

Yet, all kinds of plants do not imbibe from the soil a like proportion of the same earthy, alkaline, and other constituents. Thence, one kind of plants exhausts the soil of certain principles more than another. Cruciferous and leguminous plants deprive it more of its sulphates than the graminaceous plants, and the latter again deprive it more of its silicates. The great red clover *Trifolium pratense* requires a large proportion of sulphate of lime. If this crop, accordingly, is repeated too frequently, or at too short intervals, it frequently ceases to grow altogether, unless the sulphate is either applied directly, or in sufficient quantity in common manures of the farm. Certain maritime plants require a supply of common salt. These plants take up the salt largely by their roots, and grow feebly in proportion as the quantity of it in the soil diminishes by the continued production and removal of the same species of plants, and at length they cease to grow altogether when the soil is exhausted. Thus, though all plants exhaust the soil in growing, they do so in different degrees with respect to the substances taken up by them; and hence one species or family impoverishes the soil more with respect to the subsequent production of its own species, than with respect to other and dissimilar ones.

And not only do different species exhaust the soil in a different manner and degree, but the same species does so in a different degree, according to the time for which the plant shall be permitted to continue its growth. If plants are removed when young, they necessarily derive less of nutriment, whether mineral or organic, from the earth, than when they had arrived at maturity, and perfected their various organs. Thus, when leguminous forage plants, as the tare, are consumed in their young and green state for the food of animals, they are found to impoverish the soil greatly less than when they are suffered to arrive at their full growth, and ripen their fruits. The flax is what is termed by farmers a scourging crop; but it is found to be greatly less so, if removed in a green state, than if suffered to complete the period of its vegetation. Certain plants of the Brassica or cabbage germs, illustrate the same law. Of this, genius is the common turnip, which is usually sown in the early part of summer. In the first year, it forms a large nupiform root, and puts forth an extended system of leaves. This is the first period of its growth, and if the plant is then removed, it exhausts the soil in a moderate degree. In the following spring, however, it shoots forth a flower stalk, and bears seeds which are ripened by midsummer. If the plant is suffered to arrive at this stage, it is found by experience, to be one of the most exhausting crops which we usually cultivate: and the same remark applies to other plants—the carrot, the parsnip, and the beet, which, like the turnip, have two periods of growth, the one, that of forming their roots and leaves, the other, that of shooting forth their flowering stems, and bearing fruits and seeds.

All plants then exhaust the soil in growing, and render it less fitted for the production of succeeding races of plants, but in a different degree for plants of their own species than for dissimilar species, and in a different degree, according to the period of their growth, at which they are removed from the ground.

Nor is the effect confined to herbaceous or soft plants, whose stems yearly decay, but it extends to shrubby plants and trees. When a forest is felled or decays from age, it is rarely found beneficial to replant it with the same species of trees. The

gardiner who removes a fruit tree, as a peach tree, never replaces it by a peach, but by an apple, a pear, or some other dissimilar species. When a thorn hedge has decayed from neglect or age, it is never found beneficial to replace it by the same species of plants: thus the hawthorn is supplanted by the crab, or the sloe, or better still, by plants of some entirely different family, as the beech, the birch, or the holly.

From the earliest times, the experience of husbandmen has shewn, that the same species of plants can rarely be profitably cultivated in continued succession, on the same ground. If a crop of wheat is followed by another crop of wheat, and this by another, it is almost always found that each succeeding crop tends to decrease with respect to vigour of growth and produce. But if the first crop of wheat is succeeded by one of beans, and this by one of oats or barley, the whole may be expected to grow without sensible degeneracy; and the soil to be no further impoverished than what it must necessarily be, having its produce removed.—Hence, by changing the species of plants cultivated on any given space of land, a greater number of crops may be taken in succession, than when one species only is produced.

Further, in the case of the herbaceous plants cultivated by the farmer, it is found that certain soils admit of a more frequent repetition of particular crops than others; that clayey soils abounding in alkaline salts, admit of the more frequent recurrence of wheat than the siliceous. Some plants, too, may be cultivated for a longer period in succession than others, and may recur more frequently without injury, whatever be the kind of soil. Thus, oats may be cultivated for a considerable time in succession, without sensible degeneracy, provided the land is kept sufficiently fertile by the common manures of the farm, and so also may rice, if it is supplied with water. Hemp may be cultivated year after year, provided merely a sufficient supply of putrescent manures is given. The same is true of the Jerusalem artichoke, or tuberous-rooted sunflower in the fields, and of the onion and numerous plants in the garden. The cases do not invalidate the principle referred to. They merely shew that the ordinary manures of the farm supply the plants with the earthy, alkaline, and other constituents which they require; whereas, in the case of wheat and other plants, this source of supply is insufficient for the wants of the species.

Other circumstances are likewise to be taken into account, as influencing the practice of the farmer, in causing not one but different species of herbaceous plants to succeed to one another on the same ground.

Plants have a great difference in their habits of growth. Some have fibrous roots, which descend but a little way beneath the surface; such are all the gramina. Others have long descending fasciform roots, as lucern and other leguminosae. Such plants derive nourishment from a deeper portion of earth. Hence, the two classes of plants are better calculated to grow in succession to one another, than species whose roots descend to an equal depth, and derive their nourishment from the same portions of soil.

Another circumstance to be regarded, is the difference in the modes of culture of plants. Some require a greater degree of pulverisation of the soil, and this to a greater depth than others; and this greater degree of tillage is given, otherwise the crops will not succeed. The turnip and other plants of the cabbage germs, the beet, the carrot, and the parsnip, admit of and require hoeing and