ROTHAMSTED RESEARCH

Report for 1939-45

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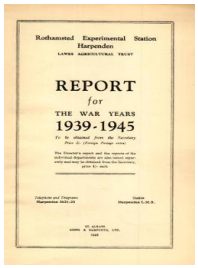

Soils and Crop Nutrition

Rothamsted Research

Rothamsted Research (1946) *Soils and Crop Nutrition ;* Report For 1939-45, pp 20 - 21 **- DOI: https://doi.org/10.23637/ERADOC-1-87**

soil metabolism was set up at Rothamsted under Dr. J. H. Quastel, F.R.S. This Unit was transferred to the University College of South Wales, Cardiff, at the end of 1945.

The Bee Section has been made a separate department recently under Dr. Butler, and a new Pedology Department has been established, in 1945, under Dr. A. Muir. Arrangements have also been completed for the setting up of a separate Biochemical Department, and for the appointment of a Colonial Soils Adviser.

The following is a brief review of the main lines of work : more detailed accounts are given by the heads of the various departments.

Soils and crop nutrition

Much of the soil work consisted of short-term investigations which could be regarded as " operational research " in the food-production campaign. These investigations, however, have had more than a short-term value for they have supplied much information which will be of value in long-range soil-fertility investigations. Amongst the problems set us by the war were : how to maintain or increase production and at the same time practise a rigid economy in the use of fertilisers, and how to handle to the best advantage the large area of old pasture land which had to be broken up.

A statistical examination by E. M. Crowther and F. Yates of the results of all the recorded field experiments made during this century in Britain and various European countries revealed the average fertiliser needs of different farm crops. This threw light on problems of fertiliser imports and showed how the supplies could be most efficiently distributed. It was of great value in formulating the war-time fertiliser policy.

As in the past, much of the soil-fertility work was a combination of field experiments and laboratory investigations. In addition to those on the Rothamsted and Woburn farms, many experiments were carried out on commercial farms in different parts of the country.

A good many of the special war-time investigations were done on behalf of the Agricultural Research Council, the Ministry of Agriculture and the Ministry of Supply, and in collaboration with the staffs of other research institutes and with the advisory chemists.

The sugar-beet manuring trials begun in 1933 were continued, and it was clearly shown that the outstanding requirements of this crop are nitrogen and sodium. It was demonstrated that sodium acts as a direct plant food and the application of 5 cwt. of common salt produced, on an average, about 5 cwt. of extra sugar. As a result of these experiments the manuring of sugar beet has been put on a more satisfactory basis. As well as throwing light on the manuring of sugar beet these experiments have proved useful in developing and improving methods of soil analysis for advisory work.

A considerable amount of work done on the manuring of flax showed that this crop is relatively unresponsive to fertilisers and should be manured like barley.

Investigations on organic manures have also been a feature of the war-time programme, and an attempt has been made to assess the physical as well as the manurial effects. The materials studied included farmyard manure, sewage sludge, straw and various

https://doi.org/10.23637/ERADOC-1-87

composts. Stacked young bracken gave excellent results. Sewage sludges proved much less effective than good farmyard manure or bracken compost and supplied little beyond nitrogen and phosphate. Promising results were obtained from composts of straw and sewage sludge. An investigation on waste leather showed that it can be converted into an active nitrogen fertiliser by de-tanning, but the process has not yet reached a commercial scale.

Another major project has been the study of phosphatic fertilisers and particular attention has been given to questions of availability and to the problem of phosphate fixation. It is perhaps not generally realised that of the phosphate applied as fertiliser not more than 20 per cent. as a rule is recovered in the crops. A new phosphate fertiliser—silico phosphate—was developed in collaboration with the Building Research Station, and was found to compare very favourably with superphosphate for swedes and for re-seeding in wetter areas.

Fertiliser placement provides an obvious economy, particularly in the use of phosphate, and the process is now well established for cereals and is being tested for other crops.

Work on trace elements has been carried out in the departments of botany, chemistry and biochemistry and considerable progress has been made in the study of manganese deficiency. Deficiencies of manganese, boron, magnesium and potassium can now be recognised and distinguished from each other and from chlorosis due to virus and fungus diseases. The trace elements contained in Chilean nitrate were studied for several years by Dr. Brenchley and Dr. Warington, boron being the most important. Iodine gave negative results, but there were indications that molybdenum improved the growth of lettuces, and this element is being studied more intensively with various crops. The toxic effects of larger amounts of molybdenum and other trace elements are also being investigated.

Soil-moisture and cultivation studies

An examination of the daily readings of the Rothamsted drain gauges for the period 1871 to 1940 and of the continuous records taken since 1925 has yielded important information about the rate of evaporation from bare soil, and laboratory experiments have helped to elucidate the physics of the process. The transpiration of short grass continuously supplied with water from a controlled water table has been measured during two summers and its dependence on the supply of energy from solar radiation established. It is proposed to make the same measurements for tall crops. This technique should provide more precise indications of the optimum quantities of water to be supplied in irrigation work.

The study of the manner in which water is retained in soil has been continued, and progress made in devising means for measuring *in situ* the suction (or pF) of the soil moisture. A method has also been devised for obtaining the volumes occupied by solids, water and air in soil clods. Measurements have been made of the fraction of soil particles of effective diameter less than 0.1μ, and a physico-chemical study of the buffer action of a number of pure polysaccharides has paved the way for an attack on the complex chemistry of the organic matter of the soil.

https://doi.org/10.23637/ERADOC-1-87