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## Report for 1937

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## Other Experiments at Rothamsted

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### SPRING OATS

Residual effect of dung, straw and sulphate of ammonia applied to the preceding potato crop

RO—Great Harpenden, 1937

Plan and yields in lb., grain above, straw below

1	St N	DL	St	DL St	DE	DE St	DE N	DL St	8
	43.6	44.8	48.1	56.1	70.1	64.8	64.1	72.9	
	61.4	67.7	64.9	76.4	90.9	87.2	81.9	89.1	
	N	DE St N	DL St N	DE	Nil	DL	St	DE St N	
	50.6	64.0	71.4	66.9	66.1	51.8	55.8	80.5	
	71.4	86.0	91.1	83.1	80.9	82.2	76.2	98.5	
	Nil	DLN	DE St	DE N	DLN	St N	DL St N	N	
	45.2	63.3	71.9	63.0	69.8	43.8	58.4	64.0	
	60.8	82.7	90.1	77.0	85.7	73.2	82.6	80.0	
	Nil	DE St N	St	N	DE	St N	St	DE N	
43.2	58.0	55.9	55.1	68.1	54.3	47.3	68.6		
59.3	82.5	76.1	70.9	84.4	79.2	67.7	93.9		
St N	DE N	DL St N	DL St	DL St N	DL	DL St	DLN		
42.3	50.2	59.2	58.1	69.4	28.7	42.4	62.3		
62.2	72.3	74.3	72.4	84.6	62.3	72.1	85.7		
DE St	DE	DL	DLN	DE St	DE St N	N	Nil		
44.2	53.7	53.7	52.4	59.1	32.5	44.4	63.9		
67.3	70.3	72.5	67.1	79.9	64.0	68.1	83.6		
41								48	

SYSTEM OF REPLICATION : 4 randomised blocks of 12 plots each.

AREA OF EACH PLOT : 1/40 acre (45.5 lks. × 54.9 lks.)

TREATMENTS (applied to potatoes in 1936) : 3 × 2 × 2 factorial design.

Dung : None, 15 tons per acre ploughed in in December (DE), or stored and applied in the bouts (DL).

Straw : None, 40 cwt. per acre (chaffed) (St), ploughed in in December, except when applied with DL, for which straw and dung were mixed and stored.

Sulphate of ammonia : None, 0.4 cwt. N per acre applied in the bouts (N).

BASAL MANURING (applied in 1936) : 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre as superphosphate, and 1 cwt. K<sub>2</sub>O per acre as sulphate of potash applied in the bouts.

CULTIVATIONS, ETC. : Ploughed on various dates during Jan. Drilled : April 12. Sulphate of ammonia applied : April 13. Rolled : May 5. Clover sown and harrowed in : May 19. Rolled : May 29. Harvested : Aug. 17. Variety : Marvellous. Previous crop : Potatoes (See 1936 Report, p. 213).

STANDARD ERROR PER PLOT : Grain 3.39 cwt. per acre or 16.8%.

**Summary of Results : Yields of separate treatments**

		No dung	Dung ploughed in in the bouts	
GRAIN : cwt. per acre ( $\pm 0.848$ )				
No sulph. amm. ..	No straw	19.5	23.1	16.0
	Straw	18.5	21.4	20.5
Sulph. amm. .. ..	No straw	19.1	22.0	22.1
	Straw	16.4	21.0	23.1
STRAW : cwt. per acre				
No sulph. amm. ..	No straw	25.4	29.3	25.4
	Straw	25.4	29.0	27.7
Sulph. amm. .. ..	No straw	25.9	29.0	28.7
	Straw	24.6	29.6	29.7

**Conclusions**

The crop was a variable one and the standard error is rather large. On most plots dung, applied to the potatoes in 1936, increased the yield of oats grain by about 3.6 cwt. per acre. There was however an anomalous depression of 3.5 cwt. per acre due to dung on the plots receiving dung in the bouts but no sulphate of ammonia nor straw in 1936. This depression is statistically significant, but no explanation can be found for it.

The residual effect of sulphate of ammonia was small. Omitting the plots which were anomalously depressed, there is some indication of a small residual depression in oats grain due to straw.

