in (*b* and *c*), or,

f. 1 pint of alcohol with as much salt as it will hold in solution as in (*b* and *c*), or,

g. 1½ quarts of vinegar saturated with salt as in (*b* and *c*), or,

h. Other remedies, the specificity of which is to be proved by the same methods.

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* Cattle Plague, p. 98.

† This temperature will meet the requirement of the fourth law of absorption by osmose as laid down by Matteucci in his fourth Lecture on the Physical Phenomena of Living Beings.—Am. Edit., p. 89.

‡ As the object of this application is to induce endosmose of the saline solution by the abdominal organs, and *not* a general perspiration, the blanket must not be too tightly secured.

i. As an independent experiment with the sulphite of soda (or if the sulphite of potassium can be had, with it also), 20 gr. powders might be thrown every hour under the tongue, to be dissolved in the saliva which is rapidly secreted and then to be swallowed.

RULE III.—If the symptoms do not indicate that the ferment has subsided, twelve hours after the medicinal draughts as prepared have been entirely taken, or if they recur, commence anew with a fresh portion of the remedy selected, and proceed as in Rule II (*b* and *c*).

RULE IV.—*a.* If nervous twitchings or the like make their appearance, apply pounded ice in a bladder or bag, to the base of the brain and the spinal cord (from between the horns for a few inches along the neck). If this application does not soon relieve, and the Homœopathic treatment is preferred, in the choice of intercurrent between the doses of the anti-septic remedies, as above to be employed; give 10 drops of the tinct. of Belladonna in four table spoonfuls of water, or if the Allopathic methods are chosen, and *diarrhœa* has supervened, add a table spoonful of laudanum * to a pint of starch emulsion (or warm water) and inject as an enema into the rectum.

b. If after twelve hours from the commencement of the treatment, symptoms of aggravation appear, the dose may be doubled. Oherwise if evidence of improvement appears, it may be less in quantity and given at longer intervals.

c. When it appears desirable to remove the bandage from the bowels, the portion of the body wet by it may be gently dashed with water from the well (60-70 deg. Fahr.), then rubbed perfectly dry, and the body covered with a fresh blanket so to exclude the action of cool air,

d. If the bandage is not used, still the animal is to be covered with a blanket, and the temperature of the stall kept not lower than 60 deg. Fahr. If the covering is sufficient, fresh air may be more freely admitted.

RULE V.—*a,* When the patient gives signs of hunger, dilute milk or boiled gruels (as in Smart's method,) to which a free allowance of salt has been added; or when thirst is manifest, water from which all chill has been taken, may be given a half hour before the administration of the medicine.

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* It would be useless to give morphia or opium in any of its forms, while a medicinal endosmose is being instituted—as it is well known that these first check and then reverse the process. They can be exhibited only when the morbid osmose has filled the bowels and brought on diarrhœa. If the brain conditions indicate the use of opium in coma, stertorous breathing, and upturned eye and contracted pupil (or a pinched eye), a warm solution should be applied and rubbed in, along the face or the under part of the neck, or one-half of a grain of morphine, or 5 grains of first decimal Homœopathic trituration may be thrown in under the tongue. It will be readily admitted as unwise, in the present state of our knowledge, to hope for the alleviation of symptoms by putting opium in any of its forms, in the stomachs, while they are in a state of suspended activity. Otherwise we admit, if scientific experiments could show that when the normal endosmosal current towards the stomachs had completely ceased, opium could exert an antagonistic power, and renew the current.

b. Should any unpleasant odors arise from the body, breath or droppings, dilute sulphuric acid may be added to a small portion of chloride of lime, and after the early escape of chlorine, and when the caustic smell of lime is perceived, the vessel is to be removed; and the contents, added to the droppings of the sick beasts, also to be removed, and covered with six inches of earth. Or carbolic acid may be used in dilute solution, and the sides and floor of the building sprinkled with it. And so with any disinfectant, such as carbolate of lime, sulphate of iron, dissolved in water, &c. Carbolic acid may be dissipated through the building by throwing from time to time a few grains of it upon a hot plate—dipped for a few minutes in boiling water and then wiped dry.

c. If constipation show itself so as manifestly to make the animal uncomfortable (and not otherwise), give two quarts of an injection of blood warm water, to which a couple of tablespoonfuls of salt have been added.

d. Should any disposition to swelling (emphysema) show itself along the back from the beginning, make the wet bandage large enough to go around the trunk; if it be only partial, or occur at a late period, shift the bandage, &c.

e. If any viscid or glairy secretions from the eyes, nose, mouth or vulva begin to flow, the parts are to be frequently bathed with a weak solution of carbolic acid, or with vinegar to which an equal portion of water has been added.

