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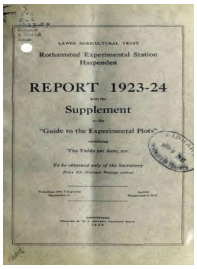
# Report for 1923-1924 With the Supplement to the Guide to the Experimental Plots Containing the Yields per Acre Etc.

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## Plant Pathology (Entomology and Mycology)

### Rothamsted Research

Rothamsted Research (1925) *Plant Pathology (Entomology and Mycology) ;* Report For 1923-1924 With The Supplement To The Guide To The Experimental Plots Containing The Yields Per Acre Etc., pp 36 - 38 **- DOI: https://doi.org/10.23637/ERADOC-1-116**

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When two or more groups are introduced into the molecule the toxicity is much affected by their relative positions in the ring (see p. 66). Several of the substances finally obtained are highly toxic both to insects and eggs; some are being tried this year on a field scale.

This investigation, like that on partial sterilisation, raises the important problem of exploiting a laboratory discovery and applying it on the large scale. Between the Rothamsted Station and the agricultural and horticultural industries there is the important difference that the one is working with a few pounds only, while the other may require in the aggregate thousands of tons. It is not possible for the Research Station to bridge this gap, nor to carry up to the farm stage the methods it may evolve. When superphosphate was discovered at Rothamsted many years ago, Lawes completely separated the factory and exploitation sides from the Rothamsted experiments. In a letter to the Ministry of Agriculture, published in the Journal of the Ministry of Agriculture, February, 1922, Lord Elvedon emphasised the lack of bridging agencies, and offered himself to finance a non-profit making syndicate for the exploitation of the "artificial farmyard manure" process (see p. 32). This is proving a very effective way of securing development. Both the insecticide and partial sterilisation work are now almost ripe for extension to the factory, as also is some of the physical work described above. The most suitable procedure has yet to be decided.

## PLANT PATHOLOGY.

New laboratories have been erected, to which in September, 1924, the Entomological and Mycological Departments migrated; work is now being done under eminently satisfactory conditions.

In the Entomological Department Dr. Imms has concentrated the attention of the Staff on insecticides, on aphids and on the gout fly of barley. The work on insecticides has already been described (p. 35).

Dr. Davidson's aphid studies have shown the important connection between the nutrition of the host plant and the rate of multiplication of the insects; contrary to general belief, it is the best nourished beans on which the aphids multiply most rapidly.

Certain varieties of field beans are only slightly susceptible to aphid attack, and plant breeding experiments suggest that this factor can be transmitted to new varieties. It appears possible, therefore, that a bean might be evolved of commercial value, and, at the same time, possessing considerable resistance to aphid attack. No rapid progress towards the production of such a variety can be expected owing to the laborious nature of the work and the necessity of making detailed tests at every stage.

A pure line of the bean aphis has been carried on continuously since 1920, over 80 generations having been passed through. The sexual cycle appears with remarkable regularity during early

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October in each year. The production of the sexual forms goes on until the following May. If, however, a temperature above 70° F. is maintained, asexual reproduction only occurs, suggesting that the change from the asexual to the sexual method of reproduction is directly influenced by temperature.

The gout fly investigation made by Mr. Frew arose out of a field problem. It was found that couch grass is the chief winter host, and that certain manures, especially farmyard manure and superphosphate, enable the barley plant to escape damage by inducing early growth of the ear out from its ensheathing leaves. Once the plant is infestated, however, nothing can be done: preventive measures only are possible, and of these, early sowing and suitable manuring are the most important.

In the Mycological Department, the chief work has been the study of wart disease in potatoes by Dr. Brierley, Miss Glynne and Mr. Roach, and the commencement of an investigation into mosaic disease of plants by Dr. Henderson Smith. Reference has already been made to the discovery that a dressing of finely powdered sulphur at the rate of 12 cwts. per acre intimately mixed with the soil greatly reduces, and probably eliminates, the disease from light soils. Another practical application of the work results from Miss Glynne's discovering how to infect susceptible varieties with the disease. At present the only method of testing the immunity of new varieties is to grow them for a year or more on badly infected soil. By using Miss Glynne's method described on p. 66 it is possible to discriminate between susceptibles and immunes in a few weeks, a matter of great importance to the plant breeder.

The work on mosaic disease started with the discovery by Dr. Bewley of the Cheshunt Experimental Station of nodules containing certain organisms which appeared on tomato-extract culture-media inoculated with juice of plants suffering from this disease. The work already done indicates that similar nodules may arise on these media when inoculated with other organisms not connected with mosaic disease; but that they also occur readily (perhaps more readily) after inoculation with certain organisms obtained from mosaic-diseased plants. Dr. Henderson Smith is in touch with the members of the Committee on Foot and Mouth disease, there being points of similarity in the two enquiries.

It has already been stated (p. 32) that algae apparently play a part in the highly important nitrogen cycle of the soil; the study of these organisms is carried out in the Mycological Department by Dr. Bristol Roach. The work has necessitated the isolation in pure cultures of a number of species of algae from the soil and the growth of these organisms on artificial media in order to discover some of their physiological properties. Dr. Bristol Roach has been able to show that most algae grow better in presence of small quantities of certain soluble carbon compounds than when they are completely dependent on carbon dioxide in sunlight for their source of carbon; the exact order of preference for these substances varies with the particular species.



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In addition to this qualitative work, Dr. Bristol Roach has introduced exact methods. She has studied quantitatively the growth of a single species in nutrient solutions differing only in the nature of the carbohydrate present, the substances tested being the sugars (pentoses, hexoses, disaccharoses), also mannite and glycerol. The rate of growth of the algae in culture, as measured by the increase in bulk, is constant under uniform favourable conditions for about the first ten days after inoculation, and parallel cultures have equal growth rates within the limits of experimental error. It has therefore been possible to devise a method for growing the alga under constant conditions of temperature, light and aeration, and by taking daily measurements of its bulk to ascertain the rate of growth in the presence of the various compounds under investigation. In this way figures have been obtained for a number of the sugars which can be regarded as representing their relative values as energy sources for the organism concerned. Without this physiological work it is impossible to ascertain with certainty the part played by the algae in the important changes going on in the soil.

## STATISTICAL CONTROL OF THE FIELD AND LABORATORY OBSERVATIONS.

It is one of the distinguishing characteristics of the recent Rothamsted work that the field and laboratory observations are, wherever possible, subjected to close scrutiny in the Statistical Department, with the view of estimating the degree of probability attaching to the results, and of indicating modifications in the plan of the experiments that may increase their accuracy. The field data are examined in order to trace correlations between weather, crop growth and other of the quantities measured, the mass of the data being so great that no other procedure gives equally useful results.

As a preliminary, Mr. Fisher found it necessary to develop adequate statistical methods for the study of field data. This work has now progressed considerably.

The methods of experimentation have been closely examined and improvements introduced which allow of a far higher degree of accuracy than could previously be attained.

The difficulties of the older methods of field experimentation arose from uncontrollable variations in the weather and the soil. Experiments repeated on the same soil in different years give discrepant results owing to the variation of the weather; while experiments repeated on different land in the same season give equally discrepant results owing to the variation of the soil. In consequence, even well conducted field experiments suffered from errors of the order of 5 or 10 per cent., a range of inaccuracy too large to meet the requirements of the practical farmer, to whom a difference of 5 per cent. in his average gross yield may make the whole difference between profitable and unprofitable farming. In order to eliminate these errors, three types of procedure have been adopted by experimenters :—

1. To repeat an experiment for a long sequence of years, so that the average yield may be taken to indicate the

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