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ESSAY

ON THE MANUFACTURE OF MANURES, AND THE APPLICATION OF THE SAME TO THE DIFFERENT VARIETIES OF SOIL. BY ASAHEL FOOT.

Common Salt.

Common salt, "highly recommended as a manure by some, has been as much depreciated by others, and hence, when directly applied, is considered as a doubtful fertiliser by almost all. The obscurity in regard to its use, however, rests chiefly on the quantity which ought to be employed. The result of comparative experiments made in Germany showed that a very few pounds per acre were sufficient to produce a largely increased return of grass, while in England it has been beneficially applied within the wide limits of from 5 to 20 bushels per acre, and when used for cleaning the land in autumn, of 30 bushels an acre.—*Appendix to Johnston*, p. 2.

Employed in moderate quantities in composts, salt is highly promotive of fermentation; applied liberally late in the fall, or early in the spring, it is very destructive to worms and insects; used in the form of a brine for soaking seed-wheat, it prevents the smut; and it acts otherwise beneficially, by stimulating the absorbent vessels of plants, or imparting to them direct food, by preventing injury from sudden transitions of temperature, and by increasing the moisture of dry, hot soils. It has a specific effect upon "all plants of the cabbage and onion tribe; nothing is more beneficial to an asparagus bed; and it is suggested to those, who consult their interests by rearing the most valuable kinds of fruits, to try the experiment, cautiously, of applying salt or brine in moderate quantities, about the roots of their trees." (*Farmer's Cabinet.*) Whether, however, it will be expedient for the farmers to introduce this manure in general practice, even if it suit his particular soil, is wholly to be decided by a reference to its comparitive expensiveness.

Charcoal.

"Charcoal" says Liebig, "surpasses all other substances in the power it possesses of condensing ammonia within its pores, particularly when it has been previously heated to redness. It absorbs 90 times its volume of ammonical gas, which may be again separated by simply moistening it with water" (p. 89.) "It is by virtue of this power that the roots of plants are supplied in charcoal exactly as in humus, with an atmosphere of carbonic acid and air, which is renewed as quickly as it is abstracted" (p. 61.) Being at the same time "the most unchangeable substance known," it is not surprising that it should constitute, not only one of the most powerful, but quite the most *durable* manure in existence.

In the language of J. Hepburn, Esq., of Lycoming, Pa. (*Cult.*, vol. 9, p. 106), "As charcoal is almost indestructible, and its effects remain as long as it exists in the soil, it is possible that it may be found one of the cheapest as well as most efficient manures for some crops, and on some soils. It appears evident from the manner of its action, that plants requiring the greatest supply of nitrogen would be the most benefitted by its application, and hence its efficacy when given to wheat."

Again, "charcoal has a *physical* as well as a chemical effect on soils, decidedly useful. It renders them, as far as it is present, light and friable; and gives additional warmth to them by its colour, which absorbs and easily retains the rays of the sun during the day." Mr. Hepburn also states the important fact, that "wherever charcoal has been applied *rust never affects the growing of wheat.*" Its use may also be recommended, on trustworthy authorities, as an excellent means of curing diseased trees and unhealthy plants. In the neighbourhood of forges, furnaces, smithies, and coalpits, considerable quantities of this manure can be obtained at a trifling cost, and it becomes the vigilant farmer to see that none of it is suffered to be lost.

Soot.

This substance, consisting chiefly of geine, nitrogen, and the salts of lime, potash, soda, and ammonia, is ranked by Dr. Dana "among the most powerful of manures in the class consisting of geine and salts." He observes, "On the principles adopted for determining the value of manures, the salts in 100 lbs. of soot are equal to one ton of cow-dung. its nitrogen gives in a value, compared with cow dung, as 40 to 1." *Manual*, p. 161.

A most satisfactory experiment with this substance has been tried by the writer, the present year. From 2 to 3 quarts of soot, which had been collected from a fire-place the last autumn, and lain exposed to the weather through the winter, was, some time in April, carefully incorporated with the soil about the roots of an egg plumtree, which, though it had borne fruit repeatedly, had attained but a very small size, and had not in the last seven years *put out so many inches of new wood*. The result has been, that by actual measurement, it has sent forth numerous shoots, the past season, from two to three feet long, and one to the length of *4 feet and a half*.

Sand, Gravel, and Clay.