RULE VI.—The *sequelæ* of the disease must be treated according to *their indications.** If the medicines have not been pressed with too much activity, there need be but little apprehension of any violent reaction on their use. And if no such reaction manifests itself, the animal is *best left* to the "*vis medicatrix naturæ.*"

RULE VII,—*a.* When convalescence is established, the diet as given by Smart may be followed. Before being admitted to the herd, the patient should be carefully washed with a weak solution of carbolic acid, into a stronger solution of which the feet first washed out in the clefts very carefully have been allowed to stand for a time. After this operation a quarantine of seven days would be advisable.

b. To cleanse the premises, *boiling* water may be sprinkled frequently and copiously over the stalls, floors, &c. If cold water is employed, the common washing soda of the shops should be added, and all boards, &c., carefully scrubbed. The clothing of attendants may be treated in either of the above ways, or may be washed with water to which carbolic acid has been added, or they may he hung up in a barrel, and sulphur slowly burned under them, &c.

* The constitutional disturbances produced by the force of the disease—perhaps also by the remedies—may require further medical treatment. This must be determined according to the preferences of the practitioner and the methods of the school to which he belongs. The foregoing pages may prove a sufficient guide to indicate which medicines in especial contingencies cover the case most completely.

This method of treatment will, we trust, be received by candid minds as fulfilling our pledge, not to commit it obsequiously to the interest or dogmas of any school. It will be doubtless considered in this respect sufficiently catholic. In the variety of agencies offered in Rule II, opportunity is offered to determine experimentally which is most efficacious. If the so called antiseptic remedies prove their superior virtue, they will furnish additional proof that this zymotic acts as a true ferment. If *ammonium causticum* takes the lead, it will afford another illustration of the Homœopathic law. If the absorption through the wet bandage (and we would like to see isolated trials of this method), should work successfully, this would draw just attention to the practicable adaptation in disease of the law of endosmose, and would ameliorate the heroic use of the water treatment.

In conclusion, whichever of these remedial methods should give the greatest percentage of cures, would best indicate the selection of a prophylactic agent; though we imagine that even the use of this would not excuse the farmer or stock-grower who did not, in the presence of this epizöotic, give to his cattle at least their ordinary quota of salt, as often as twice a week."

Before leaving the subject of cattle disease, some statements should be made regarding several forms now or recently existing, near enough to us to be matters of serious concern.

Pleuro Pneumonia. It is now generally known that the fatal contagious disease known as Pleuro Pneumonia existed in, and, to a considerable extent spread through, the milk distillery stables of New York and Brooklyn before its direct introduction into Massachusetts by means of the Dutch cattle imported by Mr. Chenery, from Europe. This fact was stated in my report for 1862, (p. 205,) and an instance was related where it had been carried (150 miles) to Albany and had destroyed fourteen out of a herd numbering thirty valuable animals, and was stayed only by the most efficient and judicious treatment. It was known also to have gone out in several other cases. For several years little has been heard, among us, of losses occasioned by this disease until very recently.

Prof. John Gamgee, of the Albert Veterinary College, London, now on a visit to this country, who has been commissioned to investigate the subject, says in a recent communication to the press, that he has "traced the malady in New York, New Jersey, Pennsylvania, Maryland, District of Columbia, Virginia, and has heard of its manifestations in Ohio and Kentucky."

The fact that it is abroad should induce in Maine farmers, not alarm but *caution*, and *caution of a quiet, deep-seated, chronic type.*

Pleuro Pneumonia doubtless had a beginning somewhere, and somehow, and at some definite time, but the evidence is sufficient that it never originated under the conditions which prevail here. There is no more reason to expect its spontaneous development in New England, than to expect an earthquake to swallow up the people, or a deluge to drown them all. If it comes here it will be brought here; and it can be easily brought, for it is one of the most insidious of diseases and lies dormant (in the incubative stage) for a considerable, and as yet uncertain, length of time.

Spanish Fever. In other sections of the country an entirely different disease has prevailed, and with very fatal results. It is popularly known as Spanish Fever, and seems to follow the track of Texan cattle as they are sent northward, themselves being rarely or never affected by it. The general impression where it has prevailed is, that the Texan cattle contaminate the pastures whereon they feed, and the roads over which they are driven, and the steamboats and cars in which they are transported, by their dejections.

How it is that these cattle communicate a disease of which themselves exhibit no appearance, is not known. One supposition is that it is due to the change of climate, another that it is due to ill-usage, and it is alleged that when these cattle are driven or conveyed leisurely northward the disease rarely appears; but when hardly driven, or hurriedly pushed along by steam and rail, with the cruel accompaniments so frequently attending such conveyance, such as crowding, thirst, fright, rough treatment, &c., it developes with rapidity and violence.

Prof. Gamgee says,* "Many thousands of these cattle were driven from Texas very early in the spring and reached the western prairies just as the grain was in the best condition for their support. Here Southern and Western cattle were mixed, and with the almost invariable result of the latter beginning to die within forty days after eating grasses upon which the Texan cattle had trodden, and continuing to die until as many as ninety and ninety-five per cent. of the animals subjected to the same influence had

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* In the same communication above referred to.

succumbed. No plague ever committed greater havoc than this one over the area of its development."

