

the past decade that its importance in plant nutrition has been realized. It is now known that almost all farm crops require minute quantities of boron in the soil, and diseases such as brown heart of turnips, corky core and drought spot of apples, dry rot of sugar beets, and cracked stem of celery may be prevented by its use. There is now research in progress to discover whether the addition of too much boron to the soil reduces the keeping quality of the fruit. Other deficiency troubles are known to be caused by lack of zinc, manganese, copper, sulphur, and magnesium.

Horticulture has been greatly benefited by recent researches in plant physiology. Through characteristic effects on the plant foliage, it is now possible to diagnose potassium and magnesium deficiencies with practical benefit. The balance between certain mineral plant foods has been demonstrated; an excess of nitrogen may be corrected to a degree by the addition of potassium, but an excess of calcium or of phosphorus can interfere with the utilization of potassium. A practical application of research in plant nutrition is found in the new greenhouse culture whereby plants are fed nutrients in solution. These methods remove numerous difficulties inherent in the use of soils and composts, and it may be that a large part of the greenhouse crops will soon be grown under these conditions.

The bacteriologist is concerned with the living organisms in the soil that bring about changes in soil fertility. Certain bacteria cause decay of vegetable matter or humus, thus making plant food available, and other bacteria that live in close relationship with leguminous plants assist in extracting nitrogen from the air for the use of the growing crop. Pure cultures of bacteria for the inoculation of legumes are maintained, and the Department exercises certain control measures over the commercial distribution of cultures.

Not all bacteria in the soil are beneficial. Some of them cause plant diseases, and some, on the other hand, produce substances that assist in controlling plant diseases. A program of research is conducted by bacteriologists and plant pathologists dealing with specific points involving the relationship of plants to soil organisms, particularly to soil-borne diseases such as root-rots of cereals, tobacco, and garden crops.

In recent years great improvements have been made in the efficiency of tillage implements and methods of culture. The laws of physics play an important part in the management of the soil and in the designing of tillage instruments. New instruments are constantly being designed and thoroughly tested by the Department. Soil drifting conditions are studied in a specially designed wind tunnel.

**Research on Crop Production.**—Man improves upon nature, not only by careful management of the soil, but also through the selection of the seed or stock from which the crop is produced. Modern practices require that seed must be pure, free from diseases and insects, and of high vitality. Regulations regarding the grading and distribution of seed are based upon careful research work, confirmed by field trials, and finally drafted into laws that are administered by the Department.

More fundamental than the appearance and vitality of the seed, however, are the inherited factors carried in the germ of the seed. The natural law of the survival of the fittest produces hardy strains of plants whose main characteristic is their ability to survive and not their usefulness to man. The plant breeder takes the most useful strains that have been developed by natural selection, and by artificial selection he improves the yield and quality of the crop. The botanist searches Canada and other parts of the world for suitable hardy varieties to form