DOCUMENTS

PRINTED BY ORDER OF

THE LEGISLATURE

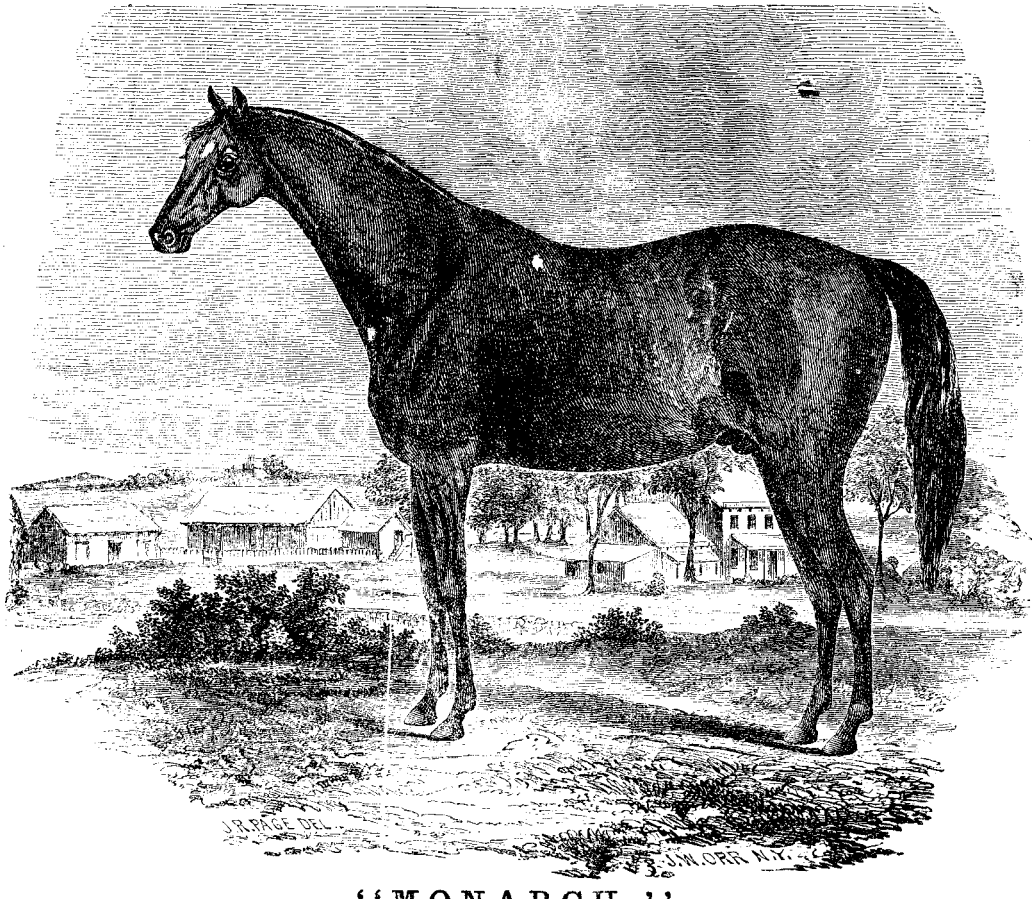
OF THE

STATE OF MAINE,

A. D. 1859.

AUGUSTA:
STEVENS & SAYWARD, PRINTERS TO THE STATE.

1859.



"MONARCH."

THIRD ANNUAL REPORT

OF THE

SECRETARY

OF THE

MAINE BOARD OF AGRICULTURE.

1858.

AUGUSTA:
STEVENS & SAYWARD, PRINTERS TO THE STATE.
1859.

BOARD OF AGRICULTURE...1858.

ROBERT MARTIN, PRESIDENT.
SAMUEL F. PERLEY, VICE PRESIDENT.
STEPHEN L. GOODALE, SECRETARY.

NAME.	SOCIETY.	P. O. ADDRESS.
FIRST CLASS—(Term expires January, 1859.)		
Seward Dill,	North Franklin,	Phillips.
E. L. Hammond,	Piscataquis,	Atkinson.
B. F. Leadbetter,	North Somerset,	Bingham.
Albert Noyes,	Bangor Horticultural,	Bangor.
Hugh Porter,	Washington County,	Pembroke.
Hiram Russ,	Franklin County,	Farmington.
Hiram Stevens,	North Aroostook,	Maple Grove.
SECOND CLASS—(Term expires January, 1860.)		
Joseph Avery,	Lincoln County,	West Jefferson.
William R. Flint,	West Somerset,	North Anson.
Francis Fuller,	Kennebec County,	East Winthrop.
Robert Martin,	Androscoggin County,	West Danville.
Samuel F. Perley,	Maine State,	Naples.
Francis L. Rice,	West Oxford,	Denmark.
John K. Russell,	Somerset Central,	Skowhegan.
J. D. Tucker,	Waldo County,	Lincolnville.
THIRD CLASS—(Term expires January, 1861.)		
John F. Anderson,	Cumberland County,	South Windham.
B. C. Bailey,	Sagadahoc County,	Bath.
W. E. Drummond,	North Kennebec,	Winslow.
S. L. Goodale,	York County,	Saco.
Daniel Lancaster,	South Kennebec,	Farmingdale.
William M. Palmer,	East Somerset,	Hartland.
John Thissell,	West Penobscot,	East Corinth.
N. T. True,	Oxford County,	Bethel.

REPORT.

To the Senate and House of Representatives:

In accordance with the requirements of the statute establishing the Board of Agriculture, I proceed first to lay before you "a detailed report of its doings" at the last session.

The Board met in Augusta on the 20th January, 1857, agreeably to the provisions of law, at the Agricultural Room in the Capitol. For purposes of organization, Robert Martin was chosen Chairman. A committee was next appointed to receive credentials, who reported the following persons present and holding certificates of election:

S. F. Perley, Naples, delegate from the State Agricultural Society.
Robert Martin, West Danville, from Androscoggin County Society.
J. F. Anderson, South Windham, from Cumberland County Society.
D. A. Fairbanks, Augusta, from Maine Pomological Society.
Joseph Avery, West Jefferson, from Lincoln County Society.
William R. Flint, North Anson, from West Somerset Society.
N. T. True, Bethel, from Oxford County Society.
Hiram Russ, Farmington, from Franklin County Society.
Seward Dill, Phillips, from North Franklin Society.
S. L. Goodale, Saco, from York County Society.
Francis Fuller, East Winthrop, from Kennebec County Society.
Daniel Lancaster, Farmingdale, from South Kennebec Society.
Francis L. Rice, Denmark, from West Oxford Society.
Albert Noyes, Bangor, from Bangor Horticultural Society.
John Thissell, East Corinth, from West Penobscot Society.
William E. Drummond, Winslow, from North Kennebec Society.
William M. Palmer, Hartland, from East Somerset Society.
Hugh Porter, Pembroke, from Washington County Society.
E. L. Hammond, Atkinson, from Piscataquis Central Society.

John K. Russell, Skowhegan, from Somerset Central Society.

J. D. Tucker, Lincolnville, from Waldo County Society.

B. F. Leadbetter, Bingham, from North Somerset Society.

B. C. Bailey, Bath, from Sagadahoc County Society.

Hiram Stevens and E. W. Hoyt, of Fort Fairfield, from North Aroostook, (contested.)

Permanent organization was then effected by the choice of officers for the year ensuing, as follows:

ROBERT MARTIN, *President.*
S. F. PERLEY, *Vice President.*
S. L. GOODALE, *Secretary.*
L. T. BOOTHBY, *Messsenger.*

The rules of order of last year were then adopted for the present session.

On motion of Mr. Dill, *Voted*, That a committee on elections be appointed: Messrs. Dill, Perley and Flint.

On motion of the Secretary, a business committee was raised to report subjects or topics for discussion: Messrs. Goodale, True and Flint.

On motion of Mr. Dill, a committee was raised to arrange for informal meetings in the evening, for the discussion of topics connected with practical agriculture, in which members of the Legislature, and all others interested, be invited to take part: Messrs. Dill, Avery and Fuller.

The Secretary here suggested, that pending the action of the business committee it might be well for each member to state what had been the practical results of the operations of the Society which he represents; whereupon, it was *Voted*, That the several members of the Board be called upon to state what had been the influence of their respective societies on the interests of agriculture, horticulture, and the arts connected therewith, and to make such suggestions in relation to their management as they may deem proper. In conformity with this vote, the President proceeded to call the several societies in alphabetical order.

ANDROSCOGGIN. The President stated that at the time of the formation of this society, agriculture was in a low state, and its operations carried on in rather a rude manner. Stock was small;

three years old steers being seldom found to average over six feet in girth. Crops were small, also.

Four years ago, when the society went into operation, there was a general indifference to it among farmers. In my own town it was exceedingly difficult to induce farmers to take their stock and products to the show, even by the most earnest personal solicitation; and the first year, only seventeen members could possibly be induced to join. Last year, sixty-nine came forward readily, and now the state of things is widely different. There is a real interest pervading the whole community, and the ladies have contributed very largely to this state of things. They oftentimes lead off in their families in its behalf. One woman insisted that if her husband would not drive the oxen to the show, she would cause the team to be sent by some one else. This team took the first premium.

The opinion was generally expressed, that at the last fair the young stock was worth double what it was five years before, and that this was mainly to be attributed to the influence of the society. Two years old steers were there presented, measuring from six feet eight to nine inches in girth; calves from six to eight months old, weighing from four hundred to six hundred pounds. Two years old cattle are worth as much now, as four years old ones were formerly. Crops have increased in the same proportion.

BANGOR HORTICULTURAL SOCIETY. A. Noyes said that the Horticultural Society there had been of great service in awakening an interest in fruit culture. He commenced fruit raising, and in common with some of his neighbors, succeeded in raising fine plums and other fruits in large quantities. There were two hard winters, which greatly injured the trees and destroyed many of them. Among the smaller fruits, many succeeded very well. He has never been troubled with mildew upon his gooseberries. The soil of Bangor seems well adapted to this fruit.

During the past twelve years, great progress had been made in fruit culture generally, in the vicinity. There were probably more vineries in Bangor than in any other town in the State, and productive in grapes of the highest excellence.

CUMBERLAND. J. F. Anderson remarked that he was but a new member of the society, having had nothing to do with it till within

three years, and was not therefore so well posted in relation to its past doings as some others. I can however say, that there has been a marked improvement in the quality of stock in our county since I have been connected with the society. Farmers take greater interest in this matter than formerly. The same is true with reference to farm improvements and all matters pertaining to agriculture. But I will not prolong my remarks, and call on Mr. Perley, who is an old and well-tried member.

S. F. Perley, responded. I am hardly prepared to make a statement of the present state of the affairs of the Cumberland County Society. A few years ago it was nearly run down. Very few took any interest in the matter, and a crisis in its affairs arrived. The question was fairly before us, whether to stand still and die, or rouse ourselves and give it vitality. This last was determined on. A few took the matter in hand, made a rally, and now the society is in good standing, and doing a good work for the agricultural interests of the county.

The improvements going on in agricultural operations among us are very marked. Much attention is now given to underdraining, especially in the lower parts of the county. Several persons are making experiments in underdraining, from which we expect to hear in due time.

In the upper parts of the county, the soil is stony, strong and well adapted to orcharding, to which increased attention is given of late. Attention is also turned to the improvement of stock, and some full blooded animals are found among us. All this, I think, is to be traced to the influence of the society's efforts.

I know the labor of the farm is hard. It requires diligence and perseverance. We become weary when night arrives, and many are ready to ask, does it all pay? I think it does. If we are weary at night, we can rest, and amid the rural scenery, and the social enjoyments of home, we have our reward. Our agricultural efforts, through our associations, help to make men more social, and bring them together as brethren. It pays in this view, even were this all. So much do I value this, that I would be unwilling to live in a community where no such association exists.

East Somerset. W. M. Palmer said that this society had been

established but recently, and had not yet made great progress. A good spirit prevailed, and a determination to make greater exertions. But short as has been our existence, we already see the effects of its influence in the improvement of stock and the increase of manure. Stock has doubled in value, and the amount of manure produced is at least twice as great as formerly.

FRANKLIN. Hiram Russ.—Our society suffered temporarily a few years ago by the formation of another in the northern part of the county, but it has rallied in numbers and strength to nearly what it was before. Its influence may be distinctly seen in the improvements going on. Wheat is less cultivated than formerly, but other grains, especially corn, are more. Fruit succeeds well. The improvement in stock has been greater than in modes of cultivation.

LINCOLN. Mr. Avery represented the oldest county in the State, and almost the youngest society. Agriculture has not been much attended to in the county. Commerce and ship-building have absorbed the attention of the people to the neglect of agriculture. Five years ago we organized our society, and held a fair at Wiscasset. A few persons had all the work to do, but their efforts have been attended with great success. Stock has improved in quality from forty to fifty per cent., and every other branch of agriculture in the same proportion. Public attention is now being strongly turned to underdraining, and other measures of improvement. This change is to be attributed to the influence of the society's operations. A division of the society is now talked of, so as to better secure the general accommodation of the people. It is thought that this will induce greater activity. We find that rivalry between the different towns to see who will make the most improvement, is one important element of success.

NORTH AROOSTOOK. Hiram Stevens.—Our society was incorporated in 1850, and the first show was held in the fall of 1851. The result of its efforts and influence is chiefly seen in a marked improvement in stock. The effort now is to excel in breeding the best cows, steers and oxen. Some full blood animals have been introduced into the county. A Durham bull and a Hereford bull and heifer were introduced into our county some years since, which have greatly improved the stock, as any one will see at even a casual

glance in passing through the county. Last spring a full blood North Devon was introduced; of course it is too soon to speak with any confidence of what the result will be.

There is still much need of improvement, especially in agricultural operations. There is enormous waste of manure, no care at all being taken of it by most of our farmers, and even those who take any tolerable care of the solid excrements use no means to preserve the liquid manures. They use no absorbents, and consequently, this most valuable half of the manure is utterly lost.

I think the construction of vaults under the stables to receive the liquid manure, well supplied with absorbents, the best method of preserving manure. By this means alone, the value of stable manure may be increased a hundred per cent.

Another means of improvement is furnishing our cattle with warm shelter. The importance of this as a matter of economy, can hardly be over-estimated.

Mr. Stevens subsequently replied to an inquiry regarding the quality and management of the new soil of his section of the State, as follows:

I think I can show that the soil in Aroostook county will not only remunerate the husbandman for his labor, but that a farm well conducted is a source of much profit. I will take for example, fifty acres situated on an elevated hard wood ridge; in such locations I consider the risk of a crop of wheat, rye, oats, buckwheat, or even corn not coming to perfection, is but a mere trifle. To fell the trees and clear the land ready for the first crop, would cost $10 per acre, making $500. This sum is usually paid for felling and clearing land, and a man can contract to have any amount cleared at that price that he may want. One and one-half bushels of seed wheat is generally sown on an acre—this is worth $2 25; value of wheat to sow fifty acres, $112.50; sowing and harrowing, $2 per acre, $100; harvesting, $5 per acre, $250; threshing, $1.13 per acre, $56.50. The whole cost of a crop of wheat grown on fifty acres, $1,119. Yield, I put at twenty-five bushels per acre, making twelve hundred and fifty bushels, which is worth $1.50 per bushel, making the value of the whole crop $1,875, which, after deducting the cost, leaves a profit of $756.

In making the above estimate I endeavor to keep below what is generally considered a fair yield on our best hard wood land; thirty to thirty-five, or forty, and even fifty bushels have been harvested from an acre in Aroostook county. In 1851 I raised thirty-five and a half bushels to the acre. This crop I entered for premium, but did not get it, from the fact that a friend of mine in another township raised thirty-seven and a half bushels to the acre.

The growing of wheat is not confined to new lands. Last spring I broke up a piece of pasture the last days of April, sowed it to wheat the 9th day of May; when it was threshed I found the yield to be twenty bushels and nineteen quarts to the acre; the wheat was of good quality, making thirty-eight pounds of fine flour per bushel. I top dressed with one bushel of plaster and two bushels of unleached wood ashes per acre, after it had got up two or three inches. My crop would have been larger, had not the midge destroyed a portion of it, which good judges estimated to be one-third.

I will try to explain how we manage with the second crop, that is taken off from lands after they have been cleared of timber. If the trees lay over one summer after felling, before they are burnt and cleared off, we plow for the second crop; but if they are cleared off the summer and fall that they were felled in June previous, the land should not be plowed for the second crop, the ground being too full of green roots. In the last mentioned case, we will consider our land of fifty acres that has had a crop of wheat taken from it. The second crop should be oats, which is harrowed in without plowing. Three bushels of oats per acre, at forty cents per bushel, would be $60 for fifty acres; sowing and harrowing, at $1.75 per acre, $87 50; harvesting, at $2.50 per acre, $125; threshing, at $2.50 per acre, $125. Cost of a crop of oats on fifty acres of land, $397.50. The yield per acre, fifty bushels, making twenty-five hundred bushels, worth thirty-five cents per bushel, amounts to $875, and after deducting the cost, leaves a profit of $477.50.

Before sowing for the third crop the land should be plowed, which costs about $2 per acre, $100. I should, in all cases, sow on buckwheat, and seed down with the third crop, where the previous crops have been wheat and oats. One bushel of buckwheat will seed an acre—fifty bushels, worth fifty cents per bushel, would be $25;

twenty pounds of clover seed per acre, one thousand pounds, at twelve cents, $120; sowing and harrowing, $1.75 per acre, $87.50; harvesting and threshing, $2.50 per acre, $125. Cost of a crop of buckwheat, on fifty acres of land, and seeding the land down to clover, $457.50; yield, thirty bushels to the acre—fifteen hundred bushels, worth forty cents per bushel, $600. After deducting the cost of raising and seeding the land to clover, it leaves a profit of $142.50. By the above estimate, which I intend should rather fall below an average, the net income is $1,376, on clearing fifty acres and taking off three crops of grain; then leaving the land seeded down for a crop of hay or grass seed. I will here state that if I should seed down for hay, I should sow on ten pounds of clover seed, and eight quarts of herdsgrass, to the acre, which would be less expense than seeding with clover, only.

NORTH FRANKLIN. Seward Dill stated that their society had been organized five years. Its members are a good deal scattered, but it has gone on prospering. Our shows have been well attended, and are increasing in interest. The society is in a good condition and its prospects flattering, and I think is doing a good work.

As an instance of improvement, I will mention a piece of land in our vicinity which was very stony and barren. The owner took it in hand, dug out the stones and cleared up thirty acres. He carted out muck which he exposed to the winter's frost, and then mixed salt and leached ashes with it, and applied the compost to this land. He used from three to four hundred bushels of leached ashes, to from fifty to seventy-five cords of muck. The result was, the production of fine crops of everything attempted to be raised from it.

I am not so much of a farmer as some perhaps may suppose. I was brought up on a farm, but have not made farming a business, although I cultivate some fifty acres of land, which is very stony and hard, and has been regarded as rather a hopeless affair. When I began to fence it, my neighbors laughed at me and wanted to know why I built a fence around such land, and concluded that its only use could be merely to keep animals off it, rather than on it, because I could never think of their living if shut up on it. They must starve, for all they could get from it. But I kept at my work, built my fence, hauled muck and applied to it, and finally

laid it down to grass, and now have the best pasture in the neighborhood.

NORTH KENNEBEC. William E. Drummond.—Our society is five years old. All its fairs have been held in the vicinity of Waterville. We have purchased grounds in Waterville, have it fenced and partially improved. Our numbers are increasing, and a good degree of improvement is taking place in the vicinity, under its auspices, in stock and every other branch of farming. We have improved stock of various kinds. In neat stock, the Durhams predominate, and in swine, the Suffolk and Essex.

OXFORD. N. T. True.—Until within two years, the society moved about. During this time everything dragged heavily. The exhibitions were meagre in quantity and inferior in character. People, wherever it went, felt it a burden. The last show before it located afforded an income of only about $30.

A committee was raised to take into consideration the subject of locating the show. This committee decided in favor of so doing, and finally fixed on a site between South Paris and Norway Village. The grounds were purchased and fenced by the citizens in the vicinity, and the society uses them free of rent so long as it chooses to occupy the same as a show ground. Since then its affairs have been highly prosperous.

Under the present auspices of the society, a very considerable improvement in stock and agriculture in general is taking place. Improved breeds of stock have been recently introduced into the county, and a growing interest in our fairs and agricultural improvement, is every where manifest. Devon, Durham, and Hereford stock may now be found among us. Devons and Herefords are regarded as the best.

Improvement is also going forward in fruit growing. Apples, pears, cherries, grapes, and the small fruits, are receiving considerable attention.

Barn cellars are increasing for the protection of manure. It is not difficult to get a cellar under a barn on level ground. My barn stood on such a piece of ground. It was thirty-six feet by forty-two feet. I raised it up two feet, and found no difficulty in making a good cellar and dry. It is not so formidable a matter to dig out a hole under a barn as many imagine.

In the northeastern part of the county, in the town of Gilead, is a strip of very fertile land, which is occupied by wealthy farmers. This land is on the Androscoggin river, and a portion of each farm is intervale. From the intervale the land rises with considerable abruptness into mountains, the sides of which are occupied as orchards and pastures, the soil of which is very fertile, though stony and hard. One young man born in this region went to Boston, and for several years engaged in trade; but he has left the city and city life, and returned to the valley of his birth and engaged in farming with real devotion and intelligence. He has introduced a Hereford and a Devon bull which are adding very much to the value of our stock. He has also introduced the Cheviot, a very hardy race of sheep, from the Cheviot mountains in Scotland. He has gone into the business of making manure in good earnest. There was a large pile of scrapings of the chipyard, which had been accumulating for years. This he put under contribution; when dug he hauled it into a shelter, and during this winter and the summer past, he has bedded his cattle with it, and then thrown it into his barn cellar to his hogs for them to work over, and to add to his "*pile.*" This we examined, and we found it exceedingly odoriferous. It had that peculiar fragrance which is always so grateful to the olfactories of a good farmer, from such a source.

West Oxford. F. L. Rice.—Our society is probably the smallest society in Maine. It was set off from the Oxford County Society eight years ago, and embraces only eight towns. The Saco river meanders through our territory, and forms a large tract of intervale and meadow, which last is but little above low water level, and is overflowed by every considerable freshet. On these meadows are cut great quantities of coarse hay on which young stock is mostly wintered. The higher intervale is very productive when well cultivated; but makes but indifferent pasture and mowing, in consequence of its great tendency to the growth of the mosses which seem to kill out the grass and prevent its forming a close turf. Back from the intervale the land is stony and hard, and on this land only do pastures and orchards flourish. Apple trees do not succeed at all on the intervale. I should have said that there is usually a strip of pine plain between the intervale and the upland, which is not much improved.

Our show last year came near being a failure, in consequence of the unwillingness of the people to carry articles for exhibition. But the society has done good. Our cattle have increased in value not less than fifty per cent. So with husbandry in general, there has been a great improvement. We now as often raise sixty bushels of Indian corn to the acre as we formerly did forty.

Two years ago one of our citizens bought at Brighton a calf of the Hungarian breed. He was a very inferior looking animal—so much so that no one would buy him. The owner put him out to winter, and he was kept on meadow hay, and with this keeping he gained five inches in four months. We now have some of his calves a year old, and they promise finely. When young they look mean, but grow rapidly after they are about a year old. They have not been grown with us long enough to test their qualities fully for farm stock, but they promise to be best adapted to our soil and climate of any breed we have ever had. They seem to be exceedingly tough and hardy.

West Penobscot. John Thissell said that the society which he represented had held but three exhibitions as yet; they had been highly satisfactory; at the last there were upwards of a hundred pairs of oxen, and it would compare well in most respects with any in the State. A quickened feeling is apparent among farmers in the fourteen towns which compose the territorial limits of the society. Improvement is most strongly marked in the better herds of blood animals; the Devons, Ayrshires and Durhams had been introduced.

South Kennebec. Daniel Lancaster said that the South Kennebec Society was organized for the purpose of interesting the people in the southern portion of the county. The shows have been well attended, and the improvement in agriculture, in stock raising, horses, butter, root crops and vegetables, and other departments, has been marked, and this improvement is going on successfully. Our premiums paid last year, amounted to about $600. A few years ago we paid only $200.

Kennebec. Francis Fuller.—The society I represent is the oldest in the State. It originated in the Winthrop farmers' association. From various causes the society at one time became reduced; but by the efforts of a few it was revived, and finally located. Its shows became more interesting annually, and received more of the

sympathy of farmers. The last show had on exhibition six hundred pairs of steers and oxen.

Importations have been made of blood animals at different times. Durhams are most in favor. Blood stock of this is bred by Mr. Wardsworth of East Livermore. Our society has promoted the interests of agriculture in various ways. Emulation through its agency has kept up improvement in neat stock. We now breed steers at three years old that measure seven feet in girth, and oxen grow to the size of eight and one-half feet. They are also improving in symmetry and beauty.

Of late years, less interest has been felt in sheep. As the county has grown older, the breeding of sheep has been gradually dropped. But within a short time attention has again been called to it, and a new interest has been awakened in sheep farming. The same is true of all kinds of stock, and of farming in general. Farmers are improving by deep plowing, subsoiling and underdraining. We expect, through the agency of our society, to carry forward and perfect all these things.

West Somerset. William R. Flint remarked that he represented the old society in his county which formerly embraced all the territory above Kennebec, but is now divided up into four societies. The liberal policy pursued by the State towards agricultural societies, has been of great service in keeping our society alive, for it almost died out while the whole remained together, on account of constant bickerings about the place for our shows. Since the formation of other societies, within our borders, its importance has increased in the estimation of our citizens, and more interest has been awakened in its behalf. It is not located, but has always held its shows at the same place.

The county is making great improvements in the quality of its stock and sheep, and a new and better interest is excited upon the farming community by means of the aid of the State and the existence of agricultural societies. The mind is interested by the diffusion of information through the reports of the Secretary of the Board. The last report may be regarded, if circulated as it should be, of more value to Maine than a gift of ten thousand dollars.

The growing of sheep, some years since, was much depressed, but the quality of wool has improved; and the number of flocks have

been kept up in Somerset county. Sheep raising is looked upon with favor, and some farmers say that they would prefer to let sheep into their pastures without charge than not to have them there. Sheep he regards as more profitable, even at present prices, than any other stock. He would not farm without sheep, and no farm should be deemed fully stocked without sheep. The cost of keeping is about $1.50 a year. The wool will pay that or more, and the increase may be regarded as profit.

The best sheep in the State are within the borders of this society. They are of the fine wooled varieties. Importations were first made into Readfield, but from the want of a demand for such wool, which kept its price down nearly to that of the common qualities, the growth of choice breeds declined and nearly disappeared from its original district. But the farmers in our section kept up their stock, and have found their interest in it. The breeds are the French and Spanish Merino, the latter of which is the hardiest. They are hardier and tougher than the old natives—are not apt to have twins, nor do they attain maturity so early as some others; but they are longer lived.

Improvement is also going on in neat stock. Our shows exhibit some of the finest specimens any where to be found, especially young cattle. At our last show a yoke of two years old steers sold for $160.

Mr Flint also added some general remarks in relation to the importance of farming in Maine, and expressed the opinion that it was the paramount interest, and is fast obtaining the position in the minds of the people that belongs to it. I hope, said he, that our young men will come to see that farming is as honorable and profitable as any other employment and calling. There are some who found this out years ago, but many do not yet believe it. It has been demonstrated in individual cases One young man of his acquaintance told another that he would take $1,000 and go into farming, and he might take the same sum and go into any other business, and in a series of years, he would make the most money. And he has done it. The first is well off and the other lives.

North Somerset. B F Leadbetter —The society I represent is in its infancy, and has not had time to accomplish a great deal. We held cattle shows before the society was formed, and they did good. Since our organization we have held two shows, and very

good ones. More interest is manifested in stock than in the production of crops. Good stock was introduced some twenty years ago, but we want the best, and are doing what we can to improve.

In relation to sheep, every farmer keeps a small flock, and these are generally very good. The products of the dairy will compare favorably with those of any other part of the country. Our swine are mostly Suffolk and their grades.

Mr. Sears of Winthrop, delivered the address at our first fair. He brought some apples to exhibit, but he found those on exhibition were so much superior to his own, that he did not show them.

Farmers sow the six-rowed barley, and prefer it to wheat; twenty-five bushels being an average crop per acre on plowed ground. Wheat does not succeed well. The Java wheat yields bad crops, makes poor flour, and is not in favor. We sow early. Oats usually sown on greensward, turned in the fall eight inches deep; fifty bushels an average crop.

Our principal crops are potatoes, corn, barley and oats, and we get good crops of all. Last season I turned over six or eight acres of grass ground and sowed it to oats, and got fifty bushels to the acre. I can see abundant evidence all around me, that our society is doing good service, in promoting improvement in everything pertaining to farming.

PISCATAQUIS. E. L. Hammond.—Our society has been increasing in numbers and activity ever since it was formed, and its existence was coeval with our county. The old Penobscot society infused into our agriculture some spirit and activity, and we have gone on improving every year since we commenced. This year our show was the best we ever had. We have very good stock, but we cannot compare for size with the older counties, as reported at this Board. We have not so large a variety of breeds as some other parts of the State. The Durhams predominate. We have a large breed of cattle among us of a coarse make, which are not thought much of by our farmers. The celebrated bull State of Maine, exhibited at the world's fair at New York, was of this breed. Where it came from, I do not know.

There are not many large flocks of sheep in the county at present, though the time was when there was one flock of about six hundred sheep, within my knowledge.

Our agricultural shows are very apt to suffer from everybody thinking that everybody else will have things at the show, and so neglect to carry articles, under the impression that they stand no chance to obtain premiums, in consequence of the multiplicity of competitors.

People are now turning their attention to deep plowing. Some experiments are now in process of trial. We call ten inches deep plowing, and use two or three yokes of oxen to execute it, according to the stiffness of the soil.

Lumbering has affected agriculture adversely. Farmers have sold off their hay to be used in the woods, instead of keeping stock. We raise a great many horses, and some one has accused us of keeping them in flocks like sheep.

Our people have not attended to the production and preservation of manures as they should, but there is increased attention to this matter. In making compost heaps it is an excellent plan to make free use of plaster. It is also good to apply to grass land. We apply two or three bushels to the acre, as a top-dressing, early in the spring. We also use it mixed with ashes to apply in the hills of corn and potatoes, and find it very effective. I do not, however, regard plaster as a manure, but only as an absorbent.

We find a very effective manure to be the deposits of leaves which gather in the hollows in the woods. This we collect with some of the top soil of the woods and compost it with salt and ashes. We have found nothing equal to it to put around fruit trees.

WALDO. J. D. Tucker.—The society I represent was organized in 1847. I do not claim to be a practical agriculturist, but am convinced that progress has been made by the farmers of Waldo county through the instrumentality of the agricultural society. Farm stock has been much improved by the introduction of Herefords and Durhams, and the crosses of these with our native stock are plainly visible in many parts of the county. We have fine oxen and cows, many that would compete with the best in Maine. I believe Waldo is not second to any county in Maine, in breeding horses. The horse, State of Maine, that took the first premium at the State Fair in Portland, in 1856, was raised, and is now owned, in Lincolnville, Waldo county. The Crockett horse that took the first premium at the State Fair in Bangor, was bred in the same town. Both

were Messengers crossed with Fox and Morgan. I am of opinion that a cross of Morgan and Messenger is very desirable to combine speed and bottom. The farmers in our county have generally been very successful in raising horses.

Much interest is manifest in raising sheep. A cross of imported Irish sheep with the natives, have been very valuable for early mutton, being of good size, and good mothers. Their lambs are suitable for market by the first of June. The merinos have been introduced into our county, and are improving the texture of the wool.

Real estate has advanced in value as the farming interest has increased.

WASHINGTON. Hugh Porter.—This society has located its fairs. Ground for its use was purchased by an Agricultural Aid Society. Its affairs are in a prosperous condition, and agriculture throughout the county is improving, though farther advanced in some localities than in others.

I do not know that I can better convey an idea of what is going on among us, than by giving a few facts. The first is a statement of Moses Wilder, who entered his farm for a premium in our society the present year. He says: "I commenced cutting the trees on my farm eighteen years ago. The winters of 1856–7, I kept on my farm sixteen head of horned cattle, one horse, six hogs, and twelve sheep. This fall, I have twenty-two head of horned cattle, seven hogs, two horses, and thirty sheep. This year I have cut twenty-five tons of hay and ten tons of wheat and oat straw. I have raised this year, one hundred and twenty bushels of oats, thirty bushels of wheat, twenty-five bushels of buckwheat, four bushels of beans and peas, sixty bushels of potatoes, and one hundred bushels of carrots and turnips. This year I have cut, as near as I can estimate, sixteen tons of hay from six acres."

As for my own labors this year, I built one hundred and fifty rods of cedar yoke fence, the sills laid on stone; eighty rods of board fence, the boards one inch thick, from four to six inches wide, with cedar posts set in the ground two and one-half feet, with rocks around the posts and under the fence. The soil is hard and gravelly. I have taken out a number of large pine stumps, which cost from $2 to $5 each to remove. I plowed six and a half acres of greensward. Some clay loam, which was rather low, I drained by ditch-

ing before the middle of September, ready to lay down to grass next spring with bone dust. This land, before plowing, produced two tons of hay to the acre. I measured off one acre of my mowing, and cut the grass, and when it was well made into hay, it weighed three tons and four hundreds. It was clear herdsgrass.

I raised twenty-two bushels of good barley, from one bushel sowing; twenty-four and one-half bushels of buckwheat on one-half acre of greensward.

I made of scantling, eleven or twelve gates, which I hung in the place of clumsy bars, on the lane, barnyard, orchard and fields. Painted some of them, and some I whitewashed."

There is in Pembroke, where I reside, an abundance of swamp muck and peat, enough to enrich every farm in town, if properly applied; and there are quite a number of our farmers who are interested in adding to their stock of manures, much more than formerly, by composting all the materials they can collect about their premises.

Barn cellars are also coming into general use in this town. On the Iron Works road leading to Charlotte, between the village and and the town line, there are eleven or twelve barn cellars. There is also quite an improvement in plows and farming implements generally, and an increasing attention to rearing the best breeds of horses and cattle. Among the blood cattle introduced may be found the Durhams, North Devons, and Ayrshires. The full blood Suffolk swine have also been introduced by Mr. Wardsworth, and we think we can raise pork to advantage.

Sheep do well, and we have a mixed breed of the South Downs, obtained from New Brunswick.

In a word, I may say we are on a general advance.

A farmers' club has been got up, and quite an interest is taken in its meetings, and the discussion of agricultural subjects. The experience of all present is brought out, and so far as I have been in attendance, I consider it a valuable source of information, with reference to sowing and planting, and cultivating the different crops, and agricultural operations generally.

The business committee then reported subjects for investigation, upon which it was

Ordered, That committees be appointed by the chair, to report, during the present session, upon the following topics:

1. To see if any, and what amendments in the present laws relative to agriculture, are advisable: Messrs. Russ, Hammond and Avery.

2. What further agencies for the advancement of agriculture should be adopted, and if any, to report plans: Messrs. Anderson, Flint and Lancaster.

3. To prepare blanks for statements, whether by questions and answers, or otherwise: Messrs. Goodale, Drummond and Thissell.

4. To inquire whether it is advisable to recommend to societies to give books, plate, fruit trees, seeds or other articles in certain cases, instead of money, as premiums: Messrs. Noyes, Fuller and Fairbanks.

5. To inquire whether it is advisable to prepare rules, directions and suggestions in relation to plowing at our fairs and shows, and if so, to prepare a draft for the same: Messrs. Porter, Rice and Goodale.

6. To inquire whether it be advisable to recommend action by the Legislature to obtain agricultural statistics: Messrs. Flint, Dill and Tucker.

7. To inquire what the Board ought to recommend in relation to testing the speed of horses at our agriculture shows: Messrs. Tucker, Palmer and Lancaster.

8. To inquire into the expediency of recommending legislative action to encourage the promotion and support of farmers' clubs. Messrs. True, Perley, Anderson and Porter.

9. Whether to instruct the Secretary to inquire into the best methods of securing immigration to Maine, and to stay the progress of emigration from among our agricultural population: Messrs. Perley, Noyes, Russ and Stevens.

10. To inquire into the expediency of locating our county shows and fairs: Messrs. Lancaster, Drummond and Leadbetter.

11. What measures shall be adopted by which to disseminate more general knowledge in agriculture, and thereby excite greater interest: Messrs. Russ, Russell and Fairbanks.

12. Is farming a profitable occupation in Maine, and can a man

who invests capital in it, realize an income equal to that invested in other occupations? Messrs. Thissell, Avery and Porter.

13. What per cent. will capital pay when invested in agricultural operations and conducted properly and judiciously? Messrs. Drummond, Anderson and Dill.

14. To inquire into the subject of drainage, and the manufacture of drain tile: Messrs. True, Porter and Stevens.

The committee on elections reported in favor of all persons present claiming seats, with the exception of Mr. Hoyt of North Aroostook, and Mr. Fairbanks of Maine Pomological Society, which report was after discussion adopted.

The drawing of lots for term of office, in accordance with the statute of last year, then took place in the manner advised by the committee on elections, who had been charged with the same The result of the lot was as follows:

Messrs. Dill of North Franklin, Hammond of Piscataquis, Leadbetter of North Somerset, Noyes of Bangor Horticultural, Porter of Washington, Russ of Franklin, Stevens of North Aroostook, each drew a lot for one year, and they constitute the first class, whose term expires January, 1859.

Messrs. Avery of Lincoln, Flint of West Somerset, Fuller of Kennebec, Martin of Androscoggin, Perley of Maine State, Rice of West Oxford, Russell of Somerset Central, Tucker of Waldo, each drew a lot for two years, and they constitute the second class, whose term expires January, 1860.

Messrs. Anderson of Cumberland, Bailey of Sagadahoc, Drummond of North Kennebec, Goodale of York, Lancaster of South Kennebec, Palmer of East Somerset, Thissell of West Penobscot, True of Oxford, each drew a lot for three years, and they constitute the third class, whose term expires January, 1861.

Mr. Lancaster offered the following resolutions regarding the public lands, which, after discussion by Messrs. Hammond, True Fuller and others, were adopted:

Resolved, That we notice with great pleasure, that the Hon. J. S. Morrill of Vermont, introduced into the House of Representatives in Congress, December 14, 1857, a bill authorizing a donation of public lands by the general government, to the several States and

territories, for the purpose of endowing colleges, to encourage agriculture and mechanic arts.

Resolved, That we confidently believe the passage of such a bill would have a most auspicious influence upon the agricultural interest of our State, as well as the country generally, by affording more ample means of readily developing our extensive agricultural resources. And we earnestly recommend to the several agricultural societies of this State and elsewhere, immediately to petition Congress for the passage of said bill.

Resolved, That a copy of these resclutions be signed by the President and Secretary of this Board, and forwarded to each member of the Maine delegation in Congress, and to the secretaries of the several agricultural societies of this State; and the several newspapers of this State are also requested to publish the same.

Mr. Hammond of Piscataquis, from the committee on Topic No. 1, made a report that no amendment to the laws relating to the subject of agriculture was necessary at present, and the same was adopted.

Mr. Anderson, of the committee on Topic No. 2, requested that the committee have further time to perfect their report, in consequence of the impossibility of doing justice to so broad a subject during our brief session, and that it then be made to the Secretary of the Board. Request granted.

Mr. Drummond, of the committee on Topic No. 3, reported in favor of charging the Secretary with the preparation of blanks for statements, and that he attend to the same subsequently to the session. Report adopted.

Mr. Noyes, from the committee on Topic No. 4, reported as follows:

On Books and Periodicals for Premiums.

Believing that a more general circulation of agricultural and horticultural works among our farmers would do a vast deal of good, your committee would therefore recommend that it is desirable.

This is an age of books, and there are many which treat on agriculture and horticulture which are of great value. Also others treating on the rearing and managing of farm stock generally, and the diseases of animals in particular, which are highly useful to the farmer, and would be eagerly sought after.

And we believe a work treating on either of the above subjects, at a cost of one dollar, would do more good in a rural district, than five or even ten dollars in money.

We would also recommend the offering of choice fruit trees, and seeds, &c., as calculated to awaken a livelier interest in agriculture and horticulture generally.

Your committee also take the liberty to suggest the propriety of awarding a year's subscription to some of the best horticultural and agricultural journals of the day.

Report accepted.

Mr. Rice, of the committee on Topic No. 5, reported as follows:

In order better to test the discipline of the team and the skill of the driver and plowman, this Board recommends that the following suggestions be made to those having charge of this interesting department in our agricultural shows and fairs:

1. That the land be laid off in lots to contain such quantity as the Trustees shall direct, the lots to be marked by stakes and numbered, the plowmen to draw lots for their plows.

2. That the numbered stake be placed at the left hand side of the lot, the start to be from this point; each plowman to draw his first furrow in the line of his numbered stake, and back the same up again, the remainder of the work to be optional—subject, however, to the regulations of the Trustees.

3. After the plows are started a list to be made of the plowmen's names, in the order of their respective numbers on the field; the plowmen also to retain their drawn numbers till the decisions are given.

4. The judges, or awarding committee, not to be on the field until after the plows are off, and are to mark the decisions as they are made according to the numbers. No person whatever, except the judges, to be allowed to walk upon the plowed ground until their decision is given.

5. That in all entries for plowing at our agricultural fairs, the competitors be required to give the number of oxen or horses he intends to use, as also the name of the manufactory, and size of the plow to be used.

In suggesting some points which your committee think should be

considered in determining good plowing, we call the attention of judges to the following:

1. Nearness to given dimensions, if any, and equality in depth and breadth throughout.

2. Squareness of sod on the upper corner; equality of the angles of its two slopes.

3. Straightness of furrows throughout, from first to last.

4. Uniformity in breadth and depth of the last furrows with those of the rest of the lot.

5. Packing of the furrows, as judged by the tread of the foot.

6. Laying of the furrows, as shown by the burying of all the green surface without flattening the backs of the furrows.

7. Straightness and narrowness of last two furrows, and distinctness of each of them.

8. Entering and throwing out the plow so as to make all the land plowed to run in a uniform line.

Your committee would further suggest that a sufficient amount of time be allowed competitors to perform their work, and that if perfected in a reasonable space, the question of time should not be taken into account in awarding premiums.

Your committee would present the following as objectionable qualities in plowing, which should be avoided, to which the attention of awarding committees is directed:

1. All obvious deviations from the straight line or prescribed dimensions of furrow, in breadth and depth.

2. Crowding a number of narrow furrows together in the ridge or first furrows of the lot.

3. Raising the first furrows above the level of the rest of the lot, by which in harrowing, the harrow will be kept up from the adjoining furrows.

4. Flattening of the furrows too much, or inequality, so that the crest of one furrow will prevent the harrow from reaching another.

5. Leaving the furrows standing on edge and gaping, so that if sown with cereal grains, a portion of the seed is suffered to fall below the range of germination.

6. Laying the last grass furrow above or below the furrows of the rest of the lot.

7. Last grass furrow too broad, or too deep, or crowded, or plastered with loose earth.

8. Want of uniformity in the end line of the land plowed.

Report accepted.

The committee on Topic No. 6, reported that the Secretary be instructed to urge upon the agricultural committee of the Legislature the propriety of submitting a bill to procure statistics, substantially like the one offered them by the Board last year—as follows:

An act additional to chapter —— of the revised statutes, relative to the duties of the assessors of cities, towns and plantations.

SECT. 1. The assessors of each city, town and plantation in this State, are hereby required to collect and transmit to the Secretary of the Board of Agriculture, on or before the first day of June in each year, such statistical information as may be required by said Board, relative to the industrial pursuits of their several precincts, as they may be annually presented on the first day of April.

SECT. 2. If the assessors of any city, town or plantation, shall willfully neglect to make the returns aforesaid, in the manner aforesaid, such assessors shall forfeit to the State a sum not exceeding one hundred dollars, to be recovered on complaint by the Secretary of the Board of Agriculture.

And also, an act additional to chapter —— of the revised statutes of the State, relative to the duties of the Board of Agriculture.

SECT. 1. The Secretary of the Board of Agriculture shall cause to be printed blank tables conveniently arranged for the returns of such facts relative to the industrial pursuits of this State, as may be deemed necessary by said Board, to present a clear and distinct statistical view of the industry of the State, and shall furnish three copies of the same, together with a copy of the directions prescribed by the Board of Agriculture, to the assessors of each city, town and plantation, on or before the first day of April in each year.

SECT. 2. The Secretary of the Board of Agriculture after he shall have received the returns aforesaid, from the assessors of the several cities, towns and plantations, shall cause to be prepared and printed, under his direction, a true abstract of the same, for the use of the Legislature, at the next session thereof.

Mr. Tucker, of the committee on Topic No. 7, submitted the following report:

Your committee are advised of the many objections that are made against the trial of the speed of horses, and have considered these objections. In our opinion, practical experience has developed the advantage desired by breeders of horses in the trial of the speed of stock horses and mares. It is very desirable to improve the speed of horses, and farmers should breed towards speed, and if their horses are not fast, they may make good roadsters. Farmers, in breeding from the very best stock, will raise a great number of horses that will be more suitable for draft or farm use than for the turf or road; speed and bottom in the sire and dam are two very important combinations, and all points of superiority should attract the attention of the farmer. We are of the opinion that points of superiority on the side of the dam are quite as important as those on the side of the sire. As for an example, the Arabians trace their breeds of horses on the side of the dam, and it is conceded that Arabian horses are not excelled for speed and great endurance by those of any other nation. It is very important that our farmers should know where to obtain that stock that is the most valuable in market, and if an amount of premiums are offered by the various agricultural societies, that will induce an entry of such stock, it will bring it immediately before our farmers, and they will have an opportunity to breed therefrom. And knowing that horses of speed command a higher price in our markets than any other class of horses, and are the first sought after by horse buyers, we are of the opinion that this Board ought to recommend the trial of the speed of horses, no less than of other qualities which go to constitute their value, at our agricultural shows.

Your committee take the liberty to digress from the question submitted to them in Topic 7, and would recommend that other classes of horses be encouraged by our agricultural societies:

1st—Is the carriage or family horse, which is indispensable even in these days of steamboats and railroads. In raising this class of horses great care should be observed to propagate from a breed of horses that are known to possess docility of disposition. Almost the first questions asked by gentlemen seeking for a carriage or

family horse, are these: is he of a docile disposition? would he be safe for my family?

2d—Is the farm horse. It is highly important that our farmers propagate from the right kind of stock for farm use; horses of moderate action are the most valuable for this purpose.

3d—Is the team or draft horse. The breeding of this class of horses is worthy of the especial attention of the farmer, and compactness as well as size should be considered.

Your committee are of the opinion that the three classes of horses last named are entitled to the especial attention of the farmers and horse breeders of Maine, and should be encouraged by the award of liberal premiums by the agricultural societies of this State.

Report accepted.

Mr. True, of the committee to inquire into the expediency of recommending legislative action to encourage the organization of farmers' clubs, (Topic No. 8,) submitted the following report:

The committee learn of the existence of eight clubs in Maine. One in Bethel, organized December, 1843; one in Naples, organized March, 1854; one in West Minot and Hebron, in 1855; one in South Windham, 1857; one in Norridgewock, 1857; one in Waterville 1857; one in Pembroke and Robbinston, 1857; one at Fort Fairfield, 1857. The Bethel club has a library of about eighty volumes, devoted to agricultural and horticultural subjects, and in Naples they have a small collection of books.

Town fairs were held, in 1857, in Bethel, Winthrop, North Wayne, Robbinston, Norridgewock, Fairfield, Leeds, Greene, West Minot, Dixfield, and have excited much interest in their respective localities.

Your committee would call especial attention to these clubs, with the hope that the efforts thus far made, may induce others to engage in this most interesting department of our agricultural operations.

Agriculture as a science, and as an art, is rapidly progressing in Maine. Of this there can be no doubt. Associated efforts have effected organizations in our county and State societies, in twenty-four incorporated bodies. But there is an humble agency at work in the shape of farmers' clubs. The mighty Mississippi depends on the countless rills at its sources to swell its stream. The giant oak must have its rootlets thrown out in every direction for food, and

so should our county and State societies be fed by the lesser, but more numerous organizations which should exist all over the State. The good results of these clubs are best appreciated where most known. It renders the members familiar with the different kinds of fruits and garden vegetables, and their cultivation. It brings to their notice the different kinds of stock, the preparation of the soil and manures, and what is of the utmost importance to human progress, it stirs him up to be a thinking as well as a working man, in addition to the cultivation of the social element.

The organization of a farmers' club is so simple, that it can be put into operation in almost any school district located in an agricultural community, and it is believed that very many can and will be so established within a limited period of time. Nor should they be regarded as independent organizations, but be rendered auxiliary to the county societies in which they are located.

Many towns are so situated that they find it inconvenient to drive their stock, and transport their heavy articles to the county fair, but through the agency of these clubs, town fairs can be established, at which a large portion of the surrounding population can be gratified by ready access, and consequently, feel a direct interest in whatever is going on.

The better to facilitate the promotion of such clubs, your committee would here give a form of a constitution, which may be subject to such modifications as peculiar locations may demand.

Preamble.

Believing that by united effort the interests of agriculture would be better promoted, the undersigned hereby agree to form themselves into a society for this purpose.

Constitution.

Art. 1. This society shall be called The —— Farmers' Club.

Art. 2. The members of this society shall consist of a President, Vice President and Secretary, who shall be elected by ballot at the annual meeting, and hold their offices for one year, or until others shall be chosen.

Art. 3. There shall be a committee on subjects, consisting of three members, who shall be nominated by the chair.

Art. 4. Stated meetings shall be held during such months of

the year as may be decided upon by the society, for the discussion of such subjects as may best subserve the object of the club.

ART. 5. The annual meeting shall be held on ——, but special meetings may be called at any time on application of two or more members to the Secretary, who shall give public notice of the same.

ART 6. Any person may become a member of this club by signing his name to this constitution.

ART. 7. This constitution may be altered or amended by a majority of the members present at any regular meeting, notice having been given at a previous meeting, or by public notice, on application to the Secretary, at least one week.

The committee would recommend that such legislative action shall be taken, if necessary, as shall enable every organized farmers' club to obtain all the legislative documents of the State pertaining to agriculture, on application of the Secretary of said club to the Secretary of the Board of Agriculture.

If a library be thought advisable, additional articles can be adopted. This latter course is of much importance. The man who pays a dollar for a book is really the owner of the whole library. The farmers' club is the farmers' lyceum, and the less formality in the discussions, and the more familiar they accustom themselves to be with each other, the more benefit will be likely to be derived.

Instead of electing the President for the year, it may prove a better course, in many cases, that he be chosen by nomination at each meeting of the club.

Report accepted.

Mr. True, after submitting the above report, made the following remarks about a club in his town:

The Bethel Farmers' Club was organized under unfavorable auspices. Not more than four or five persons could be induced to join it, and even these were exposed to the ridicule of their neighbors, but they persevered. Each member paid in $1 or more for a library. Each volume was loaned to the library, with the privilege of withdrawing the same on dissolving his connection with the club. But very few books have been withdrawn.

At first, it was thought that we should fail to interest ourselves for want of topics, but experience has proved that instead of exhausting our subjects, they press upon us faster than we can dispose

of them. We meet at each other's houses by invitation, and take our wives with us. The ladies occupy a separate room during the discussion. We allow no entertainment except good apples, and a smiling face from our host and hostess. Not an unpleasant word or act has ever arisen in our club since its organization. Meetings are held during the winter months, once in two weeks. In October a town fair is held, occupying one day, and in the evening an address is delivered by one of its members.

What are the results? Prominent among these is the fact that instead of one individual in the community becoming acquainted with a single topic, all the members are fast becoming acquainted with every topic. We have, through its instrumentality, introduced pure blood stock. We have secured a great variety of garden vegetables, the different varieties of grapes, the best method of managing our manures and soils, and the introduction of agricultural and horticultural reading.

The club is gradually increasing in numbers and strength. I have no hesitation in encouraging the formation of such clubs in every agricultural community, cautioning its members to avoid strict parliamentary usages, but to let each man feel that he is enjoying an old fashioned neighborhood visit and chat, where he can without restraint, talk over the affairs of his garden, orchard and farm.

Mr. Perley, of the committee on Topic No 9, offered the following order:

Ordered, That the Secretary of this Board be instructed to inquire into the best methods of securing immigration into Maine, and of staying the progress of emigration from among our agricultural population, and to use his best endeavors towards accomplishing the same.

Mr. Lancaster, of committee on Topic No. 10, reported as follows:

As the location of societies is a subject that is new—no one having had permanent ground and fixtures for more than five years—we are under some embarrassment to know what the practical results are, and the expediency of continuing the practice.

After inquiring of those that have the most experience upon the subject, and located their grounds with permanent fixtures, we find but few objections in the way of carrying out the system as begun.

The location of societies throughout the State is a subject of importance to our people. It should be progressed in with care, that all can be accommodated. Disaffection from local causes should be avoided, so that the society may have the co-operation of all its members. The first expense for grounds and fixtures is a serious one; but when once arranged and permanently constructed, will last for many years.

The time is coming, in our opinion, when the show ground shall not only be a place for exhibiting the best animals and articles for premium, but a general rendezvous for the sale of cattle, horses, sheep and swine—the exchange and matching of oxen and horses. When the country becomes older, it will be looked upon with great pride and interest.

The government of societies may be so altered from the old system, that location may be obtained in nearly all cases without giving offence to any.

If a representation from each town in the society could be had, to govern and regulate all its actions, it would be more systematic, and each town would feel the same interest, however remote.

As the system is now, those in the immediate vicinity of the meeting, and especially if it is a considerable village, are likely to have it managed to suit themselves, and not always for the interest of those who have a direct responsibility, and also the good of the society, at heart.

If grounds and fixtures can be obtained without embarrassing the society, (which we do not recommend,) one or more permanent locations, with the proper government, would have a desirable effect.

Objections are sometimes made by the public and those that do not care for, nor know the wants of the society, to paying an entrance fee to the grounds on days of exhibition; but, in our minds, it must be continued until we can receive more permanent aid from the State, or by endowments from private sources; nor then should it be entirely discontinued, for this reason, that assemblies can be more easily controlled on such occasions.

Report accepted.

Mr. Rice, of the committee on Topic No. 11, asked further time to report, and the privilege of reporting to the Secretary of the Board, which was granted.

Mr. Thissell, from the committee on Topic No. 12, "is farming a profitable occupation in Maine; and can a man who has capital invested in farming, realize an income equal to capital invested in other occupations?" reported as follows:

Your committee recommend *farming* as being a profitable business to be pursued in Maine; and are of opinion that a profit may be realized from capital invested in farming, equal to that invested in other occupations.

The following are some of the reasons by which we arrive at the above conclusion; and as this topic seems to involve a double question, we proceed to answer it accordingly.

First, we say that the occupation of farming is profitable, from the fact of its adaptation to our people. It is believed to be better adapted, and seems to meet their wants better than any other business; and a large proportion of our people are better adapted to, and fitted for, this occupation than for any other. Hence we say to such, that farming is profitable.

We do not mean to say that we believe that *every man* can invest capital in farming, and realize an income equal to that for capital invested in many other occupations, but a large proportion of our young men in the interior of the State, are brought up on farms and are unacquainted with other business, consequently cannot engage in it with any degree of certainty.

Many do not wish to engage in other business than that of *farming*, from the fact that they are farmers. They were born farmers, brought up farmers, and cannot well be anything else but farmers. Such may realize a profit from capital well invested, and labor judiciously applied, equal perhaps to capital invested in many other occupations.

We would not here mean to compare the profits of farming with those of shipbuilding, nor with navigation, in any of its varied forms, nor with the mercantile business, nor with many other kinds of business in favored localities upon the seacoast; neither would we advise any one to invest capital in farming for the purpose of making money, who cannot devote his time, attention, and labor, to his farm.

We ask what business there is at the present time, so good that a man can engage in it and realize a profit, without devoting his time and attention to his business. Farming gives *a remuneration for*

labor, and the man who engages in farming understandingly, may expect to receive not only a remuneration for his labor, but an income from capital invested.

We also recommend farming as being less risky, less liable to become affected by the ruinous depression of the money market, than many other kinds of business. In proof of this assertion, all classes join, at the present time, in saying that our farmers are the most independent part of our population. Some, it is true, engage in farming to no purpose; they have no system, make no proper application of time, talent nor labor; and in fact, such may more justly be called land *killers* than land *tillers*. But a man who engages in farming understandingly, and pursues it steadily and evenly, on making a proper application of time, talent and labor, and all that comes within his reach, may reasonably expect not only to receive a remuneration for labor, but an income from capital invested. This is not all. He secures to himself and family a pleasant and *happy home;* and he has the pleasing satisfaction of believing that the world is none the worse for his having lived in it; and when he passes away, he leaves a valuable legacy for those who may come after him.

Mr. Drummond, of the committee on Topic No. 13, reported that the profit on capital invested in farming in this State, when judiciously managed, is not less than twelve per cent.

Mr. True, for the committee on Topic No. 14, then submitted the following report:

The committee on underdraining of lands and the manufacture of drain tile, beg leave to report—

That they learn that there is a strong desire manifested in different portions of the State, to introduce the use of tile for underdraining.

The committee feel impressed with the belief that this is the next great step in the advancement of agriculture in this State. Much of the land now under cultivation requires it; besides, the short period of time allowed the farmer in spring to prepare his grounds for his crops, should induce him to have his land in a suitable condition to work at the earliest possible period. Every farmer knows the disadvantages of working his land when wet; and every farmer who has practiced draining, is the better able to arrange his time and labor to much better advantage than he otherwise could.

Open draining has been practiced to a considerable extent, but this method is not usually such as will prevent the soil adjacent from imbibing a large amount of water. This may be illustrated in a traveled highway. Though it may be well turnpiked, yet, if water stands in the ditches, it will be absorbed by the road and rendered wet at a much higher level than the water.

Another most important advantage in underdraining, over and above that of open draining, is that in underdraining the water is filtrated downward, thereby leaving in the soil a large portion of the soluble salts and vegetable matter for the future crop. The farmer is also induced by means of tile, to sink them at a much lower depth than in ordinary open draining. Wherever the farmer may have at command an abundant supply of small stones, he can make use of them with very great advantage; but on many farms in this State, that need most to be drained, stones are not to be obtained.

Another advantage arises from underdraining—it renders all the land capable of cultivation, giving a smooth surface, and much more agreeable to the eye as well as convenient for crossing.

Your committee believe that instead of sending out of the State for tile, that it can and should be manufactured in Maine. Clay and wood are abundant, with ready access to navigation and by railroad; and it is believed that with a moderate capital an enterprising young man would find his labor well remunerated. Your committee would respectfully suggest, that the Secretary of the Board be instructed to encourage the use as well as the manufacture of drain tile in this State, as one of the most important steps towards an improved condition in agriculture.

A discussion here ensued in the course of which it was suggested that legislation might be needed to facilitate drainage by enabling persons to cross adjacent lands in case no outlet could otherwise be obtained, and also to enable a majority of the owners in common of large tracts of low lands to drain the same.

In this connection the Secretary remarked that this subject involved principles of great delicacy, and presented serious difficulties, though perhaps not altogether insurmountable ones, and was worthy of careful deliberation. Some of the principles involved in drainage of land are similar to those in relation to flowage, and it is well known that in the early periods of settlements in the State, when

mills were a public necessity, laws relative to flowage were enacted which were, perhaps, of doubtful constitutionality, and certainly could not be first enacted at the present day. They granted large privileges to proprietors of mills, many of which are now unoccupied and worthless for milling, yet the remains of the dams obstruct the streams and flow some of the best land in the State, (for grass especially,) and there is no remedy as the laws are. It certainly does sometimes, and not unfrequently, occur, that no drainage can be effected unless a man can have the privilege of crossing his neighbor's land, and some are unwilling to grant leave to do this, however trifling the damage to one, or however great the benefit to the other. Ought valuable land thus to be locked up and kept in an unproductive and worthless condition through ignorance or obstinacy? If there be any means of assisting in the redemption of thousands and thousands of acres now yielding nothing, but which may, by being simply relieved of injurious water, add twenty or fifty, or perhaps even a greater per cent. than that, to our supply of food for man and beast, we surely cannot move too soon in our efforts to adopt them.

The importance of draining is in no danger of being over-estimated, and he was glad to know that it is attracting much attention, and that many are making experiments in it. There is a growing demand for drain tiles in this State, and we have abundant means for manufacture at as cheap a rate as in any other part of the country. Wherever bricks can be made, tiles can be manufactured.

Mr. Flint of Somerset, thought that the subject of flowage and drainage ought to be referred to a select committee to make a full report. He knew that many thousand acres of the best land in this State were held from cultivation by the operation of old laws, adapted only to the early condition of the country, which, from the change in the condition of things, are now a nuisance. There were many instances of this in his own neighborhood.

Such a committee being resolved upon, the President, in view of the necessity for legal skill and acquirements to the successful investigation of the subject, and relying on his well known courtesy and deep interest in the agricultural prosperity of the State, ventured to appoint a gentleman resident in Portland and not a member of the Board, as chairman, and announced as said committee, Messrs.

Phineas Barnes, Esq., of Portland, Goodale and Russell; and they were requested to report at the next session of the Board, or, if practicable, in season to be published in the annual report of the Secretary for 1858.

Mr. J. L. Child of Augusta, presented to the Board a package of ears of corn, grown in Michigan, resembling the King Philip corn. Also, specimens of potatoes grown in Michigan, one known as the "Webster red," and another as "Michigan pinkeye."

Mr. Lancaster presented a very handsome sheaf of wheat, raised in Bangor on the Jordan farm. The straw is stout and bright, and the heads large and well filled with large and handsome kernels of what is locally known as the Jordan wheat, but by those acquainted with the variety said to be the white flint wheat. It was produced from a few choice heads grown by Captain Joshua Jordan with his other wheat, and which attracted his attention for their uncommon size. It is said to ripen well, even if sown after the first of June, and that it is not liable to rust, or to be injured by the midge.

Whereupon it was *Voted*, That the thanks of the Board be presented to Messrs. Child and Lancaster, and that the grains be distributed among the members for trial.

Mr. True of Oxford, called the attention of the Board to the manner in which the reports of the Secretary are bound. He thought they were not done in a style creditable to the State or the Board. Such documents in other States were done up much better than they were in Maine. Ours ought to be done up in better style, especially those to be exchanged with other States. It was finally voted that the Secretary cause a number not exceeding one-half those allowed by law, to be bound in cambric in the style usual for such documents.

The Secretary stated that in his interview with the legislative committee, he learned that several petitions were before them for the incorporation of agricultural societies in sections where societies already exist. The subject was one worthy of consideration by the Board. By payment of mileage on cattle, the principal necessity for creating new societies would be removed.

After discussion, it was *Resolved*, That in the opinion of this Board, it is not expedient to incorporate additional agricultural societies in the counties which now have such societies in operation,

but rather to increase as much as possible the efficiency of those now existing.

On motion of Mr. Lancaster, *Voted*, That the several members of the Board furnish to the Trustees of the State Agricultural Society, the names of gentlemen in their vicinity suitable to be appointed on awarding committees.

Mr. Noyes of Bangor, read the following statement of J. C. Clement, giving his method of raising the one hundred and twenty-five and a half bushels of shelled corn to the acre, for which the first premium was awarded at the late State Fair held at Bangor:

KENDUSKEAG, January 9, 1858.

DEAR SIR:—As I have had quite a number of applications for my seed corn, from persons wishing me to write out my method of preparing manure and ground, and also my method of planting, I make to you the following statement of facts:

If I would grow a large crop of corn, I select a good warm, dry piece of land, spread about half the manure on before plowing, say four or five cords to the acre, putting the remainder in the hills. I prefer to plow four or five days before planting. A few hours before planting I have the ground levelled with a fine tooth harrow. I then furrow with a large seed plow to the depth of ten inches, the rows three feet apart, and running north and south, leaving two feet between the drills. I then cover the manure as soon as possible after being dropped in the hills, with one inch of loam, and press it down hard with the foot. The corn is dropped three or four kernels in each hill, and covered an inch and a half deep, leaving the ground as nearly level as possible.