I have not witnessed this disease, but from the best information I could obtain from those who have seen it, and have carefully observed the morbid appearances after death, it bears a close general resemblance to the cases spoken of in my report of 1866, occuring in York two years ago; the chief difference being that in the Spanish Fever the spleen and kidneys are somewhat more implicated. The usual symptoms are rapid and feeble pulse, from 60 to 120 per minute, high fever—labored breathing, usually short and quick, loss of appetite, loss of cud, head drooping, when standing, and, when lying, the nose thrust hard upon the ground —sometimes turned back over the side, and pressed against it; the ears drooping, back arched, flank hollow, hind legs drawn up under the body; frequent knuckling over of the hind fetlocks; disposed to lie down and get up again, which is done with difficulty. When made to move, it is often with a staggering, unsteady gait. The coat rough and staring. Frequent twitchings of the muscles appear about the shoulders and other parts of the body.

A post mortem examination shows almost uniformly a healthy condition of the first three stomachs, but the fourth is intensely congested at its upper end, and in nearly all, erosions of the lining membrane. Generally the intestines are much inflamed throughout their whole extent. The gall-bladder, and liver are more or less affected, the spleen greatly enlarged, of a dark color, and structure broken up. The kidneys exhibit a similar aspect.

A report being expected soon from the Commission specially appointed to investigate this disease, in connection with which we may also expect suggestions regarding remedial and preventive measures, it seems inexpedient to enlarge farther upon the subject at this time.

THE HAY TEDDER.

One of the greatest improvements of modern times in securing the hay harvest is the introduction of the "Tedder."

The office of this implement is to thoroughly expose the mown grass to the drying action of the air. This it does in such a manner as to accomplish, at the same time, several desirable ends. Not only is the saving of labor great but the hay is better cured, especially when the crop is a heavy one. Its action throws the grass upward, allowing it to fall lightly and loosely, so that the air circulates freely through it. Consequently, while being rapidly dried, it is, to a considerable extent, dried in the shade, and goes to the barn in better condition than if longer and more fully exposed to the sun.

To a limited extent this implement has been used by the farmers of Maine, and were its value better known and its aid properly appreciated, its use would be greatly extended.

Two "tedders" are in the market,—possibly more,—but these are all I have witnessed in actual operation. Several others have been shown at various agricultural exhibitions, recently, but of their merits or demerits it were premature to express an opinion at this time. The one known as "Bullard's" was introduced five years ago or more; the "American" more recently. Last July (1868) I had an opportunity of seeing both of these in operation on the farm connected with the Cumberland Mills, in the town of Westbrook. Bullard's had been in use on the farm for several years. Deeming it expedient, however, to have two, the American was obtained this year. Both did good work, satisfactory work; in very heavy grass Bullard's perhaps more uniformly did thorough work and somewhat more of it, as its width was considerably greater; at the same time it required more power than the "American" and more frequently needed adjustment or repairs, as the strength of the machine seemed inadequate to the amount of work it was designed to accomplish. A high degree of satisfaction was expressed with regard to both; and the remark was made to me that if compelled to dispense with either the mower or the tedder,

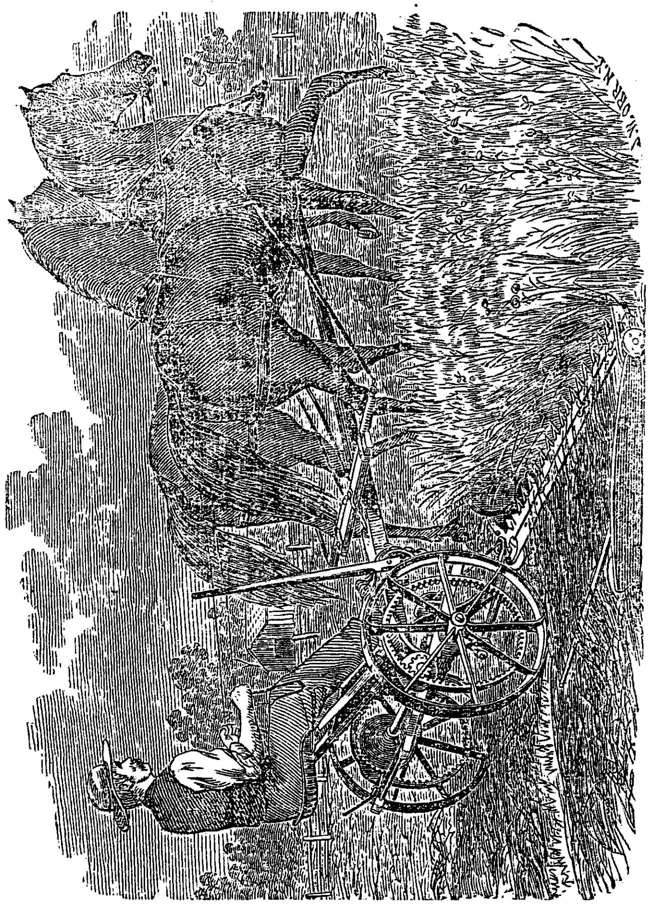
The American Hay Tedder.—Ames Plow Company, Quincy Hall, Boston, Mass.

it would be hard to say, whether the loss, by reason of the deprivation of the one or of the other, would be the lesser one. To be deprived of either was an evil not to be submitted to except upon dire necessity.

