stances which he would use, without difficulty or much expense.

With pure guano I should expect to raise a very heavy crop of wheat even on very exhausted land; but what would be the result? The crop, by consuming whatever there might have been of vegetable matter in the soil, through the stimulating power of the guano, would render it still more impoverished than before. As the weight of the crop is much more than that of the guano used, it is to be concluded that the plants are principally fed from the matter in the soil (for we may leave the atmosphere out of the case, though it contributes a share), and they appropriate all the elements of the guano besides.

Now farm-yard manure, which may be said to contain all the elements which plants require for their sustenance, does not give too great an appetite to the growing wheat, but guano does; this causes it to feed on the soil too greedily, and acts on it as the tonic medicine quinine does on a man: his appetite increases, and he gains in weight from its use; but it would be absurd to estimate his increase of weight by the quantity of quinine consumed, it being due in fact to the amount of food taken under the appetizing influence of the medicine.

Guano is chiefly powerful as a stimulant, and exhausts the soil; it acts as a dram of whiskey does on a half-starved labourer, who may put forth great strength and energy while under the excitement caused by it, but, being without substantial food in his stomach, his exertions cannot be sustained, even by an additional dram, which, if taken, would leave him more exhausted than before.

A farmer's object ought to be the enriching of his land; he should consider it a fund in which he may invest money, of which the principal is not to be drawn out, while the interest is employed in discharging his current expenses.

Such manure as guano should be applied in general but in aid of that produced on the farm by cattle house-fed. Why send to South America for guano, of which the nitrogen compounds, in which I include ammonia, are the chief elements, when these may be obtained at home at much less cost by means of a urine tank and dunghill, of which the organic parts are almost as efficacious and much more lasting. As to the phosphate of lime, of which guano is so largely possessed, it is but the same substance of which bones are composed; yet it must be admitted that, from containing also many other animal substances, guano is far more valuable than bones, however well prepared.*

It is to his farm-yard manures (with occasional aid from lime in a soil requiring it) that the farmer should look, and that must be a badly-managed farm which does not keep itself in manure.

In order to produce the greatest quantity of mixed or putrescent manure, there should be a constant effort to increase the number of live stock, and, above all, to feed* them well, for the quantity and quality of their dung will be proportioned to the quantity and quality of the food consumed by them; and every beast should be confined all the year round in stables and sheds with an abundant allowance of litter.†

The experience of the late M. Dombasle convinced him that where summer pasturage is adopted, and the cattle are fed principally on straw in winter, there is but one-fifth of the quantity of manure which would be obtained from cattle constantly and highly fed in confinement. He was of opinion that the additional portion of manure raised by the house-feeding system doubled the produce of crops, and increased the net profit in a higher proportion, because the cost of labour is the same for poor land as for that richly manured.

It is clear that as the quality of land improves, the stock maintained on it may be augmented, and as this augmentation advances, an increase of dung will progress, which again tends to increase the productiveness of the soil.

The chief point in the management of putrescent manures is to produce a sufficient but not excessive fermentation of the substances which compose them ‡ and since it is a property of horse litter to ferment too much, and consume away into a small, burnt up substance, with a great loss of its precious elements, it is better to mix it, while fresh, with dung from the cow-house or pig-sty, which ferment more slowly, and, being much cooler, check the heat of the former, rendering the temperature of the whole mass sufficiently high for its decomposition without any avoidable waste of its materials.

If there be no cow litter &c., sods, the scrapings of roads, peat mould, ferns, leaves, weeds (before their seeds are ripened), and such cold substances, may be advantageously intermixed with the fiery horse dung, to promote their fermentation, retard its own, and absorb the nutritious ingredients which may be formed, and this is not of trifling importance.

But it is more economical to plough dung into the soil (just before the crop is sown), especially if it be cold and cohesive, for the purposes of producing decay in the vegetable matter previously existing in it, and so helping to raise its temperature. By this method of using dung there is the least loss of its bulk and fertilizing elements. The nutritive powers of manures arise in the first place from their capability of generating heat, and in the second, from the readiness with which they part with their elements to the plants around them. Now, if manure, when applied to the soil, be in the commencement of putrefaction—that is, in the state in which it is beginning to part with its volatile elements—and if seeds or plants be so circumstanced as to seize upon these as they are given out, they are in the best position to attain perfection, with the least loss of manure to the farmer, because they have their food gradually and steadily afforded to them as they require it; and in order that this gradual supply may be so yielded, the state of the manure ought to be modified accordingly; that is, the putrefactive process must be quickened in some and retarded in others. As long as the process of putrefaction continues, so long will the supply of nourishment continue to be afforded by the manure.

But this process should be slowly performed; for if there were too quick a generation of the nutritive elements in the manure, the plants might be overpowered by them, and certainly there would be a loss of whatever portions the plants could not consume.

If this opinion be correct, the gradual supply of aliment to plants, in quantities barely sufficient for their use, would be the true system. The Belgian farmers collect the superfluous urine of cattle in

* The peculiarly advantageous circumstances under which farmers are placed who live near large towns need not be considered, because they are within reach of various manures at a moderate cost, and, therefore, are not forced to rely on their own farms for them: they may pursue systems of management which are exceptions to the general rules of improved husbandry.

* "I need hardly remind the farmers assembled in this room of the inferiority of manure made by the lean stock of the straw-yard, to that produced by the corn or cake-fed stock of the stable or the bullock-houses. The increased value of manure made by stock fed with oil-cake is, in fact, considered by the farmers of my neighbourhood, in Essex, to be equal to one-half of the oil-cake employed."—*Lecture of Mr. Cuthbert Johnson.*

† The reason why herbivorous animals—whose proper food is herbs or grasses—pass such large quantities of dung, compared with graminivorous, (of which grain is the natural food,) and, still more, compared with carnivorous animals (those which eat flesh) is, that the former swallow a great quantity of matter incapable of being digested, such as the woody fibre in hay and straw, and the skins of oats. Some are partly fed on animal substances, and on corn, and pass less excrement, because most of their food is appropriated to their nourishment. A meat-fed dog voids little matter for the same reason; his excrement is principally the lime of the unappropriated bones which he has eaten. As a general principle, all animals fed on substances closely resembling their own bodies in constitution, void little excrement.

‡ Mr. Baker, of Writtle, chairman of the London Farmers' Club, at a recent meeting, gave this testimony:—"On one occasion, about 23 years ago, by way of experiment, I applied 20 loads of manure, just as it was taken from the farm-yard; and I found it produced equally good crops with the same quantity of manure that had been fermented, and decomposed, and wasted by such process at least 50 per cent. I mentioned the experiment, at the time, at several meetings of farmers, but it was generally disbelieved, until its effect had been tested another year. On the succeeding crop that trial proved most satisfactory: since then I have continued to use it in that state." Thus half the quantity of dung in re-

ality produce the effect of the whole. Gardeners are in the habit of leaving a dunghill to rot until it becomes black and earthy—a mass of humus in itself; and delicate seeds require such manure. But it is extravagant for the farmer to let the material parts of fermenting cattle-litter diminish so much; for with the decrease of bulk, there is also the loss of some fertilizing elements.