

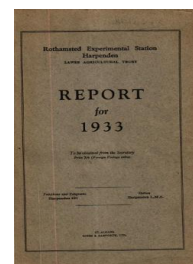
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## Report for 1933

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## Experiments at Outside Centres

### Rothamsted Research

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## EXPERIMENTS AT OUTSIDE CENTRES.

Meadow Hay. 4th Season. W. H. Limbrick, Esq., Badminton Farm, Badminton, Glos., 1933.

5 × 5 Latin square with split plots. Sub-plots : 1/20 acre.

Treatments : Phosphatic dressings at the rate of 1 cwt. P<sub>2</sub>O<sub>5</sub> per acre, and muriate of potash at the rate of 1 cwt. (0.5 cwt. K<sub>2</sub>O) per acre. The phosphates were applied in 1930 and potash in 1931. No further manuring this year.

Soil : Light red loam, 8 ins. deep. Hay cut : June 22nd.

Standard Errors : per whole plot : ±1.84 cwt. per acre or ±7.53% ; per sub-plot : ±1.79 cwt. per acre or ±7.32%.

*Dry Matter (cwt per acre)*

Muriate of potash	No Phosphate	Mineral Phosphate	Low sol. Slag	High sol. Slag	Super.	Mean
None	24.0	23.7	23.4	25.7	26.7	24.7
1 cwt.	23.8	22.6	24.3	24.0	26.4	24.2
<i>Mean</i> (±0.824)	23.9	23.2	23.8	24.8	26.6	24.5
<i>Diff.</i> (±1.13)	-0.2	+1.1	+0.9	-1.7	-0.3	-0.5 (±0.505)

### Conclusions

The response to superphosphate applied in 1930 is just significant. There are no effects of potash applied in 1931.

Meadow Hay. 4th Season. W. Eydes, Esq., Walton Lodge Farm, Chesterfield, 1933.

5 × 5 Latin square. Plots 1/15 acre.

Treatments : Phosphates at the rate of 1 cwt. P<sub>2</sub>O<sub>5</sub> per acre applied in 1930. No further manuring this year.

Basal Manuring : Nil.

Hay Cut : July 18th.

Standard Error per Plot : ±0.99 cwt. per acre or ±4.7%.

### Conclusions

The response to the phosphatic dressings is significant, low soluble slag being significantly below mineral-phosphate and superphosphate.

### Dry Matter

Cwt. per acre	Yield	Increase
<i>Mean</i> .. ..	20.9	
No Phosphate	18.6	
Mineral Phosphate	21.8	+ 3.2
Low soluble slag	20.5	+ 1.9
High soluble slag	21.1	+ 2.5
Superphosphate	22.3	+ 3.7
St. Error ..	±0.442	±0.625

Barley. G. H. Nevile, Esq., Wellingore Hall, Lincs., 1933.

6 × 6 Latin square. Plots 1/120 acre.

Treatments : Sulphate of ammonia or ammonium bicarbonate at the rate of 0.2 cwt. N. per acre. Superphosphate at the rate of 0.4 cwt. P<sub>2</sub>O<sub>5</sub> per acre.

Basal Manuring : Nil.

Soil : Light loam on Lincoln Heath. Variety : Plumage Archer. Manures applied : March 18th.

Barley sown : March 16th. Harvested : August 17th. Previous crop : Oats.

Special Notes : Plots harvested by sampling method (5 random samples per sub-plot each consisting of 4 half-metre rows side by side.) Rows spaced 6 ins. apart.

Standard errors per plot : grain : ±1.88 cwt. per acre or ±8.0% ; straw : ±3.04 cwt. per acre or 10.7%.

**Grain : cwt. per acre ( $\pm 0.768$ )**

Superphosphate	Nitrogen (0.2 cwt. N per acre.)			Mean ( $\pm 0.443$ )	Increase ( $\pm 0.626$ )
	None	Sulph. Amm.	Amm. bicarb.		
None	20.6	23.5	25.2	23.1	
0.4 cwt. P <sub>2</sub> O <sub>5</sub>	22.1	25.5	24.4	24.0	+ 0.9
Mean ( $\pm 0.543$ ) Increase ( $\pm 0.768$ )	21.4	24.5 + 3.1	24.8 + 3.4	23.6	

**Straw : cwt. per acre ( $\pm 1.24$ )**

Superphosphate	Nitrogen (0.2 cwt. N per acre.)			Mean ( $\pm 0.716$ )	Increase ( $\pm 1.01$ )
	None	Sulph. Amm.	Amm. bicarb.		
None	24.4	28.3	31.4	28.0	
0.4 cwt. P <sub>2</sub> O <sub>5</sub>	26.4	31.5	28.9	28.9	+ 0.9
Mean ( $\pm 0.877$ ) Increase ( $\pm 1.24$ )	25.4	29.9 + 4.5	30.2 + 4.8	28.4	

**Conclusions**

Significant response to nitrogen both in grain and straw. The average response to superphosphate and the average difference between the two forms of nitrogen are not significant, but there is indication, significant in the case of straw, and almost so in the case of grain, that bicarbonate is less favourable, as compared with sulphate of ammonia, in the presence of superphosphate than in its absence, the average response to superphosphate being significant in both grain and straw when the ammonium bicarbonate plots are omitted.

**Barley. South-Eastern Agricultural College, Wye, Kent, 1933.**

6 x 6 Latin square. Plots : 1/120 acre.

Treatments : Nitrogenous manures at the rate of 0.2 cwt. of N per acre. Superphosphate at the rate of 0.4 cwt. P<sub>2</sub>O<sub>5</sub> per acre.

Basal manuring : Nil.

Soil : Loam. Coldharbour series. Variety : Plumage Archer. Manures applied : March 23rd.

Barley sown : March 15th. Harvested : August 8th. Previous crop : Barley.

Special Notes : Crop slightly damaged by wireworm. Plots harvested by sampling method (5 random samples per plot each consisting of 4 half-metre rows side by side). Rows spaced 7 ins. apart.

Standard errors per plot : grain :  $\pm 3.57$  cwt. per acre or  $\pm 13.5\%$  ; straw :  $\pm 3.10$  cwt. per acre or  $11.0\%$ .

**Grain : cwt. per acre ( $\pm 1.46$ )**

Superphosphate	Nitrogen (0.2 cwt. N per acre)			Mean ( $\pm 0.843$ )	Increase ( $\pm 1.19$ )
	None	Sulph. Amm.	Amm. bicarb.		
None	22.6	27.0	26.9	25.5	
0.4 cwt. P <sub>2</sub> O <sub>5</sub>	24.3	29.8	28.1	27.4	+ 1.9
Mean ( $\pm 1.03$ ) Increase ( $\pm 1.46$ )	23.4	28.4 + 5.0	27.5 + 4.1	26.4	

**Straw : cwt. per acre ( $\pm 1.27$ )**

Superphosphate	Nitrogen (0.2 cwt. N per acre)			Mean ( $\pm 0.733$ )	Increase ( $\pm 1.04$ )
	None	Sulph. Amm.	Amm. bicarb.		
None .. ..	24.7	28.9	29.0	27.5	
0.4 cwt. P <sub>2</sub> O <sub>5</sub> ..	25.9	31.7	29.5	29.0	+ 1.5
Mean ( $\pm 0.898$ ) ..	25.3	30.3	29.2	28.3	
Increase ( $\pm 1.27$ )		+ 5.0	+ 3.9		

**Conclusions**

Significant response to nitrogen both for grain and straw without any significant differences between the two forms. The response to superphosphate is not large enough to be significant.

**Potatoes. G. Major, Esq., Newton Farm, Tydd, Wisbech, 1933.**

3 randomised blocks of 9 plots each. (No replication.) Two degrees of freedom for second order interactions are confounded with blocks and the error is estimated from interactions of deviations from regression effects. Plots : 1/60 acre.

Treatments : Sulphate of ammonia at the rate of 0, 0.4 and 0.8 cwt. N, superphosphate at the rate of 0, 0.7 and 1.4 cwt. P<sub>2</sub>O<sub>5</sub> and sulphate of potash at the rate of 0, 1.0 and 2.0 cwt. K<sub>2</sub>O per acre in all combinations.

Basal manuring : Nil.

Soil : Deep silt, rather heavy. Variety : King Edward. Manures applied : April 17th. Potatoes planted : April 21st. Lifted : September 1st. Previous crop : Peas.

Standard error per plot :  $\pm 0.360$  tons per acre or  $\pm 2.7\%$ .

**Plan and Yields in lb. of Individual Plots**

N <sub>0</sub> P <sub>0</sub> K <sub>0</sub> 408	N <sub>0</sub> P <sub>2</sub> K <sub>1</sub> 479	N <sub>2</sub> P <sub>0</sub> K <sub>2</sub> 491	N <sub>1</sub> P <sub>2</sub> K <sub>1</sub> 530	N <sub>1</sub> P <sub>1</sub> K <sub>2</sub> 514	N <sub>0</sub> P <sub>0</sub> K <sub>2</sub> 459	N <sub>2</sub> P <sub>2</sub> K <sub>1</sub> 552	N <sub>1</sub> P <sub>1</sub> K <sub>1</sub> 476	N <sub>0</sub> P <sub>0</sub> K <sub>1</sub> 444
N <sub>1</sub> P <sub>1</sub> K <sub>0</sub> 498	N <sub>2</sub> P <sub>1</sub> K <sub>1</sub> 534	N <sub>1</sub> P <sub>0</sub> K <sub>1</sub> 466	N <sub>2</sub> P <sub>1</sub> K <sub>0</sub> 533	N <sub>0</sub> P <sub>2</sub> K <sub>0</sub> 491	N <sub>2</sub> P <sub>0</sub> K <sub>1</sub> 481	N <sub>2</sub> P <sub>1</sub> K <sub>2</sub> 531	N <sub>0</sub> P <sub>2</sub> K <sub>2</sub> 479	N <sub>2</sub> P <sub>0</sub> K <sub>0</sub> 485
N <sub>2</sub> P <sub>2</sub> K <sub>0</sub> 508	N <sub>0</sub> P <sub>1</sub> K <sub>2</sub> 468	N <sub>1</sub> P <sub>2</sub> K <sub>2</sub> 553	N <sub>1</sub> P <sub>0</sub> K <sub>0</sub> 467	N <sub>2</sub> P <sub>2</sub> K <sub>2</sub> 644	N <sub>0</sub> P <sub>1</sub> K <sub>1</sub> 441	N <sub>1</sub> P <sub>0</sub> K <sub>2</sub> 473	N <sub>0</sub> P <sub>1</sub> K <sub>0</sub> 448	N <sub>1</sub> P <sub>2</sub> K <sub>0</sub> 486

