An easy mode of ascertaining the capabilities of soil : tests for the purity of artificial manures : mode of preserving the fertilizing contents of a dung-heap from escape, &c.; &c.; / by John Robinson.

AN EASY MODE

OF ASCERTAINING

THE CAPABILITIES OF SOIL;

TESTS

FOR

THE PURITY OF ARTIFICIAL MANURES;

MODE OF PRESERVING THE FERTILIZING CONTENTS OF A DUNG-HEAP FROM ESCAPE;

&c. &c.

BY

JOHN ROBINSON, B.A. & M.B.

OXON.

AN EASY MODE

OF ASCERTAINING

THE CAPABILITIES OF SOIL,

&c. &c. &c.

As there is a standard of purity in water, so there is a standard of fertility in soil. The first has reference to that water in which, when examined, no foreign or solid matter is found; the second to that soil in which the various constituents necessary for fertility are found combined in their proper proportions.

The constituents necessary for fertility are—organic or vegetable matter, lime, sand, and clay.

The proportions in which those constituents necessary for fertility should be found are the following:—

Supposing the soil to consist of ten parts,

Organic or vegetable matter should be	1 part
Lime	3 parts
Sand	3 parts
Clay	3 parts
	10

Now, it should be here observed, that, though a soil so nicely adjusted is never found in nature, yet the nearer it approaches these proportions so is its fertility. A field at West Drayton, in which they were nearly found, has yielded 7½ quarters of wheat to the acre.

With respect to the first of these constituents, the *organic matter*, the farmer need not be alarmed at any deficiency, as manuring plentifully, especially with stable-dung, will act as an efficient substitute.*

Lime, the next of these constituents, is understood in this case to be in the form of the *carbonate*. In this form, it has the property of binding gravelly and sandy soils, acting as a cement, and giving them a consistence, and of loosening and disintegrating stiff clay soils, and of rendering them consequently more porous, and more easily permeable to the roots of the plant. It has, along with lime in its other forms, the property of attracting moisture; and also that most valuable one of correcting the acidity which exists in many soils which are not thoroughly drained, or where it is not found in the proper proportion.

Acidity of Land.

Land may be examined on the instant, to ascertain the presence of acidity, by taking a handful of the soil, putting it in a vessel, adding rain-water, and stirring it. A slip of litmus paper should now be introduced, and if it receive a red tinge, the land is sour, and the acidity must be corrected by *carbonate of lime*.† Grass land, when sour, scours the stock that graze on it. In dairy farms, land when overlimed, is found unfavourable to the production of good cheese. It should be remarked that acidity is unfavourable to vegetation of every kind, and hence the necessity of lime as a constituent. Though it be the *carbonate of lime* that is meant in these remarks, there are three other forms of lime applied to land.

1. *Quick or burnt lime* having a powerful affinity to water, is used in the reclaiming of bogs; and, from its caustic nature, it is powerfully destructive of the vegetable matter with which they abound, breaking it up into mould.

2. *Sulphate of lime or gypsum* is used with great effect in manuring for clover, sainfoin, &c., it being found in high percentage among their ashes.

* Of land thus manured (with stable-dung) according to the quantities employed for the purpose by the market-gardeners in the neighbourhood of London, the fertility is truly prodigious. as it has been found to yield, in a field at Fulham, seventy-five tons of mangold-wurzel to the acre. It should be observed, at the same time, that it is no uncommon thing for such land to receive of this manure 90 or 100 loads to the acre. The gardeners' carts, on their return, never leave London without a load of this manure.

† When a slip of turmeric paper introduced into a similar quantity of soil and water is dyed brown, it is a good sign, showing the presence of the alkalies in a free state.

3. *Phosphate of lime*, in the form of bone dust, is a powerful manure for green crops, as turnips, mangold-wurzel, &c., *phosphorus* being found in these vegetables in high percentage.

SAND is necessary to every soil, being serviceable in breaking up the tenacity of clay, and in supplying, along with the *potass* which the clay contains, a glassy coating for the stalks of grain.

Should sand exist in a soil in the proportion of six of the above parts, the soil is called *sandy*, or *light;* but if in eight, it is barren, but may be improved and rendered fertile by the addition of clay and lime.

CLAY is necessary to every soil, to give it consistence, especially in wheat lands. If it be present in six of the above parts, it is called a *heavy clay soil*, requiring great labour to work it; and if it exist in eight of those parts, it is unmanageable, but it may be amended and rendered fertile by an admixture of sand and lime. Burnt clay is used by some, and is an excellent substitute for sand.

Iron, *magnesia*, and sometimes *manganese* exist in soil, but are not necessary constituents to form one that is fertile.

