the incombustible inorganic substances just described, enter into the circulation of our grain and other crops which are cultivated as food, and led the way to the establishment of agricultural chemistry, upon the immoveable foundation of observation and experiment. Before that, when any of those inorganic substances were discovered by the chemist to be contained in plants, it was imagined that they were there only by accident; but it has now been proved beyond all question, that they are invariably present in our crops, contributing not only to their growth, but, by a wise and beautiful management of the Creator, affording to animals those substances required for the formation of their bodies. Upon analysing the dung, and other excrements of animals, we find that these inorganic matters are again discharged from the body, again to be taken up by the vegetable tribes: and thus, ever on in an eternal round, they perform the part assigned to them in the economy of the universe, in contributing to the support of organic life!*

Amongst the most interesting and instructive researches which have lately been made respecting the substances which plants withdraw from the soil, are those of two German chemists, Weigmann and Polstorff. These philosophers caused the seeds of different species of plants to vegetate in sand which had been heated to redness, and treated with acids, so as perfectly to remove all organic matters; and also in artificial mould, made by mixing together the substances which are contained in fertile soils. By careful analyses of samples of the seeds employed in these experiments, the exact quantities of the inorganic elements contained in them were ascertained. The soils prepared as described, were carefully protected, by being enclosed in cases, and watered with pure water free from ammonia. In the pure sand it was found that the plants shot up, but soon decayed; while in the artificial soil they flourished vigorously, producing ripe fruits and perfect seeds. The plants obtained in both cases were analysed, and the result was, that the plants grown in pure sand contained about twice the weight, and those grown in the artificial soil from four to five times the weight of inorganic substances in the seeds used. To ascertain how the increase in the weight of the inorganic elements grown in what was considered as pure sand had occurred, a portion of it was submitted to analysis, and was found to contain silica, potash, lime, oxide of iron, and other substances, resulting from the decomposition of some grains of felspar (one of the ingredients of granite) which were contained in it, and which had been rendered soluble by the action of the carbonic acid of the atmosphere.

Thus when we understand that plants extract from the soil the inorganic substances existing in it, we easily comprehend how what is termed *exhaustion* of a field is produced; for, let us suppose, that in the soil of a field there are just 520lbs of one of those substances, silica for example, which is particularly required for the growth of wheat, and that by an examination of the whole amount of crops raised in the field, we find it has taken up 260lbs of that substance, it is evident that if we raise another crop of the same kind, in the following year, the field must have no silica for

* The inorganic substances which have hitherto been discovered in the ashes of land vegetables are, according to the researches of Drs. Will and Fresenius of Giessen, as follows:—Potash soda, lime, magnesia, peroxide of iron, oxide of manganese, silica, phosphoric acid, sulphuric acid, carbonic acid, chlorine, flourine.