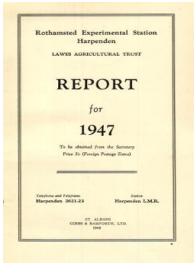
ROTHAMSTED RESEARCH

Rothamsted Report for 1947

Full Table of Content



Botany Department

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Winifred E. Brenchley (1948) *Botany Department ;* Rothamsted Report For 1947, pp 39 - 42 **- DOI: https://doi.org/10.23637/ERADOC-1-89**

DEPARTMENT OF BOTANY

By WINIFRED E. BRENCHLEY

During the year 1947 no fresh line of investigation was opened up in the Department, but attention was concentrated on consolidating the results of the work in hand, and filling up the gaps in the information required by supplementary experiments. As in previous years, the long-term classical work on Park Grass and on the dormancy of buried weed seeds received due attention. On the physiological side the part played by minor elements in plant development and the influence of certain environmental conditions on growth provided abundant material for pot and water culture experiments.

A. MINOR ELEMENTS

All over the world the part played by molybdenum in the plant economy continues to elude observers, the results being so variable even under apparently similar conditions that it is still not possible to give a definite answer, as can be done with boron.

(a) *Soil cultures*

Earlier work had shown that the relative toxicity of molybdenum to plants varies with the soil, and also that the reaction of different crops varies considerably in the same soil with similar molybdenum treatments. The growth of *flax* was greatly impeded on a manganese deficient Fen soil, and the molybdenum toxicity was masked in consequence, becoming more evident where a dressing of manganese sulphate had also been given.

In 1947 sowing was greatly delayed because of the difficulty in obtaining the soil owing to the severe winter and the flooding in the Fens. Again the characteristic habit of growth in flax appeared on the Fen soil, but where the main stems died most of the basal shoots grew vigorously, giving a short bushy plant, in striking contrast to the tall unbranched stems on the Woburn soil. Little seed was formed, though the quantity was higher where manganese was added. The development of the basal shoots delayed maturity very considerably, and when cut the plants were still green, though they were allowed to grow for six weeks after the Woburn plants had been harvested, when fully ripe with abundant seed.

An additional heavy dose of sodium molybdate was tested, giving a further reduction of crop. The seasonal effect was very marked, as the yield throughout was higher than in the previous years and the toxic effect of molybdenum was less drastic. On the sandy Woburn soil the lowest dressing of molybdate again had no poisonous effect, and the reduction of yield with greater amounts was less severe than on the Fen soil. It is hoped that at a later date the fibre will be extracted from this year's crop for comparison with that of earlier years.

Mustard showed considerable individuality in its response to molybdenum poisoning. Frequently one or two of the three plants

https://doi.org/10.23637/ERADOC-1-89

per pot were killed or seriously stunted, while the others were very similar in size and appearance to those in the control pots without molybdenum.

The acid Waterbeach Fen soil was the most harmful to growth, apart from any molybdenum dressing, and the manganese deficient Isleham Fen soil allowed as good development as several of the others. The addition of manganese pushed up the dry weight in this Fen soil above that of the controls in any of the others. The lowest dressing of molybdenum was ineffective in most cases, except on ordinary loam with and without peat, but increasing doses reduced growth in varying degrees according to the soil. The most serious toxicity occurred on the loams, and the Isleham Fen without added manganese, the crops being only from one-quarter to one-tenth that of the corresponding control. On the other soils as much as one-half to two-thirds of the control dry weight was achieved even with the heaviest dose of sodium molybdate.

Red Clover was sown in the same soils as the flax, and in similar small glazed pots. Two cuttings have already been made and the crop is being overwintered, so that only preliminary statements can be made as to the ultimate effect of the molybdenum dressings.

In the earlier weeks of the experiment the addition of manganese to the Isleham Fen soil again caused much improvement in growth, and mitigated the harmful effect of the higher dressings of molybdenum. In the autumn, after all the molybdenum had been applied and an extra dressing of basal fertiliser had been given a striking response was noted in the Isleham Fen soil without added manganese. Here the pots receiving the lowest dose of molybdenum were growing well, being dark green and healthy, whereas the controls were small, poor and chlorotic, those with the medium dose of molybdenum being similar to the controls, but rather greener. This development is being closely watched to see if it reflects an interaction between manganese and molybdenum.

