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Nec aranearum sane textus ideo melior, quia ex se fila gignunt, nec noster vilior quia ex alienis libamus ut apes.

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ESSAY

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

Starting-Point of Improvement.

Here, then, is evidently the starting-point, from which the farmer, that would run the race of improvement, must calculate his "latitude and departure." From this "post of observation" must he survey the sphere of his labours, carefully noting the several ingredients of the soils, and the different proportions of their several combinations; as well as their several physical conditions; and thus will he be qualified to enter intelligently on the execution of any scheme relating to their improvement. If a careful observer, he will early make the important discoveries.

1. That an excess of siliceous or calcareous substances, by rendering the soil too porous, occasions the speedy disappearance of his manures, and frequently frustrates all his hopes of a harvest, and frustrates all his efforts at successful cultivation.

2. That an excess of argillaceous matter, by rendering his soil too compact, obstructs the passage of the surface waters that rest upon it in spring, refuses admittance through its indurated surface to the fertilizing dews of summer, excludes the healthful influences of the sun and air from the roots of his plants at every period, receives with indifference whatever manures he applies, and renders all his labours upon it, to a great extent, abortive.

3. That a certain admixture of the different earths composes a soil sufficiently light and warm, meeting, without detriment, the ever varying states of the atmosphere, affording a ready passage to the rains in wet weather, and to the dews in dry, appropriating largely to his crops the beneficial influences of the sun and air, making the most of every particle of manure received, and amply compensating him for all the labour he expends upon it.

Soils too Compact or Porous, improved by Admixture.

Having made the above discoveries, the resolute improver of the soil will come at once to the conclusion, that what the hand of nature has left unfinished, it is for him to complete; and setting himself at work, in imitation of the postern she has furnished him, will, by a due adjustment of the different ingredients of his several soils, bring up, at length, the poorest of his lands quite to the standard of the best. He will not, however, find it advisable, in most instances, to effect this adjustment directly, that is, by carting soil from one field to another for the purpose of admixture; but, rather, to cart it first to the cattle-yard, to be blended with a portion of solid and liquid manure, and thence convey it to the localities selected for improvement.

This practice has been followed, to some extent, by the writer, and with the most distinguished success. Indeed, so marked have been the beneficial results of this system, as to leave upon his mind the full impression, that for a light, siliceous soil two loads of argillaceous earth, well mixed in the cattle-yard with one of manure, are of more actual value than would be three equal loads of clear stable manure. For a heavy, aluminous soil, a similar treatment with gravelly or sandy loam, combined with manure, will prove equally beneficial.

Soils improved by Draining.

On wet lands manure should never be applied at all. Let such lands be thoroughly drained, and in most cases it will be found that no manure is needed; the soil being already supplied with a sufficiency of vegetable matter, which, having been kept in an insoluble state by an excess of moisture, will, under more fa-

vourable circumstances, become decomposed, and furnish abundant support to vegetation. But when it is needful that manure should be applied to lands of this description, thorough draining should, in every case, precede the application, and then the expense will be remunerated.

A Fundamental Principle.

What has now been advanced will make apparent, if the writer has not failed of his object, the importance of what he deems a very fundamental principle in the application of manures, namely, that not only in the quantity and kind, but in the mode of their application also, manures should always be adapted to the peculiar character and condition of the soil. This general principle, in its relation to the nutritive manures, may be reduced, by way of detail, to a number of highly practical rules, the most important of which are the following:—

Rules for the Application of Manures.

1. The smaller the quantity of organic matter in the soil, the greater should be the quantity of manure applied, and vice versa.

A light dressing of manure on an exhausted soil, and a heavy one on a soil already stored with nutritive matter, would be alike unjudicious; the former being insufficient, not only to give a permanent fertility to the soil, but even to make the present crop a remunerating one; and the latter having no immediate office to perform, the crop to which it is given being already supplied with appropriate food.

2. The heavier, moister, and colder the soil, the lighter, drier, and warmer should be the manure applied; as horse and sheep dung in an unfermented state.

