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Devoted to Agriculture, Horticulture, and the Household Arts.

Agriculture is the nursing mother of the Arts. [XENOPHON. | Tillage and Pasturage are the two breasts of the State.—SULLY.

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Fertilizers.

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[*Abridged from Patent Office Report of* 1859, *and divided into three parts.*—ED. SO. PLANTER.]

PART III.—MAGNESIA.

[CONCLUDED FROM SEPTEMBER NO.]

Magnesia is a common substance, largely disseminated, existing in most soils, is one of the constituents of many rocks, and is most always present in vegetables and animal bodies. It is a white, light, and odorless powder, infusible at the highest temperature of our furnaces, and slightly soluble in water. It forms soluble salts, with nitric, muriatic, or sulphuric acid, and may be easily distinguished from lime, by the fact that it is precipitated from its solution by limewater. It is generally found in combination with lime in all calcareous rocks, and in certain varieties it is a constant constituent; such are the dolomites, or magnesian limestones, which are largely developed in Europe, as well as in America, and have received the name of metalliferous limestone, from the mineral substances which they contain. Magnesian limestones are found to an immense extent, in the western States, and constitute the lead and copper-bearing rocks of Missouri, &c. They are also found in New York, Pennsylvania, &c. Magnesia is moreover, one of the constituents of serpentine and talcose slate, which last-mentioned rock extends continuously from Pennsylvania to Georgia, and through the West Indies, to the continent of South America. It is remarkable as being the formation in which gold, silver, copper, chromate of iron, &c., are contained. The carbonate of magnesia and the carbonate of lime have many properties in common, the one replacing the other, and those plants which grow upon magnesian soils, contain the carbonate of magnesia instead of the carbonate of lime. Those two salts being isomorphous, according to Bergmann, magnesia forms an important part of some of the most fertile soils, and of the mud of the Nile. Einoff mentions a marl of extraordinary merit, which yielded him as high as twenty per cent. of the carbonate of magnesia. Stöckhardt says that the most famed lime stone in Saxony is a dolomite; and eighteen analyses, each specimen being from a different quarry, yielded from forty-one to forty-four per cent. of carbonate of magnesia. It is carried from the quarries to a great distance, because these limes, from undoubted and universal experience, act more powerfully and at the same time more permanently than other kinds of Saxon lime, although many of these latter are extraordinarily pure. The same eminent observer states, that well-known recent investigations of the ashes of various kinds of corn grains show a percentage of magnesia of 11.1 grains, against 3.4 of lime; and the analyses of the ashes of twenty kinds of peas, grown in the most varied soils and districts. of 8.3 to 4.5. With very few exceptions, a similar preponderance of magnesia is exhibited by other kinds of seed, so far as their mineral constituents have yet been examined, for the proportion of magnesia exceeds that of lime, in approximative round numbers, two to one in peas, beans, vetches, quince, buckwheat, linseed, &c.; two and a half or three to one in wheat, rye, oats, coffee, &c.; six or eight to one in maize, millet, and in the seeds of pines, firs, &c.

On the other hand, the opposite condition occurs regularly in the leaves and stems of plants, and in the wood of trees, in which lime has always the superiority over magnesia, and exists in two to eight times greater quantity, whence he deduces the law, that magnesia is especially necessary for the maturation of the seed, and lime for the development of the herbaceous and woody structure.* Lampadius also thinks this substance particularly favorable for the production of rye.

We have dwelt upon this subject, because much injury has been caused to agriculture by the prevalent opinion that the presence of magnesia in limestone, when calcined and applied to land, was followed by bad consequences. Much has been written to explain the cause of this, as we consider it, imaginary evil. Caustic magnesia, or magnesia without carbonic acid, may absorb carbonic acid much more slowly than lime, and in the presence of the latter substance, it will not combine. until the lime has been saturated; yet after all that has been stated, it would appear less than probable, that the presence of caustic magnesia should play so unfavorable a part, and so contrary to experience.

The salts of magnesia may be employed, as the salts of lime, for fixing ammonia, but in that case its application will depend upon its cost. When a salt of that base is added to urine, it produces a precipitate of the phosphate of magnesia and ammonia. Caustic lime, containing magnesia, is used for this purpose; but owing to the bulk of lime, the amount is rendered less portable. The phosphates of magnesia and ammonia, when applied at the rate of one hundred and thirty to two hundred and sixty pounds per acre, had a powerful effect upon the production of Indian corn; at the rate of three hundred weight per acre, it increased the crop of grain six times, and of straw three times.*

Magnesia is a constant and important constituent of sea-water. It is also found in many mineral waters, and to this fact their virtues are attributed. As it usually exists in the ashes of cultivated plants, its presence in the soil is a requisite to fertility, and its addition of manifest necessity wherever it may be wanting.

PHOSPHORUS.

Of the substances with which the farmer has to do, we think phosphorus the most important. It is found in all animals and vegetables; without it neither the one nor the other could live. It is detected, if not pure, as has been stated frequently, in combination with a particular organic substance, in the brain, the spinal marrow, the spermatic liquid, in the melt of fishes, certain mollusca, &c. It is also diffused very widely, and is discovered in combination with oxygen in all rocks, in all soils, and in the flesh bones, &c., of fish, reptiles, insects, birds, animals, and their secretions. Some of the fossil excrements of extinct animals are extensively and advantageously used as fertilizers. Wherever there are organisms, either vegetable or animal, or their remains, it is very strong evidence of the presence of phosphoric acid. It is detected in almost all limestone rocks, and particularly in those containing fossil remains. Close investigations show its presence in the older crystaline rocks; and where it has not appeared as a constituent in any analysis made hitherto, we do not look upon that as evidence of its absence, for the reason that this substance was not suspected, and the analyses were generally conducted in a manner to ignore its presence. Besides, all who have analyzed much know that phosporic acid is a great complicator, and requires special attention and care to appreciate. In small quantities (and all analyses of minerals must

* Stockhardt's Agricultural Chemistry.

* Johnston's Agricultural Chemistry.

be made upon small quantities to give exact results) it may be overlooked, and its presence not even suspected. We feel confident that future research will prove what we have stated to be perfectly true.

Organisms exist, procreate, live, and die, wherever there is heat, air, and moisture. They are in the air, in fresh and salt water, in the arable soil; and their remains constitute the principal mass of immense calcareous formations. It would appear that they are found from the equator to the regions of eternal ice; and according to the observations of the learned Ehrenberg, have been discovered at work in certain localities to the depth of twenty or thirty feet.* If they make a portion of all animated bodies, it follows that this interesting substance is omnipresent, and plays a part in fertilization much more important than has hitherto been attributed to it. An alchemist in Hamburg first discovered phosphorus by evaporating urine and calcining the residuum. Though this was done in 1669, by Brandt, it was not known to the public until many years after, when Gahn and Scheele extracted it from animal matters, and explained their process of obtaining it from the bones of animals, a mode pursued up to the present time. It is a simple substance, of a yellow color, tough, and resembling wax. It may be procured in three states, solid, liquid, and gaseous. At the temperature of freezing water, it is hard, brittle, and even friable. It crystalizes, and its density is about 1.77. Phosphorus, when exposed to the air, is luminous, owing to the fact that it absorbs oxygen and undergoes a slow combustion. Hence its name, from two Greek words, which signify light-producer. When inflamed in the air, or in oxygen gas, it produses white fumes, and when collected free from humidity, is white, pulverulent, and absorbs the humidity of the atmosphere, or deliquesces, and becomes liquid. This combination of phosphorus with oxygen is called phosphoric acid. It inflames easily, and produces obstinate wounds; therefore, it is kept under water, and handled with pinchers. In this condition it may be melted without danger, and is purified by distillation and filtration through buckskin under hot water. Phosphorus combines with oxygen in several proportions; but we shall only dwell upon that which contains five atoms of oxygen and one of phosphorus. Phosphoric acid, when perfectly pure, and thrown into water, combines with that liquid with so much rapidity that it produces a noise like that caused by plunging a red-hot iron in water, and the temperature of the liquid is elevated. It is found in Nature, combined with many other substances, forming phosphates: thus we have the phosphates of lime, magnesia, lead, manganese, iron, uranium, &c.

The phosphate of lime is known under the mineralogical term apatite, and is found crystalized in stalactites, granular, fibrous, compact, and friable. It is sometimes colorless, or yellow, blue, violet, and green, transparent, translucid, and opaque. It occurs among crystalized rocks, such as the granite, gneiss, chlorite, and talcose slates; also in the trap and basalts, and is frequently met with in metalliferous deposits connected with copper, lead, &c., in the slates of coal, in chalk, and in the tertiary formations, as well as in the sedimentary and tufaceous deposits forming at the present day.

A fact worthy of note is the connection of fluoric acid with phosphoric in its combinations, and these two substances are not only found associated together in the mineral kingdom, but in vegetable and animal matters. The teeth of animals contain both. We are disposed to believe that fluoric acid is much more common than has been remarked, and, owing to its singular properties, has been doubtless often overlooked. One of the most extensive deposits of the phosphate of lime is found in Estremadura, in Spain, and was visited and examined by Dr. Daubeny and Captain Widdington, with a view to its introduction into England as a fertilizer. That mineral, according to their analysis, contains eighty-one per cent. of phosphate of lime, and is so abundant that it is used as a building material. In the United States, mineral phosphates are found in many localities, particularly in Morris county, New Jersey, and at Crown Point, in the State of New York. The mineral was crushed and sold in our markets as a fertilizer, but, for some cause not known to us, it appears to have gone out of use.

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The coprolites, so extensively sought after, and used as fertilizers, are found in various formations, occurring in limited quantity in

* See Ehrenberg on Infusoria, and his researches as to the cause of the instability of foundations under the city of Berlin.

the mountain limestone; but the lias, green sand, &c., are the sources whence by far the largest amount is obtained. These nodules, in form and even appearance, indicate their origin. The undigested portions of fishes, scales, bones, and distinct parts of things that once lived, show them to be excrementitious matter, solidified by time and pressure. The coprolites vary considerably in their composition, according to the locality, and partly owing to the variety, some yielding as high as seventy per cent. of phosphate of lime, while others give as low as ten per cent. Some contain, beside phosphate of lime, phosphate of iron, and phosphate of alumine. According to Mr. Nisbit, the analyses of five varieties produced:

Tertiary deposit,	19.19 to 22.17
London clay,	15.96 to 28.00
Chalk,	19.00 to 26.92
Green sand,	7.72 to 18.81
Green marl,	16.47 to 26.56

Coprolites always contain, beside phosphate of lime and phosphate of magnesia, carbonate of lime, and different substances in varied quantities.

It is needless here to state that the phosphate of lime, or we might say, the phosphoric acid, whether taken from the mineral apatite or any other mineral phosphate, from coprolites fossilized or recent bones, is the same substance and may be applied with the same advantage.

We have said that phosphoric acid, according to our estimate, is the most valuable substance with which the farmer has to do. Silica, lime, magnesia, and alumine are found in abundant quantities in all parts of the earth; nor does it appear that soda and potash require great solicitude, for the latter, which is the most important of the two, enters into composition of different mineral substances, all very common, and forming portions of the great mass of the globe. We allude to feldspar and mica, both constituents of granite, and of most of the crystaline rocks. Feldspar contains as high as seventeen per cent., while sometimes mica has not less than twenty per cent. of potash. Of oxygen, hydrogen, and carbon, therefore, it hardly requires that we should feel much anxiety about them. The two former substances combined form water; the latter, independent of other supplies, is one of the constituents of carbonic acid, a constant part of the atmosphere. Nor do we think that fertility fails so much, owing to the want of nitrogen, for that gas is an ingredient of the atmosphere. Whenever it has been taken, at every height, and from every locality, the air we breathe is composed of oxygen, nitrogen, and carbonic acid, holding 79.00 parts of nitrogen. We shall not enter into the discussion of how nitrogen is assimilated, whether directly or indirectly, whether through ammonia or nitric acid or other nitrogenized components; suffice it to say, that both ammonia and nitric acid are ever forming in the air and in the soil, and that either of those compounds, the admitted purveyor of nitrogen to plants, is a consequence of the existence and decay of organized matters in the air, or near the surface of the earth. By far the larger part of organized matter is composed of the condensed gases. Even during life these gases are given off and replaced by others. After death, decay speedily ensues, and they return to the great reservoir to be assimilated by other vegetables or animals, and thus continue the circle.

Phosphoric acid, though extensively diffused, and sometimes in large quantities, does not appear to be found in the same profusion as the other substances mentioned. The phosphate of lime is a fixed salt, neither soluble nor volatile, and when removed the soil must be replaced. This is done in the shape of manures, both organic and inorganic; the main sources of the latter we have alluded to. The amount returned from the barn yard is infinitely less than that carried away in grain, hay, milk, bone, and flesh, even on the most economically regulated farms; and, notwithstanding all our care, there must be a constant decrease of that substance, unless recourse be had to exterior supplies. True, small farms near large cities, may even add more than is taken away, bringing back the refuse of the supplies which are sent to market; but that kind of circulation, from the garden to the market, to the refuse heap, and again to the field, is limited by distance and cost of transportion. Remote lands, from which such supplies are stopped, must in the course of time become impoverished, unless provision be made to replace the continual drain. Exhaustion is but an affair of time; knowing the amount of nutriment in the soil, we may make an approximate calculation, and decide when, under different modes of treatment, it will work sterility. Strong symptoms of a downward tendency in that direction begin to manifest themselves throughout the whole cultivated portion of our country. Indeed, it would be difficult to find, in any part of the civilized world, a more melancholy picture than is presented to the traveller in certain parts of our Union. The exhaustion has not only been caused by continued cropping, and the extraction of phosphoric acid; injudicious culture has had much to do with it, and, perhaps, much the greater part of the fertility has been carried into the streams, thence to rivers, and finally to the ocean. There can be no civilization without population, no population without food, and no food without phosphoric acid. Indeed, it might be easily shown that the march of civilization has followed the direction of supply of that material. There are lands which will not betray the effects of continued cropping, but these are exceptions, and they receive abundant supplies of plant food from some local circumstance. The valley of the Nile is a familiar example; here the annual deposits from the overflow of the river counterbalance the drain. Other lands, composed from the detritus of fossiliferous formations, rich in phosphates, may resist during an indefinite period. The slopes of volcanoes are instances of a different character, where the supplies are restored from ejectments coming from the interior of the earth. The history of the world shows, beyond cavil or doubt, that population cannot endure where the supplies are wanting. Each return of the seasons brings another draft upon the phosphates, and when these fail, civilization takes up another dwelling place. It is not necessary that we should travel far to verify these sad truths. Within the period of a short life, lands were called inexhaustible, which are now worthless; and a great portion of the boundless West is naturally sterile. We are on the eve of a movement from the West back to the East, where a different work is in prospective, that of the regeneration of wornout land. Perhaps science may be adequate to the task, but the recuperation of a soil will surely be more difficult than cropping it to exhaustion.

If we examine the commercial and agricultural statistics of England for the last fifty years, or even for a much shorter period, we shall be convinced that she never could have attained her present prosperous condition, but from two causes: emigration and the importion of foreign fertilizers. The bones introduced have increased to an enormous extent, during the last few years. "They are principally brought," says Maculloch, "from the Netherlands, Germany, and South America. At the present time, however, they form a part of the export trade of nearly every port in the north of Europe." From a report on agricultural shipping and produce, printed by order of the House of Commons, in 1842, we learn that, out of eleven ports of the northern countries of Europe, bones were exported to a large amount, from the following nine: Hamburg, Rotterdam, Bremen, Lubeck, Kiel, Rostock, Stettin, Elsinore and Danzic. So far back as the year 1827, two hundred and forty-eight vessels entered the one port of Hull, carrying seventeen thousand seven hundred and eighteen tons of bones, which were derived from Russia, Prussia, Sweden, Norway, Denmark, Hanse Towns, Netherlands, Mechlenburg, Hanover and Oldenburg. In 1835, the importations into Hull alone, had increased to twenty-five thousand seven hundred tons. The value of bones imported into Scotland in 1841, was seventy-four thousand nine hundred pounds sterling. In 1837, the total value of bones imported into the United Kingdom amounted to two hundred and fifty-four thousand six hundred pounds sterling.* This is independent of the home supply, which is estimated at not less than five hundred thousand pounds sterling.

The extensive importations of bones, and the application of the native mineral phosphates, (coprolites, &c.,) together with the introduction of guano, have been the main dependence of agriculture in Great Britain during the last twenty-five years. Science, indeed, has aided in making these supplies more active and efficient, great economy having been secured by improved machinery for crushing bones to fine powder, (for the finer the dust the more immediately active it becomes;) but the dissolution of bones with acid has been of still greater benefit. Farm as you may, upon the majority of soils, without the use of extraneous fertilizers, your crops will certainly diminish, until total impoverishment shall leave no other alternative than starvation or emigration.

Science teaches that the principal fertilizing element of the bone is phosphoric acid, and thus, much is saved in transportation and the economy of application.

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* Morton's Cyclopædia of Agriculture.

Bones vary much in their composition, according to the age or variety of the animal. The amount of mineral matter is less in a young animal than in an old one, and the quantity increases gradually with age. Schreger tells us that the bones of a child contain one half of phosphate in the entire mass of earthy matter, while those of a full-grown person give four-fifths, and an aged person not less than seven-eighths. The bones of adults contain less water than those of children. When a bone is sufficiently digested in muriatic acid, the mineral part is dissolved, leaving the gelatin, or cartilage, intact, which retains the original form of the bone. That portion of the bone dissolved in the acid consists of phosphate of lime and magnesia, fluoride of calcium, and carbonate of lime, with small quantities of salts of potash and soda.

We copy from Berzelius the following analysis of the bones of man and those of the ox:

	Man.	Ox.
Gelatine, (soluble in water,)	32.17	33.30
Vessels,	1.13	
Neutral phosphate of lime	51.04	55.45
Carbonate of lime,	11.30	3.85
Fluoride of calcium,	2.00	2.90
Phosphate of magnesia	1.16	2.05
Soda and muriate of soda	1.20	2.45
	100.00	100.00

The experiments made by Barras inform us that the proportion of carbonate of lime varies in different animals, as well as in the bones of the same individual. He found, for every 100 parts—

	Carbonate of Lime.
Bones of a lion,	2.03
sheep,	24.12
chicken,	11.70
frog,	5.76
fish,	2.52

Chevreuil, Dumeril, Marchand, and other chemists have analyzed the bones of various fishes; they vary considerably, as will be seen by the following results obtained by the three first mentioned:

	Skull of a Cod.	Bones of a Pike.	Bones of a Whale.
Organic matter,	43.94	37.36	78.46
Phosphate of lime,	47.96	55.26	14.20
Sulphate of lime,	..	..	0.83
Carbonate of lime,	5.50	6.15	2.61
Phosphate of magnesia,	2.20	..	..
Sulphate of soda,	..	..	0.70
Soda and common salt,	0.60	1.23	2.46
Fluoride of calcium and loss,	..	..	0.74
	100.20	100.00	100.00

This gelatinous part of the bone consists of carbon, hydrogen, oxygen, nitrogen, and sulphur. One hundred parts of gelatin of bones produce, when fermented, twenty-two pounds of ammonia, together with carbonic acid. The sulphur, as we have seen, is also an ingredient of plants.

The phosphate of lime is soluble in all acids, and we may say that all the phosphates are soluble in an excess of acid. When bones are surrounded by fermenting organic matter, such as is offered in a manure or compost heap, the phosphate of lime is dissolved in the humidity of the carbonic acid which is constantly being evolved by the fermenting mass. This operation is more or less prompt according to the action of the fermenting heap. In the field, where carbonic acid is always present, this process is constantly going on; but, owing to the presence of the cartilaginous or gelatinous portion which surrounds the particles of phosphate, the action is less apparent on a large bone than if it were in powder, and the finer the powder the more rapid the decomposition.

Many farmers are in the habit of collecting the refuse bones of their farms, and covering them up in the accumulating manure in the barn-yard; where, in the course of time, they become soft and pliable, as if they had been immersed in muriatic acid. Such an addition gives increased strength to the manure in proportion as the quantity of bones, which thus dissolved, becomes immediately active, but endure a less time than when added to the land without preparation. For when bones in large pieces are applied to the soil, the action is slow; when divided, more rapid, according to the state of division, and still greater when dissolved, as the state of division is then perfect, provided the operation has been well conducted.

The crushing of bones, owing to their tenacity and hardness, is attended with some difficulty and expense, and, therefore, where the operations are large, steam-mills are employed. But in other places the bones are steamed or boiled, after which they are easily reduced to powder. By that process, however, the gelatinous and fatty matters are extracted and used; the grease for making soap, and the gelatin for fabricating size or glue. We have seen that the organic portion of bones contained fertilizing matter, (nitrogen, sulphur, carbon, &c.) If this be previously extracted, so much is lost to the land; and it is a question of loss to the farmer if the dust be sold by weight. Some burn the bone in order to reduce it to extreme division. Here again the organic portion is entirely destroyed, save only a part of the carbon. It is known that animal black (charred bones) is a great deodorizer antiseptic, largely used by sugar boilers for refining sugar; and by chemists for whitening sulphate of quinine, &c. It has the property of condensing gases; and charcoal, derived from the calcination of bones, possesses this property to a greater extent than any other substance, it will absorb ninety times its volume of ammoniacal gas. Hence, it becomes a consideration with farmers to know whether they do not gain more by charring the bones than they lose by chasing off the volatile matters. If the bones be burned in contact with the air, the greater portion of the carbon will be driven off with the other combustible parts of the bone; and in order to avoid that result, the bones should be charred in air-tight vessels. Iron cylinders are used for the purpose.

Whatever method may be employed, it is important that the bone, previous to treatment with acid, should be divided; otherwise the operation will be imperfect, and particularly so if sulphuric acid be used to form the compound called bi-phosphate, super-phosphate, or acid-phosphate of lime, known to farmers under those appellations. For if the bone, without being reduced to power, be treated with sulphuric acid, gypsum or sulphate of lime is formed, and that substance being insoluble, surrounds and prevents the further action of the acid upon those parts of the bone not already acted on. If muriatic acid be employed, that difficulty does not present itself, because the muriate of lime which is formed is very soluble, and so long as acid may be present the decomposition of the bone continues until the operation is complete. In the latter case, the phosphates and muriates would be in solution, which is less convenient of application; this, added to other reasons not necessary to mention, makes it preferable to employ sulphuric acid, which is largely manufactured, and may be obtained everywhere. It is important, however, that the farmer should look to the density of the article, for it is by no means immaterial whether it be strong or weak; otherwise, in the case of the weak or diluted acid, he will be paying for water instead of acid. By the addition of sulphuric acid to crushed bones they are decomposed, and effervescence takes place, arising from the escape of carbonic acid, which has been liberated by the sulphuric acid combining with the lime and forming sulphate of lime, or gypsum.

The insoluble phosphate of lime is decomposed, a part of the lime combining with the sulphuric acid, and liberating the phosphoric acid, which combines with that portion of the phosphate of lime not decomposed, forming a phosphate of lime with excess of phosphoric acid, called bi-phosphate, super-phosphate, or acid-phosphate. The sulphuric acid also combines with the potash, soda, and magnesia. Heat is evolved, the excess of water (if there be not too much) is absorbed, and the mass, when the operation has been well conducted, remains in a dry pulverulent form. The gelatinous portion of the bone is also modified by the action of the acid, becoming more assimilative. The operation is simple, offering no difficulty whatever. Any farmer may fabricate his own super-phosphate with the implements he may have at hand, and avoid the necessity or risk of paying for an impure article; for every one knows that frauds, to an enormous extent, have been perpetrated upon the confiding farmer, who has often paid high prices for that which was of no value as a manure. and might be had for the collecting.

Sulphuric acid (oil of vitriol) is a substance to be procured in all our markets, and its value depends upon its density, specific gravity, or its state of concentration. The weaker it is, the less valuable. The proper density should be about 1.85.

The quantity of acid required for the decomposition of one hundred pounds of bones, depends upon whether they are in meal, half inch, or entire, or whether they are in their natural state, boiled, or burned. The finer the powder the more perfect the action, and the more acid will be required. If the bones are in their raw state, they contain, as has been said, an amount of animal or organic matter, which varies according to the age or species of animal from which they have been derived. The amount of bone-ash obtained from the calcination or burning of bones in contact with the air, may be set down, on an average, at fifty per cent. For every hundred pounds of bone-ash, eighty-seven or eighty-eight pounds of sulphuric acid will be required. The operation may be practiced in a hogshead, on a tight floor, or on the ground, or in the field where the mixture is to be used.

Take, for instance, one hundred pounds of powdered bone-ash, throw into a hogshead, to which add from five to six gallons of water, and mix with a stout wooden shovel or paddle. Then pour on about eighty-eight pounds of concentrated sulphuric acid. The mass should now be well turned and mixed. It will effervesce and foam up, give off steam in profusion, and the temperature will be found to have risen sometimes as high, or higher, than 212° Fahrenheit. Instead of adding the entire amount of acid at once, it may be divided into two portions, and added separately. In handling acid, have a little care, otherwise an eye or the clothes may be the forfeit, as such accidents have happened. After mixing for some time, the mass will stiffen, when it should be covered, and allowed to stand for a day. It may now be thrown out in a dry place, to remain sufficiently long to be ready for powdering, or it may be mixed with dry peat, charcoal, calcined plaster of Paris, or even dry mold, or sawdust, and powdered, when it is ready for use.

A mode which is extensively practiced on farms in England was first suggested by Mr. Pusey, and is, briefly, very similar to making mortar out of sand and lime. The circular wall of sand may be replaced by coal ashes, or bone-dust itself. The bone-dust is deposited in the middle of the circle, then thoroughly saturated with water, when the sulphuric acid is added, and the mass well and frequently turned over, until there is no further action. The decomposition is more perfect when the temperature is high, and this is obtained by making the wall of ashes as lofty as possible. The operation is more or less well conducted as the mixture has been the more evenly made, and the parts thoroughly mixed. The mineral phosphorite, coprolites, and varieties of guano, rich in phosphoric acid, may be treated with acids, and will produce super-phosphate of lime, having all the efficiency, and with precisely the same properties of that manufactured from bones, the only difference being that the one may contain salts, which are absent from the other, and more or less phosphoric acid.

The super-phosphate of lime, from its comparatively high value, leads to adulteration. Water is added to increase the weight; earths, chalks, lime, old plaster, oyster-shells, &c., are sometimes mixed in a manner to deceive the eye. Some of these substance may be detected, with the aid of a magnifier, by acids, or by simple washing with water, and examining the residue after decanting. If old plaster is suspected, the hair will be seen; if oyster-shells or chalk, the effervescence and particles of shells will furnish indications which will lead to closer scrutiny. The sulphate of barytes, or sulphate of lime, increases the weight of the mixture, and the former particularly will fall to the bottom, when thrown into a tumbler of water, more rapidly than the super-phosphate. Recourse may be had to a chemist, whose familiarity with the properties of different substances will enable him to arrive at conclusions not to be expected from those whose occupations are of an entirely different character.

The loss that is taking place in this most essential ingredient to life (phosphorus) is enormous, unavoidable, and impossible to estimate with any correctness. Independent of that continuous drain which takes place by the washing of the soil, together with the waste ever occurring in provisions of all kinds, grains, vegetables, and animals exported, and but a small part of which finds its way back to the place whence it came, there is another gradual yet certain loss which, in time, will be felt—I allude to the amount of phosphorus in our bodies, —a loss to be attributed to the respectful and pious custom followed in all civilized countries, that of burying the dead. By this practice much is entirely withdrawn from circulation; for the depth at which the bodies are deposited in the ground is below the reach of vegetation. Supposing the inhabitants of the United States at this time to amount to twenty-five millions, and that each individual contains, on an average, four pounds of phosphate of lime, (which will be found not far from the truth,) when this population shall have passed away, one hundred millions of pounds of the phosphate of lime will have been abstracted from the soil, or from activity in the endless change of life.* It will be borne in mind that the extinction of the present generation does not limit the loss; for population increases much more rapidly than supplies; and if we reflect how wonderful has been its augmentation in the United States since its settlement, and its probable continuance, even in a greater ratio, we shall be less apt to underrate the future consequences.

The ocean is a vast reservoir of life's requirements, from which science may find means of recovering supplies, especially of this valuable ingredient.

It is hardly necessary to remark that, while phosphoric acid is an essential part of all fertile soils, it is not the only substance required, for the application of the phosphates may be made without any apparent good result, owing to the absence of other substances not less necessary. With a view to supply every important quality, much ingenuity has been employed in making artificial and saline mixtures, not only to furnish special manures for special crops, but such also as satisfy the wants of all vegetation. Many saline mixtures may be compounded to increase the efficacy of each other, and at the same time to accelerate, promote, and supply the requirements of plants; but we cannot refrain from cautioning the farmer against the exaggerated accounts now everywhere published in favour of certain fertilizers. They are far from being always what they are described, either in composition or effect, and are very often quite the contrary. At best, composts would frequently appear to be mere dilutions, or attempts at making the truly useful do more service than is possible. The most shameful impositions are being daily practiced. From the nature of the substances employed, these frauds may not easily be detected by the farmer; but he should rather trust, if he will have unusual mixtures, to such as he may manufacture on his own ground, and under his own eye, from materials of positive utility, and purchased from dealers of undoubted character.