From what has been said, it will be seen that there is a *possibility* of forming every soil according to the above standard of fertility.

To sum up, the soil is the first consideration with every scientific Agriculturist, seeing, that in it, the seed and plant have to vegetate and grow. The soil or bed, therefore, should be well made or mixed, so as to offer no resistance to the progress of the roots that may shoot themselves out in quest of nutriment, as any obstruction they may meet with opposes their growth, particularly stagnant water, from which they instinctively turn away; hence the NECESSITY OF DRAINING.

Means of Ascertaining the Proportion of these Constituents in Soil.

Presuming that the experimentalist in this case is not a chemist:—

1. Previous to weighing out ten ounces, let the soil be thoroughly dried and pulverized.

2. Weigh out ten ounces.

3. Spread it on an iron plate or shovel, and subject it for five minutes to a white heat, stirring it from time to time.

4. Carefully remove it and weigh. The weight may now be nine ounces, which shows that one ounce has been lost—the vegetable matter which the soil contained.

5. Add to the remainder a large wineglassful of strong *hydrochloric acid* or spirit of salt, and four wineglassfuls of rain water. Stir occasionally. The quantity of *carbonate of lime* will be observed by the degree of its effervescence, and it will be dissolved.

6. Pour off the acid and water which contains the lime in solution. If the soil contain any iron, it will be dissolved by the acid. Its presence may be detected by adding a little *prussiate of potass.*

7. Dry the remainder, and carefully weigh. What has been lost is the lime.

8. Into the vessel pour rain water, and keep stirring. The clay will mix with the water, which will account for its muddy appearance, while the sand will subside to the bottom. Pour off the opaque muddy liquor, and continue to add water, to stir, and to pour it off till it be perfectly clear.

9. Dry the sand at the bottom of the vessel carefully, and weigh. The difference is the clay poured off along with the water.

From what has been said above, it will be seen that man has, to a very great extent, control over the soil as far as its amendment is concerned; and it may also be added, that he has a certain control over the

Climate,

as far as humidity is concerned.

In whatever country wheat is indigenous, it is grown in Britain in the greatest perfection in East Kent and the southern parts of Sussex, and after that in the Eastern Counties of England generally, though as one advances northward it continues to get coarser iu quality. It is also a well-known fact, that on the Western Coast of England, wheat either cannot be raised, or, at best, it is a precarious crop. The cause of this difference may be readily and truly assigned to its proximity to the Atlantic, and to the humidity it brings with it. That cause of humidity, it must be confessed, is fairly beyond man's control.

There are other causes of humidity prejudicial to grain, especially wheat, though not generally understood and noticed, common to Britain, which might be remedied, and the climate eventually improved.

Drainage is rapidly effecting this, by removing the moisture and vapour from an extended surface by narrow canals of running water.

The fact is indisputable that every watery surface is continually throwing off moisture, or evaporating, which vapour, although invisible, being held in a state of fine tenuity or solution by the elasticity or heat of the atmosphere, can be proved, by experiment, to exist. It is also proved that water in a running state evaporates less than water that is comparatively stagnant; consequently rivers evaporate much less than canals and other pieces of water.

With respect to canals, their extent in this country is between two and three thousand miles, forming an immense evaporating surface, which might now be dispensed with, seeing the facilities and cheapness of railroad conveyance; and the climate be by this means greatly improved.

The abundance of wood also increases the humidity of a district, as it is well known that trees act as attractors and conductors of electricity, and, in this respect, they are superior to metallic points. The mode by which they increase the humidity of the atmosphere may be thus explained:—Supposing the vapour, alluded to, to be held in solution by the electrical agent, no sooner is a higher affinity—the vegetable conductor—presented, than the union is broken, and the humid particles thus disengaged descend to the earth.

Again, trees and plants render the atmosphere humid by evaporation; and it is found by experiment that those plants that are exotic perspire more than those which are indigenous, of which the oak, the Scotch fir, and the holly are the principal, being truly native. The elm, for instance, is remarkable for its evaporating properties and general distribution; and, although there are seven species of this tree grown in the country, they are all exotic. Besides, such trees in the vicinity of cultivated land are absolutely prejudicial; as by their shade they obstruct the sun's rays, and by their suckers, which they send out to great lengths, they impoverish the soil, and in seasons of drought do much mischief. If we turn to East Kent, particularly the Isle of Thanet and its vicinity, we find the country clear of wood, without even fences, yet the finest wheat and most abundant crops are found there, evincing most clearly that vegetables, especially grain, to be healthy and to luxuriate, require air and ventilation as well as ourselves.

