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## Report for 1937

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## Mangolds

### Rothamsted Research

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The combined dressing was not in general so effective as the individual dressings. Where there was a clear response to minerals, the sum of the responses to the individual dressings of salt and muriate of potash was always greater than the response to the combined dressing.

The experiments do not provide sufficient material to determine whether salt is chiefly a light land fertilizer, because all the experiments except those at Rothamsted were on light or sandy soils. Salt, however, increased yields in all five experiments at Rothamsted. The contrast between the 1937 results at Rothamsted and at Woburn is striking, salt giving good increases at Rothamsted where muriate of potash had little effect, whereas with the same dressings at Woburn muriate of potash was the more effective.

Both salt and muriate of potash slightly, but fairly consistently, increased the sugar percentage. In the 10 experiments with small applications the equivalent dressings of the two minerals produced exactly the same average increase in sugar percentage, 0.21 for 1 cwt. salt or 1.2 cwt. muriate of potash. In the remaining experiments both minerals produced substantial increases in sugar percentage at Lincoln and Mattersey, but at other centres their effects were small.

The factory series of sugar beet experiments have shown that the addition of muriate of potash tends to increase the response to sulphate of ammonia. Little information has yet been obtained on the behaviour of salt in this respect. Three experiments contained salt and muriate of potash alone and in combination with a nitrogenous fertilizer. In no case, however, was the response to nitrogen appreciably affected by the presence of either salt or muriate of potash.

2. *Celery*. Experiments on celery were carried out at Mepal (Isle of Ely) in 1935 and 1936. In the first year there were significant increases in total produce of 0.43 tons per acre to 5 cwt. salt and of 0.89 tons per acre to 3 cwt. muriate of potash. Both minerals also produced a significant increase in the size of heads. The latter result is important commercially, the heads being graded by size when packed for market.

The effect of salt was strikingly different in 1936. Salt was applied in dry weather, six days before planting. No rain fell for some time afterwards. The salt decreased plant numbers by nearly 30 per cent. and yields of total produce by 16 per cent. Superphosphate visibly mitigated the salt damage, and to some extent this effect is also reflected in the yields of total produce. Under the same conditions muriate of potash produced a small but not significant increase in total yield and a significant increase in size of heads.

3. *Mangolds*. The effects of salt on mangolds are summarised on p. 43.

#### MANGOLDS

The classical experiments on Barnfield are made in the somewhat exceptional conditions of continuous growth of mangolds on the

same land. Experiments under more normal conditions were made on Great Harpenden field in 1936 and on Great Knott field in 1937 in which two levels of each of five different fertilizers were tested in all combinations. The design of the experiment was such that each experiment involved only 32 plots, thus making efficient use of the land available.

The results in the two years agreed well, and accorded with those obtained on the Barnfield experiments.

The mean yields and average responses in roots are shown in Table XXIX

TABLE XXIX

	Mangolds roots : tons per acre	
	1936	1937
Mean yield	25.50	21.40
Response to :—		
Dung (10 tons) .. .. .	+4.20	+2.04
Sulphate of ammonia (0.6 cwt. N) .. .. .	+7.73	+4.95
Salt (5 cwt.) .. .. .	+3.12	+4.92
Muriate of potash (1 cwt. K <sub>2</sub> O) .. .. .	+0.22	+0.74
Superphosphate (0.5 cwt. P <sub>2</sub> O <sub>5</sub> ) .. .. .	-0.45	+0.22
Standard error .. .. .	±0.675	±0.686

There were good responses to nitrogen (dung and sulphate of ammonia) in both years, the responses being higher in 1936 than in 1937.

There was also a good response to 5 cwt. salt in both years, particularly in 1937, and this is the more remarkable in that in both years the average response to muriate of potash was small and not significant. Superphosphate had little if any effect.

The value of potash as a general rule is of course well established. Its effect in increasing the response to nitrogenous manure (sulphate of ammonia) was strikingly demonstrated in the continuous experiments on Barnfield. There are indications of this effect (and also of a similar effect of salt) in the present experiments, as Table XXX shows.

TABLE XXX

Roots : tons per acre

	Sulphate of ammonia	Mineral Manures			
		None	Potash	Salt	Potash and salt
1936	None .. .. .	22.55	18.67	22.31	23.03
	0.6 cwt. N .. .. .	26.56	28.00	30.16	32.76
	Increase .. .. .	+4.01	+9.33	+7.85	+9.73
1937	None .. .. .	16.99	18.51	20.64	19.56
	0.6 cwt. N .. .. .	18.78	21.49	27.71	27.53
	Increase .. .. .	+1.79	+2.98	+7.07	+7.97

In both years the addition of either muriate of potash or salt increased the response to sulphate of ammonia, while the highest

response was obtained in presence of both potash and salt. In 1936 potash appeared the more effective in this respect, while in 1937 salt was more effective.

The average effects of the treatments on tops were similar to those on roots. The experiments also provide information on the question whether it is worth while applying artificials if dung is being used.

Response to	1936 Dung		1937 Dung	
	Absent	Present	Absent	Present
Sulphate of ammonia ..	+7.87	+7.59	+5.80	+4.11
Salt .. .. .	+4.09	+2.16	+5.22	+4.61
Standard error .. ..	±0.955		±0.970	

Both sulphate of ammonia and salt gave substantial increases in the presence of dung, although the increases were somewhat less than those obtained in the absence of dung.