From the British Farmer's Magazine.

Comparative Advantages of Carts and Waggons.

A waggon is a four-wheeled vehicle employed in carrying articles of heavy weight and large bulk from one place to another, and is drawn by two or four horses, according as the weight of the carriage, the loads that are drawn, the distance, and the state of the roads may require. The four-horse carriage with broad wheels, and of very strong construction, is chiefly used for long journeys and loads of heavy articles, which require to be only once placed on the vehicle, and no shifting or reloading is necessary. The body of the waggon is closely boarded, in order to contain coals and lime; and grains and flour for the market are loaded in sacks. This waggon is mainly used by coal merchants and millers, and on extensive farms the thrashed grains are carried to distant markets in the four-horse vehicles. Coals and lime are also fetched from distant places in heavy loads in the strong carriages, drawn by a team of horses.

For the lighter purposes of carrying the crops of grain and hay from the fields to the rick yard a pair-horse waggon is used, which is built with open sides and boarded bottom, and drawn by two horses in tandem, or

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* Monsieur Elie de Beaumont, who has made a similar calculation, in detail, for the amount of phosphate of lime abstracted from culture, by burial, estimates that France has thus lost not less than two millions of tons.—*See Etude sur les Gisements Geologiques du Phosphore.*

The reader will thank us for directing his attention to the above-named work, recently publisbed by our distinguished friend and professor, M. M. L. Elie de Beaumont. We have read it with great interest, and are indebted to the learned author for many valuable suggestions.

abreast, as in the four-horse carriage. The lightness of the vehicle permits a quick movement in the operations; and the use is very convenient in hay and corn harvests, when the waggon is open-built, and not encumbered with unnecessary weight of materials. Grain is carried to market in sacks very conveniently in this waggon, which in other cases is closely boarded in the sides, and becomes useful for the same purposes as the four-horse waggon, and only in the reduced ratio of two or three horses to four or five. This is the waggon of the farmer, and carries abroad and brings home all transportable articles, which are arranged in loads as circumstances may direct.

A cart is placed on two wheels in the centre of the body of the vehicle, from which two shafts extend in front, and form a connection of draught by which two horses yoked in tandem pull forwards the carriage or vehicle. The load is balanced on the wheels and on the back of the horse, which walks between the shafts, and is rendered steady by the imposition of part of the weight. The box of the cart is locked to the shafts; and being made to unlock, and the tail-board being moveable, the carriage is raised aback, and the load is discharged. This vehicle carries home and abroad loads of every kind of articles, and, being provided with projecting frames of timber spars, the crops of hay and grain are carried upon it from the fields to the rick-yard. For the purpose of distant journeys the lock is removed, the shafts being firmly joined with the body of the cart, which prevents the jogging motion, from the lock being present, that arises from the loose connection of the shafts and the cart. This provision is convenient for long journeys. The one-horse cart is contrived as the two-horse vehicle, the dimensions being reduced in strength and extent in order to suit the power of one animal. The axles of carts are mostly of iron, though wood is yet used in many cases of home use.

The four-horse waggon is a useful implement on farms that are beyond the medium extent, for the purpose of carrying lime and coals, and the thrashed grain to the market. Two waggons may be placed on large farms; and being not very heavily constructed, two horses are able to draw the loads of hay and grain during harvest. On uneven grounds in hilly countries, and from distant fields, four wheels are more secure in the travelling, and more safe from being overcast with top-loads, than any carriage with two wheels; and in these cases the advantage is very apparent. But the movements are slower; much time is spent in placing and discharging the loads, which must be inconceivably large, in order to compensate the more frequent repetition of less bulky quantities. The chief use of the four-horse waggon is not for home work, but in going abroad with heavy and bulky loads of one lading in a day, or in not more than twice sent on a journey; and a convenience is found in descending steep declivities from locking the wheel, and easing the horses from the impelling weight pushing behind them. This exemption is not large in amount, as the occurrence of very steep roads is partial, and does not form a decision of preference in the implement.

The pair-horse waggon possesses a much wider range of utility than the carriage that is drawn by four horses, and the adaptation is much more convenient for the purposes of the farm. Being lightly made and neatly joined together in the component parts, the implement is managed by two horses, and one man to drive the carriage, which is a more convenient arrangement than two persons attending one waggon, as with the four-horse vehicle. The hay and corn harvests are very conveniently carried by this waggon in such loads as the distance and the condition of the roads will admit; and the implement is built with open sides, of spars, with a projecting frame. For the purpose of carrying coals and lime, and similar substances, the sides are temporarily boarded; and all articles in sacks, as thrashed grain, are carried in the open waggon of spars and light frame. This is the true harvest carriage, being lightly and neatly made, and suited to the special purpose. The boarded vehicle drawn by two or four horses is not so convenient, though it is applied to both light and heavy purposes.

The long-shaped harvest-cart of Northumberland and the south of Scotland is placed on two wheels, drawn by two horses yoked in tandem, with a boarded bottom and open sides of spars, with a projecting frame. The implement performs exactly the same purposes as the light two-horse waggon, and is fitted on the wheels of the box-carts of the farm. It would be difficult to draw, even from an extensive and varied experience of both carriages, a fair comparison between these implements. Both vehicles are drawn by two horses, and managed by one attendant, and in that respect are precisely equal: and equal loads of any articles are carried on both vehicles on steep grounds, and in crossing declivities with deep and wide furrows. Top-loads of bulky articles, as hay and grain crops, are more safely carried on four wheels, which are not so readily overcast as the two-wheeled carriage. On the other hand, the long cart is more nimble in the motion, and quicker in being turned, than the waggon, which occupies more room in the rick-yard, when crowded, in harvest. The waggon may be boarded in the sides, to carry coals and lime. The cart is not contrived for that use; but being provided with two wheels, and these borrowed for use from the box-carts of the farm, the original cost being less than the four wheels of the waggon, may determine the comparison in favour of the cart, but which may be balanced by the other advantages of the light waggon. Both implements form the highest use, and are equally preferred.

The two-horse cart is used for heavy and distant carriages, and for performing the detail work of the farm. Greater weights are drawn by two horses in these carts than in the four-horse waggons, and a very large superiority for small works, in which waggons are wholly useless. Being provided with sparry frames, the carts convey from the fields to the rick-yard the hay and grain crops, though not very conveniently, from danger of oversetting the top-load that is placed over a light box beneath, except on comparatively level grounds, and not very distant carriages. In these situations, the pair-horse waggons and the long harvest-cart are both dispensed with; and the two-horse box-cart, with iron axle and strongly-shod wheels, performs every work of the farm, with the distant journeys and carriages. But in most cases, the long cart and pair-horse waggon are introduced for harvest performances.

The single-horse cart has been contrived for detail work, in which frequent and quick repetitions are required of the operations that are performed. For every kind of summer work, when the ground is dry and firm, in dunging turnip lands, laying lime and dung on wheat fallows, carrying earths and stones, and all detail work of the farm, the cart drawn by one horse is immeasurably superior to any other vehicle, as it carried loads of dung for an acre of turnip land very sufficient in twenty outgoings from the heap, and a cubic yard of earth and stones is drawn to moderate distances without oppression to the horse. The lightness of the carriage permits quick and easy travelling, to which the narrow wheels offer little resistance. The load is readily discharged in one heap, or distributed into several portions, by the freedom of construction in the tail-board and forelock, which raises the cart into a slanting position, to facilitate the discharge of the load. On all turnip farms, the use of this cart is indispensable; and even for distant journeys, in fetching coals and lime, and in carrying thrashed grain to the market, the single-horse cart is superior to any other vehicle in carrying greater weights of load, and with more ease to the horse. A single animal will draw a ton on moderately steep roads, and for any length of journey; thirty hundred-weight, and even two tons, are drawn by carriers' horses and at collieries and iron works. But one ton may be assumed as an average weight of load in farming operations. On level grounds of conveniently arranged farms of two hundred and three hundred acres in extent, where the journeys are short and the roads not steep, the hay and corn harvests are very quickly and conveniently carried on the one-horse carts, provided with frames of timber spars, that project before and behind the cart, and over the top of the wheels. The small loads carried are most amply compensated by the quick journeys that are made in frequency, and from the ease and despatch with which the loads are placed and discharged. In these situations, of which many are found, no other vehicles are required beyond the one-horse cart, as it performs every kind of work, preventing the necessity of providing implements that only execute one purpose. The long harvest-cart or pair-horse waggon, along with single-horse carts, will provide any farm with wheeled vehicles, but liable to the objection of different implements being kept for separate purposes, when a provision is known and used by which one implement, with an occasional change, is capable of performing all the carriage-work of the farm. The cheapest and most convenient provision of carriages for any farm will be in box-carts, made in the strength and weight of materials to be used by two horses, for carrying coals and lime in distant journeys, as likewise for the detail work of the farm during winter and in all heavy weathers, and the rather small size, and the construction light as possible, allowing the use by one horse during the turnip season, and all detail work when the ground is firm and the land dry. The wheels of these carts are fitted on the long carts of Northumberland, for the purposes of harvest; thus executing two performances with one expense of wheels. This is true economy; and rises superior to keeping four wheels of the pair-horse waggon solely for the purposes of the employment of the single vehicle. The sole advantage of the harvest waggon over the long sparry cart, in the top loads not being so easily overset, is wholly sunk in the superiority now stated; and waggons are exposed to the objection of the hind wheels being distant from the horses, and carrying a weight removed beyond the power of the animal. The box-cart may be merged into a vehicle for two horses during winter, and for distant journeys, and for one horse in all summer work, by the construction being neat and strong, materials light and durable, and the size resembling more the single-horse cart than the lumbering carriages commonly seen attached to two horses. A medium size and construction must be adopted. These carts require horses of spirit and muscular strength —tall, active, and powerful. The dull, sluggish animals of the waggon are not fitted for purposes in which only one or two horses make the exertion.

The waggon is a vehicle of slow progression, arising from the length of the construction of the implement, and from the hind wheels being placed at a considerable distance from the moving-power that is attached to the front part of the carriage. Hence the general handling of the implement is awkward and inconvenient in the turnings, and in all lateral directions. The irremovable attachment of slowness is gradually, and by habit, communicated to the animals of draught, and a pace is acquired in conformity with the jogging motion of the heavy length of the waggon. The drivers acquire the same habit, and gradually sink into the pace that the motive-powers have adopted, as being the least troublesome, and the most convenient and suitable. From these causes it is seen that in the countries in which the use of waggons prevails, and the grain is thrashed by the slow process of a man wielding a flail, the farm labourers are slow and more awkward in every kind of work than where carts are used as farm vehicles, and where grain is thrashed by machinery. A quickness is compelled to attend on the evolutions of machinery, and the habit is transferred to all other performances. A latent barbarism of the mind continues the use of these slow powers of action long after the inferiority has been discovered and acknowledged; so slowly are prejudices removed.

The purposes of use have been mentioned for which the different carriages of the farm are respectively fitted, and the superiority has been stated in the points of utility where one vehicle is seen to exceed another in the general as well as in the single occupations. The four-horse waggon is adapted only for some special purposes: in carrying top-loads on the farm, and in transporting heavy articles in distant journeys. These occasions are comparatively few, and do not justify the heavy cost of the implement remaining idle during the greater part of the year, as no part of the waggon is applied to any other use. The pair-horse waggon is more adapted for farm purposes, as has been mentioned; but still objected to as an expense dormant in one purpose of use, as the implement is wanting in any other adaptation. And for any detail work waggons are wholly useless. The two-horse cart adapts for any purpose of farm; and has only one inferiority, in being not so steady as waggons under top-loads, and more liable to be overset. The cart drawn by one horse is by far the most useful for detail work of every kind, but, though used, may fail for harvest purposes, and require the conjunction with a harvest cart. The last implement being fitted on the wheels of the box-carts, supply the inconvenience and complete the arrangement.

The prime cost of the different implements must have a large consideration in determining the performance of one vehicle over another, along with the liability of getting into disrepair, and the comparative expense of making the condition effective. A four-horse waggon equals the cost of more than two carts drawn by two horses; and as the number of animals employed are equal in both arrangements, the superiority of the two carts in a variety of purposes requires no argument of demonstration. Nearly four one-horse carts can be purchased for the price of a waggon. And here, again, the greater value need not be argued of four vehicles acting separately in varied purposes. The same difference is found in carts and the pair-horse waggon, only somewhat reduced by the price of a lighter waggon. Th harvest cart of Scotland will cost not above the one-half of the price of a pair-horse waggon; and when the cart is fitted on the axles of the box-carts, the cost will not exceed one-fourth of the latter vehicle. The differences are most important in the case of a just comparison of the implements; and being joined with the superior usefulness of carts for general and varied purposes, there is formed an incontestible reason of preference of the cart as a vehicle of the farm. The best and most extensive farming in Britain is performed, and all farming may be conducted, by carts, without any waggons; but no cultivation of land is done, or ever will be executed, with waggons without any carts. The latter observations may settle the comparison of the two kinds of carriage implements in the value of practical utility.

Transferring Engravings to White Paper.

The London Builder gives the following rule for transferring engravings to white paper:

"Place the engravings for a few seconds over the vaper of iodine. Dip a slip of white paper in a weak solution of starch, and, when dry, in a weak solution of oil of vitriol, when dry, lay a slip upon the engraving, and place them for a few minutes under the press. The engraving will thus be reproduced in all its delicacy and finish. The iodine has the property of fixing the black part of the ink upon the engraving, and not on the white." This important discovery is yet in its infancy.

Eight Useful Rules.

1. Let not the wisdom of the world be your guide.
2. Let not the way of the world be your rule.
3. Let not the wealth of the world be your chief good.
4. Let not the cares of the world encumber you.
5. Let not the comforts of the world entangle you.
6. Let not the crosses of the world disquiet you.
7. Be not too fond of life.
8. Be not too fearful of death.

Odds and Ends.

"What was the use of the eclipse?" asked a young lady. "Oh, it gave the sun time for reflection," replied a wag.

Sorrow comes soon enough without despondency; it does a man no good to carry around a lightning rod to attract trouble.

Ambition, energy, industry, and perseverance are indispensable for success in business.

There cannot live a more unhappy creature than an ill-natured old man, who is neither capable of receiving pleasures, nor sensible of doing them to others.

It will afford sweeter happiness in the hour of death to have wiped one tear from the cheek of sorrow than to have ruled an empire.

The love of ornament creeps slowly, but surely, into the female heart. A girl who twines the lily in her tresses, and looks at herself in the clear stream, will soon wish that the lily were fadeless and the stream a mirror. We say, let the young girl seek to adorn her beauty, if she be taught also to adorn her mind and heart, that she may have wisdom to direct her love of ornament in due moderation.

A correspondent assures the *Uinted Service Gazette* that unless means are devised for preventing the decay of the oak-tree by the insects that produce gall-nuts, there will not be a single oak left in the course of a few years.

It appears, from experiments of Lieutenant Rodman, United States Artillery, that guns lose nearly half their strength by being bored after being cast solid, and if cast hollow upon a cold core, they were not only so much stronger but twenty times more durable. A gun cast hollow was fired 2,500 times, while one bored from the solid burst at the seventy-third round.

The presence of cotton in woollen fabrics may be easily recognised by the following tests. When boiled for twenty minutes in a solution of nitrate of mercury the woollen fibres acquire a red color, but the cotton fibres remain colorless. When the fabric is boiled with caustic soda solution (sp. gr. 105) the wool disssolves, but the cotton is only slightly affected. Picric acid also stains wool yellow, but has no action on cotton.

An ingenious artisan, residing in Islington, has fabricated a burning-glass of most extraordinary powers. Its diameter is 3 feet; its powers are astonishing; the most hard and solid substances of the mineral world, such as platina, iron, steel, flint, &c., are melted in a few seconds on being exposed to its intense focus. A diamond, weighing 10 grains, exposed to this extraordinary lens for half an hour, was reduced to 6 grains, during which operation it opened and foliated like the leaves of a flower, and emitted whitish fumes, and when closed again it bore a polish and retained its form.

Thomas Hall, a linen-weaver in Ireland, has finished a shirt entirely in the loom. It is woven throughout without seams, and very accurately and neatly gathered at the neck, shoulders, and wrists. The neck and wristbands are doubled and stitched; there is a regular selvage on each side of the breast; and where stitching ordinarily is, so it is in this shirt. In short, it is as perfectly finished as if made by an expert needlewoman. The shirt has been exhibited to several persons in the linen trade, who are completely satisfied that it is actually the production of the loom, without any assistance from the needle.

Some years ago, a party of Cambridge philosophers undertook, for a scientific object, to penetrate into the vasty depths of Wheal-Fortune mine. The venerable Professor Farash, who made one of the number, used to relate with infinite gusto the following startling incident of his visit:—On his ascent in the ordinary manner, by means of the bucket, and with a miner for fellow-passenger, he perceived, as he thought, certain unmistakable symptoms of frailty in the rope. "How often do you change your ropes?" he inquired, when about half-way from the bottom of the awful abyss.—"We change them every three months, sir," replied the man in the bucket; "and we shall change this one to-morrow, *if we can get up safe!*

"*Walk your Chalks.*"—A very simple explanation of this expression may be given. I believe that certain ale-house frequenters, when they have been drinking long enough to make a boast of being sober, and to dispute the point with each other, will chalk a long straight line on the ground, and then endeavor, one after the other, to walk upon it without swerving to the right or left. Those who succeed are adjudged to be sober—that is, to have "walked their chalks." A witness on a trial in Buckinghamshire, about the year 1841, made use of this expression, and a barrister immediately explained it in the above manner to the puzzled court. Addressed to a person whose company is no longer desired, the expression "walk your chalks" would thus mean, "walk straight off."—*Notes and Queries.*

Excellent.

A New York judge, recently, while sentencing a number of young men who had been convicted of crime, made the following speech to the farmers of Chatauque county:

"When your boys get large enough to work, find work for them at home. On no account let them go into the village to work; nor let them go to teaming. I care not if they can get $50 per month; it will be a dead loss. They will just as surely follow the example of these boys now before you, as they leave the sacred and restraining influences of home. Give them plenty of good books and papers, make home pleasant, and keep them there until they are of age and have the wisdom to resist the temptation of high wages on a road or in a tavern, but obtained at the expense of good character."

Recipe for Making Currant Jelly.

Take the fruit in its prime, wash and drain it till nearly dry, then put it in an earthen pot or jar and set the pot in a kettle of hot water. Set the kettle where the water will boil, taking care that none of it gets into the pot. When the fruit breaks, turn it into a flannel bag, and let it drain slowly through into a deep dish, without squeezing. When the juice has all passed through the bag, put to each pound of juice one pound of powdered white sugar. Set the syrup where it will boil gently for 16 or 20 minutes, skimming it occasionally. Jellies are improved by standing in the sun for a couple of days. If the currants are too ripe the jelly will be dark colored. M. B. B. *Prairie Farmer.*

☞ Beware of sloth in secret duties, and of pride in public duties; of envy in adversity, and of self-consequence in prosperity; of self-confidence in laboring for God, and of self-complacence when your labors are crowned with a blessing.

From the Transactions of the Highland and Agricultural Society.

On Breeding and Rearing Cattle.

By Henry Tanner, *Professor of Agriculture, Queen's College, Birmingham.*

[Premium—The Gold Medal.]

[No. 1.]*

This subject is invested with deep interest, for it involves one of the most important branches of agricultural industry. Errors are often multiplied and perpetuated, and consequently must be more jealously avoided. The management of breeding cattle claims our most careful attention, because not only are the sources of remuneration from many districts chiefly dependent upon it, but the profits of every farm are, in a greater of less degree, under the influence of the system adopted, whether good or bad. I shall at once proceed to notice those points which appear to me to be of the greatest importance, and which I believe to be worthy of consideration in Breeding and Rearing Cattle.

I need scarcely stay to remark that, by the process of domestication, our breeds of cattle have undergone great changes of form, both externally and internally; so much so, indeed, that there is scarcely any part of the animal which has not yielded to the change of circumstances which has resulted from their being brought under the care of man. The deviations from the standard character of our wild breeds only continue so long as they are kept under this artificial system, for we find that as a more neglectful course of management is adopted, so the original character of the wild animal will again be developed. Hence the peculiar conformation of our improved breeds of cattle must not be loooked upon as any permanent modification of form, but as entirely dependent upon their being continued under the same system by which the change was originally produced.

The characteristic points possessed by cattle in a state of nature, are all eminently adapted for the preservation and perpetration of the species, for Nature is perfect in all her details. Under our artificial system, we require certain modifications which are better adapted to our requirements. For instance, instead of having an animal almost destitute of fat, which is the condition of our wild breeds, we desire a fuller development of this material, together with a more tractable disposition; but to attain these results we have to alter the entire system of the animal. It does appear extraordinary that man should have control over the animal race, but experience teaches him how to accomplish the desired result. We cannot accomplish this without the aid of Nature, and it is chiefly done by adopting two simple principles—1st, That the development of any part is promoted or checked by the degree of exercise which that part may have; and, 2dly, That under similar conditions like produces like.

To illustrate these points more fully, I shall state as briefly as possible the principal changes which are observed in our improved breeds of cattle. I do so as concisely as possible, because I conceive it is desired that the report should be restricted as much as possible to the management of breeding cattle, and not extend to the more general treatment of cattle.

If we take either of our improved breeds of cattle, and examine one individual of the class, we shall find that there is a marked difference in the general outline of the body. The wide and deep chest, the roundness of the barrel, and the full development of muscle and fat over the body, give the improved animal a certain squareness of outline which is totally at variance with any specimen of the original breed. Nor does the difference end here, for the internal conformation presents peculiarities of which the external form may be taken as a constant indication. The lungs and liver are found to be considerably reduced in size when compared with those possessed by animals having perfect liberty. The cause is evident, and admits of easy explanation. In a state of nature the animal is accustomed to violent exercise, and this brings the lungs into active work, and the result is a full development of the part. But suppose an animal of the same breed, kept in a very confined space the greater part of its life, the lungs, not having been equally exercised, would not be as fully developed. The progeny from this animal would also possess a tendency in the same direction; and if such an offspring were kept in a state of confinement, it would probably possess even smaller lungs than its parent. Thus the restricted exercise of our cattle has produced and perpetuated a small development of this part of the body. The same results are observable in the liver in an equal degree with the lungs; for similar active exercise induces increased energy in the liver, whilst the luxurious life of the improved animal produces a torpid and inactive liver.

Thus we observe that domestication has modified the development of the lungs and liver, and hence the functions they perform are proportionately diminished. It is well known that the food which an animal consumes chiefly consists of two classes of bodies—those which form muscle, and those which maintain the heat of the body. It is the latter class to which we must now refer. The heat of the body is maintained by the combustion of the carbonaceous matter of the food. Combustion is not necessarily attended by that manifestion of flame which is generally observed; but the same change and the same

* Divided into three parts by Editor Southern Planter.

results may be produced in a much more gentle manner. This change actually takes place in the animal body, and the carbonaceous matter of the food under this action yields to the body the heat which is more necessary for the healthy discharge of its functions.

The blood, on passing through the body, bears with it the heat-giving matter of the food, and also carries other important chemical agents in its colouring matter; when these bodies come together, a change takes place and heat is produced. Now this change does not take place to any great extent in the arteries, but it is whilst the blood is passing through the capillary vessels, which pervade every portion of the body, that the action is rendered complete, and thus these vessels not only carry nourishment for the support of the system, but also distribute an equable supply of warmth.

It is clear, then, that the larger the lung the more fully does the body receive the oxygen which is to develop heat in the body; and the natural result is, that a more perfect combination of the carbonaceous matter of food takes place. Fat is composed of the same materials as are thus used for keeping up the heat of the body, and, consequently, the more there is used in this way, the less remains for being stored away as fat. Thus large lungs are prejudicial to the formation of fat.

We may here observe that food may be very much economised by being consumed by "high-bred" animals; but it must be added that there are other attendant circumstances which act prejudicially. We may modify the operation of Nature; but she, with jealous care, guards these alterations, and continually places obstacles to check, and frequently to prevent, the perpetuation of the *unnatural* conditions which we desire so much to produce. These difficulties are constantly arising in breeding from animals of this class, and we shall subsequently have occasion to notice this fact.

With these introductory remarks I will proceed to the practical portion of this subject, and in it we shall find the principle thus briefly noticed more fully illustrated. It will be convenient to notice this subject under the following divisions:—

The Management of Cattle before Breeding.
... ... whilst Breeding.
... ... after Calving.

THE MANAGEMENT OF CATTLE BEFORE BREEDING.

In treating of this subject we are naturally led back to the period of the calf's birth, and we cannot do better than to trace its course through life. A great difference of opinion exists upon the best and most advantageous course to be pursued, and in various localities different systems are adopted. There are two modes of rearing calves; either the calf is removed from the cow immediately after birth and reared by hand, or else the calf is allowed to suck the cow. The peculiar circumstances of different farms may lead us to modify our course; but before commenting upon these various practices, it may be desirable to state them more fully.

In those cases in which the calf is never allowed to suck the cow, it is removed immediately after its birth, and, having been placed in a separate building, is well rubbed with straw. After a few hours, the first milk of the cow (generally called the beastings) is carefully given to the calf. This is best done by supporting the head on the hand, and allowing the milk to run gently into the mouth. This method is preferable to the more usual plan of making the calf suck from below. Indeed, for a few days it is better to supply the animal in this manner. Warm milk is the only food the young calf receives for about three weeks, and during this time it ought to be fed three or four times a-day. A strong, healthy calf will take from 8 to 10 quarts daily.

The calves are gradually trained to eat sliced turnips and linseed cake. The general plan is to put a bit of cake into the calf's mouth immediately after taking its milk, when it will continue to suck and dissolve the cake. When about six weeks old the same quantity of milk is given at two meals instead of three, and at noon some other food can be given. This will be chiefly cut roots, hay, and crushed cake. These are gradually increased in quantity as the calf is able to consume larger quantities, and the milk is decreased proportionately. When the calf is first put out to grass for a few hours, the house food is steadily decreased, so that it may be prepared for grass food when turned out for the summer grazing. The advantages of this method are the economy of milk, and its division amongst the calves according to the discretion of the feeder.

The second plan differs from the above in the calf being allowed to suck the cow for the same length of time, instead of the milk being drawn and given to it. When this plan is adopted, the calf is not removed after birth, but is allowed to remain beside the cow, and she soon dries it by the natural process of licking, which at the same time encourages the circulation of the blood throughout the body of the young animal, and acts as a purgative on the cow. Within a few hours the calf will probably be strong enough to stand and suck, but if not it must be assisted. Should there be great weakness, a little milk should be drawn and put into the calf's mouth at intervals, until it gains strength. Generally it is kept in a crib within a short distance, and allowed to run to the cow on her being brought into the homestead. In too many cases the calf only receives its food morning and evening; but the mid-day meal is much to be desired, and should always be allowed, for the little additional trouble is well compensated by the progress of the calf.

If the cow is an ordinary milker, she will have more milk than the calf requires, and may adopt the plan of letting one cow rear two calves; or if this is not done, the milk which the calf does not require is drawn from the cow by hand. If, however, the cow is an inferior milker, she will do but little beyond supplying her calf, and in some cases, afford it only a bare sustenance. When such is the case, the cow must have food given her to promote the formation of milk of good quality—such, for instance, as oil-cake. When a cow is rearing two calves, we frequently observe that the one being the fastest feeder gets the lion's share of the milk, whilst the other has only a spare allowance. This must be overcome by allowing the weaker one to have the start of the other in commencing its meal—unless it appears that the cow's milk is insufficient for both of the calves, in which case give the cow richer food.

The course of practice is modified by some breeders, who, after allowing the calf to suck ten days, allow it 6 or 8 pints of new milk twice daily, and after this has been continued two or three weeks, *gradually* substitute *skimmed* milk for the new milk, adding oatmeal porridge, and allowing the calf cut roots and hay until it is ten weeks old, when the milk is entirely stopped. Other breeders, when the new milk is removed, use as a substitute ¼ lb. crushed linseed, ¼ lb. bean meal, ¼ lb. molasses, daily, made into 8 or 10 quarts of soup. And this is decidedly a good artificial food for calves.

The stomachs of all ruminating animals—and cattle are of this class—it is well known, differ from those possessed by other animals, in consisting of four compartment, or stomachs, instead of only one. In the calf these stomachs are not fully formed—in fact, one only is intended for action at this period of life, and the other three are but slightly developed. The stomach which the calf possesses is the true digesting stomach, and this is the only one which ought to be brought into play during the period it is living upon milk. Unfortunately, however, it frequently happens otherwise; especially in cases where the calves, from rapid drinking, have the rumen brought into action prematurely.