**POTATOES**

**Effect of Dung, ploughed in in January, or applied in the bouts, and of Straw, Sulphate of Ammonia, Superphosphate and Sulphate of Potash**

RP—Gt. Knott, 1937

Total produce in lb. above, percentage ware below

1	DEN <sub>1</sub> P	DESt	N <sub>2</sub> St	N <sub>2</sub> StP	NIL	DEN <sub>2</sub> StK	6
	289	158	192	281	147	348	
	90.0	88.6	88.0	91.1	84.0	94.0	
	P	StK	DEN <sub>2</sub>	StPK	DLN <sub>1</sub> StP	DLN <sub>2</sub>	
	168	149	322	159	387	406	
	85.7	86.9	91.9	86.8	93.7	95.7	
	N <sub>1</sub>	DLN <sub>2</sub> StK	DEN <sub>1</sub> StK	DEN <sub>1</sub>	N <sub>1</sub> StK	DLP	
	160	389	212	245	158	267	
	85.6	94.2	90.5	89.8	88.0	98.7	
	DL	DLStPK	N <sub>2</sub> PK	N <sub>2</sub> K	DEStP	N <sub>1</sub> P	
	279	338	379	283	227	336	
	88.5	91.1	91.8	88.7	88.8	92.2	
	DLN <sub>1</sub> St	DEPK	DLN <sub>1</sub> PK	DEN <sub>2</sub> P	DLStK	DLN <sub>2</sub> StPK	
	332	215	379	371	302	344	
	90.2	89.1	91.7	91.5	91.7	93.7	
	DLN <sub>2</sub> P	N <sub>1</sub> StPK	DEN <sub>2</sub> StPK	DEN <sub>1</sub> StPK	DEK	DLN <sub>1</sub> K	
	435	272	376	294	202	372	
	93.0	88.6	91.9	89.6	87.6	92.9	
NW							
↑							
	DEN <sub>1</sub> K	N <sub>1</sub> St	DLPK	DEN <sub>2</sub> K	St	DEP	
	309	229	297	339	162	258	
	88.8	83.8	89.7	90.8	82.1	89.9	
	N <sub>2</sub> StPK	DLN <sub>2</sub> StP	DLN <sub>1</sub>	DLStP	DEN <sub>2</sub> StP	DEStK	
	340	466	337	282	350	216	
	91.0	94.0	90.7	90.8	91.1	89.6	
	DLN <sub>1</sub> StPK	N <sub>1</sub> PK	K	DEN <sub>1</sub> St	N <sub>1</sub> StP	DLN <sub>2</sub> St	
	403	273	188	271	270	384	
	91.0	88.6	85.6	89.8	90.0	93.1	
	DE	StP	DEN <sub>2</sub> St	DEN <sub>1</sub> PK	DLN <sub>1</sub> P	N <sub>2</sub> StK	
	224	159	324	310	370	259	
	88.4	83.3	91.0	90.0	92.6	89.4	
	DEN <sub>2</sub> PK	DEN <sub>1</sub> StP	DEStPK	DLN <sub>2</sub> PK	DLN <sub>1</sub> StK	PK	
	422	326	244	460	380	238	
	92.3	90.8	90.2	93.5	92.6	87.2	
	DLN <sub>2</sub> K	DLSt	N <sub>2</sub>	DLK	N <sub>1</sub> K	N <sub>2</sub> P	
	418	276	266	300	224	226	
	91.0	92.2	89.1	90.8	88.6	83.2	
67							72

SYSTEM OF REPLICATION : 4 randomised blocks of 18 plots each. Certain interactions confounded with block differences.

AREA OF EACH PLOT (after rejecting edge bouts) : 1/60 acre. Plots actually 1/40 acre (119 lks. × 21 lks.).

TREATMENTS : 3 × 3 × 2<sup>3</sup> factorial design.

Dung : None, 15 tons per acre ploughed in in January (DE), or stored and applied in the bouts (DL).

Straw : None, 40 cwt. per acre (chaffed) (St), ploughed in in January, except when applied with DL for which straw and dung were mixed and stored.

Sulphate of ammonia : None, 0.4 (N<sub>1</sub>). 0.8 (N<sub>2</sub>) cwt. N per acre.

Superphosphate : None, 0.8 cwt. P<sub>2</sub>O<sub>5</sub> per acre (P).

Sulphate of potash : None, 1.6 cwt. K<sub>2</sub>O per acre (K).

