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THE

Canadian Agriculturist,

AND

JOURNAL OF THE BOARD OF AGRICULTURE

OF UPPER CANADA.

VOL. IX. TORONTO, SEPTEMBER, 1858. No. 9.

CHINESE SUGAR CANE.

The introduction of new plants among the cultivated products of the farm must always be regarded with peculiar interest, and when the experiments prove successful, the results assume a character of great national value and importance. Root culture, so extensively practised of late years, has, to a great extent, changed the character of our agriculture; increasing largely the amount of food, not excepting even the grain crops, without diminishing, but rather improving the productive capabilities of the soil. The adoption of the ordinary white varieties of the turnip into field culture, was a most important step to a long career of agricultural improvement, leading directly to the general introduction of those appliances and improvements, which distinguish our modern systems of practical husbandry. The Swedish variety of the turnip—denominated on this continent the ruta baga—has, to a great extent, superseded the former, it being far more nutritious, and capable of being much longer kept, while the mangel-wurzel has subsequently, in a considerable degree, outstripped both, affording on certain descriptions of soil larger returns of nutritious food to most descriptions of farm stock. And yet, more recently, the Belgian carrot, and Silesian or sugar beet, containing as they do a very large amount of saccharine matter, have in some localities been largely introduced with the most advantageous results.

Still more recently, another plant has been introduced into the husbandry of Europe and America, for which we are indebted to China, and it promises to become extensively cultivated in climates having a tolerably high summer temperature. The Sorgho, or as it is more commonly designated,—Chinese Sugar Cane,—appears to be of a nature somewhat between the ordinary sugar cane and the several varieties of maize or Indian corn. In its growth

and general appearance it resembles the latter; while in the nature and amount of sugar which it contains, it is nearly allied to the former. According to a careful French experimenter, the sorgho contains from 10 to 15 per cent of sugar, while the cane ordinarily yields from 14 to 18 per cent.

The Sorgho has been tried on a small scale within the last two or three years in various parts of Canada. Last season, owing to the prevailing wetness the temperature was peculiarly unfavorable to its ripening; but the present season has been more propitious, and we have seen several instances in which its seeds have been properly nurtured, and a very sweet syrup obtained from its juice, which could be readily converted into a very tolerable quality of crystalized sugar. Still we have serious misgivings whether this plant can be cultivated profitably so far north as this, for the purpose of sugar-making; certainly not unless cane sugar should, from some cause or other, assume a higher price in the market than it has ordinarily borne for several years past. It should be remembered that, like the sugar-cane, as the Sorgho, approaches a higher latitude, the amount of its saccharine matter diminishes. In this respect both these plants differ in toto from the Beet, which is found to contain more sugar as it advances, within certain limits, northwards. In Europe it is found not worth while to cultivate Beets for sugar manufactories, below 45 degrees of latitude, whilst in northern Russia, its juice has been found to yield from 12 to 15 or 16 per cent of sugar.

As a forage plant we believe that the Sorgho can be profitably cultivated in Canada. We find from experiments made both last year and this, that it will bear twice-cutting the season, provided it be sown in good and well prepared soil, and cut the first time early, say the beginning of August, and the aggregate amount of fodder yielded in favourable seasons will be very large.

Horses, cows and pigs, eat it with avidity in the green state, and it is consumed with much relish during winter when dried and preserved in the usual way. It has been estimated that in point of nutritious qualities, 44 tons of green Sorgho are equal to 16 tons of well made hay. In the South of France it is used for making wine, and two acres of land were found to produce 132 gallons of what is said to have been an excellent wine. In distilling, the ripe plant will produce from 7 to 10 per cent of alcohol. With these facts well ascertained, it is evident that this new importation from China promises to play no unimportant part in the improving husbandry of a considerable portion of the globe.

THE JOURNAL AND TRANSACTIONS.—A pressure of business in connection with the late Provincial Exhibition, has prevented the issue of the present number so early or in so complete a form as was anticipated. Future numbers will be issued as formerly, under cover, and will embody, at as early a date as possible, the official report of the Exhibition, with the Prize List, &c.

EXAMINATION PAPER IN AGRICULTURE, UNIVERSITY COLLEGE, TORONTO, 1857–8.

(*Concluded—from Page* 175.)

Question 8.—The *origin, distribution,* and *classification* of soils?

Answer.—Soils are in general derived from the rocks upon which they lie, caused by their disintegration, by the action of water, heat, or the atmosphere, or by a combination of them. Water was, and still is, a powerful agent in the distribution. Soils in general have a close relation to the underlying strata, except in drifts brought often from considerable distances. As rocks vary in their composition, so consequently do soils, which may be classified for practical purposes under light or sandy, abounding in silica; clayey, or stiff and heavy, abounding in alumina; calcareous, abounding in lime. These three minerals mainly constitute all soils, infinitely varying in their proportions. Loams are soils containing a happy combination of them, with large quantities of organic matter. These again are divided into heavy or light, just as clay or sand predominates.

Question 9.—What are the principles and uses of ordinary ploughing, subsoil, and trench ploughing, and in what conditions of the soil are the latter operations necessary?

Ordinary ploughing should be done straight and of a uniform depth, so as to turn over the furrow at a uniform angle, varying according to the purpose or nature of cropping. Ploughing disintegrates and mechanically prepares the soil for seed, which cannot germinate and progress without a loosened bed of fine earth. Subsoil ploughing breaks up the ground below the furrow of the ordinary plough, exposing a greater depth of soil to the action of air and moisture, gives the roots of plants a wider range in search of food, and allows of injurious matters in a solvent state to escape downwards. Trench ploughing brings the greater part of the subsoil to the surface, exposes it to the action of light and air, often effects beneficial, chemical and mechanical changes.

Ploughing of all kinds should be performed when the ground is dry, when the breaking up and dividing the soil is more thoroughly done, and the injury by the treading of cattle avoided. In wet land subsoil ploughing should not be done till a year, at least, after under-draining. The former on heavy lands especially, facilitates the operation of the latter.

Question 10.—Give a brief sketch of the modern improvements in Agricultural Implements and Machines.

The modern improvements of the Plough are striking and beneficial. This implement is now as varied in its construction to meet special ends, as differences of soil and variations in preparing land for different crops. The substitution of iron for wood, especially in mould boards, has proved of great benefit, while the form of the Plough has be so mechanically improved, that it is less laborious

to manage, more durable, of less weight in proportion to its increased strength, and requiring much less motive power in effecting deeper and better work.

The horse-hoe, invented by Jethro Tull, has of late years received great improvement, and is now a most useful and effective implement, quite indispensable in row or drill husbandry. Grubbers, scarifiers, clod-crushers, &c., have either been invented of late years, or so much modified and improved, that quite a new feature has been given to the practice of cultivation, which has become more clean and thorough, and the crops consequently much increased. Machines for thrashing and cleaning grain have of late received great improvement, saving power and increasing work. While the changes made of late years in the reaping machine, adapting it for mowing grass, have been on this continent most marked and beneficial, chaff-cutters and drills for sowing seed in rows have been gradually improved and introduced of late years. The introduction of steam for agricultural purposes, including ploughing, in Great Britain, and the substitution in some degree of grubbers for ploughs, may be instanced as among the most striking changes in agricultural mechanics, indicating the advent of a new era in husbandry.

Question 11.—What are the principles and benefits of Draining, in reference particularly to Canada? Open and covered drains, their depth, form, distance, inclination, materials, and cost.

Answer.—The principles upon which Draining depends, are:—

1. That water is always more or less present below the surface of the soil.

2. That the roots of plants will not penetrate this water, and consequently do not go down so far as they otherwise would in search of food, and are consequently cut off from a due supply of nourishment.

3. Air, which is essential to vegetable as well as animal life, cannot find sufficient access in soil saturated with water.

4. That *stagnant* water is always hurtful to vegetation, inducing cold by constant evaporation, and forming noxious chemical combinations in the soil.

Benefits.

1. Soils that are stiff, and therefore difficult and expensive to work, are, by under-draining, rendered dry and friable, and consequently cultivated with more certainty and less expense.

2. Larger crops and of superior quality are reaped.

3. By carrying off the superfluous water by drains, instead of the much slower process of natural evaporation, seed time, and consequently harvest, are earlier.

4. Large root crops are raised, where before only oats and the coarser grains and grasses only could be produced. Draining thus becomes essential on all wet lands, to the successful breeding and fattening of superior cattle and sheep.

5. Summer and naked fallows are rendered much less frequent and necessary, and an improved rotation introduced.

6. The climate is rendered more salubrious, as well as the soil improved.—As this country is opened and drained, diseases both of plants and animals are diminished.