The process of digestion in the calf is invested with much interest, because it illustrates the simplicity, and at the same time the perfection, of all the functions of life for accomplishing the object in view. It devolves upon food to assist in building up the body of the young animal; hence it should supply all the materials required for forming the various parts of the body. These parts consist of muscles, sinews, nerves, fat, membranes, arteries, veins, bones, &c.; and it is possible that in milk we have all the requisite elements present? Yes; we learn from daily observation that such is the case, and a knowledge of the composition of milk confirms and explains the fact. The following analysis of cows' milk has been given by Chevalier and Henry:—

Casein,	4.48
Butter,	3.13
Milk sugar,	4.77
Saline matter,	.60
Water,	87.02
	100.00

In this food we have the saline matter required for the growth of the skeleton, the casein for the production of the muscles and various organs of the body, together with the butter and milk sugar, which are prepared to furnish warmth and fat to the body. As soon as the milk passes into to the stomach of the calf, a fluid, called *the gastric juice*, is thrown off from the coats of the stomach, in a manner somewhat similar to perspiration from the skin. This gastric juice is of an acid character, and immediately curdles the milk; for it combines with the soda holding the casein in solution, and immediately the curd is separated. Thus we have the same change immediately produced which we observe in milk which has been kept for a long period and allowed to become sour. This curdling of the milk is rapidly followed by a decomposition of its several parts, which pass into the blood and nourish the system.

Thus the internal organism of the calf points to the use of milk *alone* for the early period of its life, and a careful observation of the most successful practice tends to confirm this opinion. For the same reason we may also learn another lesson from the natural habits of the animal—that the supplies of food should rather be moderate and frequent, than larger in quantity after longer intervals. In this respect there is a great difference in the general practice of feeding the calf which is separated from the cow, as compared with others which are not taken away. We find that calves which run with the cow thrive better than others, because they can draw their supplies of milk frequently and in small quantities—in fact, at such times as they feel the want. The stomach of the calf is small, and when the process of digestion is vigorous, the food which it can contain is soon used for the support of the system, and consequently a period of want often intervenes before the fresh supplies are received. This does not arise when the calf has a freedom of access to the cow, for immediately the desire for food commences it can get a further supply. No doubt it may be questioned whether this is an economical method, and one desirable for general adoption; but there are cases which render such a course absolutely essential to success, and I believe in many other cases the question of economy is too often viewed under the contracted aspect of present cost rather than future return.

In rearing a calf there is one object to be kept steadily in view, and that is, to promote the development of the body as much as possible. In the calf which is to be fattened and killed no one will dispute it, and I believe it will be equally important in the case of those which are to be reared for beef, but it is still more important in rearing breeding stock. From the period of birth this development should be progressive, not interrupted by checks from poor and insufficient food, to be followed by better allowance for a time, and thus only alternating its progress and relapse. When high-bred stock are to be reared, a very different system from this is adopted. In fact, if it were not so, they would rapidly degenerate. In rearing these calves, they follow the natural course of allowing the calf to run with its dam, or else let it have frequent access to her, whilst at the same time she is fed with oil-cake to give richness to the milk. This is the system which is most calculated to produce the best results. The use of artificial food for the calf is carefully avoided in its early stage, but when it is desirable to force the young animal into a more rapid growth, the supplies of artificial food may be given through the medium of the cow. In this manner similar benefits will result, without any prejudicial influence upon the stomach of the calf.

We now come to consider how far such a system is economical or otherwise, and my own impression is, that a liberal system of feeding is always desirable, and that it is not as extravagant a plan as it is frequently thought to be. The object must be kept steadily in view. If *milk and butter* are to be the marketable articles, they are to have the preference, by all means let everything else yield. If, however, the object is to produce *good stock*, then the butter must yield the supremacy, and the stock take the lead. Many, however, do not like this, and want to have the supplies of butter and good stock as well. But this cannot be. They are antagonistic claimants, and one or the other must be placed in the rear. On many farms a preference will be given to the butter, but every one should clearly keep in view the main object he is aiming at, and let him not for a moment believe that he is going to sell his full quantity of butter, and yet have his stock improved, unless he adopts a judicious and liberal system of feeding.

Few who have not especially noticed this point will be disposed to credit the real difference in value between two calves (say eight or ten weeks old) reared under the different plans referred to. I do not simply refer to their worth as determined by weight, but, if I may use the term, their prospective value. The difference between them is marked as regards their subsequent progress, and some pounds may separate their value when two or three years old, provided both are carried on from their present age upon an equal and liberal system of feeding. We have not simply to look at the weight of veal, but rather to the *kindly disposition* induced in the animal, which always shows itself by a tendency to thrive.

When a farmer is rearing steers for the purpose of producing a certain weight of beef, this tendency to thrive and *lay on flesh* is valuable; and during the whole course of life this ultimate object will be most economically promoted by a liberal system of feeding; not variable, and must produce checks, but regular and progressive. In fact, such an animal should never be stationary, for not only is the animal at such a time producing no profitable return, but it is actually decreasing in value.

It is, I believe, not only of equal, but of even greater importance in the case of those animals which are reared for breeding purposes. These are to be viewed as the *parents* of others, and thereby good or bad qualities become multiplied. If it is objectionable in the case of animals intended for the butcher, it is important in a far higher degree for those which are *to produce them*, and which are to give them a conformation and tendency favourable to this end. The law of like producing like is of very general application, and we must not expect a cow, without any tendency to fatten, to convey to her offspring a disposition she does not possess. I am well aware that the character of the bull will have influence here, but it will be favoured or checked by the qualities of the dam. We must not consider that because the primary object in rearing cattle for breeding purposes is not simply for the production of beef, that therefore this may be altogether disregarded.

If we seek the best method of rearing a calf, we cannot do better than follow the course pointed out by nature, and allow it to suck its dam, either having frequent opportunities or access to her, or else freedom to run with her. If the calf is intended for veal, it will be preferable to keep some restraint upon the freedom of the calf, but if it is to be reared for stock, moderate exercise will be beneficial. Many calves are kept in small cribs, about four feet square, each being furnished with a little trough, so as to induce the calf to learn to eat artificial food and hay. In other cases each calf is fastened by a strap and a small halter, so as to prevent its running about. The former plan is undoubtedly a good one, if the calf is separated from its dam, because it allows of a freedom of exercise, but the supplies of food for the first three or four weeks are objectionable. It is better to give the cow extra food if the calf is not making sufficient progress, and it will be ample time after the third or fourth week, for the calf to commence the use of solid food. Fastening the calf by a strap, and keeping it in the dark, may be desirable for a fattening calf, but would not be adopted for store stock. When the calves are six weeks old, they should have a larger space for exercise, and several may be allowed to run together with advantage.

When the calf is intended to run with its dam, both should have shelter during inclement weather, and the cow should have her surplus milk drawn at regular intervals. When a calf of choice character and breed is to be reared, it has been recommended that, should the milk of the cow prove deficient—as is too often the case with cattle which are very high bred—that the calf be suckled by another milch cow possessing better milking character. This would, of course, be seldom done except with valuable stock, but in such a case it is desirable, and the benefit will soon be observable in the progress of the calf.

When the period has arrived for allowing the calf to get accustomed to solid food, I should commence by giving it some finely cut pieces of turnips, mangolds, carrots, &c., which, from their soft and juicy nature, are preferable to any other drier food. This may be accompanied by small supplies of the best portions of the hay, which may be gradually increased as the calf gets older, but the supply of milk should be continued as before. A small allowance of meal may be advantageously spread over the cut roots. In weaning the calf it is desirable to bring the three meals into two, and after a short time, gradually decrease the new milk in quantity. This should not be done too rapidly, for a *sudden* substitution of skimmed milk for new milk generally produces a large-boned calf, with a coarseness of habit ill adapted for ultimately producing a good feeding bullock.

We have already noticed the composition of milk, and therefore we know what the calf receives, and also what is withheld. It is clear that the system cannot add to its growth any matter which it does not receive, whilst that alone which is presented to it in its food is capable of being used in promoting the growth of its body. In giving milk deprived of its butter, we supply saline matter, which forms the skeleton, and the cheesy matter from which the muscles are formed, but we have removed the oily portion which was destined to form the fat and fatty membranes of the body. Thus the growth of the skeleton and muscles is continued, but these muscles are not furnished with those fatty membranes in which the fat is stored, and which give to the skin of the animal that sure indication of a disposition to fatten which we know as "*the touch.*" It only needs a careful observation of the calves thus reared to convince any unprejudiced mind that there is no economy in the saving thus effected. Substitutes are frequently employed, and undoubtedly lessen the bad effects; but when the primary object is to produce a superior class of stock, it will be desirable for the calves to have a liberal supply of new milk for at least two months. Linseed is very valuable as an assistant or substitute. Linseed gruel and Irish moss are also very good for this purpose. These substitutes, as more particularly stated (page 325), are very often employed, especially the mixture of linseed and bean-meal with molasses. The Irish moss is extensively used in some districts, and with successful results.*

The time of weaning must depend in some measure upon the season of the year when the calves are born. As far as possible they should be ready to wean in the month of May, and if they have been carefully managed for three or four months previously, they will be quite ready for weaning. The calves which may have been born in the preceding November or December will have made much more progress, and will also make more rapid growth during the ensuing season, for this advance, before going upon grass. The calf should be gradually accustomed to the use of green meat, and some early vetches, rye, clover, &c., will not only be an agreeable change with its regular supplies of food—cut roots and hay—but it will prepare the stomach for the more juicy food on which it is about to be put.

When the herbage has made good progress, and the weather become mild, the calves will be ready for going out. At first they should be put upon young seeds, and allowed to remain rather longer each day. It will be better for them to be sheltered at night for a month or six weeks, as the coldness may cause a very undesirable check. In fact, the calves would be better if they had the means of taking shelter through the first summer, for excessive heat and cold are alike to be avoided. An occasional change of herbage, with a free supply of water, will be the chief points to be attended to through the first summer. The calves should take the precedence of older stock, and the latter should finish the fields after the calves are taken away. If the supply of grass is abundant and good, this will be sufficient for them during the first summer.

If it should be wished to push forward the calf to an unusual degree, and it has up to this time been sucking the cow, both may be turned out into good grass, and the aid of the cow will be very evident in the growth of the calf. This, however, is only to be done in extraordinary cases; for, provided the calves have been brought forward well and prepared

* These substances are, perhaps, as good as any for making gruel for calves. Some, however, consider that giving substitutes for milk in this form encourages acidity in the stomach and scouring. Calves soon learn to eat fresh linseed cake in a dry state, and no other article is so easily digested, and so well fitted to promote health and growth.—Ed.

for turning out as directed, a good supply of grass will enable them to make sufficient progress for all general purposes.

Such, then, I conceive to be the proper management of the calf, from the period of its birth until, as a yearling, it is brought to the homestead for a further course of treatment. A system is thus adopted which leads to a constant and progressive development of all parts of the body, whilst the healthy discharge of the functions of life is carefully provided for. But it frequently happens that we have a neglectful system pursued, and the result is, that we have diseases peculiar to this age, which need special notice, not only because they urgently press upon us the importance of prevention—which is always better than the cure—but also to remind those who have taken a false course how to correct the ills which have arisen therefrom.

The earliest disease from which calves suffer most commonly is *Costiveness.* Many of these cases arise from the prejudice on the minds of some persons against using the first milk which the cow produces. This is much denser and deeper coloured than ordinary milk, and is valuable as a purgative to the newly-born calf, being the safest and most effectual agent which can be employed. Many, from a mistaken prejudice, have this milk drawn from the cow and thrown away. The consequence is, the calf loses this natural medicine, a costiveness ensues, which is very often obstinate in its nature and difficult to overcome. At other times it is caused by dry food, such as hay, passing into the stomach of the young animal before it is ready to receive it. In these cases I should give 2 or 3 ounces of castor-oil, or else 2 or 3 ounces of Epsom salts, and half drachm of powder ginger.

Navel-ill is referable, in the majority of cases, to oversight and neglect at the time of birth. Bleeding is often suffered to continue, and drain the calf's strength, whilst a careful ligature of twine would have prevented the loss.

Inflammation of the Stomach is also another result of careless management, generally arising from the calf being allowed to *drink its milk greedily* and rapidly, instead of sucking it gently. The result is, that the milk is swallowed more rapidly than the stomach can receive it, and hence is forced into the rumen. Here it becomes sour and curdles; the cheesy matter remains, irritating the coat of the stomach, and finally producing inflammation. This is the cause of death in a large number of calves, and little can be done except by prevention. A dose of Epsom salts may relieve the inflammation, especially if given when the appetite first falls off. It is generally accompanied with grating of the teeth.

Scouring may be produced by several means: a sudden change of keep, and the use of indigestible food, are the more frequent causes. The former should always be carefully guarded against, but the cause will generally suggest the remedy. If they are removed to food of more solid character, it will probably cease, but care must be taken not to allow the bowels to become too costive. Should the change of food not prove effectual, some of the cordial named below will be found useful.

When the diarrhœa arises from indigestible food remaining in the stomach and causing an irritation of the membranes, it is evident that some medicine must be given to remove the offending matter, such as castor-oil or Epsom salts and ginger already named; this may be followed by the use of a cordial or astringent mixture, consisting of—catechu, 1 ounce; spirits of wine, 1 ounce; laudanum, 1 ounce; water, 1 pint—in doses from 1 to 2 ounces twice daily.

[TO BE CONTINUED.]

General View of the Functions of the Nutritive Organs of Plants.

In order that plants may be nourished, food is required. This food, in a crude state, enters the roots by a process of *absorption* or *imbibition;* it is then transmitted from one part of the plant to another, by means of *the circulation* or *progressive movement of the sap;* it reaches the leaves and is there submitted to the action of light and air, which constitutes the function of *respiration;* and thus the fluids are finally fitted for the process of *assimilation*, and form various vegetable *products* and *secretions.*

1. Food of Pants, and Sources whence they Derive their Nourishment.—Chemical Composition of Plants.

The nutriment of plants can only be ascertained when their chemical composition has been determined. The physiologist and chemist must unite in this inquiry in order to arrive at satisfactory conclusions. Much has been done of late by Liebig, Mülder, Dumas, Boussingault, and other chemists, to aid the botanist in his investigations, and to place physiological science on a sound and firm basis. It is true that many processes take place in plants which cannot as yet be explained by the chemist, and to these the name of *vital* has been applied. This term, however, must be considered as implying nothing more than that the function so called occurs in living bodies, and in the present state of our knowledge is not reducible to ordinary chemical or physical laws. A greater advance in science may clear up many difficulties in regard to some of the vital functions, while others may ever remain obscure.

Plants are composed of certain *chemical elements*, which are necessary for their growth. These are combined in various ways, so as to form what have been called *organic* and *inorganic* compounds. The former are composed of carbon, oxygen, hydrogen, and nitrogen or azote, with a certain proportion of sulphur and phosphorus; while the latter consists of various metalic bases, combined with oxygen, metalloids and acids. In all plants there is a greater or less proportion of water, the quantity of which is ascertained by drying at a temperature a little above that of boiling water. By burning the dried plant the organic constituents disappear, and the inorganic part or the ash is left. The relative proportion of these constituents varies in different species, as seen in the following table by Solly, in which the proportions are given in 10,000 parts of the fresh plants:

	Water.	Organic matter.	Inorganic.
Potato,........	7713	2173	114
Turnip,.......	9308	588	104
Sea Kale,. ...	9238	705	57
French Beans,.	9317	619	64
Red Beet,.....	8501	1390	109
Asparagus. ...	9210	735	55
Water Cress,..	9260	633	107
S[illegible]ll,.......	9207	702	91
Parsley, ...	8430	1299	271
Fennel,.......	8761	1048	191
Salsafy,.......	7951	1929	120
Mustard,......	9462	436	102

The analysis of 100 parts of Fruits gives the following results:

	Water.	Organic.	Inorganic.
Strawberry, ..	90.22	9.37	0.41
Green Gaze whole fruit,	83.77	15.83	0.40
Cherry, do	82.48	17.09	0.43
Pear, do	83.55	16.04	0.41
Apple, do	84.01	15.72	0.27
Goosberry, ...	90.26	9.35	0.39

The following table, by Johnston, represents the constitution in 1000 parts of plants and seeds, taken in the state in which they are given to cattle, or laid up for preservation, and dried at 230° Fahrenheit; the organic matter being indicated by the carbon, oxygen, hydrogen, and nitrogen; the inorganic by the ash:—

	Wheat.	Oats.	Peas.	Hay.	Turnips	Potatoes.
Carbon,....	455	507	465	458	429	441
Hydrogen..	57	64	61	50	56	58
Oxygen ...	430	367	401	387	422	439
Nitrogen,..	35	22	42	15	17	12
Ash,......	23	40	31	90	76	50

By the process of drying, the 1000 parts of these substances lost water in the following proportions:

Wheat,	166	Peas,	86	Turnips,	925
Oats,	151	Hay,	158	Potatoes,	722

As plants have no power of locomotion, it follows that their food must be universally distributed. The atmosphere and the soil accordingly contain all the materials requisite for their nutrition. These materials must be supplied either in a gaseous or fluid form, and hence the necessity for the various changes which are constantly going on in the soil, and which are aided by the efforts of man. Plants are capable of deriving all their nourishment from the mineral kingdom. The first created plants in all probability did so, but in the present day the decaying remains of other plants and of animals are also concerned in the support of vegetation.

Organic constituents and their sources.

Carbon (C) is the most abundant element in plants. It forms from 40 to 50 per cent. of all the plants usually cultivated for food. When plants are charred the carbon is left, and as it enters into all the tissues, although the weight of the plants is diminished by the process, their form still remains. When converted into coal, (a form of carbon,) plants are frequently so much altered by pressure as to lose their structure, but occasionally it can be detected under the microscope. Carbon is insoluble, and, therefore, cannot be absorbed in its uncombined state. When united to oxygen, however, in the form of carbonic acid, it is readily taken up either in its gaseous state by the leaves, or in combination with water by the roots. The soil contains carbon (*humus*) and in some soils, as those of a peaty nature, it exists in very large quantity. The carbon in the soil is is converted into carbonic acid in order to be made available for the purpose of plant-growth. Carbon has the power of absorbing gases, and in this way by enabling certain combinations to go on, it assists in the nourishment of plants. In the atmosphere, carbonic acid is always present, averaging about 1-2000 part, arising from the respiration of man and animals, combustion and other processes.

Oxygen (O) is another element of plants. Air contains about 21 per cent. of it. Every nine pounds of water contain eight of oxygen, and it is combined with various elements, so as to form a great part of the solid rocks of the globe, as well as of the bodies of animals and man.

It is chiefly in this state of combination with Hydrogen, (H,) so as to form water (HO,) that oxygen is taken up by plants. Hydrogen is not found in a free state in nature, and with the exception of coal, it does not enter into the composition of the mineral masses of the globe. It forms 1-9th of the weight of water, and it is present in the atmosphere in combination with nitrogen. Hydrogen is also furnished by sulphuretted hydrogen and some compounds of carbon.

Nitrogen (N) is another element of plants. It forms 79 per cent. of the atmosphere, and abounds in animal tissues. The latter, during their decay, give off nitrogen, combined with hydrogen, in the form of ammonia (NH^3,) which is absorbed in large quantities by carbon, is very soluble in water, and seems to be the chief source whence plants derive nitrogen. In tropical countries where thunder storms are frequent, the nitrogen and oxygen of the air are sometimes made to combine, so as to produce nitric acid, (NO^5,) which, either in this state or in combination with alkaline matters, furnishes a supply of nitrogen. Daubeny thinks that the ammonia and carbonic acid in the atmosphere are derived in part from volcanic actions going on in the interior of the globe. The continued fertility of the Terra del Lavoro, and other parts of Italy, is attributed by him to the disengagement of ammoniacal salts and carbonic acid by volcanic processes going on underneath; and to the same source he traces the abundance of gluten in the crops, as evidenced by the excellence of Italian macaroni.

Mülder maintains that the ammonia is not carried down from the atmosphere, but is produced in the soil by the combination between the nitrogen of the air, and the hydrogen of decomposing matters. The same thing takes place, as in natural saltpetre caverns of Ceylon, with this exception, that, by the subsequent action of oxygen, ulmic, humic, geic, apocrenic, and crenic acids, are found in place of nitric acid. These acids consist of carbon, oxygen, and hydrogen, in different proportions, and they form soluble salts with ammonia. By all porous substances like the soil, ammonia is produced, provided they are moist, and filled with atmospheric air, and are exposed to a certain temperature. It is thus, he states, that moist charcoal and humus become impregnated with ammonia.

These four elementary bodies then are supplied to plants, chiefly in the form of carbonic acid (CO^2), water (HO), and ammonia (NH^3). In these states of combination they exist in the atmosphere, and hence some plants can live suspended in the air, without any attachment to the soil. When a volcanic or a coral island appears above the waters of the ocean, the lichens which are developed on it are nourished in a great measure by the atmosphere, although they subsequently derive inorganic matter from the rocks, to which they are attached. Air plants, as Bromelais, Tillandsais, and Orchidaccæ, and many species of Ficus, can grow for a long time in the air. In the Botanic Garden of Edinburgh, a specimen of Ficus australis has lived in this condition for upwards of twenty years, receiving no supply of nourishment except that afforded by the atmosphere and common rain water, containing of course, a certain quantity of inorganic matter. The following analysis was made of the leaves of this plant, in 1847, by my pupil Mr. John Macadam:

	Organic in 100 parts.	Inorganic in 100 parts
Petiole of former years growth, including midrib, . . .	82.98	17.02
Three leaves of former years growth, . .	86.24	13.76
Petiole of present years growth, including midrib, . . .	92.65	7.35
Seven leaves of present years growth, . .	92.28	7.72

All were dried at 212° Fahrenheit.

In the experimental garden of Edinburgh Mr. James McNab has cultivated various plants, as Strelitzia augusta, Currants, Gooseberries, &c., without any addition of soil, and simply suspended in the air, with a supply of water kept up by the capillary action of a worsted thread. Some of the plants have flowered and ripened fruit. These experiments show that the atmosphere and rain water contain all the ingredients requisite for the life of some plants. Boussingault, from observations made on the cultivation of Trefoil, was led to the conclusion, that under the influence of air and water, in a soil absolutely devoid of organic matter, some plants acquire all the organic elements requisite for growth. Messrs. Wiegman and Polstorf took fire quartz sand, burnt it to destroy any organic matter, digested it for sixteen hours in strong nitro-muriatic acid, and then washed it with distilled water. Various kinds of seeds, as barley, oats, vetch, clover and tobacco were then sown in it, and watered with distilled water and all grew more or less.

The elementary bodies already mentioned, in various states of combination, constitute the great bulk of plants. They occur in the form of binary compounds, as water and oily matters; ternary, as starch, gum, sugar and cellulose; quaternary, as gluten, albumen, casein and fibrine. The latter compounds seem to require for their composition, not merely the elements already noticed, in the form of a basis, called Proteine, (C^{40}, H^{31}, N^5, O^{12}, according to Mülder, or C^{48}, H^{36}, N^6, O^{14}, according to Liebig), but certain proportions of sulphur and phosphorus in addition; thus albumen = 10 Pr. + 1 P. + 1 S.; fibrine = 10 Pr. + 1 P. + 2 S.; caseine = 10 Pr. + 2 S. The tissues into the composition of which these proteine compounds enter, are tinged of a deep orange-yellow, by strong nitric acid. These compounds are highly important in an agricultural point of view, and the consideration of them will be resumed when treating of the application of manures.

INORGANIC CONSTITUENTS, AND THEIR SOURCES.

The consideration of the inorganic constituents of plants is no less important than the study of their organic elements. The organic substances formed by plants are decomposed by a moduality high temperature; they easily undergo putrefaction, especially when exposed to a moist and warm atmosphere, and they have not been formed by human art. Their inorganic constituents, on the other hand, are not so easily decomposed; they do not undergo putrefaction, and they have been formed artificially by the chemist.

The combustible or organic part of plants, even in a dried state, forms from 88 to 89 per cent. of their whole weight. Consequently the ash or inorganic matter frequently constitutes a very small proportion of the vegetable tissue. It is not, however, on this account to be neglected, for it is found to be of great importance in the economy of vegetation, not merely on account of its entering directly into the constitution of various organs, but also from assisting in the production of certain organic compounds. Some of the lower tubes of cellular plants can exist apparently without any organic matter. Thus Mülder could not detect a particle of ash in Mycoderma vini, nor in moulds produced in large quantity by milk sugar. Deficiency of inorganic matters, however, in general injures the vigor of plants, and it will be found that, in an agricultural point of view, they require particular attention—a distinct relation subsisting between the kind and quality of the crop. and the nature and chemical composition of the soil in which it grows. It has been shown by careful and repeated experiments that, when a plant is healthy and fairly ripens its seeds, the quantity and quality of the ash is nearly the same in whatever soil it is grown; and that, when two different species are grown in the same soil, the quantity and quality of the ash varies—the difference being greater the more remote the natural affinities of the plants are.

The inorganic elements of plants and their combinations, are thus given by Johnston:—

Chlorine, (Cl.)	Combined with	Metals	forming	Chlorides.
Iodine, (I.)	" "	Metals	"	Iodides.
Bromine, (Br.)	" "	Metals	"	Bromides.
Sulphur, (S)	" "	Metals	"	Sulphurets.
	" "	Hydrogen		Sulphuretted Hydrogen or Hydro. Sulphuric acid.
	" "	Oxygen	"	Sulphuric acid.
Phosphorus, (P.)	" "	Oxygen	"	Phosphoric acid.
Potassium, (K.)	" "	Oxygen	"	Potassa.
	" "	Chlorine	"	Chloride of Potassium.
Sodium, (Na.)	" "	Oxygen	"	Soda.
	" "	Chlorine	"	Chloride of Sodium, (common salt.)

Calcium, (Ca.)	combined with	Oxygen	forming	Lime.
		Chlorine	"	Chloride of Calcium.
Magnesium, (Mg.)	" "	Oxygen	"	Magnesia.
Aluminum, (Al.)	" "	Oxygen	"	Alumina.
Silica, (Si.)	" "	Oxygen	"	Silica.
Iron, (Fe.) Manganese, (Mn.) Copper, (Cu.)	" "	Oxygen Sulphur	" "	Oxides and Sulphurets.

The quantity of inorganic matter or ash left by plants, varies in different species, and in different parts of the same plant. The dried leaves usually contain a large quantity. Saussure found that—

Dried bark of Oak gave	60	of ash in	1,000
Dried leaves,	50	..	..
Dried Alburnum,	4	..	..
Dried duramen,	2	..	..

The dried leaves of Elm contain more than 11 per cent. of inorganic matter, while the wood contains less than 2 per cent.; the leaves of the Willow 8 per cent., wood 0.45; leaves of Beech 6.69, wood 0.36; leaves of Pitch-pine 3.5, wood 0.25. Thus the decaying leaves of trees restore a large quantity of inorganic matter to the soil.

The following tables show the relative proportion of inorganic compounds present in the ash of plants:—

According to Sprengal, 1,000 lbs. of wheat leave 11.77 lbs., and of wheat straw 35.18 lbs. of ash, consisting of:—

	Grain.	Straw.
Potash	2.25	0.20
Soda	2.40	0.29
Lime	0.96	2.40
Magnesia	0.90	0.32
Alumina with trace of iron	0.26	0.90
Silica	4.00	28.70
Sulphuric acid	0.50	0.37
Phosphoric acid	0.40	1.70
Chlorine	0.10	0.30
	11.77 lbs.	35.18 lbs

In 1,000 lbs. of the grain of the Oat, are contained 25.80 lbs., and of the dry straw 57.40 lbs. of inorganic matter, consisting of:—

	Grain.	Straw.
Potash	1.50	8.70
Soda	1.32	0.02
Lime	0.86	1.52
Magnesia,	0.67	0.22
Alumina	0.14	0.06
Oxide of Iron	0.40	0.02
Oxide of Manganese	0.00	0.02
Silica	19.76	45.88
Sulphuric acid	0.35	0.79
Phosphoric acid	0.70	0.12
Chlorine	0.10	0.05
	25.80 lbs.	57.40 lbs.

In 1000 lbs. of field Bean, field Pea, and Rye-grass Hay, after being dried in the air, the following is the amount of ash, and its composition:—

	FIELD BEAN		FIELD PEA.		RYE-GRASS
	Seed.	*Straw.*	*Seed.*	*Straw.*	*Hay.*
Potash,	4.15	16.56	8.10	2.35	8.81
Soda,	8.16	0.50	7.39	——	3.94
Lime,	1.65	6.24	0.58	27.30	7.34
Magnesia,	1.58	2.09	1.36	3.42	0.90
Alumina,	0.34	0.10	0.20	0.60	0.31
Oxide of Iron,	——	0.07	0.10	0.20	——
Oxide of Manganese,	——	0.05	——	0.07	——
Silica,	1.26	2.20	4.10	9.96	27.72
Sulphuric acid,	0.89	0.34	0.53	3.37	3.53
Phosphoric acid,	2.92	2.26	1.90	2.40	0.25
Chlorine,	0.41	0.80	0.38	0.04	0.06
	21.36	31.21	24.64	49.71	52.86

Dr. R. D. Thomson gives the following analysis of the inorganic matter in the stem and seeds of Lolium perenne:—

	Stem.	*Seed.*
Silica,	64.57	42.28
Phosphoric acid,	12.51	18.89
Sulphuric acid,	——	3.12
Chlorine,	——	trace.
Carbonic acid,	——	3.61
Magnesia,	4.01	5.31
Lime,	6.50	18.55
Peroxide of Iron,	0.36	2.10
Potash,	8.03	4.80
Soda,	2.17	1.38

These substances are variously combined

in plants, in the form of sulphates, phosphates, silicates and chlorides. Some plants, as Wheat, Oats, Barley, and Rye, contain a large quantity of Silica in their straw; others, such as Tobacco, Pea-straw, Meadow-clover, Potato-haulm, and Sainfoin, contain much lime; while Turnips, Beet-root, Potatoes, Jerusalem-artichoke, and Maize-straw, have a large proportion of salts of potash and soda in their composition. Sulphates and Phosphates are required to supply part of the material necessary for the composition of the nutritive proteine compounds found in grain.