BASAL MANURING : Nil.

CULTIVATIONS, ETC. : Dung and chaff applied : Jan. 11. Ploughed : Jan. 15-Feb. 11. Spring tine harrowed : April 13. Cultivated : May 1. Rolled and harrowed : May 3. Cultivated : May 5. Rolled and cultivated : May 6. Rolled and harrowed : May 18. Ridged : May 19. Stored dung applied : May 20. Artificials applied : May 22. Potatoes planted : May 27. Harrowed ridges : June 10. Grubbed and re-ridged : June 12 and 17. Grubbed : July 28. Re-ridged : July 29. Lifted : Oct. 8 and 9. Variety : Ally. Previous crop : Wheat.

SPECIAL NOTE : Potatoes passed through a 1½ inch riddle to determine the percentage ware.

STANDARD ERRORS PER PLOT : Total Produce : 0.845 tons per acre or 10.8%. Percentage ware : 1.81.

**Summary of effects of Nitrogenous Fertilizers**

Sulph. amm. (cwt. N)	No straw			Straw		
	No Dung	Dung Ploughed in	Dung In the bouts	No Dung	Dung Ploughed in	Dung In the bouts
TOTAL PRODUCE : tons per acre ( $\pm 0.422$ )						
0.0	4.96	6.02	7.66	4.21	5.66	8.02
0.4	6.65	7.72	9.76	6.22	7.38	10.07
0.8	7.73	9.74	11.52	7.18	9.36	10.60
PERCENTAGE WARE ( $\pm 0.904$ )						
0.0	85.6	88.8	91.9	84.8	89.3	91.4
0.4	88.8	89.6	92.0	87.6	90.2	91.9
0.8	88.2	91.6	93.3	89.9	92.0	93.8

**Main effects : Interactions of Dung**

Dung	Sulph. amm. (cwt. N)			Straw (cwt.)		Super. (cwt. P <sub>2</sub> O <sub>5</sub> )		Sulph. pot. (cwt. K <sub>2</sub> O)		Mean	Increase
	0.0	0.4	0.8	0	40	0.0	0.8	0.0	1.6		
TOTAL PRODUCE : tons per acre											
None ..	4.59 <sup>1</sup>	6.44	7.46	6.45 <sup>2</sup>	5.87	5.40 <sup>2</sup>	6.92	5.79 <sup>2</sup>	6.52	6.16	
Ploughed in	5.84	7.55	9.55	7.83	7.47	7.07	8.22	7.51	7.78	7.65	+1.49 <sup>2</sup>
In the bouts	7.84	9.92	11.06	9.65	9.56	9.33	9.88	9.42	9.79	9.60	+3.44 <sup>2</sup>
Mean ..	6.09	7.97	9.36	7.98	7.63	7.27	8.34	7.57	8.03	7.80	
Increase ..	+1.88 <sup>2</sup>	+1.39 <sup>2</sup>		-0.35 <sup>3</sup>		+1.07 <sup>3</sup>		+0.46 <sup>3</sup>			
PERCENTAGE WARE											
None ..	85.2 <sup>4</sup>	88.2	89.0	87.5 <sup>5</sup>	87.4	86.6 <sup>5</sup>	88.3	86.5 <sup>5</sup>	88.4	87.5	
Ploughed in	89.0	89.9	91.8	90.0	90.5	90.1	90.4	90.1	90.4	90.2	+2.7 <sup>5</sup>
In the bouts	91.7	91.9	93.5	92.4	92.4	92.0	92.8	92.8	92.0	92.4	+4.9 <sup>5</sup>
Mean ..	88.6	90.0	91.4	90.0	90.1	89.6	90.5	89.8	90.3	90.0	
Increase ..	+1.4 <sup>5</sup>	+1.4 <sup>5</sup>		+0.1 <sup>6</sup>		+0.9 <sup>6</sup>		+0.5 <sup>6</sup>			

St. errors : (1)  $\pm 0.299$ , (2)  $\pm 0.244$ , (3)  $\pm 0.199$ , (4)  $\pm 0.639$ , (5)  $\pm 0.522$ , (6)  $\pm 0.426$ .