In reference to Canada the thick and thorough system of draining practised in Britain is, perhaps, not required, or cannot be afforded. We should first get off the surface water by open drains, and afterwards make as many under-drains in the wettest portion of the farm, as circumstances allow. The more draining is practised, the better it will be understood, and the cheaper and more effectually done.

Forms of Drains.

1. Open drains merely carry off the surface water; they occupy, if large, considerable space, and are liable to fill in. But they are more or less necessary and useful, particularly in a newly settled country. The first thing to be done on many farms is to inprove the natural drainage by deepening or cutting ditches. The system can be refined by degrees.

2. Covered drains have this advantage, that they filter the water charged with manuring substances, leaving the latter available for plants, and they are not generally liable, if properly made, to get filled up.

Depth.—This should vary according to the nature of the soil and distance apart. On tenacious clays 30 or 36 inches may be sufficient. In looser soils, 4 feet. For springs much more is often required.

Form.—Gradually tapering to the bottom, which should be of sufficient width for the material to be tightly laid in.

Distance.—The distance at which drains are to be placed from each other must in great measure depend on the character of the soil, inclination of the surface, and the depth of the drains. The deeper the drain, the more water will be drawn to it. From 24 to 34 feet apart, for drains of 3 feet deep, on moderately tenacious soils, is considered sufficient. It is a good plan to put them wide apart at first, say 48 feet, and if that should prove insufficient to dry the ground perfectly, another can afterwards be made between. Pipes are the best material, and in light soils they should be fitted into collars, preventing the sand getting in at the joints. Draining in this country is an expensive operation; when better understood and practised, the expense will be much reduced. In England it costs much less—from £5 to £6 per acre. It is a permanent and most remunerating improvement, to which in this country far more attention must be given, if our agriculture is to progress.

Question 12.—Enumerate the different substances used as manures;—their properties, modes of action, and general classification.

Answer.—Manures may be divided into three great divisions:—1. *Animal;* 2. *Mineral;* 3. *Vegetable. Animal* manures consist of bones, flesh, blood, wool or hair, hoofs, horns, &c., and are exceedingly rich in nitrogen, some of them readily decompose, and therefore act quickly. *Mineral* substances which

enter as food to plants, as lime, several phosphates and sulphates, all derived from the soil. *Vegetable* matter, either in a green or decomposed state, afford many substances required by the growing crops. Science has of late instructed practice in the use of many substances as manures, which were formerly neglected. Bones and woollen rags are slow in action; but their effects are visible through a series of crops; whereas guano, rape, nitrates of potash and soda, particularly the two latter, are mainly taken up, if the season be favorable to their rapid action by the first crop.

Question 13.—What is the best practicable mode of managing and applying farm-yard manure in this country, with special reference to its liquid portion?

Answer.—Barn-yard manure should as much as possible be kept from drenching rains, and made into compost heaps, to hasten its decomposition. The liquid portion, which contains so large a quantity of saline matter in solution, should be received into tanks, where it should be allowed to ferment, and afterwards applied to the land, or the manure heap, carefully keeping it from waste. When dung is applied, it should as soon as possible be ploughed in to prevent the loss of the ammonia, a highly fertilizing material.

Question 14.—State the *principles* of *breeding*, *feeding* and *housing* of Live Stock, in reference particularly to the climate and wants of Canada; with the names and characteristics of such breeds of horses, cattle, sheep and swine as are best suited thereto.

Answer.—The first object to be kept in view in breeding the domestic animals is their general improvement and adaptation to special wants. Hence animals should be chosen for that purpose, on both sides, possessing the desired characteristics suitable to the purpose or end sought for. It requires great skill and judgment, combined with much perseverance.

In rearing it is of the utmost importance to feed young animals particularly, in a regular and liberal manner, to house them warmly, yet care must be taken to have sufficient ventilation. Stock exposed to our severe winter cold, consume a large portion of the food given them in keeping up the heat of their bodies, instead of its being converted into flesh, milk, &c. In fattening, food should be given rich in nitrogenous compounds, containing oily matter: *e. g.* oilcake, Indian corn, &c.

Of the breeds of Horses, strength combined with action is a principal point for Canada. The Suffolk Punch is strong, compact and active, and generally well suited; while the Cleveland Bay, Clyde and crosses are much esteemed In cattle the Durham or improved short horn, from its early maturity and great size, seems to be the favorite, while others prefer the Devon or Ayrshire, particularly for dairy purposes. In sheep the Leicester has hitherto been the favorite in Canada, possessing a good carcase and producing a heavy fleece; other breeds, as the Cotswolds, are beginning to attract attention. In some suitable localities the Downs are much valued. The breeds of Pigs are various, and the

coarser kinds have much declined of late years. Berkshires are commonly liked, but improved varieties of this and the Suffolk, Essex, &c., constituting smaller breeds, are of finer texture, and more suitable for domestic use.

Of the characteristics of animals, it may be observed that horses should have bright and prominent eyes, denoting spirit and eagerness in draught, to which deeply and broadly developed necks and sloping shoulders are essential. The external form of cattle should approach as near as possible a parallelogram. A delicacy of head, legs and tail, if not carried to an extreme, denotes high and useful breeding. Some have a tendency to lay on fat in lumps—particularly the Herefords—while others produce what is termed mottled meat, having the fat and lean nicely mixed in alternate layers. Some breeds, as the short horns, have a strong tendency to early maturity and fattening; others, as the Ayrshire, Alderney, &c., are usually poor and lean, but produce large quantities of rich milk. Pasture, elevation and climate are powerful modifying conditions in matters of this kind. In Canada, sheep having a large carcase and a heavy fleece pay better than the finer short-woolled, as the Merino or even Down. In the management of Live-Stock generally, liberal and systematic feeding, cleanliness and protection, are of as much consequence as good and pure breeding, and really good animals will always pay for liberal treatment.

Question 15.—What is meant by rotation of crops? Can a system of rotation be carried out in Canada? If so, what should that system be? State the rationale of the Fallow and Drill Culture.

Answer.—Rotation of crops, as the name implies, consists of bringing crops of different kinds to succeed each other in a certain order. The reason is that one kind of crop draws from the soil a greater amount of a particular substance or substances, than another crop. Wheat requires large quantities of potash, soda and phosphate of lime, while frequent and repeated cropping exhausts the soil. Hence other crops, such as roots, &c, should intervene, which draws more largely on other substances for support. On old, cleared farms the following course may be suited to many situations and soils:—First year, wheat; second, turnips, or roots well manured; third, barley, or spring grain sown with grass seeds; fourth, hay; fifth pasture. A strict system of rotation cannot be carried out generally, in so new a country as Canada. We should study to prevent exhaustion by keeping land for two or more years in pasture and growing wheat at longer intervals. Fallows and drill crops keep the land clean, and expose the soil to the action of air, heat and moisture.

Question 16.—Explain the theory of Rent, and the circumstances which affect the value of land. What should be the principal conditions of a farm lease?

Answer.—Rent is the price paid for the use of land, and like the interest paid for the use of money, the amount depends on the value of the article loaned. Rent is the amount remaining after the labor and expense of cultivation, with the farmer's remuneration for skill and labor, are paid. The value of land is

regulated by the natural capabilities of the soil; its contiguity to markets and large population, and the facilities of obtaining extraneous manures, &c. In the long run, the true interests of the landlord and tenant are identical; a principle in practice too little regarded.

The principal conditions of the lease are :—Its duration—the longer terms are preferable—such as fourteen or twenty-one years, affording full time for the tenant to get back the profits of his improvements. 2nd. Covenants in relation to the mode of cropping, repairing buildings, manures, mode and time of payment of rent, &c. 3rd. Time of entering and leaving the farm, and the destination of the lease on the decease of the tenant. 4th. The usual reservation of the landlord's right of property, such as timber, minerals, &c., and security to the tenants of his rights and interest. Leases should be drawn by, or submitted to competent parties having a practical knowledge of the farming of the district.

Question 17.—What is the best system of husbandry for Canada, so as to obtain, in the long run, the maximum of profit, without deteriorating the soil?

Answer.—The system of farming best suited to Canada for general purposes is what is termed the mixed, that is the raising and feeding of live stock in connection with arable culture. These two objects mutually assist each other, and when judiciously balanced tend to sustain the productiveness of the soil.

Question 18.—Having a farm exhausted by over-cropping, which course would be most judicious, to incur the expense of renovating it, or to dispose of it and purchase with the funds new land in the west?

Answer.—Much depends on circumstances; but as a general thing adopt renovation, particularly if the soil is naturally productive and markets near and good. "Prefer the certain to the uncertain."

Question 19.—What means must generally be used for restoring exhausted land?