Towards the close of the fifteenth century, a distinguished physician read

before the Royal Society the result of an experiment which he made, on the evaporating properties of the leaves of plants. Having weighed a sunflower with the pot that contained it, and having subjected it for twelve hours to a July sun, at the termination of that time he found that it had lost half its weight. Next day he repeated the experiment, but removed the leaves; on weighing it at the end of twelve hours, he found that it had lost one-sixth of its weight, a fact proving that the leaves are the skin and lungs of the plant.

In a series of experiments, Mr. Williams, a distinguished vegetable physiologist, of Worcester, found the evaporating properties of the subjoined trees and bushes as follows. He weighed successively 100 parts of the leaves of the oak, elm, horse-chestnut, poplar, ash, hawthorn, holly, and Scotch fir; having secured the end of the stem of each from evaporation by means of gum, he subjected them for twelve hours to a July sun, and found them to lose weight by evapo ration as follows;—

		LOSS.	
Ulmus Campestris	Elm	1-3rd of its weight	Exotic.
Populus	Poplar	1-4th "	" *(Italian.)*
Hippocastanea	Horse chestnut	1-5th "	"
Cratægus oxycantha	Hawthorn	1-6th "	" *(S. of France.)*
Quercus Robur	Oak	1-15th "	Indigenous.
Ilex	Holly	1-25th "	"
Pinus Sylvestris	Scotch fir	1-50th "	"

Food of Plants.

The essential and stimulating properties of all manures are *phosphorus* and *nitrogen*, which last is presented to us in *ammonia*, its most convenient and accessible form.

With respect to manures, instinct has taught, and experience has shown, that all animal and vegetable substance, when life has become extinct, may be advantageously used as manure; and with the same view, the refuse and excrementitious substances, voided by men and animals, further remarkably the growth of vegetation. The farmer, then, in making use of these, cannot err, as they are sure to answer his purpose. In the extensive farming of some parts of England,

however, where stock is not kept in sufficient abundance to manure the land, *artificial manures*, as they are called, are had recourse to, and without a little knowledge of chemistry, he may go egregiously wrong in their use.

Thus, a manure which may answer in wheat, will fail in the case of the turnip, mangold wurzel, and other green crops; and the strong manuring necessary for the latter would be injurious to the grain.

To begin with the turnip, which may be styled the foundation of English farming. To get a good crop of this vegetable, those manures that contain phosphorus in high percentage are essential. Thus, manuring with *nitrate of soda*, in this case, would prove a failure, seeing that salt, although a powerful stimulant in grain crops, contains no phosphorus. The manures that contain *phosphorus*, and of course would be proper for the turnip, may be classed as follows:—

Stable dung,
Excrementitious and animal matter of all sorts,
Fish,
Guano,
Bone dust.

As to grain, taking for granted the four-course system is in use, namely, turnips, barley, clover, wheat,—manure may be sparingly used after the first, provided the land has been then manured plentifully, excepting a top-dressing of guano or prepared night-soil; as we find in the case of wheat, for instance, that it is more easily lodged and more subject to disease when highly manured.*

On the whole, then, it will be found that less manure need be used provided that the land be kept dry by drainage, clean by well working it, and its constituents properly proportioned, than when these essential observances have not been attended to.

* Five cwt. to the acre of Peruvian guano, or seven of chemically prepared night-soil, will give an abundant turnip crop, with a top-dressing of two or three cwt. when the plant is in a growing state. In case of wheat or other grain, half the quantity will be quite sufficient at sowing, though the top-dressing may be about the same.

Advantage of a knowledge of the essential Constituents, and of their proportions.

1. To parties about to become purchasers of land in this country.

It usually happens, in this country, that the value of land is generally estimated according to the value of the present crop, or that which has preceded it; a very fallacious ground on which to form an estimate, inasmuch as by high manuring for one or two seasons previous to the sale, crops may be obtained from land otherwise inferior or deficient in their proportions of fertility.

To form an opinion of the real condition of the land, the soil should be examined after the crops have been removed. At this time it may sometimes be found that the soil is almost destitute of lime, and, moreover, that a good liming may be an expensive item, amounting sometimes, according to the district, to a considerable sum. Thus, in some districts, lime is as much as 10s. a ton, and but a scanty liming may be set down at ten tons per acre, amounting consequently to £5. per acre. It will thus be seen that the land is worth less by that sum, as it will require ten tons at least to bring it round to anything like fertile proportion: and so with the other constituents, sand and clay.

2. To the emigrant, a knowledge of this subject must be of immense use; as, previous to making his selection of land, the employment of a few hours will save him much future trouble and disappointment.

TESTS FOR THE PURITY OF ARTIFICIAL MANURES.

For the Nitrates of Soda and Potass.