(b) *Nutrient solutions*

Much of the work in nutrient solutions was hindered by the unusually hot summer. Two large sets of lettuce bolted prematurely and a long term experiment with red clover had to be abandoned on account of a severe infestation with red spider. The opportunity was taken of testing spray and dipping methods for the control of the pest, in collaboration with the Insecticide Department. It was found that the adults could be satisfactorily killed, but that the eggs survived the treatment and re-infection occurred.

Investigations regarding the need of certain crops for molybdenum were, however, continued and the response of the plant to the element studied under various nutrient conditions. It was found that the quantity of calcium provided had little effect on the appearance of molybdenum deficiency symptoms, though it materially altered the size and dry weight of the crop.

B. Effect of Root Temperature and Light on Growth

For some time past experiments have been carried out in water cultures to correlate the effect of high and low root temperatures on

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growth in relation to full and subdued light intensity. The culture bottles are immersed in thermostatically controlled heated tanks, or in unheated tanks with a steady flow of cold water to keep the temperature as even as possible. Control plants are grown under normal conditions on the glasshouse bench, giving fluctuating root temperatures throughout growth. At first maximum and minimum temperature readings were made daily with a form of six's thermometers specially constructed for the purpose, but more recently two electrical recording thermometers, each fitted with four bulbs, have been installed, providing a much more complete record of what is really happening throughout the day and night.

As both the heated tanks and the thermometers are worked by electricity an experiment planned to take place under winter conditions had to be abandoned owing to the frequent electricity cuts.

Data have been obtained in connection with peas, buckwheat and flax, and are now being worked up for publication.

C. Vitality of Buried Weed Seeds

The soil samples taken from Broadbalk wheat field in 1945 for the estimation of buried weed seeds are now in their third year of examination, and are due to be completed on 30th September, 1948, after which it will be possible to compare the results with those of the 1940 sampling, and to get further evidence of the value of the 5-year fallowing cycle which is adopted on the field.

During the past year numerous enquiries have been received with regard to the control of wild oat, and an appeal was made in "Agriculture" for any methods that had been tried in various parts of the country and which offered any promise of success. The information thus received has been incorporated in a further article, and it is hoped that this pooling of scattered knowledge of this pernicious weed will extend. Meanwhile, long term pot experiments at Rothamsted on the dormancy of *Avena fatua* seeds in soil have been continued, and a similar experiment on *A. ludoviciana* has been set up. Seedlings of both species buried at depths down to 9 in. reached the surface and produced normal plants. The soil from each of the replicated pots was turned out into wooden trays about 3 in. deep and kept under suitable growth conditions. A few seeds of *A. fatua* which had been buried for 19 months at depths of 15 and 20 in. germinated under these conditions, and possibly others may appear later from the same boxes.

Bartsia odontites, a weed which is semi-parasitic on the roots of wheat in Broadbalk, has shown a very restricted period of germination in the buried weed seed experiments since 1925. Seedlings have only appeared in the sample pans from the end of February to the beginning of June, none at all occurring during the rest of the year. Experiments and observations are in hand to determine whether this behaviour is inherent in the nature of the seed, or whether it can be modified by varying conditions of germination, either in the field or glasshouse.

The experiments on the dormancy of *Urtica urens* seeds are still in progress and need to be carried on for some time yet before it can be decided whether all the buried seeds have germinated. It may prove necessary to make this a long term experiment in the absence of any outside information on the subject.

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D. Park Grass Hay

For the first time since 1919 samples were taken from all the plots on the field, instead of only from selected plots. Complete botanical separations of many of the samples are in progress, and all the rest have been subjected to partial separation into grasses, leguminous and other plants. The material accumulated since 1919 is being gradually worked out, with the intention of bringing the survey up to date since the issue of "Manuring of Grassland for Hay", which dealt with all the earlier work.

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