In 1855 I tried an experiment which I found to be a good one. I filled a furrow with manure and planted it six inches apart, for the purpose of supplying vacancies made by the crows, which are very likely to visit our corn fields and take their part. They visited mine in 1855, and pulled up about a hundred hills. I found it out soon after it was done, and took the first damp morning to dig out the manure where the corn was missing, and then with a small shovel took these hills which were in the furrow six inches apart, running the shovel below the roots and manure, and then placing it carefully in the missing hills, and pressing it down. In one week it could not be distinguished in appearance, from the others; and if it is not needed it is very easy to pull it up.

I have a vat in my barn that is water tight, which is ten feet deep, twenty-one by thirty-two feet square, where my compost is made. Directly after planting, I haul in from ten to fifteen cords of muck into my vat. I winter several hogs, which have access to this vat, and are continually working it over for the purpose of getting the corn I occasionally throw in, and are thus made nearly to pay their keeping. The privy, and also the hen roost are

placed over the vat, into which my sink drain also runs. The droppings of my horses, fifteen cattle, and twenty sheep, fall into the vat, and I occasionally throw in plaster, ashes and salt, which constitute the manure I use for my corn. I consider this compost worth more than double that made in the old way, and have good reasons for thinking so; for when I used the old manure, that had been exposed a year or more, I seldom got more than fifty bushels of corn to the acre, whereas, by the present method, I raised in 1856, one hundred and seven bushels of good sound shelled corn on one acre, and last year I raised one hundred twenty-five and a half bushels of good corn, as measured by disinterested men.

My corn is of the eight-rowed variety. It was brought from the western part of the State, about ten years ago, by Captain J. Chase of Frankfort, whence I obtained mine, which I call Chase or twin corn, and which I have been planting and improving for six years past, by selecting the best and earliest ears, and those that bore two ears on one stalk, which I think is extra seed. This corn has taken premiums the past three years. It ripened in three months and a half from planting.

I select the best corn for seed. This seed is for sale at C. H. Dunning & Co.'s seed store in Bangor, and at my residence, near Kenduskeag Village. It will be put up in small bags, containing from two to twelve quarts each.

Your friend,

J. C. CLEMENTS.

The Secretary was directed to cause the same to be published.

On motion of the member from Oxford, Messrs. True, Perley and Anderson were appointed a committee to report on the expediency of establishing an agricultural library and cabinet for the use of this Board. Leave was granted to report subsequently to the session.

Mr. Dill moved that the rules and orders of this Board, the list of members, and topics and committees to whom referred, and such other matter as requires notice to be forwarded by the Secretary, be printed in pamphlet form for the use of members.

The President suggested the propriety of appointing a committee of one in each county to obtain information regarding the agricultural resources of the county—its soil, climate, and adaptation to special departments of agricultural labor—the whole embracing, so far as is practicable, an agricultural survey.

Mr. Fuller of Kennebec, offered a resolve that the Secretary of the Board, with advice of the President, be authorized to act in behalf of the Board, in any matters demanding action in the recess, which was adopted.

A committee having been appointed to distribute copies of the Secretary's report among members, attended to the same so far as then practicable—the whole not being yet bound.

Mr. Noyes then offered the following, which was passed:

Ordered, That one thousand copies of the report of the Secretary for the year 1857, be placed in charge of the State Librarian, one copy of which may be drawn thence by any farmer in the State who shall appear for the same in person, or by his representative, or by letter addressed to the State Librarian, (and enclosing the necessary postage stamps, amounting to ten cents.)

On motion of Mr. Lancaster, it was *Resolved*, That the farther distribution of the report and abstract be left to the Secretary, with the advice of the President.

A general desire manifested by the members that something should be effected by the Board during the recess, resulted, after some discussion, in adopting the following topics to be investigated and reported upon to the Secretary, after adjournment and before September 30th, 1858, and which were voluntarily assumed by those whose names are attached, except those noted as "assigned to:"

1. The cultivation of the cranberry: Seward Dill, Phillips.
2. New fruits and vegetables: (assigned to) Horace McKenny, Monroe.
3. Planting of orchards: Joseph Avery, West Jefferson.
4. New varieties of grapes adapted to Maine: Albert Noyes, Bangor.
5. New farming implements: Francis Fuller, East Winthrop.
6. List of pears best adapted to culture in Maine: S. L. Goodale, Saco.
7. Insects injurious to vegetation: N. T. True, Bethel.
8. Best breeds of cows for the dairy: W. E. Drummond, Winslow.
9. Domestic fowls: W. M. Palmer, Hartland.
10. Comparative value of the various manures: J. K. Russell, Skowhegan.
11. Comparative value of roots for cattle and hogs: Hiram Stevens, Maple Grove.
12. Culture of flax: (assigned to) J. D. Lang, Vassalborough.
13. Best breeds of sheep: William R. Flint, North Anson.
14. Horses: J. D. Tucker, Lincolnville.

15. Neat stock: B. F. Leadbetter, Bingham.

16. Composting of manures: Hugh Porter, Pembroke.

17. Drainage: D. Lancaster, Farmingdale.

18. Marine manures: B. C. Bailey, Bath.

19. Model farms: (assigned to) W. D. Dana, Perry.

20. Grasses of Maine: S. F. Perley, Naples.

21. Renovation of exhausted lands: E. L. Hammond, Atkinson.

22. Reclaiming old pastures: William R. Flint, North Anson.

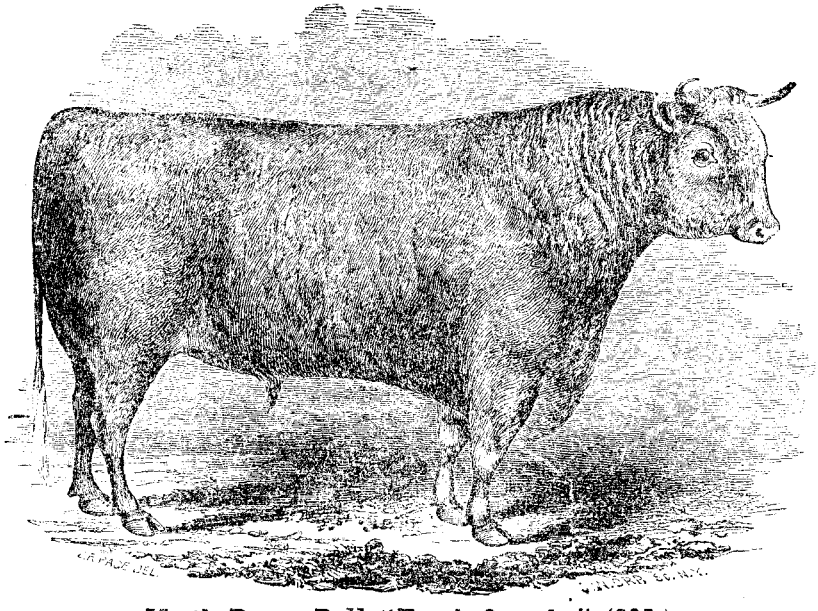
23. Renovation of old orchards: (assigned to) Nathan Foster, Gardiner.

24. Manufacture of maple sugar: F. L. Rice, Denmark.

25. Road making: Robert Martin, West Danville, and W. R. Flint, North Anson.

26. Domestic manufactures: Tucker, Bailey and Forbes.

The Board then tendered its thanks to the President and Secretary, also to Messrs. Sayward and Forbes for their services in reporting during the session, (and to which they very happily responded,) and adjourned without day.



North Devon Bull "Frank Quartly." (205.)

Imported by L. G. MORRIS in 1852. For pedigree see Davy's Devon Herd Book, Vol. 2, page 102. He won the following prizes: as a two year old at the New York State Show, held at Saratoga in 1853; also, at the American Institute in the same year; as a three year old at the New York State Agricultural Show at New York in 1854; and in 1855 he shared the herd premium at the United States Agricultural Society's Show at Boston, as the best Bull and four Cows. He is now the property of Hon. A. B. CONGER, Haverstraw, Rockland County, N. Y.

If we look at the history of agriculture in Maine, we find it for the most part to have followed in the wake of lumbering. Our forests were of vast extent, and amply stocked with valuable timber; rivers and streams to make this easily available were not wanting. To pursue lumbering, hay and grain must be had, and for these the woodsman could afford to pay a good price; so the farmer sold his early, virgin crops, to be consumed in the woods, and as these, thus consumed, could return nothing in the form of manure to his cultivated fields, the soil gradually deteriorated until it would pay but small remuneration for the labor of cultivation. Added to this was a diminishing and receding market, for the lumberman had meanwhile passed farther on. Both together conspired to turn the farmer's attention to other means by which he could raise money to pay for the necessaries of life which his farm would not yield. His next move seems to have been to turn out to pasturage a large portion of his exhausted fields, and to sell off the young cattle grown thereon to be driven out of the State. This could be done with less deterioration to the farm than the sale of hay and grain, perhaps even with positive gain. Under the circumstances, it was doubtless a judicious move, and from this, as a turning point, agriculture began to improve. For many years, large, though varying numbers of cattle were annually sold to go out of the State, but with a succession of short grass crops combined with various other causes, the number diminished until the sale entirely ceased from many parts, and the stock of cattle on hand became smaller than it should have been; so much so, that within three or four years beef cattle have actually been slaughtered in Maine which were grown a thousand miles away. Of course, prices must have been meanwhile greatly enhanced, or this could not have been done. This increase in price immediately turned the attention of farmers towards stock growing, and for a few years past the number of animals has increased with greater rapidity than at any former period.

Consequent upon this, there is now presented to our farmers a question of practical moment, and upon its decision, and the subse-

quent course of procedure, will depend in large degree the agricultural prosperity of the State for years to come. The question is this—To what point should this increase of stock be allowed to reach, and with what end in view?

It has been no small part of my intended aim in two previous reports, to show that the interests of the Maine farmer would best be subserved by a *prevailing adoption of stock husbandry in some of its branches*, as the most feasible and certain method of insuring increased fertility and enhanced profits. It is out of the question for us to think to live by the sale of grain, (certainly for the present,) for every county in the State buys more or less bread—has done so for years past, and will doubtless, for a series of years at least, in time to come. We shall do well if we grow breadstuffs to feed ourselves. What shall we sell then? How shall we best produce it? and where shall we sell it?

To give a full and complete answer to these questions would require a familiarity not only with all which is known of agriculture, but all which needs to be known. I make no such ambitious attempt, but simply offer a few suggestions with the hope of exciting attention and inviting inquiry.

To the last question however, I would venture to reply with a good degree of confidence, at the farmer's door, or as near it as may be. That home markets are of prime importance to agricultural prosperity needs no labored argument, for a moment's reflection will show that the less which is added to the cost of production by transportation, by profits of middlemen, by commissions or other charges, the greater the net return to the producer, and the greater the ability of the consumer to buy freely. We have abundant demonstration of this in the increased prosperity of agriculture, and the enhanced price of real estate in the neighborhood of the manufacturing villages which have sprung up among us, beside our water falls. Comparatively few of these beautiful water privileges are yet occupied to best advantage, nor are our resources or means of developing manufactures by any means confined to these alone. Look for instance at Piscataquis county, one of the smallest in the State in point of population, yet embracing much fertile soil, particularly in its southern portion, and great mineral wealth. On a recent tour through this county I was forcibly struck by the consideration

that its slate and iron were capable of affording employment to a vast multitude whose mouths must be filled by the husbandman; and in this case there seems to be nothing to prevent thousands upon thousands of workmen being profitably employed in developing the inexhaustible mineral wealth now lying dormant or busying only a few scores of hands, but the lack of a cheaper means of conveyance to navigable water, which some thirty or forty miles of railroad would effectually accomplish. With it, the farmer might be sure of an exchange of his products for the gold which now goes to Scotland and Wales to pay for iron and slate. Without it, he can, it is true, grow his bread and meat—and eat it—so he could as well if such mineral treasures were no nearer than Great Britain.

The same is true in greater or less degree of every other county in the State, for each and all possess dormant resources or facilities for manufacture in some of its varied branches, which if properly developed, would create an enlarged demand for the products of the farmer and add to his prosperity. Thus is it for the interest of the producer not only to grow as much as he can, and as cheaply, but also to extend all practicable aid and encouragement towards the increase, and even towards the creation of home markets, for every man who earns his living in other ways than directly from the soil, adds to the prosperity of the farmer by increasing the demand for food.

The first question proposed, viz: *What* shall we sell? requires a more extended consideration, involving as it does more varied and less understood conditions. A prevalent aim towards stock husbandry as insisted upon as above, allows great latitude of choice, both as to the particular branch to be preferred and also as to the mode of pursuing it. We may first inquire whether we shall, as formerly, occupy a large portion of land in pasturage, aiming to cultivate little more than to produce a sufficiency to barely winter the stock, and with a view to selling them to be driven away at an early age. This method, it is true, possesses advantages to recommend it, but there are objections also. Regarding the more obvious of these, it is not now proposed to treat, as each farmer can best judge for himself to what extent they may be applicable to his own case, only remarking however, that the liability of being compelled to sell off a considerable proportion whenever unfavorable seasons

and short crops deprive the owner of a sufficient supply of food to keep his stock through winter, should not be lost sight of; and the more so, as, at such times the very causes which oblige him to sell, also reduce the price which they will bring to the lowest point.

The objection which it is proposed here to mention against the extensive sale of young or lean animals, and which I do not recollect to have seen or heard alluded to in this connection, grows out of the consideration that the price at which they are usually sold is less per pound, or per hundred pounds, than the price which fat cattle bring, *while in fact they cost the producer more;* not more in time, or attention, or money, but they *exhaust the resources of the farm* to a *proportionably* greater extent; and as our strongest argument for the adoption of stock husbandry as a leading aim, is, that thereby, if judiciously pursued, the productive powers of our soil may be steadily and greatly increased, this point is deemed worthy to be stated and enforced.

In order properly to appreciate it, an acquaintance is necessary with the chemical composition of the various parts of the body, and it would be well could we add to this a knowledge of the processes of nutrition; for the investigation of no other subject is more intimately connected with the successful practice of stock growing than that of nutrition, as upon the views entertained with regard to it, will greatly depend not only the success of the farmer in rearing cattle, but also the management and application of manure. The subject is far too broad to be entered upon here, even were it fully understood, which it is not. Yet it may be remarked, that although much remains to be learned, the scientific investigations of chemical and animal physiologists have been effectual to the establishment of facts, and of principles based upon these facts, which may be safely taken as a guide to practice. Nor is it for our present purpose absolutely necessary to do more than simply to state the teachings of chemistry as to the elements which constitute the different parts of the animal body and their comparative value in an economical point of view. We find upon inquiry, that muscle, (that is, the lean flesh,) skin, ligaments, hair, wool, and horn, are much alike as to their ultimate elements, being composed chiefly of oxygen, carbon, hydrogen and nitrogen; the noticeable peculiarity in all being the existence of a considerable proportion of the latter, while fat contains oxygen,

hydrogen and carbon only, with no nitrogen whatever. The bones are composed in part of nitrogenized organic matter, similar to flesh, tendon, &c., but more than half their weight is phosphate of lime, and more than a fourth is pure phosphoric acid. Chemistry also teaches us that nitrogen is the most valuable of all the elements of fertility in soils, (because most costly to replace when abstracted from it,) and that phosphoric acid is the next in value. Now, as "all flesh is grass," and grass grows by virtue of being fed upon the elements of fertility in the soil, it is plain that animals obtain these from the soil as really, although indirectly, through the vegetable food eaten, as if they were fed directly from the soil itself, like plants; and it is equally obvious that if a pound of skin, bone, or muscle draws more heavily upon the soil than a pound of fat, the latter costs less, (in the way of exhaustion, at least,) and if it will sell for more, there is a double reason why we should endeavor to sell as many pounds of the latter and as few of the former as may be.

We may arrive at precisely the same conclusion from an examination of facts in the every day experience of practical men. Many a farmer who knows nothing of the teachings of chemistry, knows perfectly well that the manure from adult fattening animals is richer in nutriment for plants, and so more valuable, than that from young and growing cattle; and the reason is simply this, that in the fattening adult there is less demand for the flesh forming and bone forming constituents of the food, and more for the fat forming than in the case of young and growing animals, who have their frames and the needful clothing about their frames to build up from their food. Consequently so much of these contained in the food as is not required to be assimilated by the animal is voided and hence the comparative richness of the manure.

If such be the correct theory, and there seems to be no room for doubt regarding it, we see that the sale of young cattle from the farm as soon as their frames are built up and before they have attained such degree of fatness as can be cheaply added, is to some extent an exhaustive process, not very unlike the sale of hay and grain from the farm, while the full feeding necessary to produce the highest priced meat would result in enriched farms, and more still, if the animals were slaughtered at home and the offal returned to the soil to preserve and increase its fertility.

But, asks the stock grower, how shall I obtain fattening food for my animals? I have plenty of pasturage in summer and can grow hay for winter, but these alone will not produce the highest priced meat. A parallel question is, How shall I get manure to fatten my fields? for if these be in condition to grow grains freely, there would be no obstacle to the growth of fat cattle—but they are not, and if we can neither make manure nor buy it at a paying price, we must even be content to do what we can, and adapt our course of procedure to our circumstances. But it is admitted by nearly or quite all, that one-half of the manure made in our State is wasted or lost by mismanagement. Let this be saved, and production may be vastly increased at a trifling cost. Farther: let the size of our cultivated fields be graduated by our ability to manure them to the *most profitable* point, and the stock of cattle, whether young or adult, be graduated by the productive powers of the farm, and it may be confidently anticipated that steady improvement in production will be the result. Perhaps no single cause (or the waste of manure only excepted) tends more to hinder agricultural progress in Maine than the prevalent ambition to occupy too much land. Every acre of cultivated soil which is not made to yield the most profitable return which the circumstances of the case admit, should be turned out to pasture, grown up to wood, let alone, or somehow or other be prevented from damaging its owner. Thirty bushels of Indian corn to the acre, rarely pays the farmer a fair remuneration for his labor. Sixty bushels as rarely fails to pay a fair profit over and above all costs of production. The most profitable point of production may not at present be accurately known, but we may learn by repeated and careful trials, and having learned, we should aim to keep as near it as possible. Nobody can for a moment doubt that it is far higher than any average yet reached, for where one grain or grass crop suffers from an excess of manure having been applied to the hoed crop preceding it, a hundred hunger for more. The right point once attained, let the number of acres be extended as far as means serve.

It is by no means argued that we should wholly abandon the growth of young or lean animals for sale; my only object here being fairly to state this point which seems to have been overlooked. How much weight should in practice be allowed to it, and whether the advan-

tage gained in one direction, be not more than balanced by loss in others, are matters for each farmer to decide upon in view of the circumstances of his position. If he can sell hay and grain from his farm without detriment, he can surely sell young stock, for these return something to the soil while they grow, and it is certainly not half so bad policy to sell lean meat as to allow manure to waste under the eaves of the barn. The trifling cost for attention in the case of young stock—the greater cost for the same in fattening animals—the waste of nutritive matter in the food given to the latter which is usually incurred and which may be expected, until we know better than now, exactly what to feed out and how to feed—the greater value of manure from the latter—the character and distance of markets, together with such other considerations as bear upon it, should all be fairly weighed in making a decision.

The topic is rich in suggestions, and prominent among them is the desirableness of understanding and practicing the most judicious modes of feeding animals, whether old or young, and of varying the treatment according to age and circumstances, so as to accomplish the greatest results at least cost. The proper feeding of cattle is to the stock grower what the feeding of plants is to the agriculturist. A broad and promising field of study here opens to the inquirer, and one which it is hoped will in future receive more attention than it has hitherto done from our farmers.

Upon one point connected with this there is no doubt whatever, viz: that theory and experience both point to a more liberal policy in feeding, and to greater care in treatment, than has generally prevailed hitherto in our State, as the more profitable course. There has been a steady gain of better practice in this regard for many years, but there is room for more. Too many of our farmers still have faith in the virtue of coarse and scanty food and exposure to cold and wet to *toughen* cattle and render them hardy and profitable. An examination of the statements given in at our cattle shows will also reveal the fact that erroneous views prevail to a considerable extent as to the true economy both of food and shelter. If the ideas of some in these respects are really based upon correct principles, we ought to seek for a breed which would succeed best if stabled in a snow bank and fattened upon the east wind, (allowing straw enough for a cud,) instead of seeking such as will pay best

for good treatment. The time was in our early history, when if the winter provision for cattle proved sufficient to enable them to survive until spring, it was deemed fully satisfactory. Such is not now the case, for it is generally understood that an animal which barely survives winter is not in a condition to thrive at all proportionately to the amount of food consumed, as it would be had it come through winter in good order, and some have learned another important fact, viz: that every check to growth can only be cancelled or overcome by an expenditure of food considerably beyond what would have been required to keep it steadily progressing.

Such steady progress should be ever aimed at, by the bestowal of suitable and generous food and comfortable quarters, and in short, of such treatment generally as is best calculated to insure the result. When this is persevered in from infancy to maturity, the highest degree of success may be confidently anticipated.

In the feeding and fattening of cattle, little use has hitherto been made in this State of articles of food other than those produced on our own farms, but it is worthy consideration and careful experiment, whether one, at least, of the auxiliaries elsewhere so extensively and profitably employed, may not be introduced among us to advantage. It is stated on good authority that England imports at the present day no less than eighty-four thousand tons of oil cake for the purpose of feeding her cattle and fertilizing her fields. A large proportion of this is linseed cake and used for feeding, a goodly quantity of which, although not a large proportion, is exported from the United States. In my last report, reference was made to the fact that we exported to England large quantities of bones which might with great advantage be crushed and used at home, and thereby fertilize thousands of our own exhausted acres. The same reflection occurs in reference to linseed cake exported. If English farmers find it profitable to import, and that they do, is evidenced by the rapidly and largely extending use of it among them, it seems very possible at least that we might feed it out at home with advantage.

Analysis and experience both agree as to its value. Seven specimens of American linseed cake analyzed by Prof. Way in England, and which varied very slightly in their composition, showed it to contain 29.62 per cent. of albuminous compounds, 11.41 of oil, and

6.35 of ash, of which latter a third was phosphoric acid. This shows it to be richer than any of the grains in flesh-forming substances, and fully equal, if not beyond any, in fat-forming ingredients, and in fact beyond almost all articles of vegetable food except oily seeds. The profit attending its use must, of course, depend on the price which it bears in the market, and this has been variable, though on the whole for many years advancing as its worth became better appreciated. The time has not been long past when considerable flaxseed was grown in Maine, and there are not wanting at the present time men of good judgment and intimately acquainted with the subject, who express great confidence that flax culture may, at no distant period, become a most profitable branch of agricultural industry in this State, and should it become extensive, it is of great importance that the value of the cake for feeding purposes and for enriching manure be well understood.

Not having facts at hand regarding its use here, the experience of an old and successful New York farmer who has used hundreds of tons during a series of years, and an experiment by a farmer of Massachusetts, is introduced. John Johnston, near Geneva, writing during the present year, says :

"I prefer oil-cake meal to corn meal for fattening either cattle or sheep, although if I have corn of my own raising, which I always have, I feed it. But I always feed oil meal once a day, and generally the last month of feeding, I feed oil meal only, and generally leave over corn for next fall feeding, as new corn meal wont keep for many days, and when it sours it purges the cattle, and then they wont eat for some days; but they never get sick with eating oil meal, and for all I have fed, or rather fatted, a great many cattle, I have never had one die, as all I have fatted have had at least half oil meal.

I began feeding oil meal at $7 per ton, and followed it up until I paid $28,33 last year, and this season $27. These prices are too high, unless we can get nearly or quite $6 per one hundred pounds, live weight, for sheep and cattle. When I kept a regular flock of store sheep, I always fed each sheep during winter and spring, one and one-half bushels of oil meal. Then I was paying only $10 per ton. So late as 1846, I had never paid over that amount, and for five years afterwards from $12 to $14 per ton. It paid admirably fed to store sheep, as one and one-half bushels at $10 a ton, cost only 38 cents. That, with straw, will winter a sheep much better than hay, (first rate clover hay only excepted.)

The extravagant prices they pay in England, hurt us American farmers; else every ton of oil-cake in this country ought to be fed in it. I consider there is nothing I feed makes as rich manure, and all I want is manure. If I

have plenty of that, I can have everything I want, money and all; but it requires the manure to make money now-a-days, and cattle and sheep manure is the only kind that will pay here. I have done with the manures of commerce.

I raise my calves on oil meal, and do it very cheaply. Oil meal and skimmed milk, sour milk or butter-milk, make fine calves and always healthy. The first winter I feed them oil meal enough to keep them growing; the second winter give them two quarts per day, and by April or May have sold my two-year-olds for beef at from $50 to $60 each. I have fed them generally about $11 worth of oil meal each in that way.

It also pays well to fat lambs in winter. I have made Merino lambs bring me $5 each before they were a year old, by feeding them 70 cents worth of oil meal during winter. It don't take the half to fat lambs it does old sheep. I have fed oil meal many years, and as long as I do feed, I will continue to do so. I think we will get it much lower another year, as I notice flax seed has fallen very much. If beef and mutton get low, it wont do to pay a high price for oil meal. Last spring New York oil-cake brought £15 sterling per ton in England. Now it is from £10 to £10, 15s., and falling; I notice it is much lower in New York.

There are forty bushels of fifty pounds each in a net ton of oil meal, but fifty pounds of oil meal is much better to me than sixty pounds corn meal; yet they do well mixed. When I feed corn to sheep, I give that one part of the day and oil meal the other. When I have fed all corn to sheep, I have often lost some by a rush of blood to the head; their necks and heads would be gorged with blood, when all behind the neck would be very white, more so than any slaughtered sheep—but I never lose any in that way when I feed oil meal.

I sold cattle last year twenty-two months old weighing one thousand one hundred and twenty-five pounds gross, and I have some this year that I think will go about the same when they are the same age. There is only a little Durham blood in them.

It should be urged on the farmers to buy and feed oil-cake in preference to buying the manures of commerce. It will be a great deal more to their profit. If I was as able to go around the country as I was ten years ago, I would fat far more stock in winter than ever I did. There can be no profitable farming without good rich manure, but my farming days are nearly over; but if young men would only do as I have done, they would reap the benefit of it by and by."

Mr. Roberts of Massachusetts, says:

"Having wished for some time past to ascertain with some degree of accuracy the relative value of different kinds of food commonly used to fatten cattle, I have, in accordance with the wishes of the Plymouth County Agricultural Society, selected four head of small-boned medium-sized cattle, in thrifty condition, for stall feeding. They were weighed and put up for fattening in

a tight barn, well ventilated, on the 4th of September, and fed as follows: No. one—best quality of hay, as much as it could eat; No. two—on potatoes, commencing with one-half a bushel and increasing the quantity to three pecks per day; No. three—Indian meal, beginning with four quarts and increasing to nine quarts; No. four—oil meal, same as No. three; Nos. two, three and four were allowed a sufficiency of hay for digestive purposes.

Weight of animals September 4.	Weight of animals November 2.	Increase.
No. 1—575 pounds.	No. 1—642 pounds.	No. 1—67
" 2—648 "	" 2—717 "	" 2—69
" 3—802 "	" 3—934 "	" 3—132
" 4—682 "	" 4—825 "	" 4—143

I adhered to the distinctive kinds of food fed to each animal, although it has been deemed desirable by some to indulge their appetites by a mixture or variety of fodder as animals often, like men, tire of any constant aliment. In the present instance this did not appear to be the case, as they were never overfed, but their food was increased in small quantities and given to them little at a time and often. Punctuality in feeding was strictly observed. The animal stomach is a very nice measurer of time, and nothing is more important than to keep the animal as quiet and satisfied as possible; and if the time be variable, or the usual hour passed over, he becomes hungry and restless, and his condition will suffer, of course. In the selection of food, I have been guided by past experience. In the choice of potatoes it has been proved that cattle fed upon them will, in general, have as much tallow as those fed in any other way, and the beef of such cattle is thought by many to have a peculiar juiciness or sweetness. Experiments which have come to my knowledge of boiling or steaming potatoes for neat stock have not yet satisfied me that the advantages accruing are an adequate compensation for the labor and expense incurred. The animal number two shows an increase of sixty-nine pounds, which is a little more than a pound per day for the time of fattening, (sixty days.) This is a small increase compared with numbers three and four, fattened on Indian meal and oil meal, and increases the expense of fattening on potatoes about two-thirds of a cent more than the fattening on Indian meal, as will be seen by the following table:

		Cost of meat per pound.
No. 1—half ton of hay,	$6,	9 cents.
" 2—40 bushels small potatoes at 1s.,	6,67,	9 2-3 "
" 3—11¼ bushels Indian meal, at $1,05,	11,81,	9 "
" 4—11¼ bushels oil meal, at $1,	11,25,	7 6-7 "

From five years experience in the use of oil meal, I think it is of great value, both for fattening stock and enhancing the value of the manure. Th flesh of cattle fattened on it does not possess that oily flavor that some suppose it necessarily would have, but resembles that fattened on Indian corn. Many farmers make use of it merely for the richness and strength it imparts to the

excrements of cattle, while at the same time it keeps all neat cattle in good heart and entirely free from lice."

According to Mr. Roberts' experience, the oil meal gave him meat at a cent per pound less cost than Indian meal, both being reckoned at a dollar per bushel, and the experience of the one seems closely to correspond and prove corroborative of that of the other.

As there seems promise of an abundant supply of oil cake from a new source, the following from a report made the present year to the Connecticut State Agricultural Society, by Prof. S. W. Johnson, of Yale College, and chemist to the society, will be of interest in this connection:

"Recently a process has been patented for removing the hulls from cotton-seed, so that this material may be expressed for its oil. This new industry is now prosecuted in Providence, R. I., and so enormous are the quantities of cotton-seed that hitherto have been nearly useless refuse, which may thus be profitably economized, that this manufacture will doubtless be a permanent and extended one. The important agricultural uses to which the cake remaining after the expression of flax, rape and other oily seeds, have been applied, makes it important to study what are the properties of the cotton-seed cake. I have examined specimens from the Providence mills, and find that its composition is not inferior to that of the best flax-seed cake, and in some points its agricultural value surpasses that of any other kind of oil-cake of which I have knowledge; as will appear from the following statement of its composition compared with that of linseed cake:

	I.	II.	III.	IV.	V.
Water, . . .	6.82		11.19	9 23	16.94
Oil, . . .	16 47		9.08	12.96	
Albuminous bodies, . .	44.4	48.82	25.16	28.28	10.69
Mucilaginous and saccharine matters	12.74	}	48.93	34.22	40.11
Fibre, . . .	11.76	}		9.00	27.16
Ash, . . .	7.80	8.96	5.64	6.21	5.04
	100.00		100.00	100.00	100.00
Nitrogen, . . .	7.05	7.75	3.95	4.47	
Phosphoric acid in ash, .	2.36	2.45			
Sand, . . .	94		1.32		

No. I. is the cake from Providence.

No. II. gives some of the results of an analysis made by Dr. C. T. Jackson, on cake prepared by himself from hulled cotton-seed. (Patent Office Report for 1855, agricultural part.)

No. III., analysis of Dr. Anderson, on cotton-cake, made at Edinburgh, Scotland.

No. IV., average composition of eight samples of American linseed cake. (Journal of Highland and Agricultural Society of Scotland, July, 1855, page 51.)

No. V., Meadow Hay, Saxony, Dr. Wolff.

The two points of interest before us are, the *nutritive* and *manurial* value of this cake. With reference to both, chemistry and practical results agree in their conclusions. The great value of linseed cake, as an adjunct to hay for fat cattle and milch cows, has long been recognized; and is undeniably traceable in the main, to three ingredients of the seeds of the oil-yielding plants. The value of food depends upon the quantity of matters it contains which may be appropriated by the animal which consumes the food. Now, it is proved that the fat of animals is derivable from the *starch*, *gum* and *sugar*, and more directly and easily from the *oil* of the food. These four substances, are, then, the *fat formers*. The muscles, nerves and tendons of animals, the fibrine of their blood, and the curd of their milk, are almost identical in composition, and strongly similar in many of their properties, with matters found in all vegetables, but chiefly in such as form the most concentrated food. These *blood* (and *muscle*) *formers* are characterized by containing about fifteen and one-half per cent. of nitrogen; and hence are called *nitrogenous substances*. Since albumin (white of eggs) is the type of these bodies, they are also often designated as the *albuminous bodies*.

The bony frame-work of the animal owes its solidity to *phosphate of lime*, and this substance must be furnished by the food. A perfect food must supply the animal with these three classes of bodies, and in proper proportions. What proportions are the proper ones, we have at present no means of knowing with accuracy. The ordinary kinds of food for cattle, contain a large quantity of vegetable fibre or woody matter, which is more or less indigestible, but which is indispensible to the welfare of the herbivorous animals, as their digestive organs are adapted to a bulky and rough food. (See analysis V.) The addition of a small quantity of a food rich in oil and albuminous substances, to the ordinary kinds of feed, has been found highly advantageous in practice. Neither hay alone, nor concentrated food alone, gives the best results. A certain combination of the two presents the most advantages.

For fattening animals, and for increasing the yield and quality of milk, linseed cake has long been held in high estimation. This is to be expected from its composition. The muscle of flesh and the curd of milk are increased in quantity, because the albuminous substances of the linseed constitute an abundant and ready source of them; the fat of the animal and the butter of the milk are increased by the presence in the food of so much oil and mucilaginous matters.

A year or two since, Mr. M'Lagan of Scotland, reported in the Journal of the Highland Society, some trials on the value, as food, of linseed cake, cotton-seed cake, and bean meal. Analysis III. represents the composition of the cotton-cake; IV. that of the linseed cake. The bean meal has twenty-five per cent. of albuminous matters, but one and one-half per cent. of oil, and

correspondingly more of the bodies that have the same nutrient function as the mucilaginous and saccharine matters. Six animals of nearly equal size and quality were fed during three months in winter, with all the turnips and straw they would eat, and in addition, two of them received daily, four pounds of linseed cake, two, four pounds of cotton-seed cake, and two, four pounds of bean meal. The animals thrived as well on cotton-seed cake as on the other kinds of food—as shown by their appearance, and by their weight when slaughtered.

When linseed cake is fed in too large quantity it purges the animal. The quality of beef is excellent when the daily dose of oil cake does not exceed six pounds for an animal of seven hundred pounds. Cases are on record when more than this quantity has spoiled the beef, giving it a *taste like tallow*.

Probably like results would follow excessive feeding with cotton-seed cake. In the best cotton districts of India, the cotton-seed bears a high value as food for fat cattle. I know of no experiments with it on milch cows, but it is to be expected that here also it will have the same effects as linseed cake.

A Bavarian farmer has recently announced that heifers fed for three months before calving with a little linseed cake in addition to their other fodder, acquire a larger development of the milk vessels, and yield more milk afterwards, than similar animals fed as usual. Cotton-seed cake must have an equally good effect.

Some of those who have used cotton-seed cake have found difficulty in inducing cattle to eat it. By giving it at first in small doses, mixed with other palatable food, they soon learn to eat it with relish.

On comparing the analyses II. and I., with the average composition of linseed cake, IV., it will be seen that the cotton-seed cake is much richer in oil and abuminous matters than the linseed cake. A correspondingly less quantity will therefore be required. Three pounds of this cotton-seed cake are equivalent to four of linseed cake of average quality.

The value of the article in question as a manure, is obviously very considerable. The dung of cattle, etc., fed upon it, will be greatly richer, both in nitrogen and phosphates, than that of animals fed on hay alone. Where stock is kept, probably the best manner of using this cake as a fertilizer, is to feed it to the cattle, and carefully apply the manure they furnish. In this way, whatever is not economized as fat or flesh, will be available as manure.

In England and on the continent of Europe, linseed and rape-cake have been used directly as a dressing for the soil, and with results fully equal to what is indicated by their composition. These kinds of cake decompose readily, and their effect is usually finished in one season. Five hundred or six hundred pounds per acre is considered a good application; more is liable to be injurious. It is found that when applied with the seed, these kinds of cake prevent germination to a considerable degree; but if applied a week or so previous to sowing, this detriment is not encountered.

The cotton-seed is often employed in the Southern States, with good effects, as a manure for Indian corn, &c. I do not know whether like rape and lin-

seed cake, it destroys the seed. For manuring purposes it is about one-third richer than linseed cake. Its effects are mostly due to the nitrogen it contains, and therefore are similar to those of guano. It is best used in conjunction with other fertilizers. I should judge that a mixture of four hundred pounds of this cotton-seed cake with fifty bushels of leached wood-ashes per acre, would make an excellent application for most crops. It is highly important that the cake be uniformly distributed, and thoroughly intermixed with the soil.

The cotton-seed cake is doubtless an excellent material for composts, owing to its ready decomposability.

Its commercial value as a manure, if calculated from the prices adopted in this report, is $21.60. The market price is $25.00. Therefore, next to Peruvian guano, this is a substance which, if its composition proves uniform, is most nearly worth what it costs."

THE DAIRY. As a profitable branch of stock husbandry, the manufacture of dairy products deserves more attention at the hands of the Maine farmer than it has yet received. While nearly or quite all make more or less butter or cheese, the advantages which may accrue from a systematic and vigorous prosecution of dairying as a chief object, have been appreciated and profited upon by comparatively few, and what may properly be deemed dairy farms are exceedingly rare. Very little butter is exported from the State, and of cheese, large quantities are annually imported which might be profitably made at home. By the census of 1850 it appears that there were in Maine one hundred thirty-three thousand five hundred fifty-six milch cows, or about one to every five inhabitants. What the average yield of these in milk may be, we have no means of ascertaining, but if we estimate it at five quarts per day, there is one quart per day for every person. Is this enough for milk, butter and cheese? May it not be increased with pleasure and profit? By the same returns we learn that the amount of butter manufactured was nine millions two hundred forty-three thousand eight hundred eleven pounds, or about sixty-nine pounds per cow. Some of our neighbors do better. In New Hampshire, the yield is seventy-three pounds per cow; in Connecticut, seventy-five pounds; in Vermont, eighty-three pounds; in New York, eighty-five pounds. Of cheese, the amount made in this State according to the same authority, was two millions four hundred thirty-four thousand four hundred fifty-four pounds, or about eighteen pounds per cow; while our neighbors

in New Hampshire make thirty-one pounds per cow, Massachusetts fifty-four pounds, Vermont fifty-nine pounds, Connecticut sixty-two pounds, and New York fifty-three pounds. Why this great difference? Is there need of it? Cannot our practice be changed with decided advantage? These questions are deserving a well-considered answer, and together with the ways and means of accomplishing the desired end, will form the subject of some remarks in which the statements and experience of others will be freely drawn upon.

Let us first inquire what the difference amounts to between the sixty-nine pounds of butter and eighteen pounds of cheese which we make, and the eighty pounds of butter and sixty pounds of cheese which our neighbors make. If we reckon the money value of butter at twenty cents, and of cheese at ten cents, the one amounts to $15.60, and the other to $22, a difference of $6.40 per cow. So that to equal them we must manage to obtain an increase of rather more than forty per cent., and if we succeed, the value of our dairy products will be increased by $6.40 on every cow, a sum amounting to $854,758 on the number reported to be in the State eight or ten years ago.

To what is this difference to be ascribed? Is it because the soil and climate of Maine are forty per cent. worse than that of other States? By no means. Is it because our cows are on the whole so much worse than theirs? Certainly not. Is it because they are fed and treated so much worse? No; but rather because comparatively less attention is given to this branch of husbandry, and this lack of attention is manifest in many different ways. Our cows have been bred (so far as care has been bestowed upon breeding) and are valued for their ability to bring forth calves which will grow into the largest working oxen rather than for dairy excellence. The quality of our dairy products, unquestionably choice as a part of them is, has not been, on the average, so good as it should be. The little butter occasionally sold out of the State does not command so high a price as that from other States. If improvement is to be effected, greater attention must be given to the selection and breeding of cows with reference to dairy qualities, to their treatment, and to improvement in methods of manufacture.

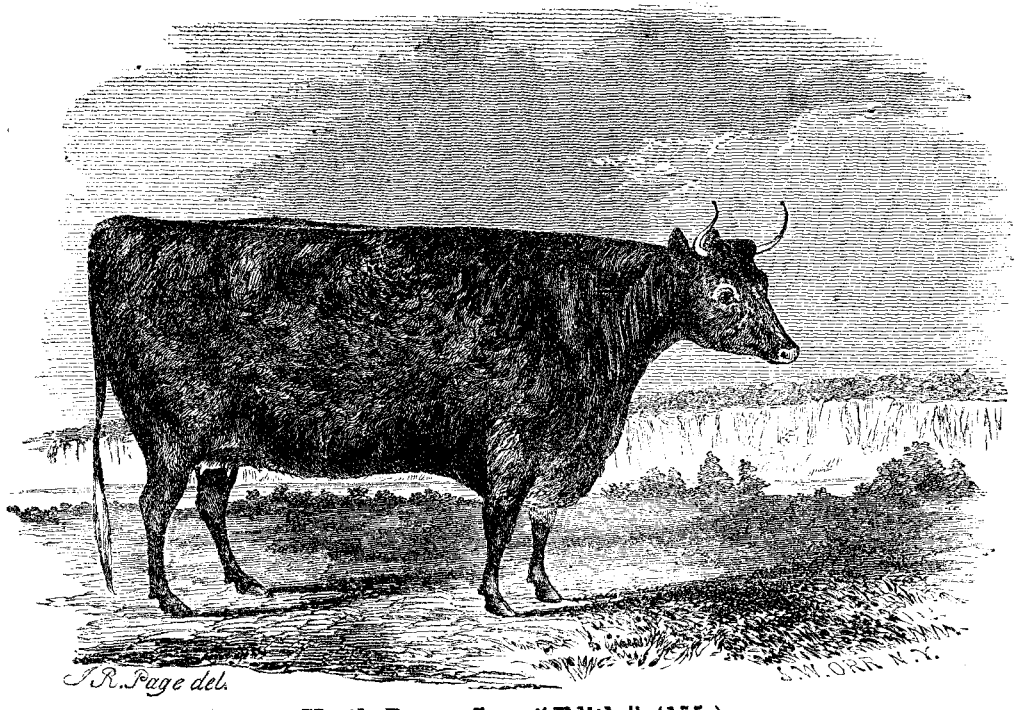
No better cows for the production of milk can any where be found than some among our native stock. Yet as these do not deserve the

name of a breed, and still less of a race, having no distinctive marks or fixed traits which descend to their progeny with an approximation to certainty, it is evident that they cannot be relied on to furnish a definite and sufficient number of desirable milkers. By judicious selection of a small proportion, a dairy might be established in which the cows would yield a return double or even treble what an equal number of the rejected ones would do; and were the skill, energy and perseverance of a Bakewell devoted to the purpose, there is no doubt whatever that a dairy breed, or a working breed, or a breed for early fattening, or one embracing so far as compatible all three, could be produced from these alone with no future introduction of foreign blood, and such a consummation is worthy of earnest and patient effort, but as this is not yet accomplished, and will require many years of labor if it ever be, we are restricted in present efforts in improvement to selection from among the best of such as we have, or resort to introduction of foreign breeds to be kept pure or crossed with native stock.

If we examine critically such as have been most largely introduced into the State, we find them to have been bred with reference to early maturity, to beef and to labor, rather than for the pail, and they are on the whole, better adapted to the yoke and the shambles than to the dairy. The Durhams or Short Horns which have been more extensively introduced than any other, were bred with special and almost sole reference to the production of beef; hence size, symmetry and early maturity were aimed at, and the eminent success which attended the effort is evidenced both by the enormous prices realized for many years for choice specimens, and by the fact that these desirable qualities were successfully imparted to our active and hardy native cattle by crossing, and the grades found useful and valuable for the general purposes of the Maine farmer. Among the earlier introduction of Durhams into Maine, were some which possessed milking qualities beyond the average of this breed, and of the grades descending from these, inheriting in many instances a well-developed lacteal system from the native mother, were not a few which yielded largely of milk and of good quality. Mr. Haxton, a discriminating writer, remarks—"The Short Horn cow is every thing that could be desired as regards symmetry and aptitude to fatten, but she is not a dairy cow in the strict sense of the term,

and under the ordinary circumstances of food and climate she is not equal to other breeds inferior to her in every other respect, but when well fed, well housed and kept comfortable, she is not without merit as a milker. A pure Short Horn cow, or even a three-parts bred one, is an unprofitable animal for a butter or cheese dairy, not merely because her milk is usually deficient in richness, but because of the delicacy of her constitution. In the English dairy counties the cows are generally allowed to pasture in the fields both in summer and winter, and in consequence of this being the prevailing custom, it is an essential qualification that they be of a hardy constitution. Now the Short Horn cow can neither withstand cold nor heat, nor sudden transitions of temperature, without suffering injury; in the former the flow of milk is arrested by the expenditure of the food in maintaining the vital energy, (which is below an average in all animals of a lymphatic temperament,) and in keeping up the natural heat of a carcass very large in proportion to the vital organs. Great heats or sudden alternations of temperature are also found to act very injuriously on her milking properties in consequence of their weakening effects on a constitution not naturally the most robust. Of course these causes are also injurious to other breeds of dairy cows, but much less so in consequence of their smaller carcass and hardier constitution. Few dairy farmers would ever think of purchasing a pure Short Horn cow, and it is questionable whether, for them, any advantage is derived even from an infusion of Durham blood; but to milk dairymen who practice house feeding with abundance of rich nutritive food, few animals will pay so well as a cow with a large proportion of Short Horn blood in her veins, as she will accomplish what few other cows can, namely, make both milk and beef at the same time."

Of the North Devons, which are rapidly becoming disseminated throughout the State, the Secretary of the Massachusetts Board of Agriculture says: "they are remarkable for hardihood, symmetry and beauty, and are generally bred for work and for beef rather than for the dairy. The proportion of meat on the valuable parts is greater, and the offal less, than on most other breeds, while it is well settled that they consume less food in its production. As working oxen, the Devons perhaps excel all other races in quickness, docility and beauty, and the ease with which they are matched.



North Devon Cow "Edith." (155.)

Imported by L. G. MORRIS in 1850. For pedigree see Davy's Devon Herd Book, Vol. 1, page 45. Edith was one of four Cows which shared the first premium as a herd at the United States Agricultural Society's Show at Boston in 1855, and in 1857 won the first prize at the New York State Show, held at Buffalo.

With a reasonable load, they are equal to horses as walkers on the road, and when they are no longer wanted for work they fatten easily and turn well. As milkers, they do not generally excel, perhaps they may be said not to equal the other breeds, and they have a reputation of being decidedly below the average: but this is probably owing to breeding, in particular families. In their native country, the average of a dairy is one pound of butter per day during the summer. But though the Devons generally are not noted as milkers, yet I have had occasion to examine several animals bought from the celebrated Patterson herd, which would have been remarkable as milkers even among the best milking stock, and I am convinced that the reputation they bear as small milkers is due to the great anxiety which has often been manifested to breed, as it were, to order, in point of symmetry and beauty of form, with a disregard to milking qualities."

Mr. Colman, in his European Agriculture, says:—"The North Devons have some strong advocates as a milking stock. The most productive cow in butter which I have found, was a North Devon, which for several weeks in succession, without extra feed, produced twenty-one pounds of butter per week."

It is universally conceded that the milk of Devons is of extraordinary richness, and second to none in this respect except the Jersey. It is said that a pound of butter can be made from nine or ten quarts, and that in some rare instances, it has been made from five quarts, while milk from the average stock of the country yields but a pound from fifteen or sixteen quarts.

Were it possible to add to the other qualities of the Devons uniform milking properties equal to what some of them are now know to possess, little more could be asked for in a breed designed for general use, and the success which has attended efforts thus far made to breed them towards milk has, so far as known, proved highly gratifying.

The Herefords, valuable as they are for the possession of the chief excellencies of the Durhams, connected with greater hardihood and the ability to thrive upon scantier fare, does not give promise of improving our stock for dairy use. When pure-bred, they are confessedly scanty milkers, and no attempts are known to have been made to improve them in this respect. Some of the grade cows, sired by the Hereford bull, which have fallen under my observation,

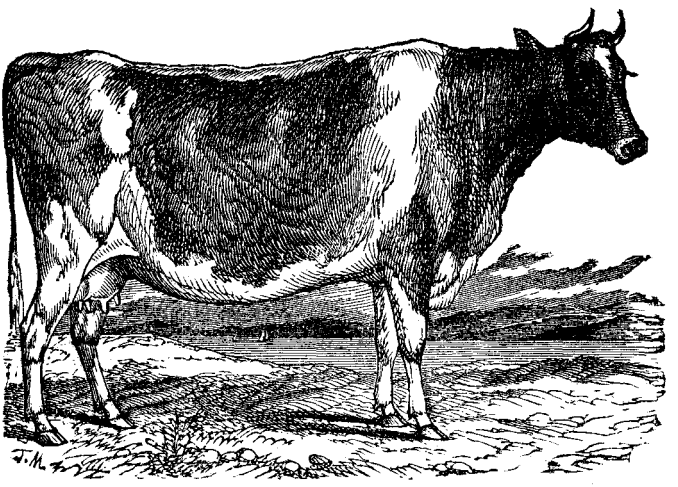
were, however, better as milch cows than could be anticipated, if we are to believe, as some teach, that the male has predominant influence in determining milking qualities; for these, when from good milking cows, gave nearly as much themselves as did their dams, and of richer quality. The progeny seemed to have inherited the vascular system of the dam connected with an improved form and grazing qualities; but notwithstanding such instances, there is no claim made in favor of this breed, so far as my knowledge extends, even by its strongest advocates, on the score of fitness for dairy purposes.

A fair indication of the degree of attention bestowed upon, and of the importance attached to, dairy qualities in the above named breeds, in the minds of their originators and propagators, may be found by examining the several scales of points made by them to indicate their relative value. The scale is of one hundred points. The head is reckoned at so much, and the chest at so much, and so on—each indicating its supposed importance. Now, in the Devon, the udder is rated at one point or one-hundreth of the whole; in the Herefords it is reckoned at two points, and the Short Horns or Durhams at three points only, while in the Ayrshires it is reckoned at twelve points or about an eighth of the whole; in none of the others at so much as a thirtieth.

There has been little attention paid to the systematic breeding of cattle with primary reference to the diary, either at home or abroad, compared with the pains bestowed to improve breeds for beef, &c.; yet there are two well-defined and established breeds of dairy stock, the Ayrshire and Jersey, of which some introductions have been made into this State, and which deserve our consideration.

The improved Jersey cow (sometimes miscalled Aldernay*) is remarkable in many respects, and very diverse opinions have been and are still held among breeders regarding its merits. Most English writers in years past, describe the breed as ill-shaped, great

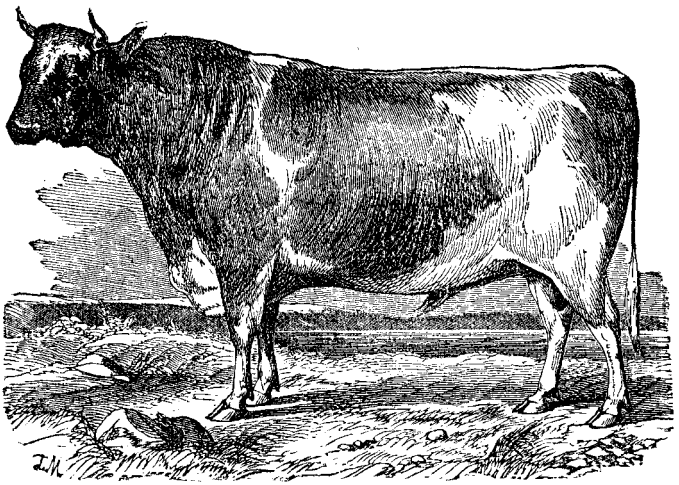
*The term Aldernay applies more properly to the cattle of the Channel Islands generally, while in the Isle of Jersey special improvements have been made. They were all originally of the same stock, and introduced from Normandy, in France. Some eighty or one hundred years ago, Norman cattle were introduced into parts of Lower Canada, and we have in the States some of their descendants which bear resemblance enough to those introduced from the Channel Islands to mark distinctly a common origin.



Improved Jersey Cow.

eaters, and on the whole unprofitable, although extraordinary richness of milk is universally conceded. But from the best information I can gather, there have been very great improvements effected within the last thirty years, and that they have rapidly risen in favor both in this country as well as abroad, so much so, that Mr. Flint, in his report for 1857, says that "the importation of Jersey cattle into Massachusetts has been more extensive within the last ten years than that of any other breed." Of late they have been introduced into this State, particularly into Kennebec, Penobscot and Cumberland counties, but too recently to speak with confidence as to their adaptation to our climate and wants, either as pure-bred or when crossed with our common stock. Some are very enthusiastic and liberal in their enconiums of the half-bloods, while others, less pleased, and preferring a more showy and symmetrical animal, have disposed of what they had.

For the farmer who desires to raise working oxen, they are both too small and have too much of a "game" look to be satisfactory. The dairyman who sells milk, can suit himself better with others, the milk of the Jersey being rich rather than abundant; but unsuited as they may be to the wants of the milk seller or the general purposes of the common farmer, there is no doubt of their ability to supply one's own table with delicious milk and cream, and the richest and yellowest butter.



Jersey Bull.

Some cows of this breed have certainly proved wonderfully productive in butter, as witness the statement of Thomas Motley of Roxbury, with regard to the yield of his imported cow Flora, whose milk was kept separately and the butter accurately weighed from churning to churning. From the 10th of May to the 9th of November, there was made three hundred sixteen pounds and seven ounces, averaging twelve pounds and three ounces for twenty-six weeks, from which time up to the 26th of April, one hundred ninety-four pounds and eleven ounces more were made—making five hundred eleven pounds and two ounces for the year. Mr. Motley, in November, stated that Flora had no meal or grain or any food whatever besides grass, except in August, September and part of October he gave her, as well as all his other cows, a feed of cornstalks, as his pastures were almost dried up. Afterwards she was fed with hay and rutabagas.

Mr. Read of Tewksbury, had an imported Jersey cow which gave in seven days in May one hundred and ten quarts of milk, producing seventeen and three-fourths pounds of butter.

Roswell L. Colt of Patterson, N. J., has had large experience of breeds, and prefers these. He thinks them well adapted to our climate, and says, "In every instance I have found those raised here, particularly of the second stock, better than the imported. As to milking qualities they give twelve, fourteen, and sixteen quarts a

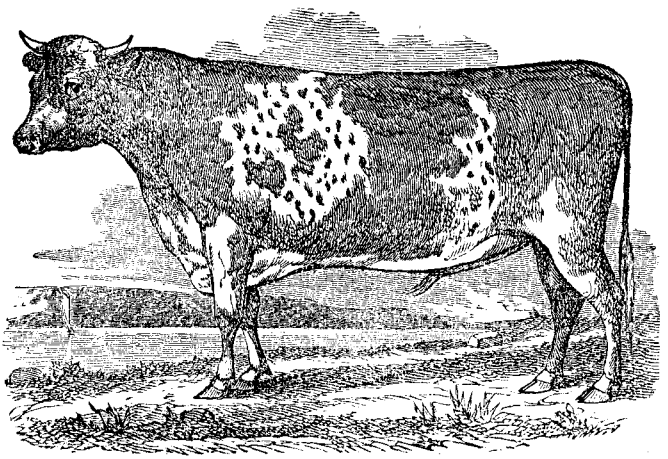
day, and of course fall off towards calving, but it is difficult to dry them up so as not to starve the unborn calf."

Col. Le Coulteur of the Isle of Jersey, who has done more perhaps than any other to improve this breed, and is considered the highest authority in regard to them, says, "a fact worthy of notice, and not generally known, is, that the Jersey cow when old and becoming of little value as a milker, will, when fed up, fatten rapidly and produce a greater quantity of butcher's meat than is supposed. In 1850, an old cow for which only £5 was offered, was put up to fatten. Her weight was eleven hundred and twenty-five pounds on 1st of October. When killed on 6th January, 1851, she weighed thirteen hundred and thirty pounds, having gained two hundred and five pounds in ninety-eight days. She was allowed twenty pounds of hay, some wheat straw, and thirty pounds of roots, consisting of white carrots, swedish turnips and mangold wurtzel."

He relates the following experiment which was instituted to ascertain whether narrow and deep vessels, customary in Jersey, or broad shallow dishes, were most profitable. It indicates also great richness of milk. His cow, Beauty, was then at pasture, and giving eight quarts at a milking. Two quarts of the milk were placed in a flat glass dish, sixteen inches wide and three and one-half inches deep; two quarts in a white ware dish, thirteen inches wide and three inches deep; two more quarts were placed in a high brown-ware vessel eight inches wide and nine and a half inches deep. After forty-six hours, the cream from the glass dish after fifteen minutes' churning, produced four ounces of butter; that from the white-ware dish, in eighteen minutes, afforded three ounces and a half of butter, while that from the brown, deep dish, gave four ounces and three-quarters in twenty-three minutes; altogether, exactly at the rate of sixteen Jersey ounces to the eight quarts, or about seventeen ounces imperial at each milking.

Haxton speaks of the Jersey cow as the dairyman's friend when her milk is mixed with that of a dozen ordinary cows, and as his enemy if he attempt to make butter and cheese from her milk alone, as from its excessive richness neither will keep well. He says, also, that "the breed has been crossed successfully with the North Devon, both as regards milking and fattening properties. Crossed with a bull of any other breed, the progeny retain to a considerable

extent the characteristic milking properties of the mother." Whether increased richness of milk follows from the use of the Jersey bull he does not say, but the probability is that it does.* That a few cows of this breed in a large dairy, or an infusion of Jersey blood in all the cows, would improve the quality of dairy products generally, there can be no doubt.



Ayrshire Bull.

The Ayrshire breed originated in the county of Ayr, in Scotland, whence its name. With regard to the exact nature of its origin

*A noteworthy instance of this comes to hand while the above is in type. Dr. Holmes, in the Maine Farmer, says:—"There is no getting rid of the fact that the Jerseys give richer and better milk than most of the other breeds, and not only that, they transmit this property to their offspring. As proof of this, read the following statement handed in by Ephraim Wood, Esq., who exhibited (at the Winthrop Cattle Show) a beautiful grade Jersey heifer, two years old, which came in last April.

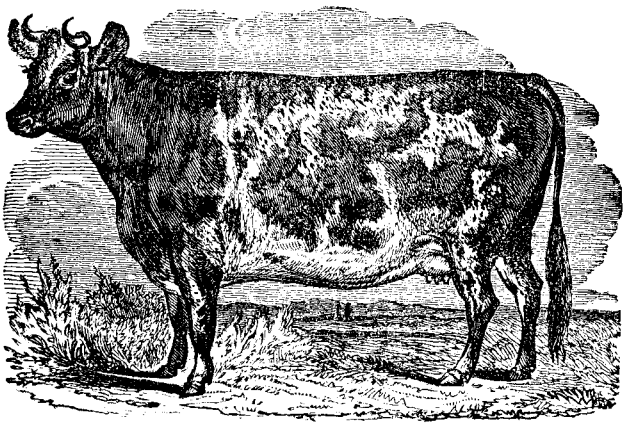
She has been kept in a pretty good pasture during the summer. Finding her to give very rich milk, he instituted a trial of its quality last month, which resulted as follows: She gave—

	Morning.	Evening.
October 24,	3 quarts.	2 quarts.
" 25,	2½ "	2½ "
" 26,	2½ "	2½ "
" 27,	2¾ "	2½ "
" 28,	2¾ "	2½ "
" 29,	2½ "	2 "
" 30,	2½ "	2 "

Total in 7 days, 34½ quarts.

November 5—churned from the above, 6 pounds of butter. This makes a yield of 1 pound of butter from 5¾ quarts of milk."

there exists a difference of opinion, some regarding it as having arisen mainly from judicious crosses of breeds from abroad upon the original cattle of the district, and that as a breed it does not date farther back than seventy or eighty years; but the weight of evidence favors the belief that it is largely of native origin. A late standard writer says: "The county of Ayr, situated on the south-west coast of Scotland, is, from its moist climate, naturally well adapted to pasture, much of it being also of a clayey soil, is expensive and difficult to cultivate for crops. The natural character of the district has produced a breed of cattle hardy and active, capable of withstanding the severities of winter in a bleak and naked country, and yet easily brought into condition with the return of warm weather and good pasture. This origin of the present breed it is difficult to trace. Some writers have supposed that it was produced by crossing the native breeds with the larger cattle of England. Very likely this may be partly the case, but the chief excellencies of the breed are unquestionably indigenous and have naturally arisen from the peculiar circumstances of climate, soil and situation. Ortelius, in his Description of the World, published in 1570, says that in Carrick, a district of Ayrshire, 'are cattle of great size, whose flesh is tender and sweet, and another kind which never become fat but yield rich milk.' This last is the original dairy breed of Ayrshire, and its milking properties would be increasingly cultivated as the country became more populous in consequence of the development of its rich mineral resources, whilst the supply of butcher meat would be left to remoter districts where no local consumption for dairy produce existed. The three counties, Ayr, Renfrew and Lanark, in which the Ayrshire may be said to be the exclusive dairy stock, comprise more than a fourth of the whole population of Scotland, and within the last thirty years the increase of population, wealth and manufacturing industry in these counties has been beyond all precedent. The demand for dairy produce has increased in the same proportion, and the skill of an intelligent and most industrious rural population has been taxed to the utmost to keep pace with this demand. Men's wits, sharpened by their interest, led them to note the points indicative of good milkers; the best individuals were put to bulls of the best kind; those cows which turned out indifferent milkers were fattened for the butcher, and the



Ayrshire Cow.

progeny of the best only kept for the dairy. In this way a superior breed spread rapidly over the district; the great body of the tenantry being men who themselves managed the details of the dairy and thus were enabled at once to pick out the bad, and perfect the good qualities of their different stocks."

As to their distinctive traits, the following is quoted from Professor Low:—"The modern Ayrshires may stand in the fifth or sixth class of British breeds as respects size. The horns are small and curving inwards at the extremity after the manner of the Alderney. The shoulders are light and the loins very broad and deep, which is a conformation almost always accompanying the property of yielding abundant milk. The skin is moderately soft to the touch and is of an orange yellow tinge about the eyes and udder. The prevailing color is a reddish brown mixed more or less with white. The muzzle is usually dark, though it is often flesh-colored. The limbs are slender, the neck small, the head free from coarseness. The muscles of the inner side of the thigh, technically called *the twist*, are thin, and the haunch frequently droops to the rump—a character which exists likewise in the Alderney breed, and which, though it impairs the symmetry of the animal, is not regarded as inconsistent with the faculty of secreting milk. The udder is moderately large without being flaccid. The cows are very docile and gentle, and hardy to the degree of being able to subsist on ordinary food. They give a large quantity of milk in proportion to their size and the food they consume, and the milk is of excellent quality.

Healthy cows, on good pastures, give eight hundred to nine hundred gallons in the year, although taking into account the younger and less productive stock, six hundred gallons may be regarded as a fair average for the low country, and somewhat less for a dairy stock in the higher."

Aiton, in his "Survey of Ayrshire," places the yield of the best of this breed at four thousand quarts in three hundred days after calving, or until they run dry. He states that this is considerably above the average yield, which may be about twenty-four hundred quarts or six hundred gallons.

Martin says:—"It has been estimated that a good Ayrshire cow will yield for two or three months after calving, five gallons of milk daily; for the next three months, three gallons daily, and a gallon and a half for the following three months. This milk is calculated to return about two hundred and fifty pounds of butter annually, or five hundred pounds of cheese. This is, however, somewhat exaggerated—four to four and a half gallons of milk a day is about the average product."

Dickson writes:—"The cows have obtained a world-wide celebrity as milkers, and are to be found in most of the dairies of noblemen and gentlemen in every part of the kingdom." He mentions one known to have produced forty quarts daily.