Silica abounds in Grasses, in Equisetum, and other plants, giving firmness to their stems. The quantity contained in the Bamboo is very large, and it is occasionally found in the joints in the form of Tabasheer. Reeds, from the quantity of silicious matter they contain, are said, during hurricanes in warm climates, to have actually caused conflagrations in striking against each other. In the species of Equisetum, the silica in the ash is as follows:—

	Ash.	*Silica.*
Equisetum arvense,...	13.84	6.38
——— limosum,.	15.50	6.50
——— hyemale,....	11.81	8.75
——— Telmateia,	23.61	12.00

The third of these furnishes Dutch Rush, used for polishing mahogany. The silica is deposited in a regular manner, forming an integral part of the structure of the plant. Many insoluble matters, as silica, seem to be deposited in cells by a process of decomposition. Thus, silicate of potash in a vegetable sap may be mixed with oxalic acid, by which oxalate of potash, and silicic acid will be produced, as in the cells of Grasses and Equisetum. Chara translucens has a covering of silicic acid, while C. vulgaris has one composed of silicic acid and carbonate of lime; and Chara hispida has a covering of carbonate of lime alone.

Lime is found in all plants, and in some it exists in large quantity. It occurs sometimes in the form of carbonate on the surface of plants. Thus, many of t e Characeæ have a calcareous encrustation. The crystals or raphides found in the cells of plants, have lime in their composition.

Soda and Potash occur abundantly in plants. Those growing near the sea have a large proportion of soda in their composition, while those growing inland contain potash. Various species of Salsola, Salicornia, Halimocnemum, and Kochia, yield soda for commercial purposes, and are called Halophytes (*als*, salt, and *phuton*, plant, Gr.). The young plants, according to Göbel, furnish more soda than the old ones. There are certain species, as Armeria maritima, Cochlearia officinalis, and Plantago maritima, which are found both on the sea-shore and high on the mountains, removed from the sea. In the former situation they contain much soda and some iodine; while in the latter, according to Dr. Dickie, potash prevails, and iodine disappears.

Iron, Manganese, and Copper, especially the two last, exist in small quantity in plants. Copper was detected, by Sarzean, in coffee.

All these inorganic matters are derived in a state of solution from the soil, and plants are said to have, as it were, a power of selection, certain matters being taken up by their roots in preference to others. Saussure made a series of experiments on this subject, and stated that when the roots of plants were put into solutions containing various saline matters in equal proportions, some substances were taken up by imbibition in larger proportion than others. Bouchardat doubts the accuracy of Saussure's conclusions on this point. He thinks that errors arose from the excretions of the plants and other causes. He performed similar experiments with plants of Mint, which had been growing for six months in water previous to experiment, and he found that in cases of mixed salts in water, the plant absorbed all in equal proportions. Daubeny states, that if a particular salt is not present, the plant frequently takes up an isomorphous one.

The differences in the absorption of solutions depend, perhaps, on the relative densities alone, and not on any peculiar selecting power in roots, for it is well known that poisonous matters are absorbed as well as those which are wholesome. The following experiments show that poisonous matters in solutions, varying from half a grain to five grains to the ounce of water, are taken up by roots, and that some substances which are poisonous to animals do not appear to act energetically upon plants:—

		Growing Plants.	
Chloride of zinc,	on	beans,	quickly destroyed.
Sulphate of zinc,	...	cabbages, and wheat,	
Sulphate of copper,	...	beans,	
Nitrate of copper,	...	beans,	
Acetate of copper,	...	cabbages,	
Bichloride of mercury,	...	beans, wheat, cabbages,	
Arsenious acid,	...	cabbages and wheat,	weak solutions did not destroy.
Arseniate of potash,	...	barley and cabbages,	
Acetate of lead,	...	beans,	destroyed in a few days.
Bichromate of potash,	...	cabbages, beans, barley,	destroyed unless much diluted.
Nitrate & sulphate of iron,	...	beans,	destroyed in a few days.
Chloride of barium,	...	beans,	quickly destroyed.
Nitrate of baryta,	...	cabbages and wheat,	
Nitrate of strontia,	...	beans,	plants uninjured except solution strong.
Muriate, sulphate, and nitrate of lime,	...	beans,	improved when very diluted.
Sulphate and muriate of magnesia,	...	beans and cabbages,	injured, and if strong destroyed.
Phosphate of soda,	...	beans and cabbages,	no injury when diluted.
Chloride of sodium,	...	beans and cabbages,	

Rotation of Crops.—As the inorganic materials which enter into the composition of plants vary much in their nature and relative proportions, it is evident that a soil may contain those necessary for the growth of certain species, while it may be deficient in those required by others. It is on this principle that the rotation of crops proceeds; those plants succeeding each other in rotation which require different inorganic compounds for their growth. In ordinary cases, except in the case of very fertile virgin soil, a crop, by being constantly grown in successive years on the same field, will deteriorate in a marked degree. Dr. Daubeny has put this to the test of experiment, by causing plants to grow on the same and different plots in successive years, and noting the results:—

		Average of 5 years
Potatoes,	in the same plot....	72.9 lbs. tubers.
	in different plots...	92.8 — —
Flax,	same.............	15.0 lbs.
	different..........	19.9
Beans,	same	32.8
	different...........	34.8
Barley,	same.............	30.0
	different..........	46.5
Turnips,	same.............	104.0
	different	173.0
Oats,	same	28.0
	different...........	32.4

This shows a manifest advantage in shifting crops, varying from 1 to 75 per cent.; the deficiency of inorganic matter being the chief cause of difference. As this matter is shown to be of great importance to plants, it follows that the composition of soil is a subject requiring special notice.—*Balfour's Botany.*

From the New England Farmer.

Twaddles and Waddles on Agricultural Education.

Twaddles.—I meant to have spoken to you the other day, Mr. Waddles, in our conversation on general agriculture, upon the subject of agricultural education, as it is one which interests me much, but time did not permit. You must know that there is much controversy at present upon this matter, and encouragement is given by some of our first men to introduce agriculture, as a department of education, into our common schools, with the prospective view of establishing an agricultural college in this State, something like those in Europe, which are in so successful operation. You must also know, Mr. Waddles, that such education is much needed, especially by the rising generation.

Waddles.—Yes, sir, I know there is much discussion upon this subject, but I question whether such facilities are as much needed as the education; and I am far from thinking that European farming, with all its objectionable appurtenances, is proper for us to adopt. It would require a thorough revolution of all our laws and customs which would be a great detriment to the real happiness of the people, and more particularly to the small, independent farmer

T.—That I think is not proposed. But you must admit that farmers should be educated for their business.

W.—Certainly; and has not every man the best means for such education, who has a farm to till, books and papers to read, and lectures to listen to? who gets his theories from his own reflection, the experience and suggestions of others, and tests them in the general course of his operations on his own land?

T.—Why, Mr. Waddles, I suppose not; he wants it taught to him. And do you not know that agriculture in America has fallen behind the age, and that the only way to bring it up to par value and dignity is to educate, thoroughly educate, all who intend to engage in it?

W.—No, Mr. Twaddles, I respectfully deny that agriculture has fallen behind the age, although in this State it may be necessarily passing out. But if our journals, books, fairs and lectures have not kept it up, pray what can? Have all these, which have been thought so useful, been in vain? And as to the means of education, a farmer is perpetually at school, conning his great volume, and studying the special capabilities of his own farm, and consequently is, or can be, as well educated for his business as others of different vocations are for theirs. Farmers are not so ignorant of their calling as many soft-handed scholars suppose them to be, though they may be hampered for want of means. As to the dignity of farming, the easy, professional man has always looked down upon the hard laboring man in all vocations. It is a whim of society, and no schooling or colleges can regulate it, any more than they can make the sky rain potatoes. Take England, with her numerous agricultural schools for the poor, which are proposed partly to be copied, and do we not find the mass of the farm laborers only little above slaves, both in morals and intellect? So fully did Mr. Colman notice this fact, that his Reports may be regarded as Books of Lamentations. And I think you will not deny that they are considered infinitely more degraded than those here, where we have no such schools or colleges, of any influence, to dignify them.

T.—Well, freely I admit it and regret it. But you forget the tenant farmer. He is generally an intelligent, well-educated person; is thought—

W.—Well of, I suppose, because he superintends on his pony, and doesn't do what the more aristocratic class regard as drudgery. Excuse me, but I suppose you don't intend to make tenant farmers here because they only are respectable there.

T.—No, sir: that would be folly; for here our land-owners are too numerous, and large tracts of land in one man's possession too uncommon.

W.—Certainly; let this whim of dignity take care of itself, as it must; the less farmers think and say of it the better. In spite, however, of the schools, the man who lives at his ease will always be distinguished from the thousands whose necessities oblige them to labor. Upon this subject a philosophical discourse might be written.

T.—Or a sermon preached.

W.—Yes; and this reminds me that you are a clergyman.

T.—True; but I once worked on a farm.

W.—And feel an interest in the education of the laboring classes, and particularly the farmer, though you from some cause or other left his honorable vocation.

T.—I left for education, but my sympathies are with him.

W.—You ought to have returned with both. And you and others say, virtually, that he is ignorant and degraded, raises meaner crops than they do in England, and don't understand his business, as you unfairly suppose from this latter fact, that there is no uniformity or system in agriculture, and that in this land of freedom each one does as he pleases on his own soil.

T.—Why, yes; I suppose I must make a general plea of guilty.

W.—Now, suppose your agricultural parishioners should politely say to you, through some "Resolutions," that your theology is very feeble, uncanonical stuff, that you don't preach as satisfactorily as others do, that you have some crude notions of your own, that you preach upon an indefinite system, if upon any, that you learned nothing useful at college, and that you don't understand your business. Would you not consider it in them (even whose servant you are) the concentration of impudence?

T.—Most certainly I should; for I think I understand *my* business.

W.—Think! Is not that presumption? Do you *know* that you understand your business, and that they are ignorant of theirs?

T.—But, Mr. Waddles, they don't understand theology.

W.—Haven't you taught them? Do you understand agriculture? Pray, is theology, with its thousand phases, better understood, and more definite than agriculture? Do we know anything more about God than we did a hundred years ago? Cannot the farmer justly say, that religion, so ably represented by a *learned* profession, is behind the age, with as much force as the clergyman can aver that farming is?

T.—But theology is a very dark and abstruse matter, and it is not my fault that there are so many religions extant, represented by equally learned men.

W.—No, sir, it is not. But you regard agriculture as so mysterious a science, that it requires learned men to successfully prosecute it. Upon this system of collegiate education, will not learned farmers be as likely to differ as learned theologians? If I become sick by digging ditches for tile, or by hard labor, or indiscretion, and die, is the learned physician to be told that he don't understand his business? Perhaps he don't. But who can teach him? The best lose patients, just as some good farmers occasionally raise poor crops. Nor because some one cures a certain disease in Europe, while many fail in it here, will it do to charge the American physicians with ignorance. There are a great variety of circumstances to consider. In England, however, generally speaking, the learned profession of medicine has lately been styled "a withered branch of science."

T.—Why, Mr. Waddles, nobody does so charge them.

W.—Perhaps not; but they might with as much consistency, as some farmers are charged.

T.—Ah, but please recollect that it is appointed for all men to die, and medicine is an uncertain science.

W.—So is farming; and it seems also to be foreordained that the elements should sometimes destroy the crops. That is a sprig of *my* theology. Now as to the other *learned* profession, the law. Can any member of this profession innocently charge a farmer with ignorance, seeing defects in his operations, while he himself daily becomes entangled in the proverbial intricacies of his own vocation?

T.—Good. I don't see how a lawyer could.

W.—Well, then, it would seem that agriculture here, without colleges, is still up even with theology, medicine and law—th three learned professions which require suc profound erudition from the schools.

T.—But, Mr. Waddles, you forget tha no vocation is perfect.

W.—No, sir, that's just what I've bee telling you; they are not. Agriculture i imperfect. But with its present literatur I think nothing better for its advancemen than individual tests on the soil, by me having strong common sense, and lovin their business. Farmers may find a prof in splitting rails, but not hairs. The who till the soil for a livelihood cannot sto long to ascertain whether plowing ten inche deep is better than nine, or whether manur buried four inches is more advantageou than that of three. It is enough for the to get their plowing at an ordinary dept and plenty of manure to apply in the ord nary way. Neither is it necessary that the should know the name and history of ever weed that falls under the hoe in their ga dens, or that carbonic acid enters largel into the organization of plants.

T.—But you ought not to overlook che mistry, botany, vegetable physiology, geol gy, &c. Certainly, these sciences ever farmer ought to be conversant with.

W.—That would be a laborious accom plishment; a little tending to the superflu ous and ornamental; and if all those wh live upon the products of the earth we obliged to wait for their food till suc farmers produced it, farming would not b likely to be profitable afterwards, even if few passed through the famine to do th raising!

T.—Strange ideas of education! Wel now tell me frankly, are you not in favor o those sciences I alluded to being taught i our common schools, so that youth, whe they come upon the farm, may know some thing of, and love these studies?

W.—Yes, voluntarily and with discrimi nation. They are now so taught in ou high schools and academies, and in some o our common, district schools, when the pa rents or scholars wish them. You, I know are in favor of teaching children somethin that will be useful to them in after life. S am I, and so is every sensible person. Bu if I do not intend my son to become a fa mer, I do not wish him to spend his time i studying these branches with a view of be coming a farmer, because, forsooth, farmin may be the most important vocation of th

State. And I would not admit that the Board of Agriculture, or the Government, should dictate to me what was best for him to pursue in after life, and educate him accordingly, whatever his, or my wishes. This idea is education become rabid. The common or high school is not the place to learn trades, but merely to get the rudiments of a general (not a special) education.

T.—But I trust you don't regard agriculture as a trade. I look upon it as the most complicated science known.

W.—So it is; unfathomable in mystery; nevertheless it's a trade, the practical operations of which are as easily learned as most any other manual vocation; and it has been well said, that the unscientific farmer can raise as good crops as the ablest chemist. Or it is an art, the thorough understanding of which is of more importance than its scientific aspect. The tilling of the earth being the common and natural business of mankind, (of which all others are the exception,) it would be cruel in the Creator to make the conditions of good crops so complicated as to defeat the purposes of agriculture.

T.—But, Mr. Waddles, I don't see but your system of education would keep every boy at home, or at least, you would have no institutions to teach the professions we have just alluded to; viz.: law, medicine, and theology.

W.—Not at all. If I had a son who wanted to study medicine, (and the Board of Agriculture had no objection,) I would send him to a medical school; for a farm would not be the best place to study this science. And so, also, of law and theology; these studies being necessarily more intellectual, for which a well conducted farm would furnish but few facilities. But if I wanted him to become a farmer, and carried on a good farm myself, I would keep him at home, or put him with some good agriculturist; where, probably, instead of creating a debt of several hundred dollars, he might earn a portion of the sum. And this would be his institution, and a very proper one. If he wished to study this subject at school, fifty cents would furnish him with the proper books. But this should be voluntary on the part of parents and children. The State obviously should not assume to teach agriculture in the common schools any more than any other useful vocation; for instance, that of a builder, machineist, shoemaker, engraver, &c.

T.—Well, sir, if the town schools did all this, would it not be better than spending years in teaching the useless dead languages and the higher mathematics? Besides, what objection can there be to teaching agricultural chemistry, botany, &c., even if they do not give the rudiments of other callings?

W.—The dead languages and the higher mathematics certainly would be useful to some classes of pupils as much as agriculture would be to others. Each should study, as well as practicable, what may be called into requisition in after life, and not what would be unlikely to be. Nothing hardly could be more improper than forcing a complete system of agriculture into our schools, as has been recommended—not only into those of the rural districts, but into those of our large towns and cities, and among children of both sexes—which would not only embrace chemistry, botany and vegetable physiology, but also the "raising of stock!" One gentleman of the Board of Agriculture, (in his undefined zeal to do something for the cause,) gave it as his opinion, that the question, "What was the best *bull*," was very proper to introduce into a promiscuous school of children! These studies are useful, but they have their time and place. It might be equally proper to teach them from the *pulpit;* for if there is much that is useless taught in our common schools, no candid and unprejudiced mind will deny that the former institution is less open to the same objection.

T.—Shocking! But certainly you can have no objection to the schools teaching how plants grow and are fed, for our life as a people depends upon this knowledge.

W.—No, I have not. Some attention should be given to the subject, by those who desire it, and such is in fact the case now. But I object, as before hinted, to shaping the minds of youth in our common schools either to this or that calling, exclusive of others. Probably no one of the Board of Agriculture would submit to it in regard to his own children. It is a matter of domestic concern.

T.—Bless you, Mr. Waddles, they do so in England, and see what crops they raise!

W.—True; but in this republican country the government is not permitted to exercise that control over the laboring classes that it does there. England has a queen, and an order of nobility; but the practical farmer is far from being comprised in this latter department; and their agricultural schools are the ordinary schools for the farming class, who expect to be forever so, and trained expressly for that calling, with no hope, or hardly the bare possibility of rising into the dignity of small landholders, or of citizenship. I ask you if the true object of agriculture is fulfilled in a country that, where, though they *may* get greater crops than we do in some productions, these crops, by the stern forcing system of large capitalists, are wrung from the bodies of the thousands of half-housed and half-famished farm labourers? English crops, produced (shall I say by human bone-manure?) as they are, ought perhaps to be regarded as disreputable to the British Isles. England, probably, has more to learn of us than we of her, not only in agriculture, but in politics and law, and perhaps in all the industrial pursuits. English farming is not so much "capital and science," as capital and oppression.

T.—But we propose here to get the science without the oppression. You are probably aware that a committee of gentlemen of the Board of Agriculture have given it as their opinion, that if a system of agricultural education were introduced into our common schools, in twenty years "the productive value of the lands throughout the whole State would be doubled."

W.—I am; and I have great respect for the gentlemen. But it is to be *very much questioned* whether the enlightened practical farmers of the State would affirmatively respond to such an opinion. Whoever has heard of the eccentric merchant of Boston, who, one bright morning before breakfast, made two thousand dollars by *marking all his goods higher,* may have the story brought to mind.

T.—That's a joke.

W.—Isn't the other?

T.—That's to be seen. But, Mr. Waddles, just think of the millions of dollars added to our agricultural products if we were to succeed in raising the enormous crops they do in England. You must admit that now the differences is a loss on our part.

W.—Not at all. We gain it in the freedom and happiness of our agricultural population. If farming is ennobled anywhere, it is and must be in America. If the mas of our farmers had an annual rent whic must be paid for their farms, like the ten ants of England, they might be hard enoug to force greater corps. But fortunately the are under no such necessity. Yet of wha corps they do raise, they take enough *t supply their own wants,* which cannot be s well said of the tillers of the soil whos "science in husbandry" we are required t emulate. Surely, if England is the land o bountiful harvests and fat cattle, it is als the land of lean and disfranchised laborer Probably agriculture may be better taugh to a few in Britain than in America; bu with what we do teach here, we also incu cate the *science of humanity,* and the divin maxim, that "The laborer is worthy of h hire."

T.—True. No one should shut his eye to the many laboring poor in England, an throughout Europe; but then we shoul only copy the good.

W.—But of this we feel no necessity. I our general system of agriculture is mor productive of happiness than theirs, we ma not be very ready to copy from them though, perhaps, there are no importan agricultural experiments instituted in tha country, which do not have more or less in fluence in this. But the ill-defined idea o establishing an agricultural college from for eign hints, with a view of advancing agri culture into one of the learned profession (considering the little harmony and unit among those already counted *learned,*) ha always struck me as tending to the ridicu lous. And if the working farmers of Massa chusetts were and are not similarly impressed the enterprises already started with grea names would not have suffered an earl blight. When they ask for manure, wi you give them a college? Scholars alway make a foolish piece of work in trying t improve that which is already well enough and hence it is that the common sense o the people will not respond to them. The would "paint the lily," and "throw a per fume on the violet." And they are too ap to think that a man who springs up like Bartlett or Seckel pear, and can bear goo fruit in any soil, is a fit subject for their in fluence. Washington and Franklin, wh belonged to no learned profession, will b remembered when Adams and Jefferson ar forgotten. Very much depends upon th character of the man himself, as to his suc cess, whether in agriculture or in any other business.

T.—Yes, sir, I readily grant this; but the American farmer's knowledge, although sufficient in quantity, is not systematized, and our agricultural college or schools, I am quite hopeful, would supply this great defect. Besides, such an institution would give tone and character to the agriculture of the State, and, properly managed, would greatly redound to its honor.

W.—I do not readily perceive how such a school could systematize (rather a vague term) our knowledge, for it could only bring good sense to bear on what is generally known from year to year, and this every sensible man can do himself. Much, however, would depend upon the character of the teachers. If they, in fact, were wiser than the best farmers, they might accomplish something; but it is not to be supposed that practically they would be. If they were merely learned in chemistry, and the collateral branches of agriculture, merely theoretical, speculative men, and intended to try experiments, then their operations would be very expensive, and of doubtful utility, and they would not be regarded as representing agriculture in its best eclectic attitude. If they inculcated what they thought the most scientific for the time being, then their teachings (so freakly and delusive has agriculture occasionally shown itself ever since the ground was cursed for Adam's sake!) would be in danger of becoming *systematized ignorance.* They undoubtedly would do something, and the probability is, that some leading, ambitious spirit among them would seize the reins, intimidate the rest by the crack of his whip, and—"go it blindly." Prof. Porter's ideal extravaganza of uniting the hydrogen of the ocean with the nitrogen of the atmosphere, to form a universal, inexhaustible, omnipresest fertilizer, might not be realized; the potato and cattle diseases would probably fare no worse, and the curculio, and all the mischievous members of entomology, would very likely commit their ravages as if in utter ignorance of such an institution.

T.—Not at all, Mr. Waddles. I should anticipate a good degree of harmony. We hear nothing of the kind in the European schools.

W.—But we know that the scientific men of Europe do not agree upon those very matters which an agricultural college ought to teach. Our agricultural professors, perhaps, would be as wise as our present Board of Agriculture; no one, probably thinks they would be wiser; for they are the most eminent men in their calling, selected from all parts of the State. Yet, does our Board do everything harmoniously and satisfactory? It is not to be expected, though a hindrance. The only thing which I ever heard of their being unanimous about, was upon the resolution to petition the Legislature to introduce a system of agriculture into our common schools. So said one paper, at least. The Secretary's Report says "almost" unanimous. Yet, with all this unanimity, only two of them appeared to discuss the subject at the Legislative Agricultural meetings. And that's the last I have heard of the matter. On the whole, I am inclined to believe that a faculty of professors would not be able to permanently advance the cause of agriculture, and would not throw more light upon the subject of vegetation than some of our best farmers—so difficult is it to find and tread a path not already beaten.

T.—Well, then, I must say it would not be properly managed. They ought simply to teach what are regarded as the best methods of soil culture.

W.—That is, the system well known.

T.—Nothing more nor less.

W.—But, who would go, or send a boy to a school to learn that which is usually known and practised among farmers? A purely agricultural college on this basis, would fail for want of patronage, as a lad would go on to a well-managed farm and earn his livelihood. If of a general, scientific character, scholars might attend, but not to learn farming, as they have at the Michigan Agricultural College.

T.—But I proceed upon the presumption that it be properly instituted, and well managed. What that would be, I frankly confess I can't at present say.

W.—Again, Mr. Twaddles, I am inclined to the belief that such an institution would be more *political* than agricultural, especially if endowed by the State, with the Governor and Council holding the appointing power. Would such an institution give tone and character to agriculture in Massachusets? And provided it were all its friends could wish, and was not, as some think it would be, a useless expenditure to the State; that it fulfilled its mission, and was an honor to old Massachusetts; would you not feel prouder to point out to a foreigner, a hardy, independent, well fed, well clothed and well housed yeomanry, than to a stupendous and successful agricultural college?

T.—Certainly, I should; but I would prefer to do both. Yet how do you propose to educate farmers—not by merely drudging on the soil—toiling, sweating, eating and sleeping—all hand-work, and no head work?

W.—By reading, reflection, in connection with the farm, and by seeing what others have done. Surely, no man need be at a loss for books and papers. In Great Britain, where it is said not so many agricultural journals are in circulation annually as are struck off by a single press here, farm schools or colleges may be more important. With so many facilities as we have here in Massachusetts for improvement in the cultivation of the soil, I should consider the establishment of an agricultural college as an act of supererogation---merely a fifth wheel to a coach, upon which some of the larger insects would fasten, and marvel at the dust they raised. Men working their own farms would shout in derision at it, and half of the agricultural journals would wage a perpetual war against it and its management. The animadversions upon the Patent Office doings and Reports, in this department, may give us some hints. And here I may observe, for want of a better opportunity, that M. Lavergne freely admits, in spite of the agricultural schools of France, the superiority of British husbandry.

T.—Well you can think as you choose; but I still go for more head-work, and less hand-work.

W.---Yes; but knowledge must be executed. Much head-work is too apt to make mere fancy farmers, and as you must know, has been the ruin of many. The Board of Agriculture could point to you instances of such, perhaps in its own circle. A knowledge of chemistry, botany and geology, will not hoe one's corn, or dig his potatoes. Then again, when a farmer becomes learned and somewhat refined, he is very apt to leave his manure fork to harder muscles and coarser brains.

T.---Yes, sir, so he is; and that's the reason why we need to make agriculture more attractive, by some method or other, to keep the young farmers at home.

W.---Pray how can you talk so when your own example has been against it? Some men will make farmers of some of their sons, but would you do it? I question whether there is a single member of the Board of Agriculture that would forcibly encourage a bright boy of his to engage in farming; and perhaps he thinks there is no necessity of it. You know very well, that an ambitious lad, who has been reared on a farm, longs to quit it, and go out into the varied world, and try his fortune. It is all very well. Such as he may return some time or other, with capital and contentment to remain. But if they do not, the presumption is that they choose to remain away. Then there are some who had rather remain at home, having no taste to battle for a livelihood in the checked throng, or to become a merchant, minister, or tin-peddler.

T.---But if we educate the farmer as we do some other classes, the ambition of nearly all would be to remain in agriculture. Why should not the farmer know as much as the clergyman?

W.---He certainly does of his calling, and may have as much native sense. But an extended rudimentary education will not save young farmers where the certainty of a life of hard labor is before them; and if it did, what would become of all the educated farmers? Learned professions are apt to be overstocked.

T.---Go to the West, on the new lands.

W.---Yes; land is too dear, and rapidly becoming otherwise occupied in Massachusetts for them; but there they might increase too fast for their own advantage, and the profitable sale of their crops. So there is some danger in this line of argument. Now, I go for a free egress and ingress in regard to agriculture; and I am inclined to believe that it will regulate itself in all its important relations, and that no one need feel alarmed that competent hands will not be found to till the earth. But you perceive this subject is endless.

T.---Well, *your* plan, so far as study is concerned, ought to be designated, "Farming made Easy!"

W.---Thank you for the honor. So important a calling in the progress of civilization ought to be made easy, not complicated; and blessed is the man who confines agriculture to the fewest simple rules, so that the honest, industrious young man, with comparatively small means, who intends to pursue it, may not be obliged to labor through a term of two or three years of misty and faliiable science before he can engage respectably and profitably in that universal labor calculated to insure his happiness and feed increasing millions.

OAK CLIFF, *on the Mystic, July*, 1860.

For the Southern Planter.

Theory of Mixed Guanos.

MR. EDITOR:—Our attention is directed to your article in the August number of your journal on "Manipulated Guano," or combining ammoniated and phosphatic guanos, and to the opinion you entertain of their superiority over the Peruvian guano alone. We also notice your desire to know definitely who is the author of this theory.

Justice to the dead requires we should inform you that *Charles Bickell, Ph. D.*, the late eminent Analytic Chemist was the author of the suggestion, and to him is due the credit of instructing planters respecting the *economical* use of Peruvian guano, which, while being *Standard* for ammonia, has this ingredient in excess, and is deficient in phosphates. It was his conversations upon this subject that induced us to establish a *Standard* for *Soluble Phosphatic Acid*—in "Rhodes' Superphosphate"—that could be used alone or in combination with guano in rational proportions, or as the experiments of planters might suggest.