Answer.—1st. By a judicious rotation of crops. 2nd. Ploughing in green crops; as clover, buckwheat, &c. 3rd. By introducing plants that send down long fusiform roots into the soil and subsoil. 4th. By deeper ploughing, subsoiling and, where necessary, deep and efficient draining. 5th. By laying down to pasture. 6th. By restoring in the form of manure, those ingredients to the soil of which repeated cropping had deprived it.

Question 20.—What suggestions occur to you for advancing the practice and interests of Canadian agriculture, and for increasing the intelligence and raising the social standing of those engaged in it?

Answer.—By leaving manufactures and protection to take care of themselves, which every political economist knows they will. To facilitate the settling of new lands, which should be thrown open at the lowest cost to first settlers. By increasing the efficiency of Agricultural Societies, and the encouragement of all attempts to impart new and improved varieties of animals, seeds, roots, &c. By the diffusion of sound knowledge and education among the masses of the people,

—not the education which would make a farmer's son feel that to be respectable, useful, and to occupy an honorable social position, he must abandon his father's pursuit and become a lawyer or a physician, and that farmers are mere "hewers of wood and drawers of water." That it is more genteel, and honorable, and better suited to develope the powers of the whole man, to measure tape, than to cultivate soil, is a pernicious error that must be abandoned. Our young farmers especially must learn to respect highly their honorable and useful calling, when they will truly respect themselves.

In an agricultural country like Canada, a liberal and persevering support of Colleges and Schools, in which the science and practice of this all-important art is taught and illustrated, of farmers' clubs, agricultural societies, the erection and diffusion of an agricultural literature, are the principal means of advancing agriculture, and of rasing our farming population to their natural position in the social scale, and of fitting them for the highest offices, which a free and enlightened people can bestow.

THE PROGRESS OF ENGLISH AGRICULTURE.

Continued from Page 191.

For several years past all the railway companies have agreed to convey live stock free, and implements at half their usual charges, to and from the shows of the Royal Agricultural Society, the railway company at the towns where they are held generally providing accommodation for the mechanical compartment. This at Chelmsford cost the Eastern Counties upwards of £3000. Railway fares and pace could alone bring the number of shilling-paying strangers who contribute to the enormous expense of these exhibitions. The population of the city of Salisbury, including men, women, and children, only amounts to 10,000 but the visitors to the show yard in 1857 were over 35,000. This is of itself a striking proof of the wide and eager practical interest which is felt in agriculture, for there is little to gratify the eye of mere holiday gazers; and when in addition we consider the mountains of coal, iron, timber, artificial manure, lime and chalk, conveyed in one direction, and the quantity of live stock and corn in the other, we cannot help coming to the conclusion that George Stevenson's locomotive has heen the great cultivator of the farmer's mind and the farmer's land—the great agent for the extraordinary advance which British agriculture has achieved in the last quarter of a century. Very significant were the figures given by the chairman of the Eastern Counties Railway at the Chelmsford dinner, when he told his farmer friends that, in the course of the preceding twelve months, the lines over which he presided had conveyed 24,000 tons of guano and other portable manures, 700,000 quarters of grain, 550 sacks of flour, 71,000 beasts, 330,000 sheep, 13,000 tons of meat and poultry, and 43,000,000 quarts of milk. Who can calculate the value of the money rewards held out to breeding, feeding, and corn-growing, in the shape of four thousand miles of railway? and how little are men who live in the midst of these changes conscious of their magnitude until the results are collected and put upon paper!

The benefit which has accrued from the Royal Agricultural Society has surpassed the expectations of the most sanguine promoters. The improvements in cultivation and implements, which had been effected by a few men in advance

of the spirit of the age, have now, in great part by its exertions, ceased to be received by the majority of farmers with contemptuous incredulity, and by the labourers with stubborn opposition. In the old days distance operated as a barrier to imitation, and three-fourths of England only heard of what was done in the well-cultivated fourth to ridicule and despise it. When the father of Mr. George Turner, of Barton, Devon, the well-known breeder of Devon cattle and Leicester sheep, who had learned something in his visits with stock to Holkham, began to drill turnips, a well-to-do neighbour looked down from the dividing bank and said to his son, 'I suppose your father will be sowing pepper out of a cruet next.' Indeed the whole history of the turnip cultivation affords a characteristic contrast between the spirit of the past and the present. It took upwards of a century to establish the proper growth of this crop, notwithstanding that the wealth of meat and corn which proceeded from it was as plain to those who would open their eyes as that a guinea was worth one-and-twenty shillings. The first difficulty was to persuade farmers to try it at all; and not one turnip was ever seen on a field in Northumberland till between 1760 and 1770. The second difficulty was to get them to be at the expense of hoeing, insomuch that Young said that he should be heard with incredulity in most counties when he bore testimony to the vast benefits which were derived in Norfolk from this indispensible portion of the process. The third difficulty was to induce them to replace broadcast sowing by drilling, which appeared, as we see, to novices no less ridiculous than peppering the land from a cruet. The bigotry of the farmer cramped the energies of the mechanics whom he now welcomes as among his best friends. The implements, even by the first manufacturers, from the absence of criticism, and competition, from the limited extent of custom, and from the want of artisans skilled in working in iron, were, however excellent in idea, both clumsy and costly. The choicest specimens which existed in 1840 have been so altered in execution by cheaper materials and improved workmanship that they can scarcely be recognised.

The Royal Agricultural Society, with its council of peers, squires, tenants, and implement-makers—its professors of chemistry, botany, and veterinary art—its thousands of subscribers, spread over every county of England—its Journal of transactions and reports—and, above all, its annual encampments in the centres of successive districts—has done for farming what the great fairs of the middle ages did for commerce—concentrated and diffused knowledge, brought customers and producers into contact, and helped to extinguish prejudices in the excitement of social gatherings. They have carried to provincial cities the best live-stock, the best implements, and the best cultivators. The influence of example, of competition, and even of rank and fashion, has been brought to bear on local obstinacy. Squires have been encouraged to improve their estates by the speeches of even greater men than themselves, and young noblemen, in want of an object, have found it in agricultural duties. Implement-makers have had the advantage of the suggestions of their customers, and, thus taught and teaching at the same time, have every year become more dependent on tenant and less on fancy farmers. Men who went to Shows stanch champions of the flail have been vanquished by the mere sight of a steam-engine driving barn-machinery; as an old Homeric Greek, if he could revisit earth, would instantly recognise the inferiority of stones hurled by the hand to the iron balls projected from the cannon's mouth. The greatest landlords, wandering unknown in the show-yards, have had opportunities of learning wholesome truths from the tenants of other landlords. Self-satisfied ignorance is abashed, and triumphant skill finds at once a large and eager audience. These agricultural exhibitions are, in fact, the Woburn and Holkham sheep-shearings, made national and expanded to the dimensions of an age of steam-driven threshing-machines. When the Royal

Society started into life there were about four hundred local societies in existence, but they were rather associations for the promotion of eating and drinking than for the promotion of the arts by which the materials for eating and drinking are increased. The speeches were usually complimentary, and the members congratulated one another upon the pre-eminence to which their own enlightened district had attained. They were, in a word, societies for maintaining local darkness instead of for the acquisition of fresh light from enlarged experience.

Having described the important functions discharged by this central Society for the advancement of farming, we proceed to touch upon the particular improvements which have been effected during its career. Attempts to drain have been made from the earliest times. Specimens may be seen of very clever workmanship more than a hundred years old: but the when it should be done, and the why, and the how, had never been reduced to rule. Lord Bacon who had a large collection of works upon agriculture, had them one day piled up in the court-yard and set in fire, for, said he, "In all these books I find no *principles;* they can, therefore, be of no use to any man." This was just the deficiency with respect to drainage, and it could not therefore progress until Josiah Parkes, in 1843, expounded the "principles," and in 1845 made suggestions which led to the manufacture of the steel tools which were necessary for forming the deep cuttings, and the cheap pipes which were essential to carrying off the water from them when formed. Up to 1843 little was done beyond tapping springs, or endeavouring to convey away the rain which fell on the surface by drains so shallow that the plough frequently spoiled them, it being the popular belief that moisture would not penetrate through retentive clay beyond twenty or thirty inches. In 1833, when Mr. Parkes was engaged in draining a peat-bog near Bolton, in Lancashire, for Mr. Heathcote, he had an opportunity of seeing the great effect produced by deep cuttings, and he was led to ponder on the advantage that would be derived from relieving the soil of a certain number of inches of the water, which is stagnant during a rainy season and remains until removed by evaporation in a dry season. By experiments continued for several years, he found that a deep drain began to run after wet weather, not from the water above, but from the water rising from the subterranean accumulations below, and that, by drawing away the stagnant moisture from the three or four feet of earth next the surface, it was rendered more friable, easier to work, more penetrable by the rain, which then carried down air and manure, and much warmer and more suitable for the nourishment of the roots of the crops. He came to the conclusion that the shallow draining, advocated by Smith of Deanston, was a vital error, and that four feet, which left a sufficient layer of dry warm surface earth, after allowing for the rise of the moisture by capillary attraction above the water level of the drain, should be the minimum depth.