**Summary : tons per acre  
Mean of all Potash ( $\pm 0.208$ )**

Superphosphate	Sulphate of Ammonia			Mean ( $\pm 0.120$ )	Increase ( $\pm 0.170$ )
	None	0.4 cwt. N	0.8 cwt. N		
None .. ..	11.70	12.55	13.01	12.42	
0.7 cwt. P <sub>2</sub> O <sub>5</sub> ..	12.12	13.28	14.27	13.22	+ 0.80
1.4 cwt. P <sub>2</sub> O <sub>5</sub> ..	12.94	14.01	15.21	14.05	+ 0.83
Mean ( $\pm 0.120$ )	12.25	13.28	14.16	13.23	
Increase ( $\pm 0.170$ )		+ 1.03	+ 0.88		

**Mean of all Superphosphate ( $\pm 0.208$ )**

Sulphate of potash	Sulphate of Ammonia			Mean ( $\pm 0.120$ )	Increase ( $\pm 0.170$ )
	None	0.4 cwt. N	0.8 cwt. N		
None ..	12.03	12.96	13.62	12.87	
1.0 cwt. $K_2O$ ..	12.18	13.14	13.99	13.10	+ 0.23
2.0 cwt. $K_2O$ ..	12.55	13.75	14.87	13.72	+ 0.62
Mean ( $\pm 0.120$ )	12.25	13.28	14.16	13.23	
Incr. ( $\pm 0.170$ )		+ 1.03	+ 0.88		

**Mean of all Nitrogen ( $\pm 0.208$ )**

Superphosphate	Sulphate of Potash			Mean ( $\pm 0.120$ )	Increase ( $\pm 0.170$ )
	None	1.0 cwt. $K_2O$	2.0 cwt. $K_2O$		
None ..	12.14	12.42	12.70	12.42	
0.7 cwt. $P_2O_5$ ..	13.20	12.96	13.51	13.22	+ 0.80
1.4 cwt. $P_2O_5$ ..	13.26	13.94	14.96	14.05	+ 0.83
Mean ( $\pm 0.120$ )	12.87	13.10	13.72	13.23	
Incr. ( $\pm 0.170$ )		+ 0.23	+ 0.62		

**Conclusions**

Significant responses to all three nutrients, with no significant falling off in the responses with the higher dressings. There is a significantly higher response to sulphate of ammonia and superphosphate in the presence of one another, and also to superphosphate and sulphate of potash in the presence of one another. The second order interaction is also significant. The errors are very low, but not exceptionally so for this farm.

**Potatoes. R. Starling, Esq., Little Downham, Ely, 1933.**

4 randomised blocks of 9 plots each. Plots : 1/60 acre.

Treatments : Sulphate of ammonia at the rate of 0, 2 and 4 cwt. per acre in combination with superphosphate at the rate of 0, 6 and 12 cwt. per acre.

Basal manuring : Nil.

Soil : Good quality black soil with clay. Variety : Majestic (sprouted Scotch).

Manures applied : April 11th. Potatoes planted : April 11th. Lifted : October 8th. Previous crop : Wheat.

Standard error per plot :  $\pm 1.88$  tons per acre or  $\pm 13.18\%$ .

**Summary : tons per acre ( $\pm 0.943$ )**

Sulphate of Ammonia (p.a.)	Superphosphate (cwt. p.a.)			Mean ( $\pm 0.544$ )	Increase ( $\pm 0.770$ )
	None	6	12		
None ..	7.67	13.17	13.43	11.42	
2 cwt. ... ..	13.61	16.20	15.74	15.18	+ 3.76
4 cwt. ... ..	14.31	17.04	17.31	16.22	+ 1.04
Mean ( $\pm 0.544$ )	11.86	15.47	15.49	14.27	
Incr. ( $\pm 0.770$ )		+ 3.61	+ 0.02		

**Conclusions**

Significant response to both fertilisers with significantly less additional response to the double dressing than to the single, that of superphosphate being negligible.

Potatoes. J. A. Tribe, Willow Farm, Binnimoor, March, 1933.

8 randomised blocks of 4 plots each. Second order interaction confounded. Plots : 1/60 acre. Treatments : 2 cwt. sulphate of ammonia, 7 cwt. superphosphate, and 2 cwt. of sulphate of potash per acre in all combinations.

Basal manuring : Nil.

Soil : Deep black Fen on clay. Variety : Scotch King Edward. Manures applied : April 11th.

Potatoes planted : April 15th. Lifted : September 22nd. Previous crop : Sugar Beet.

Standard error per plot :  $\pm 0.694$  tons per acre or  $\pm 5.6\%$ .

Individual Treatments : tons per acre ( $\pm 0.348$ )

O	Sub-blocks A			N	Sub-blocks B			Mean
	NK	NP	PK		P	K	NPK	
12.03	11.84	13.32	13.27	11.67	12.17	11.47	13.09	12.36

Responses to Fertilisers : tons per acre

Fertiliser	Mean Response	Sulphate of Ammonia		Superphosphate		Sulphate of potash	
		Absent	Present	Absent	Present	Absent	Present
Sulphate of ammonia ..	0.24 <sup>1</sup>	—	—	0.00 <sup>2</sup>	+0.48 <sup>2</sup>	+0.40 <sup>2</sup>	+0.10 <sup>2</sup>
Superphosphate ..	1.21 <sup>1</sup>	+0.97 <sup>2</sup>	+1.45 <sup>2</sup>	—	—	+0.90 <sup>2</sup>	+1.52 <sup>2</sup>
Sulphate of potash ..	0.12 <sup>1</sup>	+0.27 <sup>2</sup>	-0.03 <sup>2</sup>	-0.20 <sup>2</sup>	+0.44 <sup>2</sup>	—	—

Standard errors : (1)  $\pm 0.246$ , (2)  $\pm 0.348$ .

Conclusions

There is a significant response to superphosphate, greater, but not significantly so, on the plots receiving potash. There is no evidence of any general potash effect or of any nitrogen effects.

Potatoes. T. H. Ream, Esq., Portobello Farm, Sutton, Beds., 1933.

4 x 4 Latin square with split plots. Sub-plots 1/80 acre.

Treatments : Superphosphate at the rate of 0 and 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre in combination with sulphate of potash at the rate of 0 and 1.0 cwt. K<sub>2</sub>O per acre. Each plot divided, one half receiving Nitrate of Soda at the rate of 0.25 cwt. N per acre.

Basal manuring : No dung, sulphate of ammonia at the rate of 0.4 cwt. of N per acre.

Soil : Sandy. Variety : Ninetyfold. Manures applied : March 29th. Top dressing applied : May 12th. Potatoes planted : March 29th. Lifted : June 30th. Previous crop : Oats.

Standard errors per whole plot :  $\pm 0.511$  tons per acre or  $\pm 16.07\%$  ; per sub-plot :  $\pm 0.284$  tons per acre or  $\pm 8.93\%$ .

Tons p.a.	Neither	Super.	Potash	Both	Mean ( $\pm 0.071$ )
No N/Soda ..	2.79	2.70	3.50	3.64	3.16
N/Soda ..	2.50	3.00	3.57	3.78	3.21
Mean ( $\pm 0.256$ )	2.64	2.85	3.54	3.71	3.18
Diff. ( $\pm 0.201$ )	-0.29	+0.30	+0.07	+0.14	+0.05

Mean increase due to Super : 0.19 tons per acre. Mean increase due to potash : 0.88 tons per acre.

Conclusions

There is a significant response to sulphate of potash of 0.88 tons per acre or 27.7 per cent. The small response to superphosphate is not significant, nor is there any sign of a response to nitrate of soda.

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Potatoes. J. Morris, Esq., Honey Farm, Wimblington, Cambs., 1933.

4 randomised blocks of 9 plots each. Plots : 1/60 acre.  
 Treatments : Sulphate of ammonia at the rate of 0, 1½ and 3 cwt. per acre in combination with sulphate of potash at the rate of 0, 1½ and 3 cwt. per acre.  
 Basal manuring : 7 cwt. superphosphate per acre. No dung.  
 Soil : Black Fen, light and peaty, clayed in 1910. Variety : King Edward, once grown. Manures applied : April 21st.  
 Potatoes planted : April 21st. Lifted : October 4th. Previous crop : Wheat.  
 Standard error per plot : ±0.762 tons per acre or 8.84%.

Summary : tons per acre (±0.381)

Sulphate of potash	Sulphate of Ammonia			Mean (±0.220)	Increase (±0.311)
	None	1½ cwt.	3 cwt.		
None ..	5.99	7.49	7.57	7.02	
1½ cwt. ..	8.06	9.76	9.72	9.18	+2.16
3 cwt. ..	8.42	9.42	11.13	9.66	+0.48
Mean (±0.220)	7.49	8.89	9.47	8.62	
Incr. (±0.311)		+1.40	+0.58		

Conclusions

Significant responses to both sulphate of ammonia and sulphate of potash. In both fertilisers the additional response to the double dressing is less than the response to the single dressing, significantly so in the case of potash. The increased response to either fertiliser in the presence of the other is not large enough to be significant.

Potatoes. W. E. Morton, Esq., Thorney Abbey, Peterborough, 1933.

Experiments on sulphate of ammonia and muriate of potash.  
 4 × 4 Latin squares. Bedlam Farm, 4 randomised blocks. Plots : 1/50 acre (Gores Farm, 27 acre field, 0.0194 acre).  
 Treatments : 2 cwt. of sulphate of ammonia and 1½ cwt. of muriate of potash per acre.  
 Basal manuring : 7 cwt. of superphosphate per acre in all cases, with beet tops ploughed in or farmyard manure as shown in the table.  
 Average standard error per plot : ± 0.524 tons per acre or ± 4.92%.

