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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.

Marl.

Marl being but a modification of lime combined with variable portions of divers other substances, it may be observed, in general, that whatever principles are applicable to lime (after having been deprived of its causticity) are applicable also to the use of marl, so far as its *nature* only is regarded. We shall, therefore, treat but very briefly of this substance. Suffice it to say, that its value has been highly appreciated in Europe, and in those portions of our own country where it has been most extensively employed, and that, wherever it is practicable (and it is highly so in many parts of Berkshire county), the strong probability is, that the farmer will find his interest in making a thorough trial, of it.

The most common locality of marl is low, wet swamps. It is readily distinguished from other soils by its light-gray colour when wet, and its white chalky appearance when dry. Its whiteness, indeed, will commonly indicate pretty nearly its comparative value, since both depend on the amount of lime it contains. A surer test, however, of the amount of lime present will be, to apply to it a few drops of sharp vinegar. If the marl be worth employing as a manure, it will effervesce; that is, small bubbles will appear, occasioned by the escape of gas.

In applying marl to different kinds of soil, particular reference should be had to two circumstances; 1st. The amount of its calcareous matter; 2nd, its texture. If the proportion of its calcareous matter be large, the smaller will be the quantity proper to be applied, and vice versâ. Again, if the marl be of a strong, adhesive texture, containing a large amount of clay, its application will be most profitable on loose, siliceous soils; if, on the other hand, it be of a sandy or shelly character, strong loams and clays will be most benefited by its reception. The common mode of its application is to spread it evenly over the surface, and, in case of cultivated crops, never to turn it under till it has been thoroughly crumbled down by the action of the atmosphere. The reason of this practice is thus stated by Chaptal: "It is necessary for earths, in order to possess great fertilizing powers, to be saturated with all the principles which they can imbibe from the atmosphere. Thus those which, by the depth of their beds, have been constantly secluded from the action of the air, will require to be exposed to it a longer time before becoming fertile. The lime contained in marl, as it is taken from the bed, is never saturated with carbonic acid; but after being exposed to the air, it becomes at length saturated with the acid it receives from it, crumbles and effloresces. The decomposition of marl may be hastened by frequently turning it, so as to allow the air free access to the lime; and this method is generally practiced by those who employ marl as a manure." (Page 44.)

The quantity of marl applied per acre may vary, according to circumstances, from five to twenty five or thirty waggon loads. For a full discussion of this subject, see Hitchcock's Geology of Massachusetts, a copy of which has been lodged with the town clerk of every town in the commonwealth.

Gypsum or Plaster.

Plaster, first introduced into the United States from Paris by Dr. Franklin, has effected the most important improvement in agriculture, perhaps, that has ever been made. Extensive districts in this and other countries, have been benefited by its introduction to an extent which, considering the comparatively *small amount* of the substance employed is truly astonishing. "In Germany," says Lampidius, one of her own agricultural writers, "it may with certainty be stated that by the use of gypsum the produce of clover and the consequent amount of live stock have been increased *at least one-third.*"

"There are, however, some tracts of country where the use of plaster has been attempted without success. But this arose from its being one of the original constituents of the soil, which derived no advantage from the addition of a new quantity. The existence of this salt naturally, in those lands upon which plaster produced little or no effect, has been proved by analysis."—*Chaptal*, p. 73.

Much mystery has heretofore enveloped the *modus operandi* (mode of acting) of this manure, but before the light of science the cloud is vanishing away. Many have supposed its efficacy to arise from the *specific food* which is furnished to certain plants, as to clover, for instance, which seems to be especially benefited by its application. But when we consider that by the employing of a *handful*, as it were, of this manure, upon an acre of ground the product is increased from a few hundreds *tons* of grass, it is at once apparent thus, on such a supposition, the cause is wholly inadequate to the effect. It was reserved for the gifted and honoured Liebig to lift the veil, and to produce a theory, not only plausible in itself, but fully sustained in all its parts by the experience of practical men.

His theory is this—that the efficacy of plaster consists in its arresting as it rises in exhalations from the soil, or descends in rain, dew, and snow from the atmosphere, the *ammonia* which is generated by the decay of animal and vegetable matter and appropriating it to the use of the growing crop. We will permit him to present his own views, however, in a few extracts from his "Organic Chemistry."

