Rothamsted Report for 1936

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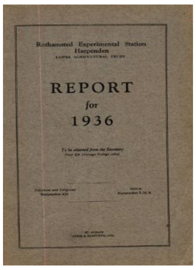

Effect of Fallow on Subsequent Yields

Rothamsted Research

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EFFECT OF FALLOW ON SUBSEQUENT YIELDS

A regular cycle of fallowing was initiated on Broadbalk wheat field in 1930-1931, primarily with the object of controlling weeds. The results of the first cycle are now available, and furnish striking information on the effect of fallow on the subsequent yields.

The field is fallowed in strips running across the plots, one fifth being fallowed each year. The yields of the different parts of each plot, which have been fallowed one, two, three and four years previously, are thus available for each year. Since a full cycle of five years 1932-1936, which deviates but little from the proper cycle, is now available, each fifth of each plot will appear once in each phase of the cycle, so that by taking means over the five years of each phase we shall eliminate differences between the parts of each plot in so far as these are constant from year to year.

These means are shown below. The plots have been arranged according to the amount of nitrogen applied in the fertiliser, the organic fertilisers, farmyard manure and rape cake, being placed last.

Effect of Fallow on Broadbalk

Mean yields of grain (cwt. per acre) 1932-36.

Plot No.	Manuring *	Year After Fallow 1	2	3	4
3	Nothing	13.6	6.4	6.1	7.3
5	Minerals	14.2	6.6	6.6	6.3
17 and 18M	Min. + Residual S.A.	16.1	7.0	6.0	6.1
	Mean	14.6	6.7	6.2	6.6
6	Min. + ½ S.A.	15.4	11.5	9.9	10.5
9	Min. + ½ N.S.	15.5	14.2	12.7	11.5
	Mean	15.4	12.8	11.3	11.0
10	S.A.	14.6	16.5	13.8	13.9
11	Super. + S.A.	13.3	12.9	12.2	11.6
12	Super. + S.A.	14.6	15.3	13.3	14.0
14	Super. + S.A.	14.7	16.0	14.3	14.0
7	Min. + S.A.	15.5	17.1	15.6	15.1
13	Min. + S.A.	15.5	16.2	13.9	14.2
16	Min. + N.S.	16.3	18.5	16.3	15.2
15	Min. + S.A. (Autumn)	16.3	15.3	13.2	13.6
17 and 18A	Residual Min. + S.A.	14.9	15.3	15.2	14.1
	Mean	15.1	15.9	14.2	14.0
8	Min. + 1½ S.A.	16.4	19.1	17.4	17.5
2b	F. Y. M.	14.3	15.2	14.1	15.5
2a	F. Y. M.	15.2	16.2	13.8	14.7
19	Rape cake	16.7	15.0	13.3	11.7

*For exact description see p. 184.

The plots receiving no nitrogen, 3, 5 and 17 and 18M, show a very remarkable increase in yield in the first year after fallow, their yields being but little below the yields of plots receiving the

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full dressing (3.7 cwt. per acre) of sulphate of ammonia, but this increase is entirely lost in the second year, the yields in this and subsequent years being reduced to just about half that of the first year after fallow.

The plots 6 and 9, which receive one half the normal dressing of nitrogen, show an increase of somewhat less than half the amount of the unmanured plots, the yields being very similar the year after fallow, but falling off much less.

The plots receiving the full dressing of nitrogen, plots 7, 10-16 and 17 and 18A, on the other hand, show no increase in yield due to fallow. Indeed the yields the second year after fallow are distinctly higher (mean 15.9 cwt. as against 15.1 cwt.) than the yields the first year after fallow. The last two years, however, do show a slight drop to 14.2 and 14.0 cwt. Plot 8, which receives 5.5 cwt. sulphate of ammonia, and plots 2B and 2A, with farmyard manure, show similar differences.

While it would be rash to attach any great weight to these small differences, since the issue is complicated by exceptionally high yields in 1934, when the strip fallowed the previous year fell at one end of the field, they are at least suggestive that the fallowing has produced some transient ill-effect. Attacks of the Wheat Bulb-fly (*Hylemyia coarctata, Fall.*) which have been reported in the year 1936 and other years, may be the cause (see p. 120), since this fly lays its eggs on fallow. Clearly, however, these attacks are not the sole cause, since they were reported also on the plots without nitrogen. The outstanding feature of these results is that fallowing can raise the yield substantially on exhausted land for one year only, but it is completely ineffective on land which receives adequate manuring.

It should be noted, however, that the results obtained in 1930 after parts of the field had been fallowed for two and four years are in conflict with the above results. In this year a very substantial increase was obtained on all the plots, the mean yield after fallow being 21.0 cwt., and after two years' cropping being 6.0 cwt. The results are reported on p. 122 of the 1930 Report. It will be interesting to see if similar results are obtained in any future years.

The investigation of the variation in effect from year to year is complicated by the fact that there may be inequalities in the inherent fertility of the different fifths of the field. These inequalities are eliminated from the five-year means, but they will affect the results of a single year. On the plots without nitrogen, however, the effects are so large that such inequalities become unimportant. The mean yields of these plots for each year are shown below.

Mean yields of grain (cwt.) on plots 3, 5 and 17 and 18M

	Year after fallow				Rainfall		
	1	2	3	4	Winter (Oct.-Mar.)	Summer (Apr.-Sept.)	Total
1932	11.8	5.1	6.1	6.5	9.4	14.2	23.6
1933	19.7	6.9	6.2	4.9	14.4	8.1	22.5
1934	18.6	10.6	8.8	10.3	8.7	10.4	19.1
1935	15.2	4.4	4.6	4.9	14.1	15.9	30.0
1936	7.8	6.4	5.5	6.3	19.6	17.1	36.7

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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