Farm	Field	Variety (Majestic)	Manures Applied	Planted	Lifted	Previous Crop	Basal Manuring
Australia	10 acre	2nd Scotch	Mar. 31	Apr. 5	Sept. 13	Beet	Beet tops
Australia	16 acre	1st Scotch	Apr. 6	Apr. 15	Sept. 13	Wheat	Dung
Bedlam	16 acre	2nd Scotch	Apr. 3	Apr. 7	Sept. 16	Beet	Beet tops Dung
Bedlam	1st Reach	3rd Scotch	Apr. 3	Apr. 4	Sept. 13	Wheat	No dung
Gores	27 acre	1st Scotch	Mar. 31	Apr. 5	Sept. 4	Oats	No dung
Gores	Stone Bridge	2nd Scotch	Mar. 31	Apr. 10	Sept. 4	Wheat	Dung

Average Yields : tons per acre (±0.262)

Farm	Field	Soil (Fenland)	O	N	K	NK	Mean
Australia ..	10 Acre ..	Black, rather heavy ..	10.55	12.37	10.62	12.06	11.40
Australia ..	16 Acre ..	Silty ..	10.04	12.40	10.62	12.99	11.51
Bedlam ..	16 Acre ..	Light ..	11.77	12.60	13.00	13.48	12.71
Bedlam ..	First Reach	Light and blowy, on peat ..	7.51	7.61	10.81	10.37	9.08
Gores ..	27 Acre ..	Light ..	6.72	7.15	10.21	11.93	9.00
Gores ..	Stone Bridge	Light ..	9.23	9.64	9.97	11.83	10.17

Fertiliser Effects

Farm	Field	Average Increase with		Interaction (±0.524)
		Nitrogen (±0.262)	Potash (±0.262)	
Australia ..	10 Acre ..	1.63	-0.12	-0.38
Australia ..	16 Acre ..	2.37	0.58	0.01
Bedlam ..	16 Acre ..	0.65	1.05	-0.36
Bedlam ..	First Reach ..	-0.17	3.03	-0.53
Gores ..	27 Acre ..	1.08	4.14	1.28
Gores ..	Stone Bridge ..	1.14	1.46	1.46

Conclusions

Five out of the six experiments show a significant response to nitrogen and an equal number show a significant response to potash. The responses to both manures are significantly different at the different places, even when the experiments showing no response are excluded. The average interaction between the two manures is not significant, but the two experiments on Gores farm show a marked (significant) positive interaction, nitrogen and potash producing greater increases in the presence of one another.

Sugar Beet. Tunstall, Suffolk, 1933.

A. W. Oldershaw, Esq., County Organiser.

4 × 4 Latin square with split plots. Sub-plots : 0.009 acre.

Treatments : Nitrate of soda at the rate of 0, 0.2, 0.4 and 0.6 cwt. of N. per acre. One half of each plot received sulphate of ammonia and the other half equal ammonia nitrogen as ammonium humate in 1932. (See 1932 Report, p. 210.)

Basal manuring : 3 cwt. superphosphate and 3 cwt. muriate of potash per acre.

Soil : Acid sand. Variety : Kleinwanzleben E. Manures applied : April 28th. Beet sown : May 6th. Lifted : December 5th. Previous crop : Sugar beet. Mean dirt tare plots 1-19 : 0.1223 ; plots 20-32 : 0.03.

Standard errors	Per whole plot		Per sub-plot	
	Tons per acre	Per cent.	Tons per acre	Per cent.
Roots (washed) ..	±0.438	±2.92	±0.785	±5.23
Tops ..	±0.292	±5.65	±0.426	±8.23
Sugar percentage ..	±0.180		±0.224	

Yields of Separate Treatments

Nitrate of Soda (per acre)	ROOTS (washed) tons per acre		TOPS tons per acre		SUGAR PERCENTAGE		TOTAL SUGAR Cwt. per acre	
	Humate	S/A	Humate	S/A	Humate	S/A	Humate	S/A
None ..	13.28	13.06	4.17	4.22	17.75	17.88	47.1	46.7
0.2 cwt. N.	15.55	14.53	5.00	4.51	17.39	17.54	54.1	51.0
0.4 cwt. N.	16.42	15.40	5.88	5.75	17.89	17.43	58.8	53.7
0.6 cwt. N.	15.82	16.03	6.18	5.69	17.11	17.16	54.1	55.0

Effects of Fertiliser (mean of ammonium humate and sulphate of ammonia)

Nitrate of Soda (per acre)	ROOTS (washed)		TOPS		SUGAR PERCENTAGE		TOTAL SUGAR	
	Tons per acre	Increase	Tons per acre	Increase		Increase	per acre	Increase
Mean ..	15.01		5.18		17.52		52.6	
None ..	13.17		4.20		17.81		46.9	
0.2 cwt. N.	15.04	+1.87	4.76	+0.56	17.46	-0.35	52.6	+5.7
0.4 cwt. N.	15.91	+0.87	5.82	+1.06	17.66	+0.20	56.2	+3.6
0.6 cwt. N.	15.92	+0.01	5.94	+0.12	17.14	-0.52	54.6	-1.6
St. Error ..	±0.219	±0.310	±0.146	±0.206	±0.090	±0.127		



Differences of 1932 Dressings (Humate minus Sulphate)

Nitrate of Soda per acre	ROOTS (washed) tons per acre	TOPS tons per acre	SUGAR PERCENTAGE	TOTAL SUGAR Cwt. per acre
Mean ..	+0.51	+0.27	+0.04	+1.9
St. Error ..	±0.278	±0.150	±0.079	
None ..	+0.22	-0.05	-0.13	+0.4
0.2 cwt. N. ..	+1.02	+0.49	-0.15	+3.1
0.4 cwt. N. ..	+1.02	+0.13	+0.46	+5.1
0.6 cwt. N. ..	-0.21	+0.49	-0.05	-0.9
St. Error ..	±0.555	±0.301	±0.158	

Conclusions

Both the roots and tops show a significant response to nitrate of soda, with a significantly smaller response per unit dressing at the higher levels.

The sugar percentage is significantly decreased by increasing dressings of nitrate of soda, with the exception of an anomalous (significant) reversal of this effect between the single and double dressing.

The residual effect of ammonium humate above that of sulphate of ammonia is not large enough to be significant.

Sugar Beet. Tunstall, Suffolk, 1933.

A. W. Oldershaw, Esq., County Organiser.

5 x 5 Latin square. Plots ; 1/56 acre.

Treatments : Second year, no further chalk applied. (See 1932 Report p.208, for first year's dress ngs.)

Basal manuring : 3 cwt. super, 3 cwt. muriate of potash and 3 cwt. of nitrate of soda per acre.

Soil : Acid sand. Variety : Kleinwanzleben E. Beet sown : May 6th. Lifted : December 1st.

Previous crop : Sugar beet.

Standard errors per plot : Roots : ±0.978 tons per acre or ±8.93 per cent. ; tops : ±0.630 tons per acre or ±10.86 per cent. ; sugar percentage : ±0.276. Mean dirt tare : 0.0960.

Chalk tons per acre (1932)	ROOTS (washed)		TOPS		SUGAR PERCENTAGE		TOTAL SUGAR	
	Tons per acre	Increase	Tons per acre	Increase		Increase	Cwt. per acre	Increase
Mean	10.95		5.80		16.35		36.0	
None	2.94		2.36		15.89		9.3	
1 ..	11.40	+8.46	6.00	+3.64	16.49	+0.60	37.6	+28.3
2 ..	13.23	+1.83	6.61	+0.61	16.32	-0.17	43.2	+5.6
3 ..	13.26	+0.03	6.88	+0.27	16.53	+0.21	43.8	+0.6
4 ..	13.91	+0.65	7.16	+0.28	16.53	0.00	46.0	+2.2
St. Error	±0.437	±0.618	±0.282	±0.399	±0.123	±0.174		

Conclusions

A large response to one ton of chalk (applied in 1932). The roots show a significant further response to two tons, but little further response. The similar increase to two tons in the case of tops is not itself significant, but may be considered so in the light of the higher yields with three and four tons.

The sugar percentage is significantly increased by one ton of chalk, but there is no further increase with the heavier dressings.

**Sugar Beet. J. Morris, Esq., Honey Farm, Wimblington, Cambs., 1933.**

8 randomised blocks of 4 plots each. Plots : 0.0153 acre.  
 Treatments : Superphosphate at the rate of 0, and 3 cwt. per acre in combination with muriate of potash at the rate of 0, and 1½ cwt. per acre.  
 Basal manuring : nil.  
 Soil : Light fenland resting on peat. Variety : Hilleshog.  
 Manures applied : May 8th. Beet sown : May 10th. Lifted : December 28th. Previous crop : Wheat.  
 Standard errors per plot ; roots : 1.402 tons per acre or 12.87%. Sugar percentage : 0.424.  
 Mean dirt tare : 0.0722.

Roots (washed) tons per acre ( $\pm 0.495$ )				Sugar Percentage ( $\pm 0.150$ )					
Muriate of potash	Superphosphate		Mean	Increase	Muriate of potash	Superphosphate		Mean	Increase
	None	3 cwt.	( $\pm 0.350$ )	( $\pm 0.495$ )		None	3 cwt.	( $\pm 0.106$ )	( $\pm 0.150$ )
None ..	10.46	10.99	10.72		None ..	15.04	15.16	15.10	
1½ cwt. ..	10.96	11.10	11.03	+ 0.31	1½ cwt. ..	15.24	15.12	15.18	+ 0.08
Mean ( $\pm 0.350$ ) Incr. ( $\pm 0.495$ )	10.71	11.04	10.88		Mean ( $\pm 0.106$ ) Incr. ( $\pm 0.150$ )	15.14	15.14	15.14	
	+ 0.33					0.00			

Total Sugar cwt. per acre

Muriate of potash	Superphosphate		Mean	Incr.
	None	3 cwt.		
None .. ..	31.5	33.3	32.4	
1½ cwt. .. ..	33.4	33.6	33.5	+ 1.1
Mean .. ..	32.4	33.4	32.9	
Increase .. ..	+ 1.0			

**Conclusions**

No significant effects.

**Peas. H. Inskip, Esq., Stanford, Biggleswade, 1933.**

6 randomised blocks of 4 plots each. Second order interaction confounded. Plots : 1/70 acre.  
 Treatments : 4 cwt. high-soluble basic slag, 2 cwt. nitro-chalk, and 1 cwt. sulphate of potash per acre in all combinations.  
 Basal manuring : Nil.  
 Soil : Sandy gravel. Variety : Laxton's Superb. Manures applied : March 9th. Peas sown : March 8th. Picked : June 20th. Previous crop : Potatoes.  
 Standard errors per plot : 2.46 cwt. per acre or  $\pm 7.16\%$ .

**Individual Treatments : cwt. per acre ( $\pm 1.42$ )**

Sub-blocks A				Sub-blocks B				Mean
O	NP	NK	PK	N	P	K	NPK	
32.1	36.2	34.2	31.6	39.8	34.0	32.5	34.0	34.3

Responses to Fertilisers : cwt. per acre

Fertiliser	Mean Response	Basic Slag		Nitro-chalk		Sulphate of potash	
		Absent	Present	Absent	Present	Absent	Present
Basic Slag	-0.70 <sup>1</sup>	—	—	+0.50 <sup>2</sup>	-1.90 <sup>2</sup>	-0.85 <sup>2</sup>	-0.55 <sup>2</sup>
Nitro-chalk	+3.50 <sup>1</sup>	+4.70 <sup>2</sup>	+2.30 <sup>2</sup>	—	—	+4.95 <sup>2</sup>	+2.05 <sup>2</sup>
Sulphate of potash	-2.45 <sup>1</sup>	-2.60 <sup>2</sup>	-2.30 <sup>2</sup>	-1.00 <sup>2</sup>	-3.90 <sup>2</sup>	—	—

Standard errors : (1) 1.00, (2) 1.42.

