ROTHAMSTED RESEARCH

Report for 1930

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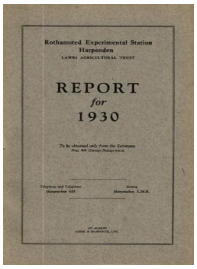

The Farm : Geological Survey . Geology of the Rothamsted Experimental Fields

Rothamsted Research

Rothamsted Research (1931) *The Farm : Geological Survey . Geology of the Rothamsted Experimental Fields ;* Report For 1930, pp 59 - 61 **- DOI: https://doi.org/10.23637/ERADOC-1-63**

Dr. Caldwell has shown that the virus cannot travel across dead tissue, nor can it enter the living cells of the plant from the xylem unless some rupture has occurred. Where a leaf is inoculated the virus travels to the stem and then moves up and down at approximately the same rate.

Dr. Sheffield has studied the mode of formation of the intracellular inclusions found in cells of the diseased plants. Small particles carried in the streaming protoplasm coalesce to form larger masses and ultimately unite to form a spherical mass which becomes vacuolate and may take on an amoeboid appearance which caused them to be regarded at first as parasitic organisms. The process has been photographed cinematographically and the film has attracted much attention.

Dr. Hamilton has devised new and better methods for the study of the insect transference of virus diseases.

THE FARM

During the year the farm and laboratories were visited by over 2,000 agricultural and scientific visitors, some of whom stayed for an extended period. Members of the staff gave over 79 lectures to farmers, students and others, these being arranged either by the County Organiser, or by the National Farmers' Union in collaboration with the organiser, or by a college or university.

GEOLOGY OF THE ROTHAMSTED EXPERIMENTAL FIELDS
REPORT BY MR. H. G. DINES, GEOLOGICAL SURVEY

The Rothamsted Experimental Fields were surveyed in 1903 by H. B. Woodward, and the result of his work was published,[1] together with a map, which, it was claimed, showed "the distribution of the subsoils and soils" of the area. In February, 1930, the Geological Survey undertook a re-examination of the farm for the purpose of bringing Woodward's map up to date. No alteration was found necessary and, apart from the additional survey of some fields that had been added to the farm since 1903, no changes of any importance were made.

In the light of present knowledge of soils and subsoils, Woodward's map cannot be regarded as a soil map, but only as a geological map showing divisions of the clay-with-flints which are usually unnecessary from a geological point of view.

The farm is situated on a dip-slope of the chalk area of the Chiltern Hills, and the fields, for the most part, are on high ground, which is covered with an irregular accumulation of clay and loam with abundant flints, known as clay-with-flints. This was originally considered to be derived, in great part, from slow decomposition of the chalk under atmospheric action. This view was later disputed by various writers on the grounds that the constituents were not present in such ratios as would result from simple solution of the calcareous portion of chalk; the clay proportion is far too high as compared with that of the flints. Close examination of the deposit also reveals that a considerable part is composed of remnants of Tertiary Beds. Flint pebbles, blocks of pudding-stone, masses of bright red clay and sarsen stones from Eocene formations, and

1 Summary of Progress' for 1903 (Mem. Geol. Surv.), 1904, Appendix I, pp. 142-150

https://doi.org/10.23637/ERADOC-1-63

ironstone fragments from Pliocene beds are present in various localities, sometimes to the exclusion of angular flints such as would result from the weathering down of the chalk alone. This irregularity of the clay-with-flints led Dr. R. L. Sherlock and Mr. A. H. Noble to regard it as of glacial origin,[2] a view which is widely accepted. At the beginning of glacial times the chalk outcrop was apparently covered with remnants of various Tertiary formations as outliers, and in some areas where bare chalk had been exposed to the atmosphere for a considerable period, some clay-with-flints (using the term in its original sense) may have formed, but the superficial deposits on the chalk to-day present the appearance of having been mixed up by disturbance such as would result from an ice sheet moving from the north or north-west over the area of the Chilterns.

