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OUR ENGRAVINGS.

DRAINING.

In my last article on this subject I went over the theoretical points necessary to be understood by every one before the practice is attacked. We saw that the water entered at the bottom of the conduit; that gravity acted more efficiently in proportion to the height of the column of water already existing in the land; and that to get rid of the superfluous water by evaporation produced cold instead of heat: in other words, that, in undrained land, the first efforts of the sun in early spring were injurious instead of beneficial.

The practical questions that first meet us are the following: what depth shall we make the drains? what direction shall we give them? and how shall we cut them?

As a general rule, increased depth will allow of an increased distance between the drains. But the question really sums itself up in this: I have so much money to spend in draining: how many cubic yards of soil can I dry for one dollar? For, if the water-level in the land be not lowered to a depth beyond the reach of capillary attraction, the full benefit of drainage will not be gained, evaporation will still exercise its malefic influence. This level we may assume to be reached at 4½ feet; and, in England, the government Inspectors had strict orders not to sign certificates for the payment of drainage loans unless they found this depth rigidly adhered to. I knew there is not much hope of such a depth being arrived at here, but I cannot help saying that at a less depth than 33 inches the work and materials will be as good as thrown away Still, it is a matter for the farmer's own consideration whether he will put down a few deep drains or a great many shallow ones, the first will, in the majority of soils in this province, draw well at intervals of 50 feet; but the latter will be probably next to useless at more than 20 feet apart. At any rate, when we have to deal with such expensive materials as pipe-tiles, I should think no sensible man would leave them within reach of the frost.

Depth of drains.	Distance apart.	Mass of soil drained in cubic yards.
2 feet.	24 feet.	3226½
3 "	32½ "	4840
4 "	50 "	6153

Generally, double the depth of drain has effect on about twice the cubical contents of earth, and about half more in extent of surface; but as regards price, at the usual cost of digging drains, &c., three times as many cubic yard are dried for one cent by deep drains as are dried for the same amount by shall owones. The exact figures are 2 cu. yds. at 2 feet deep and 24 feet apart; 4 cu. yds. at 3 feet and 33½ feet; and 12 cu .yds. at 4 feet and 50 feet, excluding fractions. I have taken the prices I have myself paid in England, about half what it would cost here.

The direction in which the drains should run. There is nothing so certain as the answer to this: up and down the greatest fall. And I think the following considerations will make this pretty plain. One law of hydraulics known to every one is that water always seeks the lowest level in all directions. In fig. 1, let *a b c d* be a field sloping from *a b* to *c d;* and let *e f* be a main drain into which the side drains *g h, i k, l m, n o, p q* and *r s* fall:

Now there is nothing more clear, in the case where drains cross the fall, than that the water that falls at *v* must have the whole distance to travel from *v*, just below the drain *i k*, in a diagonal line until it arrives at the drain *g h* (for it cannot run up hill into *j k*) that is, actually farther than the distance between the two drains: the same with the water that falls at *w*, below the drain *l m*. But take a glance at the other side of the plan, and look at the drains *n o, p q, r s*, and it will be evident that the water between each pair of drains has only a little farther to run than half the distance between the two drains, in fact where the fall is slight there is a mere trifle of extra journey for it.

Again, if we look at the plan No. 2, where *a* and *b* are vertical sections of drains, and the dark line above *c* a foot of mould. (the plough furrow, in fact) the rain that falls on *c* will be quickly absorbed, and, seeking the lowest level by gravity, will hasten at first perpendicularly towards the line *d e;* and, in doing so, the portions nearest the drains will find it easier to move towards the open conduits *d* and *e* than towards the firm ground at *h*: moving thus there will always a higher level of water at *h*, and the accumulation there will cause a strong lateral pressure on each side towards *d* and *e;* and the greater the accumulation the stronger will the pressure. Some people imagine that water finds its way into the drains as it does from the ridge of a house into the *rones* or shoots; but they are those who have never given themselves the trouble to think about the matter. Another reason why drains should run in the line of the greatest fall is, that almost invariably the substrata lie *horizontally*. Now looking at figure 3, in which *a b* is the plane of the surface soil, and *c d e f*, substrata concealed from view by the surface, it is evident that drains across the surface *a b* might very easily miss cutting any one or more of the substrata, which, as springs almost always break out at the point of intersection, would be an awkward affair. So that, although oblique drains *might* cut through a vein of sand or gravel, and thereby carry off the water it contains, the drains along the greatest fall *must* cut it; and they are so preferable, as has been shown, in other respects, that they should always be adopted.

Main drains should of course occupy the lowest place in

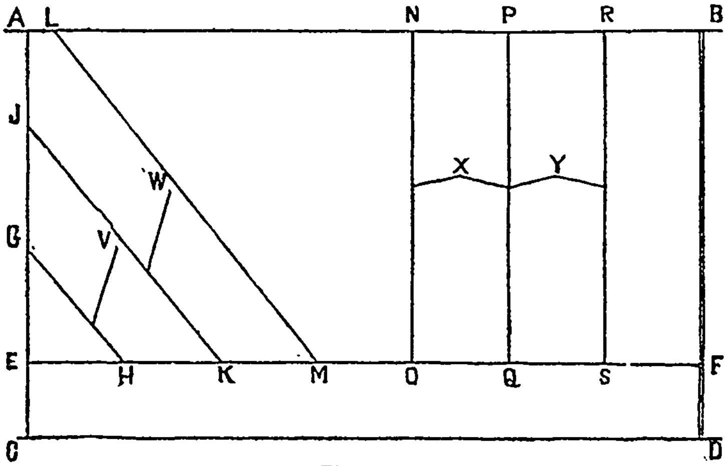


Fig. 1.

the field, or part of the field, to be drained, and where this is attended to as it ought to be, many a dollar may be saved For example, many of our Kentish farms lie along a valley formed by a tiny brook, which acts as the receiver of the ditches which, in their turn, carry off the water which issues from the drains. The fields all run *N* and *S* from the brook. The bottom of the fields is fine loam on gravel extending half way up the slope; the top a stiff (oh! very stiff) clay, full of springs and of a conglomerate of lime and shells. A grand

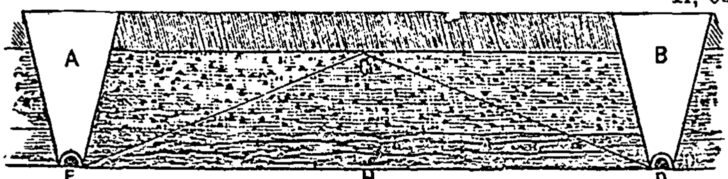


Fig. 2.

opportunity of wasting money in draining the whole piece! Whereas, in each field one main drain running into the open side ditches about the middle of the field, and receiving short side drains 45 feet apart, and from 4 to 5 feet deep, cured the whole of the farms at a very moderate outlay. Such a state of land may be seen any day for many a mile along the road from Lennoxville to Coaticook. Springs, finding a weak spot between the strata of rock, burst out, and spewing all over the lower ground, spoil every year twice as much at least as it would cost to drain it.

It may be as well to say here, once for all, that whether we are draining a town or a field, the small drains should always run into the main at right angles, with a curve for the last few feet, to allow its water to run with instead of against the current of the water it meets with in the main.

Whether the main should be lower than the small drains is a doubtful point. I prefer that they should be level, as the wash of a rush of water in sudden storms is a dangerous thing, if there is any fall at the junction. At all events, great care should be taken, whatever materials are used, to make the junction as secure as possible. When the main is being cut, the distance between the side drains having been determined upon, each side drain should be opened for a couple of yards as the main goes on: thus the main can be finished, materials placed, and the earth returned, from end to end without stopping. On springy ground, this will be found very important.

Where land is subject to more or less permanent bursts of water from springs, I advise all drainers to strike the outburst straight in the face. Cunning men, in backward districts in England, try to dodge, or circumvent, the "weeping spots", as they call them, and invariably cost their employer about four times as much as their work is worth. I knew three or four of these worthies. They always worked alone, whereas there never should be less than 3 men at a drain, and 4 are better still. All the drains I have seen made in this country are too wide atop. The great saving of expense lies in keeping down the quantity of earth moved, and if you start with two feet instead of 14 inches, it will amount to a great many pounds weight of unnecessary earth to be moved in a thousand rod of drains Fourteen inches are plenty for the top spit, diminishing gradually till, with pipes, the conduit just fits the drain. And this bring us to another important point: the tools to be used in draining, and the materials that are to serve as the conduits, or ducts, for the water.

Now it will depend upon the latter, the ducts, what tools we want, especially for the bottom spit and the last crumbs or mud. At all events we shall need a line of some sort to mark out the lengths of drain; a spade of ordinary dimensions for the two or three first draws; a pick to dislodge stones, or to get through any *hard pan* we may meet with; a shovel to throw out the crumbs with, and a draw-scoop to finish off the bottom with.

If we are to use pipes, we shall need a narrow semi-cylindrical tool, sold at any of the seed warehouses, made on purpose to cut out a narrow bed closely fitting the pipe.

If, on the other hand, we use stones or bushes, the last spit must be removed by means of a very narrow spade of the ordinary shape. The pick had better be of the *tramp* sort, as in that case the men can all work with their faces towards the opened part of the drain, except the shoveller.

The draw scoop must be semi-cylindrical for pipes; but flat-backed and 4 inches broad, if for other materials. In laying the pipes, the workman stands across the drain, and begins to lay from the mouth of the drain backwards, laying each pipe in its seat by means of a pole at the end of which is a short rod of iron at right angles on which the pipe is threaded, dropped carefully down, and adjusted to its place by the rod.

But this by the way, for fear I should forget it. I need hardly say that the tools should be kept sharp, and where *there is a tenacious clay to be cut, the workman will be all* the better for a bucket of water handy, to dip his spade into. Having drawn out our line of drain with accuracy, the question arises. shall we use a plough for the first 10 inches or not? It depends. If the subsoil is hard and not given to fall (cave) in, a plough may be used to advantage; but if the ground is wet and crumbly, rough and *tussocky*, and the drains are to be of decent depth, considering the risk of straining the horses, and of causing extra work in throwing out fallen-in sides of the drain caused by the tramping of the horses, I prefer taking the whole out by manual labour.

Whatever material we are to use, we may start by taking three draws of the common spade, each draw to be carefully shovelled out by the second man working with his face to the digger, who works backwards. This will give us about 3 x 9 27 inches in depth, and, at our proposed depth of 33 inches, as the shallowest admissible, it is time to think of the bottoming.

Suppose we are going to use bushes. The brush should have been prepared in winter, or at any rate when the leaf is off. and should consist of fresh, limber twigs about 3 feet long, as full of life as possible, and with nothing thicker than half an inch in diameter amongst them. If any of the boughs seem inclined to lie awkwardly, a slight tap with a sharp axe will correct the fault.