Conclusions

Significant response to nitrogen and a significant depression in yield by potash, appearing mainly on the plots receiving nitrogen, though the interaction is not significant. No evidence of any phosphate effects.

EXPERIMENTS CARRIED OUT BY LOCAL WORKERS.

Hay. Hertfordshire Farm Institute, St. Albans, 1933.

One strip of each of two seeds mixtures, the double strip being divided transversely into 30 plots, giving 5 randomised blocks of 6 plots each for manurial treatments. Sub-plots : 1/100 acre. Treatments : No phosphate, basic slag (85% citric solubility, 15% P<sub>2</sub>O<sub>5</sub>), at the rate of 1 cwt. P<sub>2</sub>O<sub>5</sub> per acre, Gafsa rock phosphate (90% through 120 sieve) at the rate of 1 cwt. P<sub>2</sub>O<sub>5</sub>, alone and with 0.5 cwt. K<sub>2</sub>O per acre in the form of 30% potash salt.

Mixture (1) : 6 lb. Italian ryegrass, 20 lb. perennial ryegrass, 6 lb. late flowering red clover, 1 lb. rough stalked meadow grass, 1 lb. wild white clover. Mixture (2) : 20 lb. perennial ryegrass, 1½ lb. wild white clover.

Basal manuring : Nil. Soil : Heavy flinty loam, well supplied with chalk. Manures applied : 7th January. Cut : 6th June. Previous crop : Oats.

Special notes : Grazed till May 5th. The yields are therefore one month's growth in a very dry time. Standard error : per whole plot—1.82 cwt. or 5.89%, per sub-plot—2.23 cwt. or 7.22%.

Dry Hay : cwt. per acre

	None	Basic Slag	Mineral phosphate	Potash	Slag and Potash	Min. Phos. and Potash	Mean
Mixture 1	43.7	46.3	43.3	42.8	46.2	47.1	44.9
Mixture 2	15.2	17.0	18.2	15.1	16.2	19.6	16.9
Diff. (±1.41)	28.5	29.3	25.1	27.7	30.0	27.5	28.0

Mean of both Mixtures (±0.814)

Cwt. per acre	No Phosphate	Basic Slag	Mineral Phosphate	Mean (±0.470)
No Potash .. ..	29.4	31.6	30.8	30.6
Potash .. ..	29.0	31.2	33.4	31.2
Mean (±0.576) ..	29.2	31.4	32.1	30.9

Conclusions

There is a significant response to phosphate, not significantly different for the two forms. The interactions of the two mixtures with the manurial treatments are not significant. The mixtures appear to give very different yields, though there is no statistical test applicable to this difference.

Meadow Hay. 3rd Season. Lady Manner's School, Bakewell, 1933.

5 x 5 Latin square. Plots : 1/198th acre.  
Treatments : Low and high soluble slag, rock phosphate and superphosphate at the rate of 1.0 cwt. P<sub>2</sub>O<sub>5</sub> per acre.

Basal manuring : Nil.  
Soil : Limestone. Manures applied : March 27th. 1931.

Hay cut : July 18th and 19th.  
Standard error per plot : ±3.81 cwt. per acre, or ±8.3 %.

	Yield, cwt. per acre.	Increase over no dressing.
<i>Mean</i>	45.8	
No phosphate	46.0	
Rock phosphate	43.6	-2.4
Low soluble slag	45.9	-0.1
High soluble slag	46.8	+0.8
Superphosphate	46.8	+0.8
Standard Error	±1.70	±2.40

**Conclusions**

No significant effects.

Hay. 3rd Season. Lady Manner's School, Bakewell, 1933.

3 randomised blocks of eight plots each. Plots 1/161 acre.

Treatments : Nitrate of soda at the rate of 2 cwt., superphosphate at the rate of 3 cwt., and 30% potash salt at the rate of 1 cwt. per acre in all combinations.

Basal manuring : Nil.

Soil : Limestone. Manures applied : April 3rd and 4th. Hay cut : July 3rd and 4th.

Standard error per plot : ±5.63 cwt. per acre or ±11.6%.

**Individual Treatments : cwt. per acre (±3.25)**

O	N	P	K	NP	NK	PK	NPK	Mean
40.6	52.8	41.0	36.9	52.5	57.4	42.3	64.1	48.4

**Responses to Fertilisers : cwt. per acre**

Fertiliser.	Mean Response	Nitrate of Soda		Superphosphate		Potash Salt	
		Absent	Present	Absent	Present	Absent	Present
Nitrate of Soda	+16.5 <sup>1</sup>	—	—	+16.4 <sup>2</sup>	+16.6 <sup>2</sup>	+11.8 <sup>2</sup>	+21.2 <sup>2</sup>
Superphosphate..	+3.0 <sup>1</sup>	+2.9 <sup>2</sup>	+3.2 <sup>2</sup>	—	—	+0.2 <sup>2</sup>	+6.0 <sup>2</sup>
Potash Salt ..	+3.4 <sup>1</sup>	-1.2 <sup>2</sup>	+8.1 <sup>2</sup>	+0.4 <sup>2</sup>	+6.4 <sup>2</sup>	—	—

Standard errors : (1) ±2.30, (2) ±3.25.

**Conclusions**

Significant response to nitrogen, but not to superphosphate or potash.

Meadow Hay. 2nd Season. Lady Manner's School, Bakewell, 1933.

3 randomised blocks of 9 plots each. Plots : 1/216 acre.

Treatments : 8 tons of compost, 2 cwt. of nitrate of soda, 3 cwt. of superphosphate, and 1 cwt. of 30% potash salts.

Basal manuring : Nil.

Soil : Limestone. Manures applied : March 29th, 30th and 31st. Hay cut : June 12th.

Standard error per plot : ±7.73 cwt. per acre, or ±19.6%.

Summary : cwt. per acre ( $\pm 4.45$ )

Second year's Treatment	First Year's Treatment			Mean ( $\pm 2.57$ )	Increase ( $\pm 3.63$ )
	None	NPK	Compost		
None .. ..	27.6	28.3	30.4	28.8	
NPK .. ..	46.8	54.0	46.6	49.1	+20.3
Compost ..	44.0	35.2	42.4	40.5	+11.7
Mean ( $\pm 2.57$ )	39.5	39.2	39.8	39.5	
Incr. ( $\pm 3.63$ )		-0.3	+0.3		

Conclusions

The yields with artificials are significantly greater than those with compost, and both are significantly greater than the yields without manure. The manures applied in the previous year, on the other hand, show no apparent residual effects.

Meadow Hay. Haileybury College Farm, 1933.

H. W. Gardner, Esq., Hertfordshire Farm Institute.

6 x 6 Latin Square. Plots 1/50 acre.

Treatments : Basic Slag (15%  $P_2O_5$ , 85% citric solubility) and ground mineral phosphate (28%  $P_2O_5$ , 90% through 120 sieve) at the rate of 1.0 cwt.  $P_2O_5$  per acre in combination with 30% potash salt at 0 and 0.5 cwt.  $K_2O$  per acre.

Basal manuring : Nil.

Soil : Clay loam. Manures applied : January 4th. Hay cut : July 4th.

Standard error per plot :  $\pm 3.02$  cwt. per acre or  $\pm 10.1\%$ .

Cwt. p.a. ( $\pm 1.23$ )	No phosphate	Basic Slag	Mineral Phosphate	Mean ( $\pm 0.710$ )	Increase ( $\pm 1.00$ )
No potash ..	26.8	28.5	31.7	29.0	
Potash salt ..	30.5	28.3	33.8	30.9	+1.9
Mean ( $\pm 0.870$ )	28.6	28.4	32.8	29.9	
Increase ( $\pm 1.23$ )		-0.2	+4.2		

Conclusions

Significant response to mineral phosphate, but no response to basic slag. The response to potash is not significant.

Barley. F. Richardson, Esq., Sansom Wood Farm, Calverton, Notts, 1933.

K. R. Davis, Esq., Notts Education Committee.

4 x 4 Latin square. Yields from 8 plots only obtained. Plots 1/40 acre.

Treatments : applied in 1932 to potato crop : Mineral mixture (2.12 cwt. sulphate of ammonia, 3.98 cwt. superphosphate, 3.28 cwt. 30% potash salt per acre), concentrated fertiliser (I.C.I. No. 1), organic manure (H.O.P. No. 9 fish manure). The fish manure and the mineral mixture on an equal N.P.K. basis.

Basal manuring : applied in 1932 : 12 loads dung per acre.

Soil : Very light sand on Bunter sandstone. Variety : Spratt Archer. Seed sown : March 30th. Harvested : August 15th. Previous crop : Potatoes.

Special notes : Plots harvested by sampling method (16 random samples per plot each consisting of 4 half metre rows). Rows 8 ins. apart.

Standard errors per plot : Grain : 1.59 cwt. per acre or 7.0%. Straw : 3.48 cwt. or 13.7%.

	GRAIN		STRAW	
	cwt. per acre	Increase	cwt. per acre	Increase
<i>Mean</i>	22.9		25.3	
No manure ..	22.5		22.8	
Mineral mixture ..	22.8	+0.3	24.4	+1.6
Concentrated fertiliser ..	22.9	+0.4	28.1	+5.3
Organic manure ..	23.4	+0.9	25.9	+3.1
St. Error ..	±1.12	±1.58	±2.46	±3.48

**Conclusions**

No significant effects.

Wheat. A. Hunter, Esq., The Farm, Wilford, Notts, 1933.  
K. R. Davis, Esq., Notts Education Committee.

4x4 Latin square. Plots : 1/50 acre.

Treatments : applied in 1932 to sugar beet : Mineral mixture, I.C.I. concentrated fertiliser No. 1, at the rate of 3.6 cwt. per acre and Fish manure at the rate of 10 cwt. per acre.

Fish Manure and mineral mixture on an equal N.P.K. basis.

Basal manuring : applied to sugar beet in 1930 : 12 loads of Farmyard manure per acre.

Soil : Sandy loam. Variety : Little Joss. Seed sown : November 1932. Harvested : August 22nd.

Previous crop : Sugar Beet.

Special notes : Plots harvested by sampling method (16 random samples per plot each consisting of 2 half metre rows). Rows 10 ins. apart.

Standard errors per plot : Grain : 1.14 cwt. or 6.4%. Straw : 1.41 cwt. or 6.1%.

