

in the soil which are busy preparing soluble food for the plant. The ventilation of the soil is also required to supply free nitrogen for the use of nitrogen-fixing germs, and to remove the excess of carbon dioxide which is being continually set free in the soil.

From the soil the plant derives nitrogen, chiefly in the form of nitrates, the ash substances, and water. Fortunately, although ten elements are essential for the growth of the plant, there are only four that particularly interest the farmer, the other six are usually found in abundance. These four are, nitrogen, potassium, phosphorus, and calcium. A continuous supply of all the essential elements of plant growth is absolutely necessary; for, if one constituent is absent, or present in an insufficient quantity, no matter what amount of the other nutrients may be available, the plant cannot be fully developed. Consequently, just as a chain is only as strong as its weakest link, so the crop-producing power of a soil is limited by the essential nutrient present in relatively the smallest quantity.

FUNCTION OF PLANT FOOD CONSTITUENTS.

In the absence of *nitrogen* the plant makes no appreciable growth. With only a limited supply, the plant commences to grow in a normal way, but as soon as the available nitrogen is used up, the lower and smaller leaves begin gradually to die down from the tips and all the plant's energy is centered in one or two leaves. Nitrogen is one of the main constituents of protein, which is possibly the most valuable part of a plant. It is also a constituent of chlorophyll, the green coloring matter of plants; hence with a limited supply of nitrogen, the leaves will have a sickly yellow color. Plants with large, well-developed leaves are not suffering for nitrogen. An abundance of this substance will produce a luxuriant growth of leaf and stem, but it will retard maturity, and, with cereals, will frequently cause the crop to "lodge." Therefore, when crops such as cereals, tomatoes, potatoes, etc., are to be matured, an over supply of nitrogen is injurious; but with the crops such as lettuce, cabbage, etc., which are harvested in the green condition, an abundance of nitrogen will, other fertilizing constituents being present, tend to produce a strong vigorous growth, and give crispness or quality to these crops.

Potassium, or potash, as it is commonly called, is one of the most important and least variable of all the elements of the ash of plants. It is quite evenly distributed throughout the leaves, stem, and seed, and generally occurs in the entire plant in the largest proportion of any of the essential ash constituents. The function of potassium is apparently to aid in the production and transportation of the carbohydrates. The flavor and color of fruits is generally credited to potassium. In fact, this element seems to supplement the action of nitrogen by filling out the framework established by the latter. Potash with nitrogen is always an important fertilizer with special crops where the object is to produce sugar, starch—as with sugar beets and potatoes. It is also apparently essential for the formation of protein, and, thus, indirectly aids in formation of all organic matter.

Phosphorus, in the form of phosphates, is found in all parts of the plant, but tends to accumulate in the upper parts of the stem and leaves, and particularly in the soil. Its function is apparently to aid in the production and transportation of the protein. It also seems to aid the assimilation of the other plant food