

is parted with on the next inspiration to the air entering into the lungs, and thus the great excitement is avoided.

Thus, then, we have seen that the blood arrives at the lungs loaded with carbonaceous matter: that it there comes in contact with the atmosphere, from which it receives oxygen, and parts with its carbon, which, in its new combination, forms carbonic acid; that from these changes the blood loses its dark colour, receives a bright vermilion hue, and acquires a greater amount of vitality, thus becoming fit for all the purposes of life; and that during its course round the system it is perpetually distributing warmth, and equalizing temperature. The necessity for these changes is abundantly shown by the one fact, that so long as the brain continues to receive this so renewed blood, so long is its vitality maintained, so long is it nourished and stimulated, and strengthened, and enabled to direct the whole system: while, give it for a short time only, the undecarbonised blood, and the sensorial functions are disturbed and presently destroyed. To explain this is impossible: we know it to be the fact: and we can only acknowledge and admire the infinite wisdom which so transcends and eludes all our best-directed investigations.

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## Agriculture.

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### MANURES.

BY JEAN BAPTISTE DUMAS.

The term *Manure*, in its widest sense, is extended to all substances, solid, liquid or gaseous, which are applicable to the nutrition of plants or to the promotion of their growth. Thus generally considered, manures are very diverse. In fact, every substance containing one or more elements of plants, wholly or partially susceptible of assimilation, in the act of vegetation, may be ranked as a manure. Sooner or later, the plants in contact with such substances will assimilate some of its elements—that is, either hydrogen, oxygen, carbon or nitrogen, or the water of combination, or even different calcareous, earthy or metallic salts which enter into the composition of nearly all plants.

Although the term *Manure* properly refers to every substance capable of furnishing one or more of the elements of a plant, yet custom limits the application of the name to those which furnish the nitrogen, alkaline and earthy phosphates, and other salts requisite for vegetation.

The carbon, hydrogen and oxygen exist abundantly in Nature, and a supreme intelligence dispenses them, in suitable proportions, in the forms of air and water. That which is most wanting and expensive to the agriculturist, as being the most fruitful source of abundant crops, is nitrogenous matter. Since the recognition of this great truth, and since modern chemistry has demonstrated the important agency of nitrogen, real manufactories of manures spring up and prosper, and the offal, detritus, and filth which were formerly unavailable, and were even the causes of the insalubrity of cities, are now rendered subservient to agriculture.

Every nitrogenous substance, liquid or solid, whether from the animal, vegetable or mineral kingdom, when employed in its original state and without previous preparation, constitutes a natural manure.

Among the animal manures are blood, muscular flesh, and the offal of the carcass. All the substances, in their rough state, should be used immediately, otherwise their rapid putrefaction will develop an infectious odor, and consequently render their use impossible in the environs of large cities where they are most abundant. We will see, however, in studying the prepared or manufactured manures, in what manner they can be indefinitely preserved and reduced to a bulk convenient for transportation to a distance, and thus made more uniform and constant in their action.

The herbaceous plants, turned under the soil in a green state, form a natural manure much used, especially in warm countries—for while furnishing nitrogen, they maintain a humidity very favorable to vegetation.

Without recommending this practice, we will merely remark that in the south of France and in Italy, certain plants, (such as the lupines, beans, and even maize) are specially cultivated for this purpose. For moist and cold soils they should be applied in a dry state; and of great advantage in this respect is the employment of rye-stalks and damaged hay. Leaves of trees are also applicable, for analysis has proved them to contain more nitrogen than other portions of the tree; and, moreover, they are not costly, being furnished in abundance and gratuitously by neighbouring forests.

Finally, among the natural manures of the vegetable kingdom must be classed aquatic plants, growing either in fresh or salt water. The plants which are gathered green from the marshes may be used in that state for the fertilization of the soil, as it suffices to merely turn them into the ground by ploughing.

The mixed manures which are employed without previous preparation consist of the offal of streets and excrements of animals.

Fecal matters and urine, either pure or diluted with water, are frequently applied in their natural states, merely by distribution on the surface of the soil. This mode enables all parts of such manure to be used, but it is not without inconvenience, for its great bulk renders the expense of transport heavy, and consequently limits its use to the immediate vicinity of its production. As the cities and towns produce more than is requisite for their vicinities, there is a considerable loss when it is not used in its natural state.

There are these objections, however, to fresh fecal matter: they communicate their disagreeable odor to the plants, and emit a pestilential effluvia in the act of being carried to and spread upon the field. A proper treatment previous to their application to the soil, obviates all these disadvantages.

Human excrements constitute one of the best manures. They are employed in a fresh state under the form and name of *gadoue*, or in a dry state as *poudrette*.

In China, Tuscany, Holland, Belgium, and many other countries, they are used in a fresh state, being diluted with water and then dispensed throughout the surface of the soil. In China they are kneaded with clay, and