3. The animal manures develop more or less heat, according to their nature, and their state of fermentation; those which have not been decomposed excite more heat, and maintain it for a longer time than others. The excrements of the sheep and horse are more heating in their action than those of the cow; the black or brown manures warm the soil more than marl or chalk." (Chapin, p. 37)

3. The lighter, drier, and warmer the soil, the heavier, moister, and less heating may be the manures applied; as cattle and hog dung, and compost manures.

The liability of light soils to suffer from drought, should lead the farmer, not only to exercise great care in selecting the most suitable manures, but to see that they are thoroughly incorporated with the soil, and not left in masses, to increase the evil. Moderate quantities of either animal or vegetable matter, if properly blended with the soil, will promote its moisture, by increasing its power of absorption; but if applied in excess, or left in considerable masses, the opposite effect will be produced. The same considerations should have their weight in relation to the kind or quantity of manure used (if any) in the hill, for hoed crops.

4. The more porous the soil, having a loose subsoil, the nearer the surface should the manure be deposited, to avoid infiltration.

We must beware, however, that while we draw one foot from the water, we do not thrust the other into the fire. If, on the one hand, by placing our manures too deep in the soil, we suffer loss from infiltration, so, on the other, by leaving them upon the surface, we shall find ourselves losers by evaporation, though, perhaps, to a less extent. The true practice would be, to give them just that covering which, while it would protect them from the more direct action of the atmosphere, would, at the same time, keep them longest within reach of the roots of the plants.

5. The more impervious the soil, having a compact subsoil, the deeper and more intimately should the manures be incorporated, to promote the freer action of the sun and air upon the soil, to render it easier of cultivation, to secure a wider range for the roots of the plants,

and to prevent excessive moisture in wet, and drought in dry weather.

The common air, which is, to a great extent, excluded from soils of the kind now under consideration, exerts a most powerful agency in promoting vegetation, and that in various ways: 1. By imparting to the soil the temperature of the atmosphere. 2. By furnishing nutritive principles from the decomposition of its own constituents. 3. By serving as a medium for the introduction into the organs of plants, of their appropriate aliment; and, 4. By conveying to the roots of the plants, the various fertilizing matters contained in the dews which it deposits on the surface of the earth. Says Chapin, (p. 33.) "That earth which is most easily affected by the dews, yields most readily to the action of the roots, whether it be to fix the plants firmly by their extension, or to draw from the soil its nutritive properties."

6. On soils disproportionately siliceous or calcareous, manures should be applied in combination with clay, or argillaceous loam to increase the retentiveness of the soil, by giving it a stronger texture.

The presence of a certain degree of moisture, which is not always possessed by soils of this description, is necessary, 1, to excite, by the oxygen which it contains, the vital energies of the plant; 2, by its solvent properties, to aid in decomposing the vegetable matters in the soil; and, 3, to dilute, to the requisite degree, the food thus prepared for the plants, and help to convey it into their delicate organs. "It is generally considered," says Johnston, (*Agricultural Chemistry*, p. 78.) "that solid substances, of every kind are unfit for being taken up by the organs of plants, and that only such as are in the liquid or gaseous state can be absorbed by the minute vessels of which the cellular substances of the roots and leaves of the plant are composed."

7. On soils disproportionately argillaceous, manure should be applied in combination with siliceous or calcareous matter, to increase its permeability, and thus make it more friable, raise its temperature, and secure, to a greater degree, the beneficial influences of the atmosphere.

To be convinced of the importance permeability, or looseness of texture to the soil, we need but reflect for a moment, that plants are not permitted, like animals, to roam about like animals, to roam about in quest of their food, the invariable limits of their pasturage being the extremities of their roots. How obviously necessary, then, that they should be enabled to extend their roots with the utmost freedom, and lay under contribution, without impediment, whatever elements can yield them sustenance.

