

retain watery vapor—products of the four first named. This power of absorption is due partly to their chemical, partly to their mechanical nature. We must look to their chemical constitution to determine the presence, absence, or deficiency of those first named, to their mechanical texture, to the fineness of the several particles which make up the mass of soils, to determine their absorbent quality. The substances which have been named include all that are essential to the composition of a soil, and they are also of equal value to the organization of vegetable matter. One of them, alumina, is found in such small proportions in plants that its presence is deemed of no special value. Its duty in soils is to absorb and retain atmospheric supplies of food.

The organic elements form, by different modes of combination, a very large number of substances peculiar to different plants, which substances make a difference between different classes. Thus we have gum, sugar, starch, a great number of oils, such as peppermint, turpentine, &c., a great variety of perfumes, and an almost endless variety of substances used in medicine, such as quinine, strychnine, &c., all composed of organic elements. A great many substances have been discovered amongst organic bodies composed of the same elements, and yet exhibiting physical and chemical properties essentially distinct from each other. A great class of bodies known as the volatile oils, oil of turpentine, essence of lemons, oil of balsam of copaiva, oil of rosemary, oil of juniper, and many others, differing widely from each other in their odor, in their medicinal effects, in their boiling point, contain the same elements, carbon and hydrogen, in the same proportion. No one of them contains more of either element than the others do. Nature, in her perfect laboratory, furnishing all these by skillful arrangement and mode of union; now making food to support life; now a deadly poison to destroy it; now a sweet perfume; now a most fetid odor; now a brilliant dye. We have the same elements partially under our control, and though we cannot vie with her in formative skill, yet we can, by calling the intellect to aid the labor of the hands, make the earth to yield its fruits abundantly, secure a sustenance for ourselves and a heritage for our posterity.

I propose now to give the composition of one of the crops most usually cultivated for food, as to its mineral constituents, being those which come from the soil and which cannot be furnished by the air, thereby to show the connection which exists between the soil and plants. We might go further and from an inquiry into the material of animals show a threefold connection, a system of mutual dependency, but this is not pertinent to our subject.

In the soil we find the mineral or fixed constituents to exceed the organic or those which are not fixed. In the plant, the or-