A thoroughly practical and very judicious farmer (Mr. S. S. Whitman of Herkimer County, New York,) whose acquaintance I made some years ago, and who has used the tedder from about the time of its first introduction, lately expressed himself as follows:

"I think the hay tedder stands squarly in utility by the side of the mower; and that its labor-saving value is comparatively a small part if the farmer will use it to the best advantage; for by its use the hay will be from one to five dollars per ton better in quality. The mower saves hand labor, but I think no one pretends that it improves the hay. The following maxims I have not heard disputed; that the sooner grass is cured, after it is cut, the greener and better the hay,—that the more it is tedded the sooner it is cured,—that the sooner it is cured and in the barn the safer it is from dews and storms. I claim that the tedder, thoroughly and properly used, will pay for itself sooner than the mower. It is claimed by good farmers in this vicinity that no man, young or old, can ted hay as well as the improved tedder, and that a dozen men can do it no faster. When grass is cut with a mower it lies very flat and close to the ground; consequently the sun can only dry the surface, and the air has little chance to pass through it; therefore the under side remains as green for a long time as when first cut, if there be a heavy crop. By tedding immediately after mowing it is placed in a much better position to be dried by both sun and air; and the more it is cured by the air, and the less by the sun, the greener is the hay. Let it be understood that I here mean grass which is cut while yet green, and before the stalk becomes woody and of comparatively little value. My method of tedding, and which has given the best satisfaction, is to start the tedder when the piece of grass is about half mowed, so that we have the whole tedded and lying up loosely by the time the mowing is completed. We then ted again before dinner, and once more about two o'clock, if we think best. By this method the green grass dries very quickly and we get hay of excellent quality. When hay has been wet by showers the tedder answers an admirable purpose; and I predict that it will not be many years before the tedder will be deemed as indispensable on the farm as the mower."

In our report for 1859 a large space was devoted to considerations relative to the various grasses, and to the ways and means of securing the hay crop, universally admitted to be the crop upon the success of which the prosperity of the Maine farmer chiefly depends. The tedder was there mentioned, and statements were given from several eminent cultivators who had used it. At that time the tedder was known only as an implement lately imported



WOOD'S MOWING MACHINE.

from England, and one which gave fair promise, especially if its construction could be simplified and its requirement of power for draught be lessened, of coming into general use. The years which have intervened have witnessed the improvements desired, and the fulfilment of the promise. The tedder is perhaps as widely known to-day as the mower was then.

A glance over the paper above referred to, also brings to mind other changes which have taken place relative to the aids generally employed in the hay harvest.

We note that only two of the mowers there mentioned as extensively used, or as being prominent candidates for public favor, continue to hold a place as general favorites at the present time. One of these, the "Buckeye" won a high position at an early date and has kept steadily along, retaining public confidence in a remarkable degree. The other, "Wood's," subsequently became the subject of great improvement, both in the arrangement and perfection of its parts, and in strength of construction; and rapidly rose to high favor, not only in the United States but in Europe also; and at the late Exposition at Paris carried off the highest honors. Without asserting its superiority over all rival machines, it may be pertinent to say that, more of its successful and satisfactory working has fallen within my observation than of any other, and that I deem it worthy of public confidence.

With the exception of these two, all which were then figured or described, have either dropped out from general use among us, or have reappeared with essential modifications, and under new names.

The meteorological phenomena of the year present some marked features. The early part of the season was wet almost beyond precedent; planting was unusually delayed, and, at one time, the prospect for abundant harvests was not flattering; but the harvests proved better than the promise, and upon the whole, it has been a year of general prosperity to the agricultural interest.

Sheep husbandry is passing through one of those temporary depressions, which to greater or less extent, affect all kinds of business; and it needs whatever of courage can be gathered from considerations of general utility, and of the special advantages of this branch of husbandry, together with the assurance that rise succeeds fall, to sustain the resolution of owners not to part with their flocks. In very truth this is a bad time to sell good animals, but an excellent time to weed out the inferior ones.

The prospect for the future of agriculture brightens. There is a more general feeling than ever before, among the people at large, that this is a State of immense natural resources, and of resources which have been permitted to remain dormant altogether too long. Railroads are being pushed with energy into new sections, and the facilities for transport and inter-communication will soon be largely increased.

The fact that public attention is being drawn to our unrivalled water-power, is one fraught with deep interest to the farmer. A diversified industry furnishes the best of all aids to agriculture. No art thrives alone. We are members one of another. Wherever the farmer can exchange the surplus products of his soil and of his toil at the least distance from his farm, for the greatest amount of goods needful for comfort and welfare, there he may thrive better than on richer soils and under sunnier skies with customers and helpers at longer distance.

It is my firm conviction that nowhere, upon fairly striking a balance between the advantages and drawbacks of various locations, can the place be found, where the farmer may comfortably secure to himself and those dependent on him, more of intrinsic and permanent value, or contribute more to the public welfare, than in the State of Maine. And it is pleasant to feel assured that a similar conviction is steadily growing in the minds of its inhabitants generally.

