inorganic substances necessary for its development, it can no longer receive the quantity of organic elements that are necessary for it; its development is checked—in other words, it does not thrive. Supply to the earth the elements that are wanting, and the plant will flourish.

But as all plants do not need an equal quantity of these solid principles existing in the earth, it explains why one plant may thrive in a spot where another will die. If only one of the substances necessary for the plant is wanting in a soil, it will not thrive: the other elements cannot supply what is wanting.

If the soil contains more solids than the plant can absorb, the excess remains in the earth, and if it is in sufficient quantity it may produce a second crop.

The facility which plants possess of appropriating substances to their nutrition is in exact proportion with the extent of surface and the number of organs appointed to fulfil that function, viz., leaves, roots, and branches. For this reason a plant which is abundantly supplied with leaves or roots, may still prosper where another would languish. The cereals having only narrow leaves and weak roots require a highly-manured soil. In the torrid zone the cactus, with its large, fleshy leaves, thrives even upon the parched rocks. How different, too, are the roots of a plant of lucerne from those of the wheat plant!

The existence in a soil of all the substances necessary to the organization of plants, does not, however, suffice to secure the development of those plants. They also require favourable physical conditions, such as air, light, heat, and moisture. No plant prospers deprived of air and light; without heat and moisture the richest soils remain unproductive.

The earth possesses the wonderful property of attracting the substances which serve for the nourishment of plants, taking possession of them and retaining them until it comes in contact with the roots of plants. It is remarkable that with an aqueous dissolution, the earth only extracts those principles which are useful to plants; it does not absorb those which would be useless or injurious to them. Without this beneficent property which cultivable earth possesses, the substances which serve for the nourishment of plants would be carried away by water into the subsoil, and lost to the greater part of our crops.

This power of absorption in cultivable earth has, however, its limits; from the moment that it is satisfied it can imbibe no more. It also varies, according to the nature of the soil; it exists in the greatest degree in clay, and least in sand; between these two extremes are placed chalk and the different mixed soils.

The roots only take their nourishment from those particles of the cultivable soil with which they come into immediate contact, through the finest extremities of their radicles. The absorption takes place by the co-operation of an organic acid contained in the last cell of the radicle. It is probably in the nature of this acid, that the faculty exists, which the roots possess of chosing the substances that suit them.

It was believed, for some time, that plants could only assimilate the nutritive elements when they were in a state of aqueous dissolution; this opinion is false as regards any but aquatic plants.

As plants only draw their solid nutriment from the soil by the extremities of their radicles, the quantity of nourishment contained in the earth must be much greater than that which is absorbed by one crop.

If we admit that the radicles of plants come into contact with the hundredth part of the earth, it follows that the nutritive principles stored in the soil are to be found there in a proportion a hundred times greater than would be strictly necessary to the development of the plants.

The bed of cultivable earth has yet another remarkable property—that of absorbing from the air and from the subsoil watery vapours, carbonic acid and ammonia. By the absorption of water or moisture the arable land *is warmed*; this remarkable phenomenon may be proved by direct experiments. Land which has been mellowed and well manured possesses this property in a higher degree than a hard poor one.

The absorption by the earth of carbonic acid and ammonia is favourable to the dissolution of mineral substances. Flints cannot be dissolved in pure water, but they can in water that contains carbonic acid and ammonia.

Stable dung or farm dung is a normal manure; it contains all the principles necessary for the nourishment of plants; for this reason it is the most certain in its action. It contains all the constituent parts of plants, but not all in the same proportion in which they existed in the cereals and fodder; for the entire elements of the crops are not converted into dung, the grains having received another destination, by which a considerable quantity of phosphoric acid has been carried off the land.

Stable dung has also a physical action upon the soil; it communicates heat to it, and during its decomposition into water, carbonic acid, and ammonia, it contributes powerfully to the dissolution of mineral substances. The effect that dung produces by this physical action is often greater than that which it produces as the food of plants. These simple principles which have just been set forth explain all the other phenomena.