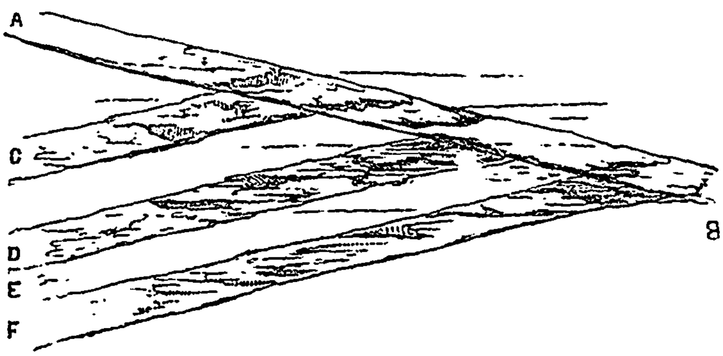


Fig. 3.

The drainer, still working backwards, should remove the remaining 6 inches with the narrowest spade, leaving the bottom 4 inches wide, and neatly finished, taking out the crumbs with the flat draw scoop. You may observe that there will in this case be a trough left at the bottom of the drain 6 inches deep, by 4 in width. This is the real conduit, the bushes are only meant to keep it open. In a few years they will perish, but the arch of the drain will remain for several years more if treated as I shall advise in the sequel.

The drain being now ready to receive its filling, let the workman take a sufficient quantity of the bushes in his hands, straightening them as much as possible, and lay them carefully at the bottom of the drain, trampling them firmly down. Then another man, a boy will do, should hand the drainer a fresh bundle to be laid further on, but with the top ends resting on the bottom end of the first bundle, and so on up the drain as far as it has been bottomed out. Care should be taken not to brush in the earth from the sides.

Now the filling-in may begin. Remembering that the water is to enter the drain from the bottom, our main object should be to prevent any rush of water downwa.ds into the top of the drain, bringing earth and sand with it, and thereby choking the duct. we take the stiffest, soapiest clay we can find, place it carefully on the bushes, and trample it down firmly. The firmest part of the original earth taken out of the drain is then returned on to the clay, and the rest thrown in anyhow.

If in bush drains the junctions with the main drain were made with pipes, it would be all the better, and the discharge of the main into the open ditch should be invariably piped for four or five yards upwards: wooden pipes, square or round, will do. The fall towards the mouth of the main where it joins the ditch should be as rapid as possible, to avoid a sudden stoppage from frost.

It may be necessary, in very level land. to use mechanical means to determine the fall of the ground. An ordinary *spirit-level*, mounted on a pole with a spike at the end, is quite sufficient for the purpose, and is used in this way.

Set the level in the middle of the ground to be drained, and placing the eye-sights in the proper direction, turn the screw until the air bubble rests in the middle of the glass tube. An assistant should hold up a rod at the end of the ground in that direction, and mark a point indicated by the observer on the rod. The same operation is gone through at the other end of the ground ; and if the two marks agree, the whole piece is on a level. But if the mark at the first station is at 3 ft. 9 in. from the ground, and 4 ft. 8 in at the second, there is a fall of 11 inches from the first to the second station. A very little practice with the level will make any one handy with it; but it is seldom necessary, except to intimidate the workmen by making them believe that the instrument will detect their tricks.

A very small descent is sufficient for the fall in pipe-drains. Cresy, the Civil Engineer, says that one foot in two hundred and twenty yards is enough: $\frac{1}{660}$! The deeper the water in the drain the less fall required: thus, deep rivers only want one foot in a mile In very low lands I have found it necessary, sometimes to take the main a long way down into the ditch to gain a fall; and I have seen, at Longleat, the Marquis of Bath's place in Wiltshire, an iron pipe carried under a mill-stream to take away the water from the drainage of a meadow on higher ground. But in all cases of this sort, the services of a competent engineer should be secured at once; it will be found the cheapest plan in the long run.

ARTHUR R. JENNER FUST.

The engravings of drainage tools, &c., will appear in the January number of the Journal.

Fine Butter and Cheese.

The Sources of Aroma and Flavor.

Prof. Segeloke of the Royal Agricultural College of Denmark, whose experiments and investigations in dairy practice have been of such great value to that country, expresses the opinion that the aromatic principles of butter are due to the partial decomposition of milk or cream and the *development of lactic acid*. In precisely what way this decomposition or development of lactic acid gives rise to the aroma in butter so much sought after and admired by the lovers of butter, is not as yet known, but it may and probably does come from chemical changes in utterly inodorous principles. He says :

"If the temperature of the milk when set for cream be from 10° to 12° centigrade (50° to 54° Fahrenheit) or more, it decomposes, forming lactic acid and several other new principles — among them, aromatic principles ; and it needs but to churn the cream to obtain an aromatic butter If on the other hand the temperature of the milk at such time be near the freezing point, the decomposition necessary for the production of aromatic principles is held in check, and consequently the aroma of butter obtained from fresh cream is so feeble that it is not perceptible to persons accustomed to butters prepared as above indicated, in the same way as French butters are made at present. But if it be desired to obtain a more aromatic butter, all that is required is to place the cream in circumstances favorable to *lactic fermentation*, and a few hours will produce the required result.

"In either case, the aroma formed may be more or less agreeable, that all depends on the fundamental principles of the milk, on the quantity of the principles necessary for the formation of aromatic principles that is present, and on the method of manipulation employed.

"In either case, again, the appearance of aromatic principles is accompanied by that of *lactic acid*. Whether the aromatic principles sought for in butter are produced by lactic fermentation, by a simultaneous general fermentation, or by several fermentations combined, I do not know."

Prof. Segelcke then asks the question: "What is the chemical composition of the aromatic principle so much admired in butter?" He suggests that to solve this interesting question, elaborate experiments would be required, and in conclusion he sums up the matter by saying that this, at least, is certain, "*that without decomposition there is no aroma* — at least no aroma in the ordinary sense of the word."

The question here raised is an important one in its relation to dairy manufactures, especially in cheese-making, where it has been found that the flavor so much admired, which cheese-mongers express by the word "nutty," or "clean, sweet, nutty flavor," is, in its best estate, the result of developing lactic acid in the curd.

Before the inauguration of the cheese factory system, when cheese was made up on the farm, the general opinion prevailed among the best and most experienced cheese-makers that a better-flavored cheese came from milk having some age — at least 12 hours' old—and that in the then method of manufacture (a kind of sweet process), a finely-flavored cheese of the best sort could not be made from milk drawn directly from the cow. This principle has been very clearly demonstrated by the Cheddar dairymen of England, who develop lactic acid in their curds, and whose cheese has long been sought after as the best sort made in England, commanding the highest prices. Of course this development of lactic acid must not be carried *too far, since it is then more or less destructive to the aromatic principles producing fine flavor*, and it is on account of developing acidity *too far* that many cheese makers fail to accomplish the highest results both as to flavor and mellow texture of their cheese. It is a curious fact in science that some of the most delightful flavors and perfumes are brought about from chemical changes or partial decomposition in products not particularly pleasing to the taste or smell.

It is well known that the development of lactic acid in cheese-making is a means of covering up and keeping down disagreeable taints; but the manner of its action, whether it be in developing with more force aromatic principles, or in killing the disagreeable taints in some way, has not as yet been fully explained.

I give these facts to show that good cheese does not result simply in separating a certain percentage of water from sweet milk, as some have supposed, but that certain changes must be brought about in the union of the different constituents of milk, and that the proper development of lactic acid in the curd is among the first and most important of these.

The effort to disguise the operation of acid in the curds under the name of "a cheesy smell" or "cheesing" is only a mystification of the art of cheese-making, likely to lead many astray. Cheese-makers should have a knowledge of lactic acid, and be taught how to use it properly and not to misuse it; for when rightly used it becomes an important aid in the hands of the cheese-maker for producing a highly flavored, rich, long-keeping and highly appetising product This the Cheddar dairymen of England have proved over and over again during an experience of more than 200 years.

Prof. Sheldon in his book on "Dairy Farming," now going through the press, gives the following sensible comments on this question:

"It is obvious that incipient decomposition, which is but another term for ripening, develops the flavors which we so much admire; and it is equally obvious that these pleasant flavors become unpleasant after a time as decomposition proceeds. Thus it follows that a given degree of acidity is useful in both cheese and butter-making, developing as it does the flavor and aroma; but if it is allowed to go too far it destroys both of them, or rather carries them into a stage in which they are no longer attractive to the palate. The introduction of extraneous matter also may easily induce a sort of fermentation or decomposition which will develop an aroma which is foreign, or may prevent the development of that which we should naturally expect to find in a well-ordered article."

In conclusion, the importance of cleanliness in all the details of dairy practice cannot be too strongly urged. Milk a compound body, and the dairyman has enough to tax his powers in treating a substance composed of so many constituents differing from each other in character. If filth or any other foreign decomposing matter be added as another element, the substance becomes still more complicated, and it is not easy to tell what new compounds will result from a union with this extraneous matter, to depreciate or spoil the product; and *there are other considerations of a sanitary nature* involved in this question of cleanliness. Filth and its products of decompostion, may result in poisons more or less virulent; for it is from this source, it is believed, comes that subtle poison sometimes developed in cheese, the nature of which is so difficult to fix by chemical analysis.

X. A. Willard. *Herkimer Co., N. Y.*

How young may heifers breed?

Young Dairyman, *New York.*—I have a heifer that took the bull at twelve months old; she will, therefore, come in at twenty-one months. I want to know if it is proper for a heifer to breed so early—whether it is not likely to injure her constitution and her milking capacity?

Reply. — We should not advise allowing a heifer to be served under the age of 15 months, so that she may come in at the end of her second year; but we have known many heifers to come in as young as the one mentioned, and do well, developing into very fine milkers; yet it must be remembered *that some heifers are as well developed at 12 months as others* at 18 months. Much must depend upon the breed, whether usually bred to early maturity, or the slow development of three and four years. It may, however, be stated as a general rule, that heifers must be well fed in order to develop the system properly for breeding so early as two years. But this question has been thoroughly settled by the best dairymen in nearly all countries in favor of heifers coming into milk at two years old. It has been found that a well developed heifer coming into milk at two years old is usually a better cow at four years than one coming in at three years; and besides this important fact, the breeder will have received 4,000 lbs. of milk the third year, instead of having kept her that year simply for her growth. It appears that an early development of the milk secretions tends to increase their power or flow, just as the exercise of the muscles increases their power. The breeders of the Island of Jersey are very particular to have their heifers come into milk at two years. The most expert Short-horn breeders usually have the first calf dropped at 24 to 30 months. — *National Live-Stock Journal.*

Jerseys or Guernseys.

Mr. W. L. Rutherford, of St. Lawrence Co., read a paper upon these breeds. He gave a short sketch of the Jerseys, and then the yield in butter of many noted cows of this breed. *He gave it as his experience, that cows which gave the most* milk yielded the smallest proportion of cream. That a cow, when yielding 28 to 30 lbs. of milk, requires 18 or 19 lbs. for a pound of butter; but when she gave 12 to 14 lbs. she made a pound of butter from 12 to 14 lbs. of milk. In two heifers, the past summer, the one yielding 28 lbs. per day required 4 lbs. of milk more for a bound of butter than another yielding 22 lbs. of milk per day. He attributed the larger proportion of fat in the Jersey milk to the less physical exercise taken by the Jersey; that this breed had been tethered and hand-fed as far back as we could trace the history of the cow; that physical exertion used up a portion of the fat-forming food.

