ROTHAMSTED RESEARCH

Report for 1937

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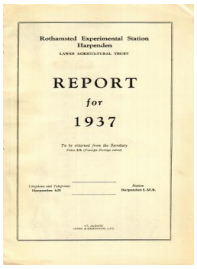

Sugar Beet

Rothamsted Research

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Reviewing the whole of the experiments it appears that poultry manure is not uniformly better than sulphate of ammonia in the cumulative series, but it approaches sulphate of ammonia closer than in the series testing first year effects. Kale appears to be a particularly unsuitable crop for poultry manure, while the only two cabbage crops grown in 1937 showed a significant superiority of poultry manure over sulphate of ammonia.

ARABLE CROPS

Sugar Beet

Each year since 1933 the Rothamsted staff has co-operated with what has now become the Committee on Research and Education of the Sugar Commission in carrying out experiments on the manuring and cultivation of sugar beet at Rothamsted, Woburn and on a number of representative sugar beet growers' farms.

During the first three years 1933, 1934 and 1935, the responses to fertilizers were comparatively small. The summers were hot and dry, and apparently provided little opportunity for the phosphate and potash to exert their full effects. Nitrogen was the only fertilizer to justify itself in the average in these years, and the single dose of potash came next in order of effectiveness. In 1936, however, there were good responses to all nutrients and especially to phosphate; the results provided us with our first favourable opportunity for relating field responses to chemical analysis of the soils. In 1937 the responses to nitrogen and phosphate were less than in 1936, but the results from potash were the best so far recorded.

The mean increase to the three nutrients in terms of sugar per acre are shown in Table XVIII.

TABLE XVIII

Mean Responses to Nutrients in Single and Double Dressings. 1933-1937
Sugar (cwt. per acre)

Year	No. of expts.	Mean yield of roots tons p. a.	Mean yield of sugar	Sulphate of ammonia 2 cwt.	Sulphate of ammonia 4 cwt.	Superphosphate 3 cwt.	Superphosphate 6 cwt.	Muriate of potash 1¼ cwt.	Muriate of potash 2½ cwt.
1933	13	11.5	37.5	+0.4	—	+0.3	—	+0.8	—
1934	15	13.5	47.6	+1.8	+3.0	+0.4	+1.0	+1.4	+0.4
1935	23	9.5	32.4	+1.8	+2.7	+0.1	+0.4	+0.8	+0.9
1936	26	10.4	36.6	+5.5	+7.7	+1.9	+3.0	+1.2	+1.9
1937	30	11.6	40.3	+3.8	+5.2	+1.5	+1.9	+1.5	+2.8

The quantity of sugar per acre required at January 1938 prices to pay for the expenditure on fertilizers is as follows :—

cwt.		*Cwt. per acre*
2	Sulphate of ammonia . .	1.4
4	,, ,, . .	2.7
3	Superphosphate . .	1.1
6	,, . .	2.1
1¼	Muriate of potash . .	1.0
2½	,, ,, . .	1.9

So far as the experiments have at present gone the fertilizer results may be summarised as follows :—

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(1) Nitrogen is almost always profitable on the average to the extent of 4 cwt. sulphate of ammonia per acre except on rich silts and fens.

TABLE XIX

Effect of Nitrogenous Fertilizers on Different Soils
Increases (+) or Decreases (—) in Sugar (cwt. per acre)

Year	Sulphate of ammonia	Coarse sands	Fine sands	Light loams	Heavy loams	Clay loams	Fens
	cwt.						
1936	2	+8.3	+4.4	+4.0	+4.9	+7.0	+3.1
	4	+11.6	+5.9	+5.6	+9.2	+9.9	+0.8
1937	2	+6.1	+3.0	+2.9	+3.4	+4.7	+0.6
	4	+7.1	+4.3	+5.4	+4.5	+6.6	−2.6

It almost invariably reduces the sugar content but this loss is more than compensated by increased yield.

TABLE XX

Effect of Sulphate of Ammonia on Sugar Content

	Mean sugar percentage	Effect of sulphate of ammonia	
		2 cwt.	4 cwt.
1933 ..	16.2	−0.3	—
1934 ..	17.7	−0.2	−0.4
1935 ..	16.9	−0.2	−0.6
1936 ..	17.6	−0.1	−0.2
1937 ..	17.3	−0.1	−0.3

The effectiveness of nitrogen on the yield of sugar per acre (Table XVIII) falls off as the dressing increases from 2 cwt. sulphate of ammonia per acre to 4 cwt. On the tops, however, the effect of nitrogen is so marked that there is no sign of falling off even when 4 cwt. sulphate of ammonia is given.

TABLE XXI

Effect of Increasing Dressings of Sulphate of Ammonia on Tops (tons per acre). Increase due to Sulphate of Ammonia

	No. of expts.	Mean yield	2 cwt.	4 cwt.
1934 ..	11	10.9	+1.2	+2.8
1935 ..	20	8.1	+1.3	+2.6
1936 ..	18	8.4	+1.8	+3.4
1937 ..	24	9.4	+1.5	+3.0

(2) Phosphate varies in its effect from centre to centre and from season to season. Table XXII shows that the smaller dose of 3 cwt. superphosphate per acre was profitable on the average of all centres in 1936 and 1937, while the double dose was profitable over all centres in 1936 only. The sugar content is practically unaffected by phosphate, but the rate of growth of the young plant seems to be benefited in many cases. Up to the present basic slag has been no better than superphosphate even on acid soils, rather the reverse. The

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effect of phosphate on tops is in the same direction as on roots but somewhat smaller.