We also find in the Laboratory Diary of Dr. Bickell the copy of a letter addressed to a well known citizen of your State, dated March 18th, 1858, in which he refers to these combinations "as being recommended by himself *five* (5) years previously." He also says, "combine 5 or 5½ per cent. ammonia, and 40 to 45 per cent. phosphate of lime, when an application of 300 lbs. per acre of such a compound will supply 16 lbs. ammonia, or as much as is contained in 100 lbs. Peruvian guano, and 120 lbs. phosphate of lime, or as much as is contained in 400 lbs. Peruvian guano. Similar mixtures of Peruvian and Phosphatic guano clearly prove on one hand that 16 lbs. of ammonia is a sufficient application per acre to give the crop a quick start; and on the other, that phosphate of lime should be amply provided for to serve as direct nutriment to the growing crop * * * A soil which is in itself deficient in phosphate of lime, (and this is common with our cultivated soils) cannot be benefitted by an application of 100 lbs. Peruvian guano, and farmers have, consequently, been led to the evil practice of applying 300 and 400 lbs. Peruvian guano in order to raise 25 or 30 bushels of wheat to the acre. It can certainly not be a wise management on the part of the farmer to supply phosphate of lime in the form of Peruvian guano, as he is obliged to add with it a surplus of a substance (ammonia) which has a nine (9) times higher commercial value than the substance he really needs, and which, besides, positively tends to develop the stock and leafy part of the plant at the expense of a healthy and sound formation of the grain. Let your planters, then, understand that they can supercede Peruvian guano just as well as any manufacturer of an artificial fertilizer can do it. The whole secret lies in a judicious use of Peruvian guano, and in its co-operation with phosphatic manure. * * * Your question as to the most proper form in which phosphate of lime should be applied to the soil, will be answered by a due consideration of the chemical and physical properties of that substance. Phosphate of lime is composed of nearly equal parts of phosphoric acid and lime, and its most important feature, at least in an agricultural point of view, is its very slight solubility in water. It is quite plain that the mineral constituents of the soil could not have entered the system of plants, and thus served as nutriments, unless they were offered to rootlets in a state of solution. Hence we find that an essential nutriment of plants, one which is wanted in considerable quantity, obstinately resists the solvent action of water. How, then, can this difficulty be overcome, and phosphate of lime be rendered available? There is but one way, namely, to apply it in a state of utmost fineness and subdivision. Of course, the more minute each particle is, the less resistance can it offer to solvents. The ultra of a subdivision of solid particles may properly be regarded as a quasi state of solution in itself.

"Among all phosphatic manures a superphosphate effects this condition of phosphate of lime in its highest perfection. In its manufacture, common phosphate of lime is treated with sulphuric acid, whereby the former is deprived of two-thirds of its lime, whilst the remaining one-third unites with the whole of the phosphoric acid to form a soluble bi-phosphate of lime. This new substance, which is the essential constituent of a superphosphate, has a strong desire to unite again with that portion of lime from which it was separated by means of sulphuric acid, and to become thereby reconverted into the original common phosphate of lime, on account of its solubility; it will, therefore, easily penetrate the soil to which it is applied. But, whilst on its way to incorporate with the great bulk of the soil, it necessarily meets with those minute particles of lime and potash—invisible to the eye, and detected only by chemical analysis—which are contained in and uniformly diffused throughout all soils. The immediate consequence of these circumstances must be the reproduction of common phosphate of lime in the very body of the soil itself; but it is reproduced there in such a state of fineness and uniformity of distribution as could not have been expected by any mechanical means.

"*Common Brown Mexican guano* stands, in this respect, next to a superphosphate, *though there is a wide difference between them.* The particles of phosphate of lime are very minute, and in a state of extraordinary looseness and friability. Let me then draw this conclusion: In case we expect from a phosphatic manure an immediate effect on a special crop, we may well pay a premium on common Brown Mexican guano; and again, we may cheerfully pay even *three times* more for each pound of phosphoric acid in a *regular* superphosphate, than we will pay for it in common Brown Mexican guano."

Hoping the foregoing may be of value to your farmers and planters,

We remain yours truly,

B. M. Rhodes & Co., Baltimore,
Office 82 Bowly's Wharf.

Baltimore, August 29, 1860.

From the New England Farmer.

Mental Activity among Farmers.

The human mind was made for action, and is active, to a greater or less degree. From the utmost imbecility of infancy, there awaits it unlimited power, expansion and ennoblement, attainable by gradual steps of progress. Not by flights or leaps, but by toiling self-culture, does it rise from the mists and darkness of ignorance to the elevation and clearer light of knowledge. On its own self will depend its progress and development. The obscurest son of poverty has within him the germs of greatness and happiness, and that will for application which oft takes the precedence for genius, is of more value than Crœsian wealth, with all its advantages and luxuries. Mind, then, in its normal and healthy condition, is capable of continual progress, which should be sought by earnest effort.

Whether the mind or the heart, thinking or feeling, is entitled to greater regard, as more important, is a question long agitated and variously decided by different individuals. But the candid and enlightened will admit that the mind is of equal worth, and should therefore receive equal attention. As an illustration of the baneful effects of an opposite course, we have only to look at certain Christians who make the cultivation of the religious sensibilities the main object. Their mental capacity remains about the same as twenty years ago, and so connected by sympathetic bonds are the mind and heart, that the religious feelings of the latter are often paralyzed and bound in superstition by the neglect and consequent narrowness of the former. Bigotry follows as a natural consequence, which to all is obnoxious, and injurious to the free exercise of holy influences.

Considering, then, the nature of mind as progressive, and the study of all to allow it development by proper action, what degree of mental activity as favoring this do we find among the farming population? Many writers and orators, particularly on certain festive occasions, would make the occupation of the farmer very intellectual. They parade the names of nearly all the sciences, and very logically prove them connected with it. That they are, may be true. It is also true that some of the most practical and successful farmers have no knowledge of these sciences, except of a few facts and some general principles. Now, however much agricultural writers and orators may flatter the vanity of the farming community in regard to their "glorious occupation," and what it may be, still the facts regarding their present condition remain as proofs that the occupation is not wholly scientific, and that farmers do not yet rank with professional men in point of intellectual culture. A farmer in our country towns can get along, and be successful to a certain degree, with a practical knowledge of his business, as well as can mechanics with theirs; admitting, however, that science may be, and often is, called into the aid of both, and that with the most happy results. But this fact is sufficient to our present purpose, that farmers can succeed without extraordinary, and even with meagre mental acquirements and advantages. This fact that they can, is indisputably established by the fact that they do. Still it may be said that farmers rank as high or higher in intelligence, sound judgment and general information than any other laboring class. There are many things in their occupation favoring this. Their judgment, in particular, is called into almost daily exercise, and thus strengthens and matures. But as for a real desire for mental culture and development, resulting in earnest mental effort, farmers as a class, to say the least, are much below professional men; though they may rank as high or higher than other so-called laboring classes. But aside from these comparisons, their mental culture and development is much less than from the importance and worth of mind, duty plainly indicates. And as one reason why their minds remain so dormant, their occupation not absolutely requiring extensive mental acquirements, their minds reach not that state of mental culture in preparation for business, which awakens earnest and lasting desire for knowledge. Consequently, if they have sufficient business tact and practical information for success, they remain satisfied. Some minds among farmers, as among all classes, seem ever to have that desire, or to have had it awakened, by the requisite degree of mental training; and they reach more elevated positions, and rank as leaders. Still, it may be questioned by certain persons, whether the farmer's occupation is consistent with the possession and indulgence of a literary taste; whether the continual cultivation of the intellect is expedient, or even justifiable, in connection with manual labor on the farm. But with what assurance can one argue that a farmer's knowledge and labor should be limited to his farm, and that his study should embrace only such subjects as are intimately connected with it, and directly subserve practical skill. Lord Bacon says, "Studies serve for delight, for ornament and for ability. Their chief use for delight is in privateness and retirement; for ornament is discourse; and for ability, is in the judgment and disposition of business." Now, it cannot be denied but that farmers, generally, have great facilities in leisure and retirement for mental improvement. And we doubt whether there is any class of men, taking these facts into consideration, with the fact that their physical exercise keeps the mind fresh, and their relish for mental food even keen, that may experience more delight and real happiness in studies, than farmers. For ornament in discourse, many, and perhaps the general class, are deficient. Even in our most prominent agricultural papers, where on one page will be glorification essays on farming and on farmers, on another, will be anecdotes or stories, in which one of the characters will be a farmer, and where roughness and verdancy will be fully displayed in the ideas and language imputed to him. And had it not somewhat of a foundation in truth, it would not be sanctioned by public opinion. Again, if studies are useful in the judgment and disposition of business, it is certainly a consideration also worthy of their commendation. The farm would furnish for it ample scope, and return satisfactory reward.

One reason why studies are contemned by practical men is, that those who use them are too apt to spend time over them to the neglect of their business. This the same writer calls sloth. A man must use judgment here, as elsewhere, in regulating his time and attention to his wants and pleasures. He who does this rightly, does much toward forming his character to a perfect sphere; the true object of man's life. Besides, in perfect physical development, manual exercise on the farm, combined with proper intellectual culture, would furnish examples more noble than perhaps any other calling. Among farmers at present, it is not so universally the rule as among merchants, and one or two other classes.

One of the great objections urged against farming is the lack of mental activity—that the mind lies so dormant. Admitting that the objection has its origin in truth, we confidently assert that sluggishness or emptiness of mind is not at all necessarily connected with farming. The fault, from causes we have mentioned, and which exist unreasonably and unnecessarily, is with the farmers themselves.

To recapitulate, our points are briefly these. Every individual has an immortal element within, called the mind. This mind is intended, and therefore, fitted for continual culture and development; consequently, it is duty to comply with these, being the requirements of God. That for various reasons, the minds of many among the class called farmers lie in too dormant a state. That they have no sufficient and warrantable reasons for this, and that the pleasures and advantages they would derive from mental culture would be sufficient, and more than sufficient, for the required labor and time. And that to many the great objection to farming—deficiency of mental activity—is not really attributable to farming, but to farmers; and that this, with many other objections, would be obviated by the course here advocated.

Life is not for inaction, quiet repose and the gratification of animalism. Beneath the pathway of every man lie the springs of happines, and he must patiently dig for them, who would refresh his soul with their cooling waters. L. H. Sherman.

Wayland, Mass.

Studies of the Soil.

BY WILLIAM EDSON.

The two sciences, as such, geology and chemistry, from which must arise, in a more or less direct manner, all theory in relation to the formation and treatment of soils, are but little understood among practical men, and are commonly treated by them as subjects entirely aloof from their duties; yet every intelligent working man, and especially the farmer, is both a chemist and a geologist, and depends, in a degree, for his success, upon his practical knowledge of these sciences.

Aside from the merely business view of this knowledge, there is another in which its value is greatly enhanced: I refer to its effect upon the mind of the recipient. We all live in two worlds, the world of mind and the world of matter. It is the lot of most to labour in one or both of these. Necessity requires us to labour in one, the world of matter, which is the labour of the hands. Manliness and Christianity urge us to labour in the other, which is the work of the mind. Life cannot be truly enjoyed independent of either health of mind or health of body, and as health of body depends directly upon bodily exercise, so health of mind depends directly upon mental exercise.

All agree that, in the duties of the intelligent farmer, the labours of the hand and brain are most harmoniously blended, and that it is for him to enjoy that rarest of all blessings, "a sound mind in a sound body.'

The farmer, as he follows the plough, may not be wholly engrossed in mere manual labour—every clod that the plough turns up, will give him a lesson in geology, and every rootlet a lesson in botany; let him be ever so indifferent, nature will insist upon his learning some one of her many secrets; she will give him something to treasure up for his future use or pleasure. By this almost involuntary study has the farmer's storehouse of knowledge been filled: by it the rude chance-farming of the ancients has advanced to the present state of intelligence and certainty.

Until quite recently, the term "scientific farming" was not used, and we now hear it oftener as a term of reproach than otherwise; but it cannot be denied that science, even as put forth by the most impractical, has done the agriculturist great good, and is destined to do still more. Perhaps one of its greatest benefits, up to the present time, is that arising from the strong feeling of emulation among farmers of the old school, to prove by their crops and profits that they can excel the theorist; urged by this feeling, they have eagerly sought for improvements, and applied them with a skill which only the good old-fashioned farmer is capable of. It has also caused discussions, and excited a thirst for experiment and inquiry which cannot result otherwise than in good for all. These are only some of the incidental benefits arising from the application of science to agriculture; the true value of this department of scientific knowledge cannot be estimated, since much more is now known than has yet been generally and skilfully applied; and again, there is much of agricultural chemistry which is yet in so vague and uncertain a state as to be almost, if not quite worthless, as far as practical farming is concerned.

If it were true, as some have the hardihood to assert, that no practical good, as far as crops and profits are concerned, arises from scientific research in this department, yet its benefits upon the mind of the farmer would be incalculable, as it raises his thoughts to the contemplation of the laws of nature, giving him one of the most stable of all pleasures, and health of mind, the crown of "green old age."

Assuming that every farmer is both a practical chemist and geologist, since the most common duties of the farm require a knowledge of these sciences, I wish to call attention to the chemistry and geology of the surface stratification.

For the sake of simplicity in the treatment of the subject, I will divide the varieties of soil into three classes, namely: 1, mechanical; 2, chemical; 3, vegetable. This general classification may strike the geological reader as novel and perhaps inadequate; but for the ordinary discussions of practical men, I think it will be found not inappropriate, if we bear in mind that the terms used are not intended to indicate by what agency the materials of which the soils are composed were brought into their present position, but simply to express the present condition of the soil itself. Thus, by mechanical, I would designate all earths which bear evidence of not having undergone any great chemical or vegetable change since being deposited in their present position—that is, the mixture of the different materials of which they are composed is simply a chemical one; by chemical, all that indicate by their strata and composition that some important change in their qualities has taken place since their deposition; and by the last term, all that are principally made up of vegetable matter.

The first of these formations, or classes of formations, to which I give the name mechanical, may be found in nearly all positions, though perhaps oftener in low than high grounds. Under this head will be classed moraines, sand-hills, and bars, ancient river-beds, and all such surface strata as bear evidence of having been deposited by some violent mechanical action.

Upon examination of the strata of this class, we find them sometimes composed of regular layers of material, which is not always coarsely divided, but yet is never thoroughly, chemically united; others have no regular layers, but seem to be composed of confused masses of gravel, sand, and clay, which are not intimately united, nor in any manner definitely divided; here is a bed or layer of gravel—it extends a few feet, and abruptly terminates in a bed of clay, or perhaps gradually growing thinner and thinner, disappears between layers of clay and sand; again, we find strata of almost pure sand. I cannot enter into a lengthy explanation of the causes of these various phenomena, but will briefly state them; thus, when the layers are comparatively regular, they are supposed to have been deposited from running water, either fresh or salt

The irregular stratification, which in fact covers a large portion of the eastern part of Massachusetts, is undoubtedly owing to glacial action, as it occurs in ice-bearing currents, while the occurrence of sand-hills is generally assigned to the action of the wind.

The currents from which were deposited a large portion of the surface formations of the eastern part of New England, are supposed to be analogous to the oceanic currents of the present, and probably arose from the same causes, namely, evaporation, difference of temperature of the polar and equatorial regions, and the earth's rotary motion.

The currents of the ocean are, without doubt, constant, considered as a whole; in other words, there always exists a series of currents and counter currents, those from the poles moving south-westerly, and those from the equator north-easterly, of the northern hemisphere; for the southern hemisphere, the reverse is true. The existence of these currents is thus accounted for. The velocity of the surface of the earth at the equator is about one thousand miles per hour, towards the east: while at 45° north or south latitude, it is but seven hundred and fifty miles per hour; therefore, water at the equator has a velocity of one thousand miles per hour, and water at 45 degs. but seven hundred and fifty miles per hour; now, if, from any cause, a body of water moves from the equator towards the north, it will still retain its easterly motion of one thousand miles per hour, lessened only by friction; hence, when it arrives at 45 deg., where the surface motion of the earth is but seven hundred and fifty miles per hour, it will have an easterly motion exceeding in rapidity that of the earth's surface by two hundred and fifty miles per hour, if it were not reduced by friction; as it is, the excess is great; this excess of velocity being combined with the northerly direction gives the currents their north-easterly course. The same reasoning applied to currents flowing from the north pole to the equator, will show why all such have a south-westerly direction. The gulf stream is an example of the first, and the currents which bring down polar ice are examples of the last. Balloonists take advantage of this same principle, and found upon it their theories of easterly aërial currents, in which they think they may be able to cross the Atlantic. The effects of these currents are *abrasion* and *drift*.

The action of a current of water sweeping over the surface is, first to remove all loose earth from high points and deposit it in valleys; but its effect does not end here, for no sooner is the loose earth removed than the solid rock is attacked, and in its turn carried down to the valleys. This mechanical action upon the rocks, together with the chemical decomposition that is constantly taking place, is called detrition; the resulting deposit is called drift.

Currents of air produce the same results as currents of water, and though the action of the wind is much less important, it is still so great as to be well worth careful consideration. The aqueous currents cease their action before the land becomes inhabited, but the aërial ones are always at work.

The effect of abrasion upon the surface is perfectly obvious; it can have nothing but a barren and hard stratum wherever it takes place. Though drift is but the counterpart of abrasion, its action is much more complicated and difficult to understand. Its effects are commonly just the opposite; for wherever drift accumulates, there we may be nearly sure of finding good land. In New England, wherever a soil is evidently composed of drift from an oceanic current, it is easy to state its chemical composition, as originally deposited; we have only to examine the exposed rocks lying in a direction north-easterly from it; their nature must of necessity determine the nature of the soil in question. It should be remembered, that, in the examination of soils, this is to be considered but as a general truth, and that there are so many modifying causes that this knowledge alone will not enable one to determine with any degree of accuracy the present chemical nature of the soil.

One of the most important considerations for the New England agriculturists, and one in which almost every farmer is directly interested, is that of river and lake deposits; these consist of not only large amounts of finely granulated mineral, but also vast quantities of vegetable matter. The extreme richness of such deposits must be acknowledged by every one who considers the following fact: first, the minerals of which they are composed are finely and intimately mixed; second, the finely divided minerals are not only carbonized, but are brought in connection with particles of carbon and decaying vegetable matter, or humus; and lastly, the entire mass is more or less impregnated with ammonia. Although it is impossible to conceive of a richer soil than this, yet it is probable that there is no class so universally neglected and despised. In scientific classification, soils formed of these deposits are called fluviatile and lacustrine; the farmer turns them off with the not very flattering title of swamp or mud hole.

As an example of the magnitude of these deposits, the following may be interesting. The area of the delta of the Mississippi is 13,600 square miles; the average depth of deposit is 528 feet, and it has been estimated that the river annually deposits thirty-seven hundred millions of cubic feet! This, at at first thought, seems large; but even at this rate, the venerable father of rivers must have diligently laboured sixty-seven thousand years.—*New England Farmer.*

Rich, Rare and Racy—How Premiums are Obtained at Agricultural Fairs.

We commend this to all who attend State and County Fairs. It is from the *Rural New Yorker*, and will be found highly beneficial to all officers who fill vacancies in committees:

Col. Moore: Some years ago I got acquainted with one of your contributors, who edited the *Wool Grower*, and he used to put me in print. I must say my vanity was flattered by seeing my name printed in the paper, with some things I said, and some I didn't say, and we've kept the papers ever since. After all, everybody likes a little fame, but some are satisfied with a smaller amount than others. Well, I have not the editor any more to set me out, so I have been thinking I would just try and see if you would not put me in the *Rural* on my own hook—especially as I want to tell you all about my going to the State Fair, at Buffalo, the other day.

CONCLUDES TO GO.

As it was not so far but what we could go with our own team, mother and I concluded we would hitch up and have a week to see the sights and some cousins we had not seen for a long time. Mother (that's wife, you know) thought we ought to take something to the Fair. I told her to take a tub of her butter, but she didn't think it was good enough, but thought I might take some of the stock. But I thought it would be a great bother. However, Sam was pretty strong in the faith that we could beat everybody on horses, and wanted to take old Nance. She's a right smart beast, is that old mare, you may depend.

TAKES THE MARE.

Well, we packed off Sam, for I was willing to give the boy a holiday. It does the boys great good to attend these kind of Fairs, I do believe, after seeing all I saw there.

GOES IN.

We got safely to town on Monday night, and Tuesday I went up to the Fair grounds to see what was going on. I got in and hunted up Sam, and found he'd got the mare entered, and had got his card on her head, and a good stall, and all things comfortable. The animal arrangements were first rate generally, and during all the time of the Fair the supply of fodder was good. I think that Maj. Patrick, who was everybody in managing things, a trump sort of a man.

HEARS SOMETHING.

As I was standing up near the business office in the crowd, I heard a couple of men talking about premiums. One said to the other:

"Are you an exhibitor?"

"Yes."

"So am I, and we had better look to the Committees."

"Why so?"

"You see the Committees are never all full, and if you are on hand at the big tent when they are called, it's easy to slip in a friend, which is a mighty nice thing sometimes."

"Well, I am showing a patent for making cowcumbers, and if you can get the premium, it will make my fortune."

"And I am showing a new kind of bobtailed hens, and a premium won't set me back."

"Well, you get me on to your committee, and I will name you for mine."

"All right; go in to win when you can."

Thinks I, perhaps if that's the way the thing leans, I may as well take care of myself as any one else. Everybody for himself seems to be the rule on these occasions. So off I streaked to the cattle-pens to find Smith, who is my neighbor, you know. Smith is in the patent bull line. [Mr. P.

evidently means "improved."] Says I, "Smith, you're showing bulls, and I am showing old Nance, and I guess if merit counts, we can win. And that's the talk here on paper." Then I told him what I'd heard about the committee.

"Is that so?"

"Exactly."

"Well, I think old Nance is the best mare in the yard."

"And you've got the best bull on the ground."

Well, sure enough, when the committees were made up, I was on Smith's bull committee, and he was on the mare committee.

THE COMMITTEE GOES OUT.

The head man took the book, as had the things in it, and we were all introduced to each other, and went down to look at the bulls. We were on the red bulls. So we went along and looked at them, and I didn't say much until we came to Smith's bull, and I looked at him pretty carefully, pulled his tail, punched my fingers into his ribs, and went through the motions, as I had seen the others. Says I, "thar's a bull that looks like it." Smith had combed him all over with a fine-toothed comb, and brushed him with a hair brush, and he did look slick, for he was just as fat as a hog. And from all I saw, I think fat at Fairs, like what the lawyer said about charity, covers a multitude of sins.

GETS THE HORNS POKED AT HIM.

Just as I said that, the fellow who had a bull in the next stall, comes up to me pretty fierce, and says he:

"What do you know about bulls?"

"Well," says I, "I think I know what they are used for in my section."

"May-be," says he, "you are on the committee?"

"I have that honor," says I.

"But," says he, "that bull hain't got any pedigree."

"Well," says I, "he had father and mother, didn't he?"

"Oh! yes; but then nobody knows who they were."

"Well, then, nobody knows but they were just as likely as your bull's parents."

"But, sir, look at my bull's pedigree. There it is, sir. Got by imported Shirt-tail, out of Skim-milk, by Thunder," &c.; and he showed a string of names as long as your arm.

"Well," says I to the committee, "are we to judge the pedigree or the animal?"

And they said, "the animal, of course."

"Then," said I to the fellow, "will your bull get better stock than this?"

"Of course he will," says he, "for he's got a pedigree, and that bull hain't."

"Well," says I, "your bull has got somebody to brag for him, and the other hasn't, that's certain." And that sort o' knocked him. "But," says I, "I've known people who felt grand over their pedigree, and I've seen a heap of people who couldn't go further back than their father and mother that banged them all to pieces for smartness. 'Handsome is that handsome does,'" says I, "and, as the hymn-book says, 'a man's a man for a' that.' Pedigree to grass—I go in for the animal."

SMITH'S BULL WINS.

When we got through and looked at our marks, the other two had Smith's bull second. I had him first. So we talked it over, and finally, as they did not care much about it, they altered the figures, and gave Smith the first premium, which I think was right.

AND THE OLD MARE.

Smith had a great time over old Nance. It turned out that each of the other two committeemen had friends whose mares were to be judged, and they pretty soon picked out their favorites. So he kept still and let them talk, and they soon got into a quarrel, and then they appealed to Smith, and he kinder sided with one, but thought old Nance was the best mare, and finally, to keep the other from getting first, they sided with him, and he went in for both of theirs. Smith says he saw some queer things on that committee.

You see we got our premiums, but you don't see, perhaps, Colonel, as well as I do, that it wants something more than merit to be sure of winning.

GETS IRREVERENT.

The State of New York is a great State, the biggest in the Union, and the New York State Agricultural Society is a great institution, but if there ain't some of the allfiredest big humbugs crawling around its Annual Fair, then I'm a tea-pot.

CONCLUDES.

I want to tell you a heap more, but I have used up so much paper, I fear you won't have patience to print my letter.

Yours to command,

JOHN PLOWHANDLE.

From the Country Gentleman.

Theory of Manuring and Rotation of Crops.

BY PROF. S. W. JOHNSON.

When the soil is deficient in one or all of those ingredients which favour the growth of the plant, and is consequently unable to produce a remunerative crop, the deficiencies may be supplied and the soil rendered productive by the use of manures. Manures are, in general, refuse, or very cheap matters, which contain some or all the elements of vegetable nutrition, and may therefore be profitably employed by the farmer, for conversion into useful and valuable agricultural products. The principles on which manuring depends are the following: 1. Plants require various kinds of solid mineral matters, and derive the same exclusively from the soil. 2. Some plants which in the natural state derive the gaseous elements of their organic structure, viz: carbon, hydrogen, nitrogen, and oxygen, from the atmosphere, must be supplied with more or less of these matters from the soil, in agricultural production. 3. Different plants require different proportions of these substances, in order to luxuriant growth. 4. Different plants require different quantities of these substances to mature a full crop. 5. Different plants, from peculiarities of structure, draw differently on the same stores of nutriment. 6. Different soils abound or are deficient, to a greater or less degree, in one or many needful ingredients of the plant. 7. The same soil has a different composition in different years, caused by the removal of matters in the crops, or by the increase of available food from weathering (tillage.) The substances usually classed together as manures, may have three distinct functions: 1st. They may chiefly serve to improve the physical characters of the soil. Such are some manures that are applied in large quantities, as lime, marl, organic matters. 2d. They act partly as solvents, or absorbents, and thus indirectly supply the plant with food; e. g., lime, gypsum, salts of ammonia. 3d. Finally, they may enter the plant as direct nutrition. If manures acted merely as direct nutrition, the theory of their operation would be very simple. It would then be possible to judge of the manuring value of any substance, by compraing its composition with that of the ashes of cultivated plants; but since many fertilizers produce all the above-mentioned effects, the question becomes a more complicated one. Notwithstanding the vast mass of facts which practice has accumulated concerning the action of a great variety of fertilizing substances, and although during late years scientific men have devoted much labour to the exacter study of their effects, we are yet in the infancy of our knowledge respecting them. In agricultural periodicals are reports of thousands of experiments on the value of manures; we find, however, the most conflicting statements, and a chaos of results. There are authentic instances of nearly every proposed fertilizer increasing crops, and as many instances of failure. Farmers, however, continue to experiment as if there was a possibility of proving, that for each kind of crop, or each variety of soil, there is a specific and unfailing fertilizer. The principles above stated, taken together with the fact that the physical adaptedness of soils to crops is indefinitely varied and constantly changing, demonstrate that there can be no fertilizing panacea. They likewise make evident that what is this year a good application for a certain crop and soil, may fail to manifest any action next year; and that what is now inefficacious, may prove highly useful at some future time. The most generally useful manures are those which contain the largest number of ingredients, and which present them to vegetation in the greatest variety of forms. Stable manure occupies the first rank among fertilizers, because it contains everything that is needful for the nutrition of plants. It is in fact the *debris* of a previous vegetation, and contains all the ingredients of plants, though in proportions altered from the original ones, and, indeed, advantageously altered. The hay, roots, and grain which mature cattle receive every day as food, are in part digested and assimilated, but since full-grown animals do not increase in weight, unless fattened, they excrete daily as much as they ingest. Those portions of their food which are most easily combustible, are, in consequence of the respiratory process, exhaled as water and carbonic acid gas; while the ash-ingredients, and the larger share of the nitrogen, are accumulated in the excreta. In this way there is a concentration of those constituents of the animal's food, which, after they have served their nutritive function for it, become the proper food of the plant. To mention merely all the numerous substances used as fertilizers, is foreign to the purposes of this article; while any detailed accounts of the effects, modes of action, and the methods of preparing them, would far exceed our limits. Among the various ingredients of manures, two in particular have acquired a special significance in late years, viz: phosphoric acid and ammonia. These bodies are commercially the most valuable of all fertilizing substances, a necessary result of their scarcity; and in general, phosphoric acid is a smaller ingredient of cultivated soils, than any other of the components of the ash of plants. Ammonia, especially in the form of carbonate, not only powerfully stimulates vegetable growth, but it probably exerts a strong solvent effect on the minerals which compose the soil. Hence, guano and other animal manures which contain or yield much ammonia and phosphoric acid, are in such large demand among those who practice "high farming." But the exclusive use of fertilizers, which supply to vegetation only a small portion of its ash-ingredients, must sooner or later be found inadequate to produce profitable returns—must, in fact, reduce the soil to a minimum of fertility. The true system of manuring is to maintain a supply in excess, of all forms of plant-food, and indeed of all materials which experience proves to have a good effect on vegetation, whether this effect be chemical or physical.