Experiments in conjunction with Mr. J. R. Bond at Oakerthorpe, Derby, in 1932, 1933 and 1934 tested the effects of dung, sulphate of ammonia and potash salt. The results are similar to those obtained at Rothamsted.

TABLE XXXI

	Mangolds roots : tons per acre		
	1932	1933	1934
Mean yield .. .. .	31.20	20.58	19.56
Response to :—			
Dung (15 tons) .. .. .	+8.13 <sup>(1)</sup>	+4.21	+9.75
Sulphate of ammonia (0.6 cwt. N)	+8.76*	+1.42	+2.21
30% Potash Salt† .. ..	+5.63	+3.68	+6.82
Standard error .. .. .	±0.354	±0.976	±0.856

\* 1.2 cwt. N.

† 1932, 2.4 cwt. K<sub>2</sub>O., 1933, 0.9 cwt. K<sub>2</sub>O., 1934, 1.2 cwt. K<sub>2</sub>O.

<sup>(1)</sup> S.E. = ±0.488.

There were large responses to dung and potash salt in all three years. The double dressing of ammonia gave a good response in 1932, while the single dressings in 1933 and 1934 were not so effective.

Responses to sulphate of ammonia

1932		1933		1934	
Potash salt		Potash salt		Potash salt	
Absent	Present	Absent	Present	Absent	Present
+7.27	+10.27	+1.81	+1.03	+0.98	+3.44
±0.498		±1.38		±1.21	

In 1932 and 1934 the presence of potash salt increased the response to sulphate of ammonia, agreeing in this respect with the Rothamsted experiments.

	1932		1933		1934	
	Dung		Dung		Dung	
	Absent	Present	Absent	Present	Absent	Present
Response to :						
Sulphate of ammonia ..	+11.74 <sup>1</sup>	+5.79 <sup>1</sup>	+2.28	+0.56	+3.02	+1.39
Potash salt ..	+6.18 <sup>2</sup>	+5.08 <sup>2</sup>	+4.90	+2.44	+9.26	+4.38
	( <sup>1</sup> ) ±0.690		±1.38		±0.856	
	( <sup>2</sup> ) ±0.498					

As in the Rothamsted experiments both sulphate of ammonia and potash salt produced increases in the presence of dung, while in the absence of dung larger (in some cases considerably larger) increases were obtained.

POTATOES

For the past thirteen years experiments on the manuring of potatoes have been made at Rothamsted and Woburn and on potato growing farms in different parts of the country : some of the recent results are collected in Table XXXII.

TABLE XXXII  
Main Crop Potatoes. Summary of Experiments 1932-37<sup>1</sup>  
Mean Yields and Mean Increases, Tons per Acre

	Yield without nitrogen	Increase for		Yield without phosphate	Increase for		Yield without potash	Increase for	
		N <sub>1</sub>	N <sub>2</sub>		P <sub>1</sub>	P <sub>2</sub>		K <sub>1</sub>	K <sub>2</sub>
<b>MINERAL SOILS</b>									
<i>No dung</i>									
Light (1 expt.) ..	11.84	+0.60	+0.84	—	—	—	12.34	-0.08	+0.03
Medium (1 expt.) ..	12.25	+1.03	+1.91	12.42	+0.80	+1.63	12.87	+0.23	+0.85
Heavy (2 expts.) ..	10.61	+1.19	+1.47	—	—	—	11.59	-0.21	-0.08
<i>With Dung</i>									
Light (2 expts.) ..	7.16	-0.20	-0.17	—	—	—	6.98	-0.07	+0.24
Medium (2 expts.) ..	10.86	+1.32	+1.50	11.49	+0.60	+0.32	11.55	+0.53	+0.21
Heavy (1 expt.) ..	10.24	+2.34	+3.22	—	—	—	12.07	+0.16	-0.10
<b>FENLAND SOILS</b>									
<i>No Dung</i>									
Light (6 expts.) ..	7.01	+1.11	+1.53	6.96	+1.23	+1.56	6.16	+2.08	+2.67
Heavy (5 expts.) ..	10.11	+2.10	+3.13	9.92	+2.54	+3.26	11.00	+0.28	+0.46
<i>With Dung</i>									
Light (2 expts.) ..	8.08	+1.16	+1.17	8.43	+0.36	+0.93	8.09	+0.75	+1.56
Heavy (1 expt.) ..	12.73	+1.59	+2.56	13.60	+0.55	+0.99	13.49	+0.58	+1.29

<sup>1</sup> Dressings per acre :  
N<sub>1</sub> = 1½ cwt. sulphate of ammonia (0.3 cwt. nitrogen).  
N<sub>2</sub> = 3 cwt. sulphate of ammonia (0.6 cwt. nitrogen).  
P<sub>1</sub> = 4½ cwt. superphosphate (0.75 cwt. P<sub>2</sub>O<sub>5</sub>).  
P<sub>2</sub> = 9 cwt. superphosphate (1.5 cwt. P<sub>2</sub>O<sub>5</sub>).  
K<sub>1</sub> = 1½ cwt. sulphate of potash (0.75 cwt. K<sub>2</sub>O).  
K<sub>2</sub> = 3 cwt. sulphate of potash (1.5 cwt. K<sub>2</sub>O).

They show that one dose of the fertilizer usually gives a good result even when farmyard manure is also supplied but the double dose may not give a sufficiently greater increase to pay for the extra manure. Nitrogen (sulphate of ammonia) has given the most consistent increases both on mineral and on fenland soils, whether dung is added or not. Phosphate and potash have given marked increases on fenland soils, greater indeed than on the mineral soils.