ROTHAMSTED RESEARCH

Report for 1929

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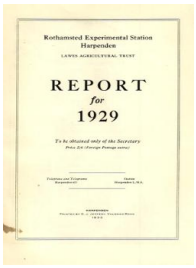

Losses from Arable Land

Rothamsted Research

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RELATION OF WEATHER CONDITIONS TO YIELD OF WHEAT AND BARLEY.

The Statistical Department is investigating the relationships between weather and crop yield under different fertiliser treatments. Of the weather factors, rainfall is at Rothamsted the most important in determining total yield, both the amount and distribution having great effect. For wheat, winter rainfall is harmful: for barley it is beneficial at Rothamsted, but not, apparently, on the lighter soils of East Anglia. Spring rainfall, January and February on light soils in East Anglia, and March and April on the heavy soil at Rothamsted, is harmful to barley but not to wheat, July rainfall benefits barley but not usually wheat. The effects, however, depend on the manurial treatment, and indeed one of the practical results of the investigation is to show the kind of treatment that would be most effective in seasons of various characters.

Up to the time of ripening, temperature is less important so far as the total growth is concerned, and hours of sunshine still less. Plant physiological work in the laboratories has partly explained the relatively small effect of temperature on the total growth of the plant: it appears that low temperatures tend to increase the size of the leaf but to reduce the amount of plant substance each unit area can make, while the higher temperatures tend to reduce the size of the leaf but to increase the amount of plant substance made by each unit area: as a result of this compensating action the yield varies less than might be expected from changes in temperature.

The position is altered however as soon as ripening begins: vegetative growth then slackens greatly or entirely ceases. High temperature hastens the setting in of this change, and if it comes early it may cut short a period of very active growth, so lowering the yield: for example, high temperatures in May and June reduce the yield of barley.

LOSSES FROM ARABLE LAND.

Weeds. Of all losses of arable crops those due to weeds are the most serious: there is no surer way of reducing yields than by allowing weeds to grow. Fallowing is a recognised method of keeping weeds down, but it is complicated by the fact that weed seeds can lie in the ground for some time without germinating. Dr. Brenchley and Miss K. Warington show that many of them have a period of natural dormancy during which they will not germinate even if the conditions are favourable. Poppy *(Papaver rhoeas)* for example has a long dormancy period and can survive for several years, so that it cannot be eliminated even in a whole year fallow: black bent *(Alopecurus agrestis)* has a short dormancy and can be eradicated by a short fallow. Comparatively few weeds germinate freely throughout the year, most of them do it best in autumn rather than in spring or summer.

Soil Acidity. The great importance of soil acidity has stimulated chemists to devise methods for measuring it and one of these, the quinhydrone method, has come into general use because of its convenience and simplicity. Dr. Crowther and Miss Heintze have found a serious flaw in it that has hitherto not been suspected. Some soils from the Gold Coast had been sent for a report on their

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suitability for cacao growing: the acidity test was applied and gave results difficult to understand. Attempts to clear up the mystery showed that the quinhydrone was reducing manganese dioxide present in the soil, forming manganous hydrate, which neutralised some of the soil acid and so upset the measurement. It was then recalled that many of our own soils contain manganese dioxide: these were re-examined and showed the same action. The International Society of Soil Science has recognised the importance of this discovery and has set up a special Committee to re-examine the European soils which had been tested by the quinhydrone method. Many of these were found also to contain manganese dioxide and, therefore, to be subject to the same error. Experiments are now in hand to get over the trouble.

DECOMPOSITION OF STRAW AND OTHER PLANT RESIDUES.

Artificial Farmyard Manure. The restriction of the area under corn in this country has reduced the output of straw, while the increase in number of cattle has tended to increase the demand for it. At present, therefore, farmers as a rule have barely sufficient straw for their needs, and the whole of it is converted by the animals into farmyard manure. Out in the Empire, however, the case is different and considerable use is being made of the Rothamsted process for making straw and other plant residues into artificial farmyard manure without the use of animals merely by encouraging its decomposition by the micro-organisms already present.

As we do not wish at Rothamsted to be concerned with business operations the process was handed over for commercial exploitation to a non-profit making syndicate, Adco, whose activities now extend to many countries. Shipments of the necessary material were made in 1929 to Africa, Australia, British Columbia, Borneo, Egypt, Fiji, Malaya, Mauritius, Newfoundland, New Zealand, Nigeria and West Indies, the last named being particularly interested because of the great value of the process in making a useful manure for sugar cane plantations out of the "trash." The largest increased consumption was in Natal; but Kenya and Tanganyika also showed marked increases. The Adco officers inform us that the 1929 shipments abroad were 40% greater than in 1928. While the commercial side is left to Adco, the scientific problems arising out of the decomposition of the straw are investigated at Rothamsted. The chemistry of the process is slowly being worked out. The first constituents of the straw to be decomposed are the hemicelluloses, then the cellulose goes, excepting in so far as it is protected by a resistant layer of lignin: it is interesting that cellulose, while fairly resistant to chemicals, is easily broken down by certain micro-organisms. These, however, do not appear to attack the lignin, so that this constituent is left mainly undecomposed but not altogether unchanged. The ratio of cellulose plus hemicelluloses to lignin seems to be the dominant factor in determining the rate of decomposition of the straw, provided sufficient available nitrogen be present. The xylan associated with the cellulose is not unavailable, but is decomposed only as fast as it is exposed by removal of the encrusting cellulosic layers. The small

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