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Rothamsted Report for 1946

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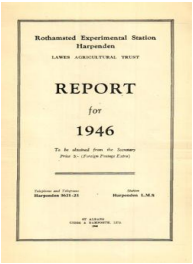

Botany Department

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DEPARTMENT OF BOTANY

By Winifred E. Brenchley

After the cessation of hostilities much of the war-time activity, especially that in association with the Chemical department, was brought to a close, and more time and apparatus was available for the normal work of the Botanical department. The minor element work was extended both in soil and water cultures, and investigations were initiated into certain field problems which had become of increasing importance during the war years.

A. Minor elements—molybdenum

The effect of molybdenum on plants continued to be approached from the two angles of toxicity and nutrition, the former in soil and the latter in nutrient solutions. The work in 1944–45 had strongly supported the hypothesis that the poisonous action of molybdenum is greatly influenced by the nature of the soil, and the factors causing this variation, as well as those bound up with the variability in the beneficial response to traces of the element, continued to be actively sought.

In *soil cultures* the general scheme of the experiments was the same as in 1944–45, though it was now possible to use larger pots for the strong growing tomatoes and Solanum, for which the small size of the pots previously available had introduced a serious limiting factor. Three of the same soils were again tested, Woburn soil and its compost, and the manganese deficient Isleham Fen soil. These were supplemented by two other fen soils, Littleport Fen, which was highly fertile, and Waterbeach Fen, which was definitely acid. In addition the allotment soil was replaced by a good loam, composted as before, and also the effect of manganese added to the Isleham Fen soil was tested in the case of flax.

Tomatoes again proved resistant to the harmful effects of molybdenum in several cases, and where response was obtained it tended to be irregular among the replicates. In Woburn soil the higher dose of molybdenum was fatal at an early date, and the lower dressing caused severe and irregular reduction of crop. The composting of this soil with peat enabled the tomatoes to withstand the harmful action of the lower dressing, and to produce a crop, again extremely variable in weight, with the heavier dose. In the manganese deficient Isleham Fen soil the crop was variable even in the controls, but on the average was quite as good as in some of the other soils. The addition of molybdate approximately halved the average crop for each progressive dose, but the poisonous effect was much less than in Woburn soil. No deleterious effect on the crop was found in any of the other soils tested.

The development of Solanum was adversely affected by both treatments of molybdenum in each of the five soils tested. The composting of both Woburn soil and top spit loam with peat reduced the poisonous action, expecially with the heavier dose, this being specially noticeable in the fruits and roots. In the Isleham Fen soil the controls were much reduced in size owing to the manganese deficiency, but the toxicity of molybdenum was even more marked here than with the other soils. Unfortunately it was

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not possible to test the effect of added manganese with this species.

With flax in most soils the toxicity of the lower dressing of molybdenum was hardly evident, but it was manifested by the higher dose. In the Isleham Fen soil the crop was much worse than in 1945, as the controls were only one third or one quarter the size, and no seed was produced in either untreated or treated plants. The addition of manganese improved growth all round, raising the dry weights, but leaving the toxic effect of the molybdenum well defined. Very little seed was formed in any of the treated plants, though the controls did better. It was an interesting confirmation that the two adverse factors, deficiency of manganese and excess of molybdenum, were able to function at the same time and that, despite the deficiency or the excess, the action of the other factor was clear and measurable.

In *nutrient solutions* striking beneficial effects had previously been obtained on a number of occasions with lettuce when small quantities of sodium molybdate (supplying 0·1 p.p.m. Mo) were added to the culture solution, and it seemed that this element was probably essential for normal growth for this crop. The results, however, were not always consistent and during the past year an attempt has been made to determine the cause for this lack of uniformity. Various crops, chiefly lettuce, red and wild white clover have been grown in different types of culture solution, and the effect of adding or withholding molybdenum noted in each case. Special attention has been paid to variations in the level of calcium supplied and the pH value of the different nutrient media selected. Lettuce is a quick growing plant and has already given some promising results, but as the varieties chosen were not suitable for summer conditions under glass confirmatory evidence cannot be obtained until next spring. Clovers, on the other hand, have a much longer growing period, and it will be necessary to carry them through the winter before all the available information from even one experiment will have been secured. Up to the present the two crops seem to be responding to the different treatments in a very similar fashion and symptoms of molybdenum deficiency have been well defined in both cases.

B. Vitality of buried weed seeds

Various aspects of the problem of weed seeds buried in the soil are still under consideration. In the experiments on Broadbalk wheat field periodic records of the weed seeds germinating from the soil samples taken in August, 1945, have been made and will be continued for the usual three year period. Until this is completed no comparison is available between the results of this sample and that of 1940, a comparison which will provide evidence as to the effect of the third 5-year fallowing cycle on three of the plots on the field.

Field observations and glasshouse experiments on dormancy and viability of wild oat seeds were continued. Germination of seeds of *A. fatua* vars. buried in soil to depths of 6 in. in pots continued even after the seeds have been at that depth for a year. Eventually it is hoped that information will be obtained about the viability of seeds kept in soil at greater depths, from which no seedlings have yet reached the surface. Preliminary investigations of dormancy in

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A. ludoviciana were made using glass germinators. Dr. Mann again sent samples and provided information about Wild Oats at Woburn.

An attempt was made to reduce the amount of viable seed produced by *A. ludoviciana* growing among wheat in the field by dusting the green ears with urethane (isopropylphenylcarbamate) mixed with kaolin, supplied by I.C.I. Although some sterility of Wild Oats was caused by the highest rate of application on the earliest date the method does not seem promising owing to the even greater sterility caused in wheat ears on which the powder fell.

Following an enquiry from the Isle of Man as to the best way of controlling annual nettle (*Urtica urens*), soil samples were sent from the infested area in order that an intensive study might be made regarding its habits of germination, with a view to being able to recommend suitable methods of control. Periodic records of the germination from both top and lower spit samples have been made and will be continued for several years. For comparison, similar records are being kept from soil samples obtained from a field known to be infested with the same species of Urtica at the Woburn Experimental Station. Both these soils are of a light sandy nature, and contain weed species, as well as *Urtica urens*, that do not occur in the heavy clay loam on Broadbalk, and these results will afford useful complementary information to that obtained at Rothamsted, quite apart from the Urtica question.

C.

In addition to the above main lines of enquiry work has been continued on the botanical composition of the herbage on Park Grass and High Field, and also other physiological work is in progress which has not yet reached the stage at which it can be reported.

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