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Report for 1930

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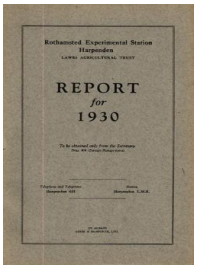

Effect of Weather Conditions on Fertiliser Efficiency

Rothamsted Research

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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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phosphatic fertiliser, the dressing for both sets being 0, 1, 2, 3 and 4 units as for the nitrogen group. A basal dressing is given to each group of plots. Each year each plot receives one dose less of the same manure as in the preceding year, then it receives none, after which it receives the full quantity of one of the other fertilisers, and then proceeds to receive one dose less, as before; after another five years it receives the third fertiliser. This procedure avoids the disturbances caused by cumulative effects. Thus in the first year the five plots of the nitrogen group receive respectively:

4 3 2 1 0 doses of N with 2 K and 2 P.

In the second year the treatment of the first four is:

3 2 1 0 doses of N with 2 K and 2 P,

while that of the fifth is 4 doses of K or P with 2 doses of the other two fertilisers. At the end of the fifteenth year the manurial cycle is complete and each plot is back to its original manurial treatment.

By the fifteenth year, however, the third rotation is half way through its course. After thirty years the second manurial cycle and the fifth rotation are both completed, and the whole begins again, with the difference that one stage in the rotation is omitted before proceeding as before.

As in Rotation 1 there is no replication of plots but the error can be estimated by comparing the yields for different quantities of each fertiliser with a smooth curve.

The data will give valuable information each year, but a specially full and detailed investigation will be possible after thirty years, when an exceptionally complete set of data should have accumulated. The details are given on pp. 128-9.

GRASSLAND

Manuring of Grassland. Fertilisers produce three distinct effects on grassland; up to a certain point they increase the quantity of their particular nutritive element in the plant (*e.g.*, nitrogenous fertilisers increase the nitrogen, phosphatic fertilisers increase the phosphorus, and potassic fertilisers increase the potassium); they may and often do increase the growth and they usually alter the herbage, encouraging some kinds of plants more than others.

Nitrogenous manures have their greatest effect when applied in spring; they suffer considerable loss when used in autumn. Given in February or March they cause a rapid uptake of nitrogen in the plant shown by a darkening of the green colour; if the soil and other conditions permit this is followed by an increased growth of young grass valuable for early grazing. Sulphate of ammonia used alone, however, while increasing the early growth, greatly reduced the wild white clover, and so reduced the later growth of herbage.

Phosphatic manures have the opposite effect on the herbage; they tend to increase the clover, and therefore the amount of protein in the herbage. They increase also the amount of phosphorus taken up by the plant; usually there is no visible sign of the additional phosphorus except on starved soils; the grazing animal, however, can usually detect it and chooses the phosphate treated land.