ROTHAMSTED RESEARCH

Rothamsted Report for 1936

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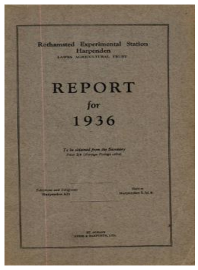

The Use of Straw As Manure

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The outstanding features of this table is the failure of fallow to increase the yield in 1936, which may reasonably be attributed to the considerably higher rainfall in this year and the consequent leaching out of accumulated nitrogen.

The other conclusion to be drawn from these results is that the yields are not at the present time being seriously reduced by weeds. If the weed factor was serious, one would expect a progressive reduction in yield as the land became more infested with weeds in the years following the fallow. Such a reduction is nowhere marked, and does not occur at all on many of the plots.

THE USE OF STRAW AS MANURE

Mechanisation, and the depression in the live-stock industry, have both brought into prominence the question of disposing of straw to the best advantage. It has become increasingly difficult to obtain adequate amounts of farmyard manure. Ploughing-in the unrotted straw alone, produces a depression of yield in the subsequent crop, as Lawes showed many years ago ; the extra supply of carbonaceous material results in a locking-up of available nitrogen in the organisms that decompose the straw. Some years ago two long-range rotation experiments were laid down at Rothamsted to test, among other things, various methods of utilising straw, and a discussion of the results so far obtained is given below.

(*a*) *Four Course Rotation*

In this experiment the effects of farmyard manure, of adco, and of straw plus artificials, are compared both in the year of application, and in the four succeeding years, the plots receiving their manures once every five years. In addition two further series of plots receive superphosphate and rock phosphate respectively once every five years. These plots, however, differ from the others in that they receive one-fifth of their dressing of sulphate of ammonia and potash annually.

For an understanding of the results of the experiment it is important to bear in mind the relative quantities of the fertiliser components on the various plots. Dung and adco are given in quantities which supply 50 cwt. of organic matter per acre. In the straw treatment as much straw is applied as went to make the calculated amount of adco. Thus the amount of organic matter in the straw as applied will be greater than that in the dung or adco, since these latter lose a certain amount of their organic matter on maturation. Artificials are added to the organic fertilisers in quantities sufficient to raise the applications to 1.8 cwt. N., 3.0 cwt. K_2O and 1.2 cwt. P_2O_5 per acre, the artificials given with the straw being applied in three doses to minimise loss by leaching. These total quantities of nutrients are also applied to the plots receiving artificials only, one-fifth of the potash and nitrogen being applied annually.

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The results of three years (excluding preliminary years) are now available. The graphs (see p. 53) show the mean yields over these three years of the plots in each phase of the cycle under each treatment. The three organic fertilisers, plotted on the left half of the diagram, all show clear residual effects in the year after application on all crops, the yields (except that of barley straw, an anomaly which may reasonably be attributed to experimental error) being decidedly greater than those of the fourth and fifth years after application. There are indications of similar but smaller residual effects in the third year after application, the magnitudes of the apparent effects, averaged over the three organic fertilisers being as follows :

Crop	Yield in 3rd and 4th years after application	Increase in year of application	Increase in 1st year after application	Increase in 2nd year after application
Wheat : cwt.	16.6	7.5	2.8	0.7
Potatoes : tons	3.4	1.4	0.9	0.4
Barley : cwt.	22.2	8.7	1.5	1.9
Ryegrass*: cwt.	10.0	19.1	8.3	1.7

