

already present in the organs of the plant. What are those substances? They may be easily detected by an examination of the soil, which will enable us to discover the circumstances, under which a sterile soil may be rendered fertile.

Arable land is originally formed from the crumbling rocks, and its properties depend on the nature of their principal component parts. Sand, clay, and lime are the principal constituents of the different kinds of soil.

Pure sand, and pure lime stone, in which there are no other inorganic substances except siliceous earth, carbonate or silicate of lime, form absolutely barren soils.

Agillaceous earths form always a part of fertile soils.

From whence come the agillaceous earths in arable land; what are their constituents and what part do they act in favouring vegetation? They are produced by the disintegration of aluminous minerals by the action of the weather; the common potash and soda felspars, Labrador spar, mica, and the zeolites are the most common aluminous earths which undergo this change. These minerals are found mixed with other substances in granite, gneiss, mica-slate, porphyry, clay slate, granwacke, and the volcanic rocks basalt, clinkstone, and lava, &c.

Aluminous minerals are the most widely diffused on the surface of the earth, and all fertile soils, or soils capable of culture, contain alumina as an invariable constituent. There must, therefore, be something in aluminous earth which enables it to exercise an influence on the life of plants, and to assist in their developement. *The property on which this depends is that of its invariably containing potash and soda.*

The fertility of sandy soils, we may here observe, is referrible to the quartz and loam, which is found in sandstone.

Alumina exercises only an indirect influence on vegetation, by its power of attracting and retaining water and

ammonia. It is itself very rarely found in the ashes of plants, but silica is always present, having in most places entered the plants by means of the alkalies, viz. ammonia, potash, and soda.

Potash is present in all clay, and even in marl. It has been found in all the argillaceous earths submitted to experiment.

A thousandth part of loam, mixed with the quartz in new red sandstone, or with lime in the different limestone formations, affords as much potash to a soil only 20 inches in depth, as is sufficient to supply a forest of pines growing upon it for a century. A single cubic foot of felspar is sufficient to supply a wood, covering a surface of 40,000 square feet with the potash required, for five years.

Land of the greatest fertility contains argillaceous earths and other disintegrated minerals, with chalk and sand, in such a proportion as to give free access to air and moisture.

When volcanic ashes have been exposed for some time to the influence of air and moisture, a soil is gradually formed in which all kinds of plants grow with luxuriance. The fertility is owing to the alkalies contained in the lava, which by exposure to the weather are rendered capable of being absorbed by the plant, for the lava itself could not from its origin contain any vegetable matter.

Sturte ascertainment that water, impregnated with carbonic acid, decomposes rocks which contain alkalies, and then dissolves a portion of the alkaline carbonates. Plants, also, by producing carbonic acid during their decay, and by means of the acid which exudes from their roots in the living state, contribute also to destroy the coherence of rocks. Next to the action of air, water, and change of temperature, plants themselves are the most powerful agents in effecting the disintegration of rocks. Various species of plants emit acetic acid during germination; and a plant which has