	GRAIN		STRAW	
	cwt. per acre	Increase	cwt. per acre	Increase
<i>Mean</i> .. ..	17.8		23.0	
No manure .. ..	18.2		23.4	
Mineral mixture ..	18.0	-0.2	22.3	-1.1
Concentrated fertiliser ..	17.5	-0.7	22.6	-0.8
Fish manure .. ..	17.4	-0.8	23.5	+0.1
St. Error .. ..	±0.572	±0.809	±0.705	±0.997

**Conclusions**

No significant effects.

Potatoes. J. E. Arden, Esq., Owmbly Cliff, Lincs., 1933.  
J. A. McVicar, Esq., County Organiser.

4x4 Latin Square. Plots 1/80 acre.

Treatments : 4 levels of sulphate of ammonia as shown.

Basal manuring : 2 cwt. of superphosphate and 2 cwt. of sulphate of potash per acre.

Soil : Limestone. Variety : Dunbar Cavalier.

Manures applied : April 10th. Potatoes planted : April 11th. Lifted : October 20th. Previous crop : Seeds.

Standard error per plot : ±0.425 tons per acre or ±4.02%.

	Sulphate of Ammonia (p.a.)	Yield tons p.a.	Increase for each dressing
<i>Mean</i> .. ..		10.56	
None .. ..		9.50	
1½ cwt. ..		10.29	+0.79
3 cwt. ..		11.12	+0.83
4½ cwt. ..		11.33	+0.21
St. Error ..		±0.212	±0.300

**Conclusions**

Significant response to increasing dressings of sulphate of ammonia, this response showing no significant departure from proportionality with the amount of the fertiliser.

Potatoes. Midland Agricultural College, Loughborough, 1933.

4x4 Latin Square. Plots 1/60 acre.  
 Treatments: 4 levels of a mixed fertiliser containing 1 part of sulphate of ammonia, 3 parts superphosphate and 1 part of sulphate of potash.  
 Basal manuring: 1 ton of lime per acre applied in autumn 1932 and 12 tons of dung per acre.  
 Soil: Light loam. Variety: Scotch King Edward. Manures applied: April 7th. Potatoes planted: April 11th and 12th. Potatoes lifted: October 17th. Previous Crop: Seeds hay.  
 Standard errors per plot: ±0.553 tons per acre or ±6.17%.

Artificials	Yield tons p.a.	Increase for each dressing
Mean .. ..	8.97	
None .. ..	8.34	
4 cwt. .. ..	8.89	+0.55
8 cwt. .. ..	9.16	+0.27
12 cwt. .. ..	9.50	+0.34
St. Error .. ..	±0.276	±0.390

**Conclusions**

The progressive response to artificials is just large enough to be significant, without any significant deviations from proportionality.

Potatoes. Midland Agricultural College, Loughborough, 1933.

4 randomised blocks of 9 plots each. Plots 0.0205 acre.  
 Treatments: Sulphate of Ammonia at the rate of 0, 1½ and 3 cwt. per acre in combination with sulphate of potash at the rate of 0, 1½ and 3 cwt. per acre.  
 Basal manuring: 12 tons of dung in the autumn and 3 cwt. of superphosphate in the spring.  
 Soil: Light loam. Variety: Scotch King Edward.  
 Manures applied: April 7th.  
 Potatoes planted: April 11th and 12th. Lifted: October 17th. Previous crop: Seeds.  
 Standard error per plot: ±1.19 tons per acre or ±11.77%.

**Summary: tons per acre (±0.591)**

Sulphate of potash	Sulphate of Ammonia			Mean (±0.341)	Increase (±0.482)
	None	1½ cwt.	3 cwt.		
None .. ..	10.03	9.44	10.29	9.92	
1½ cwt. .. ..	9.71	10.00	11.09	10.27	+0.35
3 cwt. .. ..	10.07	10.53	9.53	10.04	-0.23
Mean (±0.341)	9.94	9.99	10.30	10.08	
Incr. (±0.482)	+0.05	+0.31			

**Conclusions**

No significant effects.

Potatoes. Norton New Council School, Doncaster, 1933.

4 randomised blocks of 4 plots each. Plots 1/306 acre.  
 Treatments: 3 times of application of a dressing of 3 cwt. of sulphate of potash per acre.  
 Basal manuring: 4 cwt. of superphosphate and 3 cwt. of sulphate of ammonia per acre.  
 Soil: Medium Loam.  
 Variety: Majestic, Scotch.  
 Potatoes planted: April 10th. Lifted: August 24th.  
 Previous Crop: Potatoes.  
 Standard error per plot: ±0.883 tons per acre or 11.29%.

Date of application	Yield Tons p.a.	Increase over no potash
Mean .. ..	7.82	
None .. ..	3.58	
March 7 .. ..	9.00	+5.42
April 10 .. ..	11.18	+7.60
May 22 .. ..	7.52	+3.94
St. Error .. ..	±0.441	±0.624

**Conclusions**

The response to potash is significant, being significantly greater for the April dressing than for the other two.

### Potatoes. Kimmel School, Abergele, Denbighshire, 1933.

4 randomised blocks of 8 plots each. Plots : 1/67 acre.  
 Treatments : All combinations of 3 cwt. sulphate of ammonia, 4 cwt. superphosphate and 3 cwt. sulphate of potash per acre.  
 Basal Manuring : Nil.  
 Soil : Fairly light, with some clay and stones. Variety : Great Scot. Manures applied : May 4th.  
 Planted : May 11th. Lifted : September 29th. Previous crop : Old grass.  
 Standard error per plot :  $\pm 0.991$  tons per acre or  $\pm 18.7\%$ .

**Individual Treatments : tons per acre ( $\pm 0.496$ )**

O	N	P	K	NP	NK	PK	NPK	Mean
4.62	4.41	5.62	4.80	5.28	5.32	5.80	6.50	5.29

**Responses to Fertilisers : tons per acre**

Fertiliser	Mean Response	Sulphate of Ammonia		Superphosphate		Sulphate of potash	
		Absent	Present	Absent	Present	Absent	Present
Sulphate of ammonia ..	+0.17 <sup>1</sup>	—	—	+0.16 <sup>2</sup>	+0.18 <sup>2</sup>	-0.28 <sup>2</sup>	+0.61 <sup>2</sup>
Superphosphate ..	+1.01 <sup>1</sup>	+1.00 <sup>2</sup>	+1.02 <sup>2</sup>	—	—	+0.94 <sup>2</sup>	+1.09 <sup>2</sup>
Sulphate of potash ..	+0.62 <sup>1</sup>	+0.18 <sup>2</sup>	+1.06 <sup>2</sup>	+0.54 <sup>2</sup>	+0.70 <sup>2</sup>	—	—

Standard errors : (1)  $\pm 0.351$ , (2)  $\pm 0.496$ .

**Conclusions**

There is a significant response to superphosphate, but no apparent response to sulphate of ammonia, nor does the response to potash reach significance.

### Sugar Beet. County Farm Institute, Moulton, Northampton, 1933.

4 x 4 Latin Square. Plots : 1/50 acre.  
 Treatments : 4 levels of a mixture of fertilisers (containing sulphate of ammonia, steamed bone flour, superphosphate and potash salts) to give the following analysis : N : 5% ; insoluble P<sub>2</sub>O<sub>5</sub> : 3.5% ; soluble P<sub>2</sub>O<sub>5</sub> : 4% ; K<sub>2</sub>O : 11%.  
 Basal manuring : 12 tons of farmyard manure ploughed in and 14 cwt. burnt lime per acre.  
 Soil : Sandy loam (Northampton sand formation). Variety : Kleinwanzleben E. Manures applied : April 27th. Beet planted : April 28th. Lifted : November 2nd. Previous crop : Second year seeds.  
 Standard errors per plot : roots :  $\pm 1.12$  tons per acre or  $\pm 11.24\%$  ; tops :  $\pm 1.48$  tons per acre or  $\pm 13.36\%$  ; sugar percentage :  $\pm 0.559$ . Mean dirt tare : 0.1040 (treatments corrected separately).

Fertiliser cwt. p.a.	ROOTS (washed) tons p.a.		TOPS tons p.a.		Sugar Percentage Increase		Total Sugar cwt. p.a.	
	tons p.a.	Increase	tons p.a.	Increase	Increase	Increase	Increase	
Mean	9.95		11.11		16.72		33.2	
None	8.26		9.02		16.92		28.0	
5	9.38	+1.12	10.52	+1.50	16.80	-0.12	31.5	+3.5
10	11.85	+2.47	12.37	+1.85	16.42	-0.38	38.9	+7.4
15	10.30	-1.55	12.54	+0.17	16.76	+0.34	34.5	-4.4
St. Error	$\pm 0.560$	$\pm 0.792$	$\pm 0.742$	$\pm 1.049$	$\pm 0.279$	$\pm 0.395$		

**Conclusions**

Both the roots and the tops show a significant response to artificials. In the case of the roots there is a significant falling off in response per unit fertiliser with the highest dressing. The similar falling off with the tops is much smaller and non-significant. There are no significant differences in sugar percentage.



Sugar Beet. R. Goodhand, Esq., Redbourne, Kirton-Lindsey,  
Lincs., 1933.

A. McVicar, Esq., County Organiser.

5 × 5 Latin square with split columns. Sub-plots : 1/100 acre.

Treatments : 5 levels of a compound fertiliser (containing sulphate of ammonia, nitrate of soda, superphosphate, muriate of potash and steamed bone flour) to give the following analysis : ammonia N : 3.60% ; nitric N : 2.40% ; soluble P<sub>2</sub>O<sub>5</sub> : 12.75% ; K<sub>2</sub>O : 10.00% and bone P<sub>2</sub>O<sub>5</sub> : 3.00% ; half columns harvested early or late.

Basal manuring : Nil.

Soil : Limestone. Variety : Kleinwanzleben E. Manures applied : April 12th. Beets sown : April 18th.

Lifted, early : October 4th ; late : November 13th. Previous crop : Oats.

Standard errors : Roots : per half column, ±0.714 tons per acre or ±4.62%. Per whole plot : ±0.537 tons per acre or ±3.48%. Per sub-plot : ±0.550 tons per acre or ±3.57%. Tops : per half column, ±0.830 tons per acre or ±8.57%. Per whole plot : ±0.769 tons per acre or ±7.91%. Per sub-plot : ±0.969 tons per acre or ±9.98%. Sugar percentage : per half column : ±0.154. Per whole plot : ±0.292. Per sub-plot : ±0.249. Mean dirt tare : 0.0938. (Treatments corrected separately.)