The year has been marked by events of significance and importance which deserve mention here; and the first to which I allude is the fact that the State Agricultural Society has resumed active operations. For the first time since 1860 it has held an exhibition, and it was one which proved a full success. With an empty treasury and without aid or promise of aid from the State, (uniformly granted in previous years,) it went forward, offering its premiums conditioned upon future pecuniary ability to meet the payments, and its officers labored unweariedly, and at great personal sacrifice, to insure success. The evidence furnished by this exhibition, of substantial progress in the various departments of agricultural and mechanical industry and skill, was most emphatic and exceedingly gratifying.

Another event has transpired which may constitute an era in the history of agriculture in Maine,—namely, the entrance of the "State College of Agriculture and the Mechanic Arts" upon its actual work of educating and training young men for the industrial pursuits of life. A class of highly promising young men has been gathered; less numerous, it may be, than in some similar institutions in other States, but considerably more so than the earlier classes which entered what is now the oldest, the most numerously attended and the best equipped of our literary colleges. Sufficient evidence that the necessity of more practical education is deeply felt throughout the community, is to be found in the fact of the increased attention given to it by all our educational institutions; and especially in the recent establishment of a School of Technology, or in other words, of Science applied to the Arts, including agriculture, in connection with Bowdoin College, and which has already three professors engaged in its work.

Is not the prospect highly encouraging that, as a "liberal and practical education of the industrial classes" begins to be supplied, both the facilities for teaching "such branches of learning as are related to agriculture and the mechanic arts," and the applicants for such instruction, may be greatly multiplied?

It is respectfully submitted that the name most frequently given, in common parlance, to the "State College of Agriculture and the Mechanic Arts," namely, "The Agricultural College," is partly a misnomer, or at least lacks descriptiveness, and tends to hide the full scope and intent of that institution. The true intention of the colleges endowed by act of Congress, was *to aid all branches of industry;* those which labor to convert crude materials into forms of utility, as really as that which produces food from the soil; and it is a matter of regret that the mechanics of Maine have not evinced a more active interest in the movement, and asserted the right which is their chartered privilege.

It is undoubtedly the conviction of many staunch friends of the college, that so grave an error was committed in its location, that it must necessarily labor under serious disadvantages which might as easily have been avoided, (unless the location be changed, which may not be practicable now,) and they may also believe that some of the measures subsequently adopted were not as wise as might have been; but allowing the correctness of these views and that the errors are irrevocable, all this furnishes no reasonable ground whatever for indifference to its prosperity. If we may not have all which was hoped for, we do well to be thankful for what we may have, and pray and labor for more. Feeble as the best, compared with what is expected from it, this institution needs the coöperation of all, and the hearty and earnest endeavors of all to enhance its ability and its efficiency.

May not the time be propitious for inaugurating somewhat more of system, and harmony of action between the various agencies established among us for the aid of agriculture? To a considerable extent these are, all of them, educational in their scope and effect. The State Agricultural Society together with the County Societies, being chiefly executive in their character, labor by bringing together for comparison and illustration, for example and emulation the best products of the soil, of the workshop and the household. The Board of Agriculture, a deliberative body, by its investigations, discussions and publications, labors to gather and diffuse knowledge. These operate more upon adults, while the influence of the College is more exclusively and directly upon the youth; but the end in view, with each and all, is substantially the same.

Without offering any details, or even any general plan, it has seemed to me that the suggestion was worthy of consideration.

But agriculture can never attain its true position as an art, nor make the substantial advances which will place it alongside other industrial avocations in this progressive age, until we do more than merely to gather and to diffuse existing knowledge. *We* *need positive increase of knowledge*, fully as much as we need to impart and diffuse generally what is already attained.

Let us look at this from a practical point of view. Upon how many points of every day practice are opinions widely dissimilar? Take a familiar example, potato culture; a matter touched upon in the preceding pages. Can any thing be apparently more simple and easily ascertained than what sized tubers, and whether cut or whole, is it best to plant? Yet put these questions to a hundred farmers who have planted potatoes and dug potatoes from boyhood up, and the chance is, that you will get nothing like uniformity in the replies. That some of them are mistaken, is as certain as that of three different ways of doing a thing, each cannot be the best way, yet they have arrived at their opinions by experience and observation, but upon such observation and experience only as have fallen to their lot, and these are insufficient data upon which to form a fixed conclusion, in a majority of cases. How then can such questions of practice be decided? I answer, only by a sufficient number of carefully conducted trials; and trials, in which, so far as possible, all sources of error are avoided, and these trials repeated year after year, until conclusions are reached, which, so far as the nature of the case admits, carry the force of mathematical demonstration. Who, among us, can spare the time in the busy periods of planting and harvesting, and possesses the inclination and the ability and the means and the perseverance necessary to conduct such a series of experiments to successful issue? I see not how any one can read carefully the report of one hundred and twenty-nine experiments made in one season, as given on pages 160 to 180, and their results, without feeling assured that they furnish an exceedingly valuable contribution towards such exact *knowledge* as is wanted in the place of mere *opinions*.