If, on adding *sulphuric acid* to either of these salts, a dense vapour escapes, giving out a pungent odour, common salt is the adulterant.

If, on adding the same acid, an effervescence is the consequence, the soda of commerce, or washing soda, is the adulterant.

Guano,

when genuine, gives out a powerful ammoniacal smell when rubbed in a mortar with *caustic lime, caustic potass,* or *caustic soda.** Its *phosphorus* and *urea* may be smelled when rubbed on the palm of a warm hand with the forefinger of the other. When genuine, it should be readily dissolved on the addition of boiling rain-water. The usual adulterants are—tanner's bark, chopped fine, brickdust, Welch ocre, gypsum, &c. none of which are soluble in water.

Sulphate of Lime or Gypsum

should not effervesce on the addition of *sulphuric* or *any* acid.

Bone Manure.

The boiling of bones does not extract their *phosphorus,* but their jelly and fat, both of which are fertilizing. Bone dust should never, if possible, be purchased finely pulverized.

TO DISCOVER AND PREVENT THE ESCAPE OF AMMONIA FROM A DUNG-HEAP.

As in all compost heaps the retention of what *ammonia* they may contain is a matter of primary importance, the means of informing himself of its escape should be an object of intense interest to the farmer. He is then informed that the form in which it is found in refuse and decomposing animal matter is that of *carbonate,* a volatile salt having a tendency to escape.

Its escape, though unobservable by the eye, and not recognisable by the smell, may be easily detected by withdrawing the stopper of a bottle of *hydrochloric acid,* or spirit of salt, over the heap, when dense white fumes will arise, shewing its escape.

* The presence of ammonia in soot may also be found in this way.

Soot, or gypsum, or burnt clay finely pulverised, or very dilute *sulphuric acid*, should then be added to prevent its escape, by absorbing it, or changing its character.* The state of dilution of the sulphuric acid in this case should be ten times, or one part of acid to ten of water. A garden watering-pot may be conveniently used for this purpose.

* By adding diluted sulphuric acid to the heap, the nature of the ammoniacal salt is changed from the *carbonate* to the *sulphate*, a fixed salt.

4.

THE FARMER WARNED,

AS TO

THE DECEPTIONS

WHICH ARE BEING PRACTISED BY

DEALERS IN ARTIFICIAL MANURES;

INVOLVING AS THESE DECEPTIONS DO,

LOSS OF MONEY AND FAILURE OF CROP.

WITH

A MANUAL,

CONTAINING EASY AND CERTAIN MEANS BY WHICH HE MAY TEST THE QUALITY OF A MANURE IN THE SAMPLE, BEFORE HE HAZARDS HIS MONEY IN THE PURCHASE OF THE SAME IN QUANTITY.

BY

JOHN ROBINSON, M.B.

THE FARMER WARNED.

GUANO.

Guano, the deposit of various sea-fowl frequenting numerous islands in the Pacific Ocean, and on the western coast of South America.

Many years since, the celebrated Humboldt observed its fertilizing properties in the production of maize, the species of grain chiefly grown on the South American continent; Davy also has noticed the circumstance, and subjoined an analysis in his work on Agricultural Chemistry.

Admitting that *phosphorus* and *ammonia* are the two fertilizing principles in all manures, as they undoubtedly are, genuine Peruvian guano is a most valuable manure.

When first introduced into this country, it sold as high as £28. per ton; of late, however, you may buy something passing under that name, from £10. to £12. per ton.

With all its excellence, it may be a matter of inquiry, whether it be a manure suitable to our humid climate; the more especially, as the *salts of ammonia* it contains are mostly soluble in water, and, of course, readily pass off. It is the opinion of some, that it eventually deteriorates the land to which it is applied; whilst others think differently.

Without going into the proportions of an elaborats analysis, real guano should contain, in a state of fine comminution, *bone dust, phosphate* and *carbonate of lime.* From the fine state of this bone dust, which requires the aid of a powerful glass to be seen, the soil cannot be much benefited nor the subsequent crop

receive any advantage. Besides this fine bone dust, genuine guano should contain *phosphate of ammonia*, and *urate of ammonia*. From this it will be perceived that genuine guano contains *phosphorus* in two combinations, and *ammonia* in two; besides *urea*, or the animalized portion of urine in the *urate*, which is known to possess fertilizing properties of a superior kind. Of these principles, the *urate* and *phosphate of ammonia* are soluble in rain water, the bone dust is not. *Carbonate of lime* is also found in bone dust.

Adulteration of Guano.

Of several samples of guano which have been submitted to me for examination, I have not latterly found one which exactly corresponded with the principles or proportions of the genuine; and in two cases, a small per centage of the genuine, mixed with such heterogeneous and useless matters as carbonate of lime, red clay, peat-earth; and in every case where the sample was spurious, I found the whole mass smelling strongly of *human* urine, as if it had been steeped in it for a considerable time.