**Yields of Separate Treatments**

Fertiliser cwt. p.a.	Roots (Washed) tons p.a.		Tops, tons p.a.		Sugar Percentage		Total Sugar cwt. p. a.	
	Early	Late	Early	Late	Early	Late	Early	Late
None	13.66	15.17	6.90	8.07	16.18	16.38	44.2	49.7
4	14.45	16.17	7.76	9.54	16.36	16.48	47.3	53.3
8	14.78	16.45	8.78	10.70	15.74	16.12	46.5	53.0
12	14.86	17.02	10.28	11.73	15.64	16.34	46.5	55.6
16	14.74	16.78	9.91	13.39	15.34	15.78	45.2	53.0

**Effects of Fertiliser (mean of two harvestings)**

Fertiliser cwt. p.a.	Roots (Washed) tons p.a.		Tops tons p.a.		Sugar Percentage Increase		Total Sugar cwt. p.a.	Sugar Increase
	tons p.a.	Increase	tons p.a.	Increase		Increase		
<i>Mean</i>	15.41		9.71		16.04		49.4	
None	14.42		7.48		16.28		47.0	
4	15.31	+0.89	8.65	+1.17	16.42	+0.14	50.3	+3.3
8	15.62	+0.31	9.74	+1.09	15.93	-0.49	49.8	-0.5
12	15.94	+0.32	11.00	+1.26	15.99	+0.06	51.0	+1.2
16	15.76	-0.18	11.65	+0.65	15.56	-0.43	49.1	-1.9
St. Error	±0.239	±0.338	±0.344	±0.486	±0.130	±0.184		

**Effect of Time of Harvesting (late minus early)**

Fertiliser Cwt. p.a.	ROOTS Tons p.a.	TOPS Tons p.a.	SUGAR PERCENTAGE	TOTAL SUGAR Cwt. p.a.
<i>Mean</i> ..	+1.82	+1.96	+0.37	+7.0
St. Error..	±0.452	±0.525	±0.0973	
None	+1.51	+1.17	+0.20	+5.5
4	+1.72	+1.78	+0.12	+6.0
8	+1.67	+1.92	+0.38	+6.5
12	+2.16	+1.45	+0.70	+9.1
16	+2.04	+3.48	+0.44	+7.8
St. Error..	±1.01	±1.17	±0.218	

**Conclusions**

Both the roots and tops show a significant response to the fertiliser, set off against a significant reduction in sugar percentage. The response per unit dressing is significantly less for the higher dressings in the case of the roots but not in the case of the tops. The similar effect in the sugar percentage is not large enough to be significant.

The yields of both roots and tops are significantly greater for the later harvesting. The sugar percentage is also increased significantly. In the case of the tops and sugar percentage (but not of the roots) this difference is significantly greater for increasing dressings of fertiliser, i.e., the fertiliser has been more effective on the late harvested crop.

Sugar Beet. J. A. Cradock, Esq., College Farm, Elsham, 1933.  
A. McVicar, Esq., County Organiser.

5 x 5 Latin square with split plots. Sub-plots 1/100 acre.  
Treatments : 5 levels of a complete fertiliser (containing nitrate of soda, superphosphate, muriate of potash and steamed bone flour) of the following analysis : nitric N : 3.5% ; soluble P<sub>2</sub>O<sub>5</sub> : 7.1% ; insoluble P<sub>2</sub>O<sub>5</sub> : 3.1% ; K<sub>2</sub>O : 11.1%. Half plots top dressed with 1 cwt. of nitrate of soda.

Basal manuring : 10 loads of farmyard manure per acre.  
Soil : Deep Wold. Variety : Dippe. Manures applied : April 24th. Top dressing applied : June 12th.

Beet sown : April 28th. Lifted : October 13th. Previous crop : Wheat.  
Plant counts taken on whole plots. Mean plant number : 27276 per acre. Mean yield per plant : 1.209 lb. (clean). Mean increase in yield for one additional plant : +0.370 lbs.  
Mean dirt tare : 0.125.

Standard Errors	Per Whole Plot		Per Sub-Plot	
	per acre	per cent.	per acre	per cent.
Plant number .. .. .	±1047		±1869	
Roots (tons) unadjusted for plant number .. .. .	±0.433	±2.94	±0.522	±3.54
Roots (tons) adjusted for plant number .. .. .	±0.403	±2.74	±0.470	±3.20
Tops (tons) .. .. .	±0.330	±2.84	±0.522	±4.50
Sugar percentage .. .. .	±0.260		±0.346	

**Yields of Separate Treatments**

Fertiliser Cwt. p.a.	ROOTS (washed) Tons p.a.		TOPS Tons p.a.		SUGAR PERCENTAGE		TOTAL SUGAR Cwt. p.a.		PLANT NUMBER p.a.	
	None	N/S	None	N/S	None	N/S	None	N/S	None	N/S
None	13.65	14.18	9.58	9.89	16.00	15.52	43.7	44.0	25960	24880
4	14.66	14.48	10.66	10.70	15.96	15.92	46.8	46.1	27300	26420
8	14.87	15.01	11.09	12.02	15.68	15.40	46.6	46.2	28140	26840
12	14.81	15.39	12.02	13.04	15.54	15.38	46.0	47.3	28100	28420
16	14.91	15.30	13.46	13.40	15.40	15.00	45.9	45.9	27960	28740

**Effects of Fertiliser (mean of top dressing and no top dressing)**

Fertiliser Cwt. p.a.	ROOTS (washed) Tons p.a.		TOPS Tons p.a.		SUGAR PERCENTAGE		TOTAL SUGAR Cwt. p.a.		PLANT NUMBER per acre	
		Increase		Increase		Increase		Increase		Increase
Mean	14.72		11.59		15.58		45.8		27276	
None	13.91		9.74		15.76		43.8		25420	
4	14.57	+0.66	10.68	+0.94	15.94	+0.18	46.4	+2.6	26860	+1440
8	14.94	+0.37	11.56	+0.88	15.54	-0.40	46.4	0.0	27490	+630
12	15.10	+0.16	12.53	+0.97	15.46	-0.08	46.6	+0.2	28260	+770
16	15.10	0.00	13.43	+0.90	15.20	-0.26	45.9	-0.7	28350	+90
St. Error	±0.194	±0.274	±0.147	±0.208	±0.116	±0.164			±468	±662

Effect of Top Dressing

Fertiliser Cwt. p.a.	ROOTS (Washed) Tons p.a.	TOPS Tons p.a.	SUGAR PERCENTAGE	TOTAL SUGAR Cwt. p.a.	PLANT NUMBER p.a.
Mean	+ 0.29	+ 0.45	- 0.28	+ 0.1	- 432
St. Error	± 0.148	± 0.148	± 0.098		± 529
None	+ 0.53	+ 0.31	- 0.48	+ 0.3	- 1080
4	- 0.18	+ 0.04	- 0.04	- 0.7	- 880
8	+ 0.14	+ 0.93	- 0.28	- 0.4	- 1300
12	+ 0.58	+ 1.02	- 0.16	+ 1.3	+ 320
16	+ 0.39	- 0.06	- 0.40	0.0	+ 780
St. Error	± 0.330	± 0.330	± 0.219		± 1182

Conclusions

The roots show a significant response to the complete fertiliser with a significantly lower response per unit fertiliser in the higher dressings ; dressings above 8 cwt. produce little effect. Part, but not all, of this response is due to the significant increase in the number of roots with increasing applications of fertiliser ; here again dressings above 8 cwt. produce little effect.

The tops also show a significant response to the complete fertiliser without any lower response per unit fertiliser in the higher dressings.

The sugar percentage is significantly decreased by the complete fertiliser, the decrease per unit fertiliser being significantly greater for the higher dressings.

The top dressing of nitrate of soda increases the yield of roots and tops, the latter significantly and the former significantly if allowance is made for plant number, which does not appear to be affected by this treatment. Sugar percentage is significantly decreased.

There are no significant interactions of the top dressing and the complete fertiliser.

Sugar Beet. A. S. Williamson, Es q., Thonock, Gainsborough, 1933.  
A. McVicar, Esq., County Organiser.

4 × 4 Latin Square. Plots : 1/50 acre.

Treatments : 4 widths of singling as shown in the summary.

Basal manuring : 3 cwt. of sulphate of ammonia, 4½ cwt. superphosphate, 2½ cwt. muriate of potash, and 10 loads of farmyard manure per acre.

Soil : Sand. Variety : Kleinwanzleben E. Manures applied : April 10th. Beet sown : April 20th.

Lifted : October 23rd. Previous crop : barley.

Standard errors per plot : roots : ± 0.776 tons per acre or ± 5.68% ; tops : ± 1.309 tons per acre or ± 16.87% ; Sugar percentage : ± 0.538. Analysis of variance performed on clean roots.

Singling Inches	ROOTS (Washed)		TOPS		SUGAR PERCENTAGE		TOTAL SUGAR	
	tons p.a.	Increase	tons p.a.	Increase		Increase	cwt. p.a.	Increase
Mean	13.69		7.76		16.34		44.8	
8	13.48		7.75		16.28		43.9	
10	13.74	+ 0.26	7.20	- 0.55	16.30	+ 0.02	44.8	+ 0.9
12	13.72	- 0.02	8.28	+ 1.08	16.42	+ 0.12	45.1	+ 0.3
14	13.81	+ 0.09	7.81	- 0.47	16.38	- 0.04	45.2	+ 0.1
St. Error	± 0.389	± 0.550	± 0.654	± 0.925	± 0.269	± 0.380		

Conclusions

No significant effects.

Sugar Beet. E. Addison, Esq., Riby, Lincs., 1933.  
J. A. McVicar, Esq., County Organiser.

4 × 4 Latin square. Plots : 1/50 acre.

Treatments : 4 levels of a compound fertiliser (containing sulphate of ammonia, nitrate of soda, muriate of potash, superphosphate and steamed bone flour) to give the following analysis : ammonia N : 3.5% ; nitric N : 1.9% ; K<sub>2</sub>O : 7.5% ; water soluble P<sub>2</sub>O<sub>5</sub> : 6.2% ; insoluble P<sub>2</sub>O<sub>5</sub> : 0.7%.

Basal manuring : Nil.

Soil : Wold. Variety : Kleinwanzleben E. Manures applied : April 10th. Beet sown ; April 13th. Lifted : October 3rd. Previous crop : Wheat.

Plant counts taken on whole plots. Mean plant number : 27859 per acre. Mean yield per plant, 1.372 lb. Mean increase in yield for one additional plant : +0.231 lb.

Standard errors per plot : Plant number : ±1042 per acre ; roots, unadjusted for plant number : ±0.448 tons per acre or ±2.62% ; roots adjusted for plant number : ±0.478 tons per acre or ±2.80% ; tops : ±0.379 tons per acre or 2.57% ; sugar percentage : ±0.428. Mean dirt. tare : 0.0804.