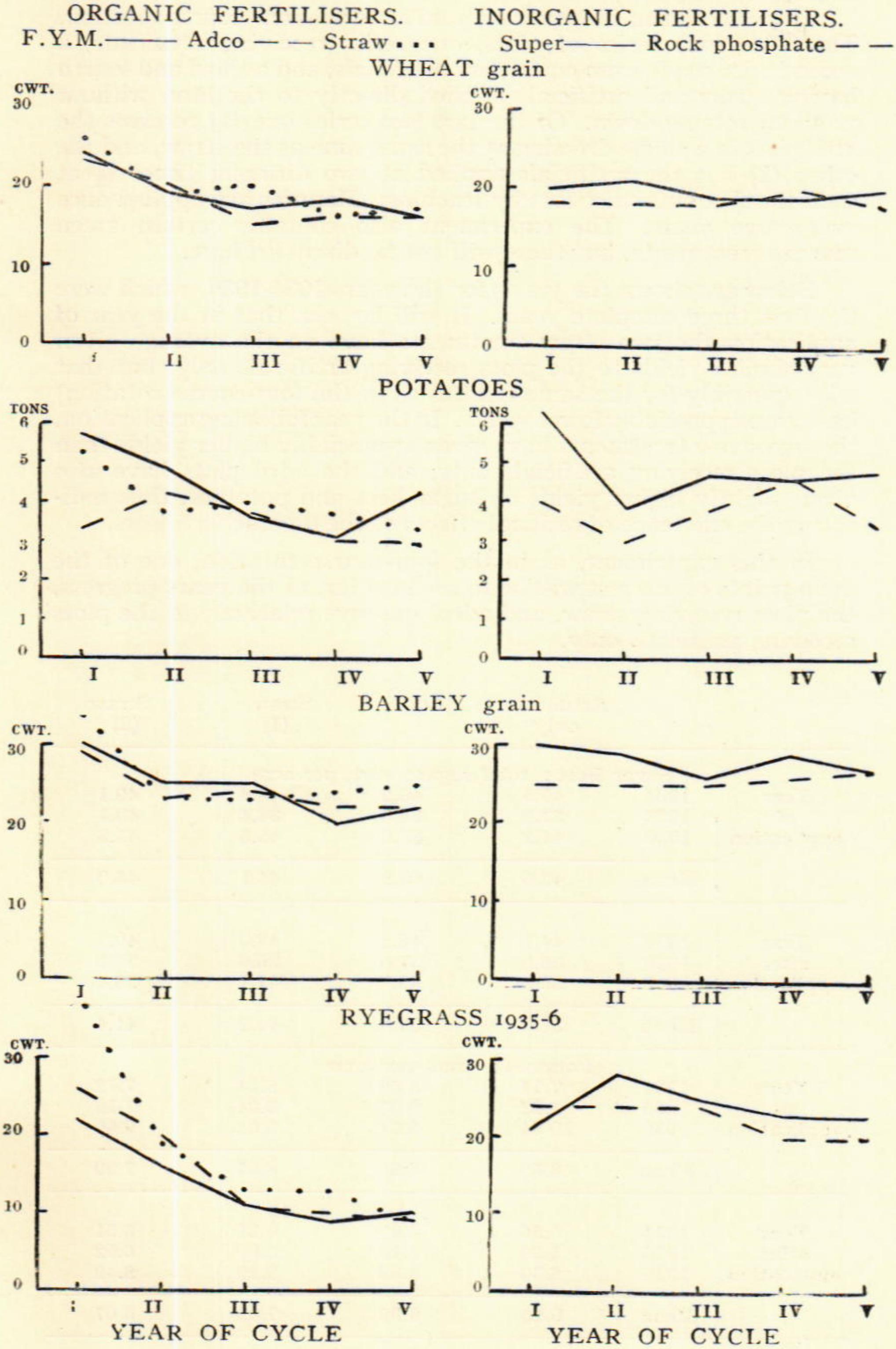
* 1935-36 only.

The differences between the three forms of organic fertilisers in the year of application and subsequent years are also shown by the graph. The most striking feature is that the straw treatment is the most successful of the three except for potatoes, for which dung is best. These differences are also illustrated by the above Table, which shows the mean yields over all phases of the cycle for each of the three years.

The two series of plots receiving inorganic fertilisers are shown on the right of the diagram. Here the only residual effects under investigation are those of phosphate. In all four crops the yields of the superphosphate plots are consistently above those of the rock phosphate, and in addition potatoes and barley show a further response to superphosphate in the year of application. It would thus appear that the residual effects of the superphosphate persist throughout the cycle, and that rock phosphate is less effective than superphosphate.

The mean yields of the superphosphate plots over all phases of the cycle might be compared with those of the organic fertilisers, to assess the relative values of organic and inorganic fertilisers. The comparison is however, scarcely a fair one, since the plots with organic fertilisers receive all the manure in one year. Even so, however, the differences are not large. One of the main points of the experiment will be to see whether these differences are progressively reduced and perhaps reversed as the experiment proceeds and the plots receiving artificials become more deficient in organic matter.

FOUR-COURSE ROTATION, 1934-6. MEAN YIELDS.