When chemical analysis first demonstrated that different classes of plants yield an ash of different composition, the idea of *special manure* had its origin. By special manures, were meant mixtures containing just the quantity of each ash ingredient removed from the soil, by an average yield of each crop. But investigation has demonstrated that there are in general no practical advantages in these attempts to feed the plant by ration. Latterly, Lawes and Gilbert, of Rothamstead, England, believed to have established by a multitude of field experiments, that ammonia is specially suited to the production of wheat, and phosphoric acid to the growth of turnips; but there are other equally authentic trials which as fully prove just the reverse, and while on a certain soil, and under a certain set of circumstances, experience may without difficulty establish a rule, as has been done a thousand times; science is not yet far enough advanced to lay down a universally applicable principle or law, concerning the special nutrition of the various classes of cultivated plants.

ROTATION OF CROPS.

It has long been a settled fact in agriculture, that the greatest return from the soil is generally secured, not by continuously growing one plant, even though it command the highest market price, but by an alternation or rotation of crops. There is no difficulty in cultivating any agricultural plant successively for any number of years on the same ground, provided enough be expended in putting the soil into the right physical and chemical condition. But such a procedure is usually more expensive than alternating the crops. The reasons of this are mostly contained in what has preceded, but a few words of explanation may still be useful. When a light virgin soil comes under the hand of the farmer, it yields good crops for a few years, but then subsides to a low state of productiveness. At first it may have yielded wheat; when no longer able to support that crop, it may still give fair crops of barley; the next year if put to turnips or potatoes, it may seem to recover its fertility somewhat, and produce a good crop of wheat, though probably clover would flourish on it. The causes of such facts lie partly in the soil, and partly in the plants themselves.

As for the soil, as already stated, its composition and texture are perpetually changing. The quantity of organic matter, especially, rapidly diminishes when the soil is under cultivation, and the soluble mineral matters are in most cases removed by cropping, faster than supplied by weathering or disintegration. As for cultivated plants, practical men have classed them according to their demands on the soil, as follows: Enriching crops, clover, lucern, and esparsette. Non-exhausting crops, peas, and beans, also cereals when cut green. Exhausting crops, tobacco, flax, hemp, and hops. Among the causes of the different exhaustive effect of various plants, are the following: 1. Different extent or structure of roots and leaves. The enriching crops expose to the air an enormous surface of foliage, and throw out very large, long, and numerous roots. The cereals have much less leaf and root surface. 2. Different rapidity of growth. Clover and root crops continue in foliage during the whole season; while the cereals ripen in July and August. 3. Periods or crises of growth; seed production. Plants which ripen seed, require a better soil than those which only produce foliage, because the rapidity of assimilation seems to increase when the reproductive function comes into activity. Plants which ripen seed, may require a richer soil, not because they remove more from it, but because they need more in a given time. 4. Some crops are entirely removed from the soil, as flax; while others leave the ground filled with an enormous mass of roots, as clover; or strewn with stalks and foliage, as the potato and beet. 5. The quantity of ash-ingredients removed from the soil by different plants, is widely unlike. In the light of the above statements, it is easy to see that when a soil refuses to yield remunerative crops of shallow-rooted and quick-growing wheat, it may still produce a luxuriant growth of deep-rooted, large-leaved, and slow-growing clover. It is evident, too, that when a clover-ley is broken up and sown to wheat, this grain may yield well, because the decaying turf and roots are a ready source of every kind of plant-food. This preparation of the soil for an exhausting crop, by the intervention of one of easy growth, is shown in the practice of green manuring, which is, in fact, a rotation of crops; but is also a fertilizing process, because the first crop is entirely sacrificed for the sake of the succeeding ones. Green manuring consists in plowing under clover, buckwheat, spurry, or other crops, when in blossom, so that the soil shall be enriched by their decay. As these plants (the last named especially) will grow on poor soils, it is possible by their help to reclaim the lightest sands, and bring them up to a fair degree of productiveness in the course of a few years.

The use of Salt as a Fertilizer.

A correspondent of the Maine Farm gives the following experiments in the u of salt. Two bushels per acre has be generally considered a safe dose:—

In the first place I will give the English method of using salt when th put their land down to grass, and then own experiments for the last thirty yea then I will bring forward a witness, wh evidence will have great weight in subst tiating the fact of the great benefit deriv from the use of salt as a fertilizer.

When I was quite young I took up old pamphlet, and, in looking it over noticed that it gave an account of the English method of laying their grou down to grass, and, among many ot things, the writer made this stateme viz: That the farmers of England plow or harrowed in seven bushels of salt to acre, and the result was—they got a hea crop of hay for ten years.

My first farm consisted of only one ac This land had been plowed and plan quite a number of years. I planted po toes the first year, and got but a small c of small scurvy ones, very similar to th raised in chip muck. The next year planted potatoes, again, on the same pie and as they were coming up or pushing ground up, I dropped a handful of liverp salt on the top of each hill, being care not to drop the salt on the stalks or tops any were above ground. When these po toes were harvested we found them a go size, very nice, smooth and clean. Si we have been troubled so much with potatoe rot I have planted my potatoes dry ground, and have used salt in the w described above to good advantage, and fr long experience, I am satisfied that it i great preventive of the rot.

Since living in Readfield I broke u field having a swale about one rod wi running across one corner. I planted po toes on both sides of this swale; on side I put manure in the hill and on other side, put in rock salt. When harvested them we found those where manure was put, two-thirds rotten, a where the salt was put, perfectly sou smooth and clean, and there never was least appearance of rot about them, althou they were the long reds, (a kind that very apt to rot.)

Three years ago I broke up two-thirds of an acre of poor land, and not having any common stable manure to put on it, I sowed on (after harrowing over once,) eight bushels of salt, and then harrowed it in and planted potatoes and peas. They came up as strong and grew as rank as they would have done had there been a heavy coat of dressing plowed in.

I have used salt, occasionally, for many years on my corn, putting it on the hill before hoeing, as we do ashes. A few years since I planted a piece of corn of about one acre. On one-third I put ashes, one-third plaster and on the other third salt. When the cornstalk was fully grown, I took a friend into the field, and, viewing the corn at a distance, (my friend not knowing of my experiments,) I asked him what part of that field he thought looked the best, and he immediately pointed to that part where the salt was put on. The salt was to the poorest part of the ground. From experiments I am fully satisfied that it is not good policy to put salt in the hill, either by itself or mixed with composts, it being too strong for the young roots.

Owing to my limited means I have not been enabled to make a thorough experiment with salt in laying my ground down to grass, but I will here introduce a witness, whose unwilling testimony will have great weight:

It is well known by every man in the vicinity of traders, more probably speaking, almost invaribly cuts a very heavy crop of hay, and generally two crops each season. A few years since I went to this trader to get some salt to put on my corn. He wanted to know what use I was going to put it to? I told him that I was going to put it on my land. Says he, *it wont do any good will it?* I told him that I thought it would, and then I gave him an account of the English method of using salt, (to which I referred above.) He answered me in these words, viz:—"*That is the very secret why I get so much hay.*" And then he told how he used it. He said that he put on six bushels to the acre, and harrowed it in before sowing his grain and grass seed.

There is one peculiar feature in the effects of salt when put into the ground, it serves to make the ground very light and mellow. I have noticed when I put salt in the hill, that it would pulverize the ground through to the top, and thought at first, it was the work of the ants, but found, on examination, it was caused by the salt.

I have given these different experiments to show the many ways that salt can be used, and if you think any of them are worth anything you can use them as it seemeth good.

STORER PIERCE—*in Rural Register.*

From the Richmond Dispatch.

Covington and Ohio Railroad.

The following letter from Col. Fontaine, to the President of the Lexington and Big Sandy Railroad, so briefly presents the facts relative to the present condition and prospects of the Covington and Ohio Railroad, that we publish it entire. The reader will observe that it is written to correct impressions and remove apprehensions in Kentucky relative to the Covington and Ohio Railroad. This it ought certainly to do; for the facts are sufficient to satisfy any reasonable mind that the great undertaking will be completed. Incidentally, too, we have the data to show that this Virginia line of railroad, from the Atlantic to the Ohio, has the advantage of any other in the superiority of its grades. It is a remarkable fact, that although the distance from Covington to the White Sulphur Springs is only *one-tenth* of the entire road, yet such is the magnitude of the difficulties encountered in that distance that they involve an expenditure of *one-fourth* of the cost of the whole road! So, when that is done, in June, '62, the balance will be certainly pushed forward with much greater rapidity.

The section of railroad from Covington to the White Sulphur traverses the mountain division of the James River and Kanawha Canal—from Jackson's River to Howard's Creek. Should the French Company determine, as they likely will, to complete the water line east and west before finishing that heaviest and most costly part of their work, the Covington and Ohio will answer for the time, as a convenient portage of all the heavy freights which follow the water line.

With both these great lines finished and in operation, what grand results we shall have for Virginia! May we live to see that day—and, having beheld this glory of our good old mother, we would, indeed, be almost like old Simeon, ready to depart:

SWEET SPRINGS, Alleghany Co., Va.,
August 28, 1860.

Richard Apperson, Esq., President Lexing and Big Sandy Railroad Company—Dear Sr: I know the deep interest you feel in the success of Virginia's great central line of railroad, not only because it is the best medium of transit for the trade and travel of Kentucky, but as a national highway between the Ohio and Mississippi valleys and the Atlantic seaports; and having heard that in Kentucky there is a great misapprehension of the present condition and future prospects of this work, I take pleasure in communicating to you information on the subject, which will correct any unfounded impression that may exist.

I have been told that in Kentucky there is now less interest felt than formerly in the prosecution of the Lexington and Big Sandy Railroad, because the Covington and Ohio Railroad—the Western portion of our central line—with which it connects at the Big Sandy, is supposed to be languishing in the hands of the State of Virginia, and because its friends have been induced to believe that the Virginia and Kentucky Railroad, whose Eastern terminus has recently been fixed at Bristol, on the Tennessee line, is likely to be pressed with more vigor, and is a better outlet for the products of Kentucky. How these impressions have been produced, I do not know, but that they are grossly erroneous, I am glad to have the means to satisfy those whose deep interest in the subject will induce them to inquire for correct information.

The Virginia and Kentucky Road leads from the southern terminus of the Virginia and Tennessee Road, at Bristol, 206 miles from Lynchburg, to the Cumberland Gap. It is a corporation on the joint stock principle, with a capital of $2,600,000. In such cases, the State subscribes in the proportion of 3 to 2, when a *bona fide* solvent private subscription is made, and then pays her subscription, only *pari passu* with previous actual cash payments of private subscribers.

The road is 104 miles long, and as a good road through such a country cannot be made for less than $30,000 per mile, it must cost at least $3,000,000, probably more. The ruling grades, I should suppose, must be at least 60 feet to the mile.

It is doubtless an important road to the section of country through which it passes, and whether the capital can be raised wi be carefully considered before Kentucky r nounces her hopes in the Lexington an Big Sandy, and the Covington and Oh Roads. I learn from the proper authorit that the State of Virginia has subscribe $85,000, and has paid $63,000 to the pr sent date.

The Covington and Ohio Railroad bein the western portion to the "*central line*," a work undertaken by the State of Virgin on State account. It is 224 miles lon commencing at Covington, the western te minus of the Virginia Central Railroa The canal traversing the valley of the Jam river, from Richmond, will also soon reac that point. The State of Virginia has different times made four several appropri tions to this railroad; first, $1,000,00 then $500,000, then $800,000, and at th last session of the General Assembly, wit the purpose of removing all doubt as to h intention of prosecuting the work to com pletion with vigor, $2,500,000 was appr priated, being more than the aggregate the three first appropriations, and makin in all the amount of $4,800,000.

I send you a copy of a very full stateme of facts in reference to this work, recent furnished me by the State Engineer, Ch. Fiske, from which you will derive an amou of very interesting detailed information. desire particularly to call your attention to few prominent facts:

1st. The whole railroad line from Ric mond, (where the improvements in th James river, now going on, will in a sho time give sufficient depth of water for ve sels of foreign trade,) is 430 *miles*, of whic distance, the Virginia Central Railroad, fro Richmond to Covington is 206 miles an the Covington and Ohio 224 miles.

2d. The whole of the Virginia Centr Railroad is now in successful operation, ex cept ten miles, which is in a rapid progre to completion by the 1st of April, 1862, an twenty-two miles of the State work—th is, from Covington to the old White Sulph Springs, in Greenbrier county, will be com pleted by the 1st of June, 1862.*

* I have recently seen nearly all the most di ficult portions of the work, and feel no dou that it can be completed by June, 1862.

In the first division, viz: From Covington the White Sulphur Springs, there are seven tu nels, whose aggregate length is 10,800 fee 6,500 feet of this tunneling is nearly excavat

3d. Thirty-nine miles of the State work ave been worked on, at the east end and n the west end, embracing a distance of orty-four miles between the terminus at Big Sandy and the mouth of Scary Creek. On the Kanawha more than half a million ollars have been expended.

4th. You will see from Mr. Fiske's notes hat the late appropriation will not only complete the work to the White Sulphur Springs y the 1st of June, 1862, but will carry it urther west, embracing the most expensive art of the line.

5th. That though the distance from Covington to the White Sulphur is only one-enth of the whole line, when he reaches hat point he will have met one-fourth of the ost! Taking the Central Railroad as a whole, from Richmond to the Kentucky line t Big Sandy, (228 miles,) embracing all he different portions being in operation on he 1st of June, 1862, 61 miles more having been worked at an expense of nearly 600,000, and $4,800,000 expended on the State's portion west of Covington, can any easonable doubt be entertained of its future igorous prosecution? Add to this the encouraging fact that the part of the line now n operation belonging to the Virginia Central Company, (195 miles,) though terminaing in a wild, unsettled mountain region, hirty miles east of the White Sulphur Springs, is paying 5 per cent. cash dividends to its stockholders, after setting apart n ample annual sinking fund to discharge ts whole debt, you may rest assured that he early completion of our great Central Road to the line of Kentucky, at the mouth f Sandy, is a fixed fact.

What are you doing with the Lexington nd Sandy road? Be good enough to let ne hear. Look at the map; with that link dded to our Central line, you will have from Louisville, with slight variations to avoid ocal difficulties, a direct road of more than 00 miles in length, terminating at an Atlantic city, with the most favorable grades f any in the world, of that extent.

But, let me call your attention to the advantages of grade in our line in a more paricular manner; commencing at a point 180 miles from Covington, viz: at the mouth of Scary—navigable water of Kanawha, going east for 152 miles, it has no grade exceeding 20 feet to the mile; the Alleghany mountain is then ascended 10 miles with grades of 29½ feet, and thence 17 *miles descending the whole way*, with no grade exceeding 60 feet to Covington, where there will soon be the James River Canal to meet it, besides the Central Railroad. Thus the navigable waters of the west will be connected with a water line at the east, by a railroad portage, with no grade opposing the heavy trade going east, exceeding 20 feet to the mile, except 10 miles at one point of 29½ feet, which, with a very slight provisional expense for assistant power, makes the whole equal to 20 feet to the mile. You will observe that Mr. Fiske expresses the opinion, that the Covington and Ohio Railroad, carrying both passengers and freight, can be worked as cheap as a canal relying on tonnage alone.

I commend to your attention what Mr. Fiske says of a railroad extended from Big Sandy down the Ohio to Cincinnati, where there would be no grade exceeding 15 feet to the mile.

With a proper knowledge of the facts, no line can be expected to supercede this in public estimation, nor can its vigorous prosecution be *seriously doubted*.

Very truly yours,

E. FONTAINE, President
Va. Central R. R. Co.

or double tracks 26 feet wide, and is now being rched. There is one tunnel which may not be nished; but if it should not be done, a temporary track can easily be constructed over it, with nore favorable grades than those now used on he Central Road.

For the Southern Planter.

The Tobacco Worm.

ÆTNA, Hanover, Sept. 11, 1860.

Mr. Editor:—The number of tobacco worms this season exceeds that of any other season for many years. I think most of them are generated by such a moth as I enclose.*

By sowing the seed of the "Jamestown weed" in one particular place, and carefully destroying all others about the farm, I have succeeded in destroying many of the *large* moth,—such as are commonly supposed to deposit the egg producing the horn worm. But, as I cannot perceive any diminution of the worms, I incline to the opinion that the

* We are sorry the specimen sent us is so mutilated that we are unable, with the help of the microscope, to make out its form.—ED.

small moth (such as I enclose) is the greater enemy of the two. These, however, I have not found seeking the flower of the "Jamestown weed," but have seen them only on the leaf of the tobacco. It may be that they congregate with other moths and winged insects around our lamps and candles on warm nights; but I am told that they never appear when fires are built about the tobacco field for the purpose of attracting the fly—a species of treachery sometimes practised by the planter, with considerable success, against the large moth. A hint, by the by, taken from the sharp practice of some of our Yankey "*bretherin*" of this "glorious Union," (save the mark,) who display "false lights" on their inhospitable coasts for the purpose of leading to destruction distressed mariners for the sake of the wrecker's fees.

Upon examination, with the help of the microscope, you will find the form of the proboscis of the small moth very similar to that of the larger one—a flatted tube, beautifully polished, very pliant, but perfectly at the command of the insect, (nearly as much so as is the trunk of the elephant), and terminated by a tapering serrated point—the teeth all setting retrograde, like the spinae of a bramble, or the teeth of a whip-saw. This proboscis the insect keeps neatly coiled up like the main-spring of a watch, except when in use.

I have communicated the above for the purpose of calling the attention of planters to the subject; for our loss by the ravages of the horn-worm is very serious. I find that a thorough examination of nearly every leaf of tobacco *twice a week* does not relieve me of the mortifying sight of vast numbers of fine leaves reduced to a skeleton. Imagine, then, the time and labour of a close inspection of each leaf of 50,000 plants—and this *repeated twice a week*.

The whole subject of the depredation of insects on crops is become of vast importance. Millions would not pay for the loss that farmers and planters sustain each year from the ravages of "joint-worm," "chinch bug," fly, army-worm, &c. Cannot some of the time and talent, now so lavishly bestowed on politics by the intelligent and cultivated farmers of Virginia, be diverted to a subject of such vital importance as this? Are not nearly all disgusted with the incessant repetition of the names of "Bell and Everett," "Breckinridge and Lane," "Douglas and Johnson," Lincoln and—his "bottle-holder"—whose name I forget? Ho much richer, or how much happier woul any one farmer in Virginia be if his ow favorite candidate be the successful one Not one in a hundred either expects, hope for, or even desires office; and not one in thousand can, by possibility, get it.

This is one of the many curses inflicte by our present consolidated Federal Government, on Virginia and the other Southern States—that the talent and loyalty o our men of ability are alienated from thei native State, and bought up by the glitter ing promises of federal promotion—a cours which was foretold to the letter—with th accuracy and eloquence of Isaiah—by thos faithful old patriots, Mason, Henry an Grayson, when they solemnly warned th people against the yoke which Madison ha prepared for them.

As my contribution toward the subject i hand, let me suggest, that as insects hav greatly increased in number within the las eight or ten years, so have the birds decreas ed in number—having perished by thou sands under the severity of the intense cold deep and long continued snows and protract ed wet weather of many winters during tha period. Let us, therefore, entreat the hunts man to spare the birds—partridges, robins and *all*—and the farmer to feed them dur ing the winter.

And, Mr. Editor, let your contributio be, to republish that series of beautiful an eloquent articles on "Birds," that reall adorned the pages of "The Southern Plan ter" a few years ago.

L. H. Minor.

The first article in the series above allude to appeared, I think, about February o March, 1858. The style of diction and a rangement is remarkably pure and finished and yet, so simple and lucid as to make th articles exceedingly attractive. The autho I am told, is a Marylander.* Be that a it may, he has most successfully cultivate the style of "Wirt" and the "Spectator."

* We know the writer to be every inch a Vi ginian.—Ed.

Thoughts.—It is counted an honor t *live* like princes, but it is a greater honor t *give* like princes.

Mercy is so good a servant, that it wi never suffer its master to die a beggar.

For the Southern Planter.

[A] Young Farmer's Experience about Ox-Yokes.

[MR.] EDITOR:

Sometime last winter, I bought a fine [yo]ke of oxen, with an old-fashioned badly [m]ade and badly used yoke on them. Early [in] the spring the neck of one of the oxen [be]came sore, which I attributed to the old [yo]ke; so I laid it aside and ordered a [yo]ke from Baltimore, thinking one of those [fa]ncy yokes, such as we see at the Fairs, [w]ould almost make an oxen's neck. When [I] put the new yoke on, it seemed to fit so [tr]imly, that I was delighted with it; but to [m]y astonishment my oxen's neck got worse [an]d worse, and the neck of the other one, [al]so, became sore from the use of the new [yo]ke; so that I was reduced to the neces[si]ty of borrowing my neighbour's oxen to [ge]t along with my work. At this time, I [ha]d employed a plain, sensible man to [bu]ild me a barn. To him I stated my [tr]oubles, who said he could make me a [yo]ke in an hour or two, that would be all [th]at an ox-yoke could be; and he set to [w]ork about it,—getting a round piece of [sas]safras timber, separated all the bark and [lit]tle knots from it, and made it perfectly [sm]ooth, and round as a marble; and boring [th]e holes for the bows at the proper places, [pu]t the same old ring and staple in it that [w]as in the old yoke which I bought with [th]e oxen. This completed the yoke. I [w]as compelled to take up my oxen and put [th]em to work before their necks got well, [no]twithstanding which (with this yoke and [al]most constant work) their necks are well; [an]d I would not give such an one for all [th]e yokes in Baltimore for my use. I hope [n]o one else in the State of Virginia will, [af]ter reading this, send to Baltimore, or [an]ywhere else, to buy a fancy ox-yoke.

The only difference between the yoke I [ha]d made, and the one I bought with the [ox]en, is, that it is a little shorter, and more [pe]rfectly smooth and round.

A YOUNG FARMER.

Mecklenburg, Va., Sept. 10, 1860.

For the Southern Planter.

The Importance of Sleep.

September 8, '60.

[M]R. EDITOR:

In your number for this month you have [a] piece entitled "Sleep." Now some of your data are not sustainable. "First," you state, "those who think most, who do most brain-work, require most sleep." Facts are against you. "Napoleon the Great" thought as much or more than any other man, and slept *less—four* hours in twenty-four. I am a great sleeper myself, and am in favor of a full allowance for man and beast, but believe the man who labors bodily requires most sleep. "The sleep of the laboring man is sweet," says the Bible, and I believe it. Lord Byron is said to have slept but little, too little, and he certainly did some thinking.

Children sleep *more* than adults, and think *less.* The most energetic, thrifty men of my acquaintance sleep least. The most healthy and successful negro-owners are those who allow their slaves a full time to sleep.

TIDE-WATER FARMER.

How to Build an Ice-House.

Messrs. Editors:—Without attempting to persuade any of the importance of a judicious use of ice, or the pleasure to be derived from it during the warm weather, I will submit my plan for building an ice-house.

The perfect success which I met in keeping ice last summer, I think, is owing largely to a new principle involved in the building; therefore, I speak of the plan for the consideration of those who are about to build for that purpose. Instead of one hollow wall for a non-conductor of heat, as in ordinary ice-houses, I have two, with a space between them for confined air. The site is on a gravel slope. The foundation, for convenience in storing ice, is dug two feet below the surface of the ground. The outside wall for non conducting material, is six inches in the clear. The inside wall is four inches, with a space for confined air of four inches. The doors for entrance correspond perfectly with the hollow walls in thickness, and are filled in the same manner—being shaped to shut with a bevel edge, like the door to safes used by merchants and bankers. At the lower side of the plates in a ceiling, upon which I put spent tan one foot thick, which tan is in direct connection with the side walls, so that any settling on the walls may be supplied from overhead. From the under side of the ceiling runs a ventilator, with a hole of one and a half inch bore, up through the roof, and is finished with an ornamental cap.

The room for ice is eight by ten feet in the clear, and eight feet high. Without a more minute description, I think the building will be understood. If not inquire further, any who wish to do so. About all the waste of ice that I observed during the summer was the bottom; and this was so slow that we used the ice without regard to economy, for a large family, and in a dairy of thirty-five cows, besides giving freely to our neighbours.

I put sticks four inches thick in the bottom, to put ice on, and also some straw about the sides, as well as underneath the ice. Can you suggest how I can prevent water at the bottom? The ground is so porous as not to need draining, I think. I have thought of placing sticks crosswise of those already in, so as to form an open space at the bottom. Will that do?

B. S. CARPENTER,
In Rural New Yorker.

From the Ohio Valley Farmer.

What is the Best Manure to Sustain the Fertility of the Soil?

I answer, that for general application, farm-yard manure must take the first rank as a fertilizer containing all the substances required to sustain vegetation. An artificial compound may be made to have the same fertilizing power as barn-yard manure, but, in order to do that, no one of its constituents must be lacking. Although the manufacturer may intensify the fertilizing power of his compound by concentration, he cannot for general use improve the proportions of the ingredients of barn manure. The excellence of barn manure consists, of course, in the fact that, being derived from the varied food of domestic animals, it contains all the mineral elements which vegetation extracts from the soil, together with a good proportion of carbon and nitrogen. Moreover, the process of animal digestion and secretion have again in a measure brought these mineral matters which had become fixed in the plant into a soluble state, and therefore again ready to contribute to vegetable nutrition. In this point of view it is evident that this manure must include both the liquid and solid excrements. In fact, of the two, th liquid excrements are the most valuable o account of the large amount of nitroge contained and the entire solubility, thoug neither of the above constitutes a complet manure.

But although barn manure may be cor sidered a complete manure, from the fac that its continued application will sustai the fertility of a soil, still the degree c fertilizing can be profitably increased b the additional use of animal manures fror time to time. Flesh, blood, hair, bone etc., are formed chiefly from those vegeta ble elements existing in the seeds and nu tritious roots of plants; they are conse quently by far richer in nitrogen, phospho ric acid, and sulphur, the distinctive ele ments of seeds, than is that part of th food of animals which is rejected in th form of excrements; and which on th other hand, is richer in some of the mir eral elements derived by the plants fror the soil. To make, therefore, the anima manure a complete manure, it is only neces sary to add to it those mineral matters i which it is deficient. Of all the fertilizin elements contained in manures, by far th most expensive and valuable is nitroger whether in the form of salts of ammonia or of nitric acid. The next most valuabl ingredient is phosphoric acid, and the thir in order is potash. If we estimate th relative efficacy of farm-yard manure an animal matter merely by the amount of ni trogen contained in them, we have the fo lowing scale of values according to John son:

Farm yard manure contains of	Nitrogen,	½	per cen
Flesh,	"	3½	"
Fish,	"	2½	"
Blood,	"	3	"
Blood dried,	"	12 to 13	"
Skin,	"	8	"
Wool, Hair, and Horn,	"	16	"
Bones,	"	5 to 6	"

It must also be borne in mind that thes animal substances are much richer in phos phoric acid than barn manure, and tha wool and horn contain about five per cen of sulphur, which answer valuable purpo ses in the nutrition of plants.

Prof. Stephens, of Philadelphia.

Industry, economy and good managemen are requisites to the farmer's prosperity.

American Guano.

There must be a most remarkable variableness in the quality or constituent properties of this Guano on the one hand, as would appear, if the various analyses which have been made of it by chemists of the highest standing, were all published, and on the other hand a remarkably selfish discrimination on the part of its proprietors in publishing only such analyses as serve to impress the public with a favorable appreciation of its merits. We have on a former occasion challenged the publication of analyses by Prof. Maupin, of the University of Virginia, and Prof. Gilham, of the Virginia Military Institute. We now add another, obtained in 1859, from the late Charles Bickell, of Baltimore, which like the above, has not been published. The following extract from a letter of Mr. Bickell to a friend, who had playfully charged him with "being bribed by the American Guano Company," will suggest to the reader *why this analysis* of the article *has also been suppressed*." But to the letter:

BALTIMORE, March 21st, 1859.

Messrs. ——— :

DEAR SIRS—I wish to set you right about my relations to the American Guano Company. From the precautions I take to prevent the publication of my analysis of Jarvis' Island Guano, you might very naturally think, or you might very naturally not think, that I am bribed; well I tell you, that I cannot be bribed, but that sometimes I can be fooled.