The first field drained on the four-feet plan was on a farm near Bolton, belonging to a celebrated Lancashire bone-setter. This was a small beginning of the subterranean net-work of pipes which has more than doubled the value of our retentive soils. In 1843 Mr. Parkes gave his evidence before the Agricultural Committee of the House of Lords, and was strongly supported by the Earl of Lonsdale, whose experience as a commissioner of highway trusts had proved to him the advantage of the system. But nothing could be done without tools and pipes. A Birmingham manufacturer, on Mr. Parkes' suggestion, produced in 1844 the set of drain-cutting implements which have by degrees been brought to perfection. A cheap conduit was still a difficulty. Stones choked up in many soils, and where they had to be broken and carted to the ground, often made the cost enormous. In 1843, at the Derby show of the Royal Agricultural Society, John Reade, a gardener by trade, a self-taught mechanic, well-known as the inventor of the stomach-pump, exhibited cylindrical clay-pipes, with which he had

been in the habit of draining the hotbeds of his master. His mode of constructing them was to wrap a lump of clay round a mandril, and rub it smooth with a piece of flannel. Mr. Parkes showed one of these pipes to Earl Spencer, saying, "My Lord, with this pipe I will drain all England." The Council, on his Lordship's motion, gave John Reade a silver medal for his idea, and in the year following offered a premium for a tile-making machine. A great deal of money was wasted in attempts, and many patents were taken out for the purpose with indifferent success; but in 1845, at Shrewsbury, Thomas Scragg received a prize for a machine which triumphed over the difficulties, and pipes can now be made quite as fast as kilns can take them.

The work from that hour went rapidly forward. In 1846 Sir Robert Peel, whose management of his own property had made him thoroughly alive to the national importance of the subject, passed the Act by which four millions sterling were appropriated toward assisting landowners with loans for draining their land, with leave to repay the advance by instalments extending over twenty-two years. Nearly the whole of the first loan was absorbed by canny Scotch proprietors before Englishmen had made up their minds to take advantage of it. But the four millions of Government-money was small in comparison with the sums furnished by private enterprise for the execution of an improvement which on the worst class of wet land gave visible proofs of its value by immediate profits. Another circumstance stimulated the work. About the period that the system of deep draining was perfected, the great landowners were anxious to encourage their tenants, depressed by the approaching free trade in corn, and thorough draining became the most fashionable improvement. The sheepfolding Norfolk rotation had done great things for light land, brought the cultivation of roots to a high pitch, and proportionately increased the live-stock on every light-land farm. The owners of strong retentive soils were anxious to imitate their light-land neighbours, and to grow the roots which were seen to afford such profits in beef and mutton. Deep drainage enabled them to realize these aspirations.

For centuries the farmers of clay soils had been engaged in trying various expedients for saving their corn crops in wet seasons. The land was laid up in "lands," "backs," or "steches," that the rain might flow off into intervening surface-drains, a few inches deep, and which were formed of turf, bushes, and stones. Not unfrequently an anxious farmer would traverse his cornfields after heavy rains, spud in hand, and try to lead the stagnant little pools to the neighbouring ditches. In favourable seasons the clay usually gave excellent crops of corn, but a wet season destroyed the husbandman's hopes. These stiff soils had been preferred, until light heath-land had been brought by sheepfolding, marling, and root-growing into profitable culture. The introduction of thorough drainage restored them to their ancient pre-eminence. Hundreds of thousands of acres, formerly condemned to remain poor pasture, or to grow at long intervals uncertain crops of corn and beans, have been laid dry, rendered friable, and brought into a regular rotation, in which roots find their place. Sheep-stock thrive where previously a few dairy cows starved; the produce has been trebled, the rental raised, and the demand for labour increased in proportion. In the neighbourhood of Yorkshire manufactories, moorland not worth a shilling an acre has been converted into dairy-farms worth two pounds. When it is remembered that the principle upon which these results depend was not enunciated till 1843, it will be seen how rapid and mighty has been the recent progress in agriculture. A second public loan of four millions was granted in 1856, and it has been estimated that in the ten previous years upwards of sixteen millions had been invested by the nation, and by private companies and individuals, in thorough drainage. There is no longer truth in the saying that the capital and soil of the country have never been acquainted. All the branches of farming business felt

the influence, for the improved stock originated by Bakewell, the artificial food raised to feed the improved stock, the scientifically constructed drills, horse-hoes, and other implements which the Norfolk rotation called into use, all met with an extended development in the retentive soils rendered kindly by the use of "Parkes' clay pipes." It will usually be found that an advance in one direction gives a corresponding impulse in every other.

The Royal Agricultural Society had an important share in the propagation of the principles of thorough drainage first propounded by their author in a complete shape in a lecture at one of their meetings at Newcastle. Another great change, by a fortunate coincidence, accompanied, or rather preceded, the conquest over the clay lands. This was the chemical revolution, which gave the farmer the use of concentrated portable manures, for stimulating the growth of crops in a degree unknown to the preceding generation. Previous to 1835, as nearly as we can fix the date, agriculturists, in addition to farm-yard dung or night-soil, employed as manures lime, chalk, gypsum, marl, soot, salt, saltpetre, rapecake, and bones. The discovery of the fertilizing properties of bone was accidently made at a Yorkshire foxhound kennel. Liberally used on the heaths and wolds of Lincolnshire, it was the philosopher's stone which turned rabbit-warrens and gorse fox-coverts into fields of golden grain. A Mr. Nelson, one of the late Lord Yarborough's tenants, used to say, that "he did not care who knew that he had made £80,000 out of his farm by employing bones before other people knew the use of them." But what succeeded in one parish or even in one field often failed in the next, and sometimes the farm which had once yielded bountifully in return for a dressing of lime or gypsum stubbornly refused to respond to a second application. Worse than all, the root crop—the foundation of the famous Norfolk rotation, the wealth of half a dozen counties—began to fail, devoured in tender infancy by the fly; and, without the turnip, where was the food for sheep and winter-fed cattle? The philosopher came to the assistance of the farmer, and rescued him by timely aid from the difficulties which beset him. Nitrate of soda and guano were imported, superphosphate of lime from bones was invented; and agricultural chemistry, having earned the place of a practical, that is, a profitable science, the anomalies in connexion with the use of lime, chalk, gypsum, &c., were mastered and explained by the joint exertions of the farmer and his new ally the chemist.

Nitrate of soda was imported from Peru and sold in small quantities by an agricultural manure-dealer somewhere about 1835, and in the same year a cargo of guano was consigned to a Mr. Myers, a Liverpool merchant. Guano (of any agricultural value) is the dung of sea-fowl feeding on fish in a zone where rain rarely falls. The guano of the Peruvian islands was protected in the time of the Incas by special laws. In 1609, its properties were fully described in a work published in Lisbon by Garsilaso de la Vega, but this precious fertilizer was neglected in Europe until the date of Mr. Myers' importation, when investigations into the chemistry of agriculture, commenced by Sir Humphrey Davy with very little practical effect during his lifetime, and carried on by continental philosophers, were beginning to bear fruit. Guano, although incredulously received by farmers in 1836, was eagerly accepted by the dealers in artificial manures, and sold, either in a pure state or under a special name, mixed with less active ingredients. In 1843, a store inferior to that of Peru having been discovered on the Ichaboe Islands, on the coast of Africa, 1100 feet long, 400 broad, and on average 35 feet deep, the whole was removed before the close of 1844, and realized upwards of a million sterling. Three years previously, an article of forty-three pages, from the German of Dr. Charles Sprengel, appeared in the first volume of the "Journal of the Royal Agricultural Society," in which, though every kind of animal manure was described, guano only received a

passing mention as a curiosity, and no note to supply the deficiency was attached by the editor; so little was it then known to the most intelligent cultivators, and so speedily had the knowledge of its value spread in the interval. This single fact would alone show that we had reached a new era in the history of farming.

In 1840, before the farming public had become accustomed to these imported manures, Professor Liebig suggested that the fertilizing power of bone manure would be increased by the application of sulphuric acid, and the consequent production of superphosphate of lime. There have been periods in our history when a book like that of Liebig would never have travelled further than the libraries of our men of science; but in 1840 we had in our dealers in manures a commercial class keenly alive to the possible profits of a philosophical suggestion. A carboy of sulphuric acid was easily poured over a few bushels of ground bones, and soon Suffolk drills, charged with superphosphate and guano, were sent to teach farmers that if they wished to grow great root-crops there was something to be added to the invaluable "muck."