The genuine guano, it is true, gives out *ammonia* very freely to the smell, but along with the *ammonia*, you will smell the *phosphorus* also strong; a peculiarity to be accounted for by the diet of the bird, which is entirely fish.

Mode of Testing.

A very simple mode of testing the genuineness of guano is, to dissolve a small portion in *hydrochloric acid*, (spirit of salt,) diluted with four times its weight of water. The salts of the genuine substance will be readily dissolved, they being all soluble, as well as the bone dust it contains, in this acid; whereas, such substances as I have mentioned above, from their not being acted upon by the acid, will sink to the bottom, or be *precipitated*, in the language of chymistry.

Pure guano is of a light brown colour, and is mixed with small portions of white substance here and there, which, on being crushed between the fingers, will appear like minute pieces of chalk, and which will be found to consist of fish bones.

Guano may be drilled in, or broad cast, at the rate of two or three cwt. per acre; and in green crops, its fertilizing properties will be most apparent.

BONE DUST.

Phosphate and *carbonate of lime*, containing a high percentage of *phosphorus*, is not likely to be much adulterated. At all events, the farmer has an infallible and ready means of assuring himself of its purity by his purchasing only what is called *half-inch dust*, in preference to the finer sort, which may be more readily adulterated.

The property for which bone dust is chiefly valuable is the *phosphorus* it contains, which enters largely into some vegetable substances, as a constituent, as the turnip, mangold-wurzel, &c.

BOILED AND UNBOILED BONES.

A question has been a good deal mooted among agriculturists, as to the superiority of bone dust which has not been boiled, over that which has; and the subject is of so much importance, that we may advantageously say a few words on the subject in this place.

It is true that boiling will extract no portion of the *phosphorus*, or the principal fertilizing principle of the bone, as *phosphorus* can only be obtained by calcination; but then, the bones, after being boiled, have lost their jelly, which contains *nitrogen* in prodigious quantity, and which may be named the great stimulant of vegetable as well as animal life.

Ammonia gives out its *nitrogen* to the growing plant, and so serves vegetation, by containing it. But besides the *nitrogen* or the jelly, its source being abstracted by boiling, the oil is also removed, which, although not very fertilizing of itself, is disposed to combine with the alkalies of the soil, and form a soapy substance, a form of nourishment particularly agreeable and congenial to all vegetable substances.

From the circumstance, then, of the *nitrogen* and oil being, by this process, abstracted by boiling, I should consider the bone dust from boiled bones dear at more than one shilling per bushel. It should be observed, that the most strenuous advocates of the boiled bone dust, are the bone crushers, who are generally soap boilers, and who, consequently, turn the fat skimmings of the boiled bones to an advantageous account.

NITRATE OF SODA.

A natural production, and a most valuable manure.

It owes its value chiefly to the *nitrogen* which the *nitric acid* contains; and the soda occasionally, as a solvent, making the vegetable dissolve the more readily the silex of the soil.

Its price varies from £17. to £20. per ton; and, consequently, its high price renders it a fair subject for the cupidity of speculators.

Adulterants, and Mode of Detection.

The first substance which I shall notice, as being employed in adulterating this manure, is common salt, in the form of bay or rock salt.

If so adulterated, it is impossible by the eye alone to distinguish the genuine from the spurious, as they are very similar in appearance; but by placing a little on a pan of hot coals, if bay salt be present, a cracking or crepitating noise will be heard, and imperfect combustion; whereas if pure, nitrate of soda should burn with a bright yellow flame.

But this test will only be available when salt in the crystallized form is present, as it is sometimes crushed and the crystals broken previous to mixing it.

The suspected sample is then to be put into a wine glass, to be dissolved in rain water, and a few drops of *nitrate of silver*, also dissolved in rain water, to be added. If pure, no change will take place; but if salt be present, a white appearance will be the result, which will be more or less dense, according to the quantity it contains. Strong hartshorn, or liquid *ammonia*, when added, will cause this white *precipitate* or sediment to disappear.

If Adulterated with the Sub-Carbonate of Soda.

This mixture is also undistinguishable by the naked eye; and when placed on hot coals, it prevents the nitrate of soda from burning, being incombustible in its nature.

Its presence, however, may be at once detected, by dissolving a portion of it

in rain water, as before, and adding a few drops of strong *oil of vitriol* or *sulphuric acid*. If the *subcarbonate of soda* be present, it will effervesce, a change which will not take place if the *nitrate* be pure.