When I was sick in bed, in the middle of January, the President came expressly from New York to pay me a visit and to talk with me about the analysis which I had previously sent him, and the worthlessness of the article. There was the analysis, most conclusive; and, here, the President of course, taking another stand to soften me down a little. He said that the practical results derived from this Guano, had been astonishing, and that he attributed them to their peculiar mixture of Sulphate and Phosphate of Lime. Besides, he said that they had been misled by the analysis from the Patent Office, (which I saw,) and which declared that Jarvis' and Baker's Island Guano, were identical. He then prayed me not to interfere with this Guano, so that he might sell some and save the company from bankruptcy.

I replied, that as soon as he sent any to Baltimore, I was obliged to expose the character of the stuff; but, if he kept away from Baltimore, it might be possible that I could manage the thunder over his head for some time; he, then, promised to send many specimens of Guano for analysis, but I have not heard of, or seen him since—that is the story. * * * * *

Yours, truly,

[Signed,] CHAS. BICKELL.

Now the reader will observe, that after withholding the analyses above referred to, by chemists, the high authority of whose names would have given general currency to the article, if they had reported favorably concerning it, they now thrust upon public attention an analyses of *samples* sent from this country to Munich for examination by Liebig, and the result they simultaneously publish in Germany, England and the United States, North and South, relying upon the authority of his name to give character to the article, notwithstanding the palpable errors in the analysis, as exposed by the Editor of the Southern Field and Fireside, whose commentary, we give along with the document.—[ED. SO. PLANTER.

LETTER FROM BARON VON LIEBIG.

Messrs. Editors:—I met a few days ago at the house of our consul here, Mr. Ten Broeck, the baron—better known in our country as Prof. Liebig, who had called upon Mr. T. B. with the enclosed paper, to get his assistance in rendering it into English and bringing it before the American public. Our worthy consul had, at the time, as much consular business on his hands as he could conveniently attend to, and was consequently rather unwilling to undertake it. In this dilemma I offered my services to Mr. Ten Broeck, who offered them to the Professor, and they were accepted.

I am happy to say that the result of my labors has proved perfectly satisfactory to both Mr. Ten Broeck and the Professor, who, to tell the truth, was a little disappointed at first in not getting Mr. T. B. to do it for him, as that gentleman has already assisted him several times in bringing his writings on similar subjects before the public, both in England and America, (although, I believe, he has never got the credit of having so.)

In order to make this matter as widely public as possible, I have prepared three copies, one of which goes to an English paper, one to a New York journal, and the other to you.

Hoping, gentlemen, that the enclosed article may prove of interest, I remain

Yours to command,

FRANK L. JAMES.

Munich, Bavaria, July 30, 1860.

RESULT OF ANALYSES AND OBSERVATIONS ON THE BAKER AND JARVIS GUANOS.

I received, a few months ago, through F. B. McDonald, Esq., American consul at Hamburg, some samples of two sorts of Guano, found on the Baker and Jarvis Islands, a small group in the Pacific ocean, lying 0°, 3′, 00″ south of the equator, and between 150° and 160° long. west. The height of these islands above the level of the sea is from thirty to forty feet, and their size varies from three to five miles long and from one to three miles broad. They are destitute of fresh water, and are quite barren, but serve as a roosting place and as a habitation to countless numbers of birds. which have covered them completely with their ordure. The mass of guano thus accumulated is being constantly increased by the debris of fish, which these birds bring as food to their young, and by the remains of dead birds, turtles, etc. One tract of this deposit on Jarvis' Island is covered with a crust from ¼ to 1 inch thick; on the Baker's Island, on the contrary, the deposit consists of a very fine powder.

Both these guanos contain a certain quantity of nitric acid and a trace of ammonia, but the essential difference between them and the Peruvian guano is the total absence in the former of guanine and of uric and oxalic acids.

To the naked eye the guano found on the one island is similar to that found on the other That on Bakers' Island (which for conveniency we will hereafter call Baker's guano, and the other Jarvis' guano,) looks like a mixture of a brown with a coarser white powder, and contains in small quantities a fine long fillament (1) like the root of some grass; the Jarvis' guano contains in addition a stone-like, white, porous substance, occurring sometimes in masses of a pound in weight. Under the miscroscope, however, they are widely different. The powder of the Baker guano consists of round white, yellow white, and brown, *shiny* granules, among which scattered crystals of Phosphate of Magnesia and ammonia were observed. The powder of the Jarvis guano seemed porous and angular, like pulverized pummice stone, and was of a yellowish white colour.

The principal ingredient of the Baker guano is the *phosphate*, with a very small admixture of the *sulphate* of lime. The following is the result of analyses of several samples, some of which I received from Mr. McDonald, and the balance through Mr. Sardy direct from New York.

COMPOSITION OF THE		BAKER'S GUANO.	JARVIS' GUANO.
Phosphoric Acid		40.270	17.601
Magnesia		2.207	0.568
Phos. Oxide of Iron		0.126	0.1607
Lime		43.379	34.839
Sulphuric Acid		0.941	27.021
Chlorine		0.132	0.203
Potash		0.171	0.456
Native Carbonate of Soda		0.676	0.332
Ammoniacal Salts		0.068	0.039
Nitric Acid		0.451	0.313
Organic Substance	Nitrogen	0.862	0.534
	Carbon	3.096	2.458
	Hydrogen, Oxygen	3.800	3.000
Sand (insoluble)		0.009	0.617
Water (loss in 100°)		3.945	12.118
		100.133	100.2597

or—

	BAKER'S GUANO.	JARVIS' GUANO.	
Phosphate of Lime	78.778	$3CaO,PO^5$	17.397
		$2CaO,PO^5$	16.026
Phosphoreted Oxide of Iron	0.126		0.1607
Sulphate of Magnesia	6.125		1.241
Sulphate of Lime	0.134		44.549
Sulph. Potash, Soda, Chlorine, Organic Matter, Water, &c.	14.950		20.886
	100.133		100.2597

Thus it appears from the above analyses that the Baker guano contains more phosphoric acid than any other known fertilizer, and is very similar in its ingredients to natural phosphorite, differing from it, however, in the following remarkable particular: Phosphorite is in a crystalized state and is completely insoluble in water. The Baker guano, on the contrary, is *amorphous* (2), is soluble to a considerable extent in water, and, when wet, colours litmus paper red. The Jarvis guano has also an acid reaction and is also partly soluble in water.

If we divide in the analysis of the Jarvis guano, the lime in the phosphoric acid into tribasic salt of lime and sulphuric acid (to form the neutral sulphate of lime), there remains $4\frac{1}{2}$ per cent. sulphuric acid free. This caused, at first, the supposition on my part, that a certain quantity of sulphuric acid had been added to this guano before it was sent to me, and that thus a part of the phosphate of lime had been converted into a superphosphate; but *physical* properties would contradict such an idea, even had I not received from Mr. Sardy, of New York, the most positive assurances that this guano is found exactly in the above condition on the Jarvis Island, and that it had undergone *no* preparation whatsoever. From this it is quite certain that the Jarvis guano contains the *phosphoric salt of lime* of Belugenstein ($PO^5 \times ^2 CaO$) naturally formed, which as yet has never been found in any other kind of guano.

I instituted a series of experiments on the quantity of phosphate which is dissolved from these guanos, respectively, in pure water and in a solution of kitchen salt in water.

If 1000 grammes Baker's and Jarvis' guano are mixed with 50 litres of water, in the 50 litres of the filtered solution

	Baker's Guano contains	*Jarvis' Guano contains*
Phosphoric Acid...	3.79	2.446
Lime...........	8.41	10.112
Sulphuric Acid....	11.63	22.845
Magnesia.........	0.82	1.379
	24.65	36.782

If we mix the guano with less water, or if we filter the water through it several times, we receive a richer solution of soluble ingredients, which contains in ten litres:

	Baker's Guano.	*Jarvis' Guano.*
Phosphoric Acid.....	4.93 gr.	9.16
Lime..	11.55	27.49

If instead of pure water we mix the guano with water containing one part kitchen salt to 1000 parts water, the solubility of the phosphates is considerably increased, and 50 litres of this very weak solution of salt dissolves from 1000 grammes

	Baker's Guano.	*Jarvis' Guano.*
Phosphoric Acid.....	4.765	5.884
Lime....	9.310	53.660
Sulphuric Acid......	12.412	73.158
	26.487	132.702

It is remarkable that the Jarvis guano, although only half so rich in earthy phosphates as the Baker guano, gives in water a greater quantity of soluble phosphoric acid. This is evidently owing to its containing bibasic phosphate of lime, which is in all solvents more soluble than the tribasic salt of lime. By increasing the quantity of salt, the solubility of the phosphates is not increased, as will be seen by the following experiments:

If we moisten 1000 grammes Baker's guano with 220 cubic centimetres of a saturated solution of common salt, (which solution consists of 80 grammes salt to 50 litres water,) the 50 litres of water would dissolve from the guano

Lime....................	8.540
Phosphoric Acid...............	3.198
Sulphuric Acid..................	12.145
	23.883 gr.

The conclusion manifestly to be drawn ftom the above is, that the addition of salt in small quantities to the Baker guano would produce a greater degree of efficacy, while increasing the quantity beyond a certain extent would diminish rather than increase the solubility of its phosphates.

Again, if instead of taking the common kitchen salt, we should take the *Abraum* (3), or *rubbish* salt, found in great quantities near Stassfurt, we arrive at the very same result. If we mix, in the proportion of 10 grammes of the last named salt to 100 grammes Baker's guano, and moisten the mixture with water, 50 litres of water would dissolve from 1000 gr. guano

Lime.........................	8.77
Phosphoric Acid...	2.94
Magnesia..............................	1.60
Sulphuric Acid	25.07
	38.38 gr.

In this case the solubility of the guano is not increased by the admixture of the salt.

As both these guanos are more soluble in water than any known natural Phosphate of Lime, it is to be expected that they are peculiarly fitted for forming superphosphates, and a far smaller proportion of sulphuric acid than they contain would suffice to place in a soluble condition a maximum of phosphoric acid. I have also made some experiments in this direction, which go to prove the truth of the supposition just made.

I added to 1000 grammes Baker's guano 180 gr. sulphuric acid; five litres of water in contact with the tenth part of this mixture dissolve

I. EXPERIMENT.		II. EXPERIMENT.	
Lime	5.709	After a longer digestion,	
Phos. Mag.	2.601	Sol. phos. acid,	
Phos. Acid	7.464	9.12	=12.26
Sulph. Acid	5.090		
	20.864		

Water in contact with Baker's guano dissolves 0.379 per cent. phosphoric acid—the admixture of sulphuric acid increases the quantity of soluble phosphoric acid twenty-four fold.

In order to examine the effect of dessication on the solubility of the phosphoric acid, I made a mixture in the same proportions as the above, and instead of lixiviating in the moist state, I dried the mass first in the water-bath and then lixiviated it with water, as the result of which process we have the following:

I. EXPERIMENT.		II. EXPERIMENT.	
Lime	5.750	After a longer digestion,	
Phos. Mag.	2.720	Sol. phos.	
Phos. Acid	5.018	acid 6.75	=7.49
Sulph. Acid	6.749		
	20.237		

In this experiment the solubility of the Phos. Acid was diminished by the dessication. According to this, then, it is far more advantageous, with the given proportion of sulph. acid, to the quality of the superphosphate, to use this mixture without drying, for by this process the quantity of phos. acid in a soluble state is sensibly diminished. By increasing the quantity of sulph. acid, however, the dessication seems to lose its noxious influence on the solubility of the phosphoric acid. *Vide* following experiment:

To 1000 grammes Baker's guano I added 200 grammes sulphuric acid; of this mixture one part was lixiviated in water, another, before lixiviation, was dried in the water-bath. The two experiments gave as soluble elements in 100 parts of guano,

	Dried in the bath.	*Manipulated moist.*
Lime	9.145	7.764
Phos. Acid	12.210	12.923
Magnesia	0.950	1.000
Sulphuric Acid	8.459	5.742
	30.764	27.429

A mixture of 100 parts of Baker's guano and 20 parts sulphuric acid and water give 120 to 125 parts (in weight) of dry superphosphate, and hence from 10 to 11 per cent. soluble phosphoric acid.

If Baker or Jarvis guano is mixed with weak milk of lime, and lixivated with water, the liquid thus obtained contains all the *nitric acid* existing in the guano, which is for the most part in combination with the lime—precipitating the lime by means of carbonate of potash and by means of evaporation, crystals of common nitrate of potash are obtained.

I regard the discovery of the guano deposits as a most fortunate event for agriculture at the present time. The prices of fertilizers rich in phosphorus, such as bones, are now continually on the increase, (which is ascribable in Germany to the fact of the wide-spreading use and the continual exportation of the bones from the country,) so that very soon no agriculturists except those who have a large capital at their disposal, will be able to procure an amount sufficing for their wants. The fact of Baker's guano being, of all fertilizers, the richest in phosphoric acid, will render it of special importance to Germany.

As far as *chemistry* can judge of the efficacy of these guanos, there is hardly a doubt that in all cases when the fertility of a field would be increased by the use of bone-dust, the Baker's guano could be used with decided advantage. The phosphate of like contained in the Baker guano is far more easily dissolved than that contained in bones, and if we take the amount of this ingredient in the latter as being 60 per cent., 100 lbs. of Baker's guano correspond in phosphate to 140 lbs. bone-dust. Thus the agriculturist will benefit his field as much by the use of 70 lbs. guano as 100 lbs. bone-dust. The guano (Baker's) contains ammoniacal salts, nitric acid, and azotic substance, containing nearly one per cent. active nitrogen. A small addition only of salamoniac is necessary to give it the full strength of Peruvian guano. It is very probable that the salamoniac could be replaced in this guano by Chili saltpetre, and the addition of a little kitchen salt, as our experiments show, would improve its solubility.

There is *no material*, which, without farther preparation, is better adapted to the manufacture of superphosphate than this guano, and by means of it every farmer could be in a position to produce in the most easy and economical manner this most active fertilizer. For this purpose it is not necessary to use concentrated sulphuric acid, but the cheaper, less concentrated *chamber acid*, (60 to 62 degrees in volume,) is just as good, 30 parts of which to 100 parts guano are sufficient to form most excellent superphosphate. The guano should be mixed first with water to the consistency of a thin paste, and the sulphuric acid then added and well stirred in. This is best done in large quantities on a stone or plaster floor. On adding the sulphuric acid, the mixture becomes heated, producing, on cooling, a friable, crumbling mass, which is easily reduced to powder by means of a wooden roller or pestle. In order to do this completely, it is perhaps expedient to mix with it a little gravelly sand. This mass exposed to the air soon dries in a moderate summer temperature.

The Jarvis guano, simply judging from its percentage of phosphoric ingredients, is of less value as an article of importation (into Germany) than the Baker guano; forty-four pounds of the latter contain as much phosphoric acid as one hundred pounds of the former. On the other hand, the Jarvis guano is rich in sulphate of lime, which is also used as a fertilizer, and its phosphoric acid is of higher value, as nearly the half of it exists in the form of soluble phosphate of lime. For turnips, clover, &c., it is just as good as the Baker guano, though pound for pound the *effects* of the latter are twice as lasting.

Some information concerning the native condition of these guanos, more certain than the mere heresay of mariners, would be of great interest to science. The absence of ammonia, uric acid, &c., in the Baker guano, is probably explained by the frequent and heavy rains which occur under the equator, and which have washed away these ingredients; but what to me is totally inexplicable, is the large amount of sulphuric acid in the Jarvis guano—*if it is mere animal excrement*, and that on a coral formation.

JUSTUS VON LIEBIG.

P. S.—The Jarvis guano seems as if it would be an excellent means of restoring cotton and sugar plantations, whose soil has been worn out by long cultivation. I am not, it is true, in a position to support these suggestions by *practical investigation*, but a few experiments in the parts where these staples are grown, would very soon lead to definite results. The Peruvian guano, rich in ammoniacal salts, tends to a large development of leaves and branches, not only without increasing the fruitfulness, but actually wearing the land out.

J. V. LIEBIG.

NOTES.

(1.) Mr. Sardy says in his letter: "On Baker's Island there is a small vine running over the deposit, fibres of which appear in the deposit."—*Translator.*

(2.) A solid substance is said to be amorphous when its component particles are not arranged in regular geometric forms.—*Trans.*

(3.) The *abraum*, or rubbish salt, found in large quantities near Stassfurt, is a mixture of chlorine and sulphates. The fact of its containing potash caused the suggestion that it might be useful as a fertilizer to land poor in the above ingredient, which led to the following analysis, (for which I am indebted to Dr. Rennig, of Dresden):

Sulphate of Potash,..................	15.76
" " Soda,....................	14.34
Chloride of Sodium,..................	2.69
" " Magnesia,................	31.49
Water,..............................	35.72
	100.00

By moistening Peruvian guano, with a solution of this salt in water, it replaces the loss of ammonia experienced by long keeping.—*Liebig.*

REMARKS BY THE EDITOR OF THE SOUTHERN FIELD AND FIRESIDE.

When the fact is duly considered that there are many millions of tons of the phosphate of lime on Baker and Jarvis' Islands in the Pacific, a description of which we publish to-day from the pen of the most eminent chemist of Europe, the reader will understand why his analyses and experiments are published simultaneously in Germany, in England, and in the Northern and Southern States of our own country. The statements are most extraordinary, and we fear a little too favorable to the owners of this immense property, to be reliable. We ask attention to a few facts which struck us with surprise on first reading the manuscript:

1st. That the guano from Baker's Island contains less than *one per cent.* of sulphuric acid, or 0.941 per cent.

2d. That 1000 grammes of this guano dissolved in 50 litres of pure water gave 11.63 grammes of sulphuric acid; being more than one and one-tenth per cent.

3d. By dissolving one per cent. of kitchen or common salt in 1000 of water, 50 litres of this exceedingly diluted brine dissolved out 12.412 grammes of sulphuric acid from 1000 of Baker's guano; or 25 per cent. more than the first analysis of this guano shows it to contain.

4th. In another experiment 12.145 grammes of this acid were obtained from 1000 grs.; and in yet another experiment 25.07 grammes were dissolved out of 1000 of the guano, being nearly 200 per cent. more than the first analysis exhibits. These errors are patent on the face of the analyses and experiments. That the addition of a small quantity of common salt to water considerably increases its power of dissolving bone earth, as found in the excrements of birds and other animals, is a fact of great agricultural value, and none the less because it was known before. Liebig is not unconscious of the scientific difficulties in which his analyses place these guanos; for he says:

"Some information concerning the native condition of these guanos, more certain than the mere hearsay of mariners, would be of great interest to science. The absence of salamoniac, nitric acid, &c., in the Baker guano, is probably explained by the *frequent and heavy rains* which occur under the equator, and which have washed away those ingredients; but what to me is totally inexplicable, is the large amount of sulphuric acid in the Jarvis guano, *if it is mere animal excrement,* and that on a coral formation."

Only a moderate acquaintance with the food of animals is needed to satisfy any one that they never consume nor void any such quantity of sulphuric acid or gypsum as is shown to exist in the Jarvis guano by Liebig's analysis; and it is highly probable that a carboy of this acid got accidentally broken near the guano before it was sent to the renowned Munich chemist, which acid expelled the carbonic acid present in the coral part of the compound, (as the analysis shows no carbonate of lime,) and thus produced this "inexplicable" anomaly in animal manures.

We are amazed that it did not occur to Baron von Liebig that the same "heavy and frequent rains" which washed away all the soluble salts of ammonia, soda, potash, and magnesia, except mere traces, or fractions of one per cent., must also dissolve and remove all soluble sulphates and phosphates of lime in animal manures! It is not a wonderful *scientific* discovery that the rain water of Germany, of Great Britain and of the United States will dissolve for all farmers so much phosphoric and sulphuric acid salts, which the far heavier rains of the equator have failed to dissolve in the last ten years and ten centuries.

Need we say more to put those on their guard who look to this journal for reliable information on all agricultural subjects?

The idea that an insoluble tribasic phosphate of lime, as it exists in bones, will change itself into a soluble bibasic phosphate in the excrements of birds or otherwise, appears to us in the highest degree improbable. The presence of so much phosphoric acid in these guanos, notwithstanding all the washing rains to which they have long been subjected, furnishes direct and satisfactory proof that this compound of lime and acid is very sparingly soluble in a state of nature.

From Patent Office Report of 1849.

Parasitic Fungi.

A Lecture, delivered in the City of Norwich, England, at the Annual Meeting of the Royal Agricultural Society, July 18, 1849,

BY EEV. EDWARD SIDNEY, A. M.

* * * * I shall endeavour to describe in simple, popular language, the nature, habits, and, as far as I can, the preventives or palliatives of the principal *parasitic fungi* of the British farm, beyond which, of course, I cannot go; avoiding all needless technicalities, and stamping my explanations with those characters which will promote their currency with every hearer. Whenever I am obliged to use a scientific term, I shall try to explain it; and I commence by remarking that the epithet *parisitic,* applied to a plant, means that it lives at the cost of that on which it grows. A *fungus* is a cellular plant without flowers, living on air and nourished through a *stalk, stem* or *spawn,* called its *mycelium.* It is propagated by minute seeds, or spores, or sporules, either colourless or not, but never green, and occasionally inclosed in skinny coverings, termed *sporidia,* or spore cases. Fungi live by imbibing juices impregnated with the peculiar principles of the matrix on which they grow. The spores mostly germinate either by a protrusion of the inner membrane, or by a lengthening of the outer covering; and the spawn is the development of these spores, or of itself already

produced, possessing the power of imbibing the juices just alluded to. The most familiar example is common mushroom spawn, which the little seeds will sometimes throw out on strips of grass, so as to be well observed. *Fungals* most commonly grow upon animal or vegetable substances in a state of decomposition; but many of the simplest organization attack tissues, in which its commencement is at least not ascertainable, or, if commencing, hasten it beyond recovery. The simplest form of a fungus is common mouldiness, which has two types. The first, as may be seen by the aid of the microscope, is composed of jointed threads made up of simple cells, placed end for end, which separate and seem capable of reproduction. * * * These cells are capable of being separated, and appear to be reproductive. The second assumes a thread-like appearanre, bearing spores upon the tips of the threads, or on short processes, and sometimes in cases, by the rupture of which they are dispersed. * * * Examples of spores in cases will be pointed out as we proceed. In a higher state, fungi take a determinate figure, formed of a cellular tissue, the centre of which is all spores, attached to it often in fours. This at length draws up, leaving only the dusty spores, as in the case of a common puff-ball. The most completely formed fungi have two distinct surfaces, one of which is even and without any opening,—the other separated into plates, called the *hymenium*, or *gills*, to which the spores are attached, generally four together. * * * So numerous are the seeds, spores, or sporules of fungi, that it is not easy to conceive a place whence they are excluded. Those which grow on matter in which decomposition has decidedly begun, have been well called the "scavengers of nature;" but others of a most minute description, some of which belong to my subject, apparently attack tissues in full health and vigour.

With regard to the properties of fungi, I can only mention in a word, that they are respectively *eatable*, *poisonous*, *medicinal*, *intoxicating*, and even *luminous*, lighting up with their living lustre mines and caverns where they grow, and in some places assuming at night the appearance of pendulous lamps hanging from the trees on which they vegetate.

I. I now propose first to describe the chief of those minute parasitic fungi which injure the corn and grasses of this country, premising that corn plants are themselves only grasses, the seeds of which are sufficiently large for our food. These little pests generally present themselves to the unassisted eye under the form of masses of dust, differently coloured, and appear on all parts of the plants except the roots. (1.) The stems or straw of our corn plants, and also the leaves, are frequently disfigured by a dark series of patches, constituting true mildew, and called by botanists *puccinia*, from the Greek *πύκα*, *thickly*, because of the dense masses of which it consists. It is found upon reed as well as corn, but the microscope reveals a slight difference in the structure of the spores, by which the puccinia of one species of plant is distinguishable from that of another. * * * Its appearance under a first-rate modern microscope is * * * that these dusty patches are crowds of club-shaped fungi, (spores,) the thicker end of each of which is divided into chambers containing the reproductive sporules. They burst through the *epidermis*, or upper skin, which they lift up, and the sporules, dispersed through the air, have been thought to find entrance through the *stomata* or pores. The ground of this notion is, that the patches of mildew are first seen in small cavities immediately beneath these *pores*, which, as Professor Henslow * * * observes, certainly looks very much as if the sporules entered there. With his usual caution he remarks, that "the fact stands in need of proof, and that hitherto the evidence is more in favour of similar fungi being imbibed by the roots of the plants which they attack." We shall shortly see that some experiments on another fungal parasite of wheat tend to show that these fungi are developed in a manner little suspected even by the most accurate observers. This parasite robs the living plants of their juices, and must not be confounded with a very minute fungus, called *dipazea*, which is peculiar to the joints of the straw; nor, as is more common, with another black fungus, which gives a dingy aspect to whole fields towards harvest, and is often called mildew, but which never attacks a plant till it is previously diseased, and which for want of any other name, I am obliged to announce by its botanical one, *Cladosporium herbarium*, the character of its growth being totally unlike mildew. It grows on old leather as well as on wheat. The dissimilarity to *puccinia* is visible enough. Spores may be seen in their cases. The common appearance of the straw, not being accurately observed, misleads. Though I have no other name but the botanical one by which to call it, I can trace its derivation to the Greek κλαδος, a branch, because the spores grow on minute branches. Whatever tends to preserve the health of the wheat will prevent also the attacks of this fungus.

(2.) We now come to other minute parasitic fungi of corn-plants. They are called *uredines*, the plural of *uredo*, from the Latin *uro*, to burn, on account of the scorched appearance of the parts on which they vegetate. Different parts are attacked by different species: the *uredo* of the maize alone growing everywhere except on the roots. The first *uredo* I shall mention is known familiarly to the farmer as rust, red-rag, red-robin, and red-gum, and comes out in yellow or orange blotches on the stem, the leaf, and chaff-scales, appearing as a powder. The hue of a whole field is often affected by it, and fears naturally arise; but it frequently happens that a few days' bright sunshine dissipates the fungus; but mischief has been done, and the crop feels it. It is called *uredo rubigo*. You may observe the spores * * * growing on the *mycelium*, which finds its matrix in the tissues of the plant. There is a curious botanical question, whether this *uredo* passes to *puccinia*. I think the best evidence confirms the opinion that such is the case.

(3.) The sooty powder on the flowering parts of corn-plants, called smut, chimney-sweepers, and dust-brand, is formed of the spores of another *uredo*, called *uredo segetum*. It renders the whole interior abortive; the pedicle of the flower swells, and a black dust occupies the whole. These spores are so diminutive that the diameter of one is only 1-2800 inch. Strange to say, some farmers welcome its appearance, because they conceive it augurs a good crop, forgetting that whatever ear it attacks, it makes one less in that crop.

(4.) Another *uredo* called bunt, or pepper-brand, seizes on the grain of wheat, and that to a great extent, if not guarded against. This *uredo* is termed *uredo fetida*, on account of its filthy odor. If you break a grain infected, you will find the flour replaced by a black mass, oily and fetid, and all the ovary is seen to be destroyed, except the integument, which swells, and incloses the spores, amounting in a single grain to nearly four millions. They are, like those of *uredo rubigo*, on their mycelium, or spawn, and are in diameter about 1-600 inch. * * * This *uredo* confines its attacks chiefly to the seed of wheat among our cereals; but some other plants, as the convolvulus, and of the grasses, as rye-grass, bromus, and poa, are subject to have their seeds destroyed in a similar manner.

(5.) These *uredines*, as well as mildew, though till recently not understood, have long been the subjects of observation. Moses threatened the disobedient Israelites with mildew, and the Romans had their false god *Robigo*, whom they thought to propitiate for the preservation of their fields from the disastrous attack of these diseases. A feast called *Robigalia*, to this deity, was always kept on the 25th of April, to deprecate blasting and mildew. The diseases themselves were long matters of curious speculation, and they were till lately regarded as accidents of vegetation, resulting in a mass of injured cells from the dampness of the soil, excess of manure, or fogs, or punctures of insects, and have even been attributed to the presence of the barberry, a fungus of which is called *œcidium*. * * * There have been many botanists who have believed that the spores of *œcidium* come up as uredines when they fix upon any cereal. It is the microscope which has enabled us to recognise in all these parasites a true fungal character, and to trace their growth; but the damage accruing from them has not been adequately estimated, for they never appear in the farm or garden without injury to the produce. For example, few can have failed to notice the effects of *uredo* on the rose trees, and also, but less frequently, on geraniums.