One of the first to experiment upon the new manure, and then to manufacture it on a large scale, was Mr. J. B. Lawes, a Hertfordshire squire and scientific chemist. He was followed by Mr. Purser, of London, who began, in 1843, with a single carboy of sulphuric acid, price 10s., and has since frequently purchased ten thousand carboys at one time. At Southampton, a few years later, Messrs. Dixon and Cardus made an excellent speculation by a contract with the Government of Buenos Ayres for the exclusive right of exporting the charred flesh and ashes of joints of meat burned for want of other fuel on the treeless Pampas, to boil down the tallow. This animal refuse, the accumulation of a quarter of a century, when treated with sulphuric acid, is converted into valuable superphosphate. But although every quarter of the globe, even battlefields, were ransacked for bones, the supply was insufficient, and some new resource was required in order to keep down the price.

The chemists having so far done their part, the next contribution to the progress of agriculture came from the geologists. Professor Henslow, whose great acquirements as a botanist had not prevented his attending to other branches of science, had noticed in 1842 some nodules at Felix Stowe, on the coast of Suffolk. In 1843, haunted with the idea that they were something of importance, he returned to Felix Stowe, collected a quantity of them, and placed them in the hands of a Mr. Potter for analysis. The analysis showed them to be fossils, commonly called coprolites, on the supposition that they consisted of animal excrement, and containing from 50 to 55 per cent. of phosphate of lime. From this discovery Professor Henslow might have realized a considerable fortune. The quarry of coprolites was to be had at a common rent, and there were manure manufacturers prepared to pay for the information, but he "did not consider such a course consistent with his position as a man of science and a clergyman," and after keeping silence on the subject for some months at the request of Mr. Potter, "who wished to have the chance of availing himself of the discovery," he gave the results of his investigation to Mr. J. B. Lawes, who made the superphosphate obtained from coprolites the subject of a patent, which he was not able to maintain. Subsequently, beds of coprolites were discovered in Cambridgeshire, Hampshire, and Dorsetshire, and further investigations in Norway placed Mr. Lawes in the exclusive possession of great beds of another fossil called *apatite*, rich in phosphates—of which he imports whole cargoes for his manufactory at Bow, near London. The superphosphate of lime, however, produced from fossils being much less soluble than that from fresh bones, can only be usually applied when mixed in moderate proportions with the latter.

One other important addition to the portable manures was discovered about seven years ago by Mr. Odams in the blood and garbage of the London slaughter-

houses, which, formerly thrown down sewers and upon dung-heaps, is now contracted for to the extent of nearly eight hundred thousand gallons a-year. Mixed with ground or calcined bones and sulphuric acid, it is converted into a powerful corn and root fertilizer, known to agriculturists as the "Nitro-phosphate manure." The mere fact that these products were articles of sale, and not of home manufacture by the farmer, had a powerful influence in extending their use. Those on whom the essays of Professors and the orations of landlords produced little effect were worried into inquiry by the agents of manure-vendors, and, as the new practice spread, were convinced almost against their will by great crops in the fields of enterprising neighbours. The vendor of artificial manures helped in another particular the general movement. He soon discovered that his fertilizing stimulants were robbed of half their value on wet or ill-cultivated land. Hence he became the eager advocate of thorough drainage, and that thorough preparation of the soil which can only be effected by the best class of ploughs, harrows, horse-hoes, and clod-crushers. His customers would have been customers no longer unless he could have convinced them that the fault was in themselves and not in the goods. He argued to ears which had at last been opened, and prevailed without the assistance of the hedge-stake. A man grudged growing weeds with the fertility for which he had paid in hard cash, nor could a manure that cost £10 or £12 a ton be refused the economy of a machine to distribute it carefully; and thus drill husbandry, which is identified with clean husbandry, spread, led by pipe-drains, from Norfolk, Suffolk, and Bedfordshire, into every county of England, and with it bought all the machines and implements required for "clean, rapid, concentrated cultivation."

It was between 1816 and 1836,—the twenty years in which the breaking up of poor pastures and the reclamation of waste lands were most vigorously carried on by means of turnip-drilling, sheep-folding, and the four-course rotation—that the crude forms of the greater number of the agricultural implements which are now considered 'standard' were either invented or brought into use among the great lightland farmers. In general the ingenuity of the mechanic outstripped the wants of the cultivator, and many excellent contrivances had been forgotten because they were in advance of the requirements of the day. Under the new demand for mechanical aids, more than one ingenious blacksmith or wheelwright rose from a humble position, and has since expanded his small forge into a factory where steam-power and the best artisans are employed in the construction of agricultural implements. The opposition raised to the introduction of some of these machines, under the idea that they were injurious to the labourer, is known to every one. Between 1836 and the present time this prejudice has been almost entirely extinguished by a series of legislative and national changes. The commutation of tithes has unlocked the land; the new poor-law has, to a certain extent, emancipated labour, although the law of settlement still weighs heavily upon the improving farmer and the enterprising peasant; the Irish famine, and the enormous emigration during the last ten years to America and Australia, have removed a mass of floating, half-employed workmen, and made way for the introduction of the threshing-machine, the drill, the haymaking-machine, and the steam-engine, without producing a murmur of discontent. Experience, moreover, has convinced most persons that the use of agricultural machinery creates an increased demand for constant labour of a superior kind, although undoubtedly it relieves the farmer from his dependence on an itinerant army of reapers and haymakers. The true effect of the iron workman is not to displace the human, but to perfect cultivation, to multiply produce, to increase the means of subsistence, and to add to the prosperity of the entire community.

It may be taken for an axiom, that when a farmer has used even one good implement he derives so much advantage from its rapid and accurate work, that

he returns again and again to the manufacturer's yard until he has, as far as possible, substituted horse for human power, and steam for horse-power. The flail, so long kept going by the pauper-creating Poor Law, could not have threshed out the breadth of corn which is now grown with the aid of stimulating manures. The picture which is given in Lisle's 'Husbandry,' written in 1714, remained often true up to our own time, because, though there might be a difference arising from the greater or less quantity of grain in the ear, according to the season and the tillage, neither the flail nor the man who worked it varied from the flails and men of bygone generations. 'A good thresher,' he says, 'assured me that five or six bushels of wheat was a very good day's threshing, and, in case the corn was clung and yielded ill, sometimes three bushels was as much as could be threshed in a day.' In another place he tells us that 'iron-clouted shoes do not well to thresh wheat in, especially if it be new corn: a thresher's shoes should, by right, be soled with an old hat.' Horses, always the more fatal expense of a farm, were wanted for other purposes as cultivation expanded: and it was found in addition that it did not pay to wear out good animals in the circular drag of a threshing-machine. Thus a way was made for the steam-engine. So early as 1802, General Bulwer, the father of the novelist, erected, at his seat at Hydon in Norfolk, what Young believes to have been the first which was used in England for agricultural purposes. The cost of it was £600, and it was to thresh, dress and grind the corn, and cut chaff and hay. The earliest experimenters usually pay, and their successors profit. As the practice was not followed, it is probable it did not answer. The rapidity with which it has spread in the last few years adds another to the particular characteristics of the agriculture of our time. The travelling steam-engine, constructed to be drawn by horses from barn to barn and parish to parish, first made its appearance in an unsuccessful shape at Liverpool in 1841, was formed into a working machine by Mr. Cambridge of Bristol in 1842, grew at once into favour, and in 1845 had become fully established. A new trade sprung up almost like mushrooms in a night, and the show at the Royal Agricultural Society at Salisbury in 1857 was attended by upwards of twenty manufacturers, from almost every district of England. One firm alone made upwards of five hundred engines of an average power of seven horses, in the twelvemonth ending December, 1856.

The threshing-machine which the steam-engine worked has advanced in an equal degree. It was originally a mere box for roughly beating out the corn from the straw, and beating the corn almost as much as the straw. Step by step it was improved, until at Lewes, in 1852, a machine was exhibited which winnowed as well as threshed the corn and delivered it ready for dredging. Since that date 'barn machinery' has been produced which 'threshes, raises the straw to the loft, winnows and dresses the corn, divides the wheat according to quality, and delivers it into sacks ready for market, while the tailings, also divided into first and seconds, remain for the pigs and poultry, and the cavings for litter in the boxes or pigsties.' These multiplied services it performs at the rate of 800 bushels a day and at a cost of 2s. 6d. a quarter. The same engine which puts in motion all this automaton work is often made available for pumping water, grinding corn, crushing cake, cutting chaff for cattle, and grinding bones for manure, while the steam from the boiler may be turned into an apparatus for cooking food for cattle.

