

the effect of these upon crops grown, we strongly recommend those who contemplate using fertilizers to commence in a small way and prove for themselves whether they can or cannot use these substances with profit. The object of this bulletin is to point out some of the main features regarding plants, soils, and fertilizers, which should be known in order that the work may be done intelligently, and to indicate briefly how experimental plots may be arranged to show whether special fertilizing materials are or are not required.

THE PLANT.

Most young plants start from a seed, which contains an embryo, or germ, that is extremely rich in albuminoids, fat, phosphates, and potash. The seed also contains a store of food, in the form of starch, fat, etc., intended to nourish the young plant until the roots and leaves are sufficiently developed to gather their own supplies. The future health and vigor of the plant will depend on: (1) the amount of food available to the tiny rootlets sent out by the young plant; (2) the temperature of the soil, (3) an abundance of sunshine, and (4) a sufficient supply of oxygen. The plant requires oxygen for respiration, and it gives off carbon dioxide as a result of the oxidation of its food, that is, it breathes; it gives off water from its leaves, or lungs, it assimilates food, and it even excretes waste material. In all this it is very similar to the animal. But it even goes further, and collects its food from the simple substances, such as carbon dioxide, and various soluble salts found in the soil, and from these builds up the complex sugars, starches, fat, and albuminoids which are essential for the life processes of the plant and which are the only foods of the animal. It is subject to improvement by selection and breeding, as is the animal, but, unlike the animal, it is entirely dependent upon the supply of food constituents within its reach, and it has no way of drawing attention to its wants, excepting as its appearance may make them known to the careful and trained observer. A clear conception of the fact that an infant plant, like the infant animal, requires warmth, air, sunshine, and an abundance of easily absorbed food, will greatly aid in understanding the conditions under which it will make the best growth.

FOOD OF PLANTS.

The plant's food is derived from the atmosphere and from the soil. From the atmosphere it gathers carbon dioxide and oxygen, and some plants, through outside agencies, are able to collect nitrogen. Nearly fifty per cent. of the dry matter of a plant is made up of carbon which is entirely derived from the carbon dioxide of the air. Although this compound forms but 3 or 4 parts in 10,000 parts of the atmosphere, the quantity is sufficient, owing to the wind continually bringing fresh supplies to the leaves. Thus there is an abundance of air around the leaves of the plant, but, if the soil is not open and porous, there may not be enough in contact with the roots, for it is worthy of note that air in the soil in which crops are growing is as essential to the life of plants as air in the stable is to the animal. This ventilation of the soil is necessary to supply oxygen required in germination of seed, to permit the roots to live, for they, too, must breathe, and to supply this life-giving element to the millions of little organisms