The milk record of his herd of Jerseys, heifers included, has been. for 1876, 4,640 lbs. per cow; for 1877, 4,282; for 1878, 4,814 lbs. per cow. He was of opinion that when Jerseys shall be fully tested they will be found as superior for cheese as for butter, and in practice their greater richness in cream will make the cheese proportionally superior. Many individual cases were given of Jersey yields, to which we may recur hereafter.—*National Live-Stock Journal.*

VETERINARY DEPARTMENT.

Under the direction of D. McEachran, F. R. C. V. S., Principal of the Montreal Veterinary College, and Inspector of Stock for the Canadian Government.

The Foot of the Horse and its management.

The upper margin of the wall is hollowed on the inside, forming a groove in which is lodged the coronary substance from which the hoof is secreted. The surface of this groove is pierced by numerous little openings into which the secreting villi enter from which the secretion of horn takes place. The thickness and direction of the wall vary not only in each individual, but also in the same foot. Thus, it is thicker, deeper, and more oblique, in front than at the sides; from the toe it gradually, in a well formed foot, decreases in depth, degree of obliquity, and thickness to the heels, except at the inflexion where it is thickened to form the point of the heel.

The Bars are the inflection of the wall at the heels running inward, and meeting at the toe of the frog present on their attached surface the same laminated arrangement for attachment as the wall.

The Frog consists of a soft elastic horny covering for the fatty, or sensitive, frog to which it is attached by villi; the two together forming an elastic pad filling up the triangular space between the bars, the use of which is to break concussion, and protect the navicular pulley and joint above. The sole consists of a quality of horn softer and less fibrous than that of the wall, yet harder and more flakey than that of the frog. It fills up the space formed by the wall and bars, it is attached to the sensitive sole by villi and derives its nourishment from that structure—at the source of its growth it is soft and porous: as it is pushed away from it, it becomes drier and harder, till we find the outer layer, especially when exposed in its natural condition to the action of the atmosphere and moisture, becomes dense, hard, and capable of protecting the delicate structures beneath from bruising by hard substances when stepped upon.

The Frogband may be looked upon as a semi-horny—semi-cuticular band, forming the bond of union between the skin and hoof.

The sensitive foot, consists of the sensitive wall, sole, and frog with the coronary ligament which is lodged in the groove on the upper margin of the wall, and from which it derives its nourishment. The wall is covered by the sensitive laminæ which dovetail with those covering the inner surface of the wall of the hoof. The other parts, except the bars, are attached by villi.

Bearing these condensed anatomical outlines in mind, our readers will more readily understand the uses of the different parts of the foot, and the general principles for maintaining it in a healthy condition.

Management of the foot.—From the time of birth, nay. even at the time of mating of the sire and dam, the foot of the future animal will be influenced by the judicious, or erroneous, judgement of them.

It is now well understood by observant breeders, that the size and form of the foot, as well as the quality of the horn, is in a great measure dependent on the transmission of good or bad qualities in the feet of the parents; hence a sensible breeder will always select a horse and mare with good feet. Our readers should reflect on this; and think how true the old saying is "no foot no horse". We know from long observation that flat feet, thin horn, brittle horn, tendency to sandcrack are all transmitted by parent to progeny.

The soil on which they are reared influences the quality of the feet materially. In all her arrangements, Nature adapts her creatures to the surrounding circumstances. Thus, on high, mountainous land, the feet of the horse are small, hard and narrow, compared with the wide, flat feet of those raised on low, level, or prairie land. The food the animal eats influences the feet, the nature of the soil during the early years of the animal's existence exerts a powerful influence, and through life, not only the quality, but the quantity of the food and manner of giving it, affects the feet. From birth the feet require close attention; thus, should the feet of the colt be allowed to become dry and hard, contraction of the whole foot results, not only from increased evaporation, but from active absorption produced by the pressure. The young foot requires a not too hard floor, with sufficient moisture to keep it soft. Its form should be preserved by judicious trimming; the wall should meet the ground evenly all round; the toe must not be allowed to become too long, or it will act as a lever, to the injury of the navicular apparatus, or the tendons. This is not sufficiently attended to by breeders generally, and many a valuable colt is so injured as to become, ere long, a confirmed cripple.

By all means look carefully after the feet of the colt. The leaving the feet to nature in animals kept artificially, deprived of the natural friction, is quite impracticable. Allow them large runs of pasture land, and it is possible they will be worn down sufficiently; but confine them in a loosebox or stall, standing on soft manure, and we find that the feet require constant attention.

During the early part of the present century the preservation of the horse's foot seems to have occupied the principal part of the attention of those Veterinarians who were the founders of the science, as we find by the elaborate treatises on the subject by Bracy Clark, Coleman, Turner, James Clark, Miles, and more recently, Dick, Gamgee, and Fleming, in Britain; and the celebrated Lafosse, in France. And so thoroughly have these men investigated the subject, that in the present day we have added comparatively little to the knowledge imparted by their teaching.

Of course, to the farmer the importance of sound feet is not so forcibly impressed by lameness and loss, owing to the fact that the horses are mostly worked on the soft land, or clayroads, and are generally sold young, before the feet are tried, as it were. They must not forget however that even the young horse's feet require attention and their quality will influence a buyer in the price he will pay the farmer—and we are convinced, that attention in breeding from animals with sound feet, and judicious management for the first three years, will insure good sound feet, and thereby enhance the value of their horses in the market.

The foot must be of medium size; a large foot is usually a weak one, often flat and thin, liable to corns, bruises, and objectionable in many ways. Although contrary to the popular idea, we find by experience, that a small foot (naturally small, and not small from disease) is far more serviceable than a large one. In such feet, the hoof is usually formed of more compact horn, harder and tougher; it is generally of a better form, and its mechanical arrangement is better adapted to resist tear and wear.

For example, compare the fine hard feet and horn of the thoroughbred, the narrow straight foot of the mule, and ass, with the large flat soft feet of the heavy draught breeds, and we find that the small feet are more durable and less liable to injury.

Much as the feet suffer from neglect in early life, it is trifling when compared with the destructive processes to which they are subjected when once they are submitted to the operations of the farrier, (for the purpose of furnishing them with a defence against the friction and concussion of the hard road), assisted by mismanagement and neglect in the stable.

When we enquire into the abuses of horse's feet by the groom and the farrier, we shall not wonder that this marvellous contrivance, this most perfect mechanism, which, as an adaptation of a means to an end, is not excelled in the whole range of the Creator's works, does in many instances give way, and becomes so altered in form and so weakened by disease as to be incapable of performing the locomotory functions without suffering; and lameness, (which is but an expression of pain) incapacitates the animal for work, and reduces enormously its value.

Mr. Lawes, Rothamsted, still persists in his calculation, that the crop of wheat in England is equal to an average of 30 bushels an acre. This, at present prices, would, as compared with last year's yield, make a difference to the farmer of £3. 10. 9, that is to say, 2 quarters at 49s. would equal £4.18, and 3 quarters 6 bushels at 45s. would bring £8. 8 9.—Good news for the landlords, as whoever goes without, they won't.

A. R. J. F.

THE POTATO DISEASE.

A select Committee of the House of Commons in England, has been investigating the question of the potato disease. Many of the largest growers have been examined, and the following are a few of the statements made by them.

Mr. Charles Rintoul farms 700 acres, partly in East Lothian and partly in West Lothian: soil, a mixture of clay and loam, but free working land, thoroughly drained. It would not pay to grow potatoes if the land were either wet or insufficiently drained. He begins his rotation with potatoes, then wheat, turnips, barley, grass for two years, and oats, two fallow crops in the seven years, and a sufficient interval of time between the main crop of the farm, the potatoes.

The land is deeply ploughed after harvest, grubbed in the spring, and the planting begins as early as possible. The manure, 40 tons of horse and cow dung, with 10 cwt. of mixed animal and mineral superphosphate, with guano for the nitrogen, is put in the drills—cost about $180 *per acre!* Mr. Rintoul thinks the land cannot be made too rich for this crop, if planted early, as they will be out of the ground and sold, before the disease attacks them. Planted in March, they are fit to dig by July 1st, and generally yield, at that time, from 100 to 200 bushels an acre; later on, in August, from 350 to 400 bushels, but the smaller quantity pays best, as *young* potatoes fetch a very high price, compared with those that are fully matured.

He is very particular as to his seed, sending selected specimens to late districts to be planted for him. Seed is changed in this way every second year. "Every year would be better, but every second year it *must* be done."

Champions Mr. Rintoul considers to be the best late sort grown, particularly in a wet season, as it is proof against the disease. In a dry season it does not crop as well as the Regent; but frequently the latter is cut down and the Champion resists.

Potatoes grown from seed take three years to develop, and are not at their best till the fourth year. Cutting for seed improves the quality of the crop; and the finest, starchiest tubers always suffer most. The witness thinks it a bad plan to plant small whole potatoes; "coarser stuff will be had if you do not grow from cuts every alternate year."

Mr. John May, Farningham, Kent, a very old acquaintance of the writer, stated: "I grow about 200 acres of potatoes a year, on good strong land, with a chalk subsoil. I grew Champions, 120 acres, first in 1877, with a few Regents and Victorias. The two last were nearly all bad, but the Champions resisted the disease. I get some fresh seed every year. I consider they do best with us growing our own two or three years, but I like to have fresh seed. One potato crop follows another in about five years. Mr. Nicoll, gardener at Arbroath, N. Britain, raised the Champion from seed. They have been good, as far as my observation goes, all over the country. Last year, the worst ever known since 1845, I do not believe there were 3 0/0 bad all over the United Kingdom.

The cultivation of this root does not so much affect its immunity from disease, as the variety grown. I believe in the theory, that a variety degenerates after a certain number of years. Potatoes that I recollect fifty years ago are now quite out of cultivation. When the Regent first came out it kept as well as the Champion does now, from which I deduce the conclusion, that the Champion in process of time will keep getting worse. I do not believe the best thing would be, for Government to do anything, but for the Royal Agricultural Society, of England, and the Highland Society, of Scotland, to offer valuable prizes for the introduction of n sorts grown from seed; it might be done by Government, if you like, but I should think it would almost be more likely to be done by the Societies. There is no doubt it would be a trouble some sort of business; and good judges must be appointed. For instance, supposing you were to start a dozen people growing them, and they all raised their own varieties, they might be exchanged from one place to another. Supposing, for example, that I raised nine or ten varieties, and you did the same, another man did the same, all over the country. In the next spring, about planting time, we might exchange, and then the best sorts would soon be found out. A good discrimination might be made in the third year.

I give the diseased potatoes to bullocks and pigs. It is a well known fact that the diseased potatoe has as much starch in it as a sound one, and it would be a folly to burn that. My experience is, that diseased potatoes are better for cattle than sound ones."

