ROTHAMSTED RESEARCH

Report for 1930

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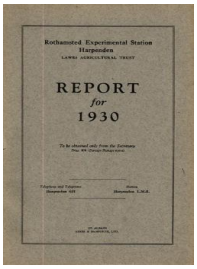

A New Continuous Experiment . Rotation I. Four Course Rotation.

Rothamsted Research

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treatment down to the present day. In 1872, however, one of the manured plots ceased to receive its farmyard manure and it has been unmanured ever since. That was nearly 60 years ago, and yet this plot gives a 50 per cent higher yield than the one which had had no farmyard manure during those early years. The results in bushels of grain per acre are given in Table IX.

TABLE IX.—Hoos Field permanent Barley: average yields of dressed corn, bushels per acre.

Years	20 years 1852-1871	5 years 1872-1876	5 years 1877-1881	10 years 1882-1891	10 years 1892-1901	10 years 1902-1911	10 years 1913-1922	8 years 1923-1930
Farmyard manure each year, 1852–1931		49.6	50.8	47.6	44.3	44.3	39.2	25.1
Farmyard manure each year, 1852–1871	48.3							
Unmanured since 1872		39.1	29.2	26.5	20.3	18.3	21.0	9.4
Unmanured all the time	22.0	13.5	14.4	15.8	10.4	9.7	14.3	5.3

For 1929 and 1930 the yields are total corn in 56lb. bushels.

There is no evidence, however, that applications of farmyard manure made only once in four or five years persist for any length of time.

Comparison of Farmyard Manure with Artificials. It is much more difficult from the Rothamsted and Woburn data to compare the values of nitrogen in farmyard manure with that in the artificial fertilisers. Over the early period in the Broadbalk wheat field (1852-1864) before the weed complication became serious, a dressing of farmyard manure containing 200 lb. nitrogen per acre gave a greater yield of wheat than 43 lb. of nitrogen in sulphate of ammonia, but a little less than 86 lb., and distinctly less than 129 lb.; the equivalent values seem to be 80 in sulphate of ammonia and 200 in farmyard manure, *i.e.*, 1 in sulphate of ammonia to 2.5 in farmyard manure.

On Barnfield mangolds the equivalents are 125 in sulphate of ammonia and 200 in farmyard manure, *i.e.*, 1 in sulphate of ammonia to 1.6 in farmyard manure.

ORGANIC MATTER AND SOIL FERTILITY: A NEW CONTINUOUS EXPERIMENT. ROTATION I. FOUR COURSE ROTATION

It has long been recognised that the return of straw to the soil in the form of farmyard manure is a most valuable method of maintaining and increasing soil fertility, while straw ploughed under the soil without previous rotting is harmful.

Investigations in the Bacteriological Department described in previous reports, have shown that the harmful effect results from an absorption of soil nitrate and ammonia by the organisms decomposing the straw, and can therefore be avoided by decomposing the straw before ploughing it under.

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Where farmyard manure is easily and cheaply made it affords the best method of doing this, but increasing numbers of farmers, especially overseas in British Africa, Australia, the West Indies, and elsewhere, cannot make enough of it and need some other way of converting straw into manure. The method of artificial rotting was worked out in the Rothamsted laboratory by Messrs. Hutchinson and Richards, and was applied on the large scale by the Adco Syndicate; it is proving very successful, requiring only a cheap nitrogen compound and water. Straw so treated has lost all its harmful effects and possesses high fertiliser value.

After various preliminary trials a rotation experiment (Rotation I) was started at Rothamsted in 1929 to compare farmyard manure with straw rotted artificially, with straw ploughed in along with the necessary nitrogenous compounds to promote decomposition, and with artificial manures.

The rotation consists of four crops: Barley, Clover and Italian Ryegrass, Wheat, Swedes.

The ryegrass is included to lessen the risk of clover sickness which on the Agdell Rotation Field has sometimes caused the crop to fail altogether. The ryegrass will, however, provide a host plant for Frit fly (*Oscinella* (*Oscinis*) *frit* L.); to mitigate this danger the crop will be ploughed in after the first cut of hay and before the middle of August.