Mr. Haxton says:—"For purely dairy purposes, the Ayrshire cow deserves the first place. In consequence of her small, symmetrical and compact body, combined with a well-formed chest and a capacious stomach, there is little waste, comparatively speaking, through the respiratory system; while at the same time there is very complete assimilation of the food, and thus she converts a large proportion of her food into milk. So remarkable is this fact, that all dairy farmers, who have had any experience on the point, agree in stating *that an Ayrshire cow generally gives a larger return of milk for the food consumed than a cow of any other breed.* The absolute quantity may not be so great, but it is obtained at less cost, and this is the point upon which the question of profit depends."

Sanford Howard, in an essay published in the transactions of the New York State Agricultural Society, says, "Whether the Ayrshires are judged by their actual produce or by the external points which by experience and observation are acknowledged to denote

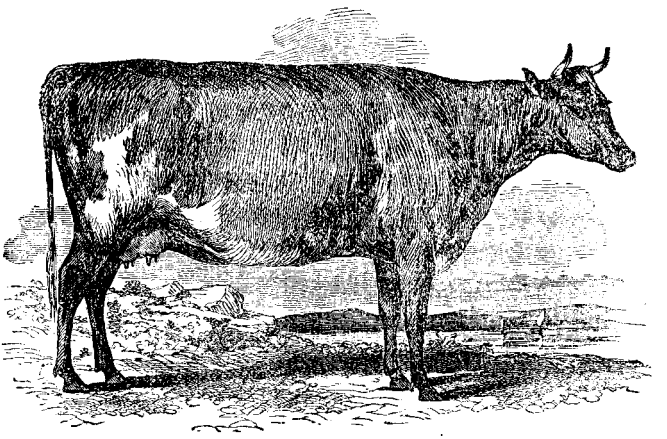
dairy qualities, it must be admitted that they take a high rank. From a fair consideration of their merits it is believed that their adoption for the dairy would secure the following advantages over the stock commonly kept for that purpose in this country:

1st. A greater quantity of milk, butter and cheese for the food consumed.

2d. Greater uniformity in the general character of the stock from its inherent or hereditary qualities.

3d. Better symmetry and constitution, and greater tendency to gain flesh when not giving milk."

From such inquiries and examination of the Ayrshires as I have been able to make, I am led to assent fully to the conclusions of Mr. Howard, and entertain no doubt that of all foreign breeds known among us, the Ayrshire promises to serve best in improving our stock for dairy use, and am satisfied that they will do this without detriment as to other desirable qualities.



Ayrshire Heifer, 3 years old,

Lately imported from Scotland. Selected by SANFORD HOWARD, Esq.

Whether the Jerseys will, or not, cross advantageously with our common stock, (a point on which some doubt has been expressed,) there is no doubt whatever as to these—the experience is sufficient and the testimony conclusive. The best cows I have ever seen were grade Ayrshires, some of which were, as individual animals, even preferable to full breds.

It is stated on good authority that "after they have yielded large quantities of milk for several years, they are as valuable for beef as the Galloway cow or any other breed of cows known in Scotland. They fatten as well, and the beef is not inferior to any other breed of cattle in Britain." As working oxen, the testimony is favorable. Mr. Hoag (who obtained the premium offered by South Kennebec Agricultural Society for best three dairy cows on one farm, for his grade Ayrshires) says, "the oxen usually measure seven feet in girth, are very intelligent, easily broken in, and keep in better condition on the same food, with hard labor, than most others;" and his opinion in this agrees with that of all, or very nearly all, who have used them, of whom inquiry has been made.

There are several other breeds of considerable repute for dairy qualities, among which may be named the Yorkshire in England, the Kerry in Ireland, and the North Dutch, none of which are known to have been imported into this State. Of the latter, a few have been introduced into Massachusetts, and are favorably esteemed. Dutch cattle were introduced into New York more than two hundred years ago, and modified somewhat by more recent importations of other breeds, still form the basis of many of the dairy cows of the Empire State.

The Short Horns undoubtedly owe their origin in part to this blood. Professor Low, after speaking of numerous importations during the last century from Holland and from "Holstein, whence the finest of the Dutch breeds had themselves been derived," says: "Of the precise extent of these early importations we are imperfectly informed; but that they exercised a great influence on the native stock (of England) appears from this circumstance, that the breed formed by the mixture became familiarly known as the Dutch or Holstein breed, under which names it extended northward through Northumberland, and became naturalized in the south of Scotland. It was also known as the Teeswater, or simply the Short Horned breed." These, through subsequent improvements by the brothers Colling and others, became the modern Short Horns.

The difference in value between a really good cow, productive in rich milk, and an indifferent one, for dairy purposes, is not often enough duly estimated. One which will give a quart of milk for

every pound and a half or two pounds of good hay consumed, (or its equivalent,) is worth a vast deal more to the dairyman than one which, similarly situated, gives but a quart to every three or four pounds. Indeed, the importance of care and skill in the selection of milk cows is believed to be not less than with regard to any other domestic animal, and the *care and skill bestowed upon their treatment should be as great;* but our farmers' wives tell us that such is not the fact; that the *likely* steers live upon the fat of the land and get the petting, and that the cows fare as they may upon what is left. Now this would not be the best policy even if our only object were to raise fine oxen, for they must have mothers, and if the dam be not well cared for, her progeny will suffer more or less for it, and this, if not felt immediately, must be in the long run; much more is such a course to be deprecated if we desire fine dairy stock. It is deemed safe to say, that the single fact, that there are among our native stock upon which no care has been bestowed either in breeding or in treatment, not a few most excellent milkers, is sufficient evidence that our climate and soil are favorable to the development of milking qualities in a degree unsurpassed by those of any other country on the globe, and this should stimulate us to corresponding efforts, that by proper treatment and careful selections, we may surpass all others.

Dairy properties being dependent in a good degree upon temperament and structure which are more or less hereditary, we should in the first place select individuals (whatever the breed) which belong to good families, and the progeny of parents which were known to excel for milk. Occasionally, among the best milking breeds an indifferent animal is found. This is objectionable, but not a sufficient reason for rejecting her as a breeder if her ancestry were uniformly good. So too we find sometimes a productive cow from a poor milking stock. While she may be all which could be desired as an individual animal, the very small chance of her transmitting her exceptional milking qualities to her progeny would be ample reason for rejecting her as a breeder, with a view to obtain milking stock. Regard should also be had on this point to both parents, for while one may have greater influence in imparting milking properties than the other, we are not safe in neglecting the parentage on either side.

It can hardly as yet be deemed conclusively settled whether the male or female exercises predominant influence in this respect, although the weight of opinion favors the latter.

In a late Massachusetts report, the writer, speaking of the expediency of crossing the Short Horn bull upon the Ayrshire cow, says, "the form becomes ordinarily more symmetrical while there is little or no risk of lessening the milking qualities of the offspring. The experience of the best breeders in all countries has pretty well established the principle, that in the breeding of animals it is the male which gives the external form, or the bony and muscular system of the young, while the female imparts the respiratory organs, the circulation of the blood, the mucous membranes, the organs of secretion, etc.; if this principle is true, it follows that the milking qualities come chiefly from the mother, and that the bull could in no respect alter the conditions which determine the transmission of these qualities, especially when they are as strongly marked as they are in the Ayrshire or the Jersey races. * * This cross would, therefore, seem to possess the advantage of combining to some extent the two qualities of milking and adaptation to beef, and this is no small recommendation to farmers situated as we are, who wish to milk for some years and then turn over to the butcher. But opinions differ on this point." *

If milking qualities descend principally from the female side, it would appear that in order to best success in rearing grade cows from choice milking breeds, we should use pure bred cows, whereas all our grades of the Ayrshire and Jersey races, so far as my knowledge extends, have received their infusion of blood from the bull, and none from the dam, no single instance being known of the introduction of full blooded cows for this purpose. The necessarily

* In a recent work by Charles L. Flint, Secretary of the Massachusetts Board of Agriculture, on "Milch Cows and Dairy Farming," published in October of the present year, (since this part of my report was written,) and which is commended to our farmers as the most comprehensive, and thoroughly practical work on this subject yet published in this country, the writer after alluding to the advocates of either theory, says, "Others still maintain that both parents are represented in the offspring, but that it is impossible to say beforehand what parts of the derivative system are to be ascribed to the one parent, and what to the other, and that there is a blending and interfusion of the qualities of both which prevent the body of their progeny being mapped out into distinct regions, or divided into separate sets of organs of which we can say 'this is

less rapid multiplication of grade animals by the latter mode is undoubtedly the reason, but may it not be said that we have not fairly and fully tried these breeds until it be done?

What is desired in a breed, or in an animal, distinctively for dairy purposes, is a system which shall prove a laboratory to convert food into milk readily and naturally, rather than into fat and muscle; for it is palpable that by no means can the same food be converted into both at once. Milking and fattening properties are to a degree antagonistic, yet not to such degree as to prevent our seeking a breed which shall readily take on flesh and fat when not converting its food into milk, or when fed with aliment suitable and sufficient both to manufacture milk and supply materials for growth and fattening.

There are certain marks which indicate a system in which we may confidently expect a free secretion of milk. Mr. Haxton says: "The points to be attended to in judging of a good milk cow, are, by universal consent considered to be the shape and size of the animal both as a whole and in detail; texture of the skin and hair; development of the lactiferous parts; temperament or habit of body and disposition; and finally, strength or endurance of constitution. A maximum development of these points marks out a first class cow of the breed to which she belongs; but the milking properties differ in endless variety, not merely as these points are prominent or the reverse, but also in proportion to the circumstances of climate, soil and treatment.

Whatever may be the breed to which a cow belongs, there are certain points of configuration which are considered essential as regards her milking properties. There may be, and are frequently, great discrepancies between the one and the other; but still, gener-

---

from the father, that from the mother.' Till this question is settled, it is safe in breeding for the dairy to adhere to the rule of selecting only animals whose progenitors on both sides have been distinguished for their milking qualities But where the history of either is unknown, a resort to a well-known breed remarkable for dairy properties is of no small importance, since, though the immediate ancestors of a male may not be known, if he belongs to a milking breed it is fair to presume that his progenitors were milkers."

I may here also add, that to the courtesy of Mr. Flint is the Board indebted for the illustrations of dairy animals accompanying this article, and which are a few of the, many in which his work abounds.

ally speaking, the rule holds good that, all things being alike, the cow which approaches nearest to a certain standard will be the best milker. The *head* must be rather lengthy, especially from the eye to the point of the nose. The nose and muzzle should be cleanly cut and free from thick skin or fleshy lumps, the cheek bones thin and in like manner devoid of thick skin or flesh—*eye* prominent, of a placid and benignant expression, with little of the white exposed to view. The horns should taper gradually to a point and have a clean, smooth surface; the breed will determine the shape and set of the horns. The *neck* should be long, thin and free from loose skin. A good milk cow may be deer or ewe-necked, but never bull-necked. The *chest* and *breast* should be deep rather than broad, and the brisket project forwards and downwards, and whether large or not, should be round, well-shaped and without loose folds of skin depending from it. The girth behind the shoulders, moderate and arising more from depth than breadth of chest; *shoulders* rather narrow at top; backbone on a line with the shoulder top; ribs arched and well home to the haunch bones, which should be wide apart and form a straight line across, neither depressed in the centre nor drooping at the extremities; *hind-quarters* lengthy, and the rump, or tail-top, nearly on a line with the backbone; thighs rather thin, but broad, well-spread and giving plenty of room for the udder; belly projecting outwards rather than downwards, with plenty of room for food; the udder should be large in a lineal direction, that is, well backward as well as upward between the hind legs and forward on the belly, also broad in front, filling up the space between the lower flanks, but rather short vertically—a deep hanging udder, from its swinging motion, being always the cause of great fatigue to the animal when walking; the teats should be of moderate size, straight, and equal in thickness from the udder to the point, and also at considerable and equal distances from each other; the two front teats especially should be well apart, and the direction of all four should be outward. When full of milk, the udder should be greatly enlarged in size, and when nearly emptied, shrink in a corresponding degree, and the skin gather into soft creases. The mammary glands running on each side of the belly, large throughout their whole course and swelling into large puffs at or near their junction with the udder; thigh veins also large and easily felt by the hand.

Of all these, the more important are the long, finely-formed head; long, thin neck; rump nearly on a line with the backbone; broad quarters; long udder from back to front, and large veins underneath the belly and downwards from the loins and thighs to the udder. When seen in front, the body of a good milk cow should present the appearance of a blunted wedge, the apex of which is the breast and shoulder. Seen from behind, she should present a square, well-spread shape. Seen sideways, she should be lengthy but not lanky.

The skin is a true index of the milking properties of a cow. It should be soft and flexible on every part of the body especially on the back ribs and also on the rump bones situated on each side of the insertion of the tail The skin on the ribs is next in importance, and if it corresponds in softness and looseness with that on the rump bones another point of excellence is established. These two points conjoined, are correct exponents of the internal constitution, and are always accompanied with more than an average tendency to milk freely and fatten rapidly. The former indicates a more than ordinary power of producing milk; the latter a great aptitude to fatten, and their conjoined presence indicates the union of both tendencies. The skin on the udder generally partakes of the quality of that on the rump and ribs, still there is this difference to be observed, that the skin of the udder must not be thick, while thickness on the rump and ribs is quite consistent with the best properties, provided it be soft, loose and flexible. In fact, a thickish, soft hide generally indicates hardiness of constitution from its greater capability to resist or modify external influences.

The hair should be moderately long, closely set, and above all, soft and woolly. As the thick, soft skin is an indication of hardiness, much more so is this the case when covered with long, thick, woolly hair. A bare, hard-haired cow, is ever to be avoided by the dairyman as well as by the grazier. If even a moderate milker, yet she will be a great eater and never pay for her food.

Animals, like human beings, are differently developed in their nervous, sanguineous, muscular and lymphatic systems, and their tempers and dispositions vary accordingly. Each breed of cattle is characterized by peculiarities of temper, activity and endurance. The Ayrshire cow presents a good specimen of a union of the ner-

vous and sanguine temperament. The Short Horn possesses a temperament in which the lymphatic is largely developed. She is slow and sluggish, but all the more disposed to fatten on that account. The muscular temperament is disappearing before the march of improvement, as animals of this description are neither good for the grazier nor the dairy, being fleshy, thick-skinned and poor milkers.

Atmospheric causes and artificial treatment also impress certain physiological characteristics upon cattle. Exposure to cold when young has a tendency to develop those parts of the system whose office it is to protect the vital functions from being injured by this cause. When an animal is early exposed to cold, the hide thickens and becomes covered with long, thick hair. It becomes inured to exposure, and is little affected by atmospheric changes. A long continuance of such treatment from one generation to another, soon impresses a peculiar habit of growth upon them, and this in time settles into a fixed and permanent temperament or physiolgical character. Even however among individuals of the same breed exposed to the same external influences, there are great discrepencies as regards constitution. Some are more hardy than others simply because certain causes, either accidentally or designedly induced, have given them better digestive powers, stronger lungs, and more vital energy. This superiority of constitution, whatever may be its cause, is generally indicated by a large round body, a soft, flexible skin, by no means thin, which is covered with a thick coat of soft silky or woolly hair. A large paunch is usually the sign of an animal which can and will consume a great quantity of fodder in the shape of hay or straw, and this we know by experience to be one of the best indications of a good healthy, hardy, thriving animal, whether cow, horse or sheep. Strength of constitution can be transmitted as well as other peculiarities; so that a careful breeder by always breeding from animals that he knows to be of good constitution, will ultimately succeed in strengthening and improving his stock."

Mr. Harley gives the shape and marks of a good dairy cow as follows: "Head small, long, and narrow towards the muzzle; horns small, clear, bent and placed at considerable distance from each other; eyes not large, but brisk and lively; neck slender and long, tapering towards the head with a little loose skin below; shoulders and fore quarters light and thin; hind quarters large and broad;

back straight and joints slack and open; carcass deep in the rib; tail small and long, reaching to the heels; legs small and short, with firm joints; udder square, but a little oblong, stretching forward, thin-skinned and capacious, but not low hung; teats small, pointing outwards and at a considerable distance from each other; milk veins capacious and prominent; skin loose and soft like a glove; hair, short, soft and woolly; general figure when in flesh, handsome and well proportioned."

Another mark not yet mentioned deserves our attention.

Some years since, a Frenchman named Guenon, announced the discovery of an external mark which he called *ecusson*, or scutcheon, by means of which he was enabled to determine with great precision and certainty the amount of milk which any cow would yield daily, its quality, and the period during which she would continue to give. The announcement attracted much attention, and his method was examined and reported upon by committees of various agricultural societies and by a commission appointed by government. These reported favorably. As early as 1837 he received gold medals from the societies of Bordeaux and Aurillac, and in 1848 it is said that a pension for life was bestowed by the National Assembly.

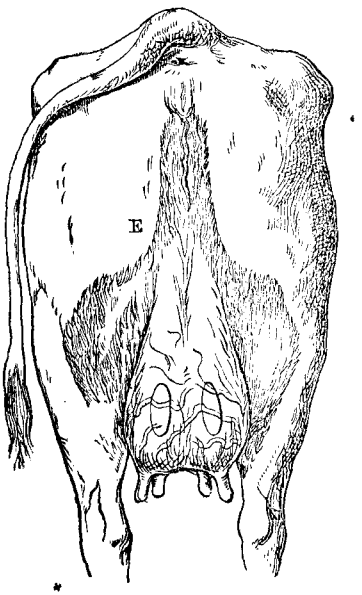


Fig. 1.

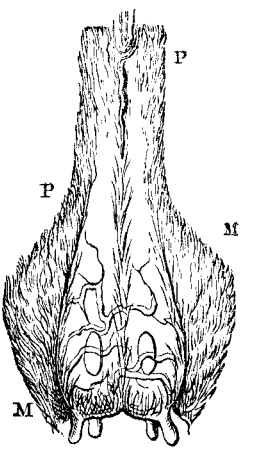


Fig. 2.

This ecusson, or scutcheon, sometimes also called the milk-mirror, is that portion of the udder, buttocks and perineum upon which the hair *grows upward.* The hair so growing, marks out distinct surfaces whose form and extent may often be distinguished with ease and always with careful examination. Frequently they are bordered by a bristly line formed by the meeting of the upward and downward growing hair, in which case they are readily perceived. But when the hair is fine and short and mixed with long hairs; when the udder is large and pressed by the thighs; when the surface contains strips or bands of ascending hair, thus lessening its extent; when the edges are indented, or when the skin is much folded, the difficulty of forming a correct estimate is much increased.

Scutcheons vary greatly in form, extent and location, and upon these differences M. Guenon based his system of classification, by which he divides cows into eight classes and each of these into eight orders; besides this, he finds what he calls genuine and bastard cows in each, and also makes three grades of each order according to size.

His classification is both too complicated and too imperfect to be of much use, and notwithstanding his sixty-four, or one hundred and twenty-eight or more divisions, many cows (certainly many of our Yankee cows) refuse to come strictly into any of them. The value of his discovery consists not in his complex system, but in the simple fact that there is a correspondence between the scutcheon and the milking properties, too general and too remarkable to be the result of accident. The cause of the relation existing between them is somewhat obscure. M. Magne, professor in the Veterinary School at Alfort, author of a valuable work entitled *Choix des Vaches Latieres*, explains it thus: "That the direction of the hair is subordinate to that of the arteries; that when a large plate of hair is directed from below upwards on the posterior face of the udder and on the perineum, it proves that the arteries which supply the milky system are large, since they pass backwards beyond it, convey much blood and consequently give activity to its functions. Upper tufts or scutcheons placed on the sides of the vulva prove that the arteries of the generative organs are strongly developed, reach even to the skin and give great activity to those organs. The consequence is, that after a cow is again with calf, they draw off the

blood which was flowing to the milky glands, lessen and even stop the secretion of milk. In the bull, the arteries corresponding to the mammary arteries of the cow, being intended only for coverings of the testicles, are very slightly developed; and there accordingly, the scutcheons are of small extent."

If this explanation is admitted as the correct one, it is easy to comprehend the value of scutcheons. The more the lower ones are developed, the greater the quantity of milk, and the more upper ones, (which are always much smaller and comparatively rare,) the sooner the cow will fail after being again in calf; and whether it be correct in theory or not, facts abundantly indicate that the larger the surface covered with ascending hair upon the udder, thighs, &c., (other things being equal,) the greater is the yield of milk.

M. Guenon's treatise on milch cows has been translated and several editions published in this country, and it can be easily obtained by any one desirous to do so. Yet as many of our farmers have never heard of the scutcheon or milk-mirror mark, it seems desirable both that attention be called to it and some explanations and illustrations given.

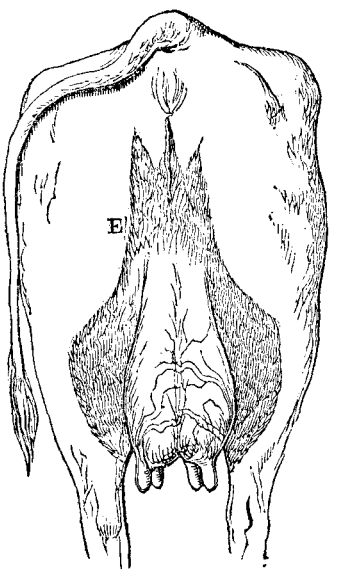


Fig. 3.

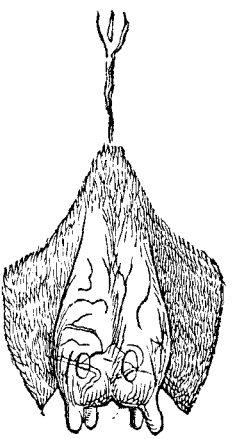


Fig. 4.

It may be well here to premise that M. Guenon claimed altogether too much, especially in the way of precision and certainty, for his

discovery; for the scutcheon alone is not sufficient, like any other particular mark taken singly, to determine with certainty the milking properties of a cow. Yet it is a valuable auxiliary to other known marks of milch cows, and is of value, by itself, in the selection of calves.

M. Magne, in the work above referred to, makes a more simple and satisfactory classification of milch cows, into four divisions, viz: very good—good—middling and bad; and he also gives intelligible explanations of the scutcheon mark, from which the following is translated, and a few of his illustrations are also copied.

With reference to the position of scutcheons, we will divide them into the upper and lower.

"The former, which are very small compared with the latter, are situated near the vulva (figures 5, 8, S) and are of rare occurrence. They consist of one or two small ovals or of one or two small bands of ascending hair, and serve to indicate how long milk continues to be given; this period is short in proportion as the scutcheons are large. It is necessary to distinguish them from the lower scutcheons which are frequently continued upwards to the *vulva*.

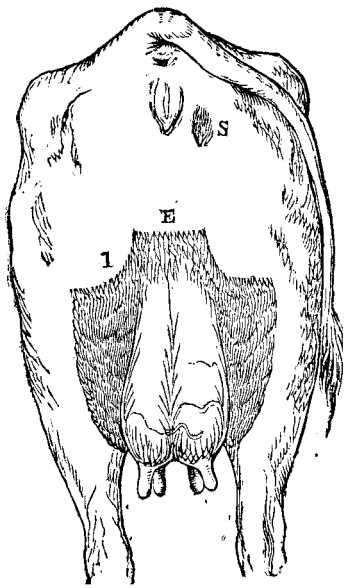


Fig. 5.

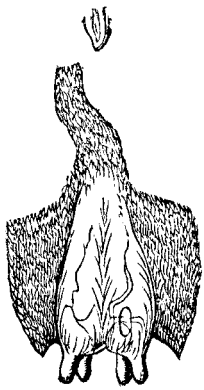


Fig. 6.

The lower scutcheons (figures 1, 3, 5, &c.,) are much larger than

the upper, and exist more or less developed on almost all cows. They indicate the quantity of milk, this being in proportion to their size. Sometimes they are very small, covering only a part of the udder or of the udder and perineum. (Figure 9.) At other times they cover the udder, the inner face of the thighs, the perineum and part of the buttocks. (Figures 1, 2, &c.)

We distinguish two parts in the lower tufts, one situated on the udder, the legs and the thighs, which we term *mammary*, (figure 2, M.) and the other placed on the perineum, and sometimes spread more or less on the buttocks, which may be termed *perinæan*. (Figure 2, P P.)

The *mammary* is sometimes large, extending over the milky glands, the thighs and the legs; sometimes circumscribed, or more or less indented by tufts of descending hairs. It sometimes terminates in the upper part of the udder in a horizontal line, but most frequently it is continued without interruption to the *perinæan* part.

The perinean part presents a large band, (figure 2,) sometimes bounded by parallel lines, sometimes by curve lines—it sometimes ascends to scarcely a fourth of the height of the perineum (figure

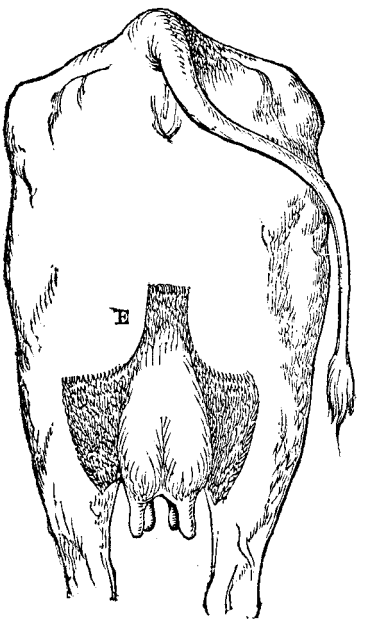


Fig. 7.

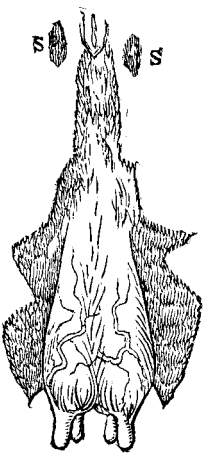


Fig. 8.

5); at other times it reaches or passes beyond the middle of that region, forming a band either straight or bent into a square, or truncated, or terminated by one or more points. (See figures 3,6, 7.)

The lower scutcheons are sometimes symmetrical, (figures 1, to 5,) sometimes without symmetry. (Figures 8, 10.) When there is a great difference in the side of the two halves, it almost always happens that the gland on the side where the scutcheon is most developed gives more milk than that of the opposite side, and we call attention to the fact that the left half is almost always larger than the right; and when the perinean part bends, it is towards this side of the body.

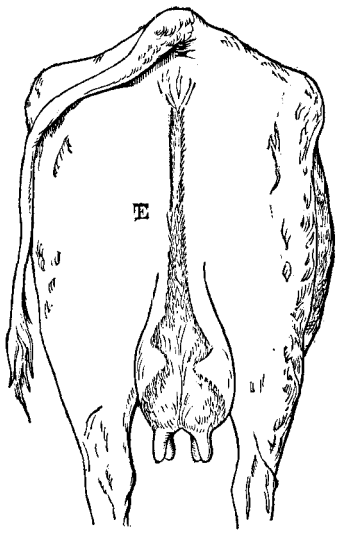


Fig. 9.

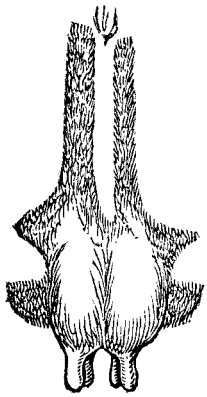


Fig. 10.

The scutcheons being valuable in proportion to the space which they occupy, it is of great importance to attend to all the rows of descending hairs which lessen its size, whether these occur in the middle of the scutcheon or form indentations on its edges. (Figures 8, 10.) These indentations, partly concealed by the folds of the skin, are sometimes perceived with difficulty. It is of much importance, however, to take them into account, for in a great number of cows they greatly diminish the size of the scutcheon. We often find cows which at first sight appear to have a very large scutcheon, and yet are only middling because lateral indentations

greatly lessen the part of the skin covered with ascending hair. Many blunders are committed in estimating the worth of cows because sufficient attention is not paid to the real size of the scutcheon.

A diminution of the quantity of milk is indicated by all interruptions in the continuity of the scutcheons with the exception of small oval or elliptical plates which are found on the posterior face of the udders of the best cows, (figures 1, 2, 4, 6,) and which M. Guenon considers a mark of the best milkers.

Lastly, we ought to mention, that in order to determine the size and consequent significance of a scutcheon, it is very necessary to take into consideration the state, both of the perineum in respect of fat, and of the udder in respect of fulness. In a fat cow, with an inflated udder, the scutcheon appears larger than it really is, while in a lean cow, with a wrinkled udder, it appears smaller.

In bulls, the scutcheons present the same peculiarities as in cows; they are, however, less varied in their contour, and especially much smaller in size.

In calves, the scutcheons exhibit the shapes which they are afterwards to assume. They are more contracted, only because the parts which they cover are but slightly developed. They are easily perceived soon after birth, but the hair which forms them is then long, coarse and stiff. After this hair falls off, the scutcheons of calves resemble those of cows, though of less size."

After the above explanation of M. Magne, it is comparatively easy to determine the value of this mark. The more the lower scutcheons are developed, the better, but shape is of little consequence. It is well to examine critically, as one which at first glance appears large, may be found indented at the sides or interrupted by lines of descending hair, and thus of less value than another more contracted in dimensions, but uniform, continuous and symmetrical.

Since first learning of Mr. Guenon's discovery, I have examined a great many cows with a view to test its reliability; have made inquiries of others who have made extensive observations, and am convinced that it is of considerable value, and especially in the selection of calves and young heifers. It is not infallible. Exceptions will be found, and we ought to expect them, for, as M. Magne well remarks, "the quantity of milk and its quality do not

depend solely on the form and size of the scutcheon; they depend on the food, the particular management, the climate, the season, the temperament, the size and energy of the principal internal organs, the capacity of the chest, the influence of the generative system, &c. All these circumstances cause the quantity of milk to vary without making any change in the scutcheon; consequently, it is impossible that the same relation can always exist between the scutcheons and the quantities of milk. We often see cows equally well shaped, having exactly the same scutcheon, and placed under the same hygienic conditions, yet not giving either equal quantities or equal qualities of milk. It often happens that two horses, having exactly the same structure and the same external forms, have not the same energy, the same fitness for work. The difference is owing, evidently, to the temperament and the activity of the internal organs—in other words, to conditions which it is often impossible to estimate by any direct method. Yet, although the mark furnished by the scutcheons has not the perfect certainty which some persons unacquainted with physiological science have wished to ascribe to it, it must not be thought that the mark is of no use. By his discovery, M. Guenon has rendered great service to agriculture. The scutcheon has the advantage of furnishing a mark which can be easily discerned and estimated even by persons of no great experience in the selection of cows—a mark perceptible on very young animals, and on bulls as well as heifers—a mark, in fine, which, when disencumbered of the complicated system in which it has been wrapped up, will ere long be in common use, and facilitate the increase of good cows by not allowing any but those of good promise to be reared."

Mr. Haxton, in his work on the Dairy Breeds of Britain, says that he "has examined many hundreds of dairy cows, and the conclusion arrived at in regard to Guenon's test is, that in a large majority of cases it is borne out by facts. In a London dairy, belonging to Mr. Biggs, where about four hundred cows are kept, and where nine-tenths of them are far above average milkers, the development or upward growth of hair on the posterior part of the udder, thighs and perineum, was too remarkable to be accounted for by accidental causes. As well might it be said that all other tests, such as length of head, softness and flexibility of skin, and

wide quarters, were accidental, and had no reference to the milking properties of a cow. When a phenomenon presents itself over and over again, accompanied in a majority of cases by certain results, we may be certain that it is not accidental, but natural; and while we may be unable to account for the results upon satisfactory grounds, it is neither philosophical nor prudent to deny or ignore the connection between the one and the other, and thus to forfeit the advantages which the fact itself is calculated to afford.

The first two cows examined in Mr. B.'s dairy, were of the improved Short Horn breed. They were large, handsome animals, in high condition; and, on examination, it was found that the upward growth of the hair did not extend much beyond the top of the udder; but there were two tufts of hair on each, one on each side a little higher up, which had an upward direction. The facts regarding these cows were, that they were not good milkers, ran soon dry, and got fat. The next cow examined was a cross of Yorkshire and Durham, of middling size, that gave twenty quarts per day for three months after calving, and was a good steady milker. She had a straight back from the shoulder to the loins, which were remarkably broad, but the quarters were coarse and drooping; the breast and chest remarkably projecting, with a thin, drooping, ill-shaped neck. The skin was rather thick and by no means flexible on the ribs, but very much so on the rump bones. The milk veins were much swollen and knotted. The escutcheon was symmetrical and well developed. This cow is full of contradictions;—a good middle, but drooping very much both at the quarters and neck; bad skin on the ribs, but remarkably fine on the rump. The largely developed escutcheon and mammary apparatus seem to have given the preponderance in favor of the good qualities, and to have produced an animal in all respects far above an average milker. Another large red and white cow, of the Yorkshire breed, was examined and measured. Length from shoulder-top to plumb of buttocks, five feet three inches; girth behind shoulder, six feet nine inches; height, four feet eight inches; neck, two feet four inches. The head uncommonly long; back very level; brisket projecting before, and drooping between the legs to an almost unsightly degree; forearm of the leg very broad; udder very large; teats placed very far asunder. This cow had a large, but not a very symmetrical escutch-

eon; for, although it ran up in a broad band from the udder, it suddenly swerved to one side. Her character previously was that of a first-rate milker, but she had not been dry for twelve months, as she had slinked her calf at six months, at which time she was in full milk; but notwithstanding this mishap, she gave at the rate of twenty quarts per day five weeks afterwards.

A fine young cow was found to have a good escutcheon, which, however, when above the udder, was all on one side. The cowman's statement was, that she soon went dry, and gave less milk on the side where the escutcheon was wanting. The rest of the examinations were nearly a repetition of the foregoing, with the exception of two cows which were standing in a stall together, the one had a good escutcheon, and the other only moderately so, but the latter was by far the best milker. Upon closer inspection and handling, the latter cow was found to have a particularly soft and flexible skin covered with fine woolly hair, while that of the other was hard, thin, and covered with short hard hair. When such cases occur they do not disprove the theory of escutcheons, but rather show that, as in one case already detailed, one good point may be neutralized by several bad ones, and hence it is that M. Francois Guenon's test will appear sometimes to fail altogether.

In Mr. Leonard's stock of forty dairy cows, (in Gloucestershire,) probably the finest pack in the county, the uniform development of the upward growth of hair on the udder and perineum is very remarkable on all the best cows, and indeed, there are only a very few of them that can be called inferior. Mr. L.'s son, who accompanied the writer and gave the necessary information regarding the milking powers of the different animals, but who had never heard of Guenon's test, admitted its general correctness. Two cows very like each other, of the same age and bred from the same bull, were pointed out as having something peculiar in their relative powers of milking. Upon examination, one was found to have a very superior escutcheon, while that of the other was as much inferior. The former was a first-rate milker, while the other was one of the worst in the whole pack. With the exception of the escutcheon, there was so little difference otherwise in the appearance of these cows, that all ordinary tests would have failed to determine beforehand which was the good milker and which the bad. Among twenty cows pasturing in one field, the test was admitted by Mr. L. to be uniformly correct.

There appears, however, to be something characteristic in the escutcheons of different breeds of cows, for while some have them in general largely developed, there are others in which they are not so, but which are, notwithstanding, quite as good milkers. The test is, therefore, more correct when applied to distinguish the milking properties of animals of the same breed, than it is when adopted as an index for judging of those of different breeds.* This principle was illustrated in the case of two packs of dairy cows in Cheshire, one belonging to Mr. Wright, and consisting of a mixture of the Long horned and Short horned breeds, and the other to Mr. Hannay, who has a dairy of very fine Ayrshires. In the former, some of the cows had very fairly developed escutcheons, but there were great differences in others, so much so, that one cow would present a large development, while another did not extend above the udder. The difference in the milking qualities did not exactly correspond to these discrepancies, showing either that the test was incorrect, or that the variety of breeds among the cows rendered it necessary to modify or alter its application. In Mr. Hannay's pack, the development of the escutcheon was found to be very uniform, although by no means so great as might be expected from the known milking properties of the animals. Compared with Mr. Wright's cows, Mr. Hannay's pack would have been judged inferior if judged by the escutcheon test alone, whereas in fact they were superior.

One principle, however, seems to be established, viz., that all things being alike as regards shape, texture of skin, &c., cows with well developed escutcheons will, in a large majority of cases,

* This remark is worthy of careful attention. It is corroborated and well stated in the recent work on "Milch Cows and Dairy Farming," by C. L. Flint, alluded to in a note on page 73. He says: "The result of my observation has been, that cows with the most perfectly developed milk-mirrors or escutcheons are, with rare exceptions, the best milkers of their breed, and that cows with small and slightly developed mirrors are in a majority of cases bad milkers. I say the best milkers *of their breed*; for I do not believe that precisely the same sized and formed milk-mirrors on a Hereford or a Devon and an Ayrshire or a native, will indicate anything like the same or equal milking properties. It will not do, in my opinion, to disregard the general and well-known characteristics of the breed and rely wholly on the milk-mirror. But I think it may be safely said, that as a general rule the best marked Hereford will turn out to be the best milker among the Herefords, all of which are poor milkers; the best marked Devon, the best among the Devons, and the best marked Ayrshire, the best among the Ayrshires; that is, it will not do to compare two animals of entirely distinct breeds by the milk mirrors alone, without regard to the fixed habits and education, so to speak, of the breed or family to which they belong."

be found to be the best milkers, and above an average; while, on the other hand, those with small escutcheons will be found under, or at most, not above, an average in their milking properties."

The above quotation from Mr. Haxton is given at length, because of its close correspondence with the results of my own observations and of nearly all those whom I have consulted with regard to this test.

The suggestions of Mrs. Winchester, in an essay published in the Abstract of Returns from our agricultural societies of last year, relative to butter making, as also those of Mr. Stetson and others, in their statements, are commended as comprising the results of successful experience, and having been so recently published, need not be here repeated. The essential points in the manufacture of butter are chiefly these: 1st. Most thorough and perfect cleanliness in everything pertaining to the dairy. 2d. Pure, cool, dry air, and abundance of it, in the milk-room. 3d. Complete separation of the buttermilk (without washing, or the use of the hands) by the aid of paddles or a lever, sponge, cloth, &c.—a grooved wooden roller upon a marble table being an excellent arrangement for this purpose.

There is greater need to improve and enlarge the manufacture of cheese in Maine than that of butter. No natural obstacle is known to exist, which should prevent the home manufacture of enough, at least, to supply the home demand, instead of importing hundreds of thousands of pounds annually into the State as we do at present.

Information regarding the principles involved in cheese making, and the practical processes of its manufacture by those who have been most successful, may be better conveyed by the following quotations, than by an attempt to present it in other form. The first is from the pen of Lyon Playfair, in Morton's Cyclopedia of Agriculture:

"The scientific principles involved in the manufacture of cheese are very little known. Milk contains about four-and-a-half per cent. of caseine, which is the principal ingredient of cheese. This caseine is almost exactly of the same composition as animal flesh. It is held in solution in the milk by means of an alkali. Any acid which removes this alkali, converts the caseine into an insoluble curd, which, when collected and dried, forms cheese. Muriatic acid is used for this purpose in some parts of Holland; vinegar, tartaric

acid, cream of tartar, and even some of the salts of oxalic acid, such as salt of sorrel, are employed in various countries. The acid, formed when milk becomes sour, also produces the same effect, so that sour milk is used instead of rennet in some parts of Switzerland. All these additions are for the express object of making an insoluble curd, by removing the alkaline solvent of the cheese. This insolubility may also be produced indirectly as well as directly. Various substances have the property of forming an acid in the milk itself (lactic acid,) which, removing the solvent of the caseine, causes the proper formation of a curd; for most kinds of cheese this indirect action is preferred. In other countries, the coagulation or curding is effected by various means, as by the juice of figs or thistles, or by decoctions of the flowers of the artichoke, of the crowfoot, and of the white and yellow bed-straw. A peculiar stringy curding is obtained by the juice of the butterwort, (*Pinguicula vulgaris.*) But in this country it is usual to depend on the peculiar action of the rennet. The stomach or intestines of young animals, especially of the sucking calf, pig, lamb, or kid, have been found to possess this indirect action. Little is known as to the exact chemical processes which ensue when rennet is added to milk. All, in fact, known is, that the stomach, dried and prepared as rennet, must be in a state in which it may decay, but not rapidly enough to run into putrefaction. The active principles of the rennet are certainly substances in the act of decay, and its peculiar value is, that it can be preserved without losing this power, which, though in abeyance, may be called into activity, when desired. The processes used in preparing the rennet, such as salting, smoking, treatment with salt, lemon juice, and spices—have for their object the prevention of putrefaction, and the repression of decay. A certain amount of decay is necessary; and, for this reason, rennets are preferred in most districts, when they have become somewhat aged by keeping. The active changing principles are soluble, and, therefore, may be extracted by water, and used directly for the curding of the milk; or the rennet itself being added to the milk, gives out its soluble ingredients to that fluid. A further decay of the exhausted rennet produces more of the transforming materials, and restores it to its active state, so that it may be used over and over again. Chemists, at present, know the fact, without having

ascertained its cause, that decaying substances, such as putrid flesh and sour milk, produce a change in fresh milk, forming, among other substances, various acids which effect its curding or coagulation.

Prepared rennet is a means of effecting this change in a regulated manner, and without the production of those offensive substances formed during the putrefaction of milk. It is by the communication of the decay of the rennet to the milk—just as a decayed apple causes decay in a fresh apple in contact with it—that this change is effected, and not by the addition of any peculiar substance; for it has been found by experiment (Berzelius,) that one part of rennet, which has curded 1800 times its own weight of milk, had decreased in weight only ,06. This view is obviously correct, when it is considered that one square inch of good rennet can curdle 80 quarts of milk, or that one spoonful of its infusion produces the same effect on 120 quarts. The action finds its parallel in that of yeast on sugar. In this case a very small quantity produces the alcoholic fermentation on an immense amount of the saccharine fluid. There can be little doubt, that the manner of preserving the rennet produces a very great effect on the qualities of the cheese produced. It is much more probable that the different kinds of decay, caused by rennets differently prepared, have much more influence on the character of the cheeses of a district than any deviation in climate or in pasture. As the cheeses of commerce do not consist simply of caseine, but also contain butter and other ingredients of the milk in small proportion, it is obvious that the qualities of cheeses must depend much on those of the milk itself. The milk of cows, goats, and ewes, has very different compositions and properties; and cheeses made from them differ also very materially. Minor differences in the milk of the same animal also produce notable variations in the cheese of different districts, even though apparently the same materials are used in their preparation. The differences are, of course, much increased according to the practices of districts of adding or subtracting cream from the milk used. The former method gives the rich Stilton cheese, while the removal of all cream yields the poor horny cheeses of Essex and Sussex. The use of whole milk produces such cheeses as those of Glouchester, Cheshire, Wiltshire, Cheddar, Dunlop, and the Gouda of Holland. The common Dutch cheeses are usually

obtained from once-skimmed milk, so that they still contain butter, but less than the varieties just named."

The following is from the same work, descriptive of the process of making Cheshire cheese:

"The cows are milked twice a day, at 5 A. M., and at 5 P. M. The cheese being always made in the morning, the evening's milk is poured into basins, or coolers, and stands over till then. It is then skimmed, to remove the cream; and a portion of it, about one half, is warmed in a flat-bottomed, shallow pan, to about 100 degrees, and then poured into the cheese tub, along with the morning's milk, and that portion of the evening's milk not warmed. The cream, mixed with a little warm milk, is now added, and the temperature of the whole being somewhere between 80 and 85 degrees, the rennet and coloring are also added, and well stirred and mixed with the milk. The annatto, or coloring matter used in the preparation of Cheshire and other cheeses, is added to the milk before the rennet. Mr. White states that half an ounce to above seventy-five pounds of cheese, is a sufficient quantity; and that it is commonly dissolved in a pint of warm milk on the previous night, for addition to the bulk in the morning. After the addition of the rennet, the tub is covered carefully for an hour, by which time, under ordinary circumstances, congulation will begin, and in fifteen minutes more be completed. The curd is now broken; which, for a sixty pounds cheese, takes about twenty minutes, and then allowed to rest fifteen minutes, to separate from the whey. The whey on the top is removed by pressing a flat-bottomed pan gently on the curd, and allowing it to fill. The whey is poured into the *set* pan from the cheese tub. The curd, so far freed from the whey, is again broken by the "breaker," or very gently by the hand, and again allowed to settle and separate. In about half an hour the whey is baled out, and, as the curd gets more and more solid, it is drawn to one side of the tub. When this has been accomplished, and the free whey all removed, a semi-circular perforated board, made to fit one-half of the tub, is placed upon the curd, and pressed down with a thirty pound weight, which gently squeezes out the whey. This whey is poured through a sieve into the *set* pan, to detain the particles of curd floating in it. The weight is now removed, and the curd cut in pieces six or eight inches square. The board and a

weight, double the last, are again applied. More whey is pressed out, and when this has been repeated once or twice with heavier weights, according as the condition of the curd requires, the curd is ready for being put into the cheese vat.

Before placing the curd into the first or large cheese vat, a willow basket is sometimes used; the curd is cut into smaller square pieces than before, and gently broken by the hand in the act of putting it in. When put in the vat, which it should not quite fill, it is covered with a close fitting board, and placed under a light and continuous pressure. When the whey ceases to drain from the sides of the vat, the curd is taken out, and broken as before. The curd is now put into the proper cheese vat; but before this, a cheese-cloth is placed in the vat. After the curd is all in, the ends of the cloth are tucked over it, then covered with the circular board ("sinker,") and placed under heavier pressure than before. To assist the discharge of the whey, iron skewers are thrust through the vat holes into the cheese, and, after a few minutes, withdrawn, when the whey follows. When the whey has ceased to follow the skewers, on being withdrawn, the vat is taken out; the curd still in it, is cut into sections, every two or three inchess, with a dull-edged knife, and again pressed and skewered as before, for a quarter of an hour or twenty minutes. After this, the curd is taken entirely out of the vat, cut into large pieces, each of which is broken by the hand, then placed in a dry cloth in the vat, and covered, pressed, and skewered; which is again repeated, until the whey is nearly all extracted. These operations, from the time of coagulation, will consume about five or six hours, by which time the curd should be sufficiently dry for being salted.

The best tests of complete coagulation, according to Mr. White, on whose authority many of the above remaks are made, are the firmness of the surface of the curd when pressed by the hand, or skimming dish, and the pale-green color of the whey.

The curd, being now comparatively free from whey, is taken out of the vat, cut into pieces, and crumbled down with the hands; or, what is better, by passing it through the curd mill. The salt, at the rate of one pound to forty-six pounds of curd, is then intimately mixed with it. The salted curd is again returned to the vat in a dry cloth, of finer texture than before; and, in order that it may be

pressed properly, it should more than fill the vat. A tin hoop is put round that part of the cheese which projects from the vat, the lower edge being within the vat, and sinking along with it when put under the press. The pressure is now considerably increased, and the skewering continued. In an hour the cheese, now completely formed, is taken out, its edges pared—the parings being put into a hole on the top, scooped out for the purpose—inverted, and put into the vat, a dry cloth being previously placed on it, and again subjected to heavier pressure. Some time during the evening the cheese is again turned, and receives a dry cloth, which terminates the first day's operations. On the second day, it is turned twice or thrice, dry cloths given, and skewering continued. On the third, this turning and dry cloths are twice repeated, but the skewering is discontinued. This usually completes the process of making; but some continue the pressure for another day. External salting is more practiced in Cheshire than salting the broken curd."

In the Transactions of the New York State Agricultural Society, we find a statement of A. L. Fish of Herkimer county, whose cows in one year averaged seven hundred pounds each of the finest quality of cheese, and in another year, seven hundred and seventy-five pounds. He says "the evening's and morning's milk is commonly used to make one cheese. The evening's is strained into a tub or pans, and cooled to prevent souring. The proper mode of cooling is to strain the milk into a tin tub set in a wooden vat, and cool by filling the vat with ice water. The little cream which rises over night, is taken off in the morning and kept until the evening and morning milk are put together and the cream is warmed to receive the rennet. It is mixed with about twice its quantity of new milk, and warm water added to raise its temperature to ninety-eight degrees; stir it till perfectly limpid; put in rennet enough to curdle it in forty minutes, and mix it with the mass of milk by thorough stirring, the milk having been previously raised to eighty-eight or ninety degrees by passing steam from the steam generator into the water in the wooden vat. In case no double vat is to be had, the milk may be safely heated to the right temperature by setting a tin pail of hot water into the milk in the tubs. It may be cooled in like manner by filling the pail with ice water. It is not safe to heat milk in a kettle exposed directly to the fire, as a *slight* scorching

will communicate its *taint* to the whole cheese and spoil it. If milk is curdled below eighty-four degrees, the cream is more liable to work off with the whey. An extreme of heat will have a like effect. The curdling heat is varied with the temperature of the air or the liability of the milk to cool after adding rennet. The thermometer is the only safe guide in determining the temperature, for if the dairyman depends on the sensation of the hand, a great liability to error will render the operation uncertain, as a sense of feeling is not a test of temperature worthy of being relied on."

Another statement, by Hon. G. Denniston of Steuben county, contains valuable suggestions, and embodies the details of practice in the best New York daries:

"The manufacture of cheese consists in the complete separation of the curd from the whey, and in the proper compressing and curing of the curd. There are leading principles, that should be noticed, relating to every stage, and which will determine the flavor and texture of the article produced.

1. The evening and mornings milk is used—the evening milk is strained into a tub, and, in the morning added to the mornings milk. The temperature of the milk united will be generally so low as to require more warmth; this is done *at all seasons of the year* by putting the milk into a tin vessel, which is floated in heated water. It is important to determine the exact temperature at which the milk should be "*set.*" Some advocate a low temperature; but experience has indicated that from eighty-four to ninety degrees, is about the range at which the milk ought to be coagulated.

2. I have noticed that the higher the temperature of the milk at the time of setting, the sooner it will coagulate, but the curd will be tougher and less in quantity; and on the other hand, if the milk be set at a very low temperature, the curd will be longer forming, will be greater in quantity and more tender in quality. The range of temperature, as I have before stated, is from eighty-four to ninety degrees, according to the season and the weather.

3. It is found necessary to *vary the heat* at setting, at different seasons of the year, so as to produce coagulation within a given time, for if the temperature should be too great in warm weather, the curd will form tough and hard, and if it be too low, in cool weather, it will form too soft, will work off with the whey, and reduce the

quantity, as well as the quality of the cheese. The *precise heat* at which the milk ought to be set, is important in cheese-making, and should be determined by careful observation of those engaged in its manufacture.

4. The *rennet* used is *calf rennet.* It is prepared by turning out the contents, and every other impurity. It is turned inside out, stretched on a stick, salted and hung up to dry. When thoroughly dried, it is packed in salt and put in a dry place. The rennet is used by steeping a small piece in a cup of luke-warm water, added thereto a little salt. I judge of the proper time for breaking the curd by pressing the surface of the milk, and if the *curd* and *whey* appear *distinct*, the one coagulated and solid, the other of a pale green shade, it indicates the curd is in a condition to separate from the whey and to become fine and smooth in breaking; but if the curd appears *soft*, it is not sufficiently formed for separation from the whey and for breaking.

5. The curd is broken by means of a "*cheese cutter*," formed of wire-work, which is passed through the curd perpendicularly and in different directions so as to separate it into small and equal parts. The finer the curd is broken the sooner it will separate from the whey.

6. The time occupied in breaking the curd is determined by the state of the curd and the whey. The curd must be in a condition to be worked even, so that, in the *after scalding process*, no element of fermentation remain in it to depreciate its quality. The curd must also be in a condition to separate from the whey, which it does by sinking. It is essential at this point to notice, as before hinted, that the curd be not too *tender* through a low temperature, nor too tough by being too warm. The proper temperature is to be observed as conducive to a proper condition of the curd in its texture and firmness. This being observed and secured the breaking process need occupy no longer time than is necessary to separate the curd into fine and uniform parts, so that it may gradually separate from the whey.

7. As soon as the curd has settled, and the whey appears clear on the top, begin to dip the whey off, and to scald. The time for raising the heat will vary according to circumstances from *three quarters of an hour* and more to be determined by the condition of

the curd; if it is hard, not so long, if short, longer, to work it harder.

8. The heat is applied in scalding the curd faster or slower according to the action of the rennet, as that acts rapidly or less so. The practice is to raise the temperature gradually from that of the curd when broken, up to ninety and from that to one hundred and six degrees, and while scalding, the whey and curd is kept in motion to keep the curd from running together, and that it may be equally cooked throughout; the *time* taken varies from half to three-quarters of an hour, and sometimes longer.

9. The rule is varied somewhat at different seasons of the year, as the temperature is cold or warm. In warm weather do not raise the scalding point as high, in cold, higher. Although the particular principle applicable to the scalding process is admitted, yet the application is to be determined by circumstances. The changes of the weather, and the particular state of the curd, (must in all cases be strictly observed,) will indicate to the observing mind the variations from the rules that are necessary to result in a good cheese.

10. The test, by which it is determined, that the curd has been *cooked enough*, is that it will feel *elastic*, and when chewed between the teeth will *squeak*. This is a simple test, and if applied with discrimination and judgment, it is an infallible one; and yet many mistake the condition of the curd, by not cooking it enough, or too much, and the consequence is that it is either too stubborn and tough, or not sufficiently so, to be in a proper condition for its after-working and manufacture.

11. As soon as the curd is sufficiently cooked, it is separated from the whey. This is done by dipping it on to a strainer, spread over a tub or sink. It is necessary to be very particular at this stage of the process—if the curd is too hot, and mats together, its temperature should be reduced by turning out cold whey until it sinks to ninety-four degrees; at this point the curd will absorb the salt freely, and afterwards press out freely.

12. *One pound* of salt is used to *forty pounds* of curd. In the cool weather of spring and autumn, one pound to fifty pounds of curd. The curd is salted when warm, and well drained. It must be worked fine so as to work the salt uniformly throughout the mass.

During the salting process the temperature should range from ninety-four down to seventy-five degrees.

13. As soon as the salt is thoroughly worked in, and packed for a few minutes, until the curd sinks in temperature to about seventy-two degrees, it should then be put to press. If it be put to press at a higher temperature it will be tough and strong—if at a lower, it will crumble, and not press well together.

14. The power with which the cheese is pressed is the "*improved Ohio press*," and varies from three to ten tons weight, according to the size of the cheese. The cheese is pressed twelve hours and then turned, and then pressed twelve hours longer. Sometimes when the cheese is large, it is pressed in all forty-eight hours.

15. If the cheese is put to press *too warm*, or the curd is soured, or the *cheese cloth* not perfectly *clean*, the *cloth* will "*adhere to the cheese.*" The remedy is indicated by the cause.

16. The coloring matter used is "*annatto,*" and is incorporated with the rennet, and applied in setting the milk with the rennet.

17. After the cheese is taken from the press, it should be cleared of all blotches or scum that may arise on its surface, and sufficient oil and some beeswax rubbed on to keep it from cracking. This being observed *strictly from day to day*, a *rind* will be produced that will be impervious to flies.

17. The cheese is rubbed with *whey oil.* The whey stands until a cream rises upon its surface, which is skimmed off, and *churned.* The milk is worked from the butter and it is then tried down, until all the milk and watery particles escape, to what is called *whey oil.* This oil is rubbed on the cheese *quite warm*, and thoroughly rubbed over its surface. Be sure to rub no more oil on, than will become incorporated *readily* with the rind.

19. A cheese that has been neglected in the scalding process, or that has not been sufficiently salted, or the curd of which has been improperly worked will likely *swell.* As has been before hinted, the *process* of *setting*, of *scalding*, of *salting*, must be particularly noticed, or the cheese will present some feature which will detract from its value.

20. A thermometer is used to test the degree of heat in all cases; and yet its use must, in all cases, be guided by observation, as con-

tingencies arise that produce chemical changes. The thermometer is a *mere instrument* to be called in aid of a practical judgment and careful discrimination, rather than an absolute rule, by which we are to be governed. There exists a *range of essentials* throughout the whole process of cheese manufacture, and at the same time a *difference in the minutiæ*, which is to be determined by observation."*

There is nothing more certain than that we have much to learn regarding the most judicious treatment of milch cows, and especially in the matter of feeding. We expect and obtain a larger production of milk from cows in a state of domestication than they yield in a wild state, but few are probably aware how much more the product might be increased.

If the sole object of the breeder is to grow fine blood stock, without regard to milk, it may do to allow the calves to run with their dams and suckle at pleasure; but if the production of milk be the object, a more artificial mode of rearing calves may, if judiciously pursued, be adopted to advantage. Rearing by hand is practiced to considerable extent by our farmers, and will not be discussed farther than to suggest some of the necessary conditions to success. It is not the method of nature, and while, for the purposes of nature, we cannot improve upon her methods, we may yet sometimes by art accomplish what nature does not; as, for instance, an orchard of fruit trees may, by grafting, be made to produce uniform and good fruit, such as seedling trees, ungrafted, would not; and we are not deterred from grafting because some trees are ruined by unskillful treatment in the operation.

It is of the first importance that we do not go counter to the indications of nature whenever we deviate from her line of action, but rather give diligent heed to them. One of these indications in the case of the young calf is, that the first milk of the dam be first given to it, as it is specially adapted to its wants; another is, that

* In the recent work of Mr. Flint, referred to on page 73, besides full details of the most approved processes of manufacture of both butter and cheese in different sections of this country, will be found an interesting account of the dairy husbandry of North Holland, where greater attention is paid to this branch of farming than to any other, and where probably it is carried to a higher degree of perfection than in any other part of the world.

the young calf be fed often and not much at a time. The manifest wants and instincts of the young of all animals teach this, and the practice of some, in feeding them but twice a day, is a serious infraction of nature's laws, and like all other infractions of her laws, *must* be attended with pernicious consequences. Another indication is, that it be fed slowly and not drank greedily.

The necessity of giving heed to these rules, and the way in which evil results from failing to do so, is clearly set forth in a prize essay on "The Chemistry of Milk," by M. A. Cuming, V. S.,* and published in the transactions of the Highland and Agricultural Society of Scotland. After discussing the chemical composition of milk, and the changes produced in it by the different sorts of food the cow might be supplied with, the writer goes on to say:

"Before leaving this part of the subject, it may not be amiss to make a few remarks as to certain effects which milk, even in its best form, sometimes has upon the health of calves, in consequence of the mode in which it is given them. In many parts it is the practice to feed calves from the hand, the chief argument in favor of which is, that it admits of the substitution of artificial foods, along with the milk, thereby in a material degree economizing it. The bad effects, however, are often more than a match for the advantages: as for instance, when the life of the animal is sacrificed to the cheapness of feeding it. It is no uncommon thing for strong healthy calves, after being three, four or five days plentifully supplied with milk from the pail, to fall sick; they refuse their milk, the countenance is dejected, the belly hard, dropsical swelling of the legs takes place, and in half a day to a day and a half they die. On opening and examining such cases there will be found in the stomach a large mass of undigested curd, (or caseine,) which has evidently been the cause of death. The causes leading to such a state, we shall speak of presently; but must first premise a few remarks upon the relation existing between milk and the stomach of a sucking animal.

Pure caseine is insoluble in water and in acid and saccharine solutions; but soluble in alkaline solutions, especially soda. Milk,

* Dr. Cuming will be recollected as the writer of a valuable communication published in the report of last year, on Horse Shoeing.

we have already shewn, contains a considerable amount of free soda, it is this soda which keeps the caseine in solution: the coagulation of milk is brought about by adding to it an acid, which neutralizing the soda, allows or causes the caseine to be precipitated. This acid may be either an extraneous body added to the milk, or it may be produced in the milk itself by the production of lactic acid from its own saccharine solution—both plans are practiced in the dairy. In Holland, and different parts of the Continent, hydrochloric acid* is used to curdle the milk in the making of cheese, and the plan upon the whole is unobjectionable, this acid being of all others the best for the purpose, as along with the soda of the milk it forms the wholesome condiment of muriate of soda (common salt.) The general practice in this country is, to curdle the milk with rennet, upon the nature and formation of which, a few words require to be said, explanatory of the chemistry and physiology of the gastric juice:

Rennet, or Runnet, as is well known, is a solution of the stomach of the calf, or other sucking animal; and its property of coagulating milk has been by many ascribed to the acid of the gastric juice which is dissolved out of it. A moment's reflection, however, upon the washings, picklings, and other processes which the membrane undergoes before being used, will satisfy us that this is not the true explanation. The gastric juice consists of two distinct principles—an acid and saline solution, and animal matter; the former is secreted by the gastric glands of the stomach, and no doubt plays an important part in the coagulation of milk *in* the animal body; but as already shewn, has nothing to do with the coagulating action of rennet. The latter (the animal part) is simply the cast off epithelia, or scales of the internal coat of the organ itself. Now, it must be borne in mind, that sugar of milk, and in fact all *fermentable* bodies, consist of three elements: namely, carbon, oxygen, and hydrogen, and that all *ferments*, or substances capable of *producing* fermentation, contain nitrogen. This epithelial matter of the stomach contains nitrogen, and there can be little doubt, that its action on the saccharine solution of the milk is the same as that of any other ferment; that is, what chemists for want of a better explanation call a catalytic action, or action of presence—a something which

* Formerly called muriatic acid.

determines a change in the arrangement of the constituent elements of a body, without either adding to them or taking from them. A necessary condition to the action of all ferments, is the presence of oxygen. The azotized body or ferment first becomes oxidized,—a process of change is set up,—this change it communicates to the saccharine or non-azotized body with which it is in contact. In the healthy function of digestion, the epithelia or animal part of the gastric juice receives its oxygen from the air, carried down into the stomach along with the food and saliva. In the preparation of rennet, the stomach requires, after being cleaned and salted to prevent its putrefaction, to be exposed to the air for a length of time, so that its epithelia may become oxidised and be brought into the fit state of change for setting up the lactic fermentation. Any other animal matter, by exposure to the air for some time, will play the same part; and the special advantages belonging to the stomach of the sucking animal, seems to be in the peculiar organization of the epithelia upon its internal surface, permitting of its being oxidised and scaled off layer after layer without the other parts taking on the putrefactive decomposition. We have been informed by those who have used it, that the stomachs of adult ruminating animals, when properly prepared, have yielded very good rennet, and the anatomy of the parts shews nothing to prevent it. The action of the animal portion of the gastric juice upon the milk *in* the stomach of the calf, we conceive to be exactly similar to what it is out of it: namely, an action of presence. By the process of decomposition and change going on in itself, it disposes a similar change to take place in the milk with which it is in contact, and thus in conjunction with the acid and saline portion of the gastric juice produces the phenomena of digestion. The condition of change which is thus a necessary part of the action of the animal part of the gastric juice, invariably requires for its fulfilment the presence of oxygen, and this oxygen we have already stated, is carried into the stomach by the food and saliva. In fact, Liebig has sufficiently shewn that the *chief* use of the saliva is to entangle and carry down air into the stomach, and no better proof can be given in favor of his views, and in opposition to those who hold that the saliva is merely for diluting the food to make it more easily swallowed, than the fact that sucking animals whose food is entirely liquid, secrete by far the greatest amount

of saliva, in proportion to their size. If these views which we have been advancing are correct, a few words will suffice to explain the true nature of the disease we have spoken of, so often fatal to the prospects of the breeder; and also point out its remedy. In a calf three or four days old, the digestive powers of the stomach are necessarily immature; able to digest sufficient nourishment under favorable circumstances, but unable to react under any extra duty laid upon them. In such a case, a large quantity of milk is given it,—it is compelled by various devices to swallow it quickly,—it is carried to the stomach without being in the slightest degree insalivated—the natural gastric acid of the stomach curdles it; but from the want of saliva, there has been no air carried down to oxidise the epithelia of the internal coat of the membrane—that is, to produce the pepsine or animal portion of the gastric juice; and, consequently, there is wanted those consecutive and ulterior changes which are necessary to healthy digestion. The curd lies in the stomach in a hard, indurated mass, it is added to from meal to meal, until acting as a foreign and irritating body, it produces those fatal effects already mentioned.