"Nitrogen exists in every part of the vegetable structure" (page 72). "The evident influence of gypsum depends only upon its fixing in the soil the ammonia of the atmosphere, which would otherwise be volatilized, with the water which evaporates" (p. 74.) In order to form a conception of the effect of gypsum, it may be sufficient to remark, that 100 lbs. of burned gypsum fixes as much ammonia in the soil as 6250 lbs. of horse urine would yield to it. (p. 98). "If a field be strewed with gypsum, and then with putrefied urine, or the drainings of dunghills, all the carbonate of ammonia will be converted into the sulphate, which will remain in the soil" (p. 184). "If we strew the floors of our stables, from time to time, with common gypsum, they will loose all their offensive smell, and none of the ammonia which to us can be lost, but will be retained in a condition serviceable as a manure" (p. 185). But this is not all. "When we give a plant nitrogen in considerable quantity, we enable it to attract with greater energy from the atmosphere the carbon which is necessary for its nutrition" (p. 183). Now "Carbon enters into the composition of all plants" (p. 3). So that, by strewing a field with gypsum, we enable plants to supply themselves from the atmosphere, not only with nitrogen, on which their most nutritious principles depend, but also with carbon, the chief constituent of all their framework.

This theory is confirmed by several circumstances which have long attracted the attention of observing farmers.

4. It has been observed that plaster acts with increased efficiency when applied in connection with manures or recently manured lands. The solution of the phenomenon, by our theory, is easy and satisfactory. The ammonia, which would otherwise escape from the decomposing manure into the atmosphere, is seized upon by the plaster, detained in the soil, and wholly converted to the use of the growing crop.

2. It has been observed that plaster acts with greater power on soils which have been recently stirred than on those which have lain for a long time unmoved. Solution: By stirring the soil its porosity is increased; consequently, it absorbs more freely the dews that fall upon it, from which the plaster separates and hoards up in the soil the rich deposits of the atmosphere. In proof of the extent to which the atmosphere is charged with fertilizing matters, which the rains and dews are constantly depositing upon the surface of the earth, we will here introduce the substance of a statement made to the American editor of the Liebig by Mr. E. Tufts, of Charlestown:—

"Eight years since, about three quarters of an acre of land, situated on one side of a lane, and on a declivity, were 'broken up.' About the same time, the proprietor of a field on the opposite side of the lane and above the land of Mr. T., commenced gardening on a large scale, and formed an 'immense bed' of compost in the lane. This heap was made of animal and vegetable matters, and from receiving constant additions is continually undergoing fermentation, and the gasses and vapours emanating from it are always perceptible. Four years ago Mr. T. observed that, in some inexplicable way, his land had become so sterile as to induce him to dispense with the use of manure. He has not used it since, and is now 'fully persuaded that its fertility is owing to certain vapours arising from the heap, and then descending on his land.' None of the soluble matters of the heap are carried to Mr. T.'s field, no manure has been applied, and its fertility continues unimpaired."—*Appendix of Liebig*, p. 366.

3. Plaster has been observed to produce but slight effects upon old, dry, and hide bound meadows. Says Liebig (p. 87), Water is absolutely necessary to effect the decomposition of the gypsum, and also to assist in the absorption of the sulphate of ammonia by the plants; hence it happens that the influence of gypsum is not observable on dry fields or meadows." To which it may be added, that, but a small quantity of putrescent matter exists in such cases, the exhalations are inconsiderable; and what is deposited from the atmosphere by the dews cannot be absorbed by the soil in consequence of its compact, impenetrable surface. On old, and even dry, *pasture* lands, the effect of plaster is much greater, there being ever present on their surface a portion of manure, to serve as a basis for its action.

4. It has been universally observed that the most striking effect of plaster is on the clover crop. Reason: "Red clover contains double the quantity of nitrogen that common hay does."—*Gray*, p. 158.

5. It has occurred, in the experience of different farmers, that where one part of a field is sown with plaster immediately before a thunder shower, and another directly after the shower, the portion sown first was benefited in a far higher degree than the other. Reason: "Rain water must, at all times, contain ammonia, though not always in equal quantity. It must be greater in summer than in spring or winter, because the intervals of time between the showers are greater. The rain of a thunder-storm, after a long protracted drought, contains the greatest quantity which is conveyed to the earth at any one time."—*Liebig*, p. 73.

