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ROTHAMSTED  
RESEARCH

## Report for 1935

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### Composition and Quality of Crops : Wheat

#### Rothamsted Research

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cal spraying methods are also being tried, and a series of experiments has been started, with quite interesting results so far, on the possibility of removing weeds from grassland by spraying.

### SOIL CULTIVATION

The cultivation experiments have continued, and an extensive series of observations on rotary cultivation is being worked up.

Soil tilth has been studied from the field side in Dr. Keen's cultivation experiments and from the laboratory side by him and his assistants, Mr. Scott Blair, Mr. Cashen and Dr. E. W. Russell. The essential point is to bring the soil into an aggregation of crumbs and to prevent it falling into a state of dust. The actual changes depend on the drying and re-wetting of the soil and are brought about largely by the weather, but the implements play a vital part in putting the soil into such form that the weather can act. The field experiments have shown some of the differences between rotary cultivation and the older methods. They are now being extended to show how the soil moisture is affected by the various cultivation processes: this work is difficult because the Rothamsted soil, by its stony nature, is not readily sampled, and no method of estimating the moisture content *in situ* is yet free from objection.

The laboratory work has now reached a stage where the numerous facts are falling into order. An important test of value of any new development is the extent to which it can be used. These physical investigations have already proved of value to experts concerned with such diverse industries as flour milling and oil boring apart from their use in agriculture.

### MINOR ELEMENTS IN PLANT NUTRITION

In 1923 Miss Warington proved definitely for the first time that a minute quantity of boron is essential for plant growth, and this result has already found applications in practice. Various crop diseases previously incurable have now been traced to a lack of available boron; notably a heart rot in sugar beet and "Internal cork" in apples in New Zealand, "Top rot" of tobacco, and diseases of potatoes, turnips, tomatoes and other crops. These diseases may occur even when compounds of boron occur in the soil, but presumably the boron is unavailable, because they are cured by addition of a small quantity of borax. The subject is being further developed and several field experiments on sugar beet have been started in affected areas in consultation with us.

It is known that oats suffer from shortage of manganese on certain soil types, and the factors controlling the availability of the manganese in soils are being studied.

Small amounts of molybdenum salts are also shown to affect plant growth considerably, causing, in some cases, simulation of

the symptoms of virus disease, and in others, the development of a trailing habit of growth where normally the growth is upright. These results are being further studied.

The effects of small quantities of nickel and cobalt salts are also being investigated.

#### COMPOSITION AND QUALITY OF CROPS

Owing to the impossibility of finding as yet any valid definition of quality, this work is done in association with the expert users of the crop, and their marks or grades, which are really measures of "commercial desirability," are accepted as the nearest measure of quality we are likely to get for the present. The buyers' grades have objective reality, for when the crop is converted into food, the resulting products show differences which vary in the same direction as the grades. So far as human food is concerned, we do not proceed to ascertain the physiological significance of these differences, but for animal food something can be done, though not yet as much as we should like because no satisfactory technique for grazing experiments in the field has yet been worked out. A beginning has been made, however, with experiments on pigs fed in pens.

The crops most investigated have been barley, potatoes, sugar beet and grass; and the expert bodies associated with the work were respectively the Institute of Brewing, Messrs. Lyons, the Beet Sugar Factory organisations, and the Basic Slag Committee of the Ministry of Agriculture. For the arable crops, the general result is that fertilisers used in the normal way will commonly increase the yields but do not affect the quality. Potassic fertilisers may effect some improvement in quality of crops grown for carbohydrates, and excessive dressings of nitrogenous fertilisers may reduce their quality. Beyond this there is no evidence that any system of manuring will bring about any significant improvement in the quality. For this the most important factors are the soil type and the season, and they have been fairly well characterised for barley. The conditions are unchecked growth, ample moisture during the spring, dry summers and good ripening and harvest conditions. For other crops the conditions are not yet so clearly defined, but it is known that suitable moisture supply and soil aeration are important.

#### WHEAT

The technical applications of the earlier work on the physics of flour doughs have been extended by Mr. Scott Blair in co-operation with Dr. Halton of the Research Association of British Flour Millers at St. Albans. The aim of this investigation is to assess the bread-making quality of a flour by means of reproducible and impersonal tests on the dough. Hitherto the only test of quality has been the baking test, and this, even in the hands of a highly skilled baker, is subjective and unreliable.

The two most important properties required of a dough are adequate elasticity ("spring") and extensibility. The former