The remedy, or at least the prevention, is simple—nature points it out herself; she never designed the calf to swallow its milk a gallon at a time; but to suck it drop by drop from the teats of its mother. By this suckling process, an immense secretion of saliva is carried on, so that a lather, like soapsuds, is seen around its mouth, and in this the air is entangled, and carried into the stomach to perform the functions we have been speaking of. It is well known to every one who has had to do with the feeding of calves, that they have an insatiable desire for sucking every thing within their reach, especially at and after being fed. We have known wise people so struck with this tendency, as to go the length of muzzling them for fear they would swallow anything that might hurt them, and yet they have died as bad as ever; had they taken the opposite plan, it would have been wiser. This tendency to suck, is one of nature's own provisions, and ought never to be thwarted. If the calf can not be allowed to suck its mother, it should have its milk given to it in smaller quantities, and more frequently than it commonly is—say four or five times a day for the first fortnight. It should also be induced by the finger, or some other object in the

mouth, to suck its milk, and not drink it; and this, with the addition of some loose object within its reach, at which it could draw till it was tired, would, we have little doubt, be the means of saving many thousand valuable calves every year."

Rearing by hand is a favorite method with many well skilled in dairy farming. As soon as the calf sucks plentifully, they milk the heifer clean, which is needful both to relieve distention and increase the lacteal secretion. The calf remains with the cow the first day, and is then removed and taught to feed by putting the finger into its mouth and presenting milk in a trough; very soon an artificial teat may be substituted for the fingers, and when commenced with thus early, they learn easily, and the separation is borne with less disturbance than after the dam becomes attached to the calf. After two or three weeks feeding with new milk, it is skimmed and warmed, adding an infusion of choice sweet hay, or scalded meal, or both; soon after which a little solid food is given as fine as hay, roots, &c. An indication of nature here not to be disregarded, is, that all changes be gradual and not sudden.

To induce the development of the full milking properties which a young animal may possess, we must abandon the too common practice of feeding young stock on coarse and innutritious food, and give such as will better accomplish the end in view. It is not possible for a calf to develop fully any good points which it may possess unless it be well fed. An indispensable accompaniment of successful breeding, whether for the dairy or for other purposes, is the bestowal of suitable and sufficient food; and this is particularly desirable up to the age of two or three years, when a good degree of vigor and strength of constitution is attained. Good feeding is by no means to be confounded with over feeding, which is not less an error than is scanty feeding. To pamper and surfeit a calf, is wholly unlike the treatment needful to keep it constantly thriving, and this latter we should aim at. The number of calves thus grown might be less, but their value would be greater, and the increased production of milk so effected, would last through their whole lives.

Nothing is more common than to find the amount of stock on a farm greater than can be fed in the way which will yield the greatest actual profit, and probably no kind of stock among us fails so

much to develop its full capabilities as milch cows. One-half the number now kept, were the best calves only selected for raising, and these well cared for, from infancy to maturity, would undoubtedly yield more milk than we now get from the whole, and at less cost.

The true policy of feeding milch cows seems to be, to give such food and so much of it, as will, in the first place, supply the waste of the system and ensure its maintenance in sound and healthy condition; and next, in addition to this, to furnish all the needful materials for making as much milk as the lacteal glands, in such healthy condition, are able to secrete. For the first, perhaps twenty pounds of hay, or its equivalent, daily, may suffice; but it is not so easy to say what will best serve for the latter—and this because sufficient attention has not been paid to this point in practice. We greatly need careful experiments to teach this very point. If one cow with better treatment will give as much milk as two do with present treatment, nothing can be plainer than that we can save half the cost of maintenance. No farmer would be willing to board two laborers, and pay each $10 per month, to do just what one would accomplish for $20 per month and his board;—in the one case he might suffer loss, and in the other, make a profit upon the transaction.

The chemical composition of milk furnishes suggestions regarding food, and also as to feeding for specific purposes, and the indications thus furnished should be made the basis of careful and repeated experiments in order to give certainty of intelligent and successful practice.

Dr. Voelcker remarks concerning the nutrition of cows for dairy purposes, that "milk may be regarded as a material for the manufacture of butter and cheese; and, according to the purpose for which the milk is intended to be employed, whether for the manufacture of butter or the production of cheese, the cow should be differently fed. Butter contains carbon, hydrogen and oxygen, and no nitrogen. Cheese, on the contrary, is rich in nitrogen. Food which contains much fatty matter, or substances which in the animal system are readily converted into fat, will tend to increase the proportion of cream in milk. On the other hand, the proportion of caseine or cheesy matter in milk is increased by the use of highly nitrogenized food. Those, therefore, who desire much cream, or who produce

milk for the manufacture of butter, select food likely to increase the proportion of butter in the milk. On the contrary, where the principal object is the production of milk rich in curd—that is, where cheese is the object of the farmer—clover, peas, and bean meal, and other plants which abound in legumine,—a nitrogenized organic compound, almost identical in properties and composition with caseine, or the substance which forms the curd of milk,—will be selected." So, too, the quality as well as quantity of butter in milk is greatly dependent upon the character of the food consumed.

The most thorough and careful experiments yet made in feeding dairy animals, are those of Mr. T. Horsfall of Yorkshire, and are communicated in the Journal of the Royal Agricultural Society of England. His account is too long for insertion here in full, but a portion is given below and specially commended to the careful study of dairymen, not that we may hope advantageously to copy his practice, but for the valuable instruction it furnishes and which it is hoped may lead to such modifications of our practice as shall be best adapted to our circumstances:

Management of Dairy Cattle. By T. Horsfall. On entering upon a description of my treatment of cows for dairy purposes, it seems pertinent that I should give some explanation of the motives and considerations which influence my conduct in this branch of my farm operations.

I have found it stated, on authority deserving attention, that store cattle of a fair size, and without other occupation, maintain their weight and condition for a length of time, when supplied daily with one hundred and twenty pounds of Swedish turnips and a small portion of straw. The experience of the district of Craven, in Yorkshire, where meadow hay* is the staple food during winter, shows that such cattle maintain their condition on one and one-half stone of meadow hay each per day. These respective quantities of turnips and of hay correspond very closely in their nutritive properties; they contain a very similar amount of albuminous matter, starch, sugar, &c., and also of phosphoric acid. Of oil—an important element, especially for the purpose of which I am treating—the stated supply of meadow hay contains more than that of turnips. If we supply cows in milk of average size with the kind and quantity of food above mentioned, they will lose perceptibly in condition. This is easily explained when we find their milk rich in substances which serve for their support when in store condition, and which are shown to be diverted in the secretion of milk.

*Meadow hay, as understood in England, is the best quality of upland hay for nutritive purposes, or what we call best English hay. A stone is fourteen pounds, or one eighth of a cwt.

In the neighborhood of towns where the dairy produce is disposed of in new milk, and where the aim of dairymen is to produce the greatest quantity, too frequently with but little regard to quality, it is their common practice to purchase incalving cows; they pay great attention to the condition of the cow; they will tell you, by the high comparative price they pay for animals well stored with flesh and fat, that condition is as valuable for them as it is for the butcher; they look upon these stores as materials which serve their purpose; they supply food more adapted to induce quantity than quality, and pay but little regard to the maintenance of the condition of the animal. With such treatment, the cow loses in condition during the process of milking, and when no longer profitable, is sold to purchasers in farming districts where food is cheaper, to be fattened or otherwise replenished for the use of the dairy keeper. We thus find a disposition in the cow to apply the aliment of her food to her milk, rather than to lay on flesh or fat; for not only are the elements of her food diverted to this purpose, but to all appearance her accumulated stores of flesh and fat are drawn upon, and converted into components of milk, cheese, or butter.

As I am differently circumstanced, a considerable portion of my dairy produce being intended for butter, for which poor milk is not adapted, and as I fatten not only my own cows, but purchase others to fatten in addition, I have endeavored to devise food for my milch cows, adapted to their maintenance and improvement, and with this view I have paid attention to the composition of milk. From several analyses I have selected one by Haidlen, which I find in publications of repute. Taking a full yield of milk, four gallons per day, which will weigh upwards of forty pounds, this analysis assigns to it of dry material 5.20, of which the proportion, with sufficient accuracy for my purpose, consists of—

Pure casein,	2.00 pounds.
Butter,	1.25 "
Sugar,	1.75 "
Phosphate of lime,	.09 "
Chloride of potassium and other mineral ingredients,	.11 "
	5.20 "

It appeared an object of importance, and one which called for my particular attention, to afford an ample supply of the elements of food suited to the maintenance and likewise to the produce of the animal, and that, if I omitted to effect this, the result would be imperfect and unsatisfactory. By the use of ordinary farm produce only, I could not hope to accomplish my purpose. Turnips are objectionable on account of their flavor; and I seek to avoid them as food for dairy purposes. I use cabbages, kohl rabi, and mangold wurtzel, yet only in moderate quantities. Of meadow hay it would require, beyond the amount necessary for the maintenance of the cow, an addition of fully twenty pounds for the supply of casein in a full yield of milk (sixteen quarts); forty pounds for the supply of oil for the butter; whilst nine pounds seem adequate for that of the phosphoric acid. You cannot,

then, induce a cow to consume the quantity of hay requisite for her maintenance, and for a full yield of milk of the quality instanced. Though it is a subject of controversy whether butter is wholly derived from vegetable oil, yet the peculiar adaptation of this oil to the purpose will, I think be admitted. I had, therefore, to seek assistance from what are usually termed artificial feeding substances, and to select such as are rich in albumen, oil, and phosphoric acid; and I was bound also to pay regard to their comparative cost, with a view to profit, which, when farming is followed as a business, is a necessary, and in any circumstances an agreeable accompaniment.

I think it will be found that substances peculiarly rich in nitrogenous or other elements have a higher value for special than for general purposes; and *that the employment of material characterized by peculiar properties for the attainment of special objects has not yet gained the attention to which it is entitled.*

I have omitted all reference to the heat-supplying elements—starch, sugar, &c. As the materials commonly used as food for cattle contain sufficient of these to effect this object, under exposure to some degree of cold, I have a right to calculate on a less consumption of them as fuel, and consequently a greater surplus for deposit as sugar, and probably also as fat, in consequence of my stalls being kept during winter at a temperature of nearly sixty degrees.

I now proceed to describe the means I am using to carry out the purposes which I have sought to explain. My food for milch cows, after having undergone various modifications, has for two seasons consisted of rape-cake five pounds, and bran two pounds for each cow, mixed with a sufficient quantity of bean-straw, oat-straw, and shells of oats, in equal proportions, to supply them three times a day with as much as they will eat. The whole of the materials are moistened and blended together, and after being well steamed, are given to the animals in a warm state. The attendant is allowed one pound to one and one-half pound per cow, according to circumstances, of bean-meal, which he is charged to give to each cow in proportion to the yield of milk, those in full milk getting two pounds each per day, others but little; it is dry and mixed with the steam food on its being dealt out separately; when this is eaten up, green food is given, consisting of cabbages, from October to December, kohl rabi till February, and mangold till grass time. With a view to nicety of flavor, I limit the supply of green food to thirty to thirty-five pounds per day for each. After each feed, four pounds of meadow hay, or twelve pounds per day, is given to each cow; they are allowed water twice per day to the extent they will drink.

As several of these materials are not commonly used as food, I may be allowed some observations on their properties. Bean-straw uncooked, is dry and unpalatable; by the process of steaming, it becomes soft and pulpy, emits an agreeable odor, and imparts flavor and relish to the mess. For my information and guidance I obtained an analysis of bean-straw of my own growth, on strong and high-conditioned land; it was cut on the short side of ripeness,

but yielding a plump bean. The analysis by Professor Way shows a percentage of—

Moisture,	14.47
Albuminous matter,	16.38
Oil or fatty matter,	2.23
Woody fibre,	25.84
Starch, gum, &c.,	31.63
Mineral matters,	9.45
Total,	100.00

In albuminous matter, which is especially valuable for milch cows, it has nearly double the proportion contained in meadow hay. Bran also undergoes a great improvement in its flavor by steaming, and it is probably improved in its convertibility as food; it contains about 14 per cent. of albumen, and is peculiarly rich in phosphoric acid, nearly 3 per cent. of its whole substance being of this material. The properties of rape-cake are well known; the published analyses give it a large proportion (nearly 30 per cent.) of albumen; it is rich in phosphates and also in oil. This is of the unctuous class of vegetable oils, and it is to this property that I call particular attention. Chemistry will assign to this material, which has hitherto been comparatively neglected for feeding, a first place for the purpose of which I am treating. If objections should occur on account of its flavor, I have no difficulty in stating that by the preparation I have described I have quite overcome this. I can easily persuade my cattle, (of which sixty to eighty pass through my stalls in a year,) without exception, to eat the requisite quantity. Nor is the flavor of the cake in the least perceptible in the milk or butter.

During May, my cows are turned out on a rich pasture near the homestead; towards evening they are again housed for the night, when they are supplied with a mess of the steamed mixture and a little hay each morning and evening. During June, when the grasses are better grown, mown grass is given to them instead of hay, and they are also allowed two feeds of steamed mixture. This treatment is continued till October, when they are again wholly housed.

The results which I now proceed to relate are derived from observations made with the view of enabling me to understand and regulate my own proceedings.

For some years back I have regularly weighed my feeding stock, a practice from which I am enabled to ascertain their doings with greater accuracy than I could previously. In January, 1854, I commenced weighing my milch cows; it has been shown by what I have premised that no accurate estimate can be formed of the effect of the food on the production of milk, without ascertaining its effect on the condition of the cows. I have continued the practice once a month almost without omission up to this date. The weighings take place early in the morning, and before the cows are supplied with food; the weights are registered, and the length of time (fifteen months,) during which I have observed this practice, enables me to speak with confidence of the results.

The cows in full milk yielding twelve to sixteen quarts each per day vary but little—some losing, others gaining, slightly; the balance in the month's weighing of this class being rather to gain. It is common for a cow to continue a yield from six to eight months before she gives below twelve quarts per day, at which time she has usually, if not invariably, gained weight.

The cows giving less than twelve quarts, and down to five quarts per day, are found, when free from ailment, to gain without exception. This gain, with an average yield of nearly eight quarts per day, is at the rate of seven pounds to eight pounds per week each.

My cows in calf I weigh only in the incipient stages, but they gain perceptibly in condition, and consequently in value; they are milked till within four or five weeks previous to calving. I give the weights of three of these, and also of one heifer, which calved in March, 1855:—

No.		1854.				1855.				Gain.
			cwt.	qr.	lbs.		cwt.	qr.	lbs.	lbs.
1	Bought and weighed,	July,	10	1	20	April,	11	3	0	148
2	" "	"	8	2	10	"	10	2	0	214
3	" "	"	8	2	0	"	10	0	0	184
4	Heifer, which calved also in March, 1855, weighed,	"	7	0	0	"	9	3	0	300

These observations extend over lengthened periods on the same animals, of from thirty to upwards of fifty weeks; a cow, free from calf and intended for fattening, continues to give milk from ten months to a year after calving, and is then in a forward state of fatness, requiring but a few weeks to finish her for sale to the butchers.

It will thus appear that my endeavors to provide food adapted to the maintenance and improvement of my milch cows have been attended with success.

On examining the composition of the ordinary food which I have described, straw, roots and hay, it appears to contain the nutritive properties which are found adequate to the maintenance of the animal, whereas the yield of milk has to be provided for by a supply of extra food; the rape-cake, bran, and bean-meal which I give will supply the albumen for the casein; it is somewhat deficient in oil for the butter, whilst it will supply in excess the phosphate of lime for a full yield of milk. If I take the class of cows giving less than twelve quarts per day, and taking also into account a gain of flesh, seven to nine pounds per week, though I reduce the quantity of extra food by giving less of the bean-meal, yet the supply will be more in proportion than with a full yield; the surplus of nitrogen and phosphoric acid, or phosphate of lime, will go to enrich the manure.

I cannot here omit to remark on the satisfaction I derive from the effects of this treatment on the fertility of the land in my occupation. My rich pastures are not tending to impoverishment, but to increased fertility; their improvement in condition is apparent. A cow in full milk, giving sixteen quarts

per day, of the quality analyzed by Haidlen, requires, beyond the food necessary for her maintenance, six to eight pounds per day of substances containing thirty or twenty-five per cent. of protein. A cow giving on the average eight quarts per day, with which she gains seven to nine pounds per week, requires four to five pounds per day of substances rich in protein beyond the food which is necessary for her maintenance. Experience of fattening gives two pounds per day, or fourteen pounds per week, as what can be attained on an average and for a length of time. If we considered one-half pound per day as fat, which is not more than probable, there will be one and one-half pounds for flesh, which, reckoned as dry material, will be about one-third pound; which is assimilated in increase of fibrine and represents only one and one-third to two pounds of substances rich in protein beyond what is required for her maintenance.

If we examine the effects on the fertility of the land, my milch cows, when on rich pasture, and averaging a yield of nine quarts per day, and reckoning one cow to each acre, will carry off in twenty weeks twenty-five pounds of nitrogen, equal to thirty of ammonia. The same quantity of milk will carry off seven pounds of phosphate of lime in twenty weeks from each acre.

A fattening animal gaining flesh at the rate I have described will carry off about one-third of the nitrogen (equal to about ten pounds of ammonia,) abstracted by the milch cow, whilst if full grown it will restore the whole of the phosphate.

It is worthy of remark that experience shows that rich pastures used for fattening, fully maintain their fertility through a long series of years; whilst those used for dairy cows require periodical dressing to preserve their fertility.

If these computations be at all accurate, they tend to show that too little attention has been given to the supply of substances rich in nitrogenous compounds in the food of our milch cows, whilst we have laid too much stress on this property in food for fattening cattle. They tend also to the inference that in the effects on the fertility of our pastures used for dairy purposes, we derive advantage, not only from the phosphate of lime, but also from the gelatine of bones used as manure.

On comparing the results from my milch cows fed in summer on rich pasture, and treated at the same time with the extra food I have described, with the results when on winter food, and whilst wholly housed, taking into account both the yield of milk and the gain of weight, I find those from stall-feeding full equal to those from the pasture. The cows which I buy as strippers, for fattening, giving little milk, from neighboring farmers who use ordinary food, such as turnips with straw or hay, when they come under my treatment, increase their yield of milk, until after a week or two they give two quarts per day more than when they came, and that too of a much richer quality.

I sometimes observe in the weekly publications which come under my notice, accounts of cows giving large quantities of butter; these are usually, however, extraordinary instances, and not accompanied with other statistical

information requisite to their being taken as a guide; and it seldom happens that any allusion is made to the effects of the food on the condition of the animals, without which no accurate estimate can be arrived at. On looking over several treatises to which I have access, I find the following statistics on dairy produce: Mr. Morton, in his "Cyclopædia of Agriculture," p. 621, gives the results of the practice of a Mr. Young, an extensive dairy-keeper, in Scotland. The yield of milk per cow is stated at six hundred and eighty gallons per year; he obtained from sixteen quarts of milk, twenty ounces of butter, or for the year, two hundred and twenty-seven pounds per cow; from one gallon of cream three pounds of butter, or twelve ounces per quart. Mr. Young is described as a high feeder; linseed is his chief auxiliary food for milch cows. Professor Johnston ("Elements of Agricultural Chemistry,") gives the proportion of butter from milk at one and one-half ounces per quart, or from sixteen quarts twenty-four ounces; being the produce of four cows of different breeds—Alderney, Devon and Ayrshire—on pasture, and in the height of the summer season. On other four cows of the Ayrshire breed he gives the proportion of butter from sixteen quarts as sixteen ounces, being one ounce per quart. These cows were likewise on pasture. The same author states the yield of butter as one-fourth of the weight of cream, or about ten ounces per quart. Mr. Rawlinson ("Journal of the Royal Agricultural Society," vol. xiii., p. 38,) gives the produce of twenty thousand one hundred and ten quarts of milk churned by hand as one thousand one hundred and nine pounds of butter, being at the rate of fully fourteen ounces per sixteen quarts of milk; and from twenty-three thousand one hundred and fifty-six quarts of milk, one thousand five hundred and twenty-five pounds of butter, being from sixteen quarts nearly sixteen and three-fourths ounces of butter. The same author states that the yield of butter derived from five churnings of fifteen quarts of cream each is somewhat less than eight ounces per quart of cream. Dr. Muspratt, in his work on the "Chemistry of Arts and Manufactures," which is in the course of publication, gives the yield of butter from a cow per year in Holstein and Lunenburg at one hundred pounds, in England at one hundred and sixty pounds to one hundred and eighty pounds. The average of butter from a cow in England is stated to be eight ounces or nine ounces per day, which, on a yield of eight to nine quarts, is one ounce per quart, or for sixteen quarts sixteen ounces. The quantity of butter derived from cream is stated as one-fourth, which is equal to about nine ounces per quart. The richest cream of which I find any record is that brought to the Royal Society's meeting during the month of July, for the churns which compete for the prize. On referring to the proceedings of several meetings, I find that fourteen ounces per quart of cream is accounted a good yield.

I have frequently tested the yield of butter from a given quantity of my milk. My dairy produce is partly disposed of in new milk, partly in butter and old milk, so that it became a matter of business to ascertain by which mode it gave the best return. I may here remark that my dairy practice has been throughout on high feeding, though it has undergone several modifica-

tions. The mode of ascertaining the average yield of butter from milk has been to measure the milk on the churning day after the cream has been skimmed off, then to measure the cream, and having, by adding together the two measurements, ascertained the whole quantity of milk (including the cream) to compare it with that of the butter obtained. This I consider a more accurate method than measuring the new milk, as there is a considerable escape of gas, and consequent subsidence, whilst it is cooling. The results have varied from twenty-four to twenty-seven and one-fourth ounces from sixteen quarts of milk. I therefore assume in my calculation sixteen quarts of milk as yielding a roll (twenty-five ounces) of butter.

As I have at times a considerable number of cows bought as strippers, and fattened as they are milked, which remain sometimes in my stalls eight or nine months, and yield towards the close but five quarts per day, I am not enabled to state with accuracy and from ascertained data the average yield per year of my cows kept for dairy purposes solely. However, from what occurs at grass-time, when the yield is not increased, and also from the effects of my treatment on cows which I buy, giving a small quantity, I am fully persuaded that my treatment induces a good yield of milk. * * *

My cows are bought in the neighboring markets with a view to their usefulness and profitableness. The breeds of this district have a considerable admixture of the short-horn, which is not noted for the richness of its milk. It will be remarked that during the time these observations have been continued on the proportion of butter from cream, more than one-half of my cows have been changed.

Having satisfied myself *that the peculiar richness of my cream was due mainly to the treatment of my cows*, which I have sought to describe, it occurred to me that I ought not to keep it to myself; inasmuch as these results of my dairy practice not only afforded matter of interest to the farmer, but were fit subjects for the investigation of the physiologist and the chemist. Though my pretensions to acquirements in their instructions are but slender, they are such as enable me to acknowledge benefit in seeking to regulate my proceedings by their rules.

In taking off the cream I use an ordinary shallow skimmer of tin perforated with holes, through which any milk gathered in skimming escapes. It requires care to clear the cream; and even with this some streakiness is observable on the surface of the skimmed milk. The milk bowls are of glazed ware, common in this district; they stand on a base of six to eight inches, and expand at the surface to nearly twice that width. Four to five quarts are contained in each bowl, the depth being from four to five inches at the centre. The churn I use is a small wooden one, worked by hand, on what I believe to be the American principle.

I have forwarded to Professor Way a small sample of butter for analysis; fifteen quarts of cream were taken out of the cream jar, and churned at three times in equal portions:—

The first five quarts of cream gave	.	.	127 ounces of butter.
Second five " "	.	.	125 " "
Third five " "	.	.	120½ " "
			372½ " "

Equal to 24 3-4 ounces per quart.

At a subsequent churning of fourteen quarts of cream—

The first seven gave 7 rolls or	.	.	175 ounces of butter.
Second seven gave 7 rolls 2 oz., or	.	.	177 " "
			352

Equal to 25 1-7 ounces per quart.

On testing the comparative yield of butter and of butter-milk, I find 70 per cent. of butter to 30 per cent. of butter-milk, thus reversing the proportions given in the publications to which I have referred. An analysis of my butter by Professor Way gives:—

Pure fat or oil, ...	82.70
Casein or curd, ...	2.45
Water, with a little salt, ...	14.85
Total, ...	100.00

The only analysis of this material which I find in the publications in my hand are two by Professor Way, "Journal," vol. xi., p. 735, "On butter by the common and by the Devonshire method;" the result in one hundred parts being:—

	Raw.	Scalded.
Pure butter, ...	79.72	79.12
Casein. &c., ...	3.38	3.37
Water, ...	16.90	17.51
Total, ...	100.00	100.00

The foregoing observation of dairy results was continued up to grass time in 1855. In April and May the use of artificial means was discontinued without diminution in the yield of butter or richness of cream, the natural temperature being sufficient to maintain that of my dairy at fifty-four degrees to fifty-six degrees.

I now proceed to describe the appearances since that time. In the summer season, whilst my cows were grazing in the open pastures during the day and housed during the night, being supplied with a limited quantity of the steamed food each morning and evening, a marked change occurred in the quality of the milk and cream; the quantity of the latter somewhat increased, but instead of twenty-five ounces of butter per quart of cream, my summer cream yielded only sixteen ounces per quart.

I would not be understood to attribute this variation in quality to the

change of food only; it is commonly observed by dairy-keepers that milk during the warm months of summer is less rich in butter, owing probably to the greater restlessness of the cows, from being teased by flies, &c. I am by no means sure that, if turning out during the warm months be at all advisable, it would not be preferable that this should take place during the night instead of during the day time. Towards the close of September, when the temperature had become much cooler and the cows were supplied with a much larger quantity of the steamed food, results appeared very similar to those which I had observed and described from December to May, 1855. During the month of November the quality was tested with the following result :—

From two hundred and fifty-two quarts of old milk were taken twenty-one quarts of cream, of which twenty were churned, and produced four hundred and sixty-eight ounces of butter, which shows :—

27.50 ounces of butter from 16 quarts of new milk.
23.40 " " from each quart of cream.

During May, 1856, my cows being on open pasture during the day were supplied with two full feeds of the steamed mixture, together with a supply of green rape-plant each morning and evening.

The result was that from three hundred and twenty-four quarts of old milk twenty-three quarts of cream were skimmed, of which twenty-two were churned and produced five hundred and fifteen ounces of butter, which shows :—

24 ounces of butter from 16 quarts of new milk.
22.41 " " from each quart of cream.

* * * * * * * * *

There is doubtless some standard of food adapted to the constitution and purposes of animals, combining with bulk a due proportion of elements of respiration, such as sugar, starch, &c., together with those of nutrition, viz.: nitrogenous compounds, phosphates, and other minerals; nor can we omit oil or fat-forming substances; for however we may be disposed to leave to philosophy the discussion as to whether sugar, starch, &c., are convertible into fat, yet I think I shall not offend the teacher of agricultural chemistry by stating that the more closely the elements of food resemble those in the animal and its product, the more efficacious will such food be for the particular purpose for which it is used.

Sugar, starch, &c., vary very considerably in form and proportion from vegetable oils, which closely resemble animal fats.

When we consider that plants have a two-fold function to perform, viz.: to serve as food for animals and also for the reproduction of the like plants, and that after having undergone the process of digestion they retain only one-half or one-third of their value as manure, the importance of affording a due but not excessive supply of each element of food essential to the wants and purposes of the animal will be evident. If we fall short, the result will be imperfect; if we supply in excess, it will entail waste and loss.

Linseed and rape-cake resemble each other very closely in chemical composition; the latter is chiefly used for manure, and its price ranges usually about half that of linseed cake. In substances poorer in nitrogen and with more of starch, gum, oil, &c., the disparity in value as food and as manure will be proportionately greater.

During the present season Mr. Mendelssohn, of Berlin, and Mr. Gausange, who is tenant of a large royal domain near Frankfort on the Oder, on which he keeps about one hundred and fifty dairy cows, have been my visitors. These gentlemen have collected statistics in dairy countries through which they have traveled. I learned from them in Mecklenburg, Prussia, Holland, &c., fourteen quarts of milk yield, on the average, one pound of butter; in rare instances twelve quarts are found to yield one pound. Both attach great importance to the regulation of the temperature. Mr. Mendelssohn tells me that the milk from cows fed on draff, (distillers' refuse,) requires a higher temperature to induce its yield of butter than that from cows supplied with other food.

On inquiry in my own neighborhood, I find it is computed that each quart at a milking represents one pound of butter per week. Thus a cow which gives four quarts at each milking, will yield in butter four pounds per week, or from fifty-six quarts sixty-four ounces of butter, or from fourteen quarts of milk one pound of butter. Taking the winter produce alone, it is lower than this; the cream from my neighbors' cows, who use common food, hay, straw and oats, somewhat resembles milk in consistency, and requires three to four hours, sometimes more, in churning. On one occasion a neighboring dairy-woman sent to borrow my churn, being unable to make butter with her own; I did not inquire the result. If she had sent her cow, I could in the course of a week have insured her cream which would make butter in half an hour. These dairy people usually churn during winter in their kitchen, or other room with a fire. Each of them states that from bean or oat meal used during winter as an auxiliary food, they derive a greater quantity of butter, whilst those who have tried linseed oil have perceived no benefit from it.

My own cream during the winter season is of the consistency of paste or thick treacle. When the jar is full, a rod of two feet long, will, when dipped into the cream to half its length, stand erect. If I take out a teacup-full in the evening and let it stand till next morning, a penny piece laid on its surface will not sink; on taking it off I find the underside partially spotted with cream. The churnings are performed in a room without fire, at a temperature in winter of forty-three degrees to forty-five degrees, and occupy one-half to three-quarters of an hour.

Several who have adopted my system have reported similar effects—an increase in the quantity with a complete change as to richness of quality. I select from these Mr. John Simpson, a tenant farmer residing at Ripley, in Yorkshire, who at my request stated to the committee of the Wharfdale Agricultural Society that he and a neighbor of his, being inconvenienced from a deficient yield of milk, had agreed to try my mode of feeding, and provided

themselves with a steaming apparatus. This change of treatment took place in February, 1855. I quote his words:

"In about five days I noticed a great change in my milk, the cows yielded two quarts each, per day, more; but what surprised me most was the change in the quality; instead of poor winter cream and butter, they assumed the appearance and character of rich summer produce; it only required twenty minutes for churning, instead of two to three hours; there was also a considerable increase in the quantity of butter, of which, however, I did not take any particular notice. My neighbor's cow gave three quarts per day in addition, and her milk was so changed in appearance that the consumers to whom he sold it became quite anxious to know the cause."

My dairy is but six feet wide by fifteen long, and twelve high; at one end (to the north) is a trellis window, at the other an inner door which opens into the kitchen. There is another door near to this which opens into the churning room, having also a northern aspect; both doors are near the south end of the dairy. Along each side, and the north end, two shelves of wood are fixed to the wall, the one fifteen inches above the other; two feet higher is another shelf, somewhat narrower but of like length, which is covered with charcoal, whose properties as a deodorizer are sufficiently established. The lower shelves being two feet three inches wide, the interval or passage between is only one foot six inches. On each tier of shelves is a shallow wooden cistern lined with thin sheet-lead, having a rim at the edges three inches high. These cisterns incline downwards slightly towards the window, and contain water to the depth of three inches. At the end nearest the kitchen each tier of cisterns is supplied with two taps, one for cold water in summer, the other with hot for winter use. At the end next the north window is a plug or hollow tube, with holes perforated at such an elevation as to take the water before it flows over the cistern.

During the summer the door towards the kitchen is closed, and an additional door is fixed against it, with an interval between well packed with straw; a curtain of stout calico hangs before the trellis window, which is dipped in salt water, and kept wet during the whole day by cold water spurted over it from a gutta-purcha tube. On the milk being brought in it is emptied into bowls. Some time after these bowls (of which a description is given in a former part of this) have been placed on the cistern, the cold-water taps are turned till the water rises through the perforated tube, and flows through a waste pipe into the sewer. The taps are then closed, so as to allow a slight trickling of water, which continues through the day. By these means I reduce the temperature, as compared with that outside the window, by twenty degrees. I am thus enabled to allow the milk to stand till the cream has risen, and keep the skimmed milk sweet, for which I obtain one penny (two cents) per quart.

Having heard complaints during very hot weather of skimmed milk, which had left my dairy perfectly sweet, being affected so as to curdle in cooking on being carried into the village, I caused covers of thick calico (the best of our fabrics for retaining moisture) to be made; these are dipped in salt water and

then drawn over the whole of the tin milk cans; the contrivance is quite successful, and is in great favor with the consumers. I have not heard a single complaint since I adopted it.

Finding my butter rather soft in hot weather, I uncovered a draw-well, which I had not used since I introduced water-works for the supply of the village and my own premises. On lowering a thermometer down the well to a depth of twenty-eight feet, I found it indicated a temperature of forty-three degrees—that on the surface being seventy degrees. I first let down the butter, which was somewhat improved, but afterwards the cream; for this purpose I procured a movable windlass, with a rope of the required length; the cream-jar is placed in a basket two feet four inches deep, suspended on the rope, and let down the evening previous to churning. It is drawn up early next morning and immediately churned; by this means the churning occupies about the same time as in winter, and the butter is of like consistency.

The advantage I derive from this is such that, rather than be without it, I should prefer sinking a well for the purpose of reaching a like temperature.

When winter approaches, the open trellis window to the north is closed, an additional shutter being fixed outside, and the interval between this and an inner shutter closely packed with straw to prevent the access of air and cold; the door to the kitchen is at the same time unclosed to admit warmth. Before the milk is brought from the cow-house the dairymaid washes the bowls well with hot water, the effect of which is to take off the chill but not to warm them; the milk is brought in as milked, and is passed through a strainer into the bowls, which are then placed on the cistern. A thermometer, with its bulb immersed in the milk, denotes a temperature of about ninety degrees. The hot water is applied immediately at a temperature of one hundred degrees or upwards, and continues to flow for about five minutes, when the supply is exhausted. The bowls being of thick earthenware—a slow conductor—this does not heighten the temperature of the milk. The cooling, however, is thereby retarded, as I find the milk, after standing four hours, maintains a temperature of sixty degrees. This application of hot water is renewed at each milking to the new milk, but not repeated to the same after it has cooled. The temperature of the dairy is momentarily increased to above sixty degrees, but speedily subsides, the average temperature being fifty-two degrees to fifty-six degrees.

It will be observed that the churnings in summer and winter occupy half an hour or upwards; by increasing the temperature of the cream I could easily churn in half the time, but I should thereby injure the quality of the butter. When the butter has come, and gathered into a mass, it is taken, together with the buttermilk, out of the churn, which is rinsed with water; the butter is then placed again in the churn, with a quantity of cold spring water in which salt has been dissolved, at the rate of one ounce per quart of cream; after a few minutes' churning, the butter is again taken out; the water in which it has been washed assumes a whitish appearance. By this process the salt is equally diffused through the butter, which requires little manipulation,

and is freed from a portion of caseous matter. A recent analysis of my butter, shows only 1.07 instead of 2.45 per cent. of casein, as before; that it ranks as choice may be inferred, when I state that my purchaser willingly gives me one penny per roll more than the highest price in Otley market, and complains that I do not supply him with a greater quantity.

In this dairy of the small dimensions I have described, my produce of butter reaches at times sixty to seventy pounds per week. Though the size may appear inconveniently small, yet I beg to remark on the greater facility of regulating the temperature of a small in comparison with a large dairy. This difficulty will be found greater in summer than in winter, as it is far easier to heighten than to depress the temperature.

I have cooked or steamed my food for several years. It will be observed that I blend bean-straw, bran and malt combs, as flavoring materials, with oat or other straw and rape-cake: the effect of steaming is to volatilize the essential oils, in which the flavor resides, and diffuse them through the mess. The odor arising from it resembles that observed from the process of malting; this imparts relish to the mess, and induces the cattle to eat it greedily; in addition to which I am disposed to think that it renders the food more easy of digestion and assimilation. I use this process with advantage for fattening, when I am deficient in roots. With the same mixed straw and oat-shells, three to four pounds each of rape-cake, and one-half pound of linseed oil, but without roots, I have fattened more than thirty heifers and cows free from milk, from March up to the early part of May; their gain has averaged fully fourteen pounds each per week—a result I could not have looked for from the same materials if uncooked; this process seems to have the effect of rendering linseed oil less of a laxative, but cannot drive off any portion of the fattening oils, to volatilize which requires a very high temperature. My experience of the benefits of steaming is such, that if I were deprived of it, I could not continue to feed with satisfaction.

I have weighed my fattening cattle for a number of years, and my milch cows for more than two years; this practice enables me at once to detect any deficiency in the performance of the animals; it gives also a stimulus to the feeders, who attend at the weighings, and who are desirous that the cattle intrusted to their care should bear a comparison with their rivals. Another obvious advantage is in avoiding all cavils respecting the weight by my purchasers, who, having satisfied themselves as to the quality of the animal, now ask and obtain the most recent weighing. The usual computation for a well-fed, but not over fat beast, is, live to dead weight as twenty-one to twelve, or one hundred to fifty-nine and one-seventh, with such modifications as suggest themselves by appearances.

Though many discussions have taken place on the fattening of cattle, the not less important branch of dairy treatment has hitherto been comparatively neglected. I therefore venture to call attention to considerations which have arisen from observations in my own practice, affecting the chemistry and physiology, or, in other words, the science of feeding. That I am seeking aid

from its guidance will be apparent, and I have no hesitation in admitting, that beyond the satisfaction from the better understanding of my business, I have latterly derived more benefit or profit from examination of the chemical composision of materials of food than from the treatment or feeding experiments of others which have come under my notice. So persuaded am I of the advantage of this, that I do not feel satisfied to continue the use of any material, with the composition of which I am not acquainted, without resorting to the society's laboratory for an analysis.

To one leading feature of my practice I attach the greatest importance—the maintenance of the condition of my cows, giving a large yield of milk. I am enabled, by the addition of bean-meal in proportion to the greater yield of milk, to avert the loss of condition in those giving sixteen to eighteen quarts per day; whilst on those giving a less yield and in health, I invariably effect an improvement.

When we take into consideration the disposition of a cow to apply her food rather to her milk than to her maintenance and improvement, it seems fair to infer that the milk of a cow gaining flesh will not be deficient either in casein or butter.

I have already alluded to the efficiency of bean-meal in increasing the quantity of butter; I learn also, from observant dairymen who milk their own cows and carry their butter to market, that their baskets are never so well filled as when their cows feed on green clover, which, as dry material, is nearly as rich in albumen as beans; I am also told, by those who have used green rape plant, that it produces milk rich in butter. From this we may infer that albuminous matter is the most essential element in the food of the milch cow, and that any deficiency in the supply of this will be attended with loss of condition, and a consequent diminution in the quality of her milk.

I am clearly of opinion that you can increase the proportion of butter in milk more than that of casein, or other solid parts. From several, who have adopted my treatment, I learn that on substituting rape-cake for beans, they perceive an increased richness in their milk. Mr. T. Garnett, of Clitheroe, who has used bean-meal largely as an auxiliary food for milch cows during the winter season, tells me that when rape-cake is substituted, his dairymaid, without being informed, perceives the change from the increased richness of the milk. Mr. Garnett has also used linseed-cake in like quantity, still his dairy people prefer rape-cake.

Mr. Whelon, of Lancaster, who keeps two milch cows for his own use, to which he gave bean-meal and bran as auxiliaries, has recently substituted rape-cake for bean-meal; he informs me that in a week he perceived a change in the richness of the milk, with an increase of butter.

The vegetable oils are of two distinct classes: the *drying* or *setting* represented by linseed, the *unctuous* represented by rape-oil. They consist of two proximate elements, margerine and olein; in all probability they will vary in their proportion of these, but in what degree I have not been able to ascertain. Though the agricultural chemists make no distinction, as far as I am aware,

between these two classes of oils, the practitioners in medicine use them for distinct purposes. Cod-liver oil has been long used for pulmonary complaints; latterly, olive, almond, and rape-oils are being employed as substitutes. These are all of the unctuous class of oils. Mr. Rhind, the intelligent medical practitioner of this village, called my attention to some experiments by Dr. Leared, published in the *Medical Times*, July 21, 1855, with olein alone, freed from margerine, which showed marked superiority in the effect; and I now learn from Mr. Rhind that he is at present using with success the pure olein, prepared by Messrs. Price & Co., from cocoa-nut oil, one of the unctuous class. That linseed, and others of the drying oils, are used in medicine for a very different purpose, it seems unnecessary to state.

The olein of oil is known to be more easy of consumption and more available for respiration than margerine—a property to which its use in medicine may be attributable. If we examine the animal fats, tallow, suet, and other fat, they are almost wholly of the solid class, stearine or margerine, closely resembling or identical with the margerine in plants; whilst butter is composed of olien and magerine, combining both the proximate elements found in vegetable oils.

It seems worthy of remark that a cow can yield a far greater weight of butter than she can store up in solid fat; numerous instances occur where a cow gives off two pounds of butter per day, or fourteen pounds per week, whilst half that quantity will probably rarely be laid on in fat. If you allow a cow to gain sixteen pounds per week, and reckon seven for fat, there will only remain nine pounds for flesh, or, deducting the moisture, scarcely three pounds (2.97) per week, equal to .42, or less than half a pound per day, of dry fibrine.

The analyses of butter show a very varying proportion of olein and margerine fats: summer butter usually contains of olein sixty, and margerine forty per cent., whilst in winter butter these proportions are reversed, being forty of olein to sixty of margerine. By ordinary treatment the quantity of butter during winter is markedly inferior; the common materials for dairy-cows in winter are straw with turnips or mangel, hay alone, or hay with mangel. If we examine these materials, we find them deficient in oil, or in starch, sugar, &c. If a cow consume two stones or twenty-eight pounds of hay a day, which is probably more than she can be induced to eat on an average, it will be equal in dry material to more than one hundred pounds of young grass, which will also satisfy a cow. That one hundred pounds of young grass will yield more butter will scarcely admit of a doubt. The twenty-eight pounds of hay will be equal in albuminous matter and in oil to the one hundred pounds of grass, but in the element of starch, sugar, &c., there is a marked difference. During the growth of the plant, the starch and sugar are converted into woody fibre, in which form they are scarcely digestible or available for respiration. It seems, then, not improbable that, when a cow is supplied with hay only, she will consume some portion of the olein oil for respiration, and yield a less quantity of butter poorer in olein.

If you assume summer butter to contain of olein,	60	per cent.
" " " margerine,	40	"
	100	"
If the cow consume of the olein,	36	"
The quantity of butter will be reduced from 100 to	64	"
And the proportions will then be, of olein,	40	"
" " of margerine,	60	"
	100	"

If you supply turnips or mangel with hay, the cow will consume less of hay; you thereby substitute a material richer in sugar, &c., and poorer in oil. Each of these materials, in the quantity a cow can consume, is deficient in the supply of albumen necessary to keep up the condition of an animal giving a full yield of milk. To effect this, recourse must be had to artificial or concentrated substances of food, rich in albuminous matter.

It can scarcely be expected, nor is it desirable, that practical farmers should apply themselves to the attainment of proficiency in the art of chemical investigations; this is more properly the occupation of the professor of science. The following simple experiment, however, seems worth mentioning. On several occasions, during winter, I procured samples of butter from my next neighbor; on placing these, with a like quantity of my own, in juxtaposition before the fire, my butter melted with far greater rapidity—by no means an unsafe test of a greater proportion of olein.

The chemical investigation of our natural and other grasses has hitherto scarcely had the attention which it deserves. The most valuable information on this subject is in the paper by Professor Way on the nutritive and fattening properties of the grasses in Vol. xiv., p. 171, of the Royal Agricultural Society's Journal. These grasses were nearly all analyzed at the flowering time, a stage at which no occupier of grass-land would expect so favorable a result in fattening. We much prefer pastures with young grass not more than a few inches high, sufficient to afford a good bite. With a view to satisfy myself as to the difference of composition of the like grasses at different stages of growth, I sent to Professor Way a specimen of the first crop of hay, cut in the end of June, when the grass was in the early stage of flowering, and one of aftermath, cut towards the close of September, from the same meadow, the analysis of which I give:

Hay, First Crop.		*Aftermath Hay.*	
Moisture,	12.02	Moisture,	11.87
Albuminous matter,	9.24	Oil and fatty matter,	6.84
Oil and fatty matter,	2.68	Albuminous matter,	9.84
Starch, gum, sugar,	39.75	Starch, gum, sugar,	42.25
Woody fibre,	27.41	Woody fibre,	19.77
Mineral matter,	8.90	Mineral matter,	9.43
	100.00		100.00

A comparison between these will show a much greater percentage of woody fibre, 27.41 in the first crop to 19.77 in the aftermath. The most remarkable difference, however, is in the proportion of oil, being 2.68 in the first crop to 6.84 in the aftermath.

On inquiry from an observing tenant of a small dairy-farm of mine, who has frequently used aftermath hay, I learn that, as compared with the first crop, he finds it induce a greater yield of milk, but attended with some impoverishment in the condition of the cow, and that he uses it without addition of turnips or other roots, which he gives when using hay of the first crop—an answer quite in accordance with what might be expected from its chemical compositon.

It is likewise to be presumed that the quickness of growth will materially affect the composition of grasses, as well as of other vegetables. Your gardener will tell you that if radishes are slow in growth they will be tough and woody, that asparagus melts in eating, like butter, and salad is crisp when grown quickly. The same effect will, I apprehend, be found in grasses of slow growth: they will contain more of woody fibre, with less of starch or sugar. The quality of butter grown on poor pasture is characterized by greater solidity than on rich feeding pastures, the cows having to travel over more space, require a greater supply of the elements of respiration, whilst the grasses grown on these poor pastures contain, in all probability, less of these in a *digestible form* available for respiration. The like result seems probable as from common winter treatment—a produce of butter less in quantity, and containing a greater proportion of margerine, and a less of olein.

It is well known that pastures vary greatly in their butter-producing properties; there is, however, as far as I am aware, no satisfactory explanation of this. If you watch cows on depasture, you observe them select their own food; if you supply cows in stall alike with food, they will also select for themselves. I give rape-cake as a mixture to all, and induce them to eat the requisite quantity; yet some will select the rape-cake first, and eat it up clean, whilst others rather neglect it till towards the close of their meal, and then leave pieces in the trough. Two Alderneys—the only cows of the kind I have as yet had—whose butter-producing qualities are well known, are particularly fond of rape-cake, and never leave a morsel; may not these animals be prompted by their instinct to select such food as is best suited to their wants and propensities? If so, it seems of the greatest importance that the dairyman should be informed of the properties of food most suitable for his purpose, especially whilst in a stall, where they have little opportunity of selecting.

It appears worth the attention of our society to make inquiries as to the localities which are known as producing milk peculiarly rich in butter. When traveling in Germany, I well recollect being treated with peculiarly rich milk, cream and butter, on my tour between Dresden and Toplitz, at the station or resting place, on the chaussee or turnpike-road, before you descend a very steep incline to the valley in which Toplitz is situated. I traveled this way after an interval of several years, when the same treat was again offered. It

was given as a rarity, and can only be accounted for by the peculiar adaptation of the herbage of the country for the production of butter."

BURLEY HALL, Yorkshire, May, 1856.

Following these were other extended series of experimental researches, in which it is exceedingly interesting to notice how, step by step, he shows the demands made upon the cow for her calf and her milk, and the food necessary to meet that ensuing waste of her substance. To solve these practical questions, he in one instance experimented during upwards of twenty-seven weeks with six milch cows. All the food given them was weighed, its chemical composition ascertained and its final disposal carefully traced to the milk they yielded, the perspiration they emitted, the flesh or fat they acquired, or the excrements they voided.

It is scarcely possible to assign an adequate value to the results of inquiries such as these, (and when so thoroughly prosecuted,) either in a scientific or practical point of view; and while it is believed that these will lead to other and still more minute investigations on the chemistry of food by competent scientific men, it is earnestly hoped that our practical farmers will both avail themselves to the utmost of the benefit to be derived from the investigations of others, and be stimulated to greater care in observation and experiment within their own spheres of action.

OBSTACLES TO WHEAT CULTURE. It is not probable that Maine is destined to become a great wheat-producing State, but no sufficient reasons are known to exist why we may not ordinarily grow as much as we need for bread. If we make stock husbandry in some of its branches our leading aim, and pursue it judiciously, our arable acres should gain in productive power every year; and the hope is entertained that before some of our children now at school shall have passed from the stage of action, a product of thirty bushels of wheat to the acre will be as common an occurrence as is a crop of ten or fifteen bushels at the present time.

The principal hindrances to its more extended culture in Maine, are universally acknowledged to be the wheat midge (often called weevil) and rust. During the past year my attention was called to the former of these more than previously, and the purpose was formed of investigating its habits and history. Several questions of a circular issued last spring were also directed to this end. The information elicited in this manner was more scanty in amount and less definite in its character than was expected—but I find that this insect has engaged the attention of many eminent naturalists, that much study has been bestowed and much knowledge obtained regarding it, which it behooves our farmers to be possessed of; and from the essay of Prof. Hind of Toronto, who obtained the first prize of £40 lately offered by the Canadian Bureau of Agriculture for an essay on insects and diseases injurious to wheat; from the writings of Dr. Fitch, entomologist to the New York State Agricultural Society, of the late Prof. Harris of Cambridge University, and other eminent naturalists, both of this country and of Europe, have I availed myself freely in preparing the following remarks.

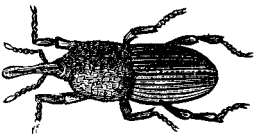
The subject may appear to be one of less importance to us than to those of other States more largely interested in wheat-growing, and perhaps it is, yet the damage already incurred by the farmers of Maine from the ravages of this apparently so frail and insignificant insect is already to be counted by millions of dollars, and in view of the fact that the midge is steadily progressing westward, is even now threatening the destruction of wheat upon the prairies of the

West, and will undoubtedly in a few years more cover the wheat fields of the entire Union, it becomes an inquiry of no little importance where we shall by-and-by obtain our wheat bread. If we may but learn betimes that it can be grown at home, we may save both anxiety of mind and depletion of purse. It is believed, too, that neither the real value of scientific investigations, nor even the direct pecuniary advantage which may accrue therefrom to agricultural operations, are fully or sufficiently appreciated by the mass of our farmers. Were it otherwise, and every one alive to the subject and anxious to help as he might, far more rapid progress would be made both in the acquirement of knowledge and in the dissemination of what is already obtained. It is vain to hope successfully to compete with an unknown enemy, while if we understand fully the history and habits of an injurious insect, or the origin and nature of a disease, though we may fail in first attempts at prevention or remedy, there is hope of ultimate success in subduing either. The Creator at the beginning as truly decreed dominion to man over the insect of the air as over the beast of the field. To assert and maintain this dominion, we need thorough and accurate knowledge and diligent and judicious adaptation of means to ends. Every farmer may if he will contribute his quota towards so desirable a consummation, and at the same time add to his own profit and happiness by careful observation and intellectual activity.

As the wheat midge has been throughout the State so commonly called "weevil" hitherto, it may not be amiss to say that this term properly applies to a group of insects entirely different from that to which the midge belongs. Weevils in the winged state are *hard-shelled beetles*, and have the fore part of the head prolonged into a snout which is used both in feeding and boring holes in which to deposit its eggs. The pine weevil, the plum weevil, (or Curculio,) and the pea weevil which causes buggy peas, are familiar instances; while the wheat midge belongs to another order, (*Diptera,*) embraincg musquetoes, flies, and other two-winged insects.

The true GRAIN WEEVIL (*Calandra granaria*) is a slender beetle of a dull reddish brown color, about one-eighth of an inch long, with furrowed wing covers. This insect, both in the beetle and grub state, devours wheat and other grains, and sometimes commits great havoc in granaries. Its powers of multiplication are very great; a

WHEAT WEEVIL,
Calandra Granaria.
(Natural size.)

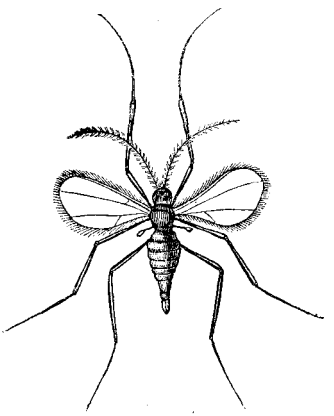


WHEAT WEEVIL,
(Magnified.)

single pair, it is said, may produce above six thousand descendants in one year. The female deposits her eggs upon the wheat after it has been housed, and the young grubs hatched therefrom immediately burrow into the wheat (each usually occupying alone a single grain) and consume its contents, leaving sometimes nothing but the hull. So secretly is this done, that simple inspection does not reveal the damage, which, however, may be detected by the weight of the grain. On throwing some into water, the damaged grains will float. After the female has deposited her egg in the grain, she covers it with a sort of glue of the same color as the hull, and hence one difficulty of detecting the grub in the grain. The grubs undergo their transformation in the grain, and in due time come out of the hulls in the beetle state to lay their eggs for another brood. On the approach of cold weather, the weevils leave the grain and take shelter in cracks and crevices of the floor and walls. They lie generally four or five inches below the surface of the heap, avoiding the light. Frequent turning of the wheat tends to drive them away, but kiln-drying is the surest destruction to them. Grain which is kept cool in a well-ventilated room with whitewashed walls, and often turned, is said to be exempt from their ravages.

WHEAT MIDGE, (*Cecidomyia tritici.*)

WHEAT MIDGE, (Natural size.)



WHEAT MIDGE, (Magnified.)

That this insect has been long known in Europe as an occasional serious depredator upon the wheat crop, seems to be established upon ample testimony. As long ago as 1740, it was destructive in Scotland. In the "Modern Husbandman" for 1745, is the following passage: "After this we had a melancholy sight; for as soon as the wheat had done blooming, vast numbers of black flies* attacked

* The observer doubtless mistook an ichneumon parasitic fly, common in Europe, which preys upon the midge, for the midge itself; thus mistaking the antidote for the cause of the evil. Concerning these, Sidney, (an English writer,) in his work on "Blights of the Wheat," says:—"The good providence of God has supplied most remarkable antidotes to the overwhelming increase of what would otherwise be the ruinously destructive hosts of insects that prey upon the corn which he has given for the sustenance of man. We derive great advantages from the insect portions of creation, both direct and indirect. Many necessaries and even luxuries come to us from these minute sources, and like the fungi, in consuming decomposing matter, they avert the dangers of numerous fatal diseases that would otherwise approach us on the wings of every breath. On the other hand, their encroachments fill us with alarm, and threaten the destruction of our harvests. But all things are wonderfully regulated by Him who holds in his hands the balances of nature, though the modes of their adjustment are often hidden from common view, and, to be known, require, like the treasures of spiritual truth, careful research. We have seen what might be apprehended from the wheat midge in this country if it multiplied unchecked; nor are persons in general aware of the marvelous antagonism provided against such disasters. Till the entomologist discovered the wonderful habits of a peculiar tribe of insects, called by the common name *ichneumon*, the existence of such a check on the minute devastators of our crops was totally unknown. Ichneumons, so called, are the instruments of this benefit. The term ichneumon has been applied to them, because they are as valuable in their operations for the destruction of insect pests, as the animals so designated are in devouring the eggs of crocodiles and serpents, in the regions where they are the terror of the inhabitants. The little ichneumons of the insect world do as great service as the ichneumons of Africa, which prevent the dangerous creatures just mentioned from becoming so numerous as to occupy the countries where they abound to the exclusion of other animals, and their own misery from the want of food. In order to understand how the curious insects about to be noticed stay the encroachment of our little midges, a few observations are necessary on their general habits. Their peculiar instinct is to lay their eggs in other living insects, mostly when they are in the larva state. Sometimes they oviposit in chrysalides, and occasionally in eggs; but never, it is believed, in any insect while in a perfect condition. The object of their eggs being thus laid is, that they may under these circumstances, which are favorable to their nature, hatch into grubs. These grubs or maggots soon commence attacking the living substances in which they were placed, and ultimately destroy them. The instinct of these extraordinary creatures leads them to the most complete regulation of the number of their eggs by the size of the victim in each case, and that of the larva to which they are to give birth. Sometimes they lay a single egg where there is only enough for the support of its grub, but the numbers vary from one to a large quantity. There is scarcely an insect in existence that is not more or less subject to this species of attack; and the ichneumons themselves vary in size according to the dimensions of the bodies on which they are destined to prey. It is not the ichneumon itself, but its larva, or maggot

the wheat ears and blowed a little yellow maggot which ate up some of the kernels, in others part of them, and which caused multitudes of ears to miss of their fulness, acting in some measure like a sort of locust till rain fell and washed them off; and though this evil happened in other summers to the wheat in some degree, and not done much harm, yet if the good providence of God had not hindered it, they might have ruined all the crops of wheat in the nation." In the Philosophical Transactions for 1772, a writer says: "What the farmers call the yellows in wheat, and which they consider a sort of mildew, is in fact occasioned by a small yellow fly about the size of a gnat. This blows in the ear of the corn and produces a worm almost invisible to the naked eye, but seen through a microscope it appears a large yellow maggot of the color and gloss of amber, and is so prolific that I distinctly counted forty-one living yellow maggots in the husk of one single grain of wheat—a number sufficient to destroy the corn in a whole ear. One of these yellow flies laid eight or ten eggs of an oblong shape on my thumb only while carrying by the wing across three or four ridges."

In the summer of 1798, the venerable Mr. Kirby, well-known as a distinguished entomologist, made careful observations of this

---

which destroys such quantities of insects. The ichneumon is a fly with four wings, whose food is honey, and the female seems to live only for the purpose of depositing eggs in the way mentioned. The most common of them is a small fly, like all the rest of the hymenopterous order. It was originally called *ichneumon tipulæ*, but now goes by the name of the *platyglaster tipulæ*. This little platyglaster may be readily found on the glumes of the wheat plants, in the months of July and August. It runs rapidly over the ears, and seems to know well which are those occupied by the larva of the midge. The author found numbers of them in various wheat fields in August, 1845; and almost invariably, on examining the ears on which they appeared, discovered that they contained the objects of their search. The ichneumon hunts for them with the utmost eagerness, and by the aid of a sharp tail places a single egg in each of their bodies. The sight has been witnessed by the following experiment: a number of larvæ, of the wheat midge were put upon a piece of white paper, pretty near each other, and an ichneumon dropped into the midst of the group. The energy of her manner, the rapid vibrations of her antennæ, and the whole of her attitude, were most amusing. On approaching one of the larvæ her agitation quickened to the utmost intensity; she soon bent her body in a slanting direction beneath her breast, applied her tail to the larva, and, becoming still as death, sent forth her curious sheath and deposited her egg in the victim, which writhed considerably under the operation. If she came to one that had an egg in it, she left it in an instant and sought another: for the platyglaster lays but one in each. This, however, often repeated, destroy a great many of these little devastators of the grain."

insect, and soon after communicated them to the Linnæan Society. He saw swarms of them about eight o'clock in the evening, at which time they were busy laying their eggs. So numerous were they that he noticed a dozen at a time laying their eggs on the same ear. At one time he gathered an ear upon which the flies were busily engaged, and was enabled by the aid of a microscope, to view the process. "I could," he says, "very distinctly perceive the eggs passing one after another, like minute air bubbles, through the vagina, the aculeus being wholly inserted into the floret;" and adds: "I examined this process for full ten minutes before the patient little animal disengaged itself, and at last it was through my violence that she discontinued her employment and flew away." In 1828, the injury to the wheat crop in Perthshire was estimated at a third of the crop. In 1830, a cultivator in the north of England observed: "Another year or two of the wheat fly will make two-thirds of our farmers bankrupts." Professor Henslow says:—"My researches have satisfied me that the damage done by this minute insect is much greater than agriculturists are aware of." Rev. Mr. Sidney, author of a work on "Blights of Wheat," says that in 1845 he found large numbers of the larvæ not only in Norfolk, where he resided, but in other parts of the country, and that the loss was very considerable.

The damage which has been effected by the midge in England is, however, but trifling compared with the losses incurred here. This is owing to various causes. There, stubble is frequently turned under after harvest; several parasites prey upon it; and from the observations of Mr. Gorrie, it would appear that the lower temperature in England may have much to do with it. He says:—"The number of flies produced appears to depend partly on the quantity of maggots deposited in the soil the previous autumn, and partly on the occurrence of mild temperature about the middle of June when the wheat ear partially appears. Unless the weather be serene and dry, with the thermometer above fifty-four degrees, Fahrenheit, at night, few or none are deposited, which may account for the manner in which its depredations have diminished since 1850."

Until recently, doubts have been entertained whether the wheat midge of Europe was the same as our own. In 1855, however, specimens were sent by Dr. Fitch to distinguished entomologists in

Europe, and upon the most critical examination, they were pronounced identical. Our wheat midge is, beyond doubt, an imported insect.

It is said to have been first noticed in western Vermont in 1820, probably brought there from England in the straw used to pack crates of crockery ware, whence it spread slowly, and in 1829 committed extensive depredations both in Vermont and parts of New Hampshire and Lower Canada. In 1830 it appeared in the northeastern part of New York. In 1831 considerable injury was sustained in eastern New York. In 1832 the destruction was so great that the cultivation of wheat was mostly abandoned throughout eastern New York. In 1834 it commenced its ravages in Maine, and was noticed the same year in large numbers in the vicinity of Montreal. In 1842 it appeared in western New York, since which time it has increased and spread with silent step, but with destructive effect.

In 1856, Dr. Fitch writes, "The pecuniary loss which our country has sustained from this insect is incalculable; but it is truly appalling, nay, terrific. Some writers have thought a wet season favored the increase of the midge, but in this country it has never been more destructive than it was in the summer of 1854, noted as one of the driest seasons known. In gathering the agricultural statistics of that year, our State Agricultural Society inserted in its circular the query, 'To what extent was the wheat crop in your vicinity injured by the midge?' And the answer to this inquiry furnished us with quite authentic information upon this topic. The able and efficient Secretary, Hon. B. P. Johnson, informed me that on getting together all the replies to this inquiry, and placing everything at the lowest figure so as to be certain the estimate was within truth, the wheat which this insect had that year destroyed in our State at its then current market price exceeded in value *fifteen millions of dollars!* This amount would be more than a third larger if estimated at the price to which wheat afterwards arose last winter. Truly it is a formidable enemy that has the power to take such an amount of money from the pockets of our citizens in a single year."

The loss incurred during the present season in New York has been estimated at ten millions.

From Upper Canada, Prof. Buckland, Secretary of the Board of Agriculture, writes me, "We have suffered more during the past

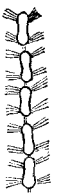
season (1858) than any previous one, and the consequence is a severe and wide-spread depression in business throughout the Province."

In our own State the loss has been very severe, although I have no sufficient data from which to estimate the amount with accuracy.

The wheat midge makes its appearance in the winged state during the latter part of June, or about the time when the ear begins to

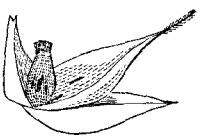
Foot of Wheat Midge, (Highly Magnified.)

Wheat Midge at rest, its wings in their natural position. (Magnified.)



Part of a Female Antenna (Highly Magnified.)

emerge from its leafy envelope, and it remains until August. Being so small and apparently so insignificant an insect, it readily escapes notice unless carefully looked for. It prefers low and sheltered places rather than elevated or windy spots, and here it may be seen by the careful observer on calm evenings swarming about in clouds like gnats and other kindred flies. It is most active about sunset, and during the evening and night is busied in laying its eggs. While thus occupied she is not readily disturbed by observation, even with the aid of a magnifying glass placed near her, but goes on deliberately laying her eggs. As many as twenty or thirty are sometimes seen on a single ear. It does not confine its attentions to wheat, but sometimes deposits its eggs in the ears of various kinds of grass.



Kernel of Wheat, the chaff pulled down showing the Maggots in their usual situation.

A mature Maggot, (Highly magnified.)