If the indications given by these experiments are verified by further trials of similar extent, conducted with equal care and precision, as I believe they would be; (every potato weighed, every distance measured, products weighed and no guessing any where,) and if, as a result of such knowledge, the potato crop of Maine were increased ten per cent., how much would that increase the annual income of the State?

Suppose that the 70,000 farmers in Maine, on an average, plant only one acre each, and dig a hundred and fifty bushels? If so, the crop would amount to upwards of ten millions of bushels, and ten per cent. of this would be one million of bushels; and these would sell for more than enough to endow an institute for original investigation such as cannot be found in the United States to-day. If such gain may be a probable result of the substitution of actual knowledge in place of opinion concerning a single item of procedure in the culture of one esculent root, for one year, what may not be expected from similar knowledge in relation to the whole range of agricultural practice?

It is a mortifying fact that no more facilities have been provided, anywhere in the United States, for original investigation. As the case now stands, if we would know what progress is making, not in the application of knowledge and mother wit to the mechanic arts, but in *real additions to agricultural knowledge,* we are compelled to send abroad for the information, and to remain in debt for it.

Experimental stations, as they are called, exist in Germany, plentifully too, compared with the paucity here, and as there conducted, are very nearly what we need. But in America, so far as I am advised, the only institution, *a leading object of which, is "to increase knowledge among men,"* is the Smithsonian; and for this we are indebted to a foreigner!—and of this it may be said, without disparagement, that however important the researches there inaugurated and supported, and however valuable its contributions to science, comparatively few of them relate to agriculture and these remotely and indirectly.

S. L. GOODALE,
Secretary of the Board of Agriculture.

JANUARY 20th, 1867.

APPENDIX.

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Amount received from the State during the year.	Amount raised by the Society during the year.	Whole amount of receipts for the year.	Am't of premiums offered in accordance with direction from Board of Agriculture.	Amount awarded on the above named offers.	Total amount of premiums offered.	Total amount awarded.	Incidental expenses of the Society for the year.	Whole amount of disbursements for the year.
Androscoggin,	297 00	591 45	888 45	75 00	13 00	678 25	352 50	513 04	865 54
Acton and Shapleigh,	130 50	348 71	479 21	32 75	18 25	238 25	381 75	18 25	400 00
East Oxford,	93 00	96 23	189 23	47 00	3 00	223 00	132 00	30 70	176 00
East Kennebec,	-	1,869 00	1,869 00	-	-	475 00	185 00	95 00	1,822 00
East Somerset,	88 38	254 45	342 83	15 00	-	434 90	215 15	137 40	328 23
Franklin,	138 45	353 02	491 47	33 00	-	434 25	325 90	150 02	475 92
Hancock,	376 00	702 45	1,078 45	100 00	-	807 00	538 00	100 00	928 00
Knox,	228 50	504 76	733 26	84 00	43 00	587 25	444 40	-	-
Kennebec,	164 50	377 06	541 56	45 00	25 00	634 50	586 50	288 60	875 00
North Kennebec,	235 50	514 00	749 50	60 00	5 00	712 50	413 75	167 94	581 69
North Aroostook,	97 15	118 60	215 75	27 00	4 75	215 30	167 75	48 00	215 75
North Franklin,	65 57	130 73	196 30	16 50	-	215 62	131 20	53 52	164 76
North Waldo,	93 98	220 20	314 18	24 00	-	326 75	240 50	18 75	-
North Penobscot,	118 90	103 00	221 90	21 00	11 00	384 32	175 28	61 25	236 53
Oxford,	154 62	655 30	809 92	30 00	10 00	389 50	272 85	434 50	790 33
Piscataquis Central,	150 32	489 34	639 66	40 50	3 00	316 34	276 23	248 56	521 79
Penobscot,	-	1,317 44	1,317 44	52 50	-	750 00	643 25	-	1,228 64
Sagadahoc,	281 16	1,098 07	1,379 23	73 00	2 00	805 75	610 15	456 67	1,366 82
Somerset Central,	160 00	300 00	460 00	40 00	-	565 00	500 00	75 00	-
Waldo,	290 47	1,260 00	1,626 47	73 00	18 00	900 00	237 50	254 00	1,727 00
West Oxford,	119 00	542 38	661 38	30 00	1 50	508 00	293 90	220 00	513 90
West Penobscot,	169 08	800 10	969 18	51 40	16 00	723 75	397 25	125 00	522 25
West Somerset,	113 81	234 00	347 81	30 00	8 00	398 00	365 00	64 75	429 75
West Washington,	239 47	545 17	784 64	50 00	-	877 85	527 95	236 65	773 60
York,	269 46	921 83	1,191 29	67 00	5 00	835 00	719 00	350 00	1,069 00