**Interactions of Sulphate of Ammonia with Straw and Minerals**

Sulph. amm. (cwt. N)	Straw (cwt.)		Super. (cwt. P <sub>2</sub> O <sub>5</sub> )		Sulph. pot. (cwt. K <sub>2</sub> O)	
	0	40	0.0	0.8	0.0	1.6
TOTAL PRODUCE : tons per acre ( $\pm 0.244$ )						
0.0	6.21	5.96	5.81	6.37	5.82	6.36
0.4	8.04	7.89	7.21	8.73	7.93	8.01
0.8	9.66	9.05	8.78	9.93	8.98	9.73
PERCENTAGE WARE ( $\pm 0.522$ )						
0.0	88.8	88.5	88.0	89.3	88.4	88.9
0.4	90.1	89.9	89.3	90.7	89.9	90.1
0.8	91.0	91.9	91.4	91.5	91.1	91.9

**Conclusions**

Dung increased the yield of total produce by 1.5 tons per acre when ploughed in in January and by 3.4 tons per acre when stored and applied in the bouts, the difference between these two increases being significant.

The double dressing of sulphate of ammonia increased the total produce by 3.3 tons per acre, there being only a slight falling-off in effectiveness at the higher level of application. Straw produced a small but not significant decrease in yield.

Superphosphate increased total produce by 1.1 tons per acre and muriate of potash by 0.5 tons per acre, both increases being significant.

There was a high percentage ware. The effects of the treatments were similar to those on yield, except that straw did not depress the percentage ware.

### SUGAR BEET

Effect of agricultural salt and muriate of potash, ploughed in in December or broadcast in January, April or at sowing, and of dung

RS—Great Knott, 1937

Plan and yields in lb.

Roots (dirty), tops, sugar percentage and plant number in descending order

1	DNA KM <sub>3</sub>	M <sub>4</sub>	M <sub>2</sub>	DNA KM <sub>1</sub>	DNA M <sub>2</sub>	NA M <sub>4</sub>	DNAKM <sub>1</sub>	DNA M <sub>3</sub>	8
	653	595	596	736	808	716	548	663	
	564	466	488	577	586	642	494	572	
	16.50	15.95	16.01	16.76	16.50	16.16	15.72	16.24	
	447	456	453	482	379	432	289	426	
	NA M <sub>1</sub>	DKM <sub>4</sub>	DNA M <sub>2</sub>	NA KM <sub>4</sub>	KM <sub>4</sub>	NA M <sub>1</sub>	K M <sub>1</sub>	DKM <sub>3</sub>	
	594	695	700	686	625	479	566	581	
	476	570	542	538	535	508	450	502	
	16.04	16.56	16.30	16.88	16.13	15.43	16.16	15.98	
	381	489	503	490	435	407	424	465	
	NA KM <sub>2</sub>	KM <sub>3</sub>	DM <sub>1</sub>	KM <sub>1</sub>	DNA KM <sub>4</sub>	M <sub>2</sub>	DM <sub>1</sub>	DKM <sub>2</sub>	
	708	672	651	520	655	441	609	592	
	492	552	573	454	597	502	530	518	
	16.56	16.42	15.87	15.52	16.13	15.06	16.42	15.75	
	468	504	478	345	400	356	446	493	
	DM <sub>3</sub>	DNA M <sub>4</sub>	NA M <sub>3</sub>	DKM <sub>2</sub>	M <sub>3</sub>	NA KM <sub>2</sub>	NA KM <sub>3</sub>	DM <sub>4</sub>	
	703	749	655	578	571	667	650	614	
	534	619	539	510	519	630	532	490	
	16.16	15.58	16.24	16.01	16.43	16.16	16.73	15.61	
	495	476	424	383	420	463	528	516	
SW									
	NA M <sub>4</sub>	KM <sub>4</sub>	DNA M <sub>3</sub>	DM <sub>2</sub>	M <sub>4</sub>	M <sub>1</sub>	DNA KM <sub>2</sub>	NA KM <sub>4</sub>	
	720	638	734	519	502	700	716	725	
	538	553	596	520	472	570	594	593	
	16.33	15.87	16.65	15.75	15.90	16.16	16.53	17.14	
	568	476	493	340	371	548	539	550	
	DNA M <sub>1</sub>	NA M <sub>2</sub>	NA KM <sub>3</sub>	DNA KM <sub>2</sub>	DKM <sub>4</sub>	DM <sub>2</sub>	DKM <sub>1</sub>	DNA M <sub>1</sub>	
	701	708	712	676	508	699	673	630	
	561	567	578	601	580	616	577	560	
	16.16	16.13	16.44	16.21	15.49	16.47	16.10	15.03	
	504	487	537	457	390	533	506	535	
	M <sub>1</sub>	DKM <sub>1</sub>	DKM <sub>2</sub>	DNA KM <sub>4</sub>	DNA M <sub>4</sub>	NA M <sub>2</sub>	DM <sub>3</sub>	KM <sub>3</sub>	
	660	718	728	731	667	643	682	621	
	476	580	594	618	628	561	542	556	
	16.42	16.33	16.82	16.50	15.64	16.56	16.42	16.30	
	534	535	525	528	424	538	553	561	
	NA KM <sub>1</sub>	KM <sub>2</sub>	DM <sub>4</sub>	M <sub>3</sub>	NA KM <sub>1</sub>	NA M <sub>3</sub>	DNA KM <sub>3</sub>	KM <sub>2</sub>	
	658	692	655	577	498	636	746	556	
	448	482	538	466	480	555	643	536	
	16.76	16.21	16.21	15.87	16.47	15.81	16.56	16.01	
57	539	546	549	512	354	482	544	511	64