The eggs are oblong, transparent, and of a pale buff color. Eight or ten days after being deposited, the young maggots are hatched,

and come to maturity in about three weeks when they are scarcely an eighth of an inch in length. Being hatched at various times they do not all come to maturity at once. They sometimes feed upon the young germ so as to prevent the seed from forming, but more usually upon the juices of the grain, causing it to shrivel or dry up, and giving it a pinched appearance.

About the end of July, or early in August, the full grown maggots leave off eating and are ready to descend to the ground for winter quarters. They are sometimes shaken from the ears by the wind, but mostly wriggle down the stalk while wet with rain, or in damp weather. Mr. E. Wood of Winthrop, writes: "This day, 9th August, a warm rain is falling, and a neighbor has brought me a head of wheat which has become loaded with worms. They are crawling out from the husk or chaff, and were on the beards, and he says he saw great numbers of them on the ground." There is no doubt that their descent to the ground is greatly facilitated by a warm rain. If dry weather intervenes between the time of their maturity and of harvesting, the maggots are sometimes gathered with the grain—in which case they soon become dry and stiff but do not lose their vitality, and if they be moistened will revive so as to crawl away into the earth if practicable.

The maggots having reached the ground penetrate half an inch or an inch below the surface. Here they remain during the winter without change. In the May or June following they assume the pupa condition in which they remain, some say for a week only, and others say for two or three weeks, when if favorably situated they work their way to the surface, break the pupa skin and assume the form of the midge. Sometimes the skin is broken before they reach the surface in which case they come out with flabby wings, which being dried by exposure to the air, soon expand and enable them to fly.

Mr. J. W. Dawson of Pictou, in his "Scientific contributions towards the improvement of Agriculture in Nova Scotia," says, "I procured a quantity of the larvæ full grown and in that motionless and torpid state in which they usually appear when the grain is ripe. A portion of the larvæ were placed on the surface of moist soil in a flower pot. In the course of two days the greater number of them had descended into the ground, previously casting their skins which remained on the surface. I afterwards ascertained that they had

penetrated to the depth of more than an inch and were of a whitish color, softer and more active than they had previously been. The fact is thus established that these apparently torpid larvæ when they fall from the ripe wheat in Autumn or are carelessly swept out from the threshing floor into the barn yard at once resume their activity and bury themselves in the ground.

The larvæ thus buried in the ground were allowed to remain undisturbed during winter and spring, the flower pot being occasionally watered. About the end of June they began to reappear above the surface and projecting about half their bodies above it, when the skin of the upper part burst and the full grown winged midge came forth and flew off. This completes the round of changes which each generation of these little creatures undergoes, and we have thus actual evidence of each stage of its progress from the egg to the perfect insect."

The chief natural enemies of the wheat midge in this country, so far as known, are some of the insectiverous birds. Dr. Fitch has discovered one parasitic insect and it is probable there may be others not yet recognized. In Europe nature has provided a considerable check to the multiplication of these flies by making them the prey of no fewer than than three kinds of ichneumons, some of which appear in great numbers where the midge abounds and multitudes must become their victims.

"Many birds prey upon the maggots. Mr. Elmer Rowell of Athens county, Ohio, has a colony of Swallows, amounting to a hundred in number, which he thinks secure him from the ravages of the midge. It is probable, however, that the most destructive to the midge maggot among the feathered tribes is the beautiful little yellow bird. In Madison county, New York, during the prevalence of the midge in the years 1838 and 1852, flocks of yellow birds were seen busily employed in the wheat fields, much to the *alarm* of the farmers, who, observing these active and beautiful little creatures picking the heads of wheat to pieces imagined that they were destroying the crop, and hence resorted to various means to kill them and drive them away. The same warfare has been frequently noticed elsewhere, and should at all times be discouraged to the utmost by all who desire to cherish the most interesting, beautiful and useful class of insect destroyers the world contains. Birds, and especially the insectivorous birds, ought to be encouraged in every

way on this continent. Facilities so unusual have been furnished by man for the increase of certain destructive insect tribes, and no corresponding effort made to maintain a check upon their excessive multiplication, that we have permitted a host of enemies to obtain a firm footing in our midst which are at all times liable to paralyze our industry in the most alarming and grievous manner."*

In a communication published in the Journal of the New York State Agricultural Society last November, Dr. Fitch writes, "as this insect continued to be so destructive to the wheat crop in this country, year after year, the question presented itself forcibly to my mind, why is it that this little creature is so vastly more injurious here than it is in Europe—why does it not multiply there and destroy wheat crops the same that it does ours? and I was able to give but one solution to this query. From all the foreign accounts, it appears that whenever the midge becomes so numerous as to be perceptibly injurious, instead of continuing its ravage, it suddenly and totally disappears, and in place of it the fields next year swarm with the little parasitic bees which have destroyed it. But in this country no such parasitic destroyer appear to quell it, and I have hence supposed that we have received this insect from Europe, whilst its parasitic destroyer has not yet reached our shores. Thus we are hence without nature's appointed means for preventing the undue multiplication of this insect. We have received the evil without the remedy; and hence it is that this little creature revels and riots in this country without let or hindrance. As a result of this view, it followed that if we could import the parasitic destroyer of this insect from Europe, it would here multiply, and check the ravage of this pest, the same that it does abroad. This being a matter of such vast moment, involving a saving of many millions of dollars to this country every year, as I was corresponding with Mr. Curtis, President of the London Entomological Society, I addressed him a letter upon this subject, a year ago last spring. This letter he laid before the Society, and it formed a prominent topic of discussion at one of their meetings, the members being astonished to learn the ravage which this insect was committing in this country, and they mutually agreed that if the midge presented itself to the notice of any one of them, so that they could obtain living specimens of its

* Hind's Essay.

parasite to forward to me, they would do so. In its larva state, these parasites might readily be sent to this country in a pot of moist earth; but as they can only be obtained in season when the midge is abroad in considerable numbers, it may be several years before we can get it."

Of remedial or preventive measures to check the ravages of the wheat midge, the one which is chiefly recommended by the best practical farmers who have favored me with their views, and the one which appears to be chiefly relied on, is early sowing. The testimony in its favor seem to be uniform and strong. As a sample (though in this instance on a very small scale) of the success which so far as I can learn has in a majority of cases attended early sowing, the following is quoted from a communication of Mr. Allan Lincoln of Gray, in Cumberland county, who writes me under date of April 24th, as follows:

"All who tried to raise corn in this vicinity the last year were successful; but with two or three exceptions no one raised any wheat. The weevil and the rust ran over the wheat fields like a devouring fire.

The frost was scarcely out of the ground a year ago to-day; and I do not know of any one except myself who sowed wheat before the first of May—most persons sowed two or three weeks later, and the result was they failed almost totally.

I am not much of a farmer myself, and consequently do not feel competent to instruct others, and yet you will allow me to say that I am firmly convinced of the importance of sowing spring wheat as early in the season as possible, to get the start of the weevil.

On the 24th of April, 1857, I sowed ten quarts of wheat on forty-two square rods of sandy soil. My neighbors' hens scratched it as much as they pleased—perhaps they devoured two quarts of it, or more—but there was enough left. Tracks were made through it by cats, dogs and hens in various directions; in this way a considerable quantity was broken down and destroyed. But it grew well, kept ahead of the weevil, was cut early, and passed through a poor old crazy threshing machine, yielding *six bushels and three pecks*, leaving in the straw, I know not how much, but probably a bushel or two more.

The farmers about me say it was the *seed*, and they want every grain of it to sow again. I let them have it to gratify them; but at

the same time I assure them that it is the *early sowing*, and not the particular seed, that gives the yield."

Mr. James Baker of Strong, in Franklin county, is understood to have succeeded for three or four years past in obtaining an average of twenty bushels per acre on several acres, and his mode has been to plow late in the fall, turning under green manure, and afterwards to harrow smoothly. In spring, as soon as the ground is sufficiently thawed and before the frost is out, the seed is sown and harrowed in. Since adopting this mode no apparent loss has resulted from the midge.

Early sown spring wheat has not always wholly escaped, and in some instances winter wheat has suffered from the midge, so that I have been led to conclude that as much, and perhaps even more, is due to a vigorous and healthy start, than simply to early sowing, in the case of spring sown grain.

William Hutton, Esq., Secretary of the Canadian Bureau of Agriculture, writes:* "The best preventive I have heard or known of, which I found very effectual on my own farm, was, to sow very early, wheat of an early kind, on early soil, rendered early by good drainage, and well shaped ridges and good cultivation, in order to give the vegetable life a start of the animal life at blossoming time."

Late sowing (of spring wheat) is equally effectual in avoiding the midge, but unfortunately renders us liable to rust, an enemy not less to be dreaded. If we could find a good *rust proof* variety of wheat (as the Scotch Fyfe is by some averred to be) which might be successfully sown as late as the first or second week in June, this would probably prove an effectual remedy. There is no doubt that some varieties of wheat are less liable to rust than others. Late sowing proved very successful in Vermont some years since.

In England it is believed that the midge has strong preferences for some varieties of wheat over others, and in both these regards we greatly need more extended and careful experiments.

That there is encouragement for trial I found evidence during the past summer, when in the course of a tour through the State, a field of wheat was seen in Penobscot County of a variety which, so far as

* Referring probably to winter wheat.

yet proved, has been found free from both and not liable to lodge with rich culture. Being desirous to learn of its success the present season, a note was addressed to the grower, Hon. William C. Hammatt, who replied as follows:

HOWLAND, Sept. 26, 1858.

DEAR SIR: The wheat I showed you is the 'Canada Club Wheat.' It is, in my estimation, one of the most valuable varieties cultivated in this region, not so much, however, from its great yield as from the *certainty*, with good cultivation, of a *fair* crop. It is a small dark colored grain, and is said to make good, but not the very first quality, flour. This, though, I cannot say of my own knowledge, not having ground any.

In the spring of 1854 I received (under the frank of our Representative in Congress, Mr. Washburn,) from the Patent Office, a very small package, say a large spoonful, perhaps two, of wheat labelled 'Canada Club Wheat,' and sowed it in rows in my garden, kept it clear of weeds through the season, and in the fall, after separating the various kinds, for there were some four or five kinds in the lot, I found I had about a pint of this sort, all the others being lost by an accident. I sowed this pint the next year broadcast, and harvested about half of a bushel, which I sowed the next year, and harvested last fall eight bushels, all or nearly all of which I sowed last spring, which is the same crop I showed you in July. This last crop has not been threshed, but promises to yield a fair crop, not so large a return, however, for the seed sown, or the ground occupied, as the former crops, as it was not put upon so rich land nor cultivated so carefully.

You will see by the above that until this year this wheat has been cultivated in very small patches, but still, it has never suffered in the least from the ravages of the midge or weevil, while the larger lots on the farm, of other varieties, have been almost destroyed by the insect. It is sown ten days or two weeks earlier than the wheat cultivated hereabouts, but whether it is from its earliness or from other cause it is so exempt from the destroying insect I cannot say; all I can say is that during the four years I have cultivated it no fly or weevil has been discovered in or about it, and it has never until this year yielded less than sixteen for one. It grows very even, but not so tall as other wheat, stands up straight, head and all, and is

so stiff in the straw as to defy the winds and the rains to lodge it. In fact, I believe it cannot be made to lodge, however rich the soil on which it is sown, and this I account as one of the greatest of its superiorities over the other kinds of wheat in cultivation hereabouts.

This wheat being shorter both in the straw and the head, looks rather discouragingly before harvest, but the heads being very compact and well filled, it always yields more than any one, unused to its cultivation, would estimate. It has never suffered from rust, not even this year, when that disease has proved a sad drawback upon our wheat harvest. The wheat, especially that sown late, and the late sown oats, have been almost destroyed by the rust this year.

I have always sown my wheat as early as possible, usually in April, or the very first days of May. This year it was washed and prepared the 4th and sowed on the 8th of May, and harvested (cradled) the 17th September.

Excuse this hasty response, and believe me very truly yours,

WILLIAM C. HAMMATT.

Burning the stubble as soon as the crop is taken off, is an effective means of lessening the numbers of the midge, and were not deep plowing much preferable it might be worthy general adoption.

Fumigation by smoke from heaps of burning weeds and rubbish sprinkled with brimstone, has been highly recommended; but it is evident that the operation is too much dependent upon wind to be reliable, and it is not always practicable.

Lime, ashes or plaster, strewn over the grain when in blossom, has been extolled as an effectual preventive, and apparent success has sometimes attended its use, but more careful observation has shown its utter inefficacy to prevent the insects from depositing their eggs.

Another means of prevention which has been recommended is, sowing the grain in locations exposed to free currents of air. It has been noticed that when considerable wind prevails at the time of blossoming, the fly is prevented or greatly checked by it in its deposition of eggs; and that when one portion of a field is more exposed to wind than another, the more exposed part usually escapes with less damage.

Whatever other remedial or preventive measures are adopted, the certain destruction of all the maggots which may be harvested with

the grain and separated when it is threshed and cleaned, should by no means be forgotten or neglected.

A study of the habits of this destrutive insect will, I think, lead to the conclusion that it is in the power of our farmers, by *judicious procedure and concert of action*, to rid themselves of this pest to such an extent at least, as will render it comparatively innoxious. It will be remembered that the maggots descend into the ground about an inch, rarely or never, even where the ground is very mellow, more than two inches. At this depth, the same spring warmth which causes the wheat to germinate and grow, animates these, and they work their way to the surface just in time to commence the work of destruction as the wheat begins to bloom. Now if before they emerge, the ground be deeply plowed and the soil carefully inverted, they are buried beyond all hope of resurrection.

Professor Hind says:—"The remedial measure which appears to be immediately suggested by a study of the habits of the wheat midge, is of the simplest description and everywhere practicable. The maggot of the midge, previous to assuming its larva condition, buries itself an inch or a little more below the surface of the ground. When the time arrives for their assuming the fly state, they *wriggle* themselves to the surface for that purpose. It is only by a series of alternate contractions and expansions of one side and the other that they can make their way up from an inch below the surface to the light and air, for they possess no feet or other exposed members when in the pupa case. If, therefore, the pupa be buried say six inches below the surface, it is *permanently imprisoned*, for nature has not provided any apparatus to enable it to effect its escape under such circumstances. If, therefore, at any time between August and May of the following year, the ground be plowed to a depth of at least six inches and in such a way that the furrow slices lie as compactly as possible, there can be no doubt that a vast majority of the pupæ will perish from inability to escape from their imprisonment.

But how much greater will be the probability of every individual pupa perishing if the ground be plowed seven inches deep immediately after harvest and left untouched until the following August? Every one knows that it is not possible in plowing to turn a sod or furrow slice completely over so that all parts shall be altogether

reversed. The furrow slices may be made to lie with great compactness, but there will be interstitial spaces into which the pupa may fall or wriggle themselves and eventually escape. When the field is plowed immediately after harvest, not only will the autumnal rains fill the spaces beneath and between the furrow slices by washing down fine particles of earth, but the influence of the many months of winter and spring will consolidate the furrow slices, and their compactness may be ensured by rolling in May, or the early part of June, before the fly appears. Rolling the land immediately after plowing is accomplished, will give further security to the prison in which the pupa are enclosed by this simple artifice."

To avail ourselves in any good degree of the benefit of the remedy thus suggested, there must be, as already mentioned, *concert of action* among our farmers, as otherwise the negligence of a part would suffice to keep us stocked with midges forever. It would be well to change our general practice and sow no grass seed with the wheat, as this might be an objection to plowing in the stubble, (unless clover be sown for the express purpose of being turned under,) but plow the ground some time between harvest and winter, *not less than eight inches deep, and ten would be better, inverting the soil as perfectly as possible*, and follow with the roller in the direction of the furrows. Next spring it may be laid down to grass with a light seeding of buckwheat or other grain, and harrowing in the seed but lightly, say not more than two inches.

To secure the simultaneous efforts of all who grow a crop of wheat to rid the state of this dreaded pest, will require exertion on the part of the more active and intelligent; and here is a most promising field of labor for county societies, town clubs, or other similar organizations. Entire success should not be anticipated in a single year, but we may confidently hope that a persistence in simultaneous efforts for three or four years, would so reduce the numbers of the midge that they would be few and far between, and unknown by any material diminution experienced in the crop.

In the cultivation of wheat (and not less with all other crops) let it never be forgotten that *vigorous health* goes far to insure exemption from all adverse influences, whether disease, insects, or whatever else; and, if we neglect any and every proper precaution to insure health and strength, we have no right to charge the blame

of a short crop upon Providence. Napoleon once remarked that "Providence always favored the heavy battalions"; so Providence always favors the crop which is well cared for, from first to last,—from the selection and preparation of the seed and the seed bed, until it be housed.

It is well, very well, as another celebrated general once directed his soldiers to do, "Trust in God," but doing so gives us no warrant for neglecting the other part of his direction, "and keep your powder dry."

RUST. In some seasons this has proved an evil of not less magnitude than the midge and sometimes even greater. During the past season it has been unusually prevalent, attacking not only those plants usually subject to it, but also one, at least, scarcely ever if at all, affected by it previously, viz. Indian corn. Unusual interest therefore attaches at the present time to whatever may be known regarding its origin, nature and remedy. Widely various and even conflicting are the theories which have from time to time been brought forward to account for it, few of which are in any degree satisfactory.

The most valuable information regarding it which has come to my knowledge is contained in the Prize Essay of Professor Hind of Toronto, before referred to, and quoted from, "On the Insects and Diseases injurious to Wheat," and from which, by permission of the Canadian Board of Agriculture, the following extract is given below:

"Rust is a fungus, a minute vegetable growth, which throws that part of its structure serving the purposes of roots through the tissue of the wheat plant, and lives upon the nourishment which should be appropriated by the growing grain. Before proceeding further with a description of 'rust,' it is essential to acquire information respecting the structure, mode of growth and reproduction of the tribe of vegetables called fungi.

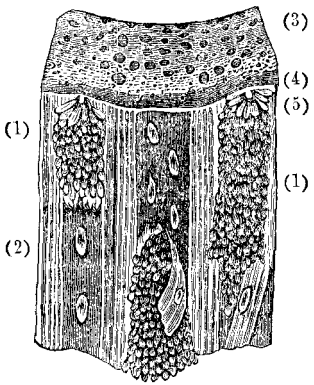
Mildew is occasioned by a minute fungus called *Puccinia Graminis*.

Rust is the growth of two kinds of fungi, *uredo rubigo* and *uredo linearis*. It is probable that the rust of this country differs from the 'rust' in England, certainly there is a great difference between the appearance of the fungus on growing wheat stems here, and the delineations given in European works on this subject.

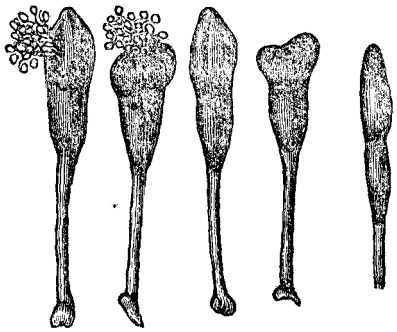
Smut, is *uredo segetum*.

Bunt, is *uredo fœtida;* 'stinking rust.'

Many other fungi prey upon other vegetables.

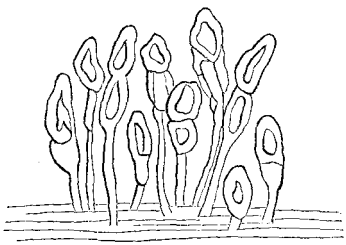


Section and portion of a stalk of Wheat affected with Rust.
(1) (1) (1) Masses of the Rubigo. (2) Stomata, or breathing pores. (3) Cellular tissue. (4) Cuticle. (5) Epidermis.



UREDO RUBIGO, (*Common Rust.*)
(Highly Magnified.)

The minute vegetable organisms called *fungi*, are cellular plants having neither leaves, stems nor roots. Their organs of nutrition consist of a series of filaments called *Mycelium* (*mykes*, a fungus) or spawn, which spreads like a net-work through the substances on which the fungi grow. They represent the roots of the fungus. From this net-work proceed bodies resembling globes,



PUCCINIA GRAMINIS, (*Common Mildew.*)

circular disks, mitres, cups and coralline branches, which bear the organs of reproduction. The mycelium is developed either under ground, or in the interior of the substance on which the plant grows. The filaments of the mycelium are composed of elongated colourless cells. Fungi are propagated by seeds or *sporules* enclosed in sporule cases or spores.

Fungi most commonly grow upon vegetable or animal substances in a state of decomposition. They require a very large supply of carbonic acid and *ammonia* for their nutrition. The proportion of nitrogenous matter contained in their tissues is much greater than in those of any other vegetable; so that their substance, if capable of being digested, is almost as nutritious as flesh.

All cultivated plants are covered with a membrane, termed the *cuticle*, and composed of cellular tissue.

The cells of the cuticle are filled with a colourless fluid, and their walls are thickened on the outside with a deposit which is usually of a waxy nature and nearly impervious to moisture. In plants growing in temperate climates, the cuticle is composed of a single row of thin-sided cells, in tropical plants several layers of thin-sided cells occur, evidently with a view to resist, by their non-conducting power, the great heat of a tropical sun. Externally to the cuticle, there is an exceedingly delicate transparent membrane called the *epidermis*.

In particular parts of the cuticle of nearly all plants, minute openings exist which are termed *stomata;* these may be opened or closed by an alteration in their form. They are not found upon the roots of plants, on the ribs of the leaves, or in plants growing in darkness, but they exist in general on all leafy expansions. They are most abundant on the under surface of leaves, except when these float on water, and then they are found on the upper side alone; but they exist equally on both surfaces of erect leaves, as in the lily tribe and grasses.

Cellular tissue exists in all plants, and composes a large portion of turnips, carrots and other fleshy roots. It constitutes the pith and outer bark of trees, and the central part of rushes. The little cells of which this tissue is composed vary in size. They are found from $\frac{1}{1000}$th to $\frac{1}{100}$th part of an inch in diameter. The general average diameter is from $\frac{1}{20}$th to $\frac{1}{100}$th of a line, and that of the cellular spores of fungi $\frac{1}{500}$th a line or $\frac{1}{6000}$th of an inch in diameter.

Vapor of water passes from the surface of plants in two ways, either by *evaporation* or *exhalation*. Evaporation from the surface of plants is dependent upon the moisture in their tissues, the temperature of the air and the dew point. When air is saturated with moisture, or in other words, when the dew point is the same as the temperature of the air, evaporation from the surface of plants ceases. It is entirely independent of vitality. Exhalation is a function of the plant; is altogether dependent upon vitality, and bears a strict relation to the number of stomata on the plant.

Exhalation is greater in summer than in autumn, and is much less active during the winter than at other periods of the year. A laurel parts with as

much fluid in two days in summer, as during two months in winter. Hales found that a common sunflower transpired on an average twenty ounces a day. The weight of the plant was three pounds, its height three and one-half feet, and the surface of its leaves five thousand eight hundred and sixteen square inches. On one warm day it exhaled as much as thirty ounces of fluid; on a warm dry night three ounces; when the *dew* was *sensible*, though slight, it neither *lost* nor *gained*, and by heavy rain or dew it gained two or three ounces.

These and numerous other experiments establish the fact that exhalation from the stomata is greatly dependent upon the mosture of the atmosphere, and that an atmosphere saturated with moisture totally arrests this function in plants. Light exercises a most important influence upon exhalation, for it has been established that if plants in which the process is being vigorously performed be carried into a darkened room, the exhalation is *immediately stopped*, and that the absorption by the roots is checked almost as completely as if the plant had been stripped of its leaves.

"It would not seem improbable, then, that the effect of light is confined to the *opening of the stomata*, which it is believed to effect; and that the large quantity of fluid discharged from them may be due to simple evaporation from the extensive surface of succulent and delicate tissue which is thus brought into relation with the air, and to the constant supply of fluid from within, by which it is maintained in a moist condition."

As is shown in the foregoing paragraphs, evaporation may take place from all parts of the surface of a plant in small quantity when air is not saturated with moisture; and in the absence or presence of light, it is, in a word, independent of vitality. Exhalation, on the contrary, is dependent not only upon the dryness of the atmosphere, but upon the opening of the stomata of the plant under the influence of light, it is therefore so far subordinate to vitality.

The stomata opening under the influence of light, the rise of the sap* in plants becomes due to evaporation and the pressure of the atmosphere. "By the evaporation of water at the surface of plants, a vacuum arises within them, in consequence of which water and matters soluble in it are driven inwards, and raised from without with facility; and this external pressure, along with capillary attraction, is the chief cause of the motion and distribution of plant juices."

When the plant has taken up a maximum of moisture, and evaporation is suppressed by a low temperature, or by continued wet weather, the supply of food, the nutrition of the plant ceases; the juices stagnate, and are altered; they now pass into a state in which they become a fertile soil for microscopic plants. When rain falls after hot weather, and is followed by a great heat without wind, so that every part of the plant is surrounded by an atmosphere

*The rise of the sap in spring is probably greatly increased by a species of germination, liberating gas in the plant.

saturated with moisture, the cooling due, to further evaporation, ceases, and the plants are destroyed by fire-blast or scorching.

I now proceed to consider the conditions favorable to the growth of rust, whose spores and sporules are at all times floating in the air.

Ammonia, we know, exists in the atmosphere, probably to the extent of one part in ten million parts on the average. At times the quantity of ammonia present is much greater than the above ratio, at other periods less. Rain water contains on an average nearly one part of ammonia to the million, and of nitric acid about five parts to the million. Dew always contains ammonia, and mists have prevailed so rich in this substance that the water had an alkaline reaction. Barral analyzed the water collected in the rain guage of the observatory at Paris. He found that in one year 10.74 lbs. of ammonia fell with the rain, and 10.7 lbs of nitric acid. In July he found the amount of the ammonia to be the greatest; in September, the amount of nitric acid to be the greatest. The ammonia was least in March, and increased gradually to July. In August it diminished suddenly, and continued to diminish until October, attaining its second maximum in February.

These observations, although very interesting, are not satisfactory, because they were made in the neighborhood of a great city. Hence we find that Boussingault discovered much less ammonia in the air far away from towns—a gallon of rain water containing only one twenty-fifth of a grain of ammonia. As a general fact, however, the water collected during fogs was extraordinarily rich in ammonia, containing on an average one-third of a grain to the gallon—but an instance has been known—before referred to—of a gallon of water from a fog containing not less than four grains of ammonia. The constant presence of this substance in the atmosphere is not only now fully established, but its influence upon vegetable growth in this gaseous form is of the highest interest, and possibly, of the highest importance.

The experiments of M. Ville, upon the effects of ammonia in air upon vegetation, show how rapidly and remarkably its influence is felt. If ammonia be artificially introduced into air in the same proportional average as carbonic acid is found to be constantly present, namely, about one part in 2500 parts of air, its influence soon shows itself upon the leaves, which continually acquire a deeper and deeper tint. The presence of such ammoniacal vapors not only stimulates vegetation, but changes the growth of the plant, and causes the development and enlargement of particular organs. In prosecuting a series of experiments on the phenomena of vegetation, with a view to ascertain whether nitrogen was directly absorbed from the atmosphere and assimilated, M. Boussingault observed the growth of minute green cryptogamia on the outside of the flower-pots, which had been exposed to the air, but he failed to detect any vegetable growth on those from which fresh air had been carefully excluded.

The sudden growth of varieties of fungi during misty weather has often been noticed, and their appearance may be accelerated by the introduction of a small quantity of vapor of ammonia into any confined space where they are

observed. I am not aware that any extensive experiments have been made upon the growth of fungi in an atmosphere rich in ammonia, such as certain fogs. I have, however, remarked with surprise their absence in an atmosphere from which ammoniacal vapors were probably abstracted by powdered charcoal, without, however, drawing any conclusions from the observation until attracted by the curious discovery of M. Boussingault, that fogs are eminently rich in ammonia.

The presence of a large quantity of this important plant food in certain fogs is not difficult to account for. Not only does the gradually increasing quantity of aqueous vapor in the atmosphere before the positive appearance of mist in any locality, collect and condense rare and widely diffused ammoniacal vapors, but the exhalations from the soil produced by decomposing vegetable matter, are arrested and accumulate. The period of the year when fogs rich in ammonia may be expected depends naturally upon the frequency of the fall of rain—upon the moisture of the atmosphere, and upon the winds. In Canada it appears reasonable to suppose that we may expect to find fogs rich in ammonia during the hot months of July and August, when the rain fall is not so great as in September. During these months mists frequently hang over the fields, particularly in low situations. The exhalation of vapor of water from the leaves of plants being then checked, and their juices partially stagnating in an atmosphere often rich in ammoniacal vapors, all the conditions for the appearance of the fungus called 'Rust' on the stems and leaves of the cereals appear to be fulfilled.

It is commonly remarked that rust is most prevalent on new land; this is perhaps explained by the large amount of vegetable matter thrown into a state of decomposition by excess of air and the consequent production of ammonia. There is no doubt that much of the ammonia thus generated would combine with vegetable acids, and be fixed by clay, &c.; but some portion could not fail to combine with carbonic acid and escape into air in the form of the volatile carbonate, as is observed to a greater degree on manure heaps even where gypsum or other solid fixers of ammonia are employed to avoid it. We must regard new land as a storehouse of ammonia and other plant food which become liable to volatilize when liberated by too free an exposure to air without proper precautions.

If the supposition be correct that 'rust' is mainly occasioned by the concurrence of mists or fogs in July and August, rich in ammonia, stimulating the growth of the sporules in the stagnated juices of the plants; and that the active agent in inducing the sudden appearance of that destructive parasite is really ammoniacal vapors, we have a remedy at hand which promises, when properly and carefully applied, if not entirely to check, at least so far to arrest the growth of the parasite as to claim a general trial, especially as its effects would probably prove equally availing in arresting mildew. What we require is an available absorbent of ammonia and its volatile compounds, not an absorbent which will destroy this valuable plant food, but one which possesses the property of inducing it to assume another form, perhaps equally available as a fertilizer, although of much slower action. Recent observa-

tions show that powdered charcoal answers these requirements. Charcoal not only absorbs ammonia to an immense extent, but it also oxidizes it to nitric acid, and thus renders it temporarily inert, but not unavailable to future fertilization.

Powdered charcoal is distributed with the utmost ease over large areas. Being an extremely light substance and easily reduced to a fine state of division, the least breath of air is sufficient to carry it for hundreds of yards. Any one who tries the experiment of gently skaking a muslin bag, containing coarsely powdered charcoal, in a gentle wind, will find that the operation of sowing, as we may technically express it, a ten acre field, would certainly not cost one-tenth part of the labor of sowing the same field with plaster; and as that operation is not unfrequent in this country, a practical guide is at once furnished of the amount of labor the operation involves. Powdered charcoal thus sown is very uniformly distributed by the least motion of air, and its effects are marvellous. In a stable, for example, strongly smelling of ammonia from fermenting urine, an ounce of powdered charcoal, shaken by means of a muslin bag or any fine net-work, rapidly and uniformly distributes itself, and instantly absorbs the ammoniacal vapors. A curious instance of the action of this deodorizer occurred at Balaclava during the heat of summer, when the stench was almost intolerable in that painfully celebrated harbor. A ship load of charcoal arrived, packed in bags, and the men who were engaged in transferring the cargo to the shore were covered with the dust, as was every object in the neighborhood—the stench which before prevailed suddenly and completely disappeared.

Nothing is more simple than the manufacture of charcoal—a few billets of wood are to be piled like cordwood, then well covered with sods, with the exception of two orifices, one to admit a little fire, and another to allow the smoke to escape, until the heap has well taken, and then to be firmly closed for the purpose of allowing slow combustion to go on in the absence of air. When cool the charcoal may be crushed in a stout canvass bag by a lever, not by blows, and when sifted, furnishes the required material for sowing.

If we assume with Fresenius that the quantity of ammonia in the atmosphere amounts to less than one ten-millionth; the amount it would contain would exceed 50.000.000 tons, while that of the carbonic acid in the atmosphere is 3.300.000.000.000 tons, the weight of the air itself being 5.050.-000.000.000.000 tons or five thousand and fifty billions.

Water is absorbed by the roots of plants alone; and the same water may repeatedly pass through the same crops, for the amount crops exhale during their growing season greatly exceeds the rainfall, hence they must derive much water from dew which is absorbed by the soil, and taken up by the roots, to be again exhaled and again deposited in the form of dew. The amount of dew may be equal to one-half of rainfall during the summer months.

Whatever 'specific' will cure mildew, will also arrest rust.* Both are fungi, very nearly allied to one another, so much so, indeed, that it has been sup-

*Mildew and rust are often found together.

posed by very eminent botanists that rust is merely a state in the development of mildew, and both species are produced under similar climatic conditions. Cuthbert Johnson says, 'Salt, if not a complete preventive, is an effectual cure of the mildew.' Mr. Chatterton, in the annals of agriculture, tells us that 'on the sea side the wheat is little damaged by the mildew, yet within three miles inland the crops are as much affected as those still further from the sea.' 'This fact can be supported by the experience of most farmers whose fields skirt our native shores.' Not only does the soil in such situations contain an abundance of common salt, but every sea breeze bathes the growing crops near the coast in moist air, holding in solution a quantity of common salt.

What will be the chemical action of common salt upon the ammonia of fogs and dews? The form in which the ammonia is present is that of a carbonate; its *exact* constitution is not of the slightest consequence. As a carbonate the chemical changes which would occur are as follows:

Common salt or chloride of sodium, acting upon a carbonate of ammonia, would produce bi-carbonate of soda, chloride of ammonium, and free ammonia. The free ammonia would combine at once with free carbonic acid, and be again decomposed, and another portion fixed by the common salt present in the moist air, and so on. The real effect of the salt is, then, to fix the ammonia of fog, mist or dew, and in that way it is most probable that this substance operates so beneficially in arresting mildew and rust. * *

Mr. Theodore Perry tells us in the 'Prairie Farmer,' that he sowed one-half of a ten acre field with one-and-a-half bushels of salt, just after seeding it with spring wheat; the result was that the salted portion was ready for the sickle five days earlier than the unsalted part, and not a particle of rust or smut could be found; and the increase of crop he estimated at five bushels to the acre. The effects of salt, it must be remembered, are always rather variable and uncertain; on wheat it is said to increase the weight of the grain, and diminish that of the straw.

Early sowing, with properly prepared seed, to escape the time when those climatal conditions occur favorable to rust, is, perhaps, one of the best remedies which can be recommended. If to this we add the selection of flinty-stemmed varieties, whose stomata on the stalk will have in great part closed before the 'time for rust,' little damage may be expected in ordinary years. The use of charcoal and common salt, as before described, will serve very materially to lessen the dangers arising from the appearance of this most destructive parasite. Common salt, or gypsum, finely powdered, may be sown broadcast; under all circumstances they will act in a favorable manner either as a partial preventive of mildew and rust, or as a manure, by fixing the ammonia of the atmoshphere. The application of lime has also been attended with success. * * * * * * * * *

It is now agreed on all hands that grain should be reaped before it becomes what is called dead ripe.

In the case of wheat and oats, when the grains have ceased to yield a milky fluid on being pressed under the thumb nail, and when the ears and a few

inches of the stem immediately underneath them have become yellow, the sooner they are reaped the better.

The connection of rust with ammonia is exemplified in many different ways. We often find, for instance, that richly manured fields are liable to rust; and where isolated patches of manure or droppings of cattle occur in a field of wheat, the grain growing on these patches will be rusted generally, but not always. Charcoal beds have long been considered 'rust proof' in the United States. Liquid manure, when applied to crops, has proved very beneficial in enabling them to escape rust, while neighboring crops, manured in the ordinary way with solid farm yard manure, were much affected. In one case the ammonia would be all absorbed, in the other case part would return to the atmosphere. Damp situations, fogs, and the season of the year when the decomposition of vegetable matter is most active, and therefore the atmosphere often charged with ammonia, are all conducive to the propagation and development of this fungus."

REPORTS.

It will be recollected (see page 41) that the Board at its session last winter designated certain topics to be reported upon to the Secretary, during the recess, for publication in his report.

Such of these as have been received are given below.

On the Cultivation of the Cranberry.

By Seward Dill, Phillips.

S. L. Goodale, *Secretary of the Board of Agriculture:*

Dear Sir:—For a report on Cranberry culture I submit herewith a chapter of my own experience.

I have a bog of some six acres, the muck of which is from three to eight feet deep, full of logs and sticks from surface to bottom, and which is covered with hard hack, a shrub very difficult to get rid of. I have endeavored to drown it out by flowing for two years at a time, but it is proof against such warfare,

I find on this bog the native cranberry, but nearly choked by brush and weeds. They are of different varieties, including all that are named by Eastwood in his work on Cranberry culture, and even more—the bell, the bugle and the cherry, both large and small, but not so large as those of Massachusetts. For three or four years I have pulled out the bushes in small patches, which makes the berries much larger.

In the fall of 1851, I obtained from West Bridgewater, Mass., a basket of vines. Failing as others have failed, to understand their habits and wants, and deeming them capable of taking care of themselves, I planted indiscriminately all over the bog. I saw nothing of them for three years, except occasionally a small bunch nearly crowded out by weeds, grass, or brush. These bore a few berries. In 1855 I discovered a small patch in the centre, which I cleared of all rubbish, and in 1856 gathered from one rod square, about a peck of berries; in 1857 about the same quantity. This season I have gathered at the rate of a bushel from a square rod.

In the mean time my natives have increased wonderfully. In 1856 I had about a bushel; this year I have about five bushels.

In the spring of 1857 I obtained a small lot of vines from Mr. William Towle of Strong, in this State, who has by the way, a fine patch of the native, principally the bell variety, quite prolific, affording him some twenty bushels of berries; also a basket of vines was received from Wells, Maine. I cleared a small patch of turf, &c. and set the two parcels upon it. They look very well and are bearing a few berries this season. I have likewise transplanted a plat of the natives, which are now flourishing satisfactorily. It is proper to state however in connection, that I neglected to flow till late into the fall or the first of winter, so that the frost injured the newly set plants by throwing them out.

The natives of my own bog are much earlier than those from Massachusetts, Wells and Strong. The first blossom early in June; those from Strong and Wells about 15th to 20th of the same month; those from Massachusetts from the 25th of June to the 10th of July. The Massachasetts vines grow very large and are great runners; the natives are quite small, while those from Wells are between the two. I have transplanted in three different modes; one has been to use the sod; another, the setting of single vines; the third has been to plant in hills, consisting of six or eight vines, about two and a half feet a part each way. I have used as dressing, common loam, coarse gravel, scrapings of earth, old chips, and pure river sand. I find the sand with sod-planting, provided the sods can be obtained clear from weeds and grass, to be much the best. In getting loam or sand, I am careful to take that which is free of weeds, especially of sorrel, which has troubled me more than any thing else; it runs and spreads even faster than the cranberry itself. I have used sand only in small quantities, for the reason that it is difficult to carry upon the bog while soft, as in summer, and that it is expensive digging sand from under the snow in winter. A Mr. Otis of Leeds, was at my place a few days since, and examined my patch of cultivated cranberries. He remarked, that an acre in the same state of cultivation, would be worth a thousand dollars. I thought the estimate a little high—perhaps half that sum would be a fair calculation.

I subjoin a few items to show the probable expense of an acre of cultivated cranberries:

One acre of land, . . .	$10 00
Clearing it of turf, &c., . .	25 00
Good vines, . . .	25 00
Setting the vines, . . .	10 00
Sanding, ...	25 00
Weeding, ...	10 00
Flowing, ...	10 00
Interest on outlay two years, . .	15 00
Making in all, . . .	$130 00

Drawing an estimate for an acre from the amount of cranberries raised, as above stated, upon my little patch, we would get, say 150 bushels. These would be worth, at a moderate reckoning, two dollars per bushel, amounting to three hundred dollars. Subtracting from this the cost for preparing an acre, one hundred and thirty dollars, we have a profit of one hundred and seventy dollars per year from an acre of cultivated cranberries.

In conclusion, I would say, that I have no doubt, that cranberries can be cultivated hereabout with success, and to very good profit. We have several small meadows in this vicinity, which have cranberries growing wild upon them; but there is very little account made of them—not even enough to induce the farmers, or their wives, or boys to gather them, unless in very rare cases.

I may also mention, that there are cranberries found upon our mountains, such as are spoken of by Eastwood. These are about the size of the field pea. They ripen near the first of September, are pleasant flavored, but soft--perhaps of not sufficient value to warrant their cultivation."

[In this connexion it may be of interest to give the following extract from a statement accompanying some fine cranberries grown by Daniel L. Hill of Wells, and shown at the Fair of the York County Society at Saco, in October last:

"He has about one acre, from which he has gathered forty barrels this fall, and can probably gather ten barrels more. Previous to three years ago the most he ever gathered on the same lot was

eight bushels. He then harrowed it over with an ox harrow and raked up what vines were torn up and hauled them off, which is all the cultivation bestowed, and they have increased in quantity each year since."—ED.]

ON NEW FARMING IMPLEMENTS.

By Francis Fuller, East Winthrop.

One of the most obvious evidences of agricultural progress among us, is the improvement that has been made in agricultural implements; and another is the favor that such implements are looked upon by practical farmers themselves. An enumeration of some of the more prominent ones may be interesting to those who have the welfare of the farmers at heart.

The Plow. This indispensable implement has had an almost infinite variety of modifications and improvements since the time when the ancient farmer used to do his plowing with a single bullock geared to a crooked stick. The most of the middle aged farmers of the present day can remember the advent of the cast iron plow—and with what caution and distrust it was at first received. It has worked its way into favor so thoroughly that a wooden mould-board plow sheathed with nail plates is becoming a curiosity.

The history of the changes and variations made for a series of years past in the plow, would fill a volume. We shall mention only two, which are of most recent adoption. These are,

First, the Michigan Plow. The principle upon which this plow works is, first, to cut a thin furrow slice of the sward, and second, to bury this slice completely under the following furrow of well pulverized soil, and this at one operation.

To effect this, two plows are in fact attached to one beam—one before the other. The first, or forward plow, is smallest, being sufficiently large to pare off a furrow slice of sward land. After one furrow is taken this slice falls down to the bottom of it as you come round again.

The hindmost plow is larger, being of the usual size. This takes up a full furrow of the soil which the forward plow has passed, and turns it over the slice deposited at the bottom of the furrow, thus

completely covering it and leaving the field in a completely pulverized condition.

Second, the Double Mould-board Plow. A double mould-board plow of medium size has been long since used by some for the purpose of furrowing for, and cultivating among, potatoes.

But recently a modification of a double mould-board plow has been got up by Mr. Wm. Cofren of Readfield, of a size sufficient to turn two furrows of sward land, one each way. The design of this is to ridge wet lands by turning two furrows meeting together over a strip of sward land, thus enclosing any manure that may have been spread upon the land, and lapping two surfaces of grass together. Ridges are thus formed with corresponding furrows or gutters between them. This has been found to be an excellent method of managing wet lands where one has not the time and means for underdraining. Corn planted on these ridges has been found to yield an extra crop, and the plow constructed by Mr. Cofren has been found to be an excellent implement to effect this mode of culture.

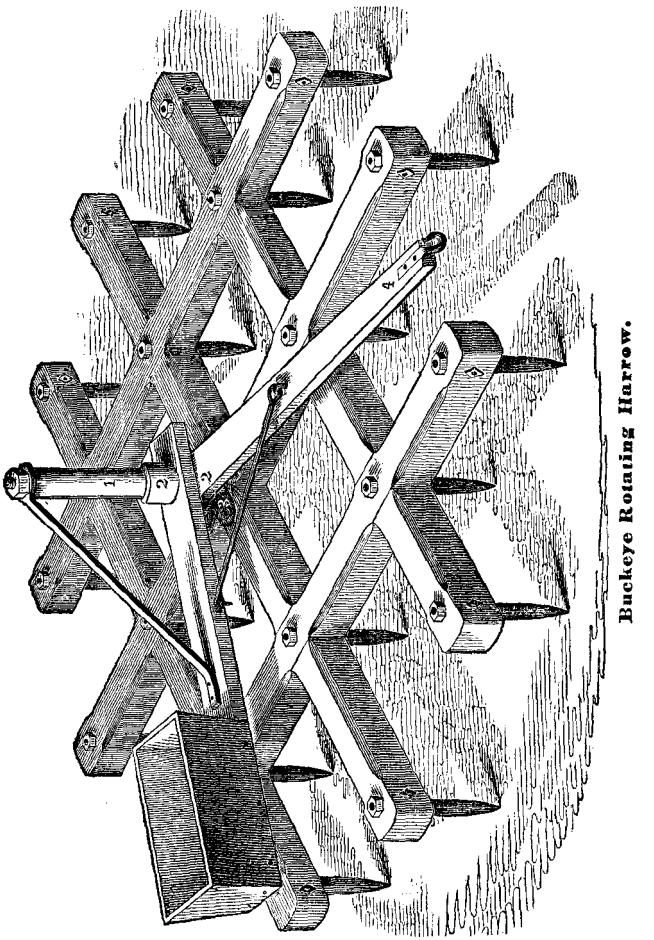
Harrow. Next to the plow we would mention the harrow. There have been various improvements and manufactures of this implement. Which is the best it is not our province to determine. It is evident to every practical farmer that the various conditions of the soil require different degrees of harrowing, and that different kinds of harrows, in weight at least, if nothing more, are required.

The most recent modification of this implement is one made by William DeWitt and O. D. Barrett of Ohio, and is called the Buckeye Rotating Harrow. Of its merits or demerits we cannot speak from any practical use that we have made of it. It is so constructed that it has both a progressive and a rotating motion. The following are the advantages claimed for it by the patentees:

1st. It will do twice as much as the common harrow in pulverizing the soil, without any extra labor for the team.

2d. It is the strongest harrow built, and does not cost as much as the common jointed harrow.

3d. It is adapted to all kinds of soil, and can be operated like the common harrow, by taking off the weight. This is of advantage only in reference to newly turned up sod, requiring to be harrowed with the furrows.



Buckeye Rotating Harrow.

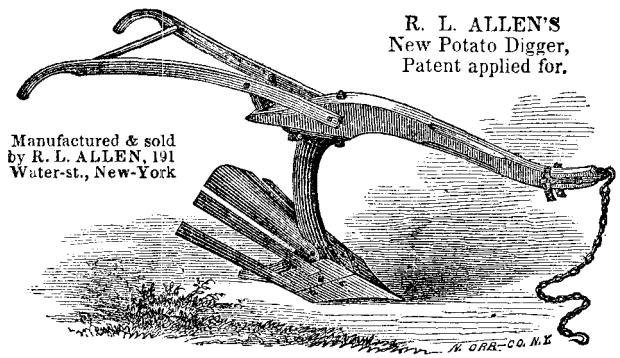
4th. By the rotating motion, the teeth are made to move in every conceivable direction, consequently, *they sharpen themselves.*

5th. This harrow leaves the ground smooth and even, as it is *impossible to clog it*, consequently stones, roots, vines, or other things, cannot be dragged along by it, to leave the ground in furrows as it frequently is by the common harrow.

Sawyer's Improved Cultivator.—Patented August 10, 1858.—Manufactured by Benjamin & Co., Winthrop, Maine. This implement is a Maine invention, and was first brought to the notice of farmers in the spring of 1858. It does not scratch over the surface

of the ground, knocking a tuft of weeds first one side and then the other, leaving the roots undisturbed, but its sharp triangular-shaped shares enter the ground and slide along under the surface at the depth of from two to five inches, as desired, cutting up all weeds and leaving the earth very light and smooth. It is readily expanded or contracted, and when hilling is to be done, mould-boards are attached, converting it into a double mould-board plow, which can be contracted or expanded at pleasure to suit the work to be done, and will make a better furrow in which to drop dressing than the ordinary plow. It is built light, strong and compact, and is very easily guided. It is a valuable implement, and must come into extensive use.

Potato Digger: An implement got up by R. L. Allen of New York, is highly recommended by some. It has not been sufficiently used in Maine to enable one to determine its real value as a digger of potatoes. It is simply a double mould-board plow, the boards being shoal and but little curved, and slit longitudinally so as to allow the earth thrown up to sift more or less through the openings. It is light, (weighing only eighty-five pounds,) of light draft, and simple in its construction, and with a pair of horses or oxen, and a boy to drive, will dig potatoes as fast as twenty men can pick them up, turning them out so clean that not one bushel in fifty is left

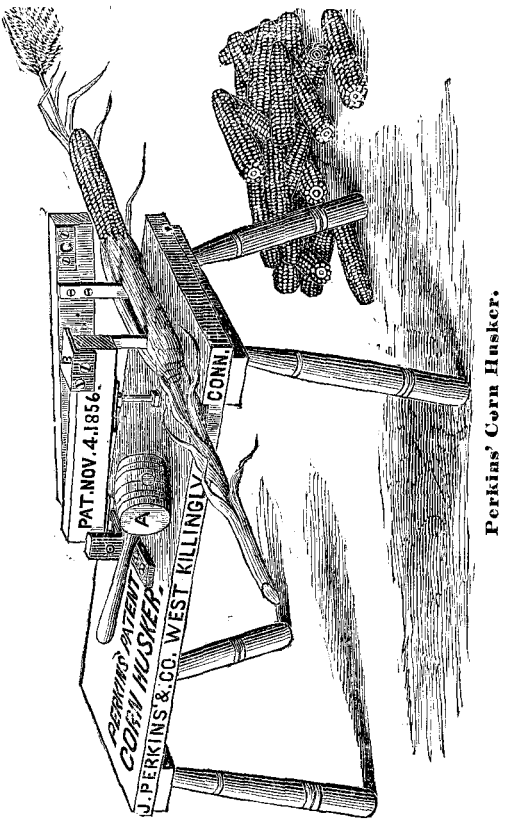


R. L. Allen's New Potato Digger.

uncovered. The standard is so high as to allow it to work well without clogging from weeds or potato tops, and it will work well on all soils, side hills, or among stones and stumps. It is also recommended as a cultivator and weeding plow. The price is $10.

Husking Machines. Two new machines have been patented and introduced to the farmers for facilitating the labors of husking Indian corn. How well they will succeed, time and use must determine.

One of them, invented by J. Perkins of West Killingly, Connecticut, operates by two motions. One motion cuts the corn from the stalk by the butt; the other separates the ear thus cut off from the husks. It may be more fully understood by reference to the accompanying cut.



Perkins' Corn Husker.

This machine will husk corn of any size, on the stalk, just as cut from the ground.

The operator, seated on the machine, holds, *with the left hand*, the ear under the cutters, and with the mallet, A, *in the right hand*, striking the short lever, B, *downwards*, cuts the ear close to

the first row of kernels, (the cutters being in contact or close together when they descend,) then striking the long lever, C, *outward*, the ear is pushed entirely out of the husk, being but two motions—first, *downward;* second, *outward.*

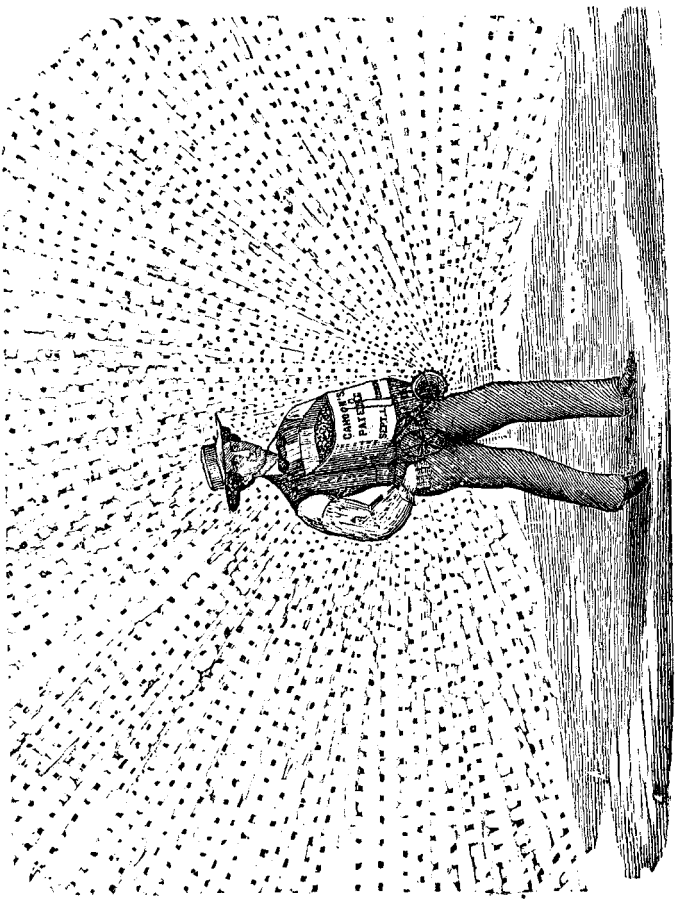
It husks as fast as the stalks are placed under the cutters, and from fifty to one hundred per cent. more corn can be husked per day, with this machine, than by hand, and all severe and painful hand labor entirely avoided.

The iron work is of wrought iron, and the machine is warranted not to break by fair usage.

Morison's Patent Corn Sheller.—Patented June 10, 1856.—Manufactured by Benjamin & Co., Winthrop, Maine. This is a New Hampshire invention, and is now being introduced into this State. It presents some new features not before introduced into any corn sheller, and is worthy of the attention of farmers. The shelling parts consist of two tapering cylinders, eight inches in length, six inches in diameter at the large end and four at the small, and a shell wheel sixteen inches in diameter and one and one-eighth inches on the face. The two cylinders are placed nearly perpendicular—the large end of one being up and of the other down, so that their surfaces are parallel to each other and about one-half inch distant. The shell wheel is on a horizontal shaft, and so placed that its periphery comes between and near the surface of the two cylinders. Both shell wheel and cylinders are provided with teeth on their peripherys. The corn is introduced through a funnel into the triangular space formed by the two cylinders and shell wheel. The cylinders, running slowly and in the same direction, give the cob a rotary motion, presenting each side to the action of the shell wheel as the cob advances through the machine, when it is separated from the corn by a seive. It shells *clean*, *easily* and *rapidly*, depositing the corn in a box without scattering or waste.

Sowing Grain Broadcast. A simple and efficient machine for sowing grain evenly has long been a desideratum among grain growers. Many inventions have been patented for this purpose, but have failed to accomplish the object in so perfect a manner as good cultivation required. A recent invention made by C. Cahoon of Port-

land, accomplishes the business in an easy and expeditions manner and is fast coming into extensive use. Two sizes of this machine are in the market, one large enough to be attached to a wagon, the seed being sown by horse power, the other to be strapped to a man's body, and the seed sown by hand power.



The inventor furnishes the following description of the construction, operation and capacity of this novel seed sower:

"The framing of this machine is made of malleable iron. In front of the framing, and on the end of a horizontal shaft, is placed a flaring tubular discharger, having blades or flanches on the inside. Above this discharger, and leading into it, is a hopper, made of sheet metal and firmly fastened to the framing. Inside of this hopper

is a stirring rod, which has a reciprocating motion when the machine is in operation, and is for the purpose of preventing the seed from clogging. On the side of the framing is a crank attached to a toothed wheel on a transverse shaft, which wheel connects by gearing with the shaft on which is placed the discharger, and speeds it up to twenty-four revolutions to one of the crank. An index is connected with a slide on the front of the machine for governing the flow of the seed, and enabling the operator to regulate the quantity to be sown per acre as may be desired. To the sheet metal hopper is attached a cloth hopper of convenient dimensions.

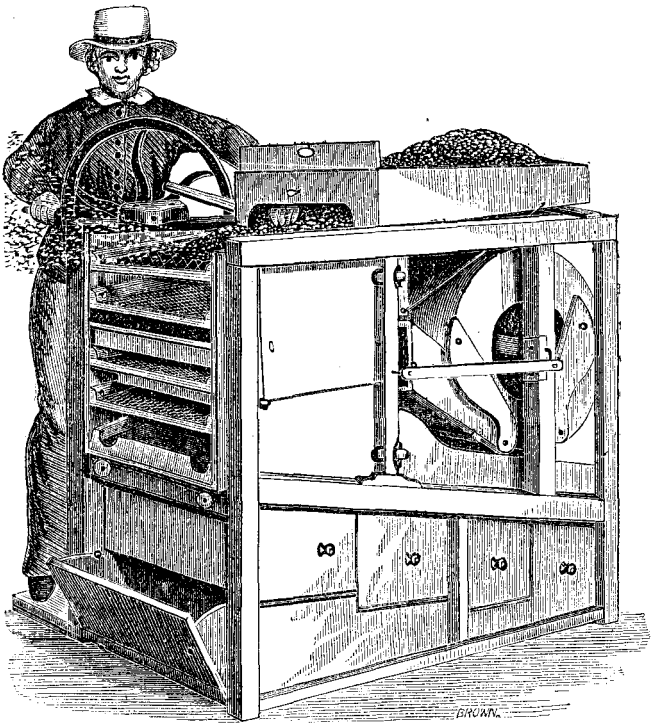
The machine can be fastened to the body by means of a belt passing over the shoulders and around the waist. When it is put in operation the discharger revolves with great rapidity, and throws the seed broadcast by centrifugal force in a plane vertical to the horizon. The seed falling into the discharger while in rapid motion is carried away from the lower part before it is thrown out, and is thus prevented from being distributed in too large quantity towards the centre, as would otherwise be the case.

This machine is substantially built and distributes the seed in a very superior manner, sowing, at the ordinary gait of a man, four acres of oats per hour, or seven acres of wheat."

Fanning and Assorting Machine. Winnowing mills and fanning mills, with seed screeners, have long been in use. The operation of the horse power and separator, by which grain is threshed and separated from its chaff at one operation, has obviated the employment of them, and they are not so much in demand as formerly. A very clever invention for the purpose of fanning and assorting seeds of any kind, especially those of a smaller and lighter kind, has been made by Rufus Nutting of Randolph, Vermont, which bids fair to come into general use.

The inventor thus speaks:—"This is an implement agriculturists have for years felt the need of more and more, but have sought for it in vain. It not only cleans rapidly every kind of grain, grass and garden seeds, beans and peas, from chaff, dust and dirt, but it *separates* from them all foul seeds, and also *assorts* each pure article into several distinct grades or sizes, thus enabling

farmer and gardener to select any grade or quality of each product for seed, for family use or for market.

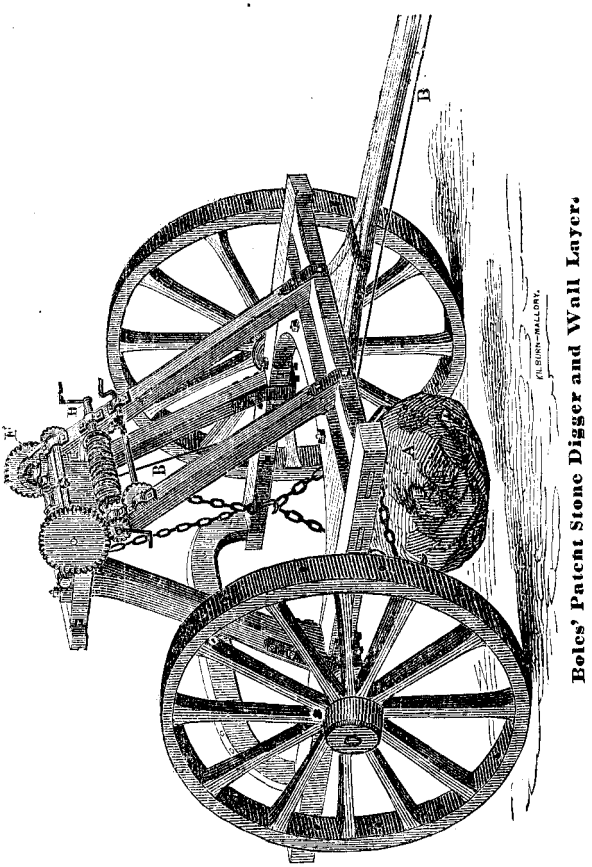


With it, wheat is perfectly cleansed for sowing, from oats, chess, cockle, and other impurities, and deposited in different apartments, so that the largest kernels may be used for sowing; so of all grains. Peas and beans are assorted according to size, thus increasing their market value twenty-five to fifty per cent. Grass, garden and flower seeds are cleaned, separated and assorted so that no sifting or picking over can improve them.

This machine is symmetrical in form, smaller than ordinary winnowing mills, and though constructed upon new principles, is very simple and not liable to be out of order, and is retained in any desired situation by the weight of the operator. It is withal so cheap that no ordinary farmer can *afford* to be without it, as by its use he will save annually, in several different ways, more than its cost."

Stone Digger. Every farmer knows that the labor of digging stone for the purpose of clearing them from his fields and laying them into wall, or for other purposes, is one that has hitherto been of severe main strength; and those that were too large to be lifted by the ordinary means at his command, must either be left to cumber his ground or be blasted and carried away in fragments.

An apparatus has recently been invented by which this labor is saved to him in a great degree, and large heavy boulders removed with astonishing ease and dispatch, compared with the amount of strength and labor heretofore required.



Boles' Patent Stone Digger and Wall Layer.

The following description will make its construction and manner of operation understood:

A, is the rock just raised above ground. F, the windlass. G, the connecting wheels between the windlass and crank-shaft H. H, the crank-shaft, with drum, secured to or detached from the shaft at pleasure. B B, the hoisting-rope, wound on the drum or crank-shaft H, and runs under a roller and through a shreeve near the end of the tongue, to which a horse is attached to hoist the rock. The small crank and shaft under crank-shaft H, is to wind up the rope when the rock is hoisted high enough and the horse is detached. The proprietors of this machine and patent right, claim that it is one of the greatest labor-saving improvements of the age. It will take rocks out of the earth of five tons weight or less, without digging to relieve them, with great ease and rapidity, and move them into the line for a wall, if desired, and place smaller ones on top until the wall is five feet high. The machine may be operated by men or by horse power. The united power of two men will lift a rock of five tons weight from the ground in ten minutes, or it may be done by a horse in one minute.

List of Pears adapted to Culture in Maine.

By S. L. Goodale, Saco.

More hesitation is felt now in submitting a list of fruits best adapted to culture in Maine than would have been fifteen or twenty years ago. The experience of so many and so widely varying seasons, shows a difference of quality and adaptation to soil and climate which renders a more lengthened term of trial desirable, before deciding with certainty. Future experience will doubtless bring some to notice preferable in various respects to those named below; yet of these, a tolerable degree of confidence is felt that their culture in good soils and ordinary seasons, will usually be attended with success.

Doyenne d'Ete. Small, handsome, of fine quality, and the earliest; of moderate growth, and apt to overbear—like all summer pears, must be picked early and ripened in the house; ripens early in August.

Madeleine. A desirable early pear; of medium size, pale yellow, juicy and sweet. Tree a vigorous and erect grower, and productive on both pear and quince; ripens soon after the Doyenne d'Ete, nearly as good, and a better grower.

Rostiezer. Small to medium; greenish with a rich brown cheek, oblong pyriform, juicy, high flavored and excellent. Tree hardy and vigorous, with long dark-colored shoots; succeeds on both pear and quince; productive and valuable; ripens early in September.

Bartlett, (Williams' Bon Chretien.) A popular pear, and probably the best of its season, but unfortunately not hardy enough to succeed here except on dry soils and in sheltered situations. Large, yellow, sometimes with a blush on the sunny side; flesh white, melting, buttery and sweet; ripens in September and October.

St. Ghislain. A medium-sized fine melting pear. Tree an upright grower and good bearer; usually very hardy. September.

Beurre d'Amalis. A good early autumn pear, and a great bearer; large, dull yellowish green, sometimes with reddish brown cheek; flesh yellowish, juicy, with a vinous flavor. Tree of vigorous and rapid though somewhat irregular and spreading growth; succeeds well on quince. September.

Dearborn's Seedling. Originated in Roxbury by General Dearborn. Fruit small to medium, yellow, melting and excellent. The tree proves hardy and productive. Ripens about the same time as the Bartlett.

Flemish Beauty. Within a year or two this pear has cracked in some localities, but before it has uniformly been excellent in all respects, and one of the best. Fruit large, beautiful and excellent, and the tree hardy and productive; ripening in September.

Doyenne Boussock. Has fruited eight or ten years and proved uniformly fine. October.

Buffum. One of the most vigorous and productive pears, and usually of very good quality. October.