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Awarded for bulls and bull calves.	Working oxen four years old and over.	Steers under four years old.	Milch cows.	Heifers and heifer calves.	Fat cattle.	Trials of speed.	Stallions.	Breeding mares.	Amount awarded for other horses and colts.	Amount awarded for swine.	Amount awarded for sheep.	Amount awarded for poultry.	Total amount offered for live stock.	Total am't awarded for live stock.
Androscoggin,	15 00	44 00	41 00	38 00	15 00	6 00	17 00	10 00	–	23 00	–	13 00	3 50	231 00	225 00
Acton and Shapleigh,	5 00	31 00	24 25	11 25	6 75	8 00	6 00	4 00	3 00	22 00	4 00	10 00	5 00	124 25	151 25
East Oxford,	6 00	19 00	10 50	3 00	–	4 00	–	3 00	2 00	7 50	–	8 00	–	103 00	63 00
East Kennebec,	11 00	5 00	11 00	6 00	11 00	3 00	11 00	18 00	10 00	27 00	–	11 00	–	227 00	125 00
East Somerset,	9 00	21 75	16 75	7 50	6 25	–	105 00	5 00	4 50	15 00	–	–	–	360 25	190 75
Franklin,	18 50	41 00	40 25	6 50	4 25	10 50	66 00	20 50	5 00	10 00	–	9 75	–	302 40	232 25
Hancock,	3 00	17 00	15 00	39 00	5 00	–	172 00	15 00	16 00	20 00	–	23 00	–	392 00	332 00
Knox,	20 00	11 00	9 00	7 00	3 00	7 00	140 00	16 00	7 00	11 00	5 00	5 00	2 00	311 00	285 50
Kennebec,	12 00	48 00	20 00	14 00	11 00	5 00	24 00	7 00	6 00	18 00	7 00	8 00	–	358 00	180 00
North Kennebec,	25 00	49 00	25 00	29 00	14 00	15 00	22 00	18 00	10 00	24 00	6 00	25 00	9 00	431 00	337 00
North Aroostook,	4 75	2 00	1 75	10 00	4 00	–	50 00	15 00	15 00	6 50	2 00	2 00	–	67 00	63 00
North Franklin,	7 90	20 50	19 85	1 75	4 60	4 25	3 50	2 50	1 75	7 30	7 00	10 50	3 50	92 20	80 40
North Waldo,	11 50	41 00	11 00	18 00	3 50	–	68 00	12 00	5 00	20 50	–	26 00	–	248 00	216 50
North Penobscot,	1 50	5 50	13 00	5 00	6 50	–	20 00	–	3 00	16 50	2 50	7 00	–	154 50	65 50
Oxford,	10 00	25 00	10 00	5 00	5 00	8 00	48 00	6 00	4 00	16 00	3 00	7 00	–	198 50	185 00
Piscataquis Central,	7 00	59 00	14 00	3 00	2 00	–	80 00	9 00	6 00	19 50	2 00	13 00	–	244 60	217 00
Penobscot,	16 00	4 00	16 00	62 00	27 00	2 00	350 00	27 00	8 00	26 00	5 00	16 00	–	696 00	559 00
Sagadahoc,	18 00	32 00	19 25	20 00	21 00	8 00	38 00	16 00	2 00	31 75	13 50	22 00	6 00	290 00	246 50
Somerset Central,	32 00	39 00	22 75	25 00	13 00	–	60 00	18 00	9 00	19 25	10 00	21 00	5 00	–	–
Waldo,	–	20 00	11 00	–	6 00	–	63 00	10 00	5 00	26 00	3 00	19 00	2 00	191 50	–
West Oxford,	14 00	13 00	13 00	8 00	8 50	9 00	27 00	4 00	2 00	17 50	5 00	5 00	4 00	273 50	160 25
West Penobscot,	24 50	21 25	15 75	18 75	22 75	8 50	5 75	16 00	6 50	32 25	–	21 25	2 00	422 00	193 25
West Somerset,	29 00	46 00	45 00	21 00	17 50	–	–	–	–	–	1 00	34 00	–	312 00	296 00
West Washington,	31 00	9 00	26 00	18 00	23 50	10 00	183 00	–	14 00	30 50	3 00	15 00	1 25	525 00	354 25
York,	18 00	17 00	22 00	24 00	5 00	9 00	190 00	10 00	13 00	40 00	–	15 00	5 00	516 00	533 00