(b) Three-course Rotation

This experiment is somewhat similar to the four-course rotation. There are four series of plots, one series receiving artificials, a second adco made from equivalent artificials, and a third and fourth having straw and artificials applied directly to the land without previous rotting down. Of the last two series one (1) receives the artificials in a single dressing at the same time as the straw, and the other (2) has the artificials applied at two different times (½ at each time) to minimise loss by leaching. Manures are applied once every two years. The experiment also contains certain green manure treatments, but these will not be discussed here.

Below are shown the yields for the years 1934-1936, which were the first three complete years. It will be seen that in the year of application the two straw treatments have on the average given very similar yields to the plots receiving artificials only, but that adco (possibly for the same reasons as in the four-course rotation) has given appreciably lower yields. In the year following application, the two straw treatments have given appreciably higher yields than the plots receiving artificials only, and the adco plots have also given slightly higher yields on sugar beet and potatoes, thus indicating the existence of residual effects of the organic fertilisers.

In this experiment, as in the four-course rotation, one of the main points of interest will be to see how far, as the years progress, the plots receiving straw, and adco, improve relatively to the plots receiving artificials only.

		Artificials only	Adco	Straw (1)	Straw (2)
		Sugar Beet: total sugar: cwt. per acre			
Year of application	1934	49.5	46.2	48.4	49.1
	1935	37.2	36.5	38.4	43.1
	1936	44.2	38.0	45.5	45.8
	Mean	43.6	40.2	44.1	46.0
Year after application	1934	44.1	42.2	48.9	49.3
	1935	35.0	37.6	36.6	35.5
	1936	36.8	39.7	41.1	39.4
	Mean	38.6	39.8	42.2	41.4
		Potatoes: tons per acre			
Year of application	1934	7.71	5.59	8.14	7.12
	1935	7.22	6.37	8.24	7.16
	1936	10.84	8.71	9.62	9.69
	Mean	8.59	6.89	8.67	7.99
Year after application	1934	5.56	6.00	6.38	5.51
	1935	4.90	6.15	5.69	6.02
	1936	8.30	8.69	9.19	8.49
	Mean	6.25	6.95	7.09	6.67

		Artificials only	Adco	Straw (1)	Straw (2)
		Barley: grain: cwt. per acre			
Year of application	1934	26.3	25.8	24.5	27.2
	1935	34.7	37.2	39.3	38.4
	1936	34.7	29.1	33.8	33.1
	Mean	31.9	30.7	32.5	32.9
Year after application	1934	25.5	21.3	26.7	26.1
	1935	35.6	35.8	36.7	35.8
	1936	27.5	25.4	28.2	29.1
	Mean	29.5	27.5	30.5	30.3

DRIED POULTRY MANURE

Experiments on the fertilising value of dried poultry manure were begun at a number of centres in 1933 and have since been continued. Wherever possible horticultural crops have been used and the experiments have been planned to measure possible cumulative and residual effects as well as the immediate effects in the year of application. Except in the first year all plots have received the same total amounts of phosphoric acid and potash so as to restrict the comparisons to the value of organic versus inorganic sources of nitrogen. In 1933 only there were additional tests of the value of the phosphoric acid in the dried poultry manure. Rather over half of the experiments were made on farms with plots of the order of 1/40th acre and the rest of the experiments were carried out very successfully on much smaller plots in school gardens. The average composition of the poultry manures used in the past four seasons has been :

N, 3.65 per cent.; P_2O_5, 3.44 per cent.; K_2O, 1.68 per cent.

There is almost as much phosphoric acid as nitrogen, but the amount of nitrogen may vary considerably according to the rations fed or the condition of the herbage. The material was dried to about 88 per cent. dry matter and was very dirty and unpleasant to handle. The ash content was about 35 per cent.

The results of the first three years showed unmistakably that the immediate effects of poultry manure were generally below those of an equivalent amount of inorganic fertilisers. Thus, at 29 centres showing a clear-out response to nitrogen, the average response of poultry manure was about three-quarters of that from sulphate of ammonia and superphosphate. A smaller number of experiments gave some indication of an appreciably greater residual value from poultry manure than from sulphate of ammonia, but these residual effects were small in comparison with the effects of direct applications.

The above trials took place in three unusually dry summers, and the wet season in 1936 provided considerably larger responses and thus gave a better opportunity of comparing sulphate of ammonia and poultry manure. In the experiments on full sized plots there were significant responses to one or both of the manures at every centre. On microplots 13 out of 15 experiments showed significant effects.

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