The clay-with-flints of the Rothamsted area is composed almost entirely of disturbed local rocks. The angular flints showing no sign of abrasion come direct from the chalk, the subangular and generally ochreous flints from old gravels once resting on the chalk, and the black flint-pebbles and blocks of Hertfordshire puddingstone from the Reading beds or other lower Tertiary deposits. Fragments of iron cemented sandstone from a Pliocene deposit are also present ; these are fossiliferous, and are especially well seen in the subsoil of West Barn, Sawyers and Long Hoos fields. The bulk of the matrics is red-brown clay with varying degrees of loaminess, which apparently is derived mainly from Reading beds. In places where the clay is heavy it presents a grey mottling due to alteration of the iron oxide which produces the colouring. Manganese oxide occurs as a black stain in some fissures in the clay, and as a coating to some of the stones. The mass of clay is scattered sporadically with the various kinds of stones, which occur sometimes mixed and sometimes exclusively in bunches or pockets. It presents every appearance of having been formed under glacial conditions, the various constituents having been mixed during a slow passage southwards in a frozen or partly frozen state.

The thickness of the clay-with-flints is variable. Generally speaking, it may be from 5 to 10 ft., but in swallow holes, which occur frequently in the underlying chalk surface, it may reach much greater thicknesses.

According to Woodward the clay-with-flints of this area can be separated into three classes, namely :

(1) Loamy clay with few stones.
(2) Heavy clay, more or less stony.
(3) Light clay, more or less stony.

These variations are shown upon his map.

The downwash that occurs on the slopes of the clay-with-flints plateau is a mixed lighter soil—more or less stony. This clothes the more gentle slopes towards the Harpenden Valley, but does not extend down the steeper slopes to the west. The edge of the clay-with-flints passes through Great Knott and Little Knott, and to the south west of the line the chalk is free from drift. The down-slipping of the drift into the Harpenden Valley probably

2 *Quart. Journ. Geol. Soc.* vol. lxviii 1912 ,pp. 199-208.

https://doi.org/10.23637/ERADOC-1-63

covers a larger area than is shown on the geological map; for instance, although the lane running from north of Red Gables to Ninnings Field is sunk to a depth of at least 4 ft. near the main road, no chalk is visible, but only material that is obviously downwash from the clay-with-flints plateau. It is not possible for the geologist, however, to map this part as anything but bare chalk since the downwash is obviously of recent date.

FIELD EXPERIMENTS AT OUTSIDE CENTRES

The outside experiments began in 1922 with a series of trials under the Institute of Brewing Research Scheme on good barley growing farms in various parts of the country to test the effects of fertilisers on the yield and quality of barley. The same scheme was used throughout and the same stock of seed. In the first four years, 1922-1925, single plots were used, and 225 plots were harvested. In 1926 the scheme was modified and curtailed and 48 plots only were used, but the experiments were in duplicate. In 1924 laboratory work on the inoculation of lucerne was sufficiently advanced to justify extended field trials. The Royal Agricultural Society provided the necessary funds. Some 39 centres were chosen in various parts of Great Britain, and eleven strips were drilled at each centre, five with inoculated seed alternating with six with uninoculated seed. These experiments have continued, and at 21 centres the plots were still in existence in 1930.

By 1926 the new methods of field experimentation had been tested on the Rothamsted farm and they were then used on commercial farms to test the value of various types of basic slags on grass and arable land. Four by four and five by five Latin squares proved entirely successful, and they were continued till 1929, when the effect of the initial dressing of phosphate had almost disappeared. A new series was laid down in 1930. The cost of these experiments was defrayed by the Basic Slag Committee of the Ministry of Agriculture.

In the meantime interest in the level of phosphatic manuring for potatoes had been aroused by Mr. J. C. Wallace's results at Kirton, and a series of experiments was arranged on a number of potato growing farms using four by four Latin squares. The first tests were made on Mr. George Major's farm at Wisbech in 1928 and at Mr. J. C. Luddington's farm at Stowbridge; several other centres have been arranged since.

Up to this point the experiments and much of the work had been done by the Rothamsted Staff, T. Eden being in charge till 1927, and H. J. G. Hines in 1928. In 1929 H. V. Garner took charge, and immediately widened the scope of the work by enlisting the co-operation of agricultural colleges, county organisers, and certain schools which possessed the necessary facilities for small plot work. This has proved very successful; it has enabled us to carry out uniform schemes of experiment over widely different types of soil and climatic conditions. The statistical staff at Rothamsted supplies the form of Latin square and works up the yield data, and the chemical staff examines the produce. Mr. Garner and other members of the field staff maintain personal touch with the workers at the various centres, but are relieved of the detailed work involved in the experiments.

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