Compound fertiliser cwt. p.a.	ROOTS (Washed)		TOPS		SUGAR PERCENTAGE		TOTAL SUGAR	
	tons p.a.	Increase	tons p.a.	Increase		Increase	cwt. p.a.	Increase
<i>Mean</i>	17.06		14.74		15.18		51.8	
6	17.06		13.50		15.45		52.7	
9	17.35	+0.29	14.64	+1.14	15.45	0.00	53.6	+0.9
12	16.97	-0.38	15.25	+0.61	14.98	-0.47	50.8	-2.8
15	16.87	-0.10	15.58	+0.33	14.82	-0.16	50.0	-0.8
St. Error	±0.224	±0.317	±0.190	±0.269	±0.214	±0.303		

**Conclusions**

The roots show no response to fertiliser. The tops responded significantly, but with a not quite significantly smaller response per unit dressing at the higher levels. The sugar percentage is significantly depressed by the fertiliser.

Sugar Beet. Cavendish Lodge, Clipstone, Mansfield.  
R. N. Dowling, Esq., County Organiser. H. T. Cranfield, Esq.,  
Advisory Chemist.

6 randomised blocks of 9 plots each. Plots : 1/50 acre.

Treatments : Ground limestone at the rate of 0, 30 and 60 cwt. per acre in all combinations with muriate of potash at the rate of 0, 1½, and 3 cwt. per acre.

Basal manuring : 2 cwt. of nitro-chalk per acre.

Soil : Sandy gravel from Bunter Drift. Very acid. Variety : Kleinwanzleben.

Manures applied : April 12th. Beet planted : May 12th. Lifted : October 30th.

Previous crop : Kale.

Standard errors per plot : roots : ±0.930 tons per acre or ±32.63% ; tops : ±0.691 tons per acre, or ±25.14% ; sugar percentage, ±0.475. Analysis of variance performed on clean roots.

ROOTS (Washed) Tons per acre ( $\pm 0.379$ )						TOPS Tons per acre ( $\pm 0.282$ )					
Muriate of potash	Limestone (cwt. p.a.)			Mean ( $\pm 0.219$ )	Incr. ( $\pm 0.310$ )	Muriate of potash	Limestone (cwt. p.a.)			Mean ( $\pm 0.162$ )	Incr. ( $\pm 0.229$ )
	None	30	60				None	30	60		
None	1.12	2.05	3.17	2.12		None	1.17	2.25	3.30	2.24	
1½ cwt.	1.66	3.81	3.02	2.83	+ 0.71	1½ cwt.	1.58	3.40	3.03	2.67	+ 0.43
3 cwt.	2.67	4.08	4.04	3.60	+ 0.77	3 cwt.	2.67	3.76	3.59	3.34	+ 0.67
Mean ( $\pm 0.219$ )	1.82	3.31	3.41	2.85		Mean ( $\pm 0.162$ )	1.81	3.14	3.31	2.75	
Incr. ( $\pm 0.310$ )	+ 1.49	+ 0.10				Incr. ( $\pm 0.229$ )	+ 1.33	+ 0.17			
SUGAR PERCENTAGE ( $\pm 0.194$ )						TOTAL SUGAR Cwt. per acre					
Muriate of potash	Limestone (cwt. p.a.)			Mean ( $\pm 0.112$ )	Incr. ( $\pm 0.158$ )	Muriate of potash	Limestone (cwt. p.a.)			Mean	Incr.
	None	30	60				None	30	60		
None	16.18	15.50	15.82	15.83		None	3.6	6.4	10.0	6.7	
1½ cwt.	16.28	15.75	15.87	15.97	+ 0.14	1½ cwt.	5.4	12.0	9.6	9.0	+ 2.3
3 cwt.	16.08	16.22	16.42	16.24	+ 0.27	3 cwt.	8.6	13.2	13.3	11.7	+ 2.7
Mean ( $\pm 0.112$ )	16.18	15.82	16.03	16.01		Mean	5.8	10.5	11.0	9.1	
Incr. ( $\pm 0.158$ )	- 0.36	+ 0.21				Incr.	+ 4.7	+ 0.5			

**Conclusions**

The single dressing of limestone significantly increases the yield of roots and tops, but the additional response to the double dressing is small and insignificant, and is significantly less than that to the single dressing. The dressing of limestone has no effect on sugar percentage.

Muriate of potash significantly increases the roots, tops and sugar percentage, there being no significant differences between the responses to the single dressing and the additional response to the double dressing.

The responses to muriate of potash are not significantly affected by either dressing of limestone.

**Sugar Beet. F. Bell, Esq., Markham Moor, Notts, 1933.**

**J. McCloy, Esq., Second Lincolnshire Sugar Co., Brigg, Lincs.**

4 x 4 Latin Square. Plots : 1/50 acre.

Treatments : 4 levels of a complete fertiliser of the following analysis : N, 5% ; water soluble P<sub>2</sub>O<sub>5</sub>, 5.7% ; insoluble P<sub>2</sub>O<sub>5</sub>, 0.7% ; K<sub>2</sub>O, 10%.

Basal manuring : 12 loads of farmyard manure per acre ploughed in in winter.

Soil : Poor sand on gravel. Variety : Klein N. English. Manures applied : April 5th. Beet sown : April 25th. Lifted : September 18th. Previous crop : Barley.

Standard Errors per plot : roots :  $\pm 0.414$  tons per acre or  $\pm 6.01\%$  ; tops :  $\pm 0.774$  tons per acre or  $\pm 20.69\%$  ; sugar percentage :  $\pm 0.500$ . Mean dirt tare : 0.0536.

Fertiliser	ROOTS (Washed)		TOPS		SUGAR PERCENTAGE		TOTAL SUGAR	
	Tons p.a.	Increase	Tons p.a.	Increase	Increase	Cwt. p.a.	Increase	
Mean	6.90		3.74		21.68		29.9	
4 cwt	6.74		3.18		21.80		29.4	
8 cwt	6.98	+ 0.24	3.66	+ 0.48	21.80	0.00	30.4	+ 1.0
12 cwt	7.04	+ 0.06	3.78	+ 0.12	22.10	+ 0.30	31.1	+ 0.7
16 cwt	6.86	- 0.18	4.35	+ 0.57	21.00	- 1.10	28.8	- 2.3
St. Error	$\pm 0.207$	$\pm 0.293$	$\pm 0.387$	$\pm 0.547$	$\pm 0.250$	$\pm 0.354$		

**Conclusions**

The tops, but not the roots, show a significant response to increasing dressings of fertiliser, the sugar percentage a depression, barely significant, with the highest dressing.

Mangolds. Oakerthorpe, Derbyshire, 1933.

G. Limb, Esq., Derbyshire Education Committee.

4 randomised blocks of 8 plots each. Plots : 1/70th acre. 1/93rd acre harvested.  
 Treatments : Sulphate of ammonia at the rate of 0 and 3 cwt., 30% potash salt at the rate of 0 and 4 cwt., and dung at the rate of 0 and 15 tons per acre in all combinations.  
 Basal manuring : 4 cwt. superphosphate per acre.  
 Soil : Medium-heavy loam on clay sub-soil. Coal measures. Variety : Yellow globe. Manures applied : May 1st, Seed sown : May 2nd, Lifted : November 3rd, and 4th, Previous crop : Wheat.  
 Standard errors per plot : Roots :  $\pm 2.77$  tons per acre or  $\pm 13.4\%$ . Tops :  $\pm 0.410$  tons per acre or  $\pm 13.1\%$ .

Individual Treatments

Tons per acre	O	N	K	D	NK	ND	KD	NKD	Mean
Roots ( $\pm 1.38$ )	14.57	17.46	20.08	21.09	21.76	21.82	23.71	24.09	20.58
Tops ( $\pm 0.205$ )	2.62	2.86	2.82	2.88	3.46	3.46	3.19	3.68	3.12

Responses to Fertilisers—Roots : tons per acre

Fertiliser	Mean Response	Sulphate of Amm.		Potash Salt		Dung	
		Absent	Present	Absent	Present	Absent	Present
Sulphate of ammonia ..	+1.42 <sup>1</sup>	—	—	+1.81 <sup>2</sup>	+1.03 <sup>2</sup>	+2.28 <sup>2</sup>	+0.56 <sup>2</sup>
Potash Salt ..	+3.68 <sup>1</sup>	+4.06 <sup>2</sup>	+3.28 <sup>2</sup>	—	—	+4.90 <sup>2</sup>	+2.44 <sup>2</sup>
Dung ..	+4.21 <sup>1</sup>	+5.08 <sup>2</sup>	+3.35 <sup>2</sup>	+5.44 <sup>2</sup>	+2.98 <sup>2</sup>	—	—

Standard errors : (1)  $\pm 0.976$ (<sup>2</sup>),  $\pm 1.38$ .

Tops : tons per acre

Fertiliser	Mean Response	Sulphate of amm.		Potash Salt		Dung	
		Absent	Present	Absent	Present	Absent	Present
Sulphate of ammonia ..	+0.49 <sup>1</sup>	—	—	+0.42 <sup>2</sup>	+0.56 <sup>2</sup>	+0.44 <sup>2</sup>	+0.54 <sup>2</sup>
Potash Salt ..	+0.33 <sup>1</sup>	+0.26 <sup>2</sup>	+0.41 <sup>2</sup>	—	—	+0.40 <sup>2</sup>	+0.26 <sup>2</sup>
Dung ..	+0.36 <sup>1</sup>	+0.31 <sup>2</sup>	+0.41 <sup>2</sup>	+0.43 <sup>2</sup>	+0.30 <sup>2</sup>	—	—

Standard errors : (1)  $\pm 0.145$ , (2)  $\pm 0.205$ .

Conclusions

Significant responses to dung and to potash both in the roots and the tops, and sulphate of ammonia in the tops only. The response to potash in the presence of dung is less, but not significantly so, than in the absence of dung.

Kale. Midland Agricultural College, Loughborough, 1933.

4 randomised blocks of 6 plots each. Plots : 1/50 acre.  
 Treatments : Nitro-chalk at the rate of 0, 3 and 6 cwt. per acre in combination with thinning.  
 Plants were 1 in. apart before thinning, 1 ft. apart after thinning.  
 Basal manuring : 12 tons of dung, 5 cwt. slag (15% P<sub>2</sub>O<sub>5</sub>) and 2 cwt. potash salt (30% K<sub>2</sub>O) per acre.  
 Soil : Light loam. Variety : Marrow stem. Manures applied : April 25th. Kale drilled : April 10th.  
 Cut : October 17th-November 9th. Previous crop : Wheat.  
 Standard Error per plot : 2.21 tons per acre or 6.87%.