The evidence of the well known chemist *Dr. A. Voelcker* is more theoretical than practical—at first sight, but I think we may glean from it the following hints for our guidance.

There is no known means of avoiding the attacks of the disease: that is to say, you may apply any sort of manure, farm yard or artificial, and still the crop will be affected. The experiments instituted by the Royal Agricultural Society (England) a few years ago were quite decisive on that point, but at the same time, good cultivation and early planting will, with a proper supply of the necessary food of the plant, help it to resist the attacks of the disease. An early supply of manure is a great assistance.

When the dung &c is applied in the beginning of spring, and well worked in, so that it becomes part and parcel of the land itself, the effect is superior to what it is when the same manure or mixture of manures is put in later. So, autumn manuring on the stubble, and ploughing it in with the artificials, would answer well.

I think Mr. Voelcker cannot mean to advise us to let ammoniacal manures remain in the land all the winter, as Messrs. Lawes and Gilbert have sufficiently proved that to be a losing game.

He goes on to account for the practice, by telling us for the twentieth time, and it will bear repeating two hundred times more, that the form in which plants take up their food is not the crude form in which we apply it. Potash, for instance, if applied when spring is well set in—May, in the Province of Quebec—is no use at all; but mixed well with the soil in the autumn, it undergoes the necessary chemical changes; the potash becomes fixed in the soil, in a state not so soluble as to be ineffective. Potash is not more necessary for the food of the potato than for wheat or turnips. It is very useful, applied in this way, to all light soils; but on heavy lands, the result of the disintegration of granitic felspathic rocks, potash has no effect.

Mr. Voelcker gives an account of some experiments he carried on at Lord Wenlock's farm, at Escrick, Yorkshire. The produce without manure was 255 bushels per acre. With potash (the crude salts from Germany, commonly called Kainit), and mineral superphosphate, the yield amounted to 333 bushels, an increase of 78 bushels over the unmanured land. but when ammonia was added to the potash and mineral superphosphate, the return was 482 bushels, and augmented produce of 227 bushels more than the unmanured land, and of 149 bushels more than the land dressed with potash and superphosphate.

Here you have an example that confirms the lesson that all sensible men concerned in teaching agriculture have always insisted on; a lesson we do not seem to have learned in this country: to get the maximum produce and a healthy crop of any kind, you must not depend on the supply of one constituent.

As a rule, Mr. Voelcker has not found much benefit from the use of potash alone; but the mixture he would recommend is—a half dressing of good farm yard dung ploughed in during the autumn; 4 cwt. of mineral superphosphate, 3 cwt. of Kainit, and 2 cwt. of sulphate of ammonia, costing, in England, about $15, exclusive of the dung. In many instances this dressing (the artificials) has increased the crop from 240 bushels to 480 bushels, a pretty good return of potatoes at 6c. a bushel for the manure!

My readers will doubtless observe the discrepancy between the evidence of Mr. Rintoul and that of Dr. Voelcker. But it is only apparent. Mr. Rintoul sacrifices largeness of crop for the sake of earliness; and therefore applies all his manure at the time of planting. Perhaps, next year he, after reading Dr. Voelcker's statement, will follow his advice—the day is long past when practical farmers in Britain refused to listen to the counsels of scientific men. Ammonia, you will notice, according to the experiments of the chemist, works its usual wonders in the potato crop. I do hope that some endeavour will be made to find a moderately cheap source of nitrogen in this country. I am sure that if we lean upon our *apatite alone*, we shall find it but a broken reed.

ARTHUR R. JENNER FUST.

Dissolved or Undissolved Phosphates.

An experimental station has been established at Easter Ross, Rosshire, N. B., for the purpose of promoting and stimulating the application of scientific truths to the tillage and cultivation of the soil.

The usual course has been pursued. Plots of land, in number 24, with their unmanured duplicates, have been treated with various artificial dressings, and a party of landowners and farmers inspected the results on the 10th of October last.

Of the 24 plots, 12 are devoted to the illustration of soluble phosphates of different sorts, and nitrogenous manures from the various nitrogenous compounds The other 12 are dressed with insoluble phosphates, with nitrogenous compounds as before.

The phosphatic materials used are: coprolite (answers nearly to our *apatite*), bone-ash, and bone-meal. The nitrogen is derived from sulphate of ammonia, rape-dust, and nitrate of soda.

After examination it appeared, that the plots manured with the soluble phosphates and sulphate of ammonia had taken the lead from the first, and were now looking the best in the proportion of 3 to 2. Mr Cameron, the chemist in charge, seemed to think that later in the season the insoluble manured plots might overtake the others; but as the inspection took place on the 10th October there would not seem to be much chance of that; and he confessed, that as it was clear that the turnip plant in its infancy required the manure to be offered to it in the most thoroughly available form, the use of soluble phosphates was not likely to be abandoned.

Phosphates (dissolved) and nitrate of soda produced great luxuriance of foliage and size of bulb. Rape-dust, with dissolved phosphates, was not so pushing a manure; as the rape-dust required time to get itself mixed with the soil and decomposed; and in the plots where phosphatic manures alone had been used, neither bulb nor top was so good as where nitrogenous compounds had been employed in connection with them—which. I take to be, now, a completely settled question, but one which, by dint of frequent repetition, should be driven firmly into the head of all farmers, and clinched there.

A. R. J. F.

Agricultural Chemistry.

At the late meeting of the British Association at Edinburgh, *Dr. F. H Gilbert*. F. R. S, the chemist associated with Mr. Lawes in his experiments at Rothamsted, gave a general account of the origin and progress of Agricultural Chemistry.

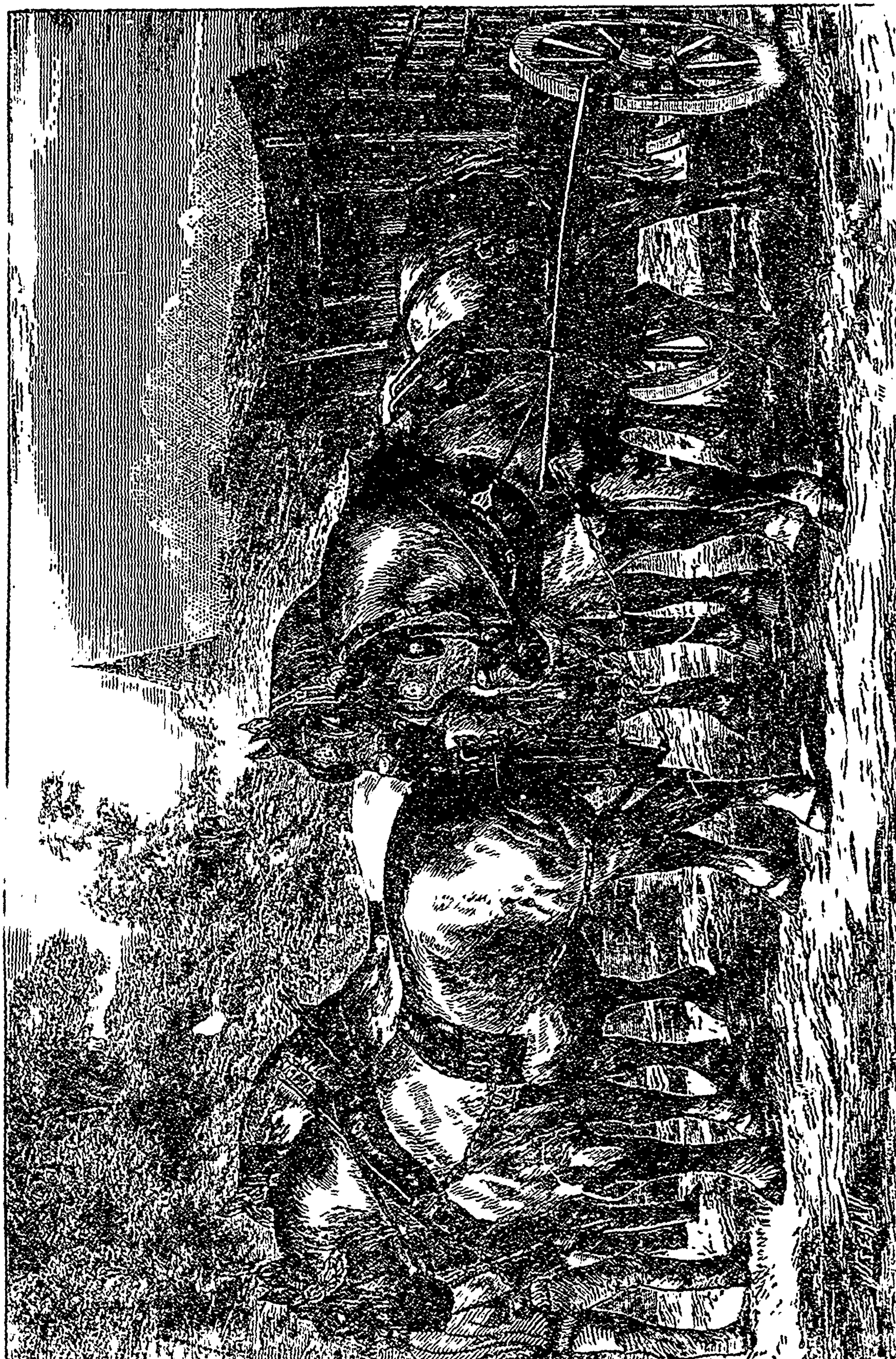
I propose to give, in as short a form as possible, a synopsis of his address. showing what chemists have done for agriculture, what, in my opinion, they have failed to do, and what they may be expected to do in the future.

Agricultural chemistry is the chemistry of the atmosphere; the chemistry of the soil; the chemistry of vegetation; and the chemistry of animal life and growth.

Without a knowledge of the composition of the atmosphere and of water, we could not form any true idea of the vegetative process. *Black*, *Scheele*, *Priestly*, *Lavoisier*, *Cavendish*, and *Watt*, combining their discoveries, taught us that common air consists chiefly of oxygen and nitrogen, with a little carbonic acid; that carbonic acid is composed of carbon and oxygen; and that water is composed of hydrogen and oxygen.

In 1804, *De Saussure* illustrated experimentally the fact that in sunlight plants increase in carbon, hydrogen, and oxygen, at the expense of carbonic acid and water. He further investigated the existence of inorganic, or earthy, materials in plants, and showed that these must be derived from the soil; and he called attention to the probability that the incombustible constituents so derived by plants from the soil were the sources of those found in the animals fed upon them.

As to the nitrogen contained in plants, De Saussure came to the conclusion that they derived it from compounds in the soil together with the small quantity of ammonia existing in



ENGLISH CART-HORSES.