Henry IV. Small and delicious, resembling the Seckel, and the best substitute for this favorite sort, which does not usually succeed well in Maine.

Fulton. Small to medium, roundish, flattened, of a cinnamon russet color, rich and excellent; native of Topsham. Should be picked early and ripened in the house. October.

Louise Bonne de Jersey. Large, pyriform, a little one-sided, yellow with a red cheek, beautiful. In heavy soils and on young trees, sometimes astringent, but always melting, buttery and of high flavor. Tree hardy and vigorous. Best on quince. October.

Onondaga, or Swan's Orange. A large melting fruit, of native origin and good quality. Tree hardy, vigorous and productive. October and November.

Urbaniste. Of moderate growth but hardy, and the fruit excellent; best on quince. October and November.

Belle Lucrative, (Fondante d'Automne.) One of the highest flavored pears and usually succeeds well; size medium; pale yellowish green, sometimes russeted; juicy and delicious. A moderate grower and an early bearer. September and October.

Beurre d'Anjou. Rather large; greenish yellow and a brown cheek; rich and buttery; ripening in November. The tree has usually proved very hardy.

McLaughlin. A valuable native variety, supposed to have originated in Cumberland county; large, russety, melting, and excellent. Tree hardy and productive. November and December.

Winter Nelis. The most delicious early winter pear yet proved here; of medium size, roundish and russety, buttery and melting, with an aromatic flavor. Tree of feeble and straggling growth. December and January.

Vicar of Winkfield. A large, long, handsome pear, usually of fair quality, and sometimes very good. Tree vigorous and productive, and has proved hardy, except during the winter of 1856–7 when some trees suffered badly. Ripens in December and January.

Lawrence. Of medium size; yellow, high flavored, melting and rich; easily ripened. Tree hardy, a good grower and bearer; valuable. December to February.

The above list might be greatly enlarged by the addition of sorts

of high promise, or which have been proved for a shorter period, or which have done well except during the disastrous winter of 1856–7 above referred to, but a list of twenty sorts is deemed ample for the present purpose.

Satisfactory success in pear culture is not to be expected without care in cultivation, and on suitable soils, and in good locations. To plant trees and then leave them to struggle with weeds, grass and neglect, is as wise as to thrust corn under a sod and expect a bountiful harvest.

On Insects Injurious to Vegetation.

By N. T. True, M. D., Bethel.

The field open to the investigation is truly a boundless one. I shall therefore do no more than to call the attention of the farmer to those insects which may the most readily arrest his attention. Having consulted the foreign works of Latreille and Kollar, and the admirable works of Drs. Harris and Fitch in this country, I have ventured to draw from them only what I considered strictly practical, adding from time to time my own observations as occasion might require.

Our knowledge of the insects injurious to vegetation is exceedingly defective, while their ravages are increasing from year to year. Scarcely a plant or tree that we cultivate at the present time is free from some destructive insect. It will be a great point gained if we can but partially escape their ravages. It is with this view that I have attempted to call attention to some of the most common and destructive insects in this State.

Many a farmer wonders why his plums drop off without knowing the cause. Hundreds of farmers may still be found whose orchards may be fast on the decline from the ravages of the borer without his knowing the cause.

There are many other insects of destructive habits not noticed here, owing to the limits allowed in having such a report printed, but the subject is one of so much importance to the farmer and gardener, that I feel strongly tempted to prepare a work on insects injurious to vegetation in New England. Such a work is much

needed, and my only wish is that some more competent person might immediately commence the task.

In the mean time hoping that the following notices of insects will lead some of our farmers and gardeners at least to be more observing of these apparently insignificant creatures, I submit this report to their consideration.

Onion Fly, (Anthomyia Ceparum, Meig.)—"Maggot smooth and shining, fleshy, bare, white."—*Kollar.*

It has not, I believe, been settled whether the onion maggot of this country corresponds with the European species, but as it evidently belongs to a class of insects (the Anthomyidæ, or flower flies,) that lay their eggs in the roots of the various garden vegetables, I have ventured to adopt Kollar's description.

This comparatively new pest in this part of the country consists of an ash grey colored fly, (female) wings clear like glass, with broad iridescent reflections and yellowish brown veins, and about one-fourth of an inch in length. According to Dr. Harris it may be seen on our windows in spring.

The fly lays its eggs on the leaf of the onion close to the ground. As soon as hatched it bores through the leaf and descends between the leaves to the base of the bulb which it destroys so as to cause the top to wilt and die. It then leaves the onion, passes into the earth and becomes a reddish brown, wrinkled pupa, out of which in from ten to twenty days the perfect fly is developed. I noticed in my garden last year, at least, two generations during the summer.

Many remedies have been proposed, such as strewing salt, ashes, powdered charcoal, and burning straw on the ground, but it is doubtful whether either of these has been of any real service. I have succeeded remarkably well for two successive years by drawing the earth entirely away from the bulbs so that the plant would lie on the ground. I also succeeded by a course directly opposite. I drew the earth high around the stock completely covering the bulb. I can recommend the former method with considerable confidence. The second generation does not inflict but trifling injury, and may pass unnoticed.

All such experiments as soaking the seed are entirely useless. Dusting with sulphur is said to have been tried successfully. Strewing fine salt just before a rain may be of use.

Planting the top onion is practiced by those who wish to obtain a small quantity for early summer use.

The Cabbage Fly, (Anthomyia Brassicæ, Bouche.)—Maggot resembling that of the onion, but thicker. The fly hardly half as large as the common house fly, ash grey, wings clear like glass.

I am not at all certain whether the European species corresponds with ours, but its ravages are the same. The maggot eats through the roots and stems of cabbages in their earlier stages of growth, the plant ceases to grow, assumes a leaden hue, withers and dies. On pulling up the plant the root will be found completely destroyed.

Probably the best remedy yet devised is to dip the roots of the plants in whale oil and then cover with powdered gypsum when transplanted. This will serve as a sheath to the plant and as nourishment for its future growth. Whale oil soap in water has been applied successfully to the roots of the plants.

For two years past the insect has been exceedingly destructive in this State.

The Radish Fly, (Anthomyia Raphani, Harris.) These maggots are found on the roots of the raddish. The insect is a small, ash colored fly, with a silvery grey face, copper colored eyes, and a brown spot on the forehead of the female.

I know of no remedy against their attacks. I have been unable to raise the radish fit for eating except by sowing very late on a clean subsoil.

The Cut Worm, (Agrotis.)—A dark, ashen grey, greasy looking worm, with a brown head, and a pale stripe along the back.

These caterpillars are the most destructive during the months of June and the early part of July. They come out of the ground a moth between the twentieth of July and the middle of August, when they may be seen briskly flying about the candles in our houses. There appear to be several species of the cut worm, but they all have the same general aspect and habits. During the day they remain concealed in the ground, but make their appearance in the night and attack all succulent plants, such as the cabbage, turnip, beans and corn, cutting off the leaves, gorging themselves with food, and retreating to their burrow before light, to be repeated the next

night, leaving the ignorant farmer or gardener to wonder at the cause of this destruction.

Perhaps the only practicable remedy that can be given, is to dig round the plant with the fingers and rout the depredator. A favorite plant may often be saved in this way. They have become exceedingly troublesome in our gardens of late years, and their habits demand special attention. Although my own garden was troubled worse in 1857 than I ever knew before, it is a curious fact that I have not seen a single specimen the present year either in field or garden.

The Squash-Bug, (Coreus tristis. De Geer.) The common striped squash-bug is so well known to every farmer and gardener that it needs no description here. These make their appearance from the crevices in walls and fences in which they may be found concealed during winter, and commit their ravages on the young squashes, melons and cucumbers, and subsequently lay their eggs on the under side of the leaves in little clusters which seems to be fastened to the leaves by a gummy substance. These hatch in a short time, feed on the leaves until they wither, when they seek fresh leaves. They do not attain their full size and peculiar yellow striped wing covers till September, when they conceal themselves for winter.

To prevent their ravages in gardens, perhaps the easiest and most effective is that of a rim of birch bark around the plant. Sawing up nail casks into rims and placing over the hill is effective. They do not seem inclined to fly down any narrow enclosure. Covering the plants with powdered gypsum or sulphur when the plants are wet, will prevent their ravages tolerably well, by acting as a shield and do not injure the plant. The thumb and finger united with a good natured temper will do much towards their extermination.

The Pea Bug, (Bruchus Pisi. Lin.) The pea bug commences its ravages by puncturing the skin of the pod and depositing its egg which hatches and perforates the pod and enters the pea where it continues till fully grown. The maggot continues to live on the marrow of the pea, bores a hole quite to the hull and before spring comes out a beetle. Hence dried peas that are kept over one year will be free from the insect.

The Curculio, or Plum Weevil, (Rhynchænus Nenuphar.) Insect, dark brown, approaching to black, short and thick with a long and slender snout which is jointed near the middle, the first joint being longer than the rest.

There is no insect in the whole range of New England cultivation whose ravages have been so complete as that of the Curculio. For the last two years not only the plum but the cherry and the apple and pear have been attacked by them. During the summer of 1857 it was no uncommon thing to see every plum on a tree scarred in several places.

The curculio commences stinging the plums almost as soon as they are set. With its snout it makes a crescent shaped cut through the skin into which it deposits an egg, then proceeds to another until it is exhausted of its eggs. These are soon hatched, appearing like a small maggot which penetrates to the stone. The plum exudes a gum, becomes diseased and falls. The grub then leaves the plum and enters the ground from which in about three weeks it comes forth a perfect insect.

But little success has as yet attended the efforts of cultivators in preventing their ravages. Among the remedies tried, whitewash, in which a little glue has been dissolved, applied with a large syringe, shaking the tree early in the morning and collecting the insects on sheets, are perhaps as practicable as any other. Salting the ground, as well as paving it beneath the trees, has been recommended, but with doubtful results.

I have contemplated heading in the plum tree to a compact form, and as soon as the tree is in blossom to cover the top with millinet until their ravages are over. This, if it should succeed, could be practiced only on a limited scale, but a few plums are certainly better than none. Perhaps a little creasote dissolved in lime water might render it so offensive to the insect as to induce it to seek some other place of deposit.

Since writing the foregoing I have the present year tried the latter experiment with so much success that I shall repeat it another year. As the insect is inclined to walk along the limbs covering the large branches with chalk has been recommended as successful.

The Spindle Worm, (Gortyna Zeæ. Harris.) "Caterpillar smooth, yellowish, with the head, top of the first and of the last

rings black, with a double row across each of the other rings, of small, smooth, slightly elevated, shining black dots." [*Harris.*

This worm commits its ravages on Indian corn by attacking the stalk near the ground which it perforates and works its way upwards and downwards, partially or wholly eating off the spindle, causing the leaves to wither, which, with the spindle, may be drawn out together. I am unable to say whether this is the same insect that attacks the upper portion of the spindle, nor can I suggest any remedy for its depredations. In some seasons it is quite injurious, and it is introduced here with the hope that attention may be called to its ravages with reference to a remedy.

Locusts. Under the common, though incorrect, name of grasshopper is comprised that class of well-known insects, embracing several species, which infest our fields, and which, during some years, are exceedingly destructive.

One of the most interesting exhibitions of insects that I ever witnessed, occurred about the year 1821 or 1822, in my native town, in Cumberland county. Early in midsummer the red-legged locust (Acrydium femur-rubrum) made its appearance in the field in countless numbers. The weather was dry and hot. During the haying season they stripped the leaves from the clover and herds-grass, leaving nothing but the naked stems. So ravenous had they become that they would attack clothing, eating it into shreds. Rake and pitchfork handles made of white ash, would be found nibbled over by them if left for them to roost upon over night. As soon as the hay was cut they attacked the grain, completely stripping the leaves, and, roosting on the naked stalks, would eat off the stems of wheat and rye just below the head and leave them to drop to the ground. I well remember of assisting in sweeping a cord over the heads of wheat after dark, and causing the insects to drop to the ground, where the most of them would remain during the night.

Their next attack was upon the Indian corn and potatoes. They stripped the leaves and eat out the silks of the former, so that it was rare in harvest to find a full ear. I well remember the curious appearance of a large bed of red onions whose bulbs they entirely eat out, leaving the dry external covering in its place. As the nights became cooler they collected on the stumps, which they liter-

ally covered, eating the moss and decomposed surface of the wood and leaving the surface clean and new. The paths were filled with their excrements.

During the latter part of August and the first of September, they would rise in the air to an immense height. By looking into the air in the middle of the day, as near as possible to the sun, they could be seen in immense numbers, appearing like so many thistle-blows borne along towards the sea before the wind, while cart-loads of dead bodies remained in the fields, forming in spots a tolerable coating of manure.

It is pretty difficult suggesting any definite rules for their destruction. The experience and exigencies of the farmer in his peculiar location, will the better suggest a remedy than any rules which can be laid down.

Apple Bark Louse, (Aspidiotus Conchiformis, Gmelin.)—A small, flat, brownish-looking insect, one-tenth of an inch in length, oyster shaped, fixed to the bark, generally with the smaller end upwards.

In many portions of the State this insect is very injurious, covering the young trees and the smooth twigs of the older trees in prodigious numbers. I am inclined to think that it is more abundant on the seaboard than in the interior. At any rate, I have rarely seen it in Oxford or Franklin counties in sufficient numbers to do any injury, while in Cumberland county it has at times proved very destructive. It is possible that it may be more destructive near large bodies of water.

Beneath these scales are deposited minute whitish eggs—their number, about thirty or forty, being greater or less as the tree may be more or less thrifty. These may be seen at any time during the winter and spring on lifting the scales. About the first of June these are hatched and crawl out from under the bark, and cover the limb with exceedingly minute white dots, which, to the casual observer, would be mistaken for the surface of the bark. In about ten days they become stationary, throw out a bluish white down, and the eggs are again deposited.

Among the easiest remedies are those of the alkaline washes, such as lime-water, soda or potash, which will have the effect to remove the scales and give to the bark a smooth and healthful appearance. But probably the best remedy is that of leaf tobacco boiled in strong

lye and mixed with soft soap till it is of the consistence of paint, and applied with a brush. Whale oil soap makes an excellent application.

A tree long infested with this insect, is sure to be rendered worthless.

Common Apple Tree Caterpillar, (Clisiocampa Americana, Harris.) Winged moth, dull redish color, approaching to greyish, two straight white stripes extending obliquely across the fore wings parallel to each other and to the hind margin, dividing the wing into three nearly equal portions. These moths are most numerous about the first of July, coming in at our windows during the evening, attracted by the lights. They deposit their eggs in belts around some twig of the apple, cherry and other trees, to the number of two or three hundred to be hatched the next spring. These at once commence spinning a tent for their protection and go forth in quest of food by stripping the branch of foliage on which they are hatched.

Orchards may easily be kept clear of them by a little attention at the proper time. As easy a method as any is to tie a few cotton rags or a bunch of tow to the end of a long pole, pour on a little turpentine or camphene, set it on fire and go round and burn their nests. This can be done without injuring the bark of the tree, while a single preparation will go over a large orchard. A brush in form of a cone fastened to a pole is an effective tool to dislodge their nests.

The Apple Tree Borer, (Saperda bivittata, Say.)—"Excavating a round flat cavity under the bark near the root, and then boring a cylindrical hole upward in the solid wood: a yellowish or white, footless, cylindrical grub, broadest anteriorly, with a brown head and black jaws."—*Fitch.*

Although almost every farm in this State has an orchard and every tree liable to be more or less injured by the borer, yet but comparatively few farmers are acquainted with the ravages of this insect. Perhaps there is no insect as destructive as the borer whose ravages can be so easily avoided.

Its depredations can be readily observed by the pile of sawdust at the base of the trunk which it has manufactured in its passage

through the wood. It will attack young trees, and sprouts at the roots of old trees, eating out the sap-wood beneath the bark until it has formed a circle an inch or two in diameter, and then ascending to the height of two, three, and sometimes to that of ten inches into the heart-wood of the tree, leaving its castings packed in its rear. Here it spends the winter in a dormant state. About the twentieth of June it bores through the sap-wood and bark and comes forth a winged beetle which flies only by night, deposits its eggs at the roots of trees from which is hatched the borer in question. Occasionally these eggs are deposited in the axils of the lower limbs of the trunk. I have known trees six inches in diameter to be completely girdled and destroyed by these insects. Old trees that are not kept clean around the base of the trunk are most likely to suffer.

A smaller species of the borer may be noticed in the trunks of old plum trees. I noticed a year or two since a Canada plum stock on which a borer had committed its ravages, and then bored through the stock and escaped the opposite side. On cutting down some large plum trees a year since, I found the trunks completely riddled their whole length by the borer. A still smaller species may be found in the limbs of apple trees whose ravages are usually confined to the surface of the sap-wood beneath patches of dead bark. In this vicinity the mountain ash is attacked and destroyed by the borer.

Trees affected by the borer have a sickly appearance which the experienced eye will at once detect.

In regard to the remedies for this pest, the first step is to keep the surface of the trunk smooth, and all shoots cut away. When the ground is cultivated they are not so inclined to deposit their eggs. Perhaps the most practical method of destroying them is to cut a narrow slit through the bark and sap-wood till you reach the borer. No injury need be apprehended to the tree by this operation. A wire will sometimes reach them. Dr. Fitch recommends puncturing the bark with an awl and pouring in scalding water. This would no doubt prove an effectual remedy in the hands of a person acquainted with their habits, but if the upward direction of the hole be ascertained, the insect may be readily killed with the awl itself. Cutting out a few will soon acquaint one with their ravages. A weak solution of sal-soda, or potash, applied to the trunks of trees the first of June, would no doubt prevent their ravages and promote the

growth of the trees. When found in the limbs, remove the dead bark and cover the surface wood with a composition of red ochre and linseed oil applied with a brush. Whale oil soap mixed with water is the cheapest wash.

A few minutes should be spent in the fall, or early in the spring, in examining the trunks of trees in every orchard, and no great trouble need be feared from its ravages.

On the Comperative Value of Manures.

By J. K. Russell, Skowhegan.

The various products of the earth are composed of a variety of elementary principles, and each product must have all the elements peculiar to itself and always in nearly the same proportion, or it cannot arrive at perfection.

Though no two plants and no two soils have precisely the same chemical composition it is fortunate for man (falsely called lord of the soil, when, in fact, he is too often the servant of it,) that the elementary principles, required by all, are generally found to a greater or less extent, diffused in all parts of the earth. Hence it is that she has sustained hitherto so large an amount of animal life, although unskillfully or wastefully tilled. If all needful elements were universally found, and in an inexhaustable supply, then there would be no need of fertilizers, as these are for the express purpose of supplying this deficiency, whether innate in the soil or the necessary result of consumption in the process of production. The "*Comparative Value of Manures*," the subject assigned me for investigation in this brief essay, would seem to suppose some standard of comparison, without which standard there could be no satisfactory solution. If all soils were naturally alike, and not subject to change by use, then the question of value would have to be settled for each kind of product according to the adaptation of the given fertilizer to supply the deficiency in the soil for that particular product.

The properties of the soil being known, the chemical elements of the particular product by a comparison with those of the soil would show wherein the product would fail of the necessary supply in the soil; and this deficiency, whether in one or more ingredients, would

have to be made up by a manure containing these deficient elements, and that would be the best manure which an analysis would show to contain these, though it did not contain any other. In this way a positive rule could be laid down for the successful cultivation of any given product. But soils *differ*, so much so that no two are precisely alike; so that the rule to be worth any thing must be shown to apply to the particular soil each cultivator may wish to use, and this would require an accurate analysis of every field if not of every foot of land. Besides, the same soil is constantly changing while its products are carried off to be consumed elsewhere. Those elements of soil, the most scanty in supply, if drawn upon constantly, as they are likely to be, must, one by one, be eliminated from the soil, though once abundant. The fertilizer that contained every needful ingredient, for the crops of last century or even last year may entirely fail to make good this loss. Here again the rule would fail, though it might have been the very best when made.

This ever-changing requirement, complicated and difficult as it must be, when one product alone is considered, becomes vastly more difficult when we consider the great variety of products, and how exceedingly unlike they are in their chemical composition. Who can say, then, what is the best fertilizer for all crops and all soils, and what the second, and what the third best, and thus assign their comparative value? This, in the very nature of the case, is plainly *impossible*. The value of fertilizers can at best be determined for each production by itself and when applied to some specified soil. This comparative value thus limited may be determined in two ways—first the farmer may apply different manures to different portions of the same field, the quality and condition of the soil being as nearly the same as possible; plant or sow a given area to the same crops and note the result. Though this method has always been within the reach of all tillers of the soil by a small expenditure of care and time, the results derived therefrom through all past time seem hardly to settle anything beyond mere conjecture. This may be of some value to the experimenter, but is hardly capable of being appropriated by another and relied upon as actual science. Hence we suppose it is that you, Mr. Secretary, have this year sent out to the farmers of Maine your circular prepared with particular reference to this class of experiments. If these experi-

ments are made extensively and with proper care, as we hope, they may throw much light upon this subject. Into this part of the subject, therefore, we will not enter.

It would seem reasonable to expect that the same knowledge might be arrived at with equal, if not greater certainty by a very different method—that of chemical analysis of the soil, the production and the fertilizers. Of the soil, to reveal its elementary principles; their number, nature and proportion of each. Of the product, to ascertain in what proportion it contains these or others, if any, and of the fertilizer to show its adaptation to supply the excess in the product over the ingredients of the soil. As an analysis of every field is not practicable any more than it would be to make test experiments upon each field, it would be necessary to classify soils upon some principle found to be sufficiently accurate for practical purposes, such as are denoted by their rocks, as granite, slate, flint, and the like, or by their earths, as clay, marl, sand, loam, or as vegetable, mineral, acid and alkaline. Observation and experience, united with occasional analyses, would, if these were accurate and reliable, not only fix easily upon some general classification, but might, in time, make that classification particular and its indications plain to all.

For the purposes of illustration, we will insert the result of the analysis of two kinds of soil—one of a new, rich and fertile soil on the bank of the Ohio river; the other of sterile land, unfit for cultivation:

Fertile Soil.		*Soil unfit for cultivation.*	
Quartz sand and silicates,	87,143	Silica and quartz sand,	96,000
Alumina,	5,666		,500
Oxide of iron,	2,220		2,000
Oxide of manganese,	0,360		trace.
Lime,	0,564		,001
Magnesia,	0,312		"
Potash and soda,	0,145		trace.
Phosphoric acid,	0,060		"
Sulphuric acid,	0,027		"
Chlorine,	0,026		"
Humic acid,	1,304		,200
Insoluble humus,	1,072		1,299

Organic matters,	.	,011
Carbonic acid, (with lime,)		,080
		100

100

The first thing we notice in these tables is, the great preponderance of silica in some form, in both good and poor soil, but it does not follow that this element is not material to vegetation. While it exists so abundantly as to be estimated to form one-sixth of the whole mineral weight of the globe, it enters into the formation of every vegetable product of the earth and forms the greatest part of the inorganic portion of some of those products. This fact makes it a valuable addition to soils where it is not abundant. Some mucky soils are of this kind, upon which clear sand might be of more value, and more indispensible, than any other fertilizer.

The next thing we notice is, that the sum of all the ingredients of the rich soil, not found to some extent in the poor, though some ten in number, does not exceed two per cent. of the whole weight. The inference we should naturally draw from this, is, that these elements form part of the necessary food of plants, and from this, as they are not abundant, that they are the very elements which would be most likely to be eliminated from the soil by continued cultivation, and would need the greatest care to replace.

Analysis of the various products of the soil throws much light upon this subject, as it shows at once what products draw most heavily upon one or more of these scanty elements, and explains why these products cannot be long raised on the same ground without the aid of a fertilizer, fitted to repair the waste. One ton of clover hay is shown to contain more than one hundred pounds of these valuable constituents, nearly one-half of which is lime, potash and soda about one-quarter, and not more than ten pounds of the abundant element, silex or silica; while rye grass, per ton, contains about fifty pounds of silex and less than that amount of all other mineral elements. Every ton of oat straw takes from the soil about sixteen pounds of potash, ninety pounds of silex, and but four pounds of other mineral matter. One ton, each, of wheat, barley and rye straw, takes less than five pounds of potash, though the straw of either of them contains more lime than that of oats. Is this absorption of potash one of the reasons why oats exhaust land

more than other grain? If so, they should be sown on land abounding in potash, or it should be manured with *un*leached ashes or something else containing a supply of potash. Potatoes use about eight pounds of potash, four of soda and two of sulphuric and phosphoric acids to the ton, and less than two pounds of other mineral matter. The tops draw from the soil about sixteen pounds of potash, *twenty-two* of lime, four of phosphoric acid and three of magnesia to the *ton, green weight*. Against such a demand no soil should be expected to hold out without liberal supplies being added of such fertilizers as contain these necessary and often deficient elements. What farmer has failed to notice that his potatoe grounds have shown more exhaustion when he comes to crop them with grain and grass, than adjoining corn land, manured the same, even though his potatoes were small, few in the hill, and rotten at that. If the analyses are correct from which we have taken these results, they fully explain the mystery and should have an important bearing, not only on the selection of manure but on the question of cost of this crop, and the right use of the tops.

We have drawn these figures of weights and proportions from tables of Sprengel's analysis of the different grass, grain and root crops, referring to only one of each, for illustration, without taking up space to insert the whole tables, as it will be found that the analysis of all the useful products of the soil leads to the same general conclusions; *that they draw very largely upon the elements of the soil liable to be wholly deficient or greatly inadequate to the wants of continued production;* that according as each plant or class of plants contains some one or more of these elements, in common, more abundantly than others, it is adapted to a particular soil, in which those elements chance to abound, and that *manures should be selected* if possible with reference to furnishing the soil with these necessary elements, without which the desired crop cannot be produced.

Allusion has been made to the desirableness of a classification of soils according to their prominent constituents and capabilities for particular productions; the classification of plants, with reference to some leading elements, is no less important. Agricultural chemists have made such a classification to some extent. Liebig classifies according as silica, lime or potash prevails, in each, as follows:

Silica Plants.	Lime Plants.	Potash Plants.
Oat, Wheat, Barley and Rye Straw, Hay, (other than clover.)	Tobacco, Pea Straw, Potato Tops, Clover Hay, Corn Stalks.	Turnips, Beets, Potatoes.

Corn stalks, if he has given the correct analysis, should be classed with the potash plants, as they contain but six parts of lime to seventy-two of potash. This classification could be extended to all plants, or they could be classified with reference to some other prominent characteristics.

We now proceed to consider the character of a few of the most common manures, and their relative value in replacing the loss consequent upon production, so far as their elements show this value. As the whole science of manuring land consists in supplying to the soil, those indispensable elements which have been exhausted, any increase of other elements will not compensate. Barrenness and sterility are inevitable. Where a single element fails, a change of product, or a supply of food suited to the plant, or abandonment, are the only alternatives.

As farm-yard manure contains the greatest number of elements necessary to fertility, it is the most certain to meet all the wants of all soils and all crops, if manuring is to be done at random, as is the usual way. Though for some soils, and for many plants, it may contain redundant and useless elements. Special manures, if applied with care to the wants of the crop and soil, may produce results of the most satisfactory kind. Manure operates upon the soil in various ways. *First*, by serving directly as food for plants. *Secondly*, by acting chemically, as solvents for the various elements of the soil, and fitting them for use. *Thirdly*, by neutralizing acids or other hurtful substances in the soil. *Fourthly*, if bulky, dry and loose, or heavy, compact and adhesive, they will change the soil for the better, having an opposite character. This is one of the reasons that clay on sand and sand on clay are in effect valuable manures. All manures may be divided into three prominent divisions: *animal*, *vegetable* and *mineral*, according to their origin.

ANIMAL MANURES. The flesh, blood, hair, wool, hoofs and horns of animals are composed of nearly the same chemical elements, and

in nearly the same proportion. Of these, carbon and nitrogen form about three-fourths. Manures of this class act powerfully on the soil, especially flesh and blood, as they decompose readily. They render back to the soil whence they derived it, more fertilizing matters than any other manure of the same bulk. This would be quite as true of the bones as of the flesh of animals, if it were as easy to secure their ready decomposition. About one-third part of the weight of *bones* is animal matter. Of the residue, more than sixty per cent. is carbonate and phosphate of lime. When we consider how small is the supply of lime in many soils, and that phosphoric acid is liable to be still scarcer, it is not strange that soils become impoverished that have nourished up succeeding generations of stock from fifty to one hundred years, without receiving back the flesh of one animal. And if, perchance, a carcass has been returned, it has not been in the place needed, nor in a form to be available for use.

England buys bones, America sells them. England is increasing the average of her crops per acre, America is rapidly lessening hers. By far the greater part of all the bones produced from the soil of this country are at present wasted. Every ton of good hay is calculated to contain sixteen pounds of bone making matter. Young animals arrest most of this, and it is lost to the soil forever. Cows giving milk demand a constant supply of phosphate of lime, much of which is necessarily lost to the soil. Bones are found to act most powerfully on such crops as contain most of the bony matter, showing inferentially that the soil was deficient in this matter. Unlike the flesh of animals this action will last for years in consequence of slow decomposition, and the small, though not the less necessary amount required. Johnston estimates that two hundred and sixty pounds of ground bone per acre will last through four rotations of crops of four years each. Pastures, now wofully neglected, could not fail to be greatly benefitted by sowing bone-dust upon them. *Night soil*, more than nine-tenths of which, in this country, is worse than wasted, is, when properly prepared, a valuable fertilizer. It should be increased in quantity, at least ten-fold, with some good deodorizer, such as plaster, coal-dust, muck, or even turf and soil for part, and then well covered. This manure has sometimes been deemed too rich for root crops, but nothing makes sweeter corn or more of it.

The excrements of horned cattle form a larger amount of fertiliz-

ing matter than all other kinds now used in this country, and should be, and perhaps is best understood and appreciated of any; though even here waste is written everywhere—upon the dung-hill, in the yard, in the street, and about the buildings. On most farms there is some show of saving the bulk in some form, though often robbed of half its value. Solid and liquid should be combined with muck or soil of some kind, so as to preserve fully the value of both, and improve the mechanical condition for immediate use. When thus applied to the soil its action is both efficient and durable, though not so quick as some other kinds more warm and gaseous in their nature. Horse manure is of this kind, and it is in consequence more extensively injured in its value than the other. It heats at once unless water is applied freely, and in a few days loses half or more its value. This requires, even more than the other, to be well mixed with soil, or something to fix the gases and retard decomposition and waste. It is peculiarly adapted to heavy, cold soils, such as clay; while that of cattle is better suited to light, warm land, such as slate or sand. In such soils manures are decomposed in half the time required in clay soil. They also allow the best portions to go down below the reach of plants so that comparatively slow decomposition is a valuable quality in manure for such soil. Hog manure is still colder than that of cattle, and hence is not fit for wet and cold soil, but should be mixed with that which is warmer to insure its full value. The value of this manure is very much affected, as is that of other stock, by the abundance and quality of the food given. Grain fed freely to hogs yields rich and highly productive manure, and it is nearer to its original value or power to reproduce itself, than when fed so sparingly as just to sustain animal life. Poorer materials, such as grass, when digested by the hog, yields no better manure than when supplied to other animals, so that, in our opinion, a large number of hogs on a farm will enrich that farm according as they draw from the granary or the purse of the farmer.

The manure of all animals is affected by a variety of other causes besides the quantity and quality of the food, such as the age of the animal, whether exhausting the food of the bony or other parts forming the growing body; by labor, producing a great demand to supply the waste of the system, by giving milk or its equivalent in

sustaining the growing young, by exposure to cold, producing waste often greater than that caused by hard labor.

Hen Manure. The fowls of the farm may be made to contribute largely to its fertility. Their manure is particularly rich in amonia and the phosphates, and should be preserved with the greatest care. In all old countries this is well understood. Fowls pick up the richest food, such as grain and other seeds, little worms, insects, bits of old bone, lime and gravel, of which they excrete together liquid and solid, animal, mineral and vegetable. Fowls draw less on the phosphates than other animals for their own support, as they have a lighter bony system; they waste less from perspiration and combustion to supply animal heat. These are among the reasons which show the exceeding great value of this manure. One bushel of this, well pulverized and mixed with a bushel of plaster, will give more growth to root crops than a cart load of old yard manure. *Guano*, being composed largely of the excrements of sea-fowls, has great value, and for like reasons this may be bought to advantage, in addition to the home supply, but not to its neglect; it is none the better for being dear bought and far fetched, at least, plants do not know the difference. Decomposed *night soil*, deprived of half its value, is sold in some of our *cities* for a great price, to be carried to the country, under the savory name of *Poudrette*. No one can afford to buy it until he has taken care not to let that which is better on his own premises go to waste. The farmer can secure the deodorization if he chooses, not by expelling the gases, but by fixing them with the free use of muck, with plaster, coal-dust, saw-dust and chip manure.*

VEGETABLE MANURE. Organic vegetable matter constitutes by far the largest part of manures in use. The form in which this is used, whether green or dry, fermented or not, has a great effect upon its fertilizing character. The green and the fermented act more promptly than the dry; but the dry continues its beneficial

*A recent analysis of the poudrette, sold by the Lodi Company, New York, made by Prof. S. W. Johnson of Yale College, shows that four hundred pounds of ordinary yard or stable manure, possesses fertilizing power equal to a barrel of the poudrette, and so long as the farmer can buy or make four hundred pounds of good stable manure for $1,50 (the price of a barrel in New York,) it is cheaper than to buy poudrette. [ED.

effect longer. The condition of the soil, whether loose or compact, warm or cold, and the character of the crop must determine the form. New and strawy yard manures may be plowed under for a grain or grass crop to good advantage, as they will decompose fast enough for the wants of the succeeding grain and grass crops. This is true when applied to potatoes; but for root or corn crops this manure should be fermented by being heaped up with alternate layers of horse manure or an occasional layer of *unleached ashes;* the whole made sufficiently wet at the time, two or three times, some four days apart afterwards, the pile should be wet to prevent fire-fang. Muck, chip manure or soil should form alternate layers, especially when ashes or lime are used for hastening fermentation. Hog manure, and anything about the premises, or straw, may go to advantage into the heap. The whole should be raised up from the ground so as to allow the air to circulate freely under it. This may be done by laying down cedar rails about four feet apart one way, and covering them the other way by rails, or something else, close enough to hold the coarser manure. The advantages secured by some such method are many. There is no loss of interest or strength as when the manure lays over till the next year to rot, as is the common practice. The worms are all killed in whatever state of advancement they may be, and seeds of weeds are also killed. Other manures, too good or too poor, too dry or too cold, are thus well disposed of, and the supply greatly enlarged, and the whole brought to the best state for early use on all soils and for all crops.

Green Manures. The advantages and disadvantages of raising crops for the purpose of plowing them in, when nearly full grown, we cannot discuss at length here, but will simply remark, that it is an ancient method and by some highly prized, though we think that the reason given in favor of it, by some writers, Johnston, for example, will not all bear investigation. Though it may improve the mechanical condition of heavy soils, care must be taken that they contain potash or lime sufficient to neutralize the acid resulting from so rapid decomposition of such a mass of green matter, on account of which, some soils are much injured for immediate use unless restored by lime or ashes. Such, at least, is sometimes the result, whether we have given the right cause or not.

Turning under the sod, especially when covered with grass, is

another example of this kind of manure, but is not obnoxious to the same objection, as it decomposes more slowly, and in practice is found to be uniformly of great value, too great to be, by so many, almost entirely disregarded. A good turf is worth at least *twenty cords* of good manure to the acre, and cannot be spared from the soil without damage, in exchange, for that amount, if, indeed, on any terms. Its power is both mineral and mechanical, and he who uses up the soil by more than two years of cultivation, and expects his land to hold out well for grass, will find out his mistake, if he tries long enough, at his own cost. This is one great source of exhaustion from which so many run away, and others are too poor to run.

Swamp Muck is of greater or less value, according to the amount of vegetable matter it contains. That formed in part of decayed leaves and timber of hard wood, is much more substantial than that composed of waste from soft wood. There is more acid in the latter than in the former, though there is too much in any to allow of its being used to much advantage on most soils, until it has been exposed to the action of air, heat and frost, or had its acid neutralized with lime, ashes or other alkaline substance. The use of muck has increased one hundred fold, within ten years, and now its value has come to be generally admitted, though but few farmers, if any, have tested it with sufficient accuracy to enable them to give its exact value, even for a single crop for any one kind or condition of soil. This accurate knowledge would be of great value to enable him to determine how much outlay to make in procuring and applying it; and it would also give him the satisfaction of laboring understandingly and with reasonable hope of reward. It may be said, however, with safety, that muck adds warmth to light colored soils, by disposing them to absorb more of the sun's heat—that it loosens soils too hard and compact, such as clay—that it makes sandy soils more retentive of moisture—that it yields organic matter where that is not abundant, and it is a valuable absorbent of gases anywhere.

MINERAL MANURES. Though this branch of the subject covers a large number of articles, we shall name but three, and those the most commonly in use, namely—*plaster*, *ashes* and *lime*. A few remarks upon each of these in the order named, must close this hasty and very imperfect essay.

Plaster, chemically termed sulphate of lime, is composed chiefly of lime and sulphuric acid. It has been in use as a fertilizer for a long time, and has been applied on all kinds of crops and on all kinds of soils, but by no means with uniform effect. Sometimes the effect has been surprising, at others not appreciable. The cause of this is still nearly as much a mystery now as it was a century ago. Many things are *conjectured*, but few known, about its action. It is known to be sparingly soluble in water, and consequently furnishes lime and sulphur whenever they are needed, and in a form ready for the use of plants. Experience proves that plaster is most useful to such plants as draw largely on these elements of the soil. But as some soils have an abundance, and some crops require but little of these, it ought not to be expected that plaster would act uniformly on all soils and all crops. It is found to absorb ammonia freely, though not as freely as charcoal, and as that useful gas is liable to escape from the soil when vegetable or animal matter is decaying, plaster arrests the fugitive and holds it to be conveyed back again to the soil. It is supposed to absorb ammonia from the atmosphere. Plaster acts favorably on mossy grass fields or pastures, removing the moss, and stimulating the growth of grass, especially clover. It is often asked whether plaster is exhaustive to the soil. There is a sense in which all manures may be considered exhaustive, for they stimulate the growth of plants, and these plants draw from the soil such elements as they require, not found in the manure, and so far are necessarily exhausting. It follows that the manure which comes nearest to supplying all the food the crop requires, is the least exhausting. That which decomposes slowly so as to last for years may leave an equivalent, or more than an equivalent, or it may supply all but such elements as are abundant in the soil, such as silica, so that the soil is actually, for all practical purposes, left as much richer as there remains of unappropriated manure. As plaster contains but two elements, it may stimulate the growth of the crops so as to hasten the period when some of the more sparingly diffused but important elements will fail and will have to be supplied by some appropriate manure. It is on this account, in part, that manures should be *combined* as much as possible, unless the particular want of the soil is known, when some special manure just meeting the demand may be the most advantageous.

Wood Ashes. "The ashes of wood contain various properties of several different minerals and salts, *all* of which are *necessary* to the growth of plants. The following table presents an analysis of the ashes of red beech and oak by Sprengel:

	Red Beech.	Oak.
Silica, . .	5,52	26,95
Alumnia, . .	2,33	0,00
Oxide of Iron, .	3,77	8,14
Lime, . .	25,00	17,38
Oxide of Manganese, .	3,85	0,00
Potash, . .	22,11	16,20
Magnesia, . .	5,00	1,44
Soda, . .	3,32	6,37
Sulphuric acid, .	7,64	3,36
Phosphoric acid, .	5,62	1,92
Chlorine, . .	1,84	2,41
Carbonic acid,	14,00	15,47
	100	100

It will be seen by this table, that one kind of ashes is richer in one element and another in another. The value of each must be estimated accordingly. The ashes of the oak and beech both contain more lime than potash, and would therefore be as efficacious on a soil deficient in lime as on one deficient in potash. Upon a soil abounding in potash, it is the lime or some other element, or several others contained in ashes, or something absorbed by them,—all of which are valuable, and must be supplied if not in the soil,—that produces the marked effect sometimes seen where leached ashes have been used. It is not at all strange that leached ashes, having lost but one element in twelve, and that forming but about one-fifth of their weight, should be deemed by some as good as when unleached, for some kinds are richer in materials most likely to be deficient in the soil, far richer than others, so as to make up and more than make up for the loss of potash, unless that article should chance to be very deficient.

In the example given, the excess of silica in the oak over the beech is more than one-twentieth of the weight; and silica, though useful, is superabundant in nearly all soils, and so may be set down

as the only valueless part of ashes. This comparatively worthless one-fifth, is made up in the beech ashes by their containing about four times as much magnesia as the oak, more than twice as much sulphuric acid, about three times as much phosphoric acid, and eight per cent. more lime—all ingredients of as great value and prime necessity as potash, and almost all of them less likely to abound. But this does not prove that ashes for all soils are as *good*, *leached* as *unleached*. Nor can that be true so long as part is not equal to the whole. Ashes are better manure for some kinds of crops than for others. They are of great value in all compost heaps. Johnston says that only about *one-fifteenth part* of the weight of ashes is immediately soluble, (this cannot be true of unleached ashes,) consequently they last for a number of years; while plaster is considered to lose its power in about three years, and saline manures in much less time.

Lime enters, to a greater or less extent, into the composition or all vegetable organisms, and forms the principal part of the bones of animals. Though generally diffused in the mineral kingdom, often very abundant, it is not always in sufficient abundance to supply all which may be needed. It may be exhausted from the soil so as to indicate barrenness, where fertility might otherwise perform her wonted labor. Johnston assumes that one per cent. of lime is necessary to meet the demand of cultivation, but in the analysis of the Ohio river fertile soil, to which we referred, lime formed but about half of one per cent., while in the example of poor soil it forms but one-hundredth. Allowing half of one per cent. as indispensable, it would require more than one hundred and fifty bushels of slacked lime to the acre, to supply that amount to the depth of six inches where lime is entirely wanting, though a much less quantity might make up a partial deficiency. The quantity necessary must depend upon a variety of circumstances, which can only be judged of by the discreet and intelligent farmer. Some crops require much more than others. Stiff clay soil, or any others abounding in vegetable matter, require more than light sandy soil. It is generally thought to be economy to apply small quantities of lime often, rather than large quantities at distant periods. Loss of interest would be something, besides it might descend into the soil too deep to be reached by the roots of most plants. To bring up such fugitives has been thought to be one of the benefits of clover. Lime has been prized

less as a manure than it should be, from its very gradual and slow action, as it dissolves so slowly that it is thought to hold its effects from ten to thirty years; but it is important to keep it near the surface. Plaster often produces its most marked results from the lime it supplies, more readily, in proper form for use, to plants, than lime itself, as it is more readily soluble. Lime, besides forming a part of all plants, has great value as a solvent to other useful elements, and as a neutralizer of acids otherwise hurtful to vegetation. It hastens the decomposition of other manures, and other vegetable matters in the soil, and for this reason it should never be mixed with manure alone, although it is almost indispensable in compost.

But we will not pursue further the details of this important mineral fertilizer, as we have extended this crude essay beyond our intended limits; and in conclusion will only say, that we hope the attention now being turned to agriculture as a science, and as an art, will in time bring light out of darkness, order out of confusion, and certainty out of conjecture.

Comparative Value of Roots for Cattle and Hogs.

By Hiram Stevens, Fort Fairfield

In investigating the comparative value of roots for cattle and hogs, I find a broad field of labor, and am utterly unable, with the limited means of information at command to do the subject justice. I find a great difference of opinion as to the comparative value of the root crop.

One writer says, when hay is worth $15 per ton, carrots are worth thirty cents per bushel, beets and turnips some less;

Another says, that carrots are worth more than English hay, pound for pound.

Another says, that carrots and beets are considered to be worth as much per ton as English hay.

Another says, that eighty bushels of rutabagas, or fifty bushels of carrots are equal to a ton of hay, which, allowing sixty pounds to the bushel, would give something over two pounds of rutabagas, or one and one-half pounds of carrots equal to one pound of hay.

A farmer of some note says, that a bushel of rutabagas, cut fine

and fed at the rate of two quarts a day to a calf, or four quarts for a yearling, is of more value than half a bushel of oats.

From my own experience in feeding rutabagas, I am satisfied that one peck of them, cut fine and fed to a grown animal, with a plenty of straw, is equal in value to the usual daily allowance of good hay.

A gentleman, in conversation upon this subject, says, he has practiced feeding his horse with one peck of carrots and one peck of oats per day, and finds that he is healthier and will perform more labor than when fed with half a bushel of oats per day.

At a recent meeting of the Oxford (England,) Farmers' Club, the question for discussion was, "The money value to the farmers of a ton of roots: Swedes, turnips, or mangold wurtzel." A resolution was passed, declaring it the opinion of the Club, "That 7s. is the value of a ton of Swedes, 5s. of white turnips, and 8s. of mangolds.

A writer in the Connecticut State Agricultural Transactions, gives, from "a careful experience in winter feeding of milch cows," his judgment of the comparative value of roots. Carrots promote the richest milk; sugar beets are next best; potatoes follow, and turnips class last in the product as to quality, but first as to quantity. They were compared as fed pound for pound. Carrots, he thinks best for small families, where they desire but a small quantity of milk, but of richest quality, and a fat, sleek-looking cow. Turnips are the best for those who sell milk, and desire to produce the greatest quantity.

By reports of those that have grown roots for several years past, I find the average cost of raising

One bushel of carrots to be 11 cents.
" " beets, " 12½ "
" " rutabagas, 8 "
" " potatoes, " 17½ "

It also appears that there is, from year to year, a decrease in the cost of production. If we may rely upon these reports, the last five years have lessened the cost of production more than 33⅓ per cent. This is owing, in part, to the application of science to agriculture, but mainly to an increased demand for the root crop as food for cattle, and the consequent use of improved implements in their culture,

and there is but little reason to doubt that the future will be as rich in all that has tended to lessen the cost of production as the past.

The following article from the Maine Farmer appears to be to the point. In answer to inquiries the editor says:

"It is a great object to the farmers of Maine to raise a supply of the best kinds of fodder for their stock during the winter. Hay, we all know, is the great dependence—the staple material for this purpose, but there are many other crops which can be raised to advantage among us, and which are very valuable for furnishing food to stock, and thereby saving hay.

In order to ascertain the real value of these crops for the purpose above named, it will be necessary to compare the nutritive properties of the several articles with good hay as the standard.

Experiments, and close and careful comparison of the results of many trials, have given the following as the comparative difference between the articles mentioned and good hay. We have published these results before, but we now put them in tabular form, so as to give the reader an easier mode of comparing them.

100 lbs. of hay are equal to	100 lbs. of hay are equal to
275 " of green Indian corn,	59 " of oats,
442 " of rye straw,	45 " peas or beans,
164 " oat straw,	64 " buckwheat,
153 " pea straw,	57 " Indian corn,
201 " raw potatoes,	68 " acorns,
175 " boiled potatoes,	105 " wheat bran,
339 " mangel wurtzel,	109 " rye bran,
504 " turnips,	167 " wheat, pea and oat chaff,
54 " rye,	179 " rye and barley chaff.
46 " wheat,	

From this "bird's eye view," it will be easy to calculate the *fodder* value of any of the above articles which you may raise. For instance, if you have five hundred and four pounds of turnips, they will give as much nutrition to your cattle as one hundred pounds of good hay, or in other words, it will take five pounds of turnips to be equal to one pound of hay.

An ox, it is said, requires two per cent. of hay per day if he does not work, and two and one half per cent. if he works. Suppose, therefore, you have an ox that weighs fifteen hundred pounds, he

will require thirty pounds of hay per day if he does not work. But you wish to feed him in part with turnips. If you give him fifteen pounds of hay, how many pounds of turnips must you give him to make up the supply? Answer. Seventy-five pounds, which, at sixty pounds to the bushel, will be five pecks.

Again: according to the table, a little more than half a pound of Indian corn is equal to a pound of hay. If, therefore, you give the same ox but fifteen pounds of hay, how much Indian corn must he have to supply the fifteen pounds? Answer. A little over eight and a half pounds. Allowing corn to weigh fifty pounds per bushel, it will take five quarts and a third.

Allowing the estimates in the table to be correct, they will be a convenient guide to farmers in feeding cattle, &c., on other articles, in order to save their hay.

A milch cow is said to require three per cent. of her weight per day. A sheep, full grown, three and a half per cent.

I find that eight hundred bushels of rutabagas, or six hundred bushels of carrots, is about the average crop per acre.

Now let us see how much fodder we have from one acre equal to good hay, as estimated by different individuals.

Allowing eighty bushels to be equal to a ton of hay, we have the value of ten tons of hay to the acre, to say nothing of the tops.

Allowing fifty bushels of carrots equal to one ton of hay, we have the value of twelve tons to the acre.

Allowing carrots to be worth as much as English hay, pound for pound, and allowing them to weigh sixty pounds to the bushel, we have the value of eighteen tons of hay to the acre.

It is generally admitted that the nutritive properties of most kinds of vegetables are due to the quantity and quality of the dry matter contained in them, as the water, although it may serve a useful purpose in filling the stomach, cannot fatten animals by itself, nor contribute directly to make flesh. Hence it follows that the fattening qualities of turnips, when used alone, must be small, as about ninety per cent. of their weight is water.

I am of opinion that the great advantage derived from roots when fed in small quantities in winter, arises from the aid they afford in the digestion of other food, together with their large amount of heat

forming elements, which appear to be required by stock fed on dry forage in cold weather.

I would not recommend to farmers to raise large quantities of roots and feed them lavishly to their stock, expecting to receive for every bushel of carrots fed to his horse, the value of a bushel of oats; nor for every bushel fed to neat stock, the value of sixty pounds of hay; nor for every bushel of rutabagas fed to cattle, the value of thirty pounds of hay.

If these results are realized, it will be by feeding in quantities sufficient only to secure good health; or, to winter an animal on straw and other coarse fodder equal to one fed on the best of English hay alone.

On Best Breeds of Sheep.

By William R. Flint, Anson.

The committee of the Board of Agriculture to whom was assigned the subject of the best breeds of sheep, ask leave to report:

That 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, Southdowns, Cotswolds, French, or any thing else,—possesses 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 the 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.

Perhaps after giving so decided a preference in favor of this

breed of sheep, it may be necessary to give some history of the animal since its first importation into this country. As early as 1808, and so down to 1823, quite a large number were imported from Spain into New England by wealthy enterprising men, and distributed considerably over the country—at which time the arts of cleansing and manufacturing the fine wools were but little understood. No machinery sufficiently nice was found to work it; hence the price was kept down to the maximum of other wools for a considerable time. The animal being but recently imported from the salubrious climate of Spain into our changeable cold climate, suffered in many instances in its health and general condition. This, with the numerous changes of our revenue laws, has had a tendency to discourage the propagation of fine-wooled sheep and brought us sadly in rear of the wants and necessities of our growing population, so that at the present time not one-third part of the demand for this article can be furnished by our own country. Time has produced changes; the animal has been acclimated and developed in form and proportion; has become hardy and robust in its nature, producing from six to twelve pounds of the finest clean wool to the fleece, worth from ten to fifteen cents more per pound than other wool. Our factories have been increased; machinery, at great cost, has been prepared for working the finest fabrics, and is now idle for want of the material in question.

Has not the time come when the farmers of Maine should enter with spirit into the wool-growing business, keeping a few less horses and many more fine-wooled sheep, and make our country independent of all other nations for wool and woolens, as it is in every other respect.

On Neat Stock.

By B. F. Leadbetter, Concord.

Perhaps none of the New England States presents greater facilities for raising neat stock than Maine. While her hills supply us with the best of pasturage, her valleys and plains afford abundance of the best quality of hay; and although it is said, and truly, that our winters are long and severe, yet it is believed that under ordinary

circumstances stock may be raised in Maine at average prices, and certainly at a great profit at such prices as stock has ranged at for the last five years. But it is believed, with the benefit to be derived from the improved breeds now among us, and the improved agriculture with which we are steadily progressing, that neat stock may be raised at a profit, even at much lower prices than we have received for the last five years. It is interesting to look back for thirty-five years, when most of our stock were natives, and contrast it with the present improved breeds, and note the difference between the small (though hardy) native, and the large, well-proportioned Durham or Hereford, as we now see them daily among us. There is a great difference between raising a calf at six months old at three dollars, or fifteen; between a yearling at seven dollars, or twenty-five; or between a yoke of five years old oxen at fifty dollars, or two hundred; and these higher prices for the improved breeds are of daily occurrence.

It is hardly to be supposed that any man will undertake to "farm it" without the aid of neat stock, and though there are doubtless many situations where the raising of sheep exclusively could be made profitable, yet I believe it is admitted that a mixed stock of cattle, sheep and horses would be generally more profitable to the farmer; and since the introduction of railroads into the State, so that every farmer can dispose of all his surplus stock at remunerative prices at his own door, it would not seem to require much argument to prove that the raising of neat stock is as profitable, to say the least, to the farmer, as any branch of industry that he can pursue. Under these circumstances, the inquiry naturally arises, what breed of stock is most profitable for the farmers of Maine?—and here we are met by almost as many differing opinions as there are breeds or grades in the State. Darius Forbes of South Paris, says: "My experience with the Herefords has been but limited; but from that experience, and what I can gather from others, and seen of them in other hands, I prefer them to all others, as being better adapted to the wants of the farmer on our soil and in our climate, than any other breed I know anything about." Again, speaking of the Durhams, he says: "To say nothing of the many bad points they exhibit to my eye, I find they are wanting in that hardiness and the power of appropriating their food, which will keep them

looking well with the ordinary feed produced from our farms, for stock. No matter how bountifully they may be fed with such food, their hair will look dull and lifeless—a staring coat and high bones will annoy a man of taste continually. This, I find, can be remedied only by feeding liberally with grain of some kind, and this must be done from calves."

Hiram Stevens of Aroostook, speaking of a cross of the Durham and Hereford, says: "This I look upon as being well adapted to this country, more so than the full blood Durham. I find them to be fair milkers, good workers, hardy, and fatten easily."

John F. Anderson, South Windham, speaking of North Devons, says: "I prefer them, as more hardy and hearty in feeding, earlier maturity, greater uniformity of color, size and shape, and better quality of milk than any, except the Alderney or Jersey cows, and better suited to the soil and climate of Maine."

Horatio Southgate, Scarborough, prefers grade Short Horns, as "more perfect in form, better development of muscles and quarters, rounder and longer in the barrel, shorter and more stocky in the legs and arms, and more gentle in temper, especially the cows, fatten more easily and on coarser food."

A. S. Bartlett of Norway, speaking of his Durham breed of cattle, says: "The size above other cattle, I consider a very desirable object. For workers, the oxen of this breed have no superiors."

I might quote many others, showing a great diversity of opinions as to the best breed of neat stock, but prefer to recommend that each farmer make this a matter of careful study for himself, and decide, in the light of all the knowledge he can obtain, as to what breed, or cross, or grade is best for him in his location and circumstances, and to *keep well* such as he does keep, believing that thus he will be sure to receive a "just recompense of reward."

On the Grasses of Maine.

By Samuel F. Perley, Naples.

S. L. Goodale, *Secretary*, &c.:

My Dear Sir:—When near the close of the last session, the "Grasses of Maine" were assigned to me as a subject upon which,

through you, to report to the Board during the present summer, it was my design to examine the subject thoroughly and critically, and to report at length. On a slight examination however, the subject opens so broad a field of research, and is of such commanding importance, that it deserves, as it seems to me, a much more extended examination and discussion than the limited time I can devote to it, and the limited space I could claim in your report will permit. I have therefore thought best, only, by a few statistics and considerations, to call the attention of the Board to the subject, and urge the necessity of its thorough examination by one more competent, and with the requisite facilities to do it justice.

According to the United States Census Report for 1850, the hay crop at that time stood fourth in value of the agricultural products of the country; corn, wheat and cotton exceeding it. If to the value of the hay crop were added the value of pasturage, the grass crop would then rank second only to Indian corn.

Maine, by the same authority, ranks fifth as a hay producing State; New York, Pennsylvania, Ohio and Vermont surpassing her. With a population less than one thirty-third, she harvests an eighteenth of all the hay crop of the country.

The grass crop of Maine, including hay, pasturage and seeds harvested, is more than double in value all the other field crops of the State, embracing corn, wheat, rye, oats, barley, buckwheat, beans, peas, hops and potatoes. The value of this crop in our State in 1850 was about $8,000,000; and now that another decade of years has almost expired, $10,000,000 would not be a high estimate.

Grass then is the great staple crop of Maine. Upon this she does, and must rely as her leading farm production. To this her soil and climate are adapted; and this interest should be fostered above all others. The best course of culture to produce it, the proper time and most economical method of harvesting are subjects of the utmost importance to the State, and to each individual farmer.

If only five per cent. of the value of the hay crop in Maine is annually lost by injudicious seeding, by harvesting at an improper time, or in an improper manner, the sum total would be some $500,000. A sum more than sufficient to endow an agricultural school, and establish a model farm in each county in the State. This sum annually lost from bad husbandry, resulting from want of a

thorough knowledge of the best ways and means to manage the crop, is a serious drain upon the resources and prosperity of the State, and deserves the careful consideration of the Board with a view to reform.

That such loss, as above named, does actually occur, may be fairly judged when we see and know that hundreds of tons are annually ruined, or greatly depreciated in value, by exposure to storms, and sudden showers while in process of curing. This may in great measure be avoided by the use of hay-caps; for it is no longer a problem unsolved whether they are of practical utility. Other hundreds of tons are left in the field till the bleached straw, and falling seeds make it evident, even to the careless passer-by, that its most valuable constituents as food for stock, albumen, gum, sugar, &c., have been assimmilated by the seed, or changed to woody fibre in the now almost worthless stems; and this from utter inability to harvest at the proper season. The more extensive introduction of the horse rake and mower on all grounds sufficiently smooth for their successful operation—and these grounds are much more extensive than farmers usually believe—and the human labor thus set free applied to the rougher portions, will very much lessen, or wholly avoid this unnecessary loss.

Again, many more tons might be harvested from the acres already occupied, at a comparatively trifling additional cost, and the value of the crop thus greatly enhanced, by the use of a greater variety, and in many cases a larger quantity of seed; and particularly by adapting the different varieties to the soils, and to the purposes, whether mowing or pasturage, for which they are best suited. Very few farmers in stocking their land, whether mowing or pasturage, use other varieties than herdsgrass, (Phleum Pratense,) and red clover, (Trifolium Pratense.) Different varieties are found by analysis to contain their constituent elements in very different proportions. One assimilates a larger amount of potash, another of lime, another of chlorine, another of phosphate, &c.; one derives its food largely from the earth, another from the air. Several varieties then, judiciously intermixed, may be grown together upon the same ground without robbing one another; producing at once a larger crop, and a better quality of hay; a mixture being always preferred to hay composed of a single variety. Precisely what this admixture

of seeds should be, the varieties and quantities best suited for pasturage or mowing, those best adapted to grow together, and to the various soils, as clay, loam, sand, gravel, &c., is a subject requiring careful observation and practical experience to determine.

New varieties also may be introduced, both native and foreign, and experiments instituted, testing by chemical analysis and by feeding to stock, the comparative value of each, and the best kinds brought more generally into use.

The time of harvesting, and best mode of curing, are subjects upon which there is a great diversity of opinion and practice. Some cut early, before the blossoms are full; others at full bloom; others when the seed is formed; while still another class delay till the seeds are nearly or quite ripe. Some dry to a crisp; others moderately; while others only wilt, pack away, and prevent mow-burning by excluding the air. All cannot be right, consequently some must suffer loss. How great that loss is cannot be precisely ascertained; and for this very reason it is winked out of sight and forgotten. But if, as some assert, half the value of hay may be wasted in curing, even when no damage accrues from exposure to storms, then surely, it is worthy of careful investigation.

The proper treatment of grass lands, both mowing and pasturage, is deserving of special attention. With most farmers, when once the ground has received what is called a fair preparation, by planting, hoeing, manuring, &c., and a certain allowance of seed—which means, generally, Timothy and clover—the only care is, annually, to take off the crop, till it will no longer pay for mowing and raking. If once in two or three years, on a lowery day, the boy has been sent round, bush-hook in hand, to disturb the bushes and brambles, that nestle in the corners and by the fences, it has been well cared for! And the pastures, half of them came into grass by chance, and by chance hardhacks, (*Spirea tomentosa*,) thistles, (*Cirsium*,) and brakes, (*Ferns*,) have supplanted the grass, and flourish without any to molest or make afraid. The question is seldom raised, with what shall I top-dress this or that pasture or field? and the top-dressing is seldom done. Shall I fall-feed this or that lot? is not asked, but the fall-feeding is almost always practiced. Now it is not too much to assert, that top-dressings of gypsum, ashes leached or unleached, powdered charcoal, lime, compost or well rotted ma-

nure, judiciously applied, at the right time, to the proper soils and varieties of grasses, and in right quantities, would, without great outlay, increase the hay crop in Maine twenty per cent. ($2,000,000) in five years.

Various other reasons equally cogent might be adduced in favor of a thorough, scientific and practical investigation of this subject, and of the necessity of a more general diffusion of intelligence in regard to it. But enough has already been said to call the attention of the Board to this paramount interest of the State. It only remains for me to make a single suggestion, viz., that the Board at its next annual meeting instruct their Secretary for 1859 to make the *grasses and forage plants of Maine* the leading topic of his report for that year. To the Board the farmers of Maine are looking for light, and upon no subject can suggestions for improvements be more valuable or acceptable than the one under consideration. Massachusetts has already preceded us in this work. With an interest proportionately much less than Maine, the Secretary of the Board of that State, C. L. Flint, Esq., has devoted one whole report to this subject. This report does credit to its author, and will do a vast amount of good wherever it may find a circulation. Let the farmers of Maine have a hand-book in which shall be compiled all that is, or may be known in regard to their most reliable and valuable crop.

On the Manufacture of Maple Sugar.

By F. L. Rice, Denmark.

The manufacture of sugar and syrup from the maple, having come to be a source of interest and income to a large portion of the farmers of Maine, it may be well to inquire if any improvement can be made in the *modus operandi* of preparing this most delicious and wholesome luxury. In the few suggestions I may make on this subject, I propose to confine myself principally to the evaporation or *boiling down* of the sap. This process has heretofore been mainly carried on by means of deep kettles, containing a large

amount of liquid, and consequently requiring a proportionate amount of heat, to keep them boiling, and at the same time affording only a limited surface for evaporation; whereas, every observing housewife knows, that, the superficial surface being the same, an equal or even greater amount of liquid can be evaporated in a given time from a shallow vessel than from a deep one. Now if instead of these deep, narrow kettles, we substitute broad, shallow pans, we reduce the quantity of liquid to be heated, and at the same time increase the surface from which to throw off vapor.

During the last sugar season, the writer, in company with several ladies and gentlemen of this vicinity, accepted an invitation to visit the sugar lot of Mr. Elbridge Harnden of East Fryeburg, whose hospitality and syrup defy competition; and who, whether he undertakes to build barns, clear up meadow lands, make sugar, or accomplish any other worthy object, is pretty sure to succeed, from the fact that he almost invariably starts in the right direction.

This lot is a low interval, beautifully situated on the east bank of the Saco, and has been cleared of underbrush and nearly all of the larger growth except the maples, so that it is now a fine grass meadow, yielding annually a valuable crop of hay. The trees from which Mr. Harnden operates, are of the variety known in this locality as the "interval maple," which being of majestic form and stately growth, renders the scenery both grand and sublime; altogether, it was, at the time we visited it, a delightfully *sweet* spot. I went with Mr. Harnden to examine a building in process of construction, designed exclusively for a sugar-house. This building was erected on the margin of the highland, for the twofold purpose of escaping the inundation, to which this interval is subject, and also to obtain a site better suited to the purposes of the builder.

On a surface inclined at an angle of some five or six degrees, he has excavated to the depth of three feet, or sufficiently to give a horizontal base, built up with granite to a little above the excavation, and completed the building with wood. It will be seen that on that side of the building where the ground is lowest, we can enter on a level with the interior, while on the opposite side the ground is some three feet higher. At this highest point, and on the outside of the building, arrangements are to be made for the reception of a cask containing the sap to be boiled, which is to be con-

vey el to the interior, through a pipe, the draught to be regulated by a faucet.