SYSTEM OF REPLICATION : 4 randomised blocks of 16 plots each. Certain interactions partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge-rows) : 3/170 acre. Plots actually 1/50 acre (46.6 lks. × 42.9 lks.).

TREATMENTS : 4 × 2<sup>3</sup> factorial design.

Dung : None, 10 tons per acre ploughed in in December (D).

Agricultural salt : None, 5 cwt. per acre (NA).

Muriate of potash : None, 1.0 cwt. K<sub>2</sub>O per acre (K).

Minerals ploughed in, in December (M<sub>1</sub>), broadcast immediately after ploughing (M<sub>2</sub>), broadcast in early spring (M<sub>3</sub>), broadcast at sowing (M<sub>4</sub>).

BASAL MANURING : Sulphate of ammonia at the rate of 0.6 cwt. N per acre, superphosphate at the rate of 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre.

CULTIVATIONS, ETC. : Dung and minerals (M<sub>1</sub>) applied : Dec. 9. Ploughed : Dec. 23-28. Minerals (M<sub>2</sub>) applied : Jan. 9. Minerals (M<sub>3</sub>) applied : April 3. Cultivated : April 12. Spring tine harrowed : April 13. Tractor rolled and drag harrowed : May 1. Springtime harrowed : May 6. Harrowed and minerals (M<sub>4</sub>) applied : May 10. Drilled, harrowed and rolled : May 18. Rolled : May 31. Horse hoed : June 14 and July 19. Singled : June 21-23. Hand hoed : Aug. 5. Lifted : Nov. 29-Dec. 7. Variety : Kleinwanzleben E. Previous crop : Wheat.

STANDARD ERRORS PER PLOT : Total sugar : 5.72 cwt. per acre or 12.5%. Tops : 0.889 tons per acre or 6.45%. Mean dirt tare : 0.135.

**Effects of mineral manures**

	None	Minerals		Both	Mean	None	Minerals		Both	Mean
		Salt	Mur. of pot.				Salt	Mur. of pot.		
TOTAL SUGAR : cwt. per acre (±2.86)						ROOTS (washed) : tons per acre				
M <sub>1</sub> ..		41.6	44.6	45.0	43.7 <sup>2</sup>		13.26	13.88	13.68	13.61
M <sub>2</sub> ..	42.8 <sup>1</sup>	50.9	42.8	48.6	47.4 <sup>2</sup>	13.32	15.54	13.37	14.83	14.58
M <sub>3</sub> ..		48.2	48.2	50.6	49.0 <sup>2</sup>		14.82	14.68	15.26	14.92
M <sub>4</sub> ..		49.3	42.0	50.2	47.2 <sup>2</sup>		15.48	13.07	15.04	14.53
Mean Increase	42.8 <sup>1</sup>	47.5 <sup>1</sup> +4.7 <sup>3</sup>	44.4 <sup>1</sup> +1.6 <sup>3</sup>	48.6 <sup>1</sup> +5.8 <sup>3</sup>	45.8	13.32	14.78 +1.46	13.75 +0.43	14.70 +1.38	14.14
TOPS : tons per acre (±0.444)						SUGAR PERCENTAGE				
M <sub>1</sub> ..		13.32	13.03	12.64	13.00 <sup>5</sup>		15.66	16.03	16.43	16.04
M <sub>2</sub> ..	13.12 <sup>4</sup>	14.27	12.94	14.66	13.96 <sup>5</sup>	16.04	16.37	16.00	16.36	16.24
M <sub>3</sub> ..		14.30	13.94	14.66	14.30 <sup>5</sup>		16.24	16.38	16.56	16.39
M <sub>4</sub> ..		15.35	14.16	14.84	14.78 <sup>5</sup>		15.93	16.01	16.66	16.20
Mean Increase	13.12 <sup>4</sup>	14.31 <sup>4</sup> +1.19 <sup>6</sup>	13.52 <sup>4</sup> +0.40 <sup>6</sup>	14.20 <sup>4</sup> +1.08 <sup>6</sup>	13.79	16.04	16.05 +0.01	16.10 +0.06	16.50 +0.46	16.17