Pure sand and gravel, from the obvious tendency they have to separate the particles, and thus increase the porosity of a tenacious and compact soil, may readily be supposed to possess no inconsiderable influence in improving such lands, as, by retaining too much water on their surface, are rendered unpleasant and difficult of cultivation, and to a greater or less degree unfruitful. It might also be taken for granted that pure clay would be alike beneficial when employed to give solidity to such light and porous soils as are incapable of retaining manures, and exposed to suffer severely from drought.

"On sandy soils a load of clay, properly incorporated, will produce a greater, because a more lasting effect, than a load of manure. Of this the fine farm formerly owned by Judge Buel is an example. This was originally a hungry, porous sand. To give it tenacity, and a proper retentiveness of moisture, Judge Buel covered his fields with clay from the Albany clay banks, at the rate of from 20 to 30 loads per acre, and his experience convinced him that a load of such clay (it contained from 20 to 30 per cent. of lime) was of more benefit than a load of barn-yard manure. He distributed his clay as fast as drawn, upon the sward surface, where it was decomposed by the rains and frosts, when it was pulverised by the roller, and further distributed by the harrow." *Cult.* vol. 9, p. 45.

"Even sand upon clay, or clay upon sand, are beneficial applications to improve the soil; the only question being, how far the benefits will repay the expense of application. The earthy materials are to plants, what the stomach is to animals—the incipient of food, and the laboratory of the main process of nutrition. The presence of clay, lime, and sand, are all essential to the soil, to enable it to perform its healthy functions. Where either of these is naturally deficient, it may be artificially supplied with manifest advantage. *Cult.*, vol. 3, p. 60.

Composts.

The *absolute value* of a compost depends on the amount of food it is capable of furnishing to plants. Its value *in relation to a particular soil*, will depend also, in a measure, on the effect it is calculated to have on the *texture* of that soil. The question of profit in *making* composts at all depends upon whether by their means the farmer can incorporate with his soil any valuable animal, vegetable, or mineral substances, which he might not *otherwise* appropriate to his crops with equal benefit, and at an equal expense.

One thing is certain; "nothing can be *added* to the elements of fertility by mixing animal, vegetable or mineral matters in a compost heap." The only questions then to be decided are, 1. Can any fertilizing matters within the farmer's reach be *better saved*—that is, *more profitably* saved, by the employment of compost heaps? and, 2. Can any such matters be more cheaply brought into *a fitter state for the use of plants* by their means? The first of these questions, it is believed, will not, as a general thing, admit of an affirmative answer; for by following the directions already laid down for the preservation of manures, the object will be nearly, if not quite as effectually, and far more cheaply, accomplished than by resorting to composts.

The only consideration, then, if "we have thus far trod on solid ground," which can render the system of composting highly advantageous to the farmer, will be the circumstance of his having on hand such animal or vegetable matters as cannot properly, or to a sufficient amount be decomposed in his barn-yard. Such exigencies will not be unfrequent. The farmer may have the misfortune, by accident or disease, to lose a horse, a cow, or a score of sheep. These are all appropriate subjects for the compost bed, and should never be suffered to decompose in the open air, so long as earth of any kind can be obtained to cover them, and to absorb the nitrogen which will escape during the process of putrefaction. Again, peat-earth, swamp-muck, and similar substances, in which there exists a large amount of woody fibre, may be the most conveniently and the most effectually reduced to a proper condition for the use of plants, in compost beds—especially in case a large amount of these matters is required in the operations of the farm.

How, then, the question now arises, shall we most readily, and at the least expense, effect the decomposition of these vegetable matters? or in other words, how shall we convert their insoluble into soluble geine—the direct food of plants.

"Every azotized constituent of animal or vegetable organism, enters spontaneously into putrefaction, when exposed to moisture and a high temperature. Accordingly, azotized matters (that is, matters containing nitrogen in any of its forms) are the only causes of fermentation and putrefaction in vegetable substances," *Liebig*, p. 230. "It is a well established fact, that the production of nitre is not necessarily dependent on the presence of animal matter; but that, under the influence of porous materials, aided by alkalies or lime, the elements of air combine and form nitric acid and nitrates." *Dana*. From all which it appears that three conditions are necessary for the decomposition of vegetable fibre; namely, 1. A sufficient degree of moisture: 2. A proper elevation of temperature: 3. The presence of some substance containing nitrogen; which may be either pure animal matter, animal matter, lime (the principal alkaline earth,) ammonia, potash, or soda, (the most important alkalies,) saltpetre (nitrate of potash,) ashes (consisting of potash, soda, and lime) common salt (chloride of sodium.)