(6.) Numerous have been the speculations, and often ingenious the experiments on the way in which the reproductive sporules find entrance into corn-plants. Various remedies have been tried, and some with success, as in the case of bunt, or pepper-brand, which may be effectually checked by good dressing of the seed. The principle of dressing is the conversion of the adhesive oily matter of the spores into that which is soapy, which is easily washed off. This requires an alkali, and suggests the use of lye of potash, soda, or wood-ashes. Liming also has a good effect. Sulphate of copper and arsenious acid, the arsenic of the shops, are often used; but, besides the other objections to them, there is the danger to the vegetative powers of the seed. It is not usual to dress for smut, which attacks not only wheat, but barley and oats; yet the same reason applies in these cases, except that more difficulties are in the way, because of the dissipation of the sporules before harvest, and the remainder being knocked out in threshing. It is important to ascertain with certainty how the contents of the spores grow. Those of bunt are too large to enter the *stomata*, yet if sown with wheat it reappears. Some think the mycelium divides the earth into molecules, each of which has a vegetative power, and that any one absorbed by the roots extends until it reaches its peculiar point of election in the system. Others conceive that the spongioles of the roots imbibe the fine contents of the spores, which grow. It is certain that due dressings and washings prevent the reappearance of bunt, and that excess of manure encourages red-robin and mildew, which have also been observed to follow long feeding with sheep. Among the antidotes to mildew, I venture to name clean farming, amendment of the texture of the soil, ventilation, and letting in light; checking over-luxuriance in the young plants, growing early varieties in places subject to it, and avoiding putting on manure directly before wheat, and hoeing the wheat when young.

(7.) There seems no reason to believe that any *uredo* mentioned in deleterious, though bunt is disagreeable in the flour. It has been said that in past times, there were gingerbread bakers who had no objection to flour which contained the black matter of bunt, as it saved them the brown sugar which they otherwise must have used, to render this confection sufficiently dark colored for the approbation of their customers. If such customers there ever were, they must have had more regard to appearance than to quality. But I am now about to describe a fungus closely allied to *uredo*, which attacks grasses for hay, that appears to be quite poisonous. It is termed *ustilago*, having a similar derivation with *uredo*, and is left by Corda in his general classification in the same group Tulasne wrote a long paper on *ustilago* in 1847, with drawings. The one in question is called *hypodytes*. Its spores are black, round, and very small, and I shall call it *grass-smut*. There was a great deal of it in 1848. In a field near King's Cliffe, almost every flower-stem of the *bromus sylvatica*, which was one of the principal grasses, was infected by it. A plant was taken by Mr. Berkeley from this field, and, instead of its throwing up fertile spikes, almost every one is attacked.

The structure in a very young stage is thread-like, but all traces of *mycelium* soon disappear, and nothing remains but a mass of minute spores. * * * In addition to the ruin of the grass, this fungus is most pernicious. According to Leveillé, the immense quantity of black dust resulting from it in the hay-fields in France, produces disastrous consequences on the hay-makers, such as violent pains and swelling in the head and face, with a great irritation over the entire system. A like account was given of these peculiar maladies by Michel in 1845, which he compared to the well-known effects of ergot, on which singular abortion of the seeds of corn and grasses I do not enlarge here, because, though accompanied by a fungus called *ergotetia*, it cannot be called one. Botanists term it *ergotetia abortifaciens*, or ergot fungus, *rendering the seed an abortion;* but the only argument they adduce in favor of its producing ergot is, that it constantly attends it. But it is clear that because two things are coincident it does not follow that they are cause and effect, while the best examination does not warrant such an interference in this instance. I will only remark that it is more common than is supposed; and I am persuaded that cattle in ill-drained localities, where it always abounds, derives serious injury from it, and that it is the unsuspected cause of many disorders both in them and human beings.

Another *ustilago* named *typhoides*, damages the stems of reeds, swelling and distorting them, and rendering them almost useless for thatching.

The only remedy for such a disease in a grass-field seems to be breaking it up, and substituting for it a crop not subject to its ravages.

I have not time to dwell on another kindred fungus occasionally on the gramineous tribes. All are more or less subject to some *uredo* peculiar them.

(8.) I may be expected to allude to the true theory of *fair rings*, which are due to three species of the most highly organized fungi, called *agarics*. Mushrooms are agarics. Those of the fairy rings throw out their spawn in a circular direction, and the ground being continually exhausted by it, a ring is formed, which is rendered greener than the surrounding grass by the stimulus of the spawn itself.

I may just observe that in some countries, grasses and corn, and particularly barley and rye, are destroyed by a curious mould, which is developed beneath the snow, and if it appears in snow without previous frost, it is often fatal to the whole crop. It has not yet been noticed in Great Britain, but the matter will be worthy of attention should any long frost occur. I cannot omit to mention here, that the mouldiness in stacked hay is generally the common *aspergill*, to be described presently, and sometimes the common *penicillium*, also coming under review. The spores of these will be seen to be injurious, and therefore such hay ought always to be steamed. The cut surface of haystalks is sometimes covered with a light orange or brick-dust red fungus, but it is entirely confined to the stems composing the hay.

II. I go on next to the parasitic fungi of leguminous plants, which are particularly subject to them. A small *dipazea* destroys peas in wet seasons, attaching all parts, especially the pods; but the blight which we mostly see on peas, bears the botanical name *erysibe*, or *erysiphe*, the Greek for mildew, and is the same kind of mould that infests peach leaves. In its early stage it is a jointed mould; seemingly superficial, which on examination shows little globules, changing from yellow to black, and springing from a flocose web filled with minute sacs containing the sporules. * * * They put out fibres, which lift them up from the surface of the leaf, and are preceded by threads, white, or grayish, consisting of bead-like joints, of which it seems the uppermost fall off and grow.

Beans are injured by a *uredo*, the *uredo of the beans*, which was very prevalent last year.

Vetches are attacked by a fungus styled *botrytis*, from the Greek βοτρυς, a bunch of grapes, because the spores grow in this way. It is called the *botrytis of the vetch*, but in some places it attacks peas and lucerne, and it might therefore bear the name of the *luguminous botrytis*. *Botrytis* is distinguished from other moulds which are circulated, and so named *monilia* or *necklace* moulds, by it not having its threads jointed.

Dutrochet first stated, and I have verified it myself by a series of experiments detailed in my little work on the blights of wheat, that if a single drop of almost any acid is mixed with albumen, in eight or ten days necklace moulds appear; but, on the other hand, caustic alkali gives *botrytis*. With fibrine of blood and phosphoric acid, the results are reversed. Every sort of vegetable matter I tried with acid yielded a mould, but when albumen contained a neutral salt none appeared. If salts of mercury are present, the mould is stopped; æthiop's mineral does not check it; oxide of lead hastens it; oxides of copper, nickel, and cobalt retard it; oxides of iron, antimony, and zinc have no effect; all perfumes stop it. Flowers of sulphur effectually check the erysiphe on the peach, but they could not be applied to pea-fields. How far a knowledge of the facts I have just stated may lead to a remedy, easily applied in the shape of manure, future experiments may show.

III. These observations naturally lead to the *botrytis infestans*, found on the leaves of the potato when suffering from the true murrain. The *mycelium* of this fungus traverses the entire cellular tissue of the plant, and emerges from the *stomata* of the leaves, choking them, and the consequence is decay. This fungus is, I believe, new to Europe; so widely distributed a species could not have been overlooked. Mr. Berkely, the very highest authority, is of opinion that the fungus is the real enemy. Certainly all other theories have failed. The principles of the geographical distribution of food-plants plainly show us that extremely minute and unappreciable differences in climacteric condition may throw plants into an unhealthy state; which conditions might exist unsuspected for a few years. Hereby plants may be brought into a state which renders them capable of being attacked by certain parasitic fungi, of which the potatoe blight may be an example, and the *botrytis infestans* becomes, as it really seems to be, the proximate cause of the malady. The *botrytis* is found on the tubers; but, besides this, a *fusarium*, which must not be confounded with the former, nor regarded as characteristic of the potato disease, but of another, often occurring in the same tuber with it, is totally different from the *botrytis*, and the spindle-shaped spores tell the origin of its designation. Genuine science alone enables us to make such discriminations; and it is not too much to hope that experiments founded on some such results as I have announced from the few I have had leisure to make, may lead to the discovery of a check to the growth of this pestiferous *botrytis*.

The root crop of the farm suffers much occasionally from fungal diseases. Parsneps are subject to a variety of the *botrytis parasitica*, which blights the leaves. The leaves of turnips are attacked by the same fungus; but a different one, called *fusi-sporium*, is found on the roots, but with no extensive injury.

Mangold-wurzel is effected by the *uredo of beet*, with brown or black spores like that of the bean; but in all these cases the connection between the disease of the leaves and decay of the roots has not been sufficiently observed.

IV. Hops are damaged by an *erysiphe*, having the habits of that of the pea. It seems to be in its early stage a peculiar mould, but this opinion needs fuller confirmation. The whole subject needs investigation, and therefore I do not dwell upon it.

V. I now pass from the parasitic fungi of the fields to those found on other parts of the farm, its buildings, yards, and interior economy. The fungi destroying timber are not sufficiently known, though their effects are so common. Dry-rot is generally attributed to the spawn either of the *merulius lacrymans* or *weeping morel*, so called from the little drops of water it contains, or to that of the *polyporus destructor*, named from its many pores. But any of the fungi found on wood, and they are very numerous, are capable of producing it; and among them are, besides the two mentioned, another *morel* called *vastator*, the dædalea of the oak, deriving its appellation from its labyrinthine structure; various *polypori thelephora*, from θηλη, a nipple, by reason of its papillose surface, and *sporothricum*, the spores bearing hairy filaments. The effects of all these pass by one designation, dry-rot. I will now describe its progress. The first signs are small white points from which a filamentous substance radiates parallel with the surface of the wood. This is spawn, which, as it gains strength, insinuates itself into any crevices, however minute, and the threads are so fine that they pass between the tubes from which the wood is organized, and forcing them apart destroy all cohesion. Sometimes various spawns interlace and form a tough stratum; and the rapidity and force of increase are such as to cause, under favorable circumstances, the total destruction of the wood. From the experiments previously described on the growth of fungals, you will perceive that the acidulation of the fermenting sap promotes their growth. Kyanizing, or the application of corrosive sublimate, has been resorted to as a preventitive. An experiment may be made to show its effects: a solution of fish-glue will be found to yield fungi in abundance, but if corrosive sublimate be mixed with it none will appear, and the same result will follow additions of certain preparations of copper and other mineral poisons. Oak felled in the spring, when full of sap, is almost sure to have the dry-rot; therefore, that which is destined for farm erections should be cut in winter, for otherwise the only chance of stopping the appearance of the fungi is to substitute some poison by saturation for its proper juices, or to force them out by an objectionable pressure. Immersion in water is beneficial, but heat applied to dry wood only hastens the malady. In Brest the dry-rot is said to be unknown, and all the timber used in its yards is kept in a creek of the harbor.

VI. Fungi of a different kind from any yet described follow the British farmer into his dairy, and interfere with his household economy. *Penicillium* and *aspergill* are two terms applied to some of them, because in their microscopic appearance they resemble sprinkling brushes. *Penicillium* is the mould on hay, as was mentioned, and is found on bread, and also in the inside of casks; and there is reason to believe its spores poisonous, for two coopers, who entered a great tun, covered with this mould, to clean it, inhaled them, and were seized with violent pains in the head, giddiness, and vomiting, which only yielded to severe medical treatment. A penicillium is the mould of milk. If these moulds appear much in the dairy, or on the bread kept in it, the best remedy is washing the walls with chloride of lime, which it is important to know, as milk often suffers in this way. Foreign badly-made cheese has an unpleasant mould in brilliant scarlet patches; but in England the principal one on cheese is an innocent mould called *torula*, from *torus*, a bed, from its coming in layers. I may here just observe that the vinegar plant, as it is called, is in its advanced state a penicillium; and the beer fungus has been called torula; but before we decide the latter, we must see a regular fructification in air. There are hundreds of non-productive spawns for want of air and light, as, for example, the strange forms which diffuse themselves in cellars, which are incomplete developments.

You will permit me to state in this place, that the fungi on stored fruit are a *torula*, a *penicillium*, common fruit *mucor*, and a mould like the first stage of erysiphe. Harting asserts that he has actually propagated the potato disease from the brown matter in mouldy apples and pears, and it is remarkable that some ingenious experiments of Mr. Berkeley, on the growth of bunt, lead to show that its propagation may arise from mere grumous matter in the spores, which proves that many of our theories are immature. The experiments were thus made:—Wheat seeds were immersed in a mixture of water and the spores of bunt. A curious mould with conjugated spores sprung up on the spores of bunt. The wheat was sown, and the plants came up infected; but no communication could be traced between the cells and the shoots thrown out by the spores; no intrusion of the *mycelium* developed by the spores into the wheat could be discovered. The inference is, that the fine contents of the spores propagate the fungus; but this is quite opposed to our general idea of the growth of fungals.

VII. I will, lastly, touch on the facts now established relative to the fungi attacking animal tissues, which are very surprising. Sappy meat has always a fungus, something analogous to what is called the yeast fungus. This fungus is a mass of molecules, probably an early state of the same that is called vinegar plant, the last stage of which has been stated to be a penicillium. What are called *sclerotia*, from σκληρος, hard, appear in animal matter under particuliar circumstances; but these are only states of other fungi, for even *agarics* have been known to spring from them. The fungus of the West Indian wasp, of the caterpiller of New Zealand, and the muscardine of the silkworm, are all well-known examples of fungi attacking living animals. The last is easily propagated by inoculating healthy caterpillars, which I mention to show that a fungal disease may be conveyed from one animal to another in a state of health. I believe a more accurate knowledge of such facts will be ultimately of great use in investigating certain diseases prevalent among animals of the farm, and hitherto inexplicable. Sclerotia have been found in bad fractures, but they are not parasites: true parasitic animal fungi grow only on the skin or mucous membranes.

M. Robin published, in 1847, a most curious account of the vegetable matters growing on living mammalia, which he classes into two divisions—those of the skin, and those of the mucous membranes. The mucous membranes of the digestive canal and of the lungs are subject to their attacks; nor is the stomach free. All herbiverous animals are liable to moulds in the digestive canal, very like the yeast fungus, but larger; yet it is confined to them, and never found in carnivora, birds, or reptiles. A penicillium of birds is tolerably well known; and pheasants, fowls, and pigeons are occasionally the prey of a mould as yet imperfectly described. An *aspergill* is found in eggs; and that found in the air-cells of the lungs of the eider-duck has been often noticed. Parasitic animal fungi yield, it is said, to sulphuric acid; whence a hint may be obtained as to remedy, but I wish to speak with due caution on these novel investigations. Attempts have been made to inoculate dead animals with these fungi; they have entirely failed; the life of the animal is essential to their growth, the conditions of which seem generally to be imperfect states of respiration or nutrition, or irregularity. There seems to be a moment when the powers of assimilation flag, and then the fungi step in and appropriate the nourishment designed for the system. It may be the same with apparently healthy plants. We may here have the first ward to the key to many a hidden secret as to the ailments of the animals of the British farm.

VIII. I have now completed my humble attempt to give a popular outline of the chief parasitic fungi of the farms of England, which only require simpler names to be easily understood; and the farmer must learn to distinguish them from the diseases of the superficial tissues. It is a subject well suited to farmers' clubs, where good botanists and microscopists might be induced to attend to their instruments, and give simple explanations. Let it be remembered that simplicity is the handmaid of all useful science, whose truths are only impeded by needless grandiloquence. I can say by experience, that endeavours to propagate it will be found good subordinate auxiliaries to the higher aims of men of my own sacred calling; and while we see that there is not a thing so small or so apparently mean, but that it sparkles with some beam of the skill of its great Maker, I conceive that it befits the office I bear to show that the nobler teaching of Divine Wisdom, by things revealed, does not tend to deface, but to elevate our conception of God's perfection in things created. This earth was not made to be neglected, nor man to be unobservant; and if these unpretending gleamings I have gathered in my few moments of leisure shall this day have proved in the least degree acceptable to the present audience, or generally of any interest to the British farmer, of the kindness of whose disposition I have had more proofs than I have deserved, I shall rejoice in the honor conferred upon me by being allowed the privilege of addressing you.

The Southern Planter.

RICHMOND, VIRGINIA.

Poor Land--What Shall we do with It ?

CONTINUED FROM OUR LAST NUMBER.

The next step to be taken after thorough tillage of the soil, is thorough manuring, either by putrescent manures—for the most part to be made on the farm—or by the application of Lime. Plaster, "concentrated fertilizers," or "green crops," to be fallowed in. Perhaps the most judicious plan a farmer can adopt, is the use, to a certain extent, of *all* these articles, the rate of expense per acre which he shall incur, to be determined by his peculiar circumstances, such as his facilities for market, "force" of hands and team which he can command, and his capital.

But as to the item of home-made manures, we can safely assert that almost every farmer can make and apply to his fields a much larger amount per annum, than he at present does. A majority of the stables, and cattle-pens, are so arranged as to allow a large per cent. of their contents to run off and be wasted. The man who is guilty of such neglect, loses year after year many a dollar, which would add to his riches and comfort. There should be attached to all stables for animals, a vat, into which the dung and urine should be collected The bedding used in the stables, leaves, straw, saw-dust, &c., becomes thoroughly saturated and decomposed, and makes a large bulk of manure, which at least twice a year should be hauled out into the fields.

Many writers contend that this pit should be roofed over, so as thoroughly to shade it, and prevent any loss by evaporation from exposure to the sun. We do not consider this at all necessary, if the bulk is shaded by having straw or dirt kept over it, since the salts in the bulk will be retained if its moisture is evaporated. But on this point we may be in error, as we have never been able to see the experiment fairly tried—and have never been sufficiently well satisfied that it would "pay," to induce us to erect a building for this purpose. We have taken great pains always to keep in our vats a sufficient amount of moisture to prevent the "dry rot" or "fire fanging" of the bulk, and to have it well covered with straw to guard against evaporation as much as was possible by this cheap method. After saving the manure from *all* the domestic animals, including the fowls, by depositing their voidings in some suitable receptacle, a great deal more may be gathered together in time for our spring crops, by saving the ashes from the houses, the chips from the wood-pile, together with the soap-suds, dish-water, and the emptying of the "chambers," which should be composted for application to grass lots, corn, or vegetables. It is a manure of much value in quality, and any man who will take the pains to accumulate it for one year, will be surprised at the quantity he may secure. Nothing should be wasted which will make another blade of grass to grow. "Let nothing be lost." We have neither time or inclination to discuss the merits of the various modes of application of manures, but will only content ourself by saying, "it is good, applied in any way," while we acknowledge our individual preference for surface manuring because that mode of application for barn-yard manure has paid us best. We would, however, impress it on all farmers who desire to witness the improvement of their lands, to make all the manure they can, on their farms, and to apply it in *some* way.

In applying guanos, super-phosphates of lime, or *concentrated* fertilizers of an expensive character, we have no doubt that the economical method, is to use the drill. But we are inclined to believe that the *most economical manner* of using them for wheat is by applying them to spring crops for fallow, such as oats or peas. These crops are thus usually rendered large, and when turned in, greatly improve the soil. Besides, any excess of the fertilizer used, beyond the actual wants of the crop is rendered soluble by the time the wheat wants it. We have heard intelligent farmers state as their experience, that a small quantity of guano applied to ground sowed in peas in the spring, gave them a large pea growth for fallow; and another small application of guano at the time of seeding the wheat, produced a finer growth of wheat at a less cost of guano, than they could have secured by using more guano at seeding time. Of the truth of this assertion, every farmer can soon satisfy himself by experiment. We have already done so. After plowing in a green crop of peas or oats, an application of lime is advisable. If lime can be bought at a moderate price, say from eight to ten cents per bushel, and the hauling is not too expensive, it will pay to use from 25 to 100 bushels per acre—the quantity to be determined by the luxuriance of the fallow. If, however, the lime has to be hauled such a number of miles as to raise its cost to from 16 to 18 cents per bushel, we should use it in a much more moderate quantity than we should do under the circumstances first stated. In that case, we should sow it broad-cast over the wheat fields, early in spring, at the rate of from five to ten bushels per acre, say in March or April. This practice kept up every year, would more than replace the amount of calcareous matter consumed by the wheat crop from the soil, which, under such a course of treatment, would soon produce clover; particularly if the land were top-dressed (after clover is seeded) with wheat-straw, or a light dressing of ashes or plaster.

There has been a great want of faith in the fertilizing properties of gypsum, in many parts of our State, arising from the fact that the gypsum which was used and found inefficient, was, in most instances, the "Lubec Ground Plaster"—this from having been a long time ground, (perhaps from plaster originally a very inferior article.) was, in reality, only a carbonate of lime, and worth only as much as the same quantity of air-slaked lime. The Nova Scotia gypsum is much better, and is usually selected with care by the persons engaged in grinding it for sale.

After succeeding in getting "a stand of clover," it is not a very difficult matter to make land rich, by allowing the clover to fall on the surface, and to shade it well for a year or two. Besides, the roots of the clover bring up from below, a very considerable amount of inorganic plant food, which they take from the subsoil.

If the soil is so very deficient in alkaline matters, as to make it a hard matter to induce clover to take hold in it, a top dressing of Carbonate of Potash or Pearlash, mixed with Plaster, we have found of great benefit.

The best way of preparing these articles for sowing, is to dissolve the Pearlash in water, and to add Plaster sufficient to absorb it—taking care to avoid having the Plaster so wet as to make it impossible to separate its particles in sowing.

The wheat-straw made on the farm should always be returned to the land, in some way or other, since it supplies to the soil, (or prevents the exhaustion of) very important elements of fertility.

One very important means of improving land which should not be overlooked, is to keep as large a stock of cattle as the provender of the farm will support. These cattle should be kept, during the Winter, warmly housed; and if they are, their owner will thereby save in the value of provender consumed, enough (with the manure accumulated,) to pay for their shelter. To all those who are unbelievers in regard to this assertion, we say try it, and report results.

We shall say nothing of draining in our present article, although it fills so important a place in the discussion of the subject in hand. We are promised by a gentleman of great experience in "Surface," and "Thorough Under Draining," a full and complete essay on this subject, which we intend to have illustrated for the benefit of our readers. We hope to have the pleasure of laying it before them very soon.

Porter's Factory for the Manufacture of Linseys, Cloths, and Carpetings.

During a recent visit to Jefferson County, Va., we called in at the factory of Mr. Colin C. Porter, (near Summit Point Depot, on the Winchester and Harper's Ferry R. R.,) to see the quality of goods manufactured by him, and to witness the operation of his machinery. We were greatly pleased with the quality and variety of articles turned out by his looms, for which he has a ready home market.

Certainly Virginia has no need to buy the manufactures of other States, when her own factories can, in their several departments, turn out such goods as does that of Mr. Porter. We never saw any better Flannels, Blankets, Fulled Cloth, or Virginia Cloth, in our life; and we left the factory, glad that its owner was a native of our own State, and a successful leader in the cause of home manufactures.

May he have many successful followers in his footsteps, until we can procure all our own goods, for our State necessities, of Virginia manufacture.

We hope Mr. Porter will send a case of his goods to the Fair in this city in October, as they will prove alike creditable to himself and his State.

Kentucky State Agricultural Society.

We tender our thanks to Messrs. Bradford and Tate, the President and Secretary of this Society, for an invitation to attend their exhibition, held from September 18th to 22nd.

Sombrero Guano.

We call attention to the advertisement of Messrs. Edmond, Davenport & Co., of this city, (in our present number,) giving the views of Dr. Morfit, of New York, in relation to the value of this Guano, together with his analyses of it, and Navassa, and Jarvis Island Guanoes.

Acknowledgments.

We have received the following pamphlets, for which we tender our respectful acknowledgements, to the persons to whose courtesy we are indebted for them:

R. Hoe & Co.'s Descriptive and Illustrated Catalogue of their various printing machines, power presses, hand presses, inking machines, &c. Also, advertising every article connected with the arts of letter-press, copper-plate, and lithographic-printing and book-binding, to be furnished at the shortest notice.

Second Circular of the Maryland Agricultural College, containing the laws for its establishment and endowment, a catalogue of the Trustees, Officers and Students, for 1860, and setting forth the design of the institution in an address from the Trustees; also its location and building, terms of admission, the expenses of pupils, &c., &c. Under the administration of Charles B. Calvert, President of the Trustees, the future of this College is, doubtless, destined to be auspicious.

Register of the Officers and Cadets of the Virginia Military Institute, Lexington, Va., containing a brief history of its establishment, and of its operation for twenty-one years; a list of the Board of Directors, Academic Staff, synopsis of the course of study in Academic School; in the special school of Agriculture; the special school of Civil Engineering; the estimated annual expenses incurred by the Cadets, &c., &c.

Premium Lists of the Kentucky State and California State Agricultural Societies, of whose Fairs both were held in September.

The Premium List of the Agricultural and Mechanical Society of South-Western Virginia Fair, to be held at Wytheville, on the 10th and 11th days of October.

Regulations and Arrangements of the 13th Annual exhibition of American manufactures, works of American industry, &c., by the Maryland Institute, to open on the 9th of October, and close on the 6th of November, 1860. We have been politely tendered an invitation to attend, of which we will gladly avail ourself, should circumstances at the time be favorable for our doing so.

List of Premiums and Rules and Regulations of the Maryland State Agricultural Society, for the 13th Cattle Show and Agricultural and Horticultural exhibition, to be held at Baltimore on October 30th, 31st, and November 1st and 2nd, 1860.

List of Premiums, &c., of the Valley Agricultural Society, for its 5th annual cattle show and fair, to be held at Winchester on the 16th, 17th, 18th and 19th October, 1860.

Premium List and Rules and Regulations of the North Carolina State Agricultural Society, for the eighth annual exhibition, to be held at Raleigh, on the 16th, 17th, 18th and 19th October, 1860. Dr. Wm. R. Holt, of Davidson, President.

An Address delivered at the eighth session of the American Pomolocical Society, held in Philadelphia on the 11th, 12th, and 13th of September, 1860, by Marshall P. Wilder, Esq., President. This is a business-like document, replete with the most important instruction, on every branch of fruit culture, so concise and well adapted to the wants of those who would cultivate a knowledge of this branch of rural economy, that we shall give it an early insertion in this journal, for the benefit of our readers.

Mammoth Pears from a Dwarf Stock—Fine Grapes.—Mr. H. J. Smith has presented us with four varieties of most luscious Pears, raised upon a dwarf stock. The Pears themselves are anything but dwarfs. They are well developed, very large, and of fine flavor. He also presented us with specimens of two or three varieties of table Grapes of delicious flavor and well matured.

New Paper.

Edgecombe Farm Journal.

We have received the first number of this new paper. It is a handsome sheet of eight quarto pages, devoted to Agriculture, Horticulture, Floriculture, Household Arts, Rural Architecture, Zoology, &c.; published by Wm. B. Smith, Esq., at the very low price of 50 cents per annum.

Edgecombe is one of the most improved and improving counties in North Carolina, agriculturally, intellectually and socially, and she will act unworthily of herself, if she does not well sustain this enterprise, undertaken not for profit. as the price will show; but for the promotion of her own progress and property. Let us hear often, through its columns, of the successful practice of such of her citizens as Mr. Bridgers, in the cultivation of crops, draining of lands, hill side-ditching, &c., &c., and public interest will be awakened to an extent that will insure the success of the Edgecombe Farm Journal.

BOOK NOTICES.

We have received from J. W. Randolph, Esq., a very interesting and instructive book, on Natural History, entitled, "The Reason Why," by the author of The Reason Why [respecting] General Science, The Biblical Reason Why, &c., &c. It is a treasury of useful knowledge, available at all times by means of a very copious index. The same may be said of the Biplical Reason Why, which our readers will find an excellent guide in the studious reading of the Scriptures.

Adventures of Travellers in Africa, also eceived from Mr. Randolph. We make the following extract from the preface of the publisher, as a compendious description of the scope and design of the book: "An intense interest has recently been awakened and widely extended, in regard to South Africa. Questions are, in consequence, frequently arising as to the character of its surface, its diversified tribes, its plants and its animals; and the remarkable circumstances under which after long concealment, they have been gradually disclosed to view. The object of the present volume is to meet such inquiries by popular details on the highest authority, abundantly interspersed with *true* stories of chivalrous enterprise and heart-thrilling adventure." It is commended to our readers as both instructive and entertaining.

Nemesis. By Marion Harland. Author of Alone, Moss Side, the Hidden Path, etc. New York: Derby & Jackson.

The enviable reputation achieved by our fair Virginia anthoress, since the publication of Alone— her first and, in our opinion, best work — is fully sustained by her last book. Proud of her former achievements, she has again entered the lists, contending for fresh laurels, and boldly throws down Nemesis to run the gauntlet of criticism. The author, in the introduction, says: "Much that I have written I have gathered from MSS.—family papers, yellow with time. I do not pretend to say that my tale is a literal transcript of the lives of the various personages introduced, or that I have not interpolated characters and events—taken an anthor's liberty with dates and *dénouements;* but that I had a broad basis of fact for the foundation, and in my superstructure, have drawn less upon the imagination than is the fashion of some so-called biographers, in their veracious memories of modern celebrities, I may with truth affirm."

Marion Harland is fast attaining the position of a "star of the first magnitude in the literary firmament," and such satellites as Southworth, Sigourney, and Harriet Beecher Stowe, are obscured by her dazzling brilliancy. Sold by J. R. Keinningham, Richmond. Price $1 25.

Fanaticism and its Results; *Or Facts vs. Fancies.* By a Southerner.

This is a well prepared and powerful development of the subject, and is admirably adapted to the present time as a campaign manual for the use of the politicians who engage actively in the pending struggle for the Presidency of the United States.