

ness of growth which is so desirable and so beautiful to see. On all lands, whether light or heavy, it falls alike. But on pulverized clays,—in compensation, as it were, for their more laborious and costly cultivation,—it not only falls, but is retained and accumulates, and brings heavier crops. If, however, the light land farmer, with his more porous and unrelentive soil, is denied this advantage, at least to its full extent, he will gratefully recollect that this manuring from the air is continuous. All the nourishment is not given at once or at twice, but is falling ever, and so can be taken up by his growing crops as it falls, and before it is carried away.

To those who allow—as they must do—that for plants in a state of nature there is an abundance of atmospheric ammonia, but deny this abundance to plants, like wheat, in their present state, I would say, with submission,—Treat the soil as I treat it, cut off from it the entailed curse of thorns and thistles, deepen it, make it friable, enrich it by exposure, and its condition will be equally artificial with that of the plant it supports.

I am provided, then, with one portion of the food or manure which the plant requires, namely, the organic portion, and if I but do my duty and fit my land for its reception, I have it in such proportions, spread it so equally, and given so continuously, as to surpass all the richness and all the labor bestowed on the soil by the hand of man.

But something else is wanting, equally important and indispensable. The rain and the dews, the air at a time snow bring with them no mineral food, and without that the plant never reaches perfection. Of this food Tull took no account, and could give no account. And if the inferior land, on which he grew his thirteenth unailing crop without manure, still gave out its supply of mineral matter, it was fortuitous,—unthought of, and unacknowledged, and must have come from his perfect and entire disintegration of the soil by tillage and exposure; and this supply, with all his good husbandry, must soon have reached its limit. For his practice was, never to go beyond the staple to move the subsoil.

We live in more favored times. We know now, by analysis, the composition of the wheat plant, and that food must be found of the same nature with itself, to make up its ingredients.—We know, for example, that its chief mineral ingredients are silica sulphate of potash in the straw, and the phosphates of potash, magnesia and lime, in the seed. No matter, then, how or whence they are procured, whether from the yard, the shop, or the soil, these substances are the same, and must be had. Does the land I have chosen for wheat possess them? I examine its texture, and find it varies; and that some parts are light, others heavy. It is well worth the outlay, then, and—as closely as that can be done—I have it analysed. The light land proves not to be wheat land; that is, the mineral constituents of wheat are absent, or only partially present. They must be all found there, however, in quantities adequate to the demand. And, I must either take this course: supply them from the yard—a costly and lavish procedure, overloading

the land with much that is useless, supplying what is wanted unequally, and entailing a heavy expense in the doing of it;—or, I must meet the special wants of the plant by special manures, easily applied, and with greater evenness and economy.

In deciding on the latter, I do not forget the balance sheet; and that the cost of the purchased dressing will reduce the profits by so much, perhaps £1 per acre. But it is a merited penalty I willingly pay for an unsuitable crop on light-working land; for the grain per acre is still from £6 to £9.

I next try the heavier land; and there I am safe. For, if it be so that the clay and the loam abound in the substances required, I need go no farther. To all intents and purposes the manure is already there; and, if I add more, it is simply superfluous and extravagant.

Now, it has been shewn to demonstration that wheat land does contain them, in most cases, in such abundance as to be practically inexhaustible.

Specimens of soils from five different farms were taken to Professor Johnston for analysis.\* The phosphates and alkalis—in their small comparative proportions—are always present in clays and loams. But a vast weight of silica is required for a good crop of wheat; and it was found that four of the analysed soils, at only 12 inches in depth, would furnish enough silica for 900 crops, and the fifth enough for 3,000 crops. But I trench by degrees twice twelve inches deep. In the first four cases, therefore, the number of crops would be 1800; and in the last, 7,200 crops.

I do not say that there is this amount of inorganic ingredients for the wheat, in their several proportions, in all clays and loams; for they vary exceedingly. But, setting aside altogether the few utterly bad clays and worthless subsoils that exist, and allowing in others a variation to an enormous extent,—reckoning also the amount of silica required for each crop to be understated by Professor Johnston,—it will come to this: Reducing these 7000 crops to 1000, or lower and lower still; and these 1800 to 500, or still lower than that; it will even then corroborate the statement of our great chemical authority, and confirm my belief, that “There is an almost unlimited supply of the mineral requisites of plants in soils”; and that “It is possible, from their universal prevalence, that sufficient working of the soil may enable us to dispense with any artificial manures.”

Here, then, is all I want for the sustenance of my wheat crops. And here, too, I will add in conclusion, there is the one great point on which the accident of living in a happier age, has enabled me, with infinite advantage, to differ in practice from Jethro Tull. By means of the deep-stirring, uplifting fork, in lieu of the glazing and level plough, I bring up these mineral treasures, inch by inch, to be disintegrated and decomposed by the summer-fallow; exposing them gradually year after year, till I reach the limited depth of

\* Prize Essays of Highland Agricultural Society, vol. ii. p. 104.