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ROTHAMSTED RESEARCH

Report for 1931

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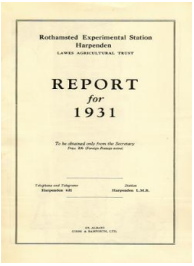

Potatoes

Rothamsted Research

Rothamsted Research (1932) *Potatoes ;* Report For 1931, pp 28 - 30 **- DOI: https://doi.org/10.23637/ERADOC-1-65**

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POTATOES

The year 1931 concludes the series of large replicated experiments with potatoes using a 9-block design, which has been found to give particularly precise comparisons. The experiment has been tried four times at Rothamsted, in 1927, 1929, 1930 and 1931, and once at Woburn, in 1929.

The comparisons to be made consisted of all combinations of 0, 1 and 2 unit applications of ammonium sulphate, 0, 1 and 2 units of potash, applied as sulphate, chloride, or potash salt containing potassium chloride. Thus, without replication, 27 different plots would have been required, of which 21 would have been treated differently. The design adopted was to assign 81 plots to the experiment arranged in 9 blocks of 9 plots each, such that within each block, 3 plots without potash received respectively 0, 1, 2 units of nitrogen, and likewise the three plots with single potash, and the 3 with double potash. The 3 plots with single or double potash within each block again were assigned to the 3 types of potash manure. The blocks thus differed only in the association of the 3 kinds of potash with the 3 quantities of nitrogen, and in different blocks each kind of potash occurs 3 times with each quantity of nitrogen.

The effect of this arrangement is to give to the comparisons of primary interest the full precision of replication within small blocks, while sacrificing information on possible hypothetical but highly complex interactions between the different manures. In all experiments save the first, each plot also was divided into two halves, ascribed independently at random to receive or not to receive a dressing of superphosphate.

The response to nitrogen in the five experiments is shown in Table III.

TABLE III.—Average response to Nitrogen as Sulphate of Ammonia.

Yields in tons per acre.

	Sulphate of Ammonia applied			Size of Single Dressing	Average increased yield of potatoes. Tons per cwt. of N. per acre.		
	None	Single Dressing	Double Dressing	Cwt. Nitrogen per acre	Single Dressing	Additional Dressing	Both Dressings
Rothamsted—							
1927 ..	6.42	7.27	7.32	.42	2.02	0.12	1.07
1929 ..	4.78	5.48	5.85	.30	2.33	1.23	1.78
1930 ..	8.04	9.22	9.65	.20	5.90	2.15	4.02
1931 ..	10.70	11.62	12.37	.20	4.60	3.75	4.18
Woburn—							
1929 ..	4.85	5.11	5.17	.30	0.87	0.20	0.53

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Average response to Potash

Yields in tons per acre.

	Yield in tons per acre. Potash applied.			Size of Single dressing. cwt. K_2O per acre	Average increase or decrease in yield of Potatoes Tons per cwt. K_2O per acre.		
	None.	Single Dressing	Double Dressing		Single dressing	Additional dressing	Both dressings
Rothamsted—							
1927 ..	6.92	7.13	6.95	1.0	0.21	—0.18	0.02
1929 ..	5.21	5.45	5.45	0.50	0.48	0.00	0.24
1930 ..	8.40	9.04	9.48	0.40	1.60	1.10	1.35
1931 ..	11.60	11.40	11.70	0.40	—0 50	0.75	0.12
Woburn—							
1929 ..	4.83	5.04	5 25	0.50	0.42	0.42	0.42

The returns in tons per cwt. of nitrogen are all significant. The variation between the different years at Rothamsted is evidently ascribable to two main causes : (1) The unit quantity of nitrogenous application has been varied, and as is only to be expected, the highest returns per cwt. are found when the unit employed is smallest; (2) There is great variation in the yield from year to year, and the highest return is to be expected, as is indeed found to be the case, in the years of highest yield. These appear to be the major factors in determining the return per cwt. of nitrogen.

A second respect in which the plots treated with more nitrogen differed from those treated with less, lies in the response to superphosphate. The average difference in yield between the sub-plots receiving superphosphate and the twin sub-plots receiving none is given in Table IV.

TABLE IV.—Increased yield of potatoes: tons per acre given by superphosphate with varying supplies of sulphate of ammonia.

	No Sulphate of Ammonia.	Single Dressing.	Double Dressing.	Cwt. P_2O_5 per acre supplied.
1929	0.23	0.51	0.78	.4
1930	0.62	0.49	1.30	.5
1931	—0.08	0.44	0.63	.5
Average : Rothamsted ..	0.26	0.48	0.90	—
Woburn 1929	0.36	—0.14	—0.29	.4

At Rothamsted it is seen that there is a very general and pronounced tendency for the plots receiving more nitrogen to respond better to superphosphate than the plots receiving less, or, what amounts to the same thing, for the plots receiving superphosphate to respond better to nitrogenous manures than the plots receiving none. At Woburn, in the one year tested, there is a marked and

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statistically significant reversal of this effect. The yields in this experiment were very small, but this does not impugn the significance of the result, which it is hoped to examine more fully by later experiments.

The interaction of response to nitrogenous and phosphatic manures is the only interaction to show itself significantly in this series of experiments; this supplies an *a posteriori* justification for sacrificing information in a group of the remote interactions, for the sake of added precision in the main effects. The actual data, moreover, for each year, show that the interactions sacrificed are in fact unimportant, while the comparisons which have been made more precise are of direct interest.

An effect on which higher precision than that actually attained would be most desirable concerns the contrast between sulphate, muriate and potash salt as sources of potash.

Table V gives the average yields in the five experiments, together with the two comparisons muriate *v.* potash salt, and sulphate *v.* the average of the other two. Only in 1927, when the precision of the experiment was considerably higher than has since been attained, could the results for a single year be judged significant.

TABLE V.

Comparison of Sulphate of Potash (S) with Muriate of Potash (M) and Potash Salt (P) as Fertilisers for Potatoes. Yields of Potatoes, tons per acre.

	S	M	P	M–P	S–½ (M+P)
1927	7.36	7.08	6.59	+.49	+.52
1929	5.47	5.45	5.44	+.01	+.03
1930	9.47	9.42	9.10	+.32	+.16
1931	11.80	11.31	11.68	—.37	+.21
Woburn, 1929..	5.28	5.05	5.20	—.15	+.30
Mean	7.88	7.66	7.60	+.06	+.25

Nevertheless, in all five comparisons sulphate has shown a positive advantage over the two forms of chloride, in such a way as to confirm unmistakably the 1927 result. The average gain is only about ¼ ton to the acre, or 2 to 3 per cent. of a fair yield. As between the muriate and the potash salt, however, the five experiments show no significant or consistent advantage.

FERTILISERS AND MATURATION OF BARLEY

Studies by W. E. Brenchley in the Botanical Department have shown that the different fertilisers influence the maturation of barley in different ways.

Phosphatic fertilisers hasten the maturation both of the straw and of the grain. On the other hand, nitrogenous fertiliser and sulphate, whether of potassium, calcium or ammonium, hasten maturity of straw but not of grain.

Mustard is also slightly hastened in maturation by sulphate, but not on all soils; the effect was not shown, for example, on a fen soil from Cambridgeshire.

https://doi.org/10.23637/ERADOC-1-65