TABLE XXII

Effect of Phosphatic Fertilizers on Different Soils
Increases (+) or Decreases (−) in Sugar (cwt. per acre)

Year	Superphosphate	Coarse sands	Fine sands	Light loams	Heavy loams	Clay loams	Fens
	cwt.						
1936	3	+2.3	+1.3	+3.0	+0.6	+2.5	+1.2
	6	+4.2	+2.7	+3.7	+1.2	+4.3	+0.2
1937	3	+1.2	+0.7	+2.6	+0.5	+0.5	+2.2
	6	+1.5	+1.4	+2.9	+2.3	+1.0	+1.0

(3) Potash had generally worked well on the lighter soils and on the fens : it had much less effect on the heavy loams and on the clays.

TABLE XXIII

Effect of Potassic Fertilizers on Different Soils
Increases (+) and Decreases (−) in Sugar (cwt. per acre)

Year	Muriate of potash	Coarse sands	Fine sands	Light loams	Heavy loams	Clay loams	Fens
	cwt.						
1936	1¼	+1.8	+2.6	+0.3	+0.2	0.0	+2.1
	2½	+3.8	+4.4	+1.5	−1.2	−1.4	+4.2
1937	1¼	+2.6	+1.7	+1.4	+1.8	+0.6	+1.0
	2½	+4.0	+3.4	+2.4	+0.7	+1.1	+3.2

It almost always improves the sugar content.

TABLE XXIV

Effect of Muriate of Potash on Sugar Content
Increase (+) or Decrease (−) Per cent.

	Mean sugar percentage	Muriate of potash cwt.	
		1¼	2½
1933 ..	16.2	+0.2	—
1934 ..	17.7	+0.2	+0.2
1935 ..	16.9	+0.2	+0.2
1936 ..	17.6	+0.1	+0.2
1937 ..	17.3	+0.1	+0.3

Potash also has the valuable property of bringing out the best value of nitrogenous manures ; the joint action of nitrogen and potash has usually been greater than the sum of their separate effects.

TABLE XXV

Effect of Potash on the Action of Nitrogenous Manure. Sugar (cwt. per acre)
Increase due to 4 cwt. Sulphate of Ammonia

	No potash present	2½ cwt. muriate of potash present
1934	+2.0	+4.1
1935	+1.7	+3.7
1936	+6.9	+8.5
1937	+4.8	+6.5

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Potash also increases the tops, but to a less extent than the roots.

The effect of fertilizers on plant number per acre is somewhat variable but tends to be favourable : the magnitude of the effects, however, is usually small.

TABLE XXVI

Effect of Fertilizers on Plant Numbers

Increase, thousands per acre due to

Year	Mean thousands per acre	Sulphate of ammonia		Superphosphate		Muriate of potash	
		2 cwt.	4 cwt.	3 cwt.	6 cwt.	1¼ cwt.	2½ cwt.
1933	22.8	+0.3	—	+0.5	—	+0.4	—
1934	27.4	+0.2	+0.4	0.0	+0.1	+0.2	+0.2
1935	29.7	+0.4	+0.3	+0.2	0.0	+0.2	+0.1
1936	25.9	+0.2	0.0	+0.4	+0.6	+0.1	+0.3
1937	28.3	+0.3	+0.3	+0.5	+0.3	+0.4	+0.7

No clear relationships have yet been found between fertilizers and the purity of the juice.

Methods of applying mineral manures to sugar beet. Experiments to compare several methods of applying mineral manures to sugar beet were carried out at five centres in 1936 and six centres in 1937. The treatments consisted of no minerals, minerals ploughed in or broadcast during December or January, and minerals broadcast in spring, shortly before sowing. Though minerals increased the yields at ten of the eleven centres, none of the three methods of application proved consistently superior to the others. The only significant differences occurred in both years on a sandy loam soil at East Kirkby, where winter applications proved superior to the spring application.

TABLE XXVII

Effect of Time and Method of Applying Minerals

Sugar. Cwt. per acre

Centre	None	Minerals Pl/w	Minerals Br/w	Minerals Br/s	Mean of minerals	Pl/w minus Br/w	Standard error	Winter minus spring	Standard error
			1936 Experiments				±		±
Wragby	42.2	46.0	46.8	46.0	46.3	−0.8	0.993	+0.4	0.860
Scotter	45.0	46.3	45.9	46.2	46.1	+0.4	0.970	−0.1	0.840
Habrough ..	59.2	59.7	58.1	57.8	58.5	+1.6	2.02	+1.1	1.75
East Kirkby ..	25.4	34.4	37.4	33.7	35.2	−3.0*	1.25	+2.2*	1.08
Harper Adams ..	62.4	66.8	66.8[1]	68.6	67.4	0.0	1.37	−1.8	1.19
			1937 Experiments						
Rothamsted ..	42.8	43.7	47.4	48.1	46.4	−3.7	2.33	−2.5	2.02
Woburn	53.3	54.8	56.6	57.0	56.1	−1.8	1.65	−1.3	1.43
Wragby	44.6	50.3	49.6	49.0	49.6	+0.7	1.56	+1.0	1.35
Market Rasen ..	34.3	39.4	40.8	40.9	40.4	−1.4	1.48	−0.8	1.29
East Kirkby ..	38.7	48.7	48.8	45.0	47.5	−0.1	1.73	+3.8*	1.49
Blyborough ..	49.7	54.0	53.6	51.3	53.0	+0.4	2.06	+2.5	1.79

(1) Minerals harrowed in. * Significant difference.

Pl/w=Winter ploughed. Br/w=Winter broadcast. Br/s=Spring broadcast.

Minerals at all centres : superphosphate plus muriate of potash, except Rothamsted and Woburn : salt plus muriate of potash.

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