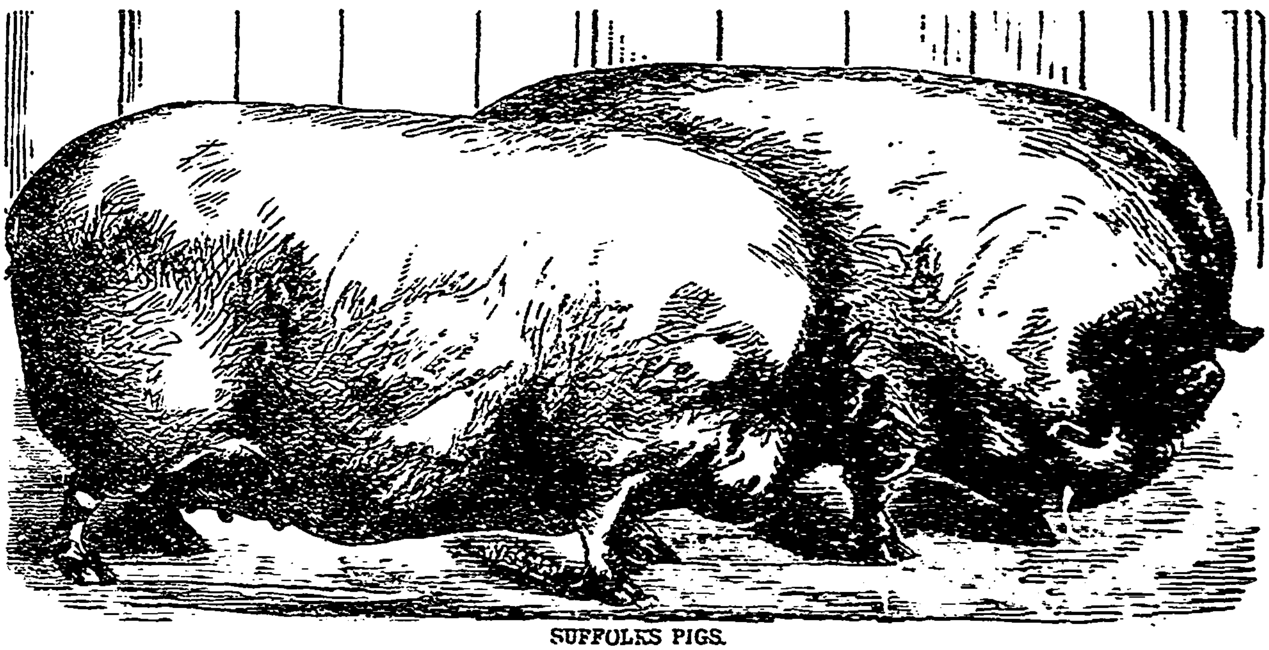
the atmosphere With the exception of Sir Humphrey Davy's lectures on the Elements of Agricultural Chemistry, published in 1813, in which he correlated all the previous discoveries, practical and scientific, bearing on agriculture, nothing much was done till 1834, when *Boussingault* became part proprietor of the estate of Bechelbronn, in Alsace In company with his brother-in-law, a practical chemist and farmer, he then established the first "farm laboratory" in existence; and from that time up to the present day, he has been engaged in promoting experiments in the science.

His first publication was a paper on the amount of nitrogen in different foods, and the equivalence of food In 1837 he published a comparison of the quantities of gluten in different wheats. In 1838, he gave to the world the results of an investigation of the principles underlying the value of a rotation of crops; and determined by analysis the the composition, both organic and inorganic, of manures.

In 1838, Boussingault published the results of an investigation on the point whether plants assimilate the free or uncombined nitrogen of the atmosphere; and his conclusions were pretty much in accordance with modern views on the subject. Moreover, he determined the amount and composition of the residues of crops, the constituents consumed in the food of a cow and a horse respectively, and yielded in the excretions and milk of a cow, and in the excretions of a horse. He was, in these last investigations, far before his age, and not his least praise is, that he coped successfully with such problems, in spite of having, in the then state of the science, to invent methods suitable to his purpose, before he could grapple with the difficulties which lay in his path. A truly original mind was his, and it met with fit recognition, when he was elected a member of the French Institute, and received from the Council of the Royal Society of England, the Copley gold medal, the highest honour at their disposal.

Such was the state of knowledge as regards Agricultural Chemistry when in 1840, Liebig's memorable work appeared. Many important and, indeed, fundamental facts had already been established in regard to vegetation, and Boussingault had brought his own and previous results to bear upon the elucidation of long recognised agricultural practices.

But there can be no doubt that the appearance of Liebig's works constituted a very important epoch in the history of our science Notwithstanding the conclusive evidence afforded by De Saussure's experiments, vegetable physiologists continued to hold the view that the *humus* of the soil was the source of the carbon of vegetation. Liebig not only adhered to the views of his predecessor, but proved clearly the impossibility of humus supplying the amount of carbon assimilated over a given area He showed that humus itself was the product of previous vegetable growth, and that it could not, therefore, be the original source of carbon; and that, from the degree of its insolubility, in pure water or in water containing alkaline or earthy bases, only a small fraction of the carbon assimilated by plants could be derived from the amount of humus that could possibly enter the plant in solution He maintained that so far as humus was beneficial to vegetation at all, it was only by its oxidation, and a consequent supply of carbonic acid within the soil; a source which he considered only of importance in the early stages of the life of a plant, and before it had developed and exposed a sufficient quantity of green surface to the atmosphere to render it independent of supplies of carbonic acid from the soil



SUFFOLKS PIGS.

But the chief point upon which Liebig expatiated was, as to the fashion in which the nitrogen always found in plants entered their substance He argued that, from the known character of free nitrogen plants did not take it up either from the atmosphere, or dissolved in water and so absorbed by the roots. The source of the nitrogen in vegetation was, he maintained, ammonia the product of the putrefaction of one generation of plants supplying means for the support of the succeeding one. In the case of a farm, he pointed out, receiving nothing from external sources, and selling off certain products, the amount of the nitrogen in the manure derived from the consumption of some of the vegetable produce on the farm itself, together with that due to the refuse of the crops (roots, leaves, &c), must always be less than that contained in the crops grown, and he concluded, that though the quantity so returned to the land was important, a main source of the nitrogen assimilated over a given area was brought down from the atmosphere in the rain

"There can be no doubt" says Gilbert, "that, owing to the limited and defective experimental evidence then at command on the point, Liebig at that time, as well as subsequently, greatly overrated the amount of ammonia available to vegetation, from that source.

In Boussingault *Réclamation*, already referred to, he gave much more prominence to the importance of the nitrogen of manures. In Liebig's edition of 1843, he combated the notion of the relative importance of the nitrogen manures; maintained, in opposition of the view put forward in his former edition, that the atmosphere afforded a sufficient supply of nitrogen for the cultivated as well as for the uncultivated plants; that the supply was sufficient for the cereals as well as for the leguminous plants; and he insisted that it was not necessary to supply nitrogen to the former, but that the incombustible, or as he called them 'mineral or inorganic constituents' were of the utmost importance as manures."

This latter theory it is, I may as well say, is the one on which the great dispute arose between the Baron and Messrs. Lawes and Gilbert. The whole fight, well contested on both sides barring a slight amount of shuffling on the part of the German, ended in a complete victory for the Englishmen, and may be found in various numbers of the R. A. S.'s Magazine.

In treating of manures, Liebig laid the greatest stress on the return of the potass and phosphates to the soil which had been deprived of them by the crops reaped and sold off the farm. But he also insisted on the importance of the nitrogen especially that of the liquid excretions of animals, and condemned the methods of treating animal manures, by which the ammonia was allowed to be lost by evaporation. Curiously enough, however, some of the passages in his first edition, in which he most forcibly urges the value of the nitrogen of animal manures, are omitted in the third and fourth editions!

With regard to the *carbon*, the tendency is to prove, with De Saussure and Liebig, that grain crops derive their supplies of it entirely from the air. At Rothamsted, there are some plots in the experimental ground that have never received a pound of carbon during the 37 years they have been growing wheat; and from some of these as much as 1500 lbs. of carbon have been taken away in the crop of this year alone. Liebig's second report to the British Association, presented at its meeting of 1842, and published under the title of *Animal Chemistry, or Organic Chemistry in its application to Physiology and Pathology*, from the manner as much as from the matter excited much controversy among physicians and pathologists. He denied that nervous action could in any way supply heat to the body; and shewed by illustration and experiment that the combustion of carbon and hydrogen in the system was enough for that purpose.

He pointed out that while plants acquired their nitrogen from carbonic acid, water, and ammonia, animals did not produce them but assimilated them as found in their food.

He denied that the vegetable fat found in the bodies of herbivorous animals could be obtained entirely from their food; and he shewed how nearly the composition of fat was obtained from the simple elimination of so much oxygen, or of oxygen and a little carbonic acid, from the various carbohydrates. The formation of fatty matter in plants was on the same principle; the result of a secondary action, starch being first formed from carbonic acid and water.

And then by a beautiful generalisation he arrived at the conclusion that the food of man might be divided into the nitrogenised and non-nitrogenised elements, the former capable of being converted into blood, the other incapable of such a transformation. The former the plastic elements of nutrition, the latter elements of respiration.

Some of Liebig's theories have stood the test of time and investigation; others have been disproved; but there is no doubt that his manner of investigation exercised an immense influence, by stimulating research, by fixing attention on the points to be investigated and the methods to be followed, and thus leading to the establishment or correction of any special views he put forward, and to a vast extension of our knowledge on the complicated questions involved.

Somewhere about the year 1848, Liebig, thoroughly convinced of the truth of his own theories, allowed a company to be formed, under his auspices, for the manufacture of artificial manures. A large capital (£20,000, if I remember) was subscribed, and a considerable trial was made of the patent preparations. They failed completely; as being composed entirely of mineral, or incombustible, materials they were likely to fail. But this good effect arose from the failure: Mr. Lawes, who had lately succeeded to the family estate at Rothamsted, in Hertfordshire, devoted himself to a series of experiments with artificial manures of all kinds, which he has now carried on, in connection with Dr Gilbert, for the last 37 years. Moreover, last year, he settled the marvellous sum of $500,000 in the hands of trustees, together with the farm at Rothamsted, with all its arrangements of cattle-sheds, store-houses, and laboratories, for the perpetual investigation of the question.

His first attempt was to prove that, unassisted by nitrogen, inorganic manures for the cereal crops were nearly useless: next, that ammonia alone would materially increase the yield of grain; and thirdly that nitrogen, whether in nitrate of soda or in sulphate of ammonia, in combination with phosphate of line, would produce year after year, in a soil previously exhausted by three white straw crops without manure, as great a crop of grain as that grown by the best farmers of the neighbourhood in their regular rotation of crops. In this he perfectly succeeded—the 38th crop of wheat is now just harvested, and many of them have given from 38 to 52 bushels an acre. The Liebig's patent manure was found to increase the crop, on an average, by about 1½ to 2¼ bushels per acre. The use of ammonia alone gave nearly 10 bushels more than the unmanured plots, but the mixture of ammonia and superphosphate of lime has raised the yield from 16 bushels, which was the normal average of the unmanured land for the first 20 years—it is now after 38 years of hard work, without manure, very much less - to the wonderful amount mentioned above. Again, one plot has been continuously received 14 cart loads (tons) of cake-and corn-fed dung per acre. The ammonia and superphosphate plot has, upon the whole beaten it. Many other experiments have been made on the most extensive scale, and more than one fallacy of the non-practical Liebig exposed. Talk of Patriots, indeed!