6. Considering the beneficial effects of plaster, at large, it has been observed that they depend, in general, not so much on any peculiarity in the location or composition of soils as on those physical conditions which render the surface of the soil an easy medium for the transmission of soluble matter; all which, it is thought, must go to corroborate the theory in question.

From the views thus presented we are led to infer—

1. That the atmosphere is an inexhaustible source of food for plants. 2. That the most available agent for securing the benefit of this food to plants is plaster. 3. That, viewed in this light, the value of plaster in agriculture can hardly be overrated. 4. That it may be safely recommended for general use on all soils containing a portion of fermentative matters, and not so compact or wet as to prevent the processes of exhalation and absorption. 5. That it should always be applied to the surface of the soil, or at least within the influences of the atmosphere. 6. That it should be sown at an early date in the season, before the period of the most abundant dews and exhalations has commenced. 7. That it should always accompany manures used as a top-dressing, or only slightly buried in the ground. And 8. That it should be liberally employed about our barn yards, stables, vaults, manure-heaps, compost-beds, &c.; not, however, in composts, under the supposition that it will hasten the fermentation of the mass. "Davy has refuted this opinion by direct experiment, placing it beyond a doubt that the mixture of plaster with manures, whether animal or vegetable does not facilitate decomposition."—*Chaptal*, p. 74.

The proper quantity to be used, when sown broadcast upon the field, has been decided by experience, as also by chemical science, to be from one to one-and-a half bushels per acre.

Wood Ashes.

Ashes, whether "live" or leached, considering the certainty, uniformity, and power with which they act, as well as the permanency of their action upon vegetation, may well be ranked among the very best manures. The *fact* of this superiority over other manures is very generally understood; the *reason* of this superiority also appears quite obvious when we reflect that they are composed entirely of organized matter, reduced to the most consolidated form, and when, further, we learn from chemistry that their chief bulk consists of the very materials which enter most largely into the finer grains and grasses. Yet, strange as it may seem, no inconsiderable portion of this priceless article is suffered to be lost to all the purposes of cultivation, being permitted to be waste about our dwellings, and to disappear as useless rubbish. To this remark, however, we find (by going, to be sure, "a great way off" for it) one very striking exception. Even leached ashes, transported thither from every State in New England, and all the way from the Canadas, "are brought up" on Long Island "at an expense of *from* 35 to 50 *cents a bushel*, and considered a profitable investment at that."—*Cult.*, vol. 6. p. 42.

The most profitable use of this manure, when applied directly to crops, is probably on light, siliceous soils, ashes being admirably calculated, not only to improve the texture of such soils, but to furnish to them just that kind of organic matter in which they are most liable to be deficient. They may be applied, however, with certain benefit to any soil, and that either by spreading them on the surface of the grass or grain lands, or by applying them to the hill or drills in the case of hoed crops. The practice of dropping a handful *in* the hill, at the time of planting, has been practised by many farmers, and with excellent results. But perhaps their highest value will be found in the compost bed, since, being capable of liberating a large amount of nitrogen, they will greatly promote the process of fermentation. "One bushel of ashes contains 5-1-2 lbs. of potash, a quantity, sufficient to decompose 200 lbs of peat earth."—*Grays' Elements*, p. 348.

Saltpetre.

Saltpetre, as a manure, has been employed in the way of experiment, by several of our enterprising farmers, and, in some instances, with signal benefit to the crops to which it has been applied; its use, however, has been abandoned by the most judicious, as being more expensive than profitable. That a solution of this substance may be serviceable for soaking seed corn, has been established by the experience of many of our farmers. That it may also be employed effectually to banish the canker-worm from our apple orchards, appears from an experiment made by O. M. Whipple, Esq., of Lowell, an account of which may be found in Coleman's Fourth report, p. 335.

Considerable quantities of this substance frequently accumulate in combination with earth under old buildings, particularly barns and horse-sheds; when available, in this form, the expense of saving and applying it will always be exceeded by the profit.