ROTHAMSTED RESEARCH

Report for 1939-45

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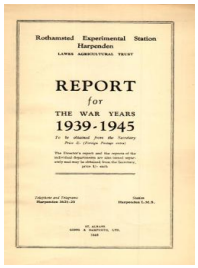

Nodule Bacteria and Other Soil Micro-organisms

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The results of soil-cultivation experiments on different soils and in different seasons are consistent with the laboratory and drain-gauge work and with comparable experiments in the United States and elsewhere. They demonstrate the depression of crop yield due to weed competition, but show that inter-row cultivation does not reduce direct evaporation from the soil.

Nodule bacteria and other soil micro-organisms

Some strains of nodule bacteria, particularly on clover, produce nodules practically ineffective in fixing nitrogen. These appear to be characteristic of poor pastures in hilly districts in the west and north of Britain, and the possibility is being investigated of improving the clover content of such pastures by inoculation with effective strains of nodule bacteria. The problem is by no means simple, however, for effective strains are liable to mutate and become ineffective on certain soils : moreover, acute competition has been found to take place between the nodule bacteria introduced by inoculation and those already present in the soil. The cause of ineffectiveness appears to be the inability of certain strains to grow strongly on the host-plant tissues or to survive therein long enough to fix appreciable amounts of nitrogen. The behaviour of the nodule bacteria is controlled by genes in the host plant as well as by the nature of the bacterial strain.

A study of the chemical nature of the bacterial secretions which cause deformation of root hairs by nodule organisms eventually led to the discovery of the high toxicity to many dicotyledonous plants of 2 : 4 dichlorphenoxyacetic acid. This and a closely related compound are now in practical use in this country and in America as differential weed killers for use in cereal crops.

Studies on the general micropopulation of field soils have been facilitated by the development of a new direct method of counting bacterial cells and of estimating the quantity of mycelium in soil by direct microscopical observation. A greatly improved technique for estimating numbers of protozoa in soil has also been devised. By the use of these improved techniques several groups of micro-organisms, formerly thought to be very rare or even adventitious in soil, have been found to be true and widely distributed soil inhabitants. These include giant rhizopods, acrasieae and myxobacteria. Of special interest are the myxobacteria which secrete compounds that destroy and dissolve gram-negative as well as gram-positive bacteria. Most of the former group are not attacked by penicillin. Soil protozoa and acrasieae have been found to be very selective in their bacterial food so that they are capable of altering the quality as well as the total size of the soil bacterial flora.

Virus diseases of plants

Plant-pathological work has increased greatly since 1939 and particular attention has been given to the diseases of potatoes, sugar beet and cereals. As far as possible all the lines of work both with viruses and fungi that were being studied in 1939 have been continued, and a good deal of advisory work has also been undertaken.

The study of viruses has been facilitated by the acquisition of an ultra-centrifuge and an electron microscope. New viruses have been

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