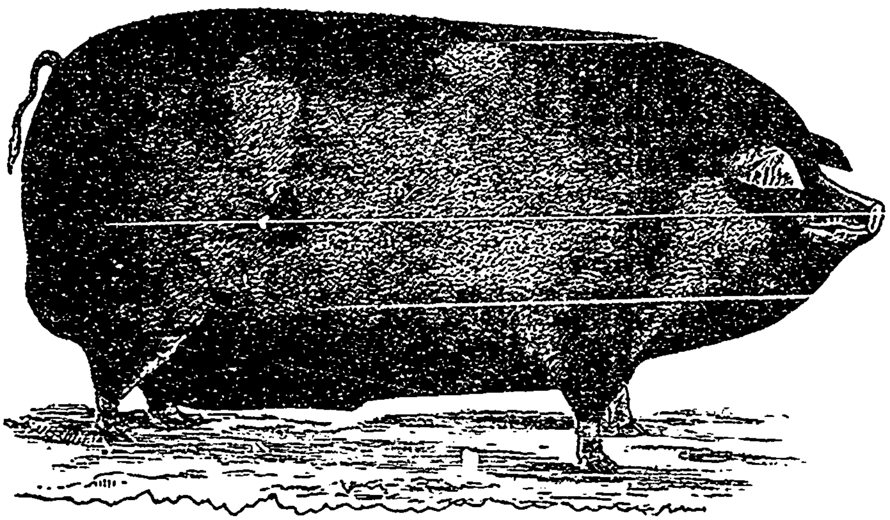
A table is appended which gives the produce of the experimental plots at Rothamsted, of which one receives no manure, the others different manures (one lot farm-yard dung, the others sulphate of ammonia and superphosphate, or nitrate of soda and superphosphate). The field has grown wheat, now, for 38 years in succession:

Harvests.	Unmanured Plot 3.	Farmyard manure. Plot 2.	Artificial manures. Plot 7.	Artificial manures. Plot 8.	Artificial manures. Plot 9.	Means of Plots 7, 8, 9.	Means of Plots 3, 2, and 7, 8, 9.
Bushels of Dressed Corn per Acre.							
1880................	11½	38⅜	34½	35¼	34⅛	34⅝	28⅛ [1]
Av. 10 yrs., 1870-79	10⅜	29½	27⅛	31⅞	35¾	31¾	23¾ [2]
Av. 18 yrs., 1852-69	14⅞	35¾	35¾	38½	36⅝	36⅞	29⅛ [3]
Av. 28 yrs., 1852-80	13⅛	33½	32⅝	36¼	36¼	35	27¼ [4]

[1] Equal to 27 bush., at 61 lbs. per bushel.
[2] Equal to 23⅜ bush., at 61 lbs. per bushel.
[3] Equal to 28⅛ bush., at 61 lbs. per bushel.
[4] Equal to 26¼ bush., at 61 lbs. per bushel.

It is evident that, while the unmanured plot shows an average higher than the last 10 years, it is considerably below that of the average yield of the previous 18 years, and the whole period of 28 years respectively. This plot has been now entirely without manure of any kind for 40 years, and is evidently suffering from exhaustion. The plot having had 14 tons of farmyard dung every year gives nearly 39 bushels, which is above the average of the three periods. The three artificially manured plots give about the same as their average for the 28 years.

In 1874, the only good wheat year of the last ten, the produce of the unmanured and the dunged plots was almost exactly the same as this year; but the mean yield of the three artificially manured plots was, in that year, 39½ bushels, against 34⅝. the yield of this year. The mean produce of whole plots (unmanured, dunged, and artificially manured) is equal to 27 bushels of 61 lbs. to the acre; and from these data Mr. Lawes calculates that, as his farm and neighbourhood suffered more than most parts of England from heavy rains in July, the average crop of the country will, when threshed, turn out to be something like 30 bushels an acre; amounting in all to something like eleven and a half a millions of quarters, precisely the amount at which I arrived, (see October No. of Journal) by a perfectly different process of reasoning. England's wants this year, at 5½ bushels per head of population, will be 24 and a half millions—therefore, deducting seed, she must import 14,000,000 quarters, or 112,000,000 imperial bushels. She will not have much difficulty in finding them.



POLAND-CHINA PIG.

We see now what chemists have done for agriculture—let us look on the other side of the question, viz: what they have left undone, b what, in time and with patient study, it is to be hoped they may some day accomplish.

Sir Ughtered Kay-Shuttleworth, chairman of the section, stated at the Edinburgh meeting, that he questioned very much whether agricultural chemists had got beyond the mere rudiments of their business. "We want chemists of authority and standing, men of large scientific training to give themselves up, not so much to what had been alluded to at the meeting, not merely to making analyses of manures for farmers, and telling them what substances they received, but men who should enter into the very essence and principles of the matter, and tell them the reasons why particular soils required particular manures, and what were the manures calculated to bring into play the best qualities of the different soils we have to do with."

I, for instance, should like very much to know why lime is of no use, or, at least, of no paying use, in the East of England; while chalk and marl (both equally carbonates of lime) are of the greatest possible benefit. Why is guano invariably used for turnips by the best farmers in Scotland, and of course profitably, whereas, in Kent, it is money thrown away, in nine cases out of ten?

If, again, hay is only grass deprived of its water, why does it not fatten cattle as well as the original herbage? Swedes and other roots are said to contain, in round numbers, 90 per cent of water. Is that water common water, or does it contain some mysterious substance unknown to chemists, which accounts for the rapid fattening of cattle fed on them? Take again the varying quality of grain and other crops—why do oats grown on gravel answer for porridge meal, and when grown on clays suit brose and cake? Why does the Vale of Aylesbury fatten on its grass the largest oxen, and the Vale of Evesham, equally rich in appearance, refuse to do anything of the sort? Why, as I have before remarked in this journal, do the Scotch turnips with straw fatten bullocks, and the Kentish turnips with hay refuse to fatten sheep? It won't do to say it is the climate, for on the coast of Sussex the same difference exists between crops of swedes with only 10 miles of distance from one to the other—notably, between Hove, near Brighton, and Shoreham. All these questions chemists must find an answer to, some day or other, if they wish to retain the farmers as their clients.

We all know, practically, that wherever a deep friable loam rests upon a thick bed of gravel, and that upon clay, we find a fertile soil that will grow anything you like to ask it. On the other hand, a thin clay, on a retentive subsoil, will grow nothing except at an immoderate expense.

Look at the table lands of the Andes. Wheatfields there have yielded good crops for more than two centuries. At Santa Fe and Quito potatoes grow for ever on the same soil, and are nowhere better. Talk about *humus* being a necessity of fertility! How about the land near Vesuvius, formed as it is by the disintegration of *lava*, and containing not the smallest particle of vegetable matter; and yet every one knows that when this lava has been exposed to the air for a time, all kinds of plants grow in it with the utmost luxuriance.

Why does the bite of the deadly *Cobra* inflict no injury on the *Mongoose*? The *Acari* feed on the poison, *strychnia*: and the *Hornbill* (Buceros) eats with impunity the fruit of the *strychnos*, (*Nux vomica*) tree: yet chemists can give no reason for such anomalies!

And, thus, we see that, in spite of all our searching, nature has still secrets of her own which she seems, at present, resolved to keep from us. Even Liebig allows that the *physical* conditions essential to the fertility of a soil are unknown to the enquirer: a mere chemical analysis being of very subordinate value, since all the mineral means of nourishment in a soil do not necessarily afford a measure of its value, nor does the want of vegetable matter prevent its being able to produce luxuriant crops. Whatever it is that causes fertility in land, climate must be a great factor in it. All the instances of perpetual fertility are found in a southern climate:

" The carpet of flowers " says Humbolt, " and of verdure spread over the naked court of our planet is unequally woven ; it is thicker where the sun rises high in the now cloudless heavens, and thinner towards the poles, in the less happy climes where returning frosts often destroy the opening buds of spring, or the ripening fruits of autumn. It is under the burning rays of a tropical sun that vegetation displays its most majestic forms." (Aspects of Nature, II. 8-29.) The mechanical state of a soil is important as regards it power of retaining manure. How often do we hear it said that top-dressing is more beneficial than manure ploughed in ? It is quite true that the practice is correct on certain light soils, and the reason is not far to seek. As long ago as 1845 (I quote from memory), Professor Way, chemist to the R. A. S. of England, ascertained that sand and gravel only retained the mechanical parts of liquid manure, leaving the soluble parts to pass through with the water unchanged.

An easy experiment will test the truth of this : fill a tube (tin will do if you have not a glass one), open at each end, with clay, and pour into it a solution of ammonia strong enough to be highly pungent to the smell : the first flow of liquid from the lower end will be water absolutely free from ammonia, as your nose will tell you. It will be same with solutions of carbonates of potash and soda, but the smell will not guide you ; chemical tests must be employed. Thus, it was found that pure clay would absorb ½ of one per cent. of its weight of ammonia ; and that 1000 grains of clay would take up 2 grains of ammonia. and well cultivated clay soils twice as much. If this soil were 10 inches deep, it would retain on one acre 2 tons of ammonia, equal to the contents of at least 14 tons of Guano. So you see that the English practice of a long course, or rotation, on clays, and a short one on sands and gravels, is scientifically correct : in this, as in almost every other customary mode of farming, the practice was in existence long before the theory was heard of.

Again, the proper distribution of manure, and its thorough division, are of great importance. Chemists, however, seem to differ, even now, as to the proper time for its application. We saw that drains would eventually remove the soluble parts of manure after a time. Therefore Lawes would prefer applying nitrogenous dressings in the spring—finding, as he does, a large amount of nitrogen in the test cisterns of his drainage system at Rothamsted, he puts all his artificials containing ammonia on the young grain in spring But on heavy land, difficult of reduction to a fine tilth, the easiest and least costly mode of preparing for a root crop is to clean the land in the autumn and plough the manure down before winter, the loss of nitrogen is less than the advantage of having a fine surface at an early period of the sowing season ; and, as Way says in another passage, " Soils of this sort, (clay) are powerful retainers of manure—the others (sands and gravels) are said not ' to hold manure '. On such soils manures must be applied more frequently, and in smaller quantities than on stiffer soils, where, owing to the retentive quality of the clay, the manure for several crops may be safely deposited at once." So the Kentish rotation on the heavy lands has been (for years before chemists discovered the reason) ; summer fallow—dunged—for wheat, clover, wheat, oats or peas or barley ; and the light land rotation ; roots—dunged—barley, clover—dunged on the young seeds in winter or in the autumn after twice mowing for hay—wheat. Four crops for one manuring, in the first case, against the same number of crops, but the dressings divided, in the other. And both systems answer equally well on the several qualities of soil.

Arthur R. Jenner Fust.

FARMING.

Mr. Jenner Fust, purposes to deliver a course of thirty lectures, on the *theory and practice of Agriculture*, at Mr. Lyall's school, 970 Sherbrooke street. Terms, &c. can be had by applying at 10 St. Vincent street, or 261 Upper St. Urbain street.