The reaping machine lay dormant in this country after it had been devised by the Rev. Patrick Bell, because it was not called for by the state of the labour-market, and was re-invented in two different forms in the United States, because the scarcity of manual labour there made it indispensable. It was brought into notice at the Great Exhibition of 1851, and answers the double object of relieving

the farmer from his dependence on itinerant labour, and of economizing that most valuable element, *time*, in garnering the harvest. It took more than fifty years to make the seed-drill a standard implement; within six years the far less valuable and less perfect reaping machine has grown into extensive use. One more gap remained to be filled up at the date of the Salisbury Meeting, in order to complete the mechanical requirements of a well-ordered farm, so that the stubble of the land, where the corn is sown by drill, reaped by horse-power, threshed out by steam, and sent in the shortest possible time by railway to market, should be at once broken up by the resistless force of a Steam Cultivator, instead of being left for the net-like twitch to spread and weeds to seed until the following spring. We almost believe, yet we dare not assert, that this crowning triumph of agricultural engineering has now been achieved. The retentive clays fertilized ten years back by deep drainage will then be brought to develope their full power of production by a gain of time often equal to a whole season.

But perhaps nothing illustrates better the change which has come over farming in the last few years than what has taken place with respect to so ancient and familiar an article of husbandry as the plough. Although an implement more than two thousand years old, it is only within the last sixteen years that it has been reduced to an uniform shape and material. In engravings, to the eye of the casual observer there is now no difference between the ploughs manufactured for the same purpose by every one of the eminent makers; and, in fact, in general construction, they are all alike, except where the "turnwrests of Kent and Sussex" are used, although some have a marked superiority in the details and in durability. They are fashioned entirely of iron and steel, of long graceful wave-like form, provided with a pair of wheels of unequal size, and drawn by a chain attached to the body of the plough. Iron screws and levers have replaced wooden wedges. A few seconds are sufficient to attach the share or adjust the coulter. It was quite otherwise in 1840. Out of six ploughs engraved in the Journal of Agriculture for that year, two are swing, two have two wheels, two have one wheel each, all are of wood, except the shares and breasts, all are drawn from the extremity of the beam, and the awkwark inferiority of their respective shapes is perceptible at a glance. In 1840, Lincoln, Rutland, Bedfordshire, Berks, and almost every other county, had its separate plough, and knew little of its form in the rest of the kingdom; the exceptions being among the customers of scientific makers, whose trade was restrained by the cost of conveyance, the want of publicity, and the want of intelligence. Mr. Pusey and Mr. Handley, who contributed articles on the Plough to the first volume of the Royal Agricultural Society's Journal, were, as gentlemen farmers, far ahead of their time, but it is evident, from their observations, that they had everything to learn in the science and practice of agricultural mechanics. Mr. Handley's acuteness led him to conclude that wheel ploughs were of lighter draught, "contrary to the opinions of the writers" whom he had consulted; but Mr. Pusey, in his general report on English agriculture, evidently prefers the Scotch swing plough, not aware that the old Bedford wheel plough, even in its unimproved state, was a better implement. After mentioning the instances in which the Scotch plough failed, he hesitatingly adds, "It is even doubted whether one wheel might not be advantageously restored." Another report on a trial of different kinds of ploughs in Berkshire showed how general was the ignorance of the simplest principles of mechanical knowledge, for he confesses that he had no idea that there would be any "difference of draught between a smooth share and one covered with tar or paint." These trials, valueless in themselves, were the commencement of investigations by well-informed persons under the auspices of Mr. Pusey, and of a series of public competitions, which have placed ploughs constructed on the best princi-

ples, and in the best manner, within the reach of every parish in England.—The improvement is as great as the change from the old musket to the Minie rifle. Skilful manufacturers, each eager to command the market, study, with all the aids of a mechanical knowledge and a wide experience, to secure excellence of design, durability of make, and economy of price, while the farmer in his turn has learnt that science is a better constructor than ignorance, and no longer prefers the chimney efforts of a village artizan. The marvel is in the rapidity with which these changes have been effected, as if some magician of agriculture had waved his hand over our favored island.

To be Continued.

MISCELLANEOUS.

USE OF LIME IN AGRICULTURE.—The action of lime is two-fold; first, physical, and second, chemical. As a mechanical agent it opens stiff clays, rendering them friable, mellow, and more easily worked; chemically, it acts upon the vegetable matter of the soil, and sets free those stores of valuable substances which, without the action of this agent, must have remained inert and useless. It also enters directly into the composition of plants, and in many varieties forms a large proportion of the weight of their inorganic constituents. It neutralizes certain acids which are often present in soils, rendering them useful to vegetation, instead of being positively injurious, which they are in their original state. The existence of water in the soil, however, affects the action of lime very considerably. If the land is wet and undrained, lime will not exert the same influence which it would do in the case of thorough drained land. A greater quantity of lime is necessary to produce a given effect, and thus the neglect of thorough drainage entails a considerable greater expenditure in liming than would have been necessary, if the land was either naturally or artificially dry.—*Cameron's Chemistry of Agriculture.*

CHANGES IN THE ATMOSPHERE.—Dr. Lindley Kemp, in his "Natural History of Creation," makes the following remarks on this subject:—"At a very early period the atmosphere was charged with carbonic acid, the carbon of which now forms parts of animal and vegetable substances. At first it contained no ammonia, but since vegetation and decomposition began, the nitrogen that existed in the nitrates of the earth, and some of the nitrogen of the atmosphere have been gradually entering into new combinations, and forming ammonia, a substance at first non-existent, but gradually increasing, and, as it is volatile, the atmosphere *now always contains some of it.* The quantity has lately become so great that it can always be detected by chemical analysis, and there is an evident tendency to increase in the atmosphere. Now suppose it to go on increasing to a certain point; it forms with air, a mixture which is violently explosive; an atmosphere charged with ammonia, is liable to explode whenever a flash of lightning passes through it, and such an explosion would doubtless destroy, perhaps without leaving traces of, the present order of things."

WONDERFUL MECHANISM IN THE EYES OF BIRDS.—A singular provision is made for keeping the surface of the bird's eye clean—for wiping the glass of the instrument as it were, and also for protecting it, while rapidly flying through the air and through thickets, without hindering the sight. Birds are for these purposes furnished with a third eyelid, a fine membrane or skin, which is constantly moved very rapidly over the eyeball, by two muscles placed in the back of the eyes. One of the muscles ends in a loop, the other in a string which goes

through the loop, and is fixed in the corner of the membrane, to pull it backward and forward. If you wish to draw a thing towards any place with the least force, you must pull directly in the line between the thing and the place; but if you wish to draw it as quickly as possible, and with the most convenience, and do not regard the loss of force, you must pull it obliquely, by drawing it in two directions at once. Tie a string to a stone, and draw it towards you with one hand; then make a loop on another string, and running the first through it draw one string in one hand, not towards you, but sideways, till both strings are stretched in a straight line; you will see how much more easily the stone moves quickly than it did before, when pulled straight forward.—*Brougham's Miscellanies.*

ADULTERATION OF FLOUR.—It is well known that the flour of various kinds of grain is often adulterated with alum, plaster, and even arsenic, when a crime is contemplated. These frauds can always be discovered, but only by means of complicated operations. A chemist, of Charleville, M. Cailletet, has just discovered a method by which even the ten-thousandth part of any mineral substance may be detected in a few instants. Chloroform, that singular compound which has already rendered so many services to science, is again the chief agent here. Flour is insoluble in this substance, and much lighter, whereas all mineral substances are heavier; were water or any other liquid used instead of chloroform, the flour would either form into a paste or be decomposed. These facts being kept in mind, M. Cailletet's method will be easily intelligible. A small quantity of the flour to be tested is introduced into a glass tube closed at one end, about an inch in diameter by eight or ten in length. Chloroform is then poured into the tube, which, after being well corked and shaken, is left to stand for some time in a vertical position. The flour will soon rise to the surface, while all the mineral substances it contained fall to the bottom; the liquid may then be decanted, and the deposit subjected, if required, to a chemical analysis.