The pans for boiling are best constructed of sheet iron, by bending up the sides and ends, or they may be made by turning up the sides, and inserting ends of wood, which last are said to be quite as durable, and somewhat cheaper.

The supports for these pans are to be of brick masonry, constructed somewhat after the manner of common arch boilers; may be from four to eight feet in length or to compare with the intended capacity of the pans. They should be supplied with suitable arch mouths for the reception of fuel, and flues to carry off the smoke and vapor.

Now, suppose the pans are all filled and boiling, and at the same time a small draught from the cask on the outside of the building is suffered to discharge into the boiling mass, the influx to be graduated to compare with the evaporation. The small quantity of cold liquid required to supply the demand for evaporation in the boiling pan, serves to keep in check the ebullition though the liquid continues to boil, and that too, with only a moderate degree of heat.

It will be seen that with the above arrangements we can fill our pans, regulate the draught, and reduce the whole to syrup, with no other labor than supplying fuel for the fires; and experiments fully prove that with this apparatus a saving of fifty per cent. of time and fuel can be effected, while at the same time a superior article of syrup or a better grade of sugar is obtained than by the ordinary process of boiling in kettles.

Buckets for catching the sap are best made of pine staves, in form the frustum of a cone, bound with wooden hoops in preference to iron, and to contain about two gallons. Mr. Harnden, above alluded to, collects his sap in a hogshead on a light frame sled with wide runners, drawn by a single ox. This method is undoubtedly preferable, at this season of the year, to using two oxen yoked together.

When syrup is to be reduced to sugar, it may be clarified in the following manner: When cool, strain through a clean woolen flannel. To thirty gallons of syrup, add two beaten eggs and about a pint of new milk. Place the whole over a slow fire, and boil moderately till the work is accomplished, observing to remove all scum from the surface as fast as it rises.

On Grapes for Open Culture.

By Albert Noyes, Bangor.

Grape growing in the open air is yet in its infancy, comparatively speaking, in Maine, and successfully practised by only a few; but for the past two or three years many, by visiting our horticultural exhibitions, have become convinced that some things can be done as well as others, and have resolved that they will, some day, sit under their own vine, and are accordingly taking the rudimental steps.

But few varieties have as yet been much cultivated save by the enthusiastic pomologist and amatuer, and more by way of experiment than otherwise. Several of the varieties which have recently been brought to notice are of good promise, such as the Diana, Hartford Prolific, Blood's Seedlings, Northern Muscadine, and more recently the Logan, Rebecca and Delaware. The latter has fruited the past season in the grounds of our Secretary, S. L. Goodale, at Saco. He writes me that the vines are too young to do justice to the variety; yet the bunches and berries were larger than the samples from Ohio, its native State, which I had the pleasure of exhibiting at the late State Fair. The vines of this variety, and the same may be said of others, are slow growers at first, but after getting established in a *good* soil, (and no vine should ever be planted in any other,) they grow rapidly and are early and prolific bearers.

The Concord, in and around Bangor, does not come up to the encomiums passed upon it by its sanguine friends. In my grounds it is later than the Isabella—which the past cold season nearly matured its fruit—while the former has never yet near ripened a berry.*

Diana proves a most superior grape, not quite so hardy as some others, but in every other respect fully sustaining its reputation elsewhere. In richness and delicacy of flavor far surpassing several others of higher repute and is well worthy of extensive planting in sheltered situations.

[*This is likely owing to Mr. Noyes' vine being younger and weaker than the vines of Isabella, as on vines of equal age and strength, side by side, in various places in the State it has usually proved a week earlier, and in some cases ten to fifteen days earlier. At Saco the Concord was better the past season, unfavorable as it was, than before, and as the vines gain in strength doubtless the fruit will improve in quality and earliness. —Ed.]

I have been unable to learn that the Rebecca has yet matured fruit in the State, but from all the facts which I can gather and from my own observations as to hardiness and the testing of samples received from Hudson, N. Y., it bids fair to eclipse the older sorts.

Now when we can raise such luscious grapes as the Delaware, Rebecca, Diana, Hartford Prolific, &c., natives of our own American soil, I think we need not seek far fetched foreign varieties, but may well be contented.

The grape is a rank feeder, and it is of importance that its food should be well *cooked* and *masticated*, in other words, the soil should be deep and well pulverized and thoroughly incorporated with a liberal supply of manures previous to planting, as it will be found difficult to do it afterwards without injury to the roots.*

The after culture is also of importance, and it is found that mulching is advantageously applied to the surface in the spring in the form of stable manures, to lay until fall, and then to be lightly forked under, and again supplied with a fresh coating, to lay until spring and then served in like manner, and so on, alternately, spring and fall. And a weekly application of liquids, guano water, soap-suds, or refuse slops will be found highly beneficial and well repay the trouble.

Now that we have such a number of known to be good and hardy varieties, and so easy of cultivation, and as yet so free from blight, mildew or any other enemy to prey upon them, why may we not be a grape growing people? Let each one who has a suitable spot of ground, (and who has not?) resolve at once to plant a vine and determine to take care of it afterwards; and when the rich and luscious clusters tempt the palate, let himself and *his children* partake freely of the health-giving fruit, and a marked difference at no very distant day, will be found in the health of our households, and posterity will bless us.

[*A deeply pulverized, *warm, dry* and *good* soil is indispensible; but heavy manuring as often practiced is believed to be objectionable in our climate from its tendency to cause rank and late growth of wood which does not ripen sufficiently, and by retarding the ripening of the fruit. With the soil above named, an annual top dressing of compost is deemed sufficient.—Ed.]

On Road Making.

By Robert Martin, West Danville.

The Committee on Road Making submit their views with diffidence, not having had sufficient experience to do the subject justice. Its great importance is evident from the fact that, on an average, not less than $2,000 is expended annually in each town for making and repairing roads, making an annual expenditure of about $1,000,000.

To make a good road on level land, or nearly so, we suggest to clear the ground as low as you would have the water-level, of all stones, roots, logs and sticks, then commence plowing in the centre and turn a back furrow, the second about in the same place of the first, so that all may be plowed so shoal that the next or second furrow may be one inch or more deeper than the first, and so on, each furrow deeper than the last, to the outside of the travel, and let this plowed surface remain. Outside of this portion, sink the ditches, by plowing and carting on to the traveled part of the road, six to eighteen inches deeper than the bottom of the last furrow which was to remain—the depth of the ditches depending much upon the quality of the soil.

To make a road on side-hill. Commence plowing in the centre; plow the upper side and throw over to the lower side till level or nearly so; then commence plowing as in the first case; plow in the same way and width. If the ground descends sufficiently, take all the dirt from the upper side to make the road of proper height in the centre, descending each way enough to permit the water to pass off readily; always remembering to prepare for the water to pass away from the ditches either by causeway or side outlets.

To make a road over a wet, muddy soil. Commence plowing in the centre, as before; after plowing, throw from the ditches to the centre a sufficient quantity to raise the middle one foot more than the outside of the travel; on this spread small bushes, the tops outward each way from the centre; on these bushes, throw from the sides or cart on, till the centre is from four to six feet higher than the bottom of the ditches—the last covering to be of sand or gravel, if to be had.

To make a road over quagmire. Plow as before, and sink the ditches deeper and raise the middle higher. Also, make the road

as narrow as will be safe and convenient. If from ledge or other obstruction the ditches cannot be sunk to a proper depth, very frequent cross-drains or causeways must be put in.

Always cover causeways with stone if to be had within five miles.

When it is absolutely necessary to cover a stream with wood, in all cases ascertain how narrow a space will discharge the water with safety, and extend the covering no further.

To build road over hilly land. Plow the low portions as before, and let it remain; then plow the hill and cart down upon the low surface which has been plowed.

On long and gentle descents where the water is likely to follow the horse or carriage track in the centre, and cause the road to gully badly, a cheap remedy is to erect bars from two to four inches high, descending outward each way from the centre, on an angle of forty-five degrees.

Another very good protection for such a piece of road is to sink the bars into the road and carefully place small stones of about equal size on the bottom for the water to pass out upon. In all cases of road-making and repairing, remove from the high to the low places and make the surface smooth.

Perhaps some may ask why we are so particular to have each furrow in plowing the bottom of a road deeper than the last. We answer, when water falls upon the surface of the earth it descends to what is termed a waterlevel, and it is not unfrequently the case that the waterlevel is more uneven than the surface; and the object of plowing and throwing up roads is to create to a certain extent an artificial waterlevel, so that the water which does not pass off into the ditch on the surface, but descends into the road, when it comes to the bottom of the plowed portion will find an artificial waterlevel, and easily pass out from the centre to the ditch each way.

We close by expressing the wish that the suggestions here offered will call out those whose talents and experience enable them to treat the subject as its importance demands.

A discussion held at the last session of the Board of Agriculture, on drainage and flowage, noticed on pages 36, 37, led, as will be seen by reference to the appointment of a committee to investigate the subject and to report thereon. Mr. Barnes, although not a member of the Board, cheerfully consented to serve upon this committee, and has furnished for publication the valuable paper given below.

On Drainage and Flowage.

By Phinehas Barnes, Esq., Portland.

Upon that branch of the subject referred to the committee, which relates to the drainage of meadows and the recovery of swamp lands, for general cultivation or for grazing, it is hardly necessary for the committee to go into any extended statements, showing its importance to the agricultural economy of the State.

It is sufficiently well known that in almost all parts of the State, there are large tracts of land of this description, containing elements of great fertility, but now almost wholly useless. Not unfrequently they are of many hundred acres extent in one body.

There may be some differences of statement in regard to the special importance of grazing, and the value of the hay crop to the farmers of Maine, but nearly all will agree upon the proposition, that our agricultural prosperity depends, very greatly, upon our ability to sustain the domestic animals in large numbers and in good condition.

The geology of the settled parts of the State being usually primitive, the natural soil of our uplands is not generally of great fertility. But into the valleys and level spaces, which we now call meadows and swamps, the wash of vegetable material and other fertilizing substances has been going on for ages, producing upon these tracts, together with the vegetable mould resulting from the growth and decay of plants upon their own surface, a soil, which, when drained and cleared, will yield the largest amount of forage crops at the least expense.

There are some districts or townships, where the proper recovery of the low lands within their limits, would double, and more than double, the value of the whole territory, and indefinitely increase

its power of sustaining the domestic animals and a prosperous agricultural population.

A judicious discrimination is to be observed, of course, in regard to the instances, where this improvement should be attempted.

Upon some of the meadow lands referred to, the present growth of wood and timber may be sufficiently valuable to make it improper to clear them at present. Some other low lands may be infested with pernicious mineral elements, so as to be unavailable for agriculture. In some cases, the vegetable mould may be too shallow to repay for any considerable expense in reclaiming them. There may possibly be cases—though it is believed they are few—wher from natural obstacles, such as the intervention of beds of rock, or the long distance necessary to reach a suitable outfall, low lands cannot be drained without exorbitant expense.

We confine our suggestions to the recognized cases, where the fertility and quantity of the meadow soil is ascertained to be sufficient to warrant some liberal enterprise of draining, and where there is no inducement to preserve the present forest growth.

The discussion of this subject at the last meeting of the Board of Agriculture, shows that the attention of some of the members was directed to the case of lands, which are thrown out of cultivation by the operation of the flowage laws. It is in some sense a misfortune, that when there is such a growing interest in regard to drainage, large and numerous tracts of lands are found to be flooded by force of positive statute law. In this conflict of interest and opinion on this subject, the advancing light of agricultural science is necessarily in favor of the land, rather than of the mill, and a new settlement of this question will some day be reached—an adjustment, which will permit neither of these interests to force the other, but provide a more equitable balance between them.

But upon much consideration of the present state of interests under the flowage laws, and of their history for many years, the committee respectfully advise against agitation of this question at the present time. It might excite against those improvements which are practicable and feasible, a hostility, which would overbalance the expected advantages of a change.

One single consideration, under this head, appears to be nearly decisive. Upon some of our streams and mill-reservoirs, the owners

of mills have purchased by deed, for full equivalents, the right to flow extensive tracts of land—obliged however, in cases where land owners were unwilling to sell, to resort to the privilege allowed them by the flowage laws. It is evident, then, if these laws should be essentially modified, that the land owners, who had not granted the right to flow, could compel the waters to be drawn off, and thus destroy the interests which had been purchased, and paid for, in fee. This would present great difficulties, both in legislation and in the judicial determination of rights.

In other cases, mill owners have acquired prescriptive rights to flow, and it does not appear that lands so flowed, could be reclaimed, even if the statutes for flowage were wholly repealed.

It is to be observed also, that where flowage rights are really valuable and productive, they have tended to build up manufacturing villages and towns, which are the best markets for the agricultural products of the vicinity. There is a compensation, therefore, in the matter—a gain as well as a loss—when all the mutual interests are considered.

The committee feel obliged, therefore, to dismiss this part of the subject—reserving only a single suggestion to be brought forward, in another part of this paper.

Recurring then, to the case of lands, where only the ordinary natural obstacles to drainage exist, these lands may occur in small parcels, perhaps belonging to a single proprietor, but requiring to be drained through the land of another, who refuses consent. Such cases are, probably, not beyond the reach of legislation, yet the committee would not advise resort to statutory enactments for relief. The danger of strife between individuals and neighbors would be too great.

But where meadow and swamp lands, suitable for drainage occur in large bodies, resort must be had to some special means, of accomplishing the object, beyond the mere consent of adjacent land owners; and although in the principle of the thing this case is not different from the former, yet the magnitude of the enterprise, while it might better justify legislation, if legislation be necessary, also affords the potent element of combined self-interest, which may accomplish the object, by voluntary action. The impulses, both of public spirit, and of private gain, being awakened among intelligent land owners and

others, with reference to such an improvement, can effect this purpose, in the majority of cases, without any new legislation.

The committee seek to recommend such methods as will secure and confirm the necessary legal rights, consistently with our general system of land titles, and in a manner, that shall give permanence to the improvement, and secure its benefit, as far as practicable, to those who contribute the means.

It is easy to suggest a general statute, similar to the flowage laws, authorizing the drainage of such lands by cutting channels or removing obstructions in the lands of other proprietors. To such legislation there is no essential objection, upon legal principles. Precisely such a statute exists in Massachusetts, in her revised code, founded upon an earlier law passed in 1796, and this resting upon a Provincial statute passed in 1702. The preamble to this old statute of Queen Anne, is quaint, but significant and comprehensive:

"Whereas great quantities of meadows and low grounds, belonging to sundry persons in several towns, are spoiled by the overflowing of rivers, brooks and waters occasioned by banks and stoppages in their courses, which by industry may be removed to the benefit and profit of their owners, and also much meadow and pasture ground might be gained out of swamps and other rough and unprofitable grounds, by drowning and draining the same. To the intent, therefore, that the owners of such lands and meadows may be encouraged and enabled to remove such obstructions as occasion such overflows, and to dam and flow their swamps and other grounds, and thereby bring them to meadow and pasture, that they may be made profitable to them,—

SECTION 1. Be it enacted by his excellency the Governor," &c.*

But the committee do not advise any present resort to such general laws. They would involve complicated and dilatory machinery of legal proceedings, if we may judge from the nature of the case, and from the terms of the statute now in force in Massachusetts. It requires the union of at least a majority of proprietors, the appointment of commissioners by a court of law, provision for the cases of leasehold titles, and mortgages, the assessment of expenses

*It is worthy of notice that this *drainage* law, was twelve years anterior to the first *flowage* law, which dates from 1714.

in proportion to the benefits received, payment of compensation to parties suffering damage, an appeal from the commissioners to the court, and exceptions upon law to the court of last resort. In the present state of public sentiment among us, such a statute might induce litigation of a disastrous character, alike fatal to the peace of an agricultural community, and to the success of a good enterprise.

The committee prefer the method of voluntary action, resting upon enlightened estimation of the value of such works, upon motives of individual self-interest, and of public benefit to the whole communities in which such lands are situated, and especially upon the power to be derived from the skillful combination, and association of intelligence, of capital, and the activity of influential men.

Is it too much, or too strange to propose that associations should be formed in Maine, for *land-improvements*—that a corporation may be formed, as well to convert a swamp into grazing lands, as to clear a stream for driving logs?

A large part of our difficulty in subduing the soil, has arisen from the fact, that each farmer is obliged to work single-handed, with scanty capital, or none at all, and with little means of bringing capital to his aid.

To clear a meadow or swamp of some hundreds or thousands of acres, is to develop wealth of a known and certain character, now dormant and useless, buried under encumbrances, requiring a union of efforts and means for their removal. It is a speculation—in the best sense of the term,—whether of large profit to individual projectors or not, yet sure to be of the utmost advantage to the community, and to add largely to taxable property. And what is most material, the product of such an enterprise, unlike the result of many corporate projects, is a property, which can never be lost. If the land is thoroughly reclaimed and improved, it remains forever, subject to no destruction or decay.

Whether the association for such an undertaking should be merely the private agreement of a few persons, having sufficient spirit and means, or the incorporated union of a larger number, would be determined by the conditions and facilities of each case.

First of all,—after the purchase, or obtaining agreements for the purchase of as large a portion as practicable, of the lands to be improved,—a map should be prepared from careful surveys, exhibit-

ing the whole area of the sunken lands, with the adjacent watersheds, and outfalls, showing the course and size of all the streams, and all the special obstructions in their channels. With this map, also, there should be a carefully prepared profile of levels and slopes, from the highest point of the tract, to the lowest outfall required.

The parties will then be able to make approximate estimates of the cost of the proposed works. These estimates need not, at first, embrace the entire cost of the whole work, because in many cases, the primary outlays will develope such beneficial changes, that further estimates of cost can then be made, with much more certainty. There are many instances, where the labor of fifty men for a single month, would remove an immense body of stagnant water from an area of miles in extent,—cases, also, where that amount of labor, applied in drainage, would raise large portions of the tract, at once, out of water, and make them ready for the plow, as soon as the surface of the soil should be dried by evaporation.

Such maps and estimates being made, and submitted—if necessary—to free public inspection, if then the work is thought to require the associated means and credit of a considerable number of persons, the form of an incorporated joint stock company, with share capital and stockholders, is on many accounts the best.

We have long had a statutory provision for the creation of proprietaries for the management of common lands,—a method practicable for the present case, but open to some objections. It is judicially settled, that these proprietary lands are subject to partition, at any time. Such partition, even at the suit of a single proprietor, might defeat the whole movement. Such lands also descend, as real estate, to heirs, and are subject to dower, so that they are liable to be severed into small fractions and non-contributing interests.

A joint stock company would hold the title to the lands purchased, and direct the improvement as a single enterprise. Special acts of incorporation would readily be granted, or, a general law for the formation of such companies would be easy and familiar. The committee subjoin to this report a draft of such a law.

The lands purchased would be the joint stock and motive power of the enterprise, and should be large enough to promise a valuable return for the outlay, even though not embracing the whole tract,

from which the waters are to be removed. Some individual owners might refuse to sell, but a spirited company would have no difficulty in purchasing a sufficient body.

With a simple organization and simple rules, and a limited number of judicious and economical officers, such a company may enter upon these improvements with confidence, and proceed with celerity. Whether associates can be obtained, whether the stock can be taken up, are of course, primary questions. These will depend upon the particular facts of each case—upon the good judgment of the first projectors, and—in a great degree—upon the state of agricultural enlightenment, in any given locality. In some places, there will be light, energy and liberality—in others, there may be darkness and stagnation of ideas, more fatal than stagnant waters.*

With good plans, and fair elements of success, capital will be attracted to such enterprises, because they propose the actual production of wealth—the creation of fertile land, which as soon as recovered, will be sure to be in demand, for purchase or for rent.

A partial capital, at first, may be sufficient, in many cases—where, as before stated, the first outlay, will make such beneficial changes as to remove all hesitation, and portions of the common lands being made at once fit for use, may be sold and the proceeds applied to the further works.

Upon the practical methods of effecting drainage, the committee do not purpose to go into details. Each case will suggest its own method to practical men. Whether the drainage can be effected by merely widening and deepening outlet streams, or by straitening their whole course, whether ditches should be made around the entire margin of the whole tract, and across its whole area, or may be sufficient if confined to the area of the company's own land, whether the work of draining and of clearing the forest growth, if any, may be carried on at the same time, whether the standing wood and tim-

* In an agricultural community, debating the question of undertaking such an improvement, it is a consideration by no means to be overlooked, that a large part of the money cost of the work, will not be carried off, but will remain in the very community itself, which will furnish the *subsistence* of the laborers, who do the work. Upon this point, experienced railroad contractors give us the valuable fact, that a force of laboring men, engaged upon such works, in an average agricultural district, will leave behind them, for their subsistence—single men, not far from fifty per cent., and men with families, seventy-five per cent.—of all the wages they receive.

ber may be sold, or any of it, used for fencing, whether it may be expedient to burn the refuse material on the surface, lest the soil which has been recovered from water, should be destroyed by fire, whether the works should be done by contract, or by day labor,—these and other such questions, the several improvers will settle for themselves.

In some cases, also, the question will arise, whether, besides general drainage, the lands may not admit of being flooded at particular seasons of the year, by special contrivances, either for the direct effect of such flooding upon some kinds of natural grasses, or for the fertilizing sediments which may be deposited. The expedients necessary for such purpose could be managed and controlled by the same company.

In all cases, of course, these improvements may, more or less, affect or interfere with the lands of parties, who do not join in the enterprise. Their rights are, necessarily, to be regarded.

First, there may be persons, owning parts of the meadow or swamp lands in question, willing to give full consent to the acts of the improvers, but declining to join the enterprise, or make any contribution to it, expecting to enjoy its benefits without cost. Such a course is ungracious and provoking, and has often defeated most useful improvements, through the effect of a sort of counter-selfishness, inasmuch as men are unwilling to incur risks and advance money for the benefit of those, who will do nothing for themselves.

But if the actual improvers can obtain a sufficiently large body of the lands to make the object of value to themselves, it is submitted that they ought, on all grounds of high minded self interest and of public spirit, to go forward in the work without regard to this illiberal course of others. The public interest will be advanced, and posterity will be the gainers at any rate.

Secondly, it may be that the owners of some of these lands in question—or, what is of more consequence—the owners of lands lying below, through which the drainage must be carried out, may withhold their consent to the necessary excavations and alterations in the natural course of the streams.

The questions thus arising are of course fundamental, and lie at the very beginning of such enterprises.

Beyond any doubt whatever, the power of the Legislature extends

to such cases. Referring, however, to what we have before stated, of the inexpediency of resorting to general laws to remove such difficulties, we would only recommend, that if a really valuable enterprise is blocked by such obstacles, the promoters of it should apply for reasonable special enactment in each case, when they will show specifically the grounds of their enterprise, the detail of its facts, the "public use" which they expect to serve, the "exigency" which arises in their way, and thus obtain the needful authority, *and no more*, with due provision for compensation.

Such legislation rests upon common and familiar principles, and is similar to what is done is cases of booms, piers, river improvements and bridges. Within a few years, also, some such special statutes have been framed, to effect the drainage of quarries in our lime-rock districts—a precisely similar case to the one we have in view.

But the Committee earnestly recommend, and with well founded belief that success would follow the adoption of their advice, that in all cases, the promoters of land drainage, waiving to the very last, every resort to legislation, should adopt the policy of fair, open-handed, liberal *purchase* of the necessary rights to interfere with the lands of other persons.

If these rights can be purchased, they should in every case be secured by written and recorded deed to the company and its assigns in suitable terms, so that not only may the requisite title be held by the company itself, but that, when the improved lands are conveyed to purchasers, the necessary easements and appurtenant privileges may be held by them and their assigns, free from any interference, and in perpetuity.

The map or plan of the lands to be improved, with all the adjacent lands, upon which any appurtenant privileges are to be acquired, being made as perfect as practicable, by the delineation upon it, not only of all the natural water-courses originally existing, but also of the new channels, and excavations or dykes designed to be made, together with the property lines of the several owners, should be recorded in the registry of deeds—and then, the conveyances, by which the company acquires its rights, should specifically refer to that plan. The services of a judicious conveyancer, should by all means be engaged, in preparing the title deeds, as well as in examining the

plan before it is recorded, to see that it shows everything, which may at any time afterwards be necessary, to elucidate the titles, and to define the appurtenant privileges. This particularity is indispensible, because, primarily and generally, the titles to lands bordering upon, or traversed by streams, have reference to their natural channels, and as these are to be changed, in many respects, by the drainage operations, the titles must be made to conform to the artificial changes.

When the improvement is completed, when the improvers have reclaimed hundreds and thousands of acres before worthless, now brought to the best condition for grazing or the plow, before unsaleable and even untaxable, at a mill for an acre, now ready to yield an income representing a capital of $50, or $200 for every acre, it may be disposed of, in parcels to adjacent proprietors, or to new settlers, or retained as a source of profit to the improvers, whether held as a joint stock interest, or parcelled amongst them in severalty, as they prefer. If no joint interest is preserved, then the company may be dissolved, due care having first been taken, that good title to every necessary privilege has been secured to its grantees.

A method somewhat similar to what we have thus recommended for the case of natural meadows and swamps, may be resorted to, in many places, in this State, for the restoration of low lands now artificially flooded by mill-dams, and for the perpetual extinguishment of all flowage rights, for mill purposes. Where there is a considerable body of such lands, exposed to flowage for the benefit of some unimportant and cheap mill-privilege situated at the lowest controlling level, is it not a reasonable and practicable suggestion, that the land owners above, or as many of them as possible, should unite in contributing to a common fund, with which they may *buy out* the injurious mill-site, and thus obtain for themselves, the command of the stream—either sweeping off, at once and forever, all the structures, which have impeded its natural out-flow—or, if the case be a suitable one—maintaining the dam and its flood-gates, in their own hands, for the purpose of flowing their meadows, just so far, and at just such times, only, as will be most beneficial to themselves?

In the latter case—if they wish to retain the dam, and make it serviceable to agriculture—they should adopt some convenient and simple form of association, by which they can maintain their common

purpose. In the other case—if they choose to abolish, forever, all right and power of flowage,—they have only to dispose, among themselves, of the mill-site and lands they have thus purchased, by entering into a deed of agreements and grants conveying to each other, in fee, the right to have this channel unobstructed, with such covenants and conditions running with the land, that all future owners shall be forever barred from restoring the impediments.

Certainly, this means of improvement ought to be practicable, in cases, where mill-sites, once, perhaps, important and useful, have now become of little value, compared with large tracts of meadow ground lying above them.

The very statement of the problem gives the solution of it. The higher value always commands the lower, where sensible men are the trading parties.

We are perfectly aware, that most of the suggestions of this report, are entirely simple and obvious, and such as may not seem to have required this prolonged statement of them. But, however simple the idea of such works, they have never yet been undertaken among us, upon any scale commensurate with the magnitude and value of these repositories of agricultural wealth. Since some attention is now directed to this matter, it seems not unlikely to be of service, to have these obvious ideas and methods put together, in a certain orderly and accessible form, as a means of exciting more definite reflection upon the subject, and of aiding the resolution of enlightened improvers.

We are aware, also, that we have made but little reference to certain questions, which lie at the very threshold of such an enterprise. "Can the ways and means be found in our communities for prosecuting such works?" And,—"will it pay?"

The answer to these questions will depend partly upon an understanding of facts, and partly upon our moral sentiments and impulses.

The prime cost of the land, and the appurtenant privileges—the expense of making excavations, and other artificial changes—the value of the lands, when reclaimed—these things are matters of fact, which cannot be too well pondered and settled.

Ignorance will be apt to see "lions in the way," but sensible men are always willing to encounter facts.

Yet, even if a sound judgment declares the facts to be well made out, we shall hardly begin such works, unless we have also the sentiments of courage, of hopefulness, the love of cultivated nature, the aspiration after the highest conditions of improvement, the impulses of philanthropy, and a truly patriotic love for the state and fatherland, in which our lot is cast. If we believe that to subdue and renovate the earth, is one of the noblest occupations of man, that a wise and bountiful Providence has adjusted these means of compensation between upland and meadow, and has caused the ages to deposit their fertilizing wealth, in the vallies, *for us*, in this age, and not merely for some remote posterity beyond our day, and, especially, that here, in our temperate northern clime, the measure of our agricultural prosperity is the abundance and excellence of our flocks and herds,—if these are our sentiments, and if such are our convictions, we are then in a condition to handle our facts, and work out the elements of our problem into its positive results.

A practical people, like the agricultural classes in Maine, with the light and energy now rapidly increasing among them, ought not to be long in settling the question of this kind of improvement by practical experiments. We have neglected this means of wealth too long. Many an unhappy farmer in Maine has worn out a short and painful life, upon a hard and rocky upland farm,—many such a farm in this State, has been abandoned for easier and more fertile soils in the west—when, in sight of these very farms—part and parcel of them, perhaps—lay neglected meadows, a few acres of which, thoroughly reclaimed, would have changed the whole life and fortunes of their owners.

We venture to condense our own belief and our own hope on this subject, into these three simple propositions—two of them propositions of incontrovertible physical fact, and the third, of equally incontrovertible moral truth.

First—That water will run down hill, if we will give it a chance to do so.

Second—That thoroughly reclaimed meadow lands, are the most valuable lands in Maine.

Third—That men of sense and of conscience, will act for their own interest, when they find out what their interest is.

An Act to enable the proprietors of meadows and other low lands to improve the same.

SECT. 1. Corporations may be formed for the purpose of improving meadow and other low lands in this State, by draining or flowing the same, on application of any number of proprietors, to a justice of the peace, and such proceedings had thereon, as are prescribed in the Fifty-fifth Chapter of the Revised Statutes, in respect to the corporations therein named. And any corporation formed for that purpose, may take, hold, manage and dispose of all such lands, and interests in lands as they shall purchase for improvement in the manner contemplated in this act.

SECT. 2. The property of such corporation shall be represented by shares, to be held by the members as shareholders, and of such par value, as may be prescribed by the bye-laws of the corporation. And no assessments shall ever be made upon said shares, beyond the par value so established; and such shares shall be personal property.

SECT. 3. The lands and any other property of such corporation, shall be taxed to the corporation, in the several towns where the same shall be situated, and neither the property of the corporation, nor the shares of the members, shall be subject to taxation otherwise.

SECT. 4. This act shall take effect on its approval by the Governor.

UNDERDRAINING. In my report for 1856, some space was devoted to the subject of underdraining, partly by way of explaining its theory, urging its necessity as a fundamental and indispensable step towards the successful cultivation of the retentive soils which comprise a very considerable portion of the strongest lands in the State; and partly by giving statements in detail of successful practice—chiefly in the case of B. F. Nourse, Esq., at Orrington, Penobscot county, whose operations are believed to be more thorough and extensive than any other of a similar kind yet accomplished in New England.

That this subject begins to receive the attention due to its importance, I have abundant evidence in the numerous instances which have fallen under my observation, in which attempts of greater or less magnitude have been made to prove its value in practice, and by the frequent inquiries made regarding the results of experience and the best and most economical methods of operation. A somewhat extended article was prepared and intended for insertion here, but it is mostly laid aside, retaining only a few general remarks, in order to give place to several communications with which I have been favored by the courtesy of others, and which it is believed will prove of much greater value.

Essential and indispensible as the presence of water is to the processes of vegetation, its scarcity or excess is equally a serious calamity to the agriculturist, and it is difficult to say which of the two is the greater. This must have been learned by early observation, and doubtless correspondingly early efforts were made to control the supply both by drainage and irrigation. Of the latter we have accounts in ancient history, and underdraining is by no means the novelty which some suppose. An ancient Roman writer gives directions not very unlike some modern ones. "Fill the bottom of your ditch with stones. If stones are not to be had, use bundles of green willows; if willows are not to be had, fill it with bundles of twigs."

Walter Blith, in a work dedicated to Oliver Cromwell, when Protector, says: "And for thy drayning trench, it must be made so deepe that it go to the bottome of the cold, spewing, moyst water that feeds the flagg and rush—a yard or foure feet deepe, if ever thou wilt drayne to purpose." And again: "To the bottome where

the spewing spring lyeth, thou must go and one spade's graft beneath, how deepe soever it be, if thou wilt drayne thy land to purpose. I am forced to use repetitions of some things because of the sutablenesse of the things to which they are applyed, as also because of the slownesse of people's apprehension of them, as appears by their non-practice of them. But for these common or many trenches, oftentimes crooked too, that men usually make in their boggy grounds, some one foot, some two, I say away with them as a great piece of folly, lost labor, and spoyle which I desire to preserve the reader from."

Nor is even the use of tile for draining such as to render it an exception to the adage, "there is nothing new under the sun," if it be true, as stated, that the garden of the monastery at Mauberge, in France, was drained with earthen tiles laid four feet deep, some time prior to A. D. 1620. This garden was long famous for the abundance and excellence of its productions and sadly puzzled the good people of the district by a fetility beyond that of similar land adjoining. In 1850, it was converted into a park, and the grading consequent on the change, exhibited a thorough system of underdraining which had evidently been executed earlier than some interments dating at 1620.

In order to drain with satisfactory results, both as to the subsequent condition of the land and to the purse of the operator, the first thing demanding attention is to lay out the drains properly, for if this be well done, their efficacy will be greater and their cost less than if improperly done. In an extended system of drainage, unless the operator be perfectly familiar with the principles involved and with the details of practice, it will prove the more economical method to secure the services of a competent agricultural engineer, and this will often be the better way, where only a beginning is immediately contemplated; for a wrong beginning will ensure embarrassment in subsequent operations, and entail loss of labor and expense. Such persons have not long been within reach, but the demand has produced a supply, and they can now be had.

The levels are first taken. If the descent be slight, this is indispensable; if considerable, it will so facilitate operations by giving data for accuracy and for judicious expenditure of labor, as to be scarcely less desirable. Having the levels, the next thing is to decide upon the plan, and on irregular surfaces, there is large scope

for the exercise of judgment so to arrange the drains according to the nature of the case, as to secure the best results at least cost. The accompanying illustrations of the drains of Messrs. Nourse and Anderson, where contour lines show the varying surface of the land, will give a better idea of proper arrangements than can be conveyed in words.

On regular surfaces where there is a continuous slope from the higher portion of the land, the drains should be parallel, and at distances not too great to allow the surplus water from all the land to reach them in reasonable time. This distance varies greatly as the soil is more or less retentive and no fixed rule can be given.

In the stiffest clays it will require as long for water to reach drains at twenty feet apart as in others less retentive at sixty or eighty. For an average distance between, upon such soils in this State as most need draining, taking into account efficacy and economy, and the large proportion of time during which such land will probably be devoted to grass, forty to fifty feet asunder may be near the mark; (supposing the drains to be not less than three and one half feet deep,) but if such land were to be much of the time under cultivation a less distance would be preferable.

The proper depth is a point upon which great diversity of opinion has existed and continues to exist, some maintaining that two and one-half feet is sufficient, while others firmly hold that five or six feet is not too great. The true method is believed to be to vary the depth according to the nature of the soil. In such as are most tenacious of water, thirty-three inches may be, on the whole, advisable, but they should then be correspondingly nearer. A greater depth might be desirable, but cost and efficiency together should govern. In those of more open texture and having a porous subsoil charged with water flowing from a higher level, the drains should be deeper and further asunder; four or even five feet may be none too deep in such cases, and at five or six rods apart may do sufficient service.

The size of drains deserves consideration. In most cases, and especially where the land is not springy the minor drains may, if the conduit be perfect, be smaller than is often supposed. A tile of two inches bore, if laid with tolerable care and descending one foot in a hundred, may be relied on to convey more than one thousand gallons of water every twenty-four hours, the amount varying with the per-

fection with which they are laid and the length of the drain. The greater the length, and the more accurately they are laid, the greater will be the velocity and the less the friction of the water on the pipe.

As an almost invariable rule the drains should be made in the direction of the steepest descent. There may be isolated cases where from the nature of the strata this may be departed from—such are supposable and are said to occasionally occur, but I have never seen one. A different view is held by some and was formerly much advocated. Not unfrequently beginners at this work run their drains obliquely down the declivity, but the opinion of all skilled drainers is settled that such is not good practice, as their efficacy is diminished, and if tile be used, a larger size may be required, the passage of the water being slower.

There is no better safeguard against errors in the practice of drainage than to understand the principles connected with it. Clearly understood their application in practice becomes comparatively easy, and this too will best enable us to appreciate its necessity and estimate its results. The more important of these are thus concisely stated by a recent writer.*

"1st. The specific gravity of water is 817 times heavier than air.

2d. By its gravity it always has a disposition to descend, but the instant it meets with resistance it exerts its force equally in every other direction.

3d. That force is invariably exerted until it has found a level and it can then only be said to be at rest.

4th. That whenever this equilibrium is attained it remains in that state (stagnant) until disturbed.

5th. That in perforating the soil with a drain that portion nearest the drain is first set in motion and this is followed in successive rotation by the next nearest portion and so on to the extent of its action.

6th. That its action ceases wherever the compactness of the soil is sufficient to overcome the gravity of the water held in it by suspension.

7th. That water not only descends by its specific gravity, but ascends by capillary attraction, wherever the lower portion of the

* In the "Farmer's Magazine."

soil rests in water, the complete disintegration of its particles facilitating that object.

8th. That water passing from a higher to a lower level through the soil always has a tendency to rise to the surface, and would invariably do so, unless intercepted by open or under-ground drains —hence the origin of springs.

9th. Water, on reaching the surface of the earth, would continue to descend in the soil until resisted, which it invariably would be wherever a porous soil was preceded by a retentive one.

10th. That water in its purest state, as rain water, is slightly charged with ammonia; but to an inconsiderable extent, excepting after long seasons of drought.

11th. That water becoming stagnant in a soil becomes deleterious to plants growing upon the surface, the mineral deposits, especially iron, after entering into its composition, rising towards the surface.

12th. That water passing through a hollow pipe meets with resistance produced by friction. A pipe filled at one end cannot be made to run full at the other.

13th. That the velocity with which drains discharge themselves depends upon their inclination and the permeability of the soil.

14th. The specific gravity of water being greater than that of air, it invariably displaces the latter in the soil, but upon its removal air again occupies the space originally held by it, and thus a continuous action is produced in the soil.

15th. Water when frozen expands, and thus by its power the hardest substances become broken up or have their external surfaces abraded by its action."

The *principal* advantages which may be expected from underdraining retentive soils or such as overlie a retentive subsoil, whether clay, hardpan or other, (such as are already *porous enough*, and into which all surplus water readily descends to a depth of four feet or more, so that a hole of this depth will not retain water at any time more than forty-eight hours, will not be benefited by digging trenches through it, or burying tiles or other draining material) very briefly stated, are these: The land is warmer, by saving all the heat which would otherwise be lost by evaporation. It can be worked earlier in spring and later in autumn, thus virtually lengthening the season It is less subject to injurious action of frost, and

many plants pass the winter safely in drained soil, which, in a wet one, might be thrown out and winter-killed. It secures free admission of air to the soil, which is not only of great direct advantage to the roots of plants, but gradually produces changes in the soil and subsoil akin to those following the use of the plow and subsoiler, assimilating it to the character of the surface soil, and it also hastens the decomposition of all fertilizing matters in the soil, enabling plants to obtain the full benefit therefrom, which they are capable of yielding; and lastly, it furnishes a good degree of *security against drought*, and this both by increasing the depth of soil in which the finer rootlets or plants may range in search of food and moisture, and by securing an increased deposition of dew at night upon the surface soil.

Perhaps it should be added, also, that thus only can the full advantage of deep culture be obtained. Subsoiling, which is of little or no benefit on wet lands, is of great advantage upon drained ones, and *should always accompany drainage*, not only to secure greater depth of soil immediately, but also to allow the freer passage of water into the drains.

Without extending these remarks farther, I will proceed to introduce some facts regarding its practice among us. Last year, the Cumberland County Agricultural Society offered $150, in two premiums, for the greatest improvements to be effected upon farms during the years 1857, '58. The farms entered for these premiums, were visited by the committee appointed for the purpose, both last year and this, and from their report, prepared by S. F. Perley, Esq., (President of the Maine State Agricultural Society,) the following extract is taken. Having had the pleasure of accompanying this committee on both tours, I can testify (utterly needless though it be to any acquainted with the chairman) that the facts *are by no means overstated*:—

"First in importance, and first in the labors of the applicants for the premiums, and of other farmers, is the practice of underdraining. First in importance, because it is a preparation for a more thorough system of cultivation—the production of better crops for the labor expended. On almost every farm in the county, and particularly is it the case on the clays and clay-loams, some fields or parts of fields are found naturally rich, but too wet for cultivation,

always falling heavy and clammy under the plow or cultivator, never susceptible of being finely pulverized—a condition absolutely indispensable to the highest success in growing any crops—or at best, coming to a condition suitable to work so late in the season as to render it unavailable except for crops of inferior value. Upon such grounds the cereal and root crops will not flourish, and the improved grasses soon fail, and are succeeded by water grasses and ferns, (brakes,) nearly worthless except for the compost pile. Often a wet swale is found extending into a field, the remainder of which is of such a character that it may be worked as soon as spring opens; but the whole must be delayed for the wet portion to dry, or be worked in patches, involving loss of time and less perfect cultivation. These places are often met with on the most available portions of the farm, frequently in close proximity to the buildings where dressing could be applied and crops harvested at much less cost than on lands more remote. Unsightly are such grounds; and unprofitable the occupation of them until the surplus water is removed. This can be thoroughly done only by underdraining.

During the last two years some twenty-five acres have been drained on the farms visited, requiring between three and four miles of drains. The Committee have had the pleasure of seeing, with their own eyes, the wonderful change which is wrought in a variety of soils by removing the superabundant water, and in each case with the same satisfactory result.

Mr. J. F. Anderson of Windham, has drained four acres of tough blue clay, requiring one hundred and thirty-five rods of drains, a small part of which was laid with poles, the remainder with tiles. This land is springy, and was formerly so wet in places as to make it difficult to drive over it to remove the hay crop; frequently (as was stated to the Committee,) it had been found necessary to use hay-poles and carry by human strength the hay to the drier parts of the field where it could be approached with a team. So tenacious was this soil, that in certain places, six months was required for the surface water to make for itself channels to the drains. And the full effect of drainage upon such land cannot be felt short of several years. At the time of our last visit to this field, August 31, 1858, three days after a heavy rain, we found one team breaking the sward, and another sub-soiling across the general line of the drains; and the

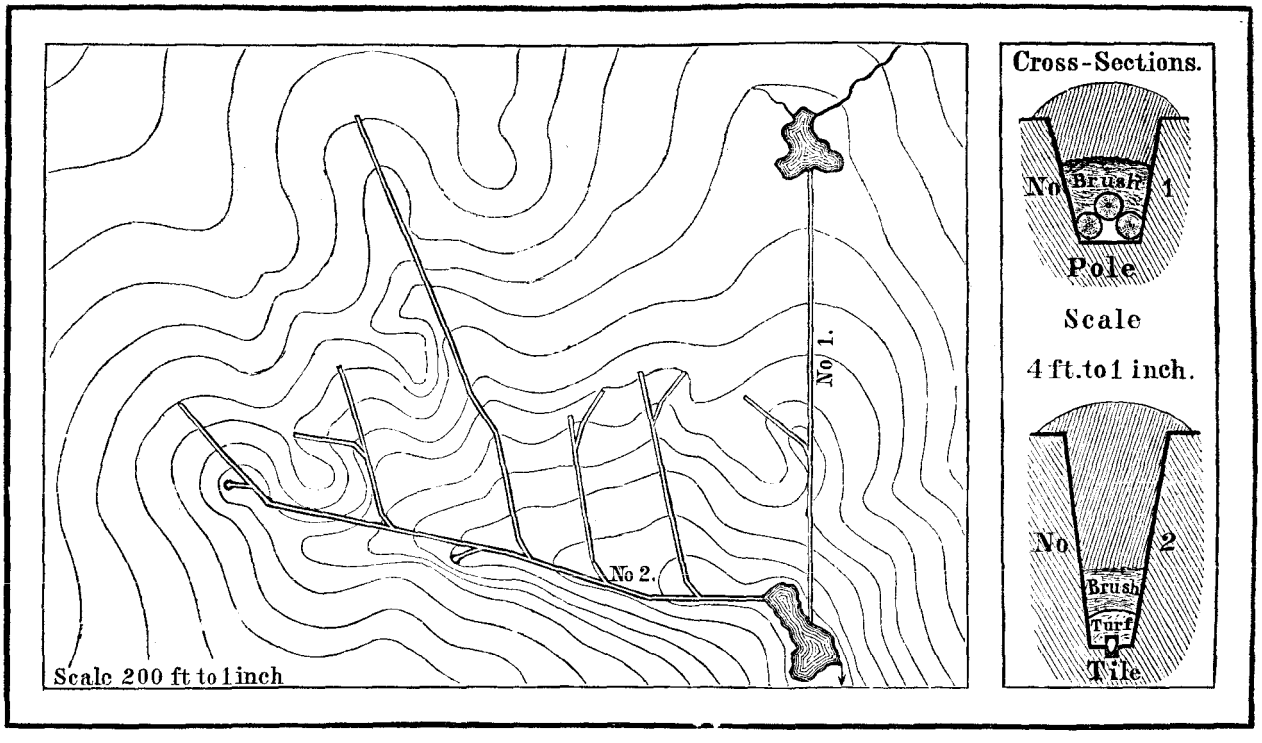
soil was in fair working order, even the places which had formerly been so wet. The plate shows a plan of Mr. Anderson's drains. It will be seen that they are very irregular and at unequal distances asunder; placed so designedly to take the water from those portions suffering most. The following is Mr. Anderson's statements in regard to his draining operations:

"GENTLEMEN:—In offering my farm for your two years' premium, I will premise the details of a report of what has been accomplished, by stating that it has been my aim to comprehend every department of the farm I occupy, in a general system of improvement, giving to each its due share of attention, and abstaining, as much as possible, from allowing any one to lose its proper rate of advancement by yielding to either a disproportionate amount of the money, labor and time which ought to be wisely distributed over the whole, having regard to the relative importance of each.

In compliance with your request, I have prepared a sketch of the drains in the field where they are completed. I have endeavored, by tracing out the contour line, to show the cause of their irregularity, which arose from their generally following up the depression of the surface; thereby obtaining all the advantage of drains of very much deeper actual excavation, which, in the main drain, averaged four and one-half feet, and in the side drains was from four feet to three feet from the natural surface. The excavation of the pole drain averaged about two and one-half feet from the natural surface.

The average cost per rod of the drains in this field was $1.45. This high figure was reached from an excess of excavation in the width, from the considerable depth and the compact, solid character of the digging. The drains constructed this year in another field completed, cost but 70 cents a rod. They are however but three feet deep, and the cost of the tile was eight cents a rod less this year than it was last year.

My drains were dug thoroughly and laid with care to guard against displacement and filling up. After the excavation was completed and the bottom graded, a line was stretched along between the middle and one side, and a channel two inches in depth and the width of the tile used was cut in the compact clay bottom into which the tile were dropped and brought in contact with each other, end to end; a piece of turf was then placed, grass side down, upon the



"Plan of Drainage on the grounds of John F. Anderson, Maplewood Farm, South Windham."

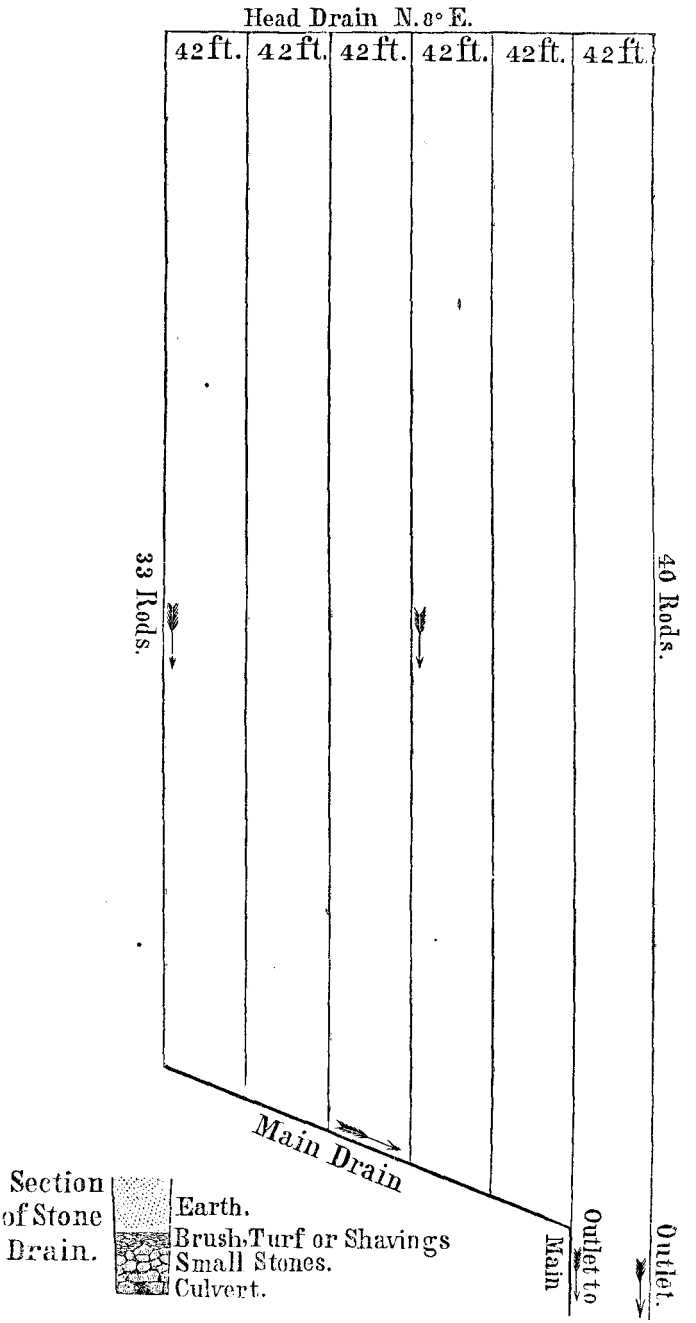
joints of the tile, and then about two feet in depth of brush (the running juniper) was carefully placed in and well trodden down, and finally the earth filled in and rounded over. The poles were placed two at the bottom and a larger one upon them to allow passage for the water, as shown in the cross section, furnished, and laid to break joints; the brush then put over them and then the earth.

My fields have been essentially and permanently improved by under-draining; of one field, drained last autumn, I have this year turned the sod of four acres with a heavy breaking up plow followed directly in furrow by an old fashioned subsoil, loosening the earth to an average depth of *more* than eighteen inches—there having been found, upon repeated trials, generally more than twenty inches from the natural surface of the ground to the solid furrow sole. This piece of ground, I will prove to you by evidence, was never before this season, in the driest time, known to be dry; and during the two first days' plowing, before the rain, it was everywhere too dry to allow of good work, even those places where teams would, heretofore, mire in the haying season, being hard and dry.

The drains of the other field now partly opened, are to be laid with tile manufactured in our State and county, as soon as Mr. Hawks, the maker, can burn them—within a few weeks."

The reduced cost of tile, this year, mentioned by Mr. Anderson, arises from the fact, that a tile machine and kiln has been established in the town of Westbrook, by Mr. Abijah Hawks. The committee called on Mr. H. at his yard, who put his machine in motion for the benefit of all concerned. The clay appears to be of the best quality; the tiles as good in all respects as those made in other States; and the cost, as per Mr. Anderson's statement, considerably lower than the imported ones. Mr. Hawks had not completed his kiln when the committee were there; but we have since seen samples of his tiles at the State Fair which demonstrate, that though this is his first attempt, and the first in the State both in moulding and burning, he has nevertheless been successful.

Col. John P. Perley, of Bridgton, drained one field of four acres, in the fall of 1857; and had another of the same area about half completed at the time of the committee's second visit, August 30, 1858. The first field, being a plane with a pretty strong eastern dip, admitted of a regular system of drains, as is represented on



Plan of field drained by Col. Perley, Bridgton.

preceding page. The drains are forty-two feet asunder, three feet four inches deep; six of them emptying through one main, and one alone; all constructed of stone, as represented by a cross section on the plate. The whole length of drain required upon the first four acres, was two hundred and eighty-five rods, at an expense of eighty-eight cents per rod; equal to $62.50 per acre.

The soil of this field is a gravelly loam with a good mixture of vegetable mould, about two feet deep, underlaid by a hard pan. The ground next adjoining above, and much of the field itself, is springy; and the water, previous to draining, finding no passage through the pan below, percolated through the soil in its way to the lower level, rendering almost the whole field wet, and certain parts of it boggy, even in the driest times. When the Committee visited it, in June, 1857, it was difficult to pass over portions of it without miring. Only a small part of it had ever been, or could be, cultivated. Water grass, ferns and willows, were almost its only production.

This field was broken up in the spring of 1858, and planted with corn, potatoes and beans; and though the turf was rooty, rugged and tough, no time having been allowed for it to decay, yet the crops looked remarkably well. It was very noticeable, even at a distance, the darker, richer color, and the larger size of the corn, over and near the drains, than that growing between them. At the time of our last visit, August 30, 1858, the discharge of water from four acres was found, by actual measurement, to be twelve gallons per minute, equal to seventeen thousand two hundred and eighty (17,280) gallons every twenty-four hours—at a temperature of fifty-nine degrees Far. This water without the drains, must percolate through the soil to its lower level, or pass off by evaporation into the atmosphere. Suppose only one-half to pass away by the later process, it would be a matter of deep interest, had we the data, to ascertain the amount of fuel which would be required, daily, to raise the temperature of that quantity of water from its present condition to the vapor state, and how much the temperature of the soil must necessarily be reduced by this constant process of evaporation. The effect of drainage upon this porous soil was much more rapid and efficient than upon the clay land drained by Mr. Anderson. The drains being nearer, and equi-distant also, facilitated the rapid passing away of the water; and *the first work done upon this farm,*

in the spring of 1858, *was upon this field, formerly too wet to work at all.*

The efficiency of underdraining to render available a soil which was before worthless has been forcibly and practically illustrated upon the farm of Wm. Bradbury, Esq., of New Gloucester. Some nine or ten acres of mucky, mossy, wet swale, and adjoining lands, a little more elevated, were underdrained with tile in the fall of 1857. In August, 1858, by invitation, the Committee visited this ground and found heavy crops of corn, potatoes, carrots and oats, growing where, previous to draining, nothing but the most valueless of fresh grasses could have flourished. The corn, potatoes and carrots were lightly manured. The oats were not. The following statement of cost, &c., have been kindly furnished for this report.

'Cost of 400 rods of underdrain made on the farm of William Bradbury, Esq., New Gloucester.

Digging 400 rods of drain 4 feet deep, . .	$208 00
Placing tile in drain, ...	15 00
Filling drain (this includes the cartage of a large quantity of small stones,)	60 00
5300 2 inch drain tile at $20 per M, . . .	106 00
1000 3 inch drain tile at $30 per M, ...	30 00
Freight, cartage to and from depot, labor loading and unloading, &c., &c., ...	31 60
	$450 60

This work was done in October and November of 1857, and under all the disadvantages incident to a job in which no one engaged had any experience. This season, with the experience we have, the lower price of labor, and of tile, a similar improvement could be made for 25 per cent. less. The result of this experiment (for such it is in this part of the County) is all that the most sanguine could wish, or could have expected. Between nine and ten acres of land, most of which was very nearly worthless, (as a good portion of it was covered with water after the fall rains commenced, up to June or July the following season) has been made so dry that the wettest part of it was plowed this year early in June; and it could have been done fifteen days earlier had not other work prevented. Since the draining, no water has remained on the surface over twelve or

fifteen hours, and that only once or twice after very heavy rains. Crops of corn, carrots, oats and potatoes, have grown as well on it as on the best cultivated of the neighboring farms.'

Mr. E Newcome, of Westbrook, has commenced underdraining, and makes the following statement:—'I am underdraining with brush instead of tiles or stone, and believe it will do execution as long as either. This suggestion was received from a friend in Massachusetts, who had drained a piece of low boggy land with that material. It has now been laid over twenty years, and has never given him any trouble. The land is well drained and produces abundantly. I have not done much at underdraining yet, but where I have I am well satisfied with the operation. I dig about three feet deep, and one and a half wide; fill about two feet with brush as solid as it can be packed by jumping upon it, and then fill with earth rounding up to make allowance for settling; and if there is any surplus earth, spread it over the grass land. I have laid forty-four rods of drains as above, at a cost of thirty-five cents per rod. This would have cost about fifty cents per rod if the brush had to be cut on purpose. Mine was cut and laying on the ground near the ditch, so that much of it did not need to be carted.'

By invitation of Mr. Goodale, Secretary of the Board of Agriculture, who again accompanied the Committee in their tour, we visited his Nurseries, in York County, for the purpose of noticing the effect of drainage after a series of years had elapsed. The Saco Nursery is situated, in part, upon a stiff clay. The drains, here, were laid of tile, excepting one of brush, and some ten years since. The best effect of the drainage should, therefore, be apparent. Such is the case. The soil, formerly, as stated, was wet, cold and clammy; it now feels mellow to the tread; is pulverulent; works kindly with plow or spade; may be entered upon early in the spring, and sustains plants in a luxuriant condition, as we had occular proof, of almost every variety adapted to the climate, both native and exotic. The Biddeford Nursery is upon a sandy or gravelly loam underlaid by a hard pan, so nearly level as to retain the water falling upon it until carried away by evaporation. The lower part of it was formerly an alder swamp and considered waste land. Four years ago it was underdrained with fifty feet spaces between the drains, and connecting tiles placed at the main for intermediate drains, at twenty-

five feet asunder, should there be a necessity for them. But the intermediate drains have not been laid, the ground having been made dry and well adapted to cultivation by the former.*

Several others have put down short drains during the past two years; and in no instance, after trial, has there been a doubt expressed of their efficacy or utility.

A question will be proposed by some, like the following: Is it then recommended to all the farmers of the County, to proceed at once to underdrain their farms? We answer, by no means. There are some lands underlaid by a porous subsoil, which are already sufficiently drained. There are others which, from their impracticable nature as being heavily encumbered with stones—as being, from the nature of their composition, sterile, or from their location not readily accessible—would not be worth their first cost, increased by the expense of underdraining. We would not recommend any farmer to rush headlong into debt, for the purpose of draining his whole farm at once. Yet we fully believe that the same labor and fetilizers applied to underdrained land, will produce from fifty to one hundred per cent. better crops than the same spent upon land previous to drainage. This remark is meant to apply to all lands in which stagnant water remains about the roots of plants more than a few hours after a heavy fall of rain. And while we would not recommend a disproportionate outlay in this branch of farm improvement, we would strongly urge the necessity of making it one of the leading items in general farm improvement.

An objection may be raised, that draining is expensive, and that the farmer of limited means cannot avail himself of its benefits. The same objection may be raised against other improvements—good buildings, good fences, good tools, good stock; these are all expensive. The objection is not valid against the practice of draining, any more than against any other valuable improvement. But the objection calls to mind a popular error of which, it were well if the public could be at once disabused; to wit: that *capital* is *not neces-*

* It may not be amiss to add that the main drain in this instance traversing the lower part, tapped, in its course, several springs which constantly discharge a considerable quantity of water, and its effect upon several acres of wet land next adjoining has been so great that it has since been cleared of alders, &c., and successfully planted with Indian corn and other crops. ED.

sary in *farming*. An impression seems to prevail, that a man without capital, without credit, without enterprise, without intelligence, we had almost said without brains, qualified for nothing else, may yet be a farmer. Wrong, all wrong. Farming needs the services of our best men, and capital is just as necessary in this as in any other occupation. As well might the lumberman, the merchant and the manufacturer expect, without capital, to attain to the greatest success in their business, as the farmer in his. Each, with the exercise of diligence, economy and skill, may succeed measurably without capital; but neither is prepared to take advantage of the markets, to avail himself of improved machinery, implements and methods of conducting business, without capital proportionate to the extent of the business in which he is engaged.

Intimately connected with thorough draining, is the practice of *deep tillage*. The latter should always follow the former. This subject has been hitherto almost wholly neglected. Very few of the *subsoil farms* in this County have yet been discovered; none of them thoroughly explored and entered for occupation. One would suppose, judging from the practice of farmers, that their title deeds cover, at most, only ten inches of the surface; and if by chance the plow happens to drop below that depth, they look back with an anxious countenance, as if they expected some other claimant to appear and enter against them an action for trespass. We will cite but two instances of deep tillage. One is the garden (of five acres) of the New Gloucester Shakers, which has been trenched throughout two feet deep with the spade, and the crops growing there *prove the value of deep cultivation*. The other is the flower garden of Mrs. Cyril Pearl, in Baldwin. Her success was certainly remarkable, and was found, upon inquiry, to be owing not merely to her cultivating the finest varieties, but also to the fact that the ground had been prepared *two* or *three feet deep*.

It will not be expected, in a report like the present, that we should enter into a discussion of the principles involved in underdraining, or into a detailed description of the various methods which have been adopted, or the material used in constructing drains. We must refer the inquirer to the various publications upon this subject, and particularly would we recommend a visit to grounds which have been drained. The kind of drain to be adopted, whether tile, stone, poles,

brush or other material, must depend upon the cost of the different materials in the particular locality. Stones or tiles would seem to be the most enduring; yet instances are cited where poles and brush have lasted many years."

Another instance of draining in Cumberland county, by Mr. Joshua E. Hall of Gorham, but not visited by the Committee, is thus related by him:—

"The land underdrained lies on the front of my farm near the buildings, and on account of its unsightly appearance several attempts were made about twenty years since by means of open drains to reclaim it, but from the nature of the soil it was found impossible to keep a drain open, and none of the trials giving promise of success, the whole was abandoned and the 'swamp' given up as unconverted and unconvertable, and for ten years previous the only labor bestowed thereon has been to cut and take off by hand (as it was impossible to drive a team on it) its scanty crop of rushes and water grasses.

It is but little lower than the surrounding land, except to the south-west, when the land gradually rises to an elevation of some fifty feet higher than the swamp and extends in a large gravelly plain. The swamp is in a circular shape, whose greatest diameter is nineteen rods and least fifteen, with an inclination to the north-east of four and one-half feet in nineteen rods, and previous to its being underdrained one-half of it was so miry that it was impossible for heavy animals to go on it. The soil is a black muck, filled with bodies and roots of trees in all stages of decay. The subsoil, except towards the western part where it is sandy, is of impervious clay, in some parts very near the surface, in others four feet below, and a small stream of water never failed to flow from it.

The main drain, which is four feet deep and nineteen rods long, was put through the lowest part, leaving about two-thirds of the land (the part experimented with) on its northern side. On the south-west and west side, at the margin of hard land, a drain was dug in the form of an arc to correspond with the shape of the swamp sixteen rods long and from four to six feet deep, as the uneveness of the surface required. Then two other drains were dug from the head, one to the main of similar depth and five rods apart, entering the

main diagonally, making in all sixty-one rods of drains at an average cost for digging of sixty-two cents per rod.

The head drain I filled with small stones to within two feet of the surface—covered with inverted sods, then leveled with the earth thrown out. The main, when the bottom was hard enough to warrant it, we made a small duct with stone, then covered with sods, &c. In the soft places, I had large flat stones pressed into the mud at the bottom on which pine poles, about eight inches through, were laid a few inches apart, and securely fastened by spiking on pieces of plank; these were covered with small flat stones, then sods, &c. In the side drains I used four by four joist, in the same way as the poles in the main. The joist cost about the same as tile, of suitable size, and I used them in preference because they were at hand, and I feared tile would become broken and disjointed where the bottom of the drain was of unequal hardness.

The draining was done in June and August, and November 10th I commenced plowing the land, and, to the surprise of every one, there was not the slightest appearance of water visible—the cattle would slump in the softest places, but without reaching mud or water; and where before draining water was always on the surface and the whole soil completely filled, there is now no indication of it. I have great faith in drainage and am now prepared to believe statements that six months ago I should have deemed scarcely credible."