The Decadence of England !

I have just received the " Agricultural returns " for the harvest of 1880, issued by the the Statistical Department of the Board of Trade, England ; and thinking that it is full time that those people, who talk about several millions of acres of land in Great Britain having gone out of cultivation, should be brought to book, I have condensed the Board's statement into a form that must be of interest to all my readers who still love their natal soil ; showing, as it does that, in England and Scotland at least, progress and prosperity are still the law of the national life.

In Great Britain, the area under cultivation has increased by 126,000 acres since 1879, and the total increase during the decennial period since 1870 is no less than 1,694,000 acres, or more than the whole of the county of Devon. This increase was chiefly won in England. 1,187,000 acres, Scotland 287 000, and 220,000 acres in Wales.

So much for land going out of cultivation ! What my clever friends ran their heads up against was, probably, the fact that a great number of acres of coarse clay lands have been laid down to grass, in which state they will be less costly and more remunerative, than when they were growing 18 or 20 bushels of wheat an acre, once in five years. In wheat there were 2,909,000 acres, or 19,000 more than in 1879. Wheat, however is not so favourite a crop as formerly, as the quantity of acres grown this year was 591,000 less than in 1870. The acreage of the barley crop was fully equal to the average of years, and there were 5 0/0 more oats grown than usual.

Taking, then, all the corn crops in a lump, we find that there were 8,876,000 acres sown, or a decrease of rather more than 1 0/0 from the previous year, and of 7 0/0 from the year 1870.

Green crops.—An increase of 10,000 acres in potatoes ; and the area, 561,000 acres, is nearly equal to the area of 1870. Turnips, swedes, &c., including cabbages, lucerne, and other forage crops, about 2 0/0 less than in 1879. The whole about the same average as throughout the last ten years.

Clover and grasses laid down for two or three years—rotation grasses as they are called, to distinguish them from permanent meadows or pastures—are about as in 1879 ; but the land laid down to permanent grass has increased by 260,000 acres, and now equals 45 0/0 of the whole cultivated area of G. B. ; having increased by about 2,500,000 acres since 1870. In Scotland, until lately, there was no permanent grass, except a few *parks* round gentlemen's houses, and near towns. *Park*, in England, means an enclosure of from 200 to 1200, or more, acres ; in Scotland they are about 4 or 5 acres.

Orchards have increased from 165,000 acres, in 1878, and 175,000, in 1879, to 180,000 in 1880 ; and market gardens from 41,000 to 44,000 acres. A better sal obtains for vegetables—that is, the poorer inhabitants of the large towns are beginning to eat them. A slight decline in the number of farm horses may be noted ; but the stock of horses had increased up to last year, when the numbers were higher than in any year since 1870. Milch cows 1 0/0 fewer in number, but other cattle show an increase of 2 0/0 ; the number of horned stock in G. B. being, this year, 5,912,000.

Of sheep there appears to have been a loss of 1,000,000 from the terrible attacks of liver-rot last year. There are only 26,619,000 sheep and lambs—not nearly enough, considering the large increase of permanent pasture. Scotland, owing probably to her different mode of sheep management, was not afflicted with this dire disease. The marshes and heavy land pastures in Mid-England and in Wales were the principal seats of the disorder. America has the undisputed honour of having reduced the number of swine in G. B. by 91,000 since 1879, and by 483,000 since 1878.

In Ireland, the changes are much the same as in Great Britain. The cultivated area is a little larger than in the last two years. The increased area in oats makes up for the diminished acreage of barley and wheat; but corn crops in general have diminished by 450,000 acres since 1870.

Potatoes, in Ireland, occupied 821,000 acres in 1880, against 843,000 in 1879, and 1,044,000 in 1870. The total acreage of green crops amounts to 1,250,000, as compared with 1,500,000 acres in 1870.

Flax has increased by 24 0/0 since 1879.

As to live stock, there is, as might be expected from the scarcity of even food for man in 1879, a decrease, but only since last year, for, as regards cattle and horses, the numbers are fully equal to those of 1870. Sheep have diminished in number by nearly half a million, and pigs are 20 0/0 fewer than in 1879.

By a fairer method of computation than taking the produce of one year and comparing it with the produce of another; namely, contrasting the state of the country at the end of the present decade with what it was at the end of the last; we find that the decline of 8 0/0 in the land under green crops and grain in the United Kingdom in 1880, as compared with 1870, is more than made up for by the increased pasturage and meadow land. Otherwise, it would be impossible to account for the increase in the number of cattle, —viz. 8 0/0 in horned stock, 12 0/0 in horses, 6 0/0 in pigs, —the only set off being the 6 0/0 loss in sheep, which was solely owing to the disease in the liver. Even in Ireland (counting ten sheep for one head of cattle), we find the general farm-stock increased 8 0/0 in the decade. Thus the growth of pastoral interests has probably more than compensated for the loss in tillage.

Well, these statistics although not quite so favourable as one could wish, shew nothing less than a decadence. Let us look now, at the general returns of trade and population for the year 1879-1880, and compare them with those for the year 1869-1870. *Increase*—population, 11 0/0; revenue, 8 0/0; public wealth, 30 0/0; commerce, 13 0/0; shipping, 16 0/0; textile manufactures, 29 0/0; minerals, 45 0/0; railway traffic, 45 0/0; post-office, 45 0/0; schools, 122 0/0; public morality, 13 0/0; welfare of the poor, 19 0/0. *Decrease?*—it does not appear in the returns that there was any decrease, except in paupers, in public immorality, and the rate of taxation per head of the population; which latter item is lighter than it was 10 years ago, being now 48s. per inhabitant. In the decade, the National debt, too, has been decreased by 24 millions sterling.

If the United Kingdom had only increased in wealth, manufactures, commerce, and public instruction in the same ratio as the number of inhabitants—11 per cent—it would have been a very favourable showing. But it is clear, that it has grown in prosperity much more than in population, and that every succeeding decade sees Great Britain richer, wiser, and happier, thanks to the industry and civic virtues of her people.

Since I wrote the above, the English funds have risen to par! A Montreal newspaper "does not see that this is any proof of the confidence of people in the strength of the Government;" but attributes it entirely to the enormous amount of money seeking investment. No doubt this partially accounts for the rise in price, but confidence in the payment of dividends must have something to do with it, or else why have the French *rentes* not risen to par, instead of remaining, as they do, at 85? In 1830, a speech of the Duke of Wellington reduced the price of Consols from 84 to 80; and, a day or two afterwards, his refusal to advise William IV to dine with the Lord Mayor, for fear of his being insulted by the people, sent them down to 77! There is no better political barometer than the funds.

Arthur R. Jenner Fust.

ENGRAVINGS.

The engraving of horses in our present number represents four cart horses of the sort called, now, the *Shire-horse*. They are of all colours, but each of the great London brewers, millers, and distillers, piques himself on having all his teams of the same colour. They are of the stamp of which the French farmers at the Paris show of 1878 said, that they were elephants and not horses. (1)

The two pigs are of the *Suffolk* breed; by no means exaggerated in the smallness of their heads. Very profitable for killing at 16 or 17 weeks old, but apt to be too fat for bacon hogs. They have found out, in England, that the breeds have been too much refined for good flitches; and, for practical purposes, except for London roasting pork, they are going back to a coarser strain.

The single pig is a *Poland-China*, a cross, probably, of the Berkshire, and perhaps of one or more other breeds, with the Chinese.

Canadian vs. European Butter.

The returns of the Secretary of the Montreal Board of Trade, and an able article in the *Monetary Times*, on the subject of Canadian Dairying, are worthy of careful consideration. The butter-making of Canada must undergo considerable improvement before it occupies a good position in the markets of the world. In England our butter takes the lowest price, being sold, on an average, at about seven pence a pound, while French butter reaches 14½ pence, Irish 14⅞ pence, American 11⅞ pence. Since 1870, the value of our butter has actually decreased in value, while the quantity exported in 1879 was four and a half million pounds less than in 1872. Of the ten million pounds sterling that Great Britain expends annually on this article of consumption, Canada receives only £425,689, or about four per cent of the values; while in volume our supplies form six per cent of the British imports. These are startling figures. This condition of matters is due, of course, to the inferior quality of the article manufactured here. The importance of this branch of national commerce is apparent to all, especially to those who have considered the great facilities for dairy operations afforded by this Province. The processes at present adopted by Canadian butter-makers cannot be approved of. The practice is to churn about once a week, and to pack each churning from week to week in the same tub, until the accumulation is large enough to make a market parcel. The creaming, too, is performed in the least economical manner. In the salting operation, a great error is generally committed by the application of an excess of salt, which lowers the market grade of an otherwise good quality of butter. An examination of French butter, making would demonstrate, that the extreme care and cleanliness which are so characteristic of the trade is fully paid for by the liberal prices obtained in England. The *Monetary Times*, writing on this subject of dairy produce, says, "..f.our farmers cannot

(1) The *Shires* are the midland counties of England, so called by the inhabitants of Middlesex, Kent, Surrey, &c.

send their butter to market twice a week in summer, they might, as the Danes have done, make the winter butter the *best product of the year. To do this they will need to grow* richer forage crops, and to feed more liberally and carefully than they do now. Butter factors might go round and collect the products of each farm at the homesteads, and thus overcome the objection of the farmer to attend market as often as is required in France. The salting, packing, and branding, would then be under the control of the merchants. A much better way would be the creamery system, but there will always be some decided objections to it from people who live at a distance. Carried out on a large scale by farmers living within easy distance of each other, however, it would be much cheaper than making at home. The practice of packing in smaller and more tasteful cases also deserves attention. The consideration of these questions, by the farmers, must result in the production of an improved quality of butter. In many cases, a thorough reform must be inaugurated. Ancient systems and bad *customs, if adhered to, will prevent improve*ment. With the adoption of greater care and consideration, we have no doubt that our butter trade with Europe will assume the position, both as to quality and quantity, which we desire for it. The quality of the article, however, will always continue to regulate the demand in the markets.

Montreal Star.

CORRESPONDENCE.

Lennox Factory, North Sutton, P. Q., 15*th Nov.* 1880.

ARTHUR R. JENNER FUST, Esq.

Dear Sir.—Having observed, in the Journal of Agricultnre of the Province of Quebec, for Oct. last, your remarks on the first prize cheese exhibited by Messrs. Boden and Wilson, Montreal. I beg to send you a copy of a Letter received by me from the above firm, dated 22nd Sept., 1880.

MR. MACFARLANE.

Dear Sir.—We are glad to be able to inform you that we took 1st prize with your cheese at the exhibition yesterday. We took 2nd with Maple Grove, and 3rd with Scott's. Yours truly,

BODEN & WILSON.

P. S.—At the New-York Exhibition, of 1879, Harlow Chandler, merchant, Montreal, exhibited cheese, made by me, and was awarded 3rd Diploma thereon.