The efficiency of these substances as decomposers will probably be found to correspond somewhat with the order in which they stand; but in making from them a selection for his particular purpose the farmer must of course be guided by circumstances. Whether his interest will be subserved at all by making composts, will depend on his facilities for accumulating undecomposed vegetable matter. Whether it will quit cost to employ his stable manures in composts, will depend upon the extent to which he can secure them (solid and liquid) in his cattle yard or in his soil, and upon the cheapness with which he can procure other decomposers; and whether he shall make use of lime, or of any one of the alkalies or alkaline compounds, in preference to another, he will decide with reference to the comparative expense of these articles, and the idea he has of their comparative value.

If animal manure be decided upon as the decomposer, it should be employed in as green a state as possible, its decomposing power depending entirely on its nitrogen, which even an incipient fermentation will diminish. The proportion in which the manure is to enter into the compost, should be determined by the species of the manure—it being recollected that urine, night soil, hog dung, sheep dung, horse dung, and cow dung, contain different amounts of the decomposing principle (nitrogen) corresponding with the order in which they are here arranged. The common practice has been, to allow one load of manure for 2 or 3 of vegetable matter; but it has been shown that this must depend on the quality of the manure.

It is equally evident, that the proportion of *vegetable* matter should not be regulated by the ease or difficulty with which it is likely to be decomposed; or in other words, by the amount of labour it will require the manure to perform. If the vegetable matter to be decomposed, be peat earth or swamp muck, it should have a previous opportunity of parting with its tannin, acids, and excessive moisture, by exposure for some length of time, to the atmosphere.

The ingredients being in the requisite state, and the proportions of their admixture determined on, the pile may be constructed as follows: First, lay the foundation (of the form, size, and depth desired) with vegetable matter—cover this to the proper thickness with the manure; and thus proceed with alternate layres of vegetable matter and manure, till the pile has acquired a sufficient height, when it should be finished (in a somewhat conical form) with a *thick* layer of earth, to prevent the escape of such volatile products as will be formed during the subsequent fermentation. If it be wished to hasten the process, lime, ashes, or salt may be added for this purpose; and, in any case, a small addition of plaster will be useful from its tendency to preserve the salts of the pile.

At the end of six or eight weeks, the whole mass should be shoveled over, broken down, and carefully blended together; and in case fermentation is still proceeding, a quantity of the finer earthy materials may be added. As soon as the work of decomposition is done, it should be removed immediately to the place of its destination.

"Weeds, leaves of trees, and all the succulent plants that grow so abundantly in ditches and waste lands, under hedges and by the road sides, if cut or pulled when in flower, and slightly fermented, furnish from 20 to 25 times more manure than straw does. These plants, carefully collected, furnish to the agriculturist an immense resource for enriching his lands. The turf that borders fields and highways, may be made to answer the same purpose by cutting it up, with all the roots and the earth adhering to them, rotting the whole in a heap, and afterwards carrying the mass upon the fields." —*Chaptal.*

To form a compost with Lime, our late Agricultural Commissioner (Revd. H. Colman,) directs to "raise a platform of earth on the headland of a field, eight feet wide, one foot high and of any length according to the quantity wanted. On the first stratum of earth lay a thin stratum of lime fresh from the kiln; dissolve or slack this with salt brine from the nose of a watering pot; add immediately another layer of earth; then lime and brine as before, carrying it to any convenient height. In a week it should be turned over, carefully broken and mixed, so that the mass may be throughly incorporated. This was applied in the hill to corn. The crop was equal to that obtained by barn manure on parts of the field immediately contiguous.—*Fourth Report*, p. 317.

In forming a compost of peat and lime, Dr. Dana recommends to slack a cask of lime with so much brine as will be saturated with a bushel of salt, and after ten days blend it thoroughly with three cords of peat, shovel it over occasionally for six weeks, and apply it directly to the soil.—p. 197.

Of the use of clear lime in forming composts, there seems to be, amongst our most intelligent farmers, a considerable shyness. The result of Mr Colman's observation on this subject was, that, in its application to peat composts, it assists in their decomposition; but its tendency is to expel their ammonia, to drive off the