The farmer is recommended to be particularly careful in these examinations, as from the high price of the pure article when compared with the cheapness of that used in adulteration, it is a matter of much profit, provided there is a good sale and the practice escapes detection.

There is another substance, too, which is sometimes used in the adulteration of the nitrate, called *petre*, a compound substance, the residue of some manufacture, which is of no use as a manure, and which may be tested for the common salt it contains by the *nitrate of silver*, as above.

The quantity of *nitrate of soda* used for agricultural purposes is about 3 cwt. to the acre.

SALTPETRE, or NITRATE OF POTASS.

The action of *saltpetre* as a manure is similar to that of *nitrate of soda*, the vegetable using the nitrogen for its nutriment, and the potass acting also as a solvent for the silex of the soil. It sells in general at about £27. per ton; and it may safely be said to be worth all the difference, as the potass it contains enters into every vegetable substance as a constituent, while soda is almost exclusively a marine production.

This is another salt which, from its high price, is very liable to adulteration; but as the adulterants are the same as those of the *nitrate of soda*, the party is referred to that head.

Saltpetre, when placed on hot coal, burns with much energy, and emits a white flame, while that of nitrate of soda is yellow.

About 3 cwt. per acre drilled, or broad cast, is the quantity used.

GYPSUM, or SULPHATE OF LIME.

The excellence of this manure in the grasses, clover, and particularly sainfoin, renders this article one of much importance to the farmer. Its price varies according to the locality. In some districts you may obtain it as low as £1. a ton.

Adulteration.

The only adulterant used in this case is *carbonate of lime* in some of its forms, and which may readily be detected by the following simple

Test.

Place your suspected mixture in a tumbler; add rain water, and mix well by stirring. To this add a few drops of strong *sulphuric acid*. If the gypsum be pure, there will be no change; but if so adulterated, an effervescence will be the consequence.

A ton to the acre may be used with advantage.

THE HISTORY

OF

THE REAPING MACHINE,

FROM THE TIME OF THE ROMANS TO THE GREAT EXHIBITION OF 1851.

FROM

"THE GARDENER'S CHRONICLE."

THE HISTORY

OF THE

REAPING MACHINE.

It may be interesting at the present time to give a short account of the various steps by which the Reaping Machine has attained its present form. It is by no means a novelty, for the corn fields of the Britons were reaped by machinery in the days of the Romans. If we figure to ourselves a low cart, pushed before an ox, with the shears of Bell's or Hussey's reapers nailed to the top of the tail-board,—a sturdy Roman in the bottom of the cart raking inwards, with hasty strokes, the ears of corn as the cart is urged along, and trampling them under his feet within the body of the carriage,—we shall have obtained a pretty good idea of a Roman reaping machine and its *modus operandi* in the field.

The Roman idea was obviously to ripple or strip off the ears of corn—securing the grain in the first place, and afterwards the straw as provender and litter for cattle; and from the days of the Romans up to those of Arthur Young this idea, and the rude implement for carrying it into practice, appear to have been lost sight of. About the latter period, attention was again turned in this direction, for Young, in his "Annals of Agriculture," notices the fact of Loft's "translation from Pliny and Palladius" having suggested the above idea to Mr. William Pit, of Pendeford, who brought out a reaping machine on the Roman principle.

The "Complete Farmer," a work printed in 1793, quoting from Young, gives a drawing and description of the machine. It consists of a series of ripples or stripping-rakes fixed on the periphery of a drum, for rippling off the corn and throwing it backwards into the cart, from which it is removed when full. The drum is set in motion by a band from the wheel of the cart, which is pushed before the horse like its predecessor. Mr. Pit's copy, therefore, from the ancient model, must be taken as the first modern attempt at the reaping machine.

About the commencement of the present century, Mr. Boyce entered the field with a new idea, and patented a reaping machine which cut with revolving scythes, but was destitute of efficient gathering apparatus. In this case, the cutting department appears to have met with some approbation; but the gathering being a complete failure, the whole fell to the ground a fruitless speculation.

Mr. Pluncket, a London machinist, brought out the third machine, an improvement of Boyce's, the principal difference between the two being that he substituted a circular steel-plate, sharp at the edge, and serrated like a sickle, for the scythes. It was drawn behind the team, like the American reapers now-a-days, the horses going along the standing corn, and, like the original, it was destitute of gathering apparatus. A short description of it may be seen in the Supplement of the "Encyclopedia Britannica," article Agriculture.

In 1806, Mr. Gladstone, a millwright, of Castle Douglas, entered the field with further improvements. His cutting-wheel was smooth-edged, like a scythe, and shielded with projecting prongs, which aided in collecting the corn, and holding it while being cut; and it was also furnished with apparatus for sharpening the knife as it revolved, besides a gathering apparatus, in the shape of revolving rakes. A drawing and description of this machine may be seen in the "Edinburgh Encyclopedia," article Agriculture.