8. On positively wet soils the application of manure should in every case, be preceded by thorough draining.

"Whenever water is converted into steam, the ascending vapour carries off much heat along with it. Let two adjoining fields be wet or moist in different degrees, that which is wettest will almost at all times give off the largest quantity of vapour and will therefore be the coldest. What is the remedy? A removal of the excess of water. And how? By effectual draining. The first effect upon the soil is the same as if you were to place it in a warmer climate, and under a milder sky, where it could bring to maturity other fruits, and yield more certain crops." [Johnston, p. 54.]

"If the water is withdrawn from a marsh, free access is given to the air, and the marsh it is changed into a fruitful meadow." [Liebig, p. 115.]

To the elevating of the temperature of cold, wet soils, too much importance can hardly be attached. "The solvent power of water over solid substances is increased by an elevation of temperature. To this fact is ascribed, among other causes, the peculiar character of the vegetable productions, as well as their extraordinary luxuriance, in tropical countries." [Johnston, p. 48.] It is heat alone, that, by animating the vegetable organs, enables the plant to elaborate within itself the nourishment which it receives." [Chapin, 36 and 102.]

Additional Rules.

The relations of manures to the roots of plants, and the peculiar action of manures on different plants and on different classes of crops, give rise to the following additional rules.

9. The deeper the roots of any plant penetrate the earth, the deeper should the manures be deposited; and the more superficial the roots of any plant, the nearer the surface should they be lodged.

The mouths of plants being uniformly placed at the extremities of their roots, the necessity is obvious, that, in order to derive from them the benefit intended, the substances employed as manures should be distributed in the soil, with some regard, at least, to the extension and position of these roots. That system which should lead the farmer to prepare in the same manner a patch of ground for strawberry plants, whose creeping roots scarce penetrate beneath the surface, and another for parsnips, which have been known to strike their roots to the perpendicular depth of six feet, would be indeed ridiculous.

10. The quantity and quality of manures should be carefully adapted to the character of the plant cultivated, as being a great or small consumer, and as having a special partiality for a particular constitution of soil, or for a particular kind of nutritive principles.

Some species of plants, as Indian corn, for instance, are well known to demand a supply of food which would surfeit and destroy the more delicate grains; some thrive luxuriantly in cold and wet, and others in warm and dry soils, to which an exchange of locality would prove fatal; and some, again, evince a natural appetite for the rank exhalations of fermenting manures, as those, in general, which have long tap roots, and large, fleshy stalks, while others prefer ammonia, as red and white clover; others lime, as potatoes and wheat; others common salt, as the asparagus plant, &c.

11. Whenever manure is furnished to the soil, the quantity supplied should be amply sufficient to secure the fullest development and most vigorous growth of the plants intended to be cultivated.

It is most interesting and important discovery of modern science, that plants, through the agency of their leaves, derive no small proportion of their elementary substances from the atmosphere; and that this proportion is graduated, to a greater or less extent, by the quantity, strength, and vigour of their foliage. "Hence, the proportion of organic matter derived from the air, in any crop we reap, must always be the greater, the more rapid its general vegetation has been." [Johnston, p. 146.]

In illustration of the extent to which the atmosphere is drawn upon by plants for their nourishment, as well as the agency which manures exert in the operation. "Sprengel states, that it has been very frequently observed in Holstein, that if, on an extent of level ground sown with corn, some fields be marled, and others left unmarled, the corn on the latter portions grows less luxuriantly and will yield a poorer crop than if the whole had been unmarled. [D.]

12. Unfermented manures should be appropriated, in general, to the use of hoed crops; fermented manures and composts alone, to the finer grains and grasses.

The reasons for this rule (which have been, in a measure, already anticipated,) are, that while Indian corn, potatoes, and most tap-rooted plants are benefited, in the highest degree, by the powerful gases thrown off from manures undergoing fermentation, their effect upon the finer grains is, to hasten unduly the growth of the straw, and thus to expose the crop, to the very serious evils of lodging, blasting, &c. "The plant," in this case, "absorbs more nourishment than it can readily digest, and becomes affected by a kind of obesity; the texture of its organs is rendered soft, loose, and spongy, and unable to give their products the due degree of consistency." [Chapin, p. 76.]