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Amount awarded for management and improvement of farms.	Amount awarded for manures and experiments with them.	Amount awarded for plowing at the exhibition.	Amount awarded for fruit and flowers.	Honey, sugar and syrup.	Butter and cheese.	Agricultural implements.	Household manufactures and needle work.	Manufactures of wood, iron and leather.	Other mechanical products.	For all objects not enumerated above.
Androscoggin,	-	-	-	26 75	1 50	18 00	6 00	19 25	9 50	-	60 00
Acton and Shapleigh,	-	-	9 00	13 50	3 50	13 25	-	49 00	3 00	-	84 00
East Oxford,	-	-	6 00	1 00	-	7 50	2 00	15 00	6 00	2 00	5 00
East Kennebec,	-	-	-	3 00	6 50	7 00	-	12 00	2 00	-	-
East Somerset,	-	-	-	-	-	10 25	-	7 40	-	-	-
Franklin,	-	-	-	-	1 00	4 00	1 00	20 50	2 00	3 50	4 00
Hancock,	-	-	-	20 00	5 00	18 00	2 00	17 00	6 00	8 00	37 00
Knox,	-	-	-	20 00	1 00	9 00	-	30 00	-	-	78 40
Kennebec,	-	-	-	8 00	3 00	24 00	15 00	65 00	15 00	13 00	15 00
North Kennebec,	-	-	-	7 00	3 00	20 00	-	20 50	-	-	-
North Aroostook,	-	-	-	-	75	8 00	-	10 00	-	-	15 00
North Franklin,	-	-	2 50	-	25	4 75	1 50	22 70	4 25	1 00	1 00
North Waldo,	-	-	-	3 50	-	5 00	1 50	13 75	1 00	-	-
West Penobscot,	-	-	-	20 85	4 75	17 25	5 25	48 10	1 50	2 00	-
Oxford,	-	-	7 00	13 50	-	4 25	5 00	14 46	13 00	-	13 64
Piscataquis,	-	-	-	2 25	1 50	17 00	-	25 23	-	-	1 75
Penobscot,	-	-	-	25 00	5 00	16 25	-	-	-	-	-
Sagadahoc,	3 00	3 00	9 00	24 75	4 00	18 00	1 00	63 15	5 00	11 00	165 50
Somerset Central,	-	-	-	-	1 75	12 00	-	40 00	-	-	-
Waldo,	-	-	-	10 50	3 00	11 00	-	24 00	2 00	-	-
West Oxford,	-	-	-	11 50	6 90	16 75	6 50	56 50	5 75	-	12 75
North Penobscot,	-	-	-	6 25	-	12 00	2 00	24 11	4 70	-	9 02
West Somerset,	-	-	-	-	-	10 00	-	18 00	-	-	-
West Washington,	-	-	-	9 50	1 00	14 50	1 25	30 25	18 00	-	-
York,	-	-	-	33 00	6 00	25 00	5 00	83 00	32 00	-	138 00

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Amount awarded for Indian corn.	Wheat.	Rye.	Barley.	Oats.	Buckwheat.	Hay.	Potatoes.	Carrots.	Beets.	Turnips.	Total am't offered for grain and root crops.	Total am't awarded for grain and root crops.
Androscoggin,	9 50	16 00	-	1 00	1 00	-	5 00	11 00	-	50	50	-	-
Acton and Shapleigh,	9 75	23 25	1 50	1 00	-	-	-	6 25	1 25	1 75	1 25	49 00	46 00
East Oxford,	9 20	3 00	-	-	3 00	-	-	3 00	-	-	-	47 00	18 20
East Kennebec,	6 00	-	-	-	-	-	-	6	-	-	-	92 00	12 00
East Somerset,	2 25	-	-	2 25	-	-	-	2 25	-	-	-	24 75	6 75
Franklin,	-	-	-	-	-	-	-	-	-	-	-	49 65	3 50
Hancock,	16 00	5 00	-	-	-	-	7 00	-	-	3 00	7 00	134 00	72 00
Knox,	10 00	43 00	-	3 00	-	-	-	9 00	-	-	4	228 50	77 00
Kennebec,	7 00	25 00	-	6 00	-	-	-	5 00	3 00	5 00	3 00	83 00	43 00
North Aroostook,	3 75	4 75	-	-	1 75	4 00	-	3 00	-	-	-	54 00	17 25
North Kennebec,	-	5 00	-	-	-	-	-	-	-	-	-	111 00	5 00
North Franklin,	2 00	8 75	-	1 00	1 00	1 00	-	4 25	-	-	-	47 95	18 50
North Waldo,	-	-	-	-	-	-	-	-	-	-	-	44 75	-
North Penobscot,	12 00	11 00	-	-	-	2 00	-	5 00	-	-	-	105 00	31 00
Oxford,	-	10 00	-	-	-	-	-	6 00	-	-	-	72 00	21 00
Piscataquis Central,	-	5 00	-	-	-	-	-	-	-	25	75	43 50	6 00
Penobscot,	7 50	-	-	-	-	-	-	7 50	-	-	3 00	122 50	18 00
Sagadahoc,	10 25	2 00	3 75	4 50	2 00	3 50	-	11 00	50	3 75	4 50	153 75	60 00
Somerset Central,	-	-	-	-	-	-	-	-	-	-	-	75 00	-
Waldo,	10 00	18 00	-	-	3 00	-	-	5 00	-	-	-	127 00	-
West Oxford,	10 00	1 50	-	-	-	-	-	150 00	50	50	50 00	73 25	25 00
West Penobscot,	26 70	16 00	-	2 00	2 50	2 50	-	30 45	-	-	-	184 20	91 30
West Somerset,	8 00	8 00	-	-	-	-	-	5 00	-	-	-	56 00	21 00
West Washington,	10 00	1 20	1 00	8 00	16 00	1 00	-	16 50	1 00	1 50	1 50	188 70	49 70
York,	18 00	5 00	-	-	-	-	-	2 25	1 50	1 50	50	115 00	-

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