Mr. Salmon, of Woburn, Bedfordshire, next made his appearance as a rival with the first machine on the clipping principle. It had also a more complete gathering apparatus than the former, laying down the cut corn in separate parcels ready for binding. Drawings of this machine may be seen in the Supplement of the "Encyclopedia Britannica," article Agriculture.

In 1811, the late Mr. Smith, of Deanston, took up the subject, exhibiting a machine on a small scale, worked by two men; in 1812 a larger, worked by one horse; and in 1814 one by two horses. His attention appears principally to

have been directed to the gathering department. A drawing of his two-horse machine, with a description, may be seen in the Supplement to the "Encyclopedia Britannica." Its cutting-wheel was like that of Gladstone's, but it was pushed before the horses by means of a pole from the rear; was borne on four wheels, which gave it greater stability than its predecessor, although more awkward to turn; and its gathering apparatus was a drum—in shape, the frustrum of a cone with its base uppermost.

In 1815, Mr. Scot, of Ormiston, next came out with improvements, both in the cutting and gathering departments. On the periphery of the cutting-wheel, sixteen serrated blades are fixed, projecting forwards, and thus both cutting and clipping as they pass through the shields in front in which they work. The gathering drum has rakes which project through its circumference in front, but are drawn into the interior behind, and thus let the corn fall off in a regular swathe. The machine is borne on two wheels in the centre of the cutting-wheel, and is pushed before the horse, yoked by two shafts, as in the old Roman contrivance. A plan and description may be seen in the "Edinburgh Encyclopedia," article Reaping.

In 1820, Mr. Joseph Mann, of Ruby, Cumberland, exhibited a working model of a reaping machine to the Abbey Holme Agricultural Society, which underwent several subsequent improvements. At first, it was placed before the horses; subsequently behind them. It had a polygonal cutting wheel of twelve sides, and a gathering drum with twenty-five rakes, with a fixed rake at the side for stripping or cleaning the revolving rakes when the cut corn fell into a regular swathe. It was borne on three wheels, two in the rear and one in front, to which the horses' shafts were attached. A drawing of it may be seen in the fourth volume of the "Quarterly Journal of Agriculture, 1833."

In 1822, Mr. Ogle, of Rennington, near Alnwick, entered the field with two new ideas, the straight alternate-working knife, and the fan or flapper. A drawing of this machine may be seen in the fifth volume of the "Mechanics' Magazine." Its appearance and *modus operandi* are so like those of Mr. M'Cormick's, that the one would pass for the other, both requiring a man with a rake.

The next candidate who entered the field was the Rev. Patrick Bell, in 1826, who, whether the ideas were original with himself or not, connected Salmon's cutting apparatus, Ogle's flapper, and an endless gathering cloth, his own inven-

tion. As in the Roman machine, his machine is placed before the horses. Perhaps the most important part of his invention is the new arrangement of previous improvements, giving them a practical utility; for his machine is the first which has been able to keep its ground in the harvest field, all the others having been laid aside. Shortly after the invention, several machines were sent to the United States, and both in the New World and in Forfarshire they have ever since been in successful operation.

Between 1830 and 1851, various improvements were made by Mann, Smith, and others, on the revolving cutting machines. On the list may be mentioned several patentees, for instance—Mr. Duncan in 1840, Mr. Phillipps 1841, Mr. Townshend 1841, Messrs. Middleton and Phillips 1843, Mr. Gibson 1846; but all with equal want of success. Across the Atlantic it was different, for there parties were animated by different circumstances and different ideas; and hence the contents of the Great Exhibition—a modification of Oglé's machine by Mr. M'Cormick, and a combination of Ogle's and Salmon's, or rather of Bell's cutting apparatus, in Hussey's machine, both successful.

It will thus be perceived how distant, as it were, some of our most ingenious minds have kept themselves from those points on which the ultimate success of the reaping machine now appears to depend. To the Romans is due the putting the cart before the horse; to Mr. Boyce, the placing it behind him; to Mr. Gladstone, the shielding or sheathing of the cutting-knife; to Mr. Salmon, the shears; to Mr. Ogle, the straight, single, alternate-working knife and fan; to Mr. Bell, the combination of shears, fan, and gathering-cloth; and to Mr. Hussey, the combination of Salmon's and Ogle's cutting apparatus with Ogle's mode of gathering with a rake. But although these are all great improvements, yet, doubtless, we are far from the nearest attainable point to perfection.

NEW AMERICAN

THRESHING MACHINE.