A somewhat detailed account of Mr. B. F. Nourse's draining on his farm in Orrington up to 1856, was given in my report of that year. Considerable interest having been manifested in various quarters in his labors, and some anxiety felt to learn whether the results of his experience were satisfactory enough to warrant farther progress, or to justify similar attempts at improvement by others, I was induced to address to him a note of inquiry, to which he responds as follows:

S. L. GOODALE, Esq., *Secretary*, &c.:

Dear Sir:—In answer to your inquiries in regard to my progress in thorough draining and its effects since 1856, I send with this a reduced plan of that part of the farm which has been drained more or less thoroughly. Upon the plan, the courses of the drains are

represented by lines distinguishing the tile from the stone channels, the respective distances shown by scales both of feet and of rods, and the fall or inclination of the land by dotted lines of continuous level at intervals that represent each four feet fall.

The extent of the work done, its cost since your report of 1856, &c., are candidly stated in a letter to the Hon. H. F. French of New Hampshire, who desired information of such experiments as had been made in New England in agricultural land draining, for use in the preparation of his forthcoming work upon this subject. With his consent I send you copy of the letter, from which to use whatever may serve your purpose.

In addition, I answer familiarly upon the points to which you direct attention especially.

Results of Experience. My work, or most of it, is too recent to afford the full measure of good results which are always obtained from judicious draining; for it is happily, a process from which the benefits increase with the lapse of time and the subsequent tillage of the soil. But the results already apparent are enough to justify the outlay, which was far too large, because so much of it went to pay for *learning how to do it.* My 'cold,' springy land, is now warm and sufficiently dry for early spring or late fall plowing; is naturally a strong soil, 'good grass land' as they say, and with a deep plowing and subsoiling and other only ordinary culture, bears large crops of grain and roots. Your statistics of last year report some of the root crops.* This year a field of nearly six acres, seeded to grass with barley, gave a bountiful yield of the grain. Fifty-one bushels being the yield of one acre measured from one corner of the field, in which to the eye there was no difference between its several parts before harvesting.†

Assuming that the cost must of necessity be what I expended—$40 per acre for draining—the interest upon that sum, at six per cent, is $2.40 per annum—for ten acres would be $24. Good cul-

* See Abstract of Returns for 1857, pages 108 to 112. The crops referred to were six hundred bushels of mangolds per acre, seven hundred and thirteen bushels of carrots, seven hundred and thirty-eight of English turnips, and eight hundred of rutabagas, each, per acre. Also, forty-seven bushels of barley on an acre. Ed.

† The average of the whole field was about forty-five bushels per acre, as since ascertained.

ture costs less on drained lands than on the same before draining; therefore interest is the only debit item. Now, I undertake to say, and can demonstrate, that the owners of our strong loamy and retentive soils of average quality in Maine will increase their products by draining and subsoiling, compared with same soils not drained, using subsequent good culture alike for both, of any crop of the farm, enough to pay that interest three times. Take for instance, the staple crop grass for hay; the effect is at once apparent in an old worn field without plowing. But plow, subsoil, till for a year or two with moderate application of manures, and then seed down with grain. The results for five years, including the grain crop, will show a difference of twenty-five to thirty-three and a third per cent. in favor of the drained land, or ten to fifteen bushels of grain the first year, and three-fourths to one ton of hay each year after—averaging $7 50 per acre; on ten acres $75, or more than three times the $24 interest. The difference in favor of drainage on every other crop is greater than it is on grass. If this be true, or the half be true, what better investment can a farmer make of his money, or his labor which is more than money, than to expend it in draining his land?

The cost, in my case, was quite too much. I could now do equally good and effective work for two-thirds the expenditure, hiring every thing. The costly item with most persons in draining is the opening of ditches. To show how cheaply this can be done for laying tile, see an article in the last number of the New England Farmer, by J. Herbert Shedd, a practical land drainer and engineer, which is worth publishing in the agricultural reports of every State for its valuable facts.

To open trenches wide enough to lay a stone channel requires the removal of so much more earth, that this alone should prevent the use of stone, however abundant, if tile can be had at a moderate price—say $12 per thousand. Applying information now so accessible and so complete, hiring experienced ditchers to open the trenches, and doing the remainder of the work with the force of men and team belonging upon the farm, our farmers should be able in each season after haying, to lay drains in one or more acres, forty feet apart and four feet deep, at a cost not exceeding $30 per acre; or in land quite free from stones and with tile cheap and convenient, at $25 per acre.

In the last number of the "Country Gentleman," John J. Thomas describes and advertises a draining plow that he has invented, or has altered from the subsoil plow, which works well in breaking up the compact subsoil or hard pan, thus saving the labor of men with the pick. Having used the common subsoil plow in a similar manner, I have no doubt Mr. Thomas' plow is a labor saving machine that will cheapen the cost of draining.

The distance apart and depth of drains should be regulated somewhat according to the constitution of the soil, its location, inclination, &c. With a rapid fall and deep drains, I find effectual drawing of the water at four rods apart. They were so laid at first, for partial drainage, and intermediate drains were designed to be laid afterward. The service is now so good that it does not seem expedient to lay the others; but I regret that the whole had not been planned and laid originally at forty feet, which I think near enough for thorough work.

To attain the greatest value with the least expenditure, we should observe the same common sense rule in this as in other operations—obtain the aid of skill and experience. The farmer may know just what kind of a house he desires to build, and to give intelligent specifications for every part of it, with a good reason for each; he may even be well informed of the sum that such a house ought to cost. But unless he was an architect or builder he would act unwisely in attempting to build it himself, if an architect or mechanic could be obtained. At least he would consult some one skilled in the art and avail himself of general directions suited to his own location, materials, &c. No less should the farmer employ an engineer or land drainer, practiced and skillful, before beginning his thorough draining, if such a person is accessible. He can learn the theory from books; can study the scientific reasons for each part of the process; and may be able to use levelling instruments so as to ascertain the fall of his land. Yet he will do well to employ an agricultural engineer to go upon his farm, survey and plan for it an entire system of drains. No matter if he intends at first opening but a few rods, or to dry but an acre or two; he then knows *where to begin* and *how to do it*—two important items to ensure success and save the hazard of having to do the work over again. The sum of $25 or $50 is thus well expended. We have

now such skilled persons, though this branch of engineering is new. And there is no longer a necessity for each farmer to educate himself so expensively as some of us have done, when there was no one to show what was to be done, and how best to do it.

In conclusion. It is said that farming in Maine is a hard business—scarcely affording a living to him who owns and *works* his farm. I shall not dispute the saying though I think the Maine farmers as a class have as large a share of comforts, and send forth from their homes as large a proportion of intelligent and respectable men and women as any other, in a generation. But let the saying be true. Then drain the farms, put more productive value in ten active acres than there now is in fifty sluggish acres, and make farming profitable.

Full sure I am that we amatuer farmers, who till the soil by proxy and manage at second hand, would go rapidly astern for all that the products of our undrained fields can do to save us: on the other hand, it may be found here as elsewhere, that capital well invested in such improvements as thorough draining, under good and systematic farming, can be made to pay. The time is not far distant when it will be regarded here, as it now is in England and Scotland, that draining is a necessity, as the basis of all other good farming—and when the neglect of it, on suitable lands, will be evidence of a farmer's shiftlessness, want of thrift and economy, as unmistakeable as to many of your readers (if you publish this) will appear the indiscretion, if not the folly, of

Your friend,

B. F. Nourse.

November 1858.

The letter above referred to, and for which Judge French will please accept the thanks of the Maine Board of Agriculture, for his courtesy in allowing its use here in advance of the publication of his work on drainage for which it was intended, is next given:

Goodale's Corner,
Orrington, Me., Sept. 1, 1858.

My Dear Sir: — So much depends upon the preliminary surveys and "levels" for conducting works of thorough draining and irrigation cheaply yet to obtain the most beneficial results, that a

competent person, such as an engineer or practiced land drainer, should be employed to make them, if one can be obtained. Unfortunately for me, when I began this operation, some years ago, there were no such skilled persons in the country, or I could learn of none, professionally such, and was forced to do my own engineering. Having thus practically acquired some knowledge of it, I use and enjoy a summer vacation from other pursuits, in the prosecution of this; and this employment for the last few weeks has delayed my answer to your inquiries. Nor could I sooner arrive at the figures of cost, extent, &c., of this season's work.

This is expected to be completed in ten days, and then I shall have laid of

Stone drains, including mains, . .	702 rods.
Tile drains (two inches or larger,) . .	1043
In all, . . .	1745 rods.

Or about five and a half miles, laying dry *satisfactorily* about thirty-five acres. The character and extent of the work will better appear by reference to the plan of the farm, which I send with this for your inspection. The earlier portion was fairly described by the Committee of the Bangor Horticultural Society. (See Report for 1856, of the Maine Board of Agriculture.) It was far too costly, as usual in works of a novel character, conducted without practical knowledge. No part of my draining, even that of this season, has been done so cheaply as it ought to be done in Maine, and will be done when tiles can be bought at fair prices, near at hand. I call your attention particularly to this, because the magnitude of the cost as I represent it, ought not to be taken as a necessary average or standard outlay per acre, by any one contemplating similar improvement, when almost any farmer can accomplish it equally well at far less cost. My unnecessary expenditures will not have been in vain, if they serve as a finger post to point others in a profitable way.

My land had upon its surface and mingled in its supersoil, a large quantity of stones, various in size from the huge boulders requiring several blasts of powder to reduce them to movable size, to the rubble stones which were shoveled from the cart into the drains. To make clean fields, all these had to be removed, besides the many

"heaps" which had been accumulated by the industry of my predecessors. A tile drain needs no addition of stone above the pipe; indeed, the stone may be a positive injury, as harboring field vermin, or if allowed to come within two feet of the surface, as obstructing deep tillage and favoring the access of particles of soil upon or into the tile with the rapid access of water which they promote. Carefully placed to the depth of six or eight inches, in a four feet drain, quite small stones are perhaps useful, and they certainly facilitate the drawing of water from the surface. Such was, and still is, with many, the prescribed method of best drainage in Scotland and some parts of England. The increased cost of adding the stone above the tile, is obvious; and when the width of the drain is enlarged to receive them, the cost is materially enhanced. Yet such has been my practice, at first under the impression of its necessity, and all the time from a desire to put to use and out of sight, the small stones with which I was favored in such abundance. The entire cost of removing and burying more than two thousand five hundred heavy loads of stone, is included in the cost of drains as set down for the seventeen hundred and forty-five rods.

Including this part of expense, which is never *necessary* with tile, and cannot be incurred in plain clay soils, or clay loams free of stone, the last seven hundred rods cost an average of ninety-seven cents per rod completed. This includes the largest mains of which one of sixty-three rods was opened four feet wide at bottom of the trench, of which the channel capacity is eighteen by eighteen, equal to three hundred and twenty-four square inches, and others, one hundred and ten rods of three and one-half and three feet width at bottom; all these mains being laid entirely with stone. The remainder of the seven hundred rods was laid with two inch tile which cost at the farm $18 per thousand. These last were opened four rods apart, and lay dry about seventeen acres at a cost, including the mains, of $678, or $40 per acre. In this is included every day's labor of man or beast and all the incidental expenses, nothing being contributed by the farm, which is under lease.

I infer that an intelligent farmer, beginning aright and availing himself of the use of team and farm labor when they can best be spared from other work, as in the dry season after haying, or paying fair prices for digging his ditches only, and doing the rest of the

work from the farm, can drain thoroughly at a cost, fairly reckoned, of $20 per acre, drains four rods apart and four feet deep, or at $25 per acre forty feet apart, three feet nine inches deep.

My subsoil is very hard, requiring constant use of the pick and a sharpening of the picks every day, so that the labor of loosening the earth was one-third or one-half more than the throwing out with shovel. The price paid per rod for opening only, to the depth of three and a half feet (or perhaps three and three-quarters average) of a width for laying tile, was twenty-five cents per rod. At this price, the industrious men skillful with tools, earned $1,12 to $1,25 per day, besides board; and they threw out one-third more earth than was really necessary, for "room to work," as they said. *But they labored hard fourteen hours per day.* The same men, working in a soil free from stones and an easier subsoil, would in the same time open from fifty to one hundred per cent. more length of ditch.

The greater part of these drains were laid four rods apart. When first trying this distance upon a field, of which the soil was called 'springy and cold,' and was always too wet in the spring and early summer for plowing, a partial rather than 'thorough' drainage was attempted, with the design at some future day to lay intermediate drains. The execution of that design may yet appear expedient, although the condition of the soil alrerdy obtained is satisfactory beyond expectation.

Owing to the excess of water that saturated the soil in spring and fall, the former proprietors of the farm had not attempted the cultivation of the field alluded to for many years. Originally producing heavy crops of hay, it had been mowed for thirty years or more, and was a good specimen of 'exhausted land,' yielding one-half or three-fourths ton of hay per acre. This field is designated on the plan as the "Barley field, 1858," lies south-west of the dwelling house and contains nearly six acres. Its northerly half being the lower end of the field was drained in 1855, having been summer plowed and sowed with buckwheat which was turned under when in flower as a fallow crop. The other half was drained in 1856, plowed and subsoiled the same fall. In 1857, nearly the whole field was planted with roots, potatoes, rutabagas, mangolds, carrots, English turnips, &c., and one acre in corn. For these crops fair dressings

of manure were applied, say ten or twelve cart-loads of barn manure, plowed in, and one hundred pounds of either guano or bone-dust harrowed in or strewed in the drill for each acre; about fifteen loads per acre of seasoned muck or peat, were also plowed in. There was a good yield of all the roots; for corn the season was unfavorable. Last spring a light dressing of manure, but all that we could afford, was applied, the whole well plowed, harrowed, seeded to grass, with barley, harrowed and rolled. The barley was taken off last week, and from the five and three-fourths acres seventeen heavy loads were hauled into the barn, each estimated to exceed a ton in weight. The grain from a measured acre was put apart to be separately threshed, and I will advise of its yield when ascertained.* This was said by many farmers who saw it, including some from the western states, to be the "handsomest field of grain" they had ever seen.

The young grass looks well, and I hope next summer to report a good cut of "hay from drained laid."

Last winter, there were no snows to cover the ground for sleighing until March; and lying uncovered, our fields were all frozen to an unusual depth. But *our drains did not cease to run through the winter*, and Mr. O. W. Straw, who works the farm, and was requested to note the facts accurately, wrote to me this spring "the frost came out of the drained land one week first," (that is earlier than from the undrained land adjacent) and "in regard to the working condition, the drained land was in advance of the undrained land ten days at least." The absence of snow, permitting this unusual depth of frost, had caused a rare equality of condition the last spring, because until the frost was out, the drains would not draw surface water. Usually, when early snows have fallen to protect the ground and it remains covered through the winter, the frost goes off with the snow, *or earlier*, and within a few days the land becomes in good condition for plowing, quite two weeks earlier than the driest of my undrained fields, or any others in the vicinity.

These remarks apply to land in which the drains are four rods apart. The farm lies with an inclination northerly and easterly, the fall varying from one in thirty-three to one in eight, that in

* This was threshed about the middle of November, and yielded "fifty-one bushels, round measure." The entire field averaged forty-five bushels per acre.

most of the drains laid four rods apart being about one in twenty-five. The drains in the "barley field" fall one in twenty-seven average—all affording a rapid run of water, which from the mode of construction and subsequent subsoiling, finds ready access to the drain channels. Hence we never observe running water upon the surface of any of our drained lands either during the heaviest rains or when snows are melting, and the wasteful "washing" from the surface that formerly injured our plowed grounds has ceased.

It is fair to suppose that it is the considerable descent which renders the drains so effectual at four rods apart; and that where there is but slight fall, other circumstances being the same, it would be necessary to lay drains much nearer for equal service.

The results of one man's experiments or practice, whether of success or failure, should not be conclusive to another unless all the circumstances are identical. These are ever varying from one farm to another, and only a right understanding of the natural laws or principles brought into use, can determine what is best in each case. Therefore a description of the methods I have used, or any detailed suggestions I may give as the result of experience, would not be worth much unless tested by the well-ascertained rules applicable to them, which men of science and skill have adopted and proved by the immensely extended draining operations in Great Britain and those begun in this country.

These are now given in elaborate treatises and quoted in Agricultural journals. But they should be made familiar to every farmer in all their practical details and with methods suited to our country where labor is dear and land cheap, as contrasted with the reversed conditions in England, where the practice of "thorough draining" has so generally obtained and has so largely improved the condition of both landlord and tenant. Your book will do this, and thus do a great good, for draining will greatly enlarge the productive capacity of our lands, and consequently their value, while it will render labor more effective and more remunerative both to the employer and the employed.

The fact of increased production from a given quantity of land by draining being ascertained beyond question, and the measure of that increase at its minimum being more than the interest at six per cent. upon the sum required to effect it, even at $50 per acre, the

question of expediency is answered. To the owner of tillage lands there is no other such safe, sure and profitable investment for his money. He lodges it in a bank that will never suspend payments, and from which better than six per cent. dividends can be received annually. Very truly yours,

B. F. NOURSE.

To Hon. H. F. FRENCH, Exeter, N. H.

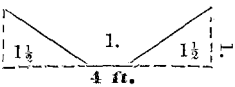
The article by J. Herbert Shedd, of Boston, land drainer and engineer, published in the "New England Farmer," referred to by Mr. Nourse in his letter on page 239, was one of great practical value. To its author is the Board indebted for a copy, subsequently re-written for publication in this report. It is also enlarged, and has tables added, which greatly increase its original value.

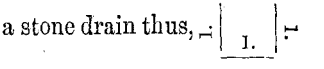
EXCAVATION OF TRENCHES.

The amount of earth to be removed from a trench depends upon its depth and the use which is required of it—whether for open drains, covered stone drains, or for pipe tile; and again, upon the size of each, determined by the quantity of water to be conveyed. The quality of soil also affects the quantity to be removed, if it is of such nature as to require a greater slope to sustain the sides than is necessary for other purposes.

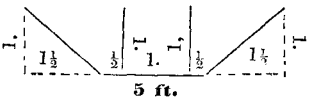
The width of trench at the bottom, for an open drain, is determined by the quantity of water to be conveyed, and should be at least two-thirds the depth of the volume of water; the inclination or slope of the sides should be such as earth of that quality would naturally take under the action of the weather. It varies in different kinds of earth from an angle of twenty-one degrees with the horizon to fifty-five degrees. The natural slope of common earth is thirty-three degrees and forty-two minutes with the horizon, or in other words, the slope forms the hypothenuse of a right angled triangle, the base of which is one and one-half, and the perpendicular one. This is the slope at which railroad excavations are usually made. In the table of cubic contents given below, the width at the bottom is assumed at one foot and the side slopes one and one-half to one.

The excavations for stone or brick drains may be made with vertical sides. The table of cubic contents is made up for widths from one foot to four.

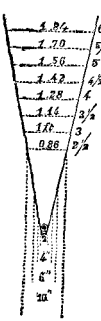
From this table and that for open draining, the cubic contents for an open drain of any width at bottom to five feet may be easily made up. The cross section of an open drain being represented thus, 

and that for a stone drain thus, 

The bottom of the open drain being increased to two feet, the contents will be equal to both volumes added together, thus,

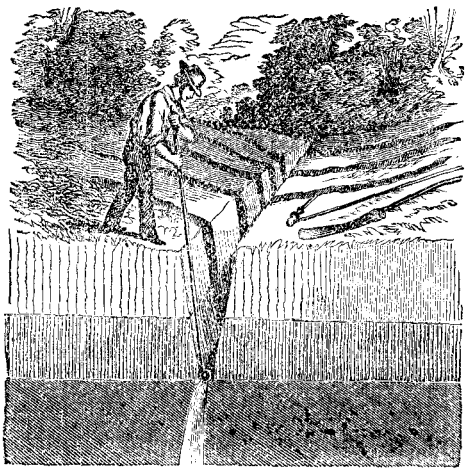


The excavation for pipe drains should be made as narrow as possible and allow the men convenient use of their tools, on account of the great saving made in the quantity of earth removed. The dimensions that may be given to them are shown by the accompanying diagram.



The full lines represent the sides of the trench; the horizontal dotted lines are at certain distances from the bottom as shown by the figures at the side opposite each. The figures above each line represent the width of opening at surface for a trench of that depth; the widths are given in feet and hundreths. The decimal may be divided by eight and the result will be inches, nearly. The vertical dotted lines show what earth must be removed in order to increase the width at bottom to receive the larger sizes. The trench may be opened and the sides carried down on the slope shown by the full lines in the diagram, in the same manner for each size of the pipe, until they have approached so near that a pipe of the size required can be just passed between them. The cut may then be carried down vertically to the depth required. A body of earth is thus left on each side, which would be thrown out by carrying the sides down on a regular decrease from the width at top to that at bottom. It will be well in sandy ground to make the trenches wide enough at the bottom to allow gravel to be thrown around each joint, to prevent the sand washing in and filling up the pipe.

If the trench is to be three feet deep it need be opened only one foot wide at the surface, and with proper tools it can be carried down to a width of about two inches at the bottom; though of course the foot of a man cannot come within six or eight inches of the bottom, in which case the pipes are laid by a man walking on the surface at the edge of the trench, who lifts the pipe, piece by piece, with a kind of hook made for the purpose, and lays them carefully in the trench, as shown by this engraving.



The cross section of the land, shown in front, represents it as having had the advantage of draining, by which the water-table is brought to a level with the bottom of the drain, as shown by the heavy shading. An "Irish spade" and a pipe-layer are shown lying on the ground. If the work is done by a common spade, the width of opening at the surface may be the same and the sides can be carried down as near together as the width of the spade will allow. A skillful workman will dig the trenches with ease in this way, after some practice, though it may be a little troublesome at first. I am now having trenches dug in which the opening at the surface is even less in width, for the required depth, than is here shown.

The quantity of earth removed by a man in one day, depends very much on its quality, whether compact or loose.

1. In hard, gravelly, and clay soils, where picking is constantly necessary, a man can throw out from three to five cubic yards in a day of ten hours.

2. In ordinary clay and gravel, with an occasional use of the pick, he can throw out about ten cubic yards a day.

3. In loose earth, without picking, or in shoveling after the picking of another, as in railroad excavations, he can throw out fifteen to eighteen cubic yards a day. In estimating the cost of getting, hauling one hundred feet and spreading or levelling the different soils, allowing for incidental expenses and a good profit for the contractor, we class them under four heads, as follows:—

1 yard of sand removed for nine and one-fourth cents.

1 yard of clay removed for fourteen and three-fourths cents.

1 yard of stony earth removed for nineteen and one-half cents.

1 yard of hardpan removed for twenty-three and seven-eighths cents.

Add about one-half cent for each additional hundred feet hauled. An ordinary one-horse cart, such as is used on railroad work, will carry about two-thirds of a cubic yard at a load.

Rock excavation varies in cost from twenty-five cents to three dollars per yard, depending very much on the execution of a blast, and the ease with which the rubbish can be cleared away. The excavation of rock from a trench will, under ordinary circumstances, cost about $1.50 per cubic yard for dry blasting. Wet blasting costs from two to three times as much as dry, depending on quality and position.

The daily wages of the laborer is an important item in the cost of removing earth, and depends, of course, on the season, the locality and the nature of the work, the average being about one dollar per day (of ten hours,) on such work as we are at present considering. Our estimates of cost have been made up on this value of labor. An estimate of cost, on any other value of labor, may be made up from these tables very readily. The cost of removing one yard in class No. 1, is twenty-five cents. No. 2, ten cents. No. 3, six and one-fourth cents.

Cubic contents removed from open drain, one foot wide at bottom, side slopes one and a half to one: one hundred feet in length, with the cost of removing:

Depth.	Cubic feet.	Cubic yards.	Class No. 1.	Class No. 2.	Class No. 3.
2½	1187.5	43.98	$11 00	$4 40	$2 75
3	1650.0	61.11	15 28	6 11	3 82
3½	2187.5	81.02	20 25	8 10	5 06
4	2800.0	103.70	25 92	10 37	6 48
4½	3487.5	129.17	32 29	12 92	8 07
5	4250.0	157.41	39 35	15 74	9 84
5½	5087.5	188.42	47 10	18 84	11 78
6	6000.0	222.22	55 55	22 22	13 89

Cubic contents removed from trenches for stone or brick drains, one hundred feet in length, expressed in cubic yards:

Depths.	Widths.						
	1.	1½.	2.	2½.	3.	3½.	4.
2½	9.26	13.89	18.52	23.15	27.78	32.41	37.04
3	11.11	16.66	22.22	27.77	33.32	38.88	44.44
3½	12.96	19.44	25.92	32.40	38.88	45.36	51.84
4	14.81	22.22	29.62	37.03	44.44	51.84	59.24
4½	16.66	25.00	33.32	41.65	50 00	58.31	66.64
5	18.52	27.78	37.04	46.30	55.56	64.82	74.08
5½	20.37	30.56	40.74	50.93	61.12	71.30	81.48
6	22.22	33.33	44.44	55.55	66 66	77.77	88.88

To find the cost: multiply the number of yards by twenty-five for earth of Class 1, by ten for earth of Class 2, and by six and one-fourth for earth of Class 3. The result will be cost in cents for drain one hundred feet long.

Cubic contents removed from trenches for pipe or tile drains, one hundred feet in length.

Depths.	1 inch pipe.		2 in. p.	3 in. p.	4 in. p.	5. in. p.	6 in. p.	8 in. p.
	Cub. ft.	Cub. yds.	Cub. yds.	Cub. yds.	Cub. yds.	Cub. yds.	Cub. yds.	Cub. yds.
2½	127.5	4.72	4.76	4.90	5.12	5.47	6.39	7.65
3	174.0	6.46	6.50	6.64	6.86	7.21	8.13	9.39
3½	227.5	8.43	8.47	8.61	8.83	9.18	10.10	11.36
4	288.0	10.67	10.71	10.85	11.07	11.42	12.34	13.60
4½	355.5	13.17	13.21	13.35	13.57	13.92	14.84	16.10
5	430.0	15.93	15.97	16.11	16.33	16.68	17.60	18.86
5½	511.5	18.94	18.98	19.12	19.34	19.69	20.61	21.87
6	600.0	22.22	22.26	22.40	22.62	22.97	23.89	25.15

The quantity removed by increasing the width at the bottom of the trench, to admit larger pipes, is very slight, and is the same in every case, without regard to the depth of the trench.

Estimate of cost of removing earth from trench one hundred feet long.

Depths.	1 inch pipe.			2 inch pipe.			3 inch pipe.			4 inch pipe.		
	Classes:			Classes:			Classes:			Classes:		
	1.	2.	3.	1.	2.	3.	1.	2.	3.	1.	2	3.
2½	1.18	0.47	0 30	1.19	0.48	0.30	1.22	0.49	0.31	1.28	0.51	0.32
3	1.62	0.65	0.40	1.63	0.65	0.41	1.66	0.66	0.42	1.72	0.69	0.43
3½	2.11	0.84	0.53	2.12	0.85	0.53	2.15	0.86	0.54	2.21	0.88	0.55
4	2.67	1.07	0.67	2.68	1.07	0.67	2.71	1.08	0.68	2.77	1.11	0.70
4½	3.29	1.32	0.82	3.30	1.32	0.82	3.34	1.33	0 84	3.40	1.36	0.85
5	3.98	1.59	1.00	3.99	1.60	1.00	4 03	1.61	1.01	4.08	1.63	1.02
5½	4.74	1.89	1.18	4.75	1.90	1.19	4.78	1.91	1.20	4.88	1.93	1.21
6	5.55	2.22	1.39	5.56	2.23	1.39	5.60	2.24	1.40	5.65	2.26	1.41

Estimate, (Continued.)

Depths.	5 inch pipe.			6 inch pipe.			8 inch pipe.		
	Classes:			Classes:			Classes:		
	1.	2.	3.	1.	2.	3.	1.	2.	3.
2½	1.37	0.55	0.34	1.60	0.64	0.40	1.91	0.77	0.48
3	1.80	0.72	0.45	2.03	0.81	0 51	2.35	0.94	0.60
3½	2.30	0.92	0.58	2.52	1.01	0.63	2.84	1.14	0.71
4	2.86	1.14	0 72	3.09	1.23	0.77	3.40	1.36	0.85
4½	3.48	1.39	0.87	3.71	1.48	0.93	4.02	1.61	1.00
5	4.17	1.67	1.04	4.40	1.76	1.10	4.71	1.89	1.18
5½	4.92	1.97	1 23	5.15	2.06	1.29	5.47	2.19	1.38
6	5.74	2.30	1.43	5.97	2.39	1.50	6.29	2.52	1.57

This estimate is for the cost of excavation only. The bottom must be trimmed and levelled to a proper grade, which will cost about a cent a rod or six cents for one hundred feet. The earth can be returned into the trenches for about five cents per cubic yard. The cost of superintendence, and wear and breakage of tools, must be added, and a margin left for contingencies. Obstacles often occur in opening trenches, which cannot be foreseen from the surface, such as bars of hard-pan, layers of small stone, rocks, and roots of trees. In meadows, trunks of trees and old stumps are often found three or four feet below the surface, and in such sound condition as to increase the cost of excavation very materially.

There has been no provision made in these estimates for obstacles of this kind.

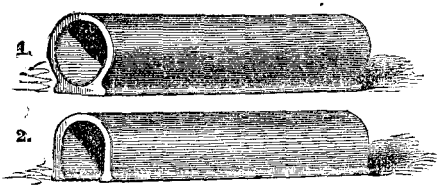
J. HERBERT SHEDD.

BOSTON, November, 1858.

As many of our farmers are not familiar with drain tile, either as to its manufacture, uses or capabilities for the conveyance of water, the information conveyed in the following paper by the same author, and published in the "New England Farmer," will prove useful. The publishers of that paper will accept our acknowledgments for the use of the illustrations accompanying.

"Various materials have been used in drains for conduits, but none with such success, and at so small a cost, as the pipe-tile. All other kinds are more liable to be stopped by roots of trees, burrowing of small animals, washing in of earth, gulleys worn in the bottom, breaks in the continuity, &c., &c. The expense of tile drains is much less than those formed of any other material, unless more is paid for the transportation of tile than their original cost at the manufactory.

The process of tile manufacture is as follows: after the clay has been properly ground, it is shoveled into the tile machine and pressed out by a piston worked with a screw or cam-wheel, through dies formed in the shape required for the tile, and run off on canvassed rollers, three or four side by side, in lengths of five or six feet; these strips are cut into the proper lengths, usually fourteen inches, by the single act of lifting a frame, to which wires are attached at small distances, which cut through the soft clay, and leave the tiles ready to be carried away to dry for burning; when sufficiently dried, they are placed on end, in a kiln made for the purpose, and fire applied until they have acquired about the color of good, red brick. Tiles are now furnished in Boston at the following rates:



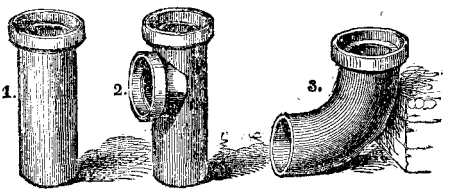
Sole or pipe tile, in form as figure No. 1:

1½ inch . . .	$10.75 pr. M.	3 inch . . .	$21.50 pr. M.
2 inch . . .	13.25 "	4 inch . . .	34.25 "
	5 inch . . .	$48.50 pr. M.	

Horse-shoe tile, in form as figure No. 2:

2½ inch . . .	$13.50 pr. M.	3½ inch . .	7.00 r M.
	5½ inch . . .	$33.50 pr. M.	

For sewers of small size, or for drains exposed to the action of frost, and for conducting pure water, the vitrified stone ware drain pipe is used with great success; it is made of the best material, and is entirely proof against all corroding agents. This pipe is very different from the red clay socketed and glazed pipe often seen, being formed of Jersey stone ware clay, well ground and pressed through a strong machine at an expense of great power, and burned in the kiln until vitrified; it is also glazed in the kiln by vaporized Liverpool salt when the pipe is at a white heat. These pipes are sold in Boston in two-feet lengths at the following prices:



No, 1, plain Pipe, | No. 2, Double Joint. | No. 3, Elbow.

2 inch, socketed . .	11c pr. ft.	6 inch, socketed . .	30c pr. ft.
3 inch, " . .	14c pr. ft.	8 inch, " . .	45c pr. ft.
4 inch, " . .	17c pr. ft.	9 inch, " . .	56c pr. ft.
5 inch, " . .	23c pr. ft.	12 inch " . .	90c pr. ft.

Elbows and double joints. double price per foot. The manufacturers of this article will make any shape or size to order; on account of the ease with which this material can be worked, it can be adapted to many useful purposes on a farm. one of which is in making "peep holes," by which to examine tile drains. Another very useful purpose is in conducting spring water to the house and barn, for which is used a pipe of one inch bore in two feet lengths, with separate collars. This size is sold at 6 cents a foot, including collars. It is capable of bearing the pressure of 150 feet head of water.

No. 1, represents the Pipe. | No 2, the Collar.

This form, viz., the cylindrical pipe with collars, is, undoubtedly the best for pipe tile, to be used in underdraining. It is in extensive use in England, and its manufacture is now begun in this country.

Water can get into the pipe-tile very freely at the joints, as may be seen by a simple calculation. It is impossible to place the ends

so closely together, in laying, as to make a tight joint on account of roughness in the clay, twisting in burning, &c., and the opening thus made will usually average about one-tenth of an inch on the whole circumference, which is, on the inside of a 2 inch tile, 6 inches, making six-tenths of a square inch opening for the entrance of water at each joint. In a lateral drain, 200 feet long, the tiles being 13 inches long, there will be 184 joints, each joint having an opening of six-tenths square inch area,—in 184 joints there is an aggregate area of 110 square inches; the area of the opening at the end of a 2 inch tile is about 3 inches. 110 square inches inlet to 3 inches outlet; 37 times as much water can flow in as can flow out. There is, then no need for the water to go through the pores of the tile, and the fact is, I think, quite fortunate, for the passage of water through the pores would in no case be sufficient to benefit the land to much extent. I tried an experiment by stopping one end of an ordinary drain pipe, and filling it with water; at the end of 65 hours water still stood in the pipe, three-fourths of an inch deep.

How large an area a certain sized pipe will drain is a question into which enters a great many elements; among which are the following: amount of rainfall, per centage of evaporation, perviousness of the soil, amount of drainage area beyond that occupied by pipes, amount of fall which can be given to the drain, friction of water with inside of pipe. It will be seen at once that it is impossible to lay down an arbitrary rule for all cases, though the area may be determined for each case by itself. The practice of extracting the square root of the drainage area in acres, to find, roughly, the diameter in inches for the main drain of any system, has been used in England. The rainfall there is about two-thirds the amount in New England, but the amount of evaporation here is double the amount there. Again, in England the fall of one inch, vertical depth, of water would be considered a great rain; here a rainfall of three or four inches, vertical depth, is not uncommon. Other things are different in the two countries, so that the rule if safe in England might not be so here. In the average of conditions in New England, I think the addition of one inch to the result obtained by the English rule would give a good diameter of pipe for the work; for instance, suppose 9 acres are to be drained, square root of 9 is $3 \times 1 = 4$. 3 inch pipe to drain

9 acres in Old England, 4 inch pipe to drain 9 acres in New England,; but this result is by no means safe for all cases.

If space permitted, I would show, by calculation, what amount of water certain sizes of pipe, under certain conditions could discharge. I will give one result with a 2 inch pipe having the least fall at which it is likely to be laid—i. e., 3 inches fall in 100 feet—velocity 0.895 feet per second—will discharge eleven thousand four hundred gallons a day.

J. HERBERT SHEDD."

Experiments.

In a circular issued last spring, four experiments were proposed for trial upon an acre of Indian corn, and also upon an acre of potatoes; an eighth of an acre in each case being differently manured. One of these had for its object a comparison of the value of common farm manure, new and old, with guano, leached and unleached ashes, &c.; a second, the comparison of farm manure with bone dust, superphosphate of lime, guano, &c., and with a compost of muck; a third was intended for trial by those within reach of marine manures, and to show the comparative efficacy of seaweed, muscle bed, and fish refuse, alone or in compost, and common farm manure. The fourth was intended for those who could not conveniently obtain, or cared not to employ, any fertilizers except those in most common use; and to illustrate whether new or old was preferable—whether it is better to plow in farm manure deeply under the surface, or to harrow it in lightly—whether to spread all, or put part in hills or drills,—whether it is preferable to use animal manure as it comes from the yard or cellar, or in a compost with muck, and also to compare muck composted with animal manure, with the same composted by addition of salt and lime, &c. Other points might also receive some elucidation by the trials proposed, if carefully and numerously made; and my intention was, if such proved to be the case, to gather the results as they might be reported, and present them in tabular form. But from some cause, or, more likely, a combination of causes, few were tried, or, if tried, were not reported, and of these few, only two or three did not vary in some respects from the suggestions of the circular; so that the intention was frustrated.

The occasion is embraced to offer a few remarks regarding their objects and the modes of conducting them.

The object of experiments is to develope and establish *facts* as the basis of all true knowledge or science, as these and these alone are decisive. We greatly need accurate knowledge in regard to a great many points in practice. Opinions there are already in abundance and widely diverse. Were all the theologians in the State convened and examined as to their opinions, and all the farmers also,

it would hardly be safe to predict with certainty in which body would be found the greater diversity. There is a right and best way to do anything and everything which needs to be done on a farm, and there are a great many ways which are not best. How shall the former be known? The answer is, by careful study, observation and *experiment*, and these repeated, continued and compared until certainty takes the place of conjecture.

Thought is the parent of experiment, and experiment in its turn gives stimulus to further study. It may be said that almost every farmer does experiment more or less; upon his stock, by employing differing modes in breeding, feeding and general treatment; and upon his crops by applying different manures, in differing modes and upon varying soils, and in many other ways; and why should not these experiments, continued as they have been for many centuries, suffice to have established the desired facts before now, if experiment be capable of doing it at all? The answer to this is not difficult. Experiments, to be *decisive*, must be *accurate*—and more—*they must unite all the conditions of exactness, with a knowledge of all collateral influences* which affect the results. And here is a great difficulty; rarely are the experiments of the farmer conducted with sufficient definiteness of aim, and accuracy of details in the methods pursued; and more rarely still, if ever, is he cognizant of every particular influence which affects the results. For not only does he deal with inert matter, which can be weighed, measured and analysed, but with the laws of life and health in both animal and vegetable organisms. Chemical analysis may aid us here, for it can tell what is in a grain, a root, a bone, in fat or in flesh; but while it can inform us as to the elements of which an organic substance is composed, it can tell us nothing as to how they are put together. Chemistry solves no physiological problems, and its hypotheses here are but guesses. It can conduct us to the threshold of life, and there its guidance ceases.

In its proper sphere, chemistry is an exact science. Let so much of a given acid and so much of a given base be brought together, and the chemist will predict with certainty what the resultant salt will be, and this salt is ever the same, let its component parts come from where they will—to-day—to-morrow—anywhere. But the sap and tissues of a plant, the blood, milk and nerves of an animal

are not always the same, nor will they yield up all their mysteries to chemical analysis.

Chemistry can better instruct with regard to the ultimate elements of which a crop is composed, than with regard to its nutritive value when fed to man or beast, or with regard to means by which the product when cultivated, can be increased. As to the former, it is at home and speaks *ex cathedra*, but in treating of the latter, it trenches upon the "physiology of probabilities," and its teachings are but approximations to truth, and need the confirmation of experiment. The chemist may from an analysis of divers grains and roots conclude their comparative value for nutritive purposes to be so and so, but the farmer, upon trial, not unlikely finds it somewhat different. The chemist, upon examination of a soil and its crop, may conclude, and rightly, too, that a little more silica and potash in the one, might have resulted in an increased product of the other; but it does not follow that a few pounds or a few tons added in the shape of flint stones and feldspar, would have increased the crop. But I need not pursue this train of thought further. Suffice it that *we need experiments*, carefully, watchfully made, upon a great range of subjects, and while we may not expect that any we may try shall enable us at once to attain absolute certainty, yet if we combine to the greatest practicable extent, the elements of accuracy and certainty, we may hope to attain approximations to truth which shall prove of exceeding practical value.

The better place for such researches is, undoubtedly, upon an amply endowed experimental farm, conducted by competent persons, and furnished with all the needful facilities. Such are not among us, but lacking these, many will doubtless be inclined to attempt something in this line, and it may be useful to mention some of the more common causes of failure, and the conditions most likely to be attended with success; and in this connection I cannot do so well as to quote from a recent address of Prof. Anderson, Chemist to the Highland and Agricultural Society of Scotland, whose remarks, somewhat abridged and condensed, are substantially as follows:

"In the older state of matters the farmer was a passive recipient of knowledge; he took what came under his notice; but now he has become an active recipient, gathering it from all available sources. No longer content with the experience gathered on his own farm, or

in his own district, he seeks a more extended acquaintance with general practice and a knowledge of the principles on which his art is founded so as to enable him to form an intelligent judgment as to what is correct, and what doubtful, in all that he sees, and how far he may safely transplant into his own farm peculiarities of practice which he sees successfully carried out in other places. In testing these points, he soon finds that he cannot depend upon loose observations made by himself, and still less upon those he hears from his neighbors; and he is irresistibly led to seek for more definite data and to institute experiments so as to enable him to arrive at satisfactory conclusions. He thus begins to wield that most important implement of agricultural inquiry from which his art has already obtained incalculable benefit and is destined to obtain still greater.

There is no subject which more deeply merits the attention of the agriculturist than the mode of conducting his experiments so that precise and conclusive results may be obtained from them. But if any one takes the trouble to examine with a critical eye the numerous experiments contained in the pages of our agricultural journals, he cannot fail to notice that, among many which are interesting and instructive, the number which do not lead to definite and satisfactory conclusions, although they may have been made with the utmost possible care, is surprisingly large. The causes of this are various: Sometimes there are obvious omissions in the reports, or in the precautions necessary to exclude fallacies; at other times the results of well-conducted experiments are incompatible with one another, and very frequently they fail from want of simplicity and definiteness of plan.

Several series of elaborate and otherwise well-conducted experiments might be named in which the effects of different manures are contrasted with one another; but the precaution of leaving an unmanured plot has been omitted, so that it is impossible to tell what proportion of the effect has been due to the natural fertility of the soil and what to the manure. Want of simplicity is most commonly observed in the use of too complex mixtures of manures, of which one may be quoted in which are given the result of the application of a mixture of dissolved bones, wood ashes, prepared night soil, sugar refuse, and nitrate of soda, as an illustration of a complexity of manures, which must prevent satisfactory conclusions.

As the progress of agriculture is every day demanding more precise and elaborate experiments, the necessity for attending to all possible sources of fallacy, and of eliminating them as much as circumstances will permit, becomes more and more important.

There are certain rules, by attending to which success may be rendered probable, but it is important to bear in mind that failures cannot be altogether avoided, and the cause of this lies in the fact that the conditions of the experiment are not entirely under our control. Among the many modifying circumstances the vicissitudes of the weather are those which exercise the most important influence, and they affect the results in a manner and to an extent quite unexpected; for altogether independently of the fact that the crops are generally affected by a favorable or an unfavorable season, there is no doubt that meteorological conditions exercise a special action on different manures.

Variations in the soil are a fertile source of discrepancies in the results of experiments; and, though it might be supposed that this is more under our control, any one at all conversant with the subject will admit the difficulty of finding a considerable breadth of land of sufficient uniformity to admit of absolute dependence being placed in the results. Differences in the physical and chemical characters of the soil so trifling as to escape notice, often produce a very marked effect; and even the degree of inclination of the surface sometimes causes considerable differences. But without enlarging upon these points, we must proceed to indicate the conditions most likely to lead to good results. And we remark—

1st. Before commencing, the experimenter should lay down a definite plan. He should not begin his experiments at random, but should at the outset form a clear conception of what it is he wishes to ascertain; and for this purpose he ought to begin by examining the literature of the subject, when he will, in all probability, find that many experiments of a similar character have already been undertaken. In examining these, he will see the particular points in which they have fallen short of accuracy or precision, the fallacies to which they were liable, and the additional precautions necessary to insure success.

2d. It is particularly important that the experimenter should not attempt too much. In place of making a great variety of dis-

cursive experiments, their number should be confined within the narrowest possible limits; the greatest care should be expended on the details, and no more undertaken than can be easily carried out. The most common error is that too many experiments are commenced at once, and the attention flagging after a time, the minute precautions which add so much to their value are apt to be slurred over; the more especially as it is often necessary to complete the experiment at harvest time, or at some period when there are many other matters to occupy the attention. It should be a fundamental rule that one good experiment is worth a dozen imperfect ones.

3d. When the plan has been clearly made out, and the substances with which the experiment are to be made have been decided on, it is next necessary that their composition be ascertained by careful analysis. In one instance on record in which, after numerous and careful experiments had been made, almost all the substances employed turned out to have been grossly adulterated. In selecting samples for analysis, the utmost care should be taken to obtain a fair average by taking portions from different parts of the bulk of each and mixing them.

4th. The ground on which the experiments are to be made must now be fixed upon, and care must be taken to select a space over which the soil is as uniform as possible. The subsoil should also be examined at a number of different points to see that it be also of similar character throughout; for if it differs, it may affect the results to considerable extent. The field should be as level as possible, and drained, but not recently manured, because under these circumstances the comparative effects of the manures employed are more distinctly brought out. The general characteristics of the soil should be carefully noted, the crops of the previous rotation and, if possible, the quantity of produce ascertained. The soil may be analysed, but this is by no means necessary, as the chemistry of the soil is still so imperfect that comparatively little information is to be derived from it. The space allotted should then be divided into the requisite number of plots, each substance being tried in duplicate, and several unmanured spaces being left in different parts of the field.

5th. It is necessary to determine the relative proportions of the different manures, in doing which, either equal weights may be taken,

or they may be employed in such quantities that their money values may be equal. The adoption of the latter is preferable, as it affords the readiest means of calculating the profit derived from such application, but care must be taken not to adopt the conclusions absolutely, but to modify them in proportion to the varying prices of the manures; for instance, experiments made with Peruvian guano, when at $45 per ton, would contrast more favorably with other manures than if made at the present time.

6th. The preliminaries being thus arranged, we next proceed to the actual details of the experiment. And here proper care is, in the first instance, to be directed to the application of the manures in such a manner that each is kept strictly within the limits of its own plot. The progress of the crops should be carefully watched, the various epochs noticed, such as the time of blooming and coming into ear, if a ceral crop, &c., &c. When harvest time approaches, great attention should be paid to the proper time for gathering the crop on each plot, which should not be done till each is fully ripe. In general, the crop from all is harvested on the same day; but this is erroneous practice, for some manures materially accelerate the ripening, while others have no such effect, and of course the latter are placed at a disadvantage, if collected at the same time as the others. The whole produce of each plot should be weighed, and not, as is frequently the case, only a small portion of it. It is often customary to weigh only a certain portion, but this is a most fallacious plan, and ought not on any account to be depended upon. In case of the cereals, the produce of each plot should be separately threshed, and the quantity of straw and of good and light grain and their weight per bushel ascertained.

7th. The effects produced on the next crop should be determined with as great care as possible. No new manure should be added; but the produce of each plot should be again carefully observed and weighed, in order to see whether any, and what, effect remains over to the second year. This is a precaution rarely adopted, although it is a most important one. It is a familiar fact, that manures differ greatly in the permanence of their action—passing gradually down from farm yard manure, of which the effect extends over a considerable number of years, to nitrate of soda, which appears to be entirely exhausted upon the crop to which it is applied. The

determination of this residual effect is an important element in the estimation of the relative economy of the different manures, and should by no means be neglected.

8th. The experimenter having completed his experiments, will be very chary about the conclusions he draws from them. If he wishes to make certain, he will repeat the same experiments in a subsequent season on a different field, but with no other variations, so that any chance anomolies, or any effects produced by meteorological or other peculiarities, may be eliminated. Indeed, the most perfect of all results would be obtained, if several individuals chose to form themselves into a kind of experimental club, and agree all to make the same experiments for several successive years, so that they might finally set at rest the questions which they have proposed to themselves for solution.

The above observations have reference exclusively to experiments with manures; but they apply also, *mutatis mutandis*, to those made on the feeding of cattle. But in the latter there are, if possible, still greater sources of fallacy, dependent upon peculiarities in the constitution, and even the temper of the animals submitted to experiment. There is no fact more familiar to feeders than that an animal of a placid disposition will fatten more rapidly than one of a restless and excitable temper; and there are many other conditions which are apt to render the results of even the most careful experiments nugatory. Still, on the whole, the conditions of success are very similar.

In conclusion, I may be allowed to say that, at no previous period in the history of agriculture in Maine, has there been apparent a stronger desire for accurate practice and for scientific attainments in all which bears upon the art than at the present, and the hope is confidently entertained that enterprise and emulation will prompt each and all to acquire and disseminate such knowledge—so shall future progress be increasingly rapid, and the aggregate wealth of the State largely increased.

By no means least among the encouraging signs of the times, may be noted the evident decrease of that spirit of unrest which in times

past has caused such a tide of emigration to flow out from among us. In its stead we now behold immigrants flocking in to occupy our newer lands, and among many occupants of older farms, there may be witnessed a quiet determination to arrest exhaustive culture, and to develope latent capabilities, accompanied with an unwonted willingness to invest all which can be spared in *permanent* improvements. The thought and intent of laying plans involving a life-long, home residence, and designed to extract from one's own acres, both comfort and profit during the years to come, is an augury for good, which, in a secular aspect, can hardly be too highly estimated, and cannot fail to ensure most gratifying advances.

S. L. GOODALE,
Secretary of the Board of Agriculture.

JANUARY 5th, 1859.

APPENDIX.

COMPILED FROM RETURNS OF AGRICULTURAL SOCIETIES, FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1857.

FINANCES.

Societies.	Received from the State.	Am't received from members and donations.	Am't received from all other sources.	Whole am't of receipts for the year.	Amount of premiums and gratuities offered.	Amount of premiums, &c., awarded.	Current expenses of the Society.	Whole am't of disbursements.	Value of Real Estate.	Value of other property.	Liabilities.
Maine State Society, .	1,000 00	886 00	6,714 50	8,600 50	5,000 00	3,158 00	4,952 65	8,110 65	-	-	-
Androscoggin County, .	300 00	585 00	451 20	1,036 20	692 50	453 70	326 51	780 00	9,000 00	-	7,000 00
Cumberland County, .	300 00	142 00	372 18	814 18	653 00	513 00	290 57	803 57	-	848 09	-
East Somerset, . .	150 00	628 00	82 50	860 50	300 00	247 25	53 00	800 00	1,200 00	300 00	800 00
Franklin County, . .	200 00	485 00	248 85	933 85	527 80	-	384 66	-	1,500 00	100 00	813 09
Hancock County, . .	-	-	442 91	442 91	490 75	268 89	222 61	417 89	-	-	-
Kennebec County, . .	150 00	57 00	341 27	548 27	334 75	306 50	259 18	565 68	-	400 00	217 00
Lincoln County, . .	300 00	132 00	196 75	628 75	400 00	334 85	399 25	704 10	-	170 00	-
North Aroostook, . .	200 00	20 00	355 97	575 97	330 17	212 92	84 00	296 42	-	150 00	-
North Franklin, . .	200 00	15 00	172 23	387 23	472 00	349 64	134 10	418 76	-	-	-

North Kennebec, . .	150 00	252 00	224 00	626 00	610 00	502 50	160 00	-	2,500 00	100 00	2,000 00
North Penobscot, . .	-	10 00	65 00	-	218 00	124 00	60 00	184 00	-	-	-
North Somerset, . .	150 00	45 00	106 65	301 65	218 73	172 45	115 46	287 91	-	-	-
Oxford County, . .	200 00	8 00	692 78	900 78	338 00	277 76	414 58	1,138 97	1,000 00	200 00	521 71
Penob. & Aroostook Union,	99 50	18 00	87 91	205 51	190 50	175 45	52 50	228 00	-	-	-
Piscataquis County, .	89 00	100 00	6 00	-	269 31	214 23	91 53	-	-	-	-
Sagadahoc County, . .	300 00	639 42	388 13	1,325 78	600 80	402 34	153 91	1,197 23	3,800 00	74 00	3,130 59
Somerset Central, . .	150 00	81 00	359 35	590 35	700 00	414 50	156 00	544 25	1,200 00	50 00	600 00
South Kennebec, . .	150 00	150 00	327 83	627 83	1,176 50	849 30	499 86	-	-	-	-
Waldo County, . .	276 35	137 00	99 14	512 49	378 00	263 00	183 25	478 98	-	-	-
Washington County, .	300 00	32 00	318 65	650 65	705 90	564 20	388 00	952 20	-	-	-
West Oxford, . . .	200 00	10 00	408 00	618 00	230 75	190 62	90 00	800 00	1,100 00	-	250 00
West Penobscot, . .	150 00	35 54	178 00	363 54	370 45	258 30	30 00	288 30	-	-	-
West Somerset, . .	120 80	59 00	75 75	255 55	170 85	153 19	96 40	-	-	-	-
York County, . . .	300 00	179 00	399 28	878 28	720 00	487 74	-	-	2,000 00	-	1,800 00

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

FOR FARMS, &c.

Societies.	Am't awarded for management of farms.	Am't awarded on experiments in draining.	Experiments in subsoil and plowing.	Plowing at Exhibition.	For reclaiming meadow land.	For manures, and experiments with them.	For orchards and nurseries.	For other farm improvements.	Total offered for farm improvements.	Total awarded for farm improvements.	Am't awarded for agricultural implements.	For objects other than agricultural.
Maine State Society, . .	-	-	-	-	-	-	-	-	-	-	-	-
Androscoggin County, . .	-	-	-	7 00	-	-	-	-	-	-	14 50	100 00
Cumberland County, . .	150	-	-	-	-	-	-	-	-	-	8 00	75 00
East Somerset, . . .	-	-	-	-	-	-	-	-	-	-	-	-
Franklin County, . . .	-	-	-	16 75	-	-	-	-	-	-	15 00	-
Hancock County, . . .	-	-	-	8 00	-	-	-	-	10 00	-	3 00	-
Kennebec County, . . .	-	-	-	5 00	-	-	-	-	12 00	5 00	6 00	48 00
Lincoln County, . . .	-	-	-	17 00	-	-	-	-	-	-	3 00	42 60
North Aroostook, . . .	-	-	-	5 00	-	-	-	-	-	-	4 75	30 00
North Franklin, . . .	-	-	-	9 00	-	3 00	-	-	-	-	-	94 00

North Kennebec, . . .	-	-	-	-	-	-	-	-	18 00	-	13 00	77 00	
North Penobscot, . . .	-	-	-	-	-	-	-	-	-	-	2 00	31 00	
North Somerset, . . .	-	-	-	-	-	-	-	-	-	-	2 00	-	
Oxford County, . . .	-	-	-	9 00	-	-	-	-	80 00	-	6 50	56 00	
Penobscot and Aroostook Union,	-	-	-	-	-	-	-	-	-	-	1 50	10 50	
Piscataquis County, . .	-	-	-	13 00	-	-	-	-	-	-	-	22 00	
Sagadahoc County, . . .	-	6 00	-	10 00	-	-	-	-	75 00	16 00	3 50	83 00	
Somerset Central, . . .	-	-	-	-	-	-	-	10 00	68 00	-	4 75	68 00	
South Kennebec, . . .	-	-	-	12 00	-	-	-	-	-	-	2 50	135 00	
Waldo County, . . .	-	-	-	9 00	-	-	21 50	-	57 50	30 50	2 00	94 00	
Washington County, . .	6 00	-	-	20 00	-	-	-	-	-	6 00	26 00	114 00	
West Oxford, ...	-	-	-	8 00	-	-	-	-	-	-	-	75 62	
West Penobscot, . . .	-	-	-	3 75	-	-	-	-	-	-	5 75	30 50	
York County, ...	10 00	-	-	12 00	-	13 00	-	-	29 00	23 00	4 00	110 00	

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED, (*Continued.*)

FOR FARM STOCK.

Societies.	Am't awarded for Bulls.	Am't awarded for Working Oxen.	Am't awarded for Milch Cows.	Am't awarded for Heifers and Calves.	Am't awarded for Fat Cattle.	Am't awarded for Horses.	Am't awarded for Swine.	Am't awarded for Sheep.	Am't awarded for Poultry.	Am't awarded for all other Live Stock.	Total amount offered for Live Stock.	Total amount awarded for Live Stock.
Maine State Society, . .	343 00	207 00	192 00	182 00	44 00	1,119 00	48 00	122 00	23 00	69 00	2,460 00	2,350 00
Androscoggin County, .	39 00	67 00	36 00	28 50	3 00	58 00	8 50	4 50	2 75	22 50	488 00	269 75
Cumberland County, . .	28 00	38 00	33 00	13 50	7 00	45 00	26 00	18 00	-	18 00	263 00	228 50
East Somerset, . . .	6 75	25 50	12 50	23 00	-	47 25	2 50	6 25	-	24 00	180 00	148 09
Franklin County, . .	21 50	10 00	10 00	8 50	11 50	33 25	5 00	11 00	5 00	162 91	260 00	240 00
Hancock County, . .	14 00	8 00	7 00	10 00	-	26 00	-	-	-	48 50	189 00	122 50
Kennebec County, . .	24 00	66 00	19 50	20 00	6 50	71 50	6 00	6 00	-	-	225 00	200 00
Lincoln County, . .	25 00	6 00	12 00	10 00	7 00	37 00	1 00	9 00	5 00	40 00	188 00	153 25
North Aroostook, . .	4 00	10 25	13 50	8 50	-	27 25	9 00	14 00	-	25 00	139 00	112 00
North Franklin, . .	10 50	39 00	4 50	5 50	6 50	30 00	2 00	24 00	3 75	28 25	203 00	154 00

North Kennebec,	36 00	43 50	23 00	15 00	5 00	140 00	10 50	32 00	10 50	41 00	408 00	356 50
North Penobscot,	6 00	21 00	3 00	5 75	–	14 00	–	4 00	–	13 00	88 00	67 00
North Somerset,	7 80	21 00	3 75	2 60	–	8 75	75	6 00	–	58 35	127 1[illegible]	109 30
Oxford County,	20 00	22 00	15 00	13 00	–	31 00	4 00	9 00	–	32 00	160 00	146 00
Penob. and Aroostook Union,	11 75	3 00	13 00	5 75	3 00	21 00	7 00	7 00	–	–	97 00	95 75
Piscataquis County,	24 00	28 00	12 00	10 00	–	33 00	5 00	19 00	50	13 50	147 50	144 50
Sagadahoc County,	30 75	11 25	11 00	28 75	12 00	25 75	14 25	5 25	6 34	62 25	252 00	207 50
Somerset Central,	24 25	55 00	17 00	18 75	6 00	120 00	13 00	26 00	5 25	–	430 00	286 75
South Kennebec,	41 00	100 00	41 00	32 00	12 00	163 00	32 00	51 00	9 00	73 00	764 00	554 00
Waldo County,	5 00	25 00	6 00	9 00	–	24 00	–	–	2 50	17 00	127 00	86 50
Washington County,	35 00	46 00	31 00	36 00	–	47 00	13 00	23 00	–	–	–	231 00
West Oxford,	6 00	5 00	3 00	5 00	5 00	21 50	–	6 00	–	7 00	91 00	58 50
West Penobscot,	28 25	20 00	7 25	16 75	–	47 00	–	19 00	–	21 00	199 50	159 25
West Somerset,	12 25	18 00	6 00	7 75	–	14 00	5 00	18 25	–	41 25	158 00	122 50
York County,	15 00	34 00	10 00	9 00	10 00	138 00	15 00	3 00	6 50	31 00	215 00	184 00

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED, (*Continued.*)

For Farm Products.

Societies.	Amount awarded for Indian Corn.	Wheat.	Rye.	Barley.	Oats.	Any other Grain Crop.	Grass Crops.	Potatoes.	Carrots.	Beets.	Turnips.	Other root crops.	Total am't offered for Grain and Root Crops.	Total am't awarded for Grain and Roots.	Am't awarded for any other cultivated Crop.	Am't awarded for Fruits and Flowers.	Am't awarded for Honey and Sugar.	Am't awarded for Butter and Cheese.
Maine State Society,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	119 00	41 00	160 00
Androscoggin Co.,	1 00	5 00	2 00	–	3 00	–	–	4 50	2 00	1 00	1 50	13 00	62 00	33 00	–	11 00	1 00	23 00
Cumberland County,	12 00	4 00	–	–	3 00	–	–	2 00	3 00	–	3 00	3 00	64 00	30 00	–	8 00	2 00	10 00
East Somerset, .	21 25	3 25	1 50	4 00	3 50	50	–	3 75	2 25	–	2 25	–	60 00	47 25	–	1 75	–	15 25
Franklin County,	12 00	–	–	2 50	7 00	–	–	8 00	2 50	1 00	1 00	–	75 00	34 00	–	6 00	–	8 75
Hancock County,	1 50	1 50	1 50	1 50	1 00	2 50	1 00	–	50	50	1 00	1 00	83 00	13 50	–	12 25	1 50	32 84
Kennebec County,	5 00	4 75	–	3 75	3 00	–	–	3 75	3 00	–	1 50	–	–	24 50	–	7 00	–	18 00
Lincoln County, .	10 00	6 00	3 00	2 00	3 00	3 00	–	6 00	3 00	1 00	1 00	8 50	47 50	46 50	–	20 00	–	22 50
North Aroostook,	9 00	4 00	5 00	50	–	6 50	–	4 00	–	–	25	3 50	92 00	33 00	3 50	2 00	50	15 00
North Franklin, .	17 25	15 00	2 00	2 25	5 25	3 75	–	4 50	1 50	2 25	1 25	–	117 00	55 00	17 25	4 00	3 25	9 75
North Kennebec,	4 00	–	–	–	–	–	–	3 00	–	–	–	9 00	75 25	19 00	–	7 00	1 00	19 00

North Penobscot,	1 00	–	–	–	–	–	–	–	–	50	–	–	48 00	1 50	–	10 00	50	12 00
North Somerset, .	5 25	5 25	–	3 25	3 75	3 85	–	5 25	75	–	1 10	40	32 35	23 85	50	2 65	37	4 90
Oxford County, .	3 00	7 00	1 00	–	3 00	–	–	–	–	–	–	–	60 00	14 00	5 50	12 50	–	24 00
Penobscot and Aroostook Union,	3 00	3 00	–	–	–	1 50	–	–	1 00	–	–	–	27 25	8 50	13 95	4 00	75	7 00
Piscataquis County,	3 00	–	–	–	–	–	–	–	–	–	1 00	–	19 00	4 00	–	6 25	2 75	18 00
Sagadahoc County,	6 50	3 00	2 00	–	2 00	–	–	12 00	2 00	4 00	–	–	71 00	31 50	9 00	14 75	1 00	26 50
Somerset Central,	–	–	–	–	–	–	–	6 00	–	–	–	–	89 00	–	–	26 50	8 00	14 00
South Kennebec,	18 00	7 00	–	–	–	–	–	8 00	–	–	–	–	125 00	33 00	15 50	31 00	9 00	23 00
Waldo County, .	–	–	–	–	–	–	–	10 00	2 00	2 50	6 50	5 00	56 00	–	–	11 50	3 00	8 00
Washington County,	–	3 00	–	3 00	5 00	3 00	–	8 00	3 00	–	7 00	–	–	25 00	–	24 25	5 00	30 00
West Oxford, . .	3 50	6 00	3 00	–	–	–	–	2 00	–	–	–	–	34 00	14 50	3 00	3 00	3 00	6 00
West Penobscot, .	4 75	2 00	–	1 00	–	–	–	3 50	2 75	–	–	4 30	94 00	18 30	2 50	23 75	–	14 50
West Somerset, .	1 20	–	–	–	–	–	–	60	–	60	–	–	–	2 40	–	50	50	4 50
York County, . .	–	–	–	–	–	–	–	4 00	–	–	–	–	78 00	–	–	29 00	3 00	12 00

INDEX.

INDEX.