AFRICAN DESERT PLANTS: ADAPTATION OF STRUCTURE TO PURPOSE.—The quantity of grass which grows on this remarkable region is astonishing, even to those who are familiar with India. It usually rises in tufts with bare spaces between, or the intervals are occupied by creeping plants, which, having their roots buried far beneath the soil, feel little the effects of the scorching sun. The number of these which have tuberous roots is very great; and their structure is intended to supply nutriment and moisture when during the long droughts they can be obtained nowhere else. Here we have an example of a plant, not generally tuber-bearing, becoming so under circumstances where that appendage is necessary to act as a reservoir for preserving its life; and the same thing occurs in Angola to a species of grape-bearing vine, which is so furnished for the same purpose. The plant to which I at present refer is one of the Cucurbitaceæ, which bears a small scarlet-coloured eatable cucumber. Another plant named Leroshua is a blessing to the inhabitants of the Desert. We see a small plant with linear leaves, and a stalk not thicker than a crow's quill; on digging down a foot or 18 inches beneath, we come to a tuber, often as large as the head of a young child; when the rind is removed, we find it to be a mass of cellular tissue, filled with a fluid much like that in a young turnip. Owing to the depth beneath the soil at which it is found, it is generally deliciously cool and refreshing. Another kind, named Mokuri, is seen in other parts of the country, where long-continued heat parches the soil. This plant is a herbaceous creeper, and deposits underground a number of tubers, some as large as a man's head, at spots in a circle a yard or more horizontally from the stem. The natives strike the ground on the circumference of the circle with stones, till, by hearing a difference of sound, they know the water-bearing tuber to be beneath. They then dig down a foot or so and find it.—*Livingston's Missionary Travels.*

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THE DISEASES OF SWINE

Are not very numerous.—*Colic* is not very common. The symptoms are those of sudden and extreme pain; and the remedy a dose of tincture of opium and spirit of nitrous ether, from one drachm to eight of the former, and double this quantity of the latter (according to the size of the animal), with a few ounces of warm water. Bleeding may also be adopted if relief is not at once afforded by the medicine.

Inflammation of the Bowels is more frequent. There is great fever and loss of appetite. The treatment should consist of copious bleeding, in the first instance—the most convenient place for the operation being the vein on the inside of the fore-arm. *From two ounces up to two pounds may be taken, according to the size of the pig. If* the vein inside of the arm cannot be opened, the tail may be cut, but it is quite useless merely to take away a few drops of blood. The bowels should also be relaxed by oily purgatives, such as linseed oil; and if costiveness exists, injections should be thrown up; in addition to this, warm baths will be found exceedingly useful, and for small pigs very convenient. In sub-acute inflammation, calomel and opium combined will be found a very excellent medicine, the dose being from two grains to five of each.

In constipation of the bowels, without active inflammation, there are various medicines that are very suitable. Jalap, in doses of from one scruple to a drachm, with six to twelve grains of scammony, will be found useful. Epsom salts, Glauber salts, and infusion of senna, are all desirable medicines, requring, however, to be given in the form of a drench. Linseed oil is a useful purgative, and which the animal will often take voluntarily, and its activity may be increased by a few drops of croton oil, in cases of obstinate constipation.

Diarrhœa is not very uncommon in the pig. The following medicine will be suitable:—

Powdered opium	15 grains.
Prepared chalk	4 drachms.
Powdered ginger	1 drachm.
Peppermint water	4 ounces.

This will be sufficient for eight or ten doses, one of which may be given twice a-day whilst the symptoms continue. If the faeces are slimy, a dose of salts should also be given.

Protrusion of the Rectum.—This disease, as it may be called, is rather frequent with young pigs. The animal should be kept clean and quiet, and all food denied, with the exception of a little milk, so that the bowels may be tolerably empty before the gut is returned. The pig being carefully secured, the parts should be washed, and the rectum carefully returned, and pushed up some little distance. Some strong thread, doubled several times, should then be passed through the anus, and tied with a knot, and no solid should be given for some days, the animal being kept mostly on milk.

Inflammation of the Chest and the Lungs is by no means an uncommon disease in the pig, attended with quick breathing, fever, and diminished appetite. In addition to blood-letting, the bowels should be moderately opened (not purged), and the following medicine administered once a-day:—

Calomel	1 to 3 grains.
Tartarized antimony	1 to 3 "
Nitre	5 to 20 "

After one or two doses the calomel may be omitted. When the disease is well defined, and the animal valuable, blisters may be applied to the chest.

Catarrh, or Cold.—A cough and discharge from the nostrils are the principal symptoms, and, with care and housing, the animal will often soon get well. In severe cases, it is well to give medicine, such as the following:—

Antimonial powder	2 to 6 grains.
Nitre	10 to 30 "
Digitalis	1 to 2 "

To be given daily for several days. Sometimes this disease extends to the lungs, and

becomes *bronchitis*, which is attended with danger. In addition to the above treatment, the animal should then be bled, and a stimulant rubbed on the brisket.

The *Epidemic*, as it is called in other animals, attacks pigs also, and proves sometimes very troublesome. The principal local symptoms are lameness in the feet, from soreness between the claws, and inflammation of the substance connecting the bone with the horn, so much so that pus often forms, and the hoof is cast. There is much fever in the system. The treatment should consist in the administration of a dose of Epsom salts internally, and the application to the feet of some astringent, such as a saturated solution of sulphate of copper or zinc, or the preparation advised for foot-rot in sheep.

Diseases of the Skin.—Pigs are rather liable to *eruptive diseases of the skin*, induced frequently by a high state of living. A cooling lotion, such as—

Muriate of ammonia .....4 drachms.
Acetic acid.....1 ounce.
Cold water.....1 pint,

will make a convenient topical application.

Measles.—Its seat is somewhat beneath the skin, on which we find a number of small, watery pustules externally, of a reddish color, and there is fever, cough, discharge from the nostrils, and pustules under the tongue. It is rarely fatal, but yields to cooling treatment, such as Epsom salts and nitre, with attention to feeding.

FRUIT TREES—APPLES.

The apple is, in point of usefulness, by far the most important fruit cultivated in Canada—constituting as it does a portion of the food of the country, both for man and beast—and a more extended cultivation, with the introduction of better sorts, would greatly increase its usefulness. Its costs no more either in space or labor, to cultivate a good kind of apple than a poor one, and many of the good sorts grow faster and are more productive than the common seedlings; whilst the difference of cost at the time of planting is not worth mentioning.

The first apple in point of excellence in Canada is the Fameuse or Pomme de Neige. Whether this variety was brought from France by the early settlers of Lower Canada or raised here, we do not know; but it has long been the favorite apple of this region. The tree is remarkably thrifty and hardy, and with the good treatment which all apples require, will produce every second year a full crop of beautiful, round, deep red fruit, with a snow white flesh, of the most delicious taste. This fruit can, be kept in good order in a cold, but not freezing apartment, till February or March, although its season is usually understood to terminate in January. It has been thought that the Fameuse will not grow to advantage except on the slopes of the Montreal mountain, but this is a mistake. We have eaten as good Fameuse apples, grown in the old orchards on the Detroit River, as in Montreal.

The Pomme Grise is usually ranked next in importance to the Fameuse, and is likewise a free-going, hardy tree; but the fruit, although excellent and long-keeping, is small and thinly set on the tree. The same space and labor would produce ordinarily four or five barrels of Fameuses to one of Pomme Grises.

The St. Lawrence, which originated, we believe, in this vicinity, may be ranked next in importance. It is a free grower and a great bearer. The fruit is very large, handsome, and good. It ripens nearly a month earlier than the Fameuse, and does not keep beyond Christmas. In fact, the fully ripe fruit is so soft and juicy that it will not keep well over a month or six weeks.

The Bourassa is an esteemed old variety, with a fine reddish-grey color, and a dry, sweet, aromatic taste; but the tree is so slow-growing and liable to premature decay, that it is seldom planted.

The above are all the varieties which may, strictly speaking, be called Lower Canadian. Of apples imported from Britain and the United States we have tried the following:—

The Early Harvest. This is the earliest apple grown here. It matures in the month of August, when its pleasant acid taste is more grateful than a sweeter flavor would be.

It is a free-grower, but, so far, rather a shy bearer. The fruit is green, and of a good size.

The Red Astrachan, which is the next earliest kind, is a remarkably handsome, rapidly growing tree, and produces a splendid large scarlet apple; but the flavor is very poor, and so far as our experience goes, the crop is very small. We have, however, no trees over twelve or fifteen years old, and most sorts produce much more abundantly after that age.

The Ribston Pippin is an immense bearer, and the fruit is handsome and of pretty good quality. It is an early autumn apple in this region, and does not keep well.

The Keswick Codlin is also an immense bearer, producing a green apple suitable for cooking purposes.

The American Summer Pearmain is an early Autumn apple of a handsome mottled appearance, moderate size, and very excellent flavor. In this latter respect we think it next to the Fameuse, and it will keep about as long. The tree which is a free grower is, however, so far as we have seen yet, a shy bearer.