FROM

"THE DAILY SUN,"

Nov. 1*st*, 1853.

NEW

AMERICAN THRESHING MACHINE.

Amongst the more remarkable contributions to the American Exhibition was noticed, with especial commendation, an improved Threshing Machine, or, as it is called on that side of the Atlantic, "Grain Separator." This implement, which was patented in 1852 by its inventor, Mr. Moffit, of Cincinnati, has now been brought over to this country; and yesterday, Mr. Mechi, who in his go-a-head tendency may be considered an English Yankee, subjected it to a public trial at Tiptree. Its performance well entitles it to the attention of agriculturists; and we have no hesitation in saying that it is a valuable accession to the stock of those mechanical inventions by which the business of the farmer has of late years benefitted so largely.

The machine, which is portable, weighs only fourteen cwt., threshes easily and without waste at the rate of 1 bushel in 40 seconds, turns out the grain perfectly clean and ready for market, and is manufactured in America at a cost price of £23. It is thus about twice as light in draught as the lightest of our machines of the same description; does as much if not more work than the best of them, and with much less power; dresses the grain, which they do not; and can be profitably disposed of at one-half, or at least one-third, less money than our implement-makers charge. Any practical man who considers all these advantages will appreciate at once their importance; yet they are secured

by very simple arrangements, and by mechanical details which separately possess no very striking novelty. We build threshing-machines strong and dear enough to rob us of the benefit of all future improvements, and tremendously heavy either to work or to draw. The American farmer demands and gets a machine, which it does not ruin him to buy, or his horses to pull about; which runs on coach and not waggon wheels, and which, without breaking the heart of the power that drives it, yields the largest and most satisfactory results. Nothing, therefore, can better illustrate the difference in the mechanical genius of the two countries than this Grain Separator as compared with its British rivals.

Among the distinguishing features of Mr. Moffit's patent may be noticed, that in threshing damp or wet grain he avoids "wrapping" or "choking," by using an ingenious open straw carrier of wooden rods, connected by iron links, and driven by a cog-wheel, and that for cleaning the grain he has introduced a peculiar riddle, in which straw cannot lodge; a wire rolling screw, through which grass, seeds, and other impurities fall; and a conveyer for carrying back the tailings. To push along the grain, he employs the archimedean screw, much in the same manner as in the flour-mills of this country—a decided improvement upon the cup-lifting apparatus of our implement-makers, which they seem to feel a perverse pleasure in resorting to when they have the least excuse for doing so. The drum was yesterday driven by a 6-horse portable engine of Ransome's, at about 1,200 revolutions per minute; and, with that speed, the proportion of broken kernels was exceedingly small. The bars of the drum are armed with numerous wrought-iron teeth, which break the straw much more than we in this country consider desirable. Another objection taken to the machine is, that it does not give off the straw and the chaff separately in the most convenient and economical form. Taken altogether, however, this "separator" is a highly creditable specimen of the mechanical ingenuity of our cousins. It promises none of those startling results which drew such attention to the reaping-machines imported in 1851; but it may prove of the highest value if, through the formidable competition which it foreshadows, our implement-makers are induced to bring their scale of charges more within reach of the practical farmer's means, and to combine lightness of construction with the greatest possible efficiency and economy in the work done.

It will be remembered, that at the Exhibition in Hyde-park, a number of American ploughs were exhibited, the dearest of which were not more expensive than the lowest priced British ploughs. That disparity, it was said, (though we believe not justly,) was more than counterbalanced by the inferiority of the article. But no such answer can in the present instance be given; and though Mr. Moffitt comes over to dispose of his patent. other American inventors will soon follow to work theirs. The British locksmiths, who have for ages been content to carry on their business by rule of thumb, will immediately find Mr. Hobbs turning out by machinery far better and cheaper locks than theirs. So, the gunsmiths will find Colonel Colt bringing the same agent to bear in supplying the demand for his revolvers. It is no secret that Mr. Whitworth, of Manchester, has brought back from his recent tour, as a Royal Commissioner, through the manufacturing districts of the United States, a report filled with the most startling evidence of the progress which the Mercantile Arts are making there.

The inventive genius of this country is about to be encountered on its own soil by a rivalry which it cannot too soon prepare itself to face; and one of the first classes that must meet this competition is the body of Agricultural Implement Makers. It will not be the fault of that pushing, bustling, restless advocate of improvement, the owner of Tiptree, if our Garretts and Ransomes escape the contest. The American reaping-machines found their way to his wheat crops, as if instinctively, in 1851. The American threshing-machine comes now; and we are promised, at no distant date, a steam cultivator, the invention of an American, which is to deprive Agriculture of her motto, and render it no longer necessary to "Speed the Plough."