N

Tons per acre ( $\pm 1.103$ )	Nitro-chalk (cwt. p.a.)			Mean ( $\pm 0.637$ )	Effect of thinning ( $\pm 0.901$ )
	0	3	6		
Not thinned ..	29.22	32.89	38.28	33.46 30.83	- 2.63
Thinned ..	25.78	32.97	33.75		
Mean ( $\pm 0.780$ )	27.50	32.93	36.02	32.15	
Incr. ( $\pm 1.103$ )	+ 5.43	+ 3.09			

**Conclusions**

Significant response to nitrogen, the falling off in response per unit fertiliser at the higher level not being significant. Significant reduction in yield by thinning without any significant interactions with nitrogen.

**Kale. Farm Institute, Sparsholt, Winchester, 1933.**

4 randomised blocks of 6 plots each. Plots 1/60 acre.  
 Treatments : Sulphate of ammonia at the rate of 0, 2 and 4 cwt. per acre in combination with thinning.  
 Basal manuring : 3 cwt. superphosphate and 3 cwt. 30% potash salt per acre.  
 Soil : Light loam with flints, thinly overlying chalk. Variety : Thousand Head.  
 Manures applied : May 22nd. Seed sown : May 23rd. Kale cut : December 19th-23rd. Previous crop : Sainfoin ley.  
 Special Notes : It was noted that on one side of the experiment the kale was considerably thinner than on the other and kale had to be planted out to fill up gaps.  
 Standard error per plot :  $\pm 1.28$  tons per acre or  $\pm 11.0\%$ .

Tons per acre	Sulphate of Ammonia. Cwt. p.a. ( $\pm 0.640$ )			Mean ( $\pm 0.370$ )	Increase ( $\pm 0.523$ )
	0	2	4		
Unthinned ..	10.92	12.42	10.36	11.23 12.05	+ 0.82
Thinned ..	13.26	12.33	10.55		
Mean ( $\pm 0.453$ )	12.09	12.38	10.46	11.64	
Incr. ( $\pm 0.640$ )	+ 0.29	- 1.92			

**Conclusions**

The double dressing of sulphate of ammonia significantly depresses the yield. The differences between the thinned and unthinned plots are not large enough to be significant.

**Spring Cabbage. R. C. Wood, Esq., Avoncroft College, Evesham, 1933.**

5 x 5 Latin Square. Plots : 1/100 acre.  
 Treatments : Plots receiving nitrogen had 0.39 cwt. N per acre, those receiving potash 1.32 cwt. K<sub>2</sub>O per acre.  
 Basal manuring : Hoof and horn (14%N) at the rate of 10 cwt. per acre.  
 Soil : Light loam. Variety : Early Offenham.  
 Manures applied : March 16th. Cabbages planted : September 28th, 1932. Cut : May 22nd. Previous crop : Runner beans.  
 Standard error per plot :  $\pm 1.11$  tons per acre or  $\pm 8.19\%$ .

	Yield Tons p.a.	Increase over no dressing
Mean ..	13.55	
No manure ..	12.70	
Nitrate of soda	13.69	+ 0.99
Sulphate of pot.	12.93	+ 0.23
Both ..	14.33	+ 1.63
Nitrate of potash	14.08	+ 1.38
St. Error ..	$\pm 0.496$	$\pm 0.701$

**Conclusions**

A significant response to nitrogen. No significant response to potash. The response to nitrate of potash is entirely accounted for by its nitrogen content.

## Brussel Sprouts. Bowman's Farm, London Colney, 1933.

H. W. Gardner, Esq., Hertfordshire Farm Institute.

8 randomised blocks of four plots each. Second order interaction confounded. Plots : 1/50 acre. Treatments : Sulphate of ammonia at the rate of 2½ cwt., superphosphate at the rate of 6 cwt., and sulphate of potash at the rate of 3 cwt. per acre, in all combinations.

Basal Manuring : Nil. Soil : Medium to heavy loam. Manures applied : June 29th. Planted : May. Harvested : October 26th, 27th, December 14th-15th, January 25th, March 8th. Previous crop : Temporary Grass.

Standard Error per plot, total of all pickings, graded sprouts : ±3.62 cwt. per acre or ±9.48%.

### Individual Treatments : cwt. per acre

Pickings	Sub-blocks A				Sub-blocks B				Mean
	O	NP	NK	PK	N	P	K	NPK	
	Graded Sprouts								
1st	6.8	6.9	9.9	10.3	7.4	5.7	7.8	9.7	8.1
2nd	9.8	9.6	12.5	15.6	9.1	7.1	12.5	11.4	10.9
3rd	8.8	8.5	10.1	11.2	10.1	7.7	10.0	11.6	9.8
4th	9.6	8.7	10.4	9.7	9.2	8.7	9.5	10.1	9.5
<i>Total</i> (±1.81)	35.0	33.7	42.9	46.8	35.8	29.2	39.8	42.8	38.3
	Total Sprouts								
Total	42.4	40.9	50.6	54.7	42.4	34.9	47.1	51.7	45.6

### Responses to Fertilisers : cwt. per acre

#### Graded Sprouts : total of all pickings

Fertiliser	Mean Response	Sulphate of Ammonia		Superphosphate		Sulphate of Potash	
		Absent	Present	Absent	Present	Absent	Present
Sulphate of Ammonia ..	+1.1 <sup>1</sup>	—	—	+2.0 <sup>2</sup>	+0.2 <sup>2</sup>	+2.6 <sup>2</sup>	-0.4 <sup>2</sup>
Superphosphate ..	-0.2 <sup>1</sup>	+0.6 <sup>2</sup>	-1.1 <sup>2</sup>	—	—	-4.0 <sup>2</sup>	+3.4 <sup>2</sup>
Sulphate of Potash ..	+9.7 <sup>1</sup>	+11.2 <sup>2</sup>	+8.1 <sup>2</sup>	+6.0 <sup>2</sup>	+13.4 <sup>2</sup>	—	—

Standard errors : (1) ±1.28, (2) ±1.81.

### Increase due to Potash in different pickings

#### Graded Sprouts : cwt. per acre

	1st	2nd	3rd	4th	Mean
Super absent ..	+1.78	+3.12	+0.62	+0.60	+1.53
Super present..	+3.68	+5.10	+3.29	+1.20	+3.32
Mean .. ..	+2.73	+4.11	+1.96	+0.90	+2.43

### Conclusions

In the yields of graded sprouts there is a large and significant response to potash, which shows in all the pickings. This response is significantly greater for the earlier pickings so that potash not only increases the total yield but also gives an earlier crop.

There is no average response to super, but the interaction with potash is significant, a depression without potash being converted into an increase with potash; equally the response to potash is significantly greater in the presence of superphosphate.

Sulphate of ammonia has produced no effects.

The percentage of graded sprouts to total of all sprouts picked is not affected by treatments with the possible exception (not quite significant) that potash increases this percentage.



**Tomatoes. Hertfordshire Farm Institute, Horticultural Dept., 1933.**

Continuation of the 1932 experiment on the same plots (See 1932 Report, p.226).  
8 randomised blocks of 4 plots each. Plots : 0.00386 acre.

Treatments : Organic manures applied in 11 top dressings ; sulphate of ammonia applied in 22 top dressings (at half rate). Top dressings to provide N at the rate of 4.2 cwt., soluble P<sub>2</sub>O<sub>5</sub> at the rate of 5.8 cwt., insoluble P<sub>2</sub>O<sub>5</sub> at the rate of 2.2 cwt., and K<sub>2</sub>O at the rate of 8.0 cwt. per acre.

Basal manuring : 20 tons dung, ½ ton sulphate of potash, ½ ton lime, 2½ cwt. superphosphate and 2½ cwt. steamed bone flour per acre.  
Standard error per plot : 3.44 tons per acre or 6.70%.

	Yield tons p.a. 1933	Mean Yield tons p.a. 1932-33
<i>Mean</i>	<i>51.44</i>	<i>53.25</i>
Dried blood ..	49.96	52.44
Hoof and horn	52.28	53.68
Sulphate of Am.	52.88	53.51
Fish meal ..	50.65	53.38
St. Error ..	±1.22	—

**Conclusions**

Any possible differences between the various kinds of nitrogenous top dressings appear to be masked by the basal dressings of dung, etc.

**Lettuce. Oaklands Farm Institute, St. Albans, 1933.**

H. W. Gardner, Esq.

6 randomised blocks of 9 plots each, some second order interactions being partially confounded with blocks. Plots : 11 square yards.

Treatments : Sulphate of ammonia at the rate of 0, 1½ and 3 cwt., superphosphate at the rate of 0, 3 and 6 cwt., and sulphate of potash at the rate of 0, 1 and 2 cwt. per acre, in all combinations.

Basal manuring : Nil.

Soil : Medium loam. Variety : Lobjoit's Cos. Seed sown : March 9th. Manures applied : March 9th.

Lettuce cut : In succession, finishing June 25th. Previous crop : Market garden crops (greenstuff).  
Standard error per plot (number of lettuce cut) : ± 9860 or ± 29.6%.

**Number of Lettuce cut per 1/100 acre**  
Mean of all Levels of Potash (±40.3)      Mean of all Levels of Nitrogen (±40.3)

Super-phosphate	Sulphate of Ammonia			Mean	Sulph. of pot.	Superphosphate			Mean
	0 cwt.	1½ cwt.	3 cwt.			0 cwt.	3 cwt.	6 cwt.	
0 cwt.	410	367	285	354	0 cwt.	395	372	285	351
3 cwt.	374	326	292	331	1 cwt.	343	305	359	336
6 cwt.	335	248	365	316	2 cwt.	324	315	303	314
<i>Mean</i>	<i>373</i>	<i>313</i>	<i>314</i>	<i>333</i>	<i>Mean</i>	<i>354</i>	<i>331</i>	<i>316</i>	<i>333</i>

**Mean of all Levels of Super. (±40.3)**

Sulphate of potash	Sulphate of Ammonia			Mean
	0 cwt.	1½ cwt.	3 cwt.	
0 cwt. ..	421	359	272	351
1 cwt. ..	370	264	372	336
2 cwt. ..	328	316	298	314
<i>Mean</i> ..	<i>373</i>	<i>313</i>	<i>314</i>	<i>333</i>

**Conclusions**

The effects of treatments on the number of lettuces cut are not large enough to be significant owing to the high variability. The mean weight per lettuce (of those cut) was also recorded and analysed, but no significant effects were found. This is to be expected since the lettuces tended to be cut on reaching a definite size ; in view of this consideration it was not thought worth while to publish the mean weights.