There are five treatments:

1. Farmyard manure.

2. Straw decomposed artificially before being ploughed in (Adco compost).

3. Straw ploughed in without preliminary decomposition, artificial manures, however, being applied.

4. No organic matter; artificial manures only, the phosphate being superphosphate.

5. As 4, but the phosphate is ground mineral phosphate.

Each crop is grown every year, and each is followed by the next in the rotation. The field thus is divided into four sections each at a different stage in the rotation.

Each section is divided into five blocks of five plots each. Each plot receives one of the five treatments once in five years. Once it has had this treatment it receives no more for the next four years,* when the original treatment is repeated. In any one year only one plot in each block, five in all, are treated, and each of these receives one of the five treatments; thus all five treatments are represented each year. In the course of the five years the whole rotation has passed over the plot, and when the fifth year comes and the treatment has to be renewed, the crop to receive it is not the one that had it before, but the next in the rotation. Each plot has the same crop in every fourth year, and the same manurial treatment every fifth year; it thus has the same crop and the same manure only once in 20 years.

Five blocks of five plots each give 25 plots for each crop, and for the four crops there are 100 plots in all.

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* This is modified so far as concerns the sulphate of ammonia and muriate of potash given to the plots receiving phosphatic fertilisers (see page 125).

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In any one year there is no replication of the plots, but at the end of 20 years there will be a five-fold replication for the five four-course crop cycles, and the four fivecourse manurial treatments will then be completed.

Useful information will be forthcoming each year, but a particularly valuable lot of data susceptible of full statistical treatment will be available in 1949.

The cost of the experiment is being generously defrayed by Earl Iveagh. Full details, and the first year's results are given on pp. 125-7 and 130-1.

THE EFFECT OF WEATHER CONDITIONS ON FERTILISER EFFICIENCY

The effect of weather on fertiliser efficiency and crop yield is studied in the Statistical Department. The rainfall at Rothamsted is lowest in spring and highest in late autumn; the peak of the curve is in November, but it has not always been so; forty years ago it was at the end of September, and seventy years ago at the beginning of September. The peak is possibly now moving backwards again and we may be reverting to a period of wetter early autumns and drier late autumns; a movement like this has apparently happened before; the somewhat scanty records suggest that it happened in the eighteenth century, and again in the middle of the nineteenth century.

A detailed study of the effect of rain, inch by inch and month by month, on the Rothamsted wheat under different schemes of fertiliser treatment, has already been made, and now the same methods have been applied to the Rothamsted barley. The rain falling in the six months when barley is not in the ground is just as important as that falling while the barley is growing, but the effects of rain in different months vary with the manurial treatment. The plants on potash starved plots 2 O and 2 A seem specially to suffer after a wet winter.

Temperature is less important than rainfall, but it plays a great part in the early days of the plant life. On the average a rise in soil temperature of 1°F shortens the time between sowing the seed and appearance of the plant above ground by one day for spring sown cereals and by 1½ to 2 days for autumn sown cereals at Rothamsted. Swedes and turnips, however, are not affected by soil temperature, it being usually sufficiently high by the time they are sown. In order to obtain further information on these weather relationships, and also on the very important problem of the relation between quantity of fertiliser and crop growth, a second rotation experiment has been set up. The rotation consists of six courses: (1) Barley; (2) Clover hay; (3) Wheat; (4) Potatoes; (5) Forage crops (rye, beans and vetches), followed by mustard and then rye, both of which are ploughed in; and (6) Sugar Beet. The area under each crop is divided into fifteen plots. Of these, five, chosen at random, receive nitrogenous fertiliser in varying amounts, one plot receiving none, one receiving one unit dressing, a third receiving two unit dressings and the fourth and fifth receiving three and four dressings respectively. Another five plots also chosen at random receive potassic fertiliser in varying amounts, and the remaining five receive varying quantities of

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