ROTHAMSTED RESEARCH

Report for 1931

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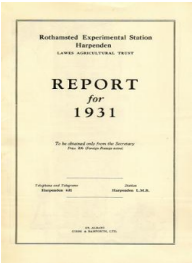

Methods for Agricultural Soil Survey

Rothamsted Research

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Of all plants yet tested, broad beans seem to require most, but even for them access to 0.2 mgms. and probably less, of boric acid (H_3BO_3) per week per plant during the growing season suffices, while peas and barley require much less. Apparently all plants require some.

These very small amounts are usually, if not invariably present in the soil. No clear case is known where addition of boron has improved plant growth in the field. There are a few possible exceptions which deserve further investigation: *e.g.* a certain tobacco disease in Java may be attributable to boron deficiency.

When the need of the plant is satisfied, further quantities of boron may easily do much harm; citrus growers in California have suffered loss through the presence of boron in the irrigation water. Manuring with boric acid is certainly not recommended; indeed, it is strongly to be deprecated.

SOIL PHYSICS

During R. K. Schofield's charge, the work on soil cultivation was continued.

In the laboratory further search was made for easy and rapid methods of soil testing. A new machine, called the Pachimeter, was devised by R. K. Schofield and G. W. Scott Blair to study the process of rolling a plastic cylindrical mass of moist soil or clay between two plates under a gradually increasing load. It was found that the load at which permanent lengthening of the cylinder first occurs is, within limits, a definite and reproducible value which varies considerably with the nature of the soil or clay examined, and this measurement promises to be of value in soil classification and surveying. The method has attracted a good deal of attention outside the sphere of soil investigations, and especially in the flour-milling industry.

R. K. Schofield has developed a new rapid method for determining the "base exchange capacity" of a soil: it consists in measuring the decrease in conductivity of a potassium phosphate solution when a weighed quantity of soil is introduced.

C. G. Hawes, Executive Engineer, Lloyd Barrage and Canals Construction, Sind, spent nine months in the department studying methods of distinguishing soils likely to give trouble under irrigation conditions.

METHODS FOR AGRICULTURAL SOIL SURVEY

In recent years there has been marked development in the number and extent of the soil surveys undertaken in this country and elsewhere, and it has become essential to work out satisfactory methods for field and laboratory examinations. Much progress has already been made in the United States and in Russia. The Russian methods have been studied in Russia during the past few years by several members of the Rothamsted staff. E. W. Russell worked for some months with a soil survey party in South Russia; G. V. Jacks and H. L. Richardson have worked there for shorter periods; while E. M. Crowther, H. L. Richardson, and the Director have traversed the country with the leading Russian soil experts to learn their methods from them at first hand.

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Somewhat different methods are used in the United States.

In order to make a careful study of these, one of their leading soil surveyors, L. L. Lee of the New Jersey Experimental Station, was invited to visited Rothamsted for a year during which time he made two typical surveys: a detailed survey of the Rothamsted farm, showing how the methods are used in making an intensive survey of a small area, and a more general survey of Kent, showing how they deal with a large area in a limited space of time. A number of meetings took place with soil surveyors in this country, out of which emerged agreements as to procedure which will prove of great value for future work. One of the German "Kulturtechniker" Dr. Janert, was also invited here for a year to apply his heat of wetting and other methods to the study of British soils.

GENERAL MICROBIOLOGY

Much of the earlier work of the Station was concerned with the effects of partial sterilisation of soil, and the view was expressed that the increased numbers of bacteria following on the partial sterilisation treatment resulted from the suppression of soil protozoa. This has been confirmed by much subsequent work and regular relationships have been traced between the numbers of bacteria and those of protozoa; when one is high the other is low, and *vice versa*.

The further deduction was made that these higher numbers of bacteria produced a larger amount of ammonia in the soil and therefore increased the total amount of plant food. It now appears that this requires important qualification; the amount of ammonia and carbon dioxide produced does not increase proportionately to the numbers of bacteria, but much less. As the bacterial numbers increase so their individual efficiency decreases. In experiments with cultures of bacteria in artificial media it was shown that additions of the protozoa *Colpidia* reduced the bacterial numbers, and increased the individual efficiency. The relationships between numbers and efficiency could be expressed by a straight line, but the actual line for the protozoa-free cultures differed from that expressing the results for the cultures containing protozoa in a way suggesting that *Colpidium* stimulated ammonia production by the bacteria quite apart from its effect in reducing numbers of bacteria.

This work on the interaction of the various groups of the soil organisms is being continued.

The work on nitrification described in the last Report is being continued.

EFFLUENT FROM SUGAR BEET FACTORIES

The study of the purification of effluents from sugar beet factories has been continued, and useful information has been obtained in regard to the possibility of inoculating filters with particular strains of bacteria.

SOIL BACTERIA

Bacterial Numbers in Field Soils

An essential part of the work of the Bacteriological Department is to form estimates of the numbers of bacteria in the soil. The plating method was used at Rothamsted for many years, and it

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