William's Favorite. This is a long scarlet fruit of great beauty, which ripens early in September. A tree about ten years old, which has latterly grown with remarkable rapidity, has come into bearing this year for the first time, and gives promise of being one of the most useful orchard varieties. The flavor is pretty good, the flesh reddish and somewhat dry, and we think it would keep two or three months. The American books speak very high of this variety.

The foregoing are all the sorts of any importance that we have tested, except two good kinds which we suppose to have been seedlings, and of which there are probably no other trees in exisience. One of these—an old tree which we have called the Canada Reinette—bears abundantly, a handsome, rather small, sweet, dry, and good keeping fruit, and the other, which we have called the Acid Apple, bears the greatest abundance of fruit we ever saw, which, however, requires an extra allowance of sugar in cooking.

Our experience respecting planting apples or pears does not confirm the general opinion that young trees from the United States or Canada do not thrive so well as those raised here. We have been, and know others who have been, alike unsuccessful with all. The great point is to have the trees in good order when they are planted, with roots neither dried nor frozen; and there is more danger of drying the roots in transporting trees carelessly for a mile or two, than in a journey of several hundred miles, if they are properly packed at the nursery.

The prejudice against trees from a distance is mainly owing to the dried condition in which they are delivered by tree pediars, or to the exposure which they suffer at auction, when sold in that way.

Trees may be transplated here from 15th October to the setting in of the frost, and from the drying of the ground in spring to the 15th, or even in some years, the 20th of May.—*Montreal Witness.*

A PICTURE FOR THE FARMER.

In the August number of the *Atlantic* is an article on "Farming Life in New England," which exposes the errors and defects of the system of agriculture in the Northern States, and portrays the effects of the wasteful, "shiftless," and unskilful management exhibited in the first, greatest and best department of human industry, The following picture of a farmer's home will be recognized as a truthful portraiture of many—perhaps the majority—of farm houses even in this "Garden of the New World:—"

"A square, brown house; a chimney coming out of the middle of a roof; not a tree nearer than the orchard, not a flower at the door. At one end projects a kitchen; from the kitchen projects a wood shed and waggon cover, occupied at night by hens; beyond the wood shed a hog pen, fragrant and musical. Proceeding on further in this direction, we look directly across the road, to where the barn stands, like the hull of a great black ship-of-the-line, with its port-holes opened threateningly upon the fort opposite, out of one of which a horse has thrust its head for the possible purpose of examining the strength of the works. An old ox-sled is turned up against the wall close by, where it will have the privilege of rotting. This whole establishment was contrived with a single eye to utility. The barn was built in such a manner that its deposits

might be convenient to the road which divides the farm, while the sty was made an attachment of the house for the convenience in feeding its occupants.

"We enter the house at the back door, and find the family at dinner in the kitchen. A kettle of soap-grease is stewing upon the stove, and the fumes of this, mingled with those that generated by boiling the cabbage which we see upon the table, and by perspiring men in their shirt-sleeves, and by boots that have forgotten or do not care where they have been, make the air anything but agreeable to those who are not accustomed to it. This is the place where the family live. They cook everything here for themselves and their hogs. They eat every meal here. They sit here every evening, and here they receive their friends. The women in this kitchen toil incessantly, from the time they rise in the morning until they go to bed at night."

Contrast this with what might be the condition of the "Farmer's Home," and there will be found a great gulf between.

THE INTERIOR OF NORTH AMERICA.

Prof. Henry, of the Smithsonian Institution, has collected facts respecting the interior of the United States, which will command the attention of scientific men and statesmen. The induction from these facts is, that the entire region of the United States west of the 98th degree west longitude, (say the western boundary of Minnesota,) with the exception of a small portion of Western Texas and the narrow border along the Pacific, (including California) is a sterile waste of comparatively little value, and which can never be available to the agriculturist. The importance of this statement will be more fully comprehended when it is considered that the line of Prof. Henry, which extends southward from Lake Winnipeg to the Mexican Gulf will divide the surface of the United States into nearly two equal parts.

The intense heat and extreme dryness of this region, which will make the Great American Plains a barren waste forever, is caused to a large extent according to Prof. Henry's theory, by the fact that the returning Trade Winds, sweeping over the elevated masses of the Rocky Mountains, are deprived of their moisture; in other words, the heated air which ascends at the equator, saturated with moisture it has extracted in its passage over the ocean, after depositing a portion of its vapor in the tropics at the rainy season, it is further dessicated by the ridges and mountains which it meets, the vapor being condensed on the windward side by the cold due to the increased vertical height, and it finally passes over and strikes the plains as dry as a sponge which has been thoroughly squeezed. Without moisture there can be no fertility, no agriculture; and a great portion of this wilderness, according to Prof. Henry, is as irredeemably barren, for the purposes of agriculture, as the deserts of Africa. If this theory be true it will greatly modify the opinions which have been entertained by politicians and statesmen of the future destiny of the "Great West." Prof. Henry stated these facts to us a few days since, which we confess, greatly modified our ideas of the vast extent of Territory which we had always supposed was yet to be filled with human habitations like the already productive prairie states bordering the Mississippi.

No Man Can Borrow Himself out of Debt.—If you wish for relief you must work for it, economise for it. You must make more and spend less than you did while you were running in debt. You must wear homespun instead of broad-cloth, drink water instead of champagne, and rise at four instead of seven. Industry, frugality and economy —these are the handmaids of wealth, and the sure sources of relief. A dollar earned is worth ten borrowed, and a dollar saved is better than forty times its amount in useless gewgaws. Try our scheme and see if it is not worth a thousand banks and valuation laws.—*Philadelphia Argus.*

Cost of Underdraining.—On "the Premium farm of the Empire State," there are sixty-one miles of underdrains, all laid by the present proprietor, R. J. Swan, of Rose Hill, near Geneva. The cost has been much less than usual, as drains from two and a half to three feet deep have been laid complete at an expense of 28½ cents per rod. Digging, 12½ cents; laying the tiles and filling the drains with plows, 3 cents; average cost of tiles and cartage, 13 cents. The tiles alone frequently cost 25 cents per rod, freight included.

How to Increase the Value of a Cow.—Every one who owns a cow can see at a glance that it would be profitable to increase the value of her, but every one can't tell how to do it. We can, and we think that we can make it equally palpable to our readers. If a cow is kept for butter, it certainly would add to her value if the butter-making properties of her milk should be improved. In summer or winter this can be improved just as the yield of a cultivated crop can be improved by what is fed to each, and it is simply a question of will it pay, in manuring the one or feeding the other. Indian corn will add to the quantity and quality of the butter to a very sensible degree, and it is simply a question of easy solution, by experiment, whether it will add to the profit of the butter maker to buy corn at 1 or 2 cents a pound, and convert a portion of it into butter at 25 cents a pound, or whatever the market price of corn and butter may be, and another portion of it into fat, and another portion of it into manure, for that is the natural result of the chemical change produced in the laboratory of the cow's stomach. The same result will follow any other kind of feeding. Good pasture will produce an abundance of milk, often as much as the cow can carry; but does it follow that even then it will not be profitable to feed her with some more oleaginous food to increase the quantity of butter just as it sometimes proves profitable to feed bees to enable them to store more honey. It certainly does appear to us that the value of a cow, feeding upon ordinary winter food, may be almost double by making that food suitable for the purpose of increasing the quantity of milk, if that is the purpose for which the cow is kept. Farmers generally understand that they can convert corn into beef, pork and lard, and some of them know exactly at what price per bushel it will pay to convert it into these substances; but does any one know at what rate it will pay to convert corn or any other grain into butter, or any other kind of feed into the dairy products? Is the whole business a hap-hazard one? We fear so. Some persons know that they can increase the saleable value of butter by adding the coloring matter of carrots to it. Does any person know the value of a bushel of carrots fed to a cow to increase her value as a butter-producing laboratory? Experimental proof upon this point would be far more worthy of agricultural prizes than it is to see who can show the largest sized roots; for by a few carefully conducted experiments we should be able to increase the value of a cow almost at pleasure.—*N. Y. Tribune.*

Curious Relic of '45.—Some men were lately employed cutting peats for the Misses Macdonald, of Coul, in Badenoch, when one of their number, John Macdonald Crachie, came upon a dish containing about a stone of butter buried about a foot and a half beneath the surface. The dish fell to pieces on removing it, but the butter was quite fresh. In olden times, says our correspondent, the place was used as a 'sheiling' for cattle, but that is a story of at least eighty years ago, so perhaps, the butter had been lying there since the "Forty-five;" for when soldiers were ranging through the country, lifting cattle and all goods that they could lay their hands upon, the guidwives of the day, whenever they heard of the red-coats coming the way, used to hide their gear wherever they could, and the nearest bog was often a favorite place for deposits. —*Inverness Courier.*