I am Dear Sir, Your Obedt. Serv. WILLIAM MACFARLANE,

Sir,

In the remarks of Cap. E. A. C. Campbell, in the Oct. Journal, about the horses shown at the Dominion Exhibition held in Montreal, he makes particular mention of what he called a remarkably fine, thoroughbred-looking 3 years old stallion, and says in his opinion that he was the pick of the basket (an opinion shared by a great number), but was unable to find out to whom the horse belonged, or how he was bred.

The magnificent young stallion referred to, and which attracted so much attention at the Exhibition, is owned by Mr. A. L. McDonald, of Richmond, Q., was sired by a stallion imported from England, in 1869, by the Hon. M H. Cochrane, which afterwards became the property of the Huntingdon Live Stock Importing Company—his dam, a well bred and good mare. This colt was first in his class at the Exhibition and was also first at the Co. of Richmond Agricultural Society's Show, competing against all ages and breeds. J. M.

POULTRY DEPARTMENT.

Under the direction of Dr. Andres, Beaver Hall, Montreal.

Coop for Raising Chickens.

A very good coop, as represented by the accompanying illustration, was invented by Mr. J. M. W. Kitchen, Morristown, N. J. who wrote to us in regard to it as follows:

The coop I am about to describe has been used by me for four years, and has proved a great success, as by its use the process of raising chickens is brought to a maximum of desirable results, at a minimum of cost. I can, by its use, raise five hundred chickens a year, with an average attendance of twenty minutes per day during the first four months of the chickens' life.

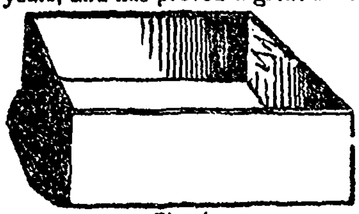


Fig 1.

The hens are set in the coops, and the chickens make them their homes till extreme cold weather. I commence setting the hens about April 1st. When a hen becomes broody, one of the nest frames (Fig. 1) is set in one corner of the coop.

A slight nest is made in it, a part of which is tobacco stems for protection against lice. A few old eggs are put in the nest as a decoy, the hen is put in the coop, and the door shut.

Water is placed in the pen, and corn to last three weeks. My hens generally take to the nest immediately. Some of the wilder ones take some hours for consideration of the matter, while occasionally one will not sit at all. After the hen

takes to the nest, remove the old eggs, and replace with those that are to be hatched. Put the date of the setting on the side of the coop, and then there need be but little attention given, except to renew the water, till the chicks come out. Then remove the nest frame, and apportion the chicks among such hens as are selected for motherly duties. I generally put from ten to sixteen with a hen, according to the weather, etc.

The coops are set where desired, and can be removed now and then, if thought best, though mine remain in one spot all the season, the hen scratching in the earth at the bottom of the coop, keeping all clean on the earth-closet principle. The feeding box (Fig. 3), is filled with a dry mixture of cracked corn, wheat screenings, very fine chopped pressed beef-scraps, and coarse sand. This is poured into the feeding-box from a tin pail with a broad spout, the water is poured into the tin-pans with a watering can (Fig.2). The chicks and hen help themselves through the pigeon holes, thrive admirably, and I never hear a hungry cry from my chickens. The feeding and watering is done in the morning, when the coop-doors are opened. The chicks are not allowed out of the coop till they have their pin-feathers; then they are only allowed out on pleasant days, and are shut up every night, and are not let out in the morning, while young, till the dew is pretty well off the grass.

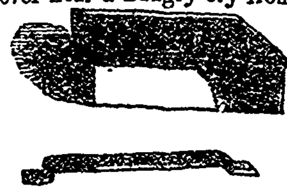


Fig. 3.

The construction of the door admits of very rapid opening and shutting of the various coops. It is done with a kick, vigorous or light, as is necessary, to let out only the small chicks or those of larger growth. The door (Fig. 4) was a matter of considerable study before it reached its present shape. The problem was to have a door that would admit of any sized chicken or fowl. The door must not clog with dirt. It must stay of itself partly or fully open, and withstand the efforts of the hen to change her position when once placed, and it must be made to work with as little effort as possible. I believe this door fulfils these conditions.

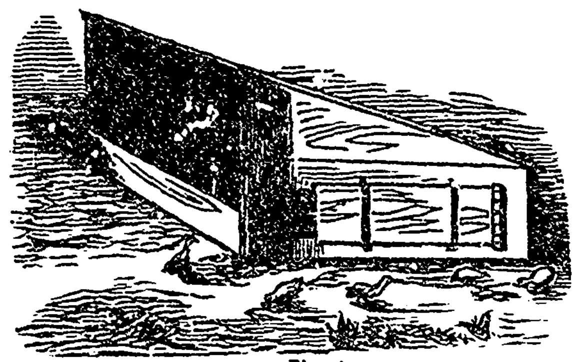


Fig. 4.

The coop is made of 15-in. pine barnsiding, is 3 ft. by 3 ft., 2 ft. high in front. (Figs. 4 and 5.) The front is protected with one-half inch wire netting.

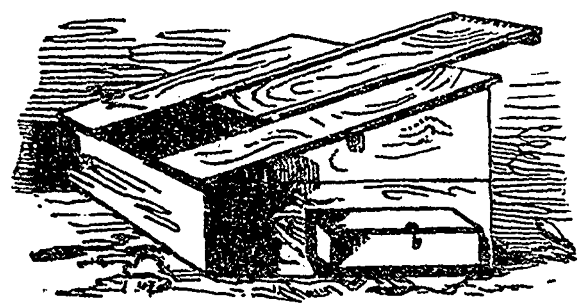


Fig. 5.

The middle roof board (Fig. 5) slides off entirely, is held in place by the *two* buttons on the underside and a small hook and eye on the front of the coop. The hoop iron for holding the sliding door (Fig. 3) is bent into a concave shape before application, so that it acts as a spring to hold the door firmly in place.

DIGESTION.

The digestive function in poultry is partly mechanical and partly chemical. In its several stages, it differs widely from that of some quadrupeds who feed on similar food. In these, grains are frequently swallowed without being crushed by the teeth, and as their stomachs have not the power of digesting solid grain, it is voided whole. In fowls, on the other hand, the grain is *all* swallowed whole, and it is digested in the stomach.

The digestive organs of fowls consist of the gullet and crop, the gizzard, stomach, liver, and intestines. The gullet, or œsophagus, runs down the neck towards the right side, swelling out, in front of the chest, into a membranous bag, which is called the crop or craw.

The crop is somewhat analogous to the paunch in the ox or sheep. It receives the gullet into its upper part, and proceeds downwards, about the middle of the bag, in such a manner that the crop is in some measure aside from the regular communication between the upper and lower opening of the gullet. Its office is to receive the food when first swallowed, and to macerate it, and dissolve it by means of a liquor, which is separated by the glands, which may be observed covering its surface.

The food, after passing the crop, goes through the remaining part of the gullet into a cavity, shaped like a funnel, of smaller dimensions. This is similar to the second stomach in some quadrupeds, and is furnished with a large number of glands. These glands may be called gastric glands; they are placed near each other, and are hollow. Their office is to secrete a solvent or digestive fluid and to discharge it through a small opening into the cavity. When this fluid has diluted and digested the food sufficiently, it is prepared to pass into the gizzard.

The gizzard is the last stomach, and is composed of a body of very firm and dense muscles, and lined with a thick, gristly membrane. Towards the cavity of the stomach, this lining forms folds and depressions, which on the opposite surfaces are adapted to each other. The gizzard is comparatively small and narrow, and has its outlet near its entrance. It is calculated, in every respect, for producing very powerful trituration, and is adapted to answer the purposes which are subserved by grinding teeth in other animals.

The outlet of the gizzard discharges the digested food in the form of paste, having a grayish color, into the chyle-gut, which is the first of the intestines. This is situated on the right side, depending into the belly and joined at each end to the liver. The liver prepares bile from the blood conducted by the veins, and, by means of a duct, carries the bile from the gall bladder into the chyle-gut, in a *downward direction*, to be mixed with the digested food. This peculiarity is different from other animals. Another fluid, brought from the pancreas to the chyle-gut, completes the apparatus for digestion.

The food now proceeds on to the small intestines. The surface of these is lined with the mouths of numerous absorbents, which perpetually open to take up the aliment prepared in the stomach and chyle-gut. The refuse is passed to the rectum, to be discharged from the body.

Fowls are also furnished with kidneys, for removing superfluous fluid from the blood. The kidneys lie in a hollow beside the back-bone, and the urine is carried from there in a bluish-colored canal into the vent-gut, or rectum. It here mixes and is discharged with the dung. Fowls have no bladder, and it is, therefore, a criterion of health when the excrement is moist.—*Bennett's Poultry Book.*

Poultry in the Orchard.

Not long ago I visited a friend who keeps pure bred poultry, and is quite a gardener. I will tell you how he manages to keep the poultry healthy, keep them out of the garden, and secure plenty of fruit in his little orchard. Instead of picketing his garden, he puts a high, strong picket-fence around his orchard, and keeps about fifty fowls in it. He says that fowls absolutely keep the orchard free from insects, keep it in a growing condition, and the insect food makes them lay eggs right along. He has his poultry-house in one corner of the orchard, with nest-boxes, places for dusting, water, etc., and a small space of freshly plowed ground for them to scratch in.

I think I never saw a thriftier orchard or a thriftier lot of fowls, and I would commend his practice to all farmers and others who combine the poultry business with raising fruit. There is no other bird as good on insects as a chicken, and the food is just what they want.—*P. Stone, in Ohio Farmer.*

Destroying Lice.

A natural condition of poultry is lousiness; but there need be no trouble in keeping them free from lice. Use tobacco stems, or refuse leaves, or tobacconists' cuttings, freely in the nests, putting them about four inches deep in them; let lice be never so thick, in a very short time they will be all gone from the boxes.

Perhaps some of our readers have raised tobacco in their gardens; this they can use to good purpose, as follows: A correspondent writes thus: "To keep my birds free from vermin, I put a quantity of tobacco stems in a vessel that will hold eight or ten gallons of water, and let them soak for two or three days, stirring up the mass every day until the water is quite red and strong. Then, with an old paint brush, or a sponge tied on the end of a stick, I wash the roosts, nest boxes, and every place I can reach, with the liquor. Next, with a syringe I throw it into every crevice and corner of my poultry house. If the liquid is strong and thoroughly used, it need not be done more than twice in the season. We know that many of our readers keep their fowls under the same roof, and many times in the same room as that in which their horses or cattle are kept. If so they need to be particularly careful in keeping their birds free from vermin."

We can endorse every word that he says; and we believe tobacco has thus found one of the best places in which it can be used. We have tried kerosene, or coal oil; also carbolic acid, but we believe that, in many instances, disease has been caused by their use, as we have noticed, immediately after sprinkling with carbolic acid, the birds have become affected with running at the nostrils, their eyes become red, and a peculiar cough, like the cough of a croupy child, lasting for several days and apparently disarranging the whole system, has attacked them. Will some of our readers tell us if they have had the same experience?—S. J. A.

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