Standard Errors : (1) ±1.43, (2) ±1.65, (3) ±2.02, (4) ±0.222, (5) ±0.256, (6) ±0.314.

**PLANT NUMBER : thousands per acre**

	None	Minerals		Both	Mean
		Salt	Mur. of pot.		
M <sub>1</sub> ..		25.8	25.6	23.6	25.0
M <sub>2</sub> ..	26.8	27.0	27.4	27.3	27.2
M <sub>3</sub> ..		25.8	29.1	29.2	28.0
M <sub>4</sub> ..		26.9	25.4	27.9	26.7
Mean Increase	26.8	26.4 -0.4	26.9 +0.1	27.0 +0.2	26.8

M<sub>1</sub> = Minerals ploughed in in December,  
M<sub>3</sub> = broadcast in early spring.

M<sub>2</sub> = broadcast immediately after ploughing.  
M<sub>4</sub> = broadcast at sowing.

**Effect of dung and interaction of dung with minerals**

	Minerals				<i>Mean Increase</i>		Minerals				<i>Mean Increase</i>	
	None	Salt	Mur. of pot.	Both			None	Salt	Mur. of pot.	Both		
	TOTAL SUGAR : cwt. per acre ( $\pm 2.02$ )						ROOTS (washed) : tons per acre					
No dung	40.5	45.6	43.2	47.6	44.2 <sup>1</sup>	+ 3.2 <sup>2</sup>	12.64	14.16	13.38	14.30	13.62	
Dung	45.2	49.4	45.6	49.5	47.4 <sup>1</sup>		13.99	15.40	14.11	15.10	14.65	+ 1.03
	TOPS : tons per acre ( $\pm 0.314$ )						SUGAR PERCENTAGE					
No dung	12.52	13.87	13.02	13.57	13.24 <sup>3</sup>		15.98	16.09	16.08	16.64	16.20	
Dung	13.73	14.75	14.01	14.83	14.33 <sup>3</sup>	+ 1.09 <sup>4</sup>	16.11	16.01	16.13	16.36	16.15	- 0.05

Standard Errors : (1)  $\pm 1.01$ , (2)  $\pm 1.43$ , (3)  $\pm 0.157$ , (4)  $\pm 0.222$ .

PLANT NUMBER : thousands per acre

	Minerals				<i>Mean Increase</i>	
	None	Salt	Mur. of pot.	Both		
No dung	25.8	26.3	26.9	27.8	26.7	
Dung	27.7	26.5	26.8	26.1	26.8	+ 0.1

**Conclusions**

Minerals produced a significant increase in total sugar. The response to salt was 4.4 cwt. per acre as against 1.4 cwt. per acre for muriate of potash, though the difference between the two responses was not significant. The effects on tops were similar. The differences in sugar produced by the different methods of applying the minerals were not significant. In tops, however, the later applications gave significantly higher yields than the earlier applications.

Dung produced significant increases of 3.2 cwt. per acre in sugar and 1.1 tons per acre in tops. The increase in sugar was greater in the absence of potash than in its presence, but not significantly so.



## MANGOLDS

Effect of sulphate of ammonia, superphosphate, muriate of potash, agricultural salt and dung

RM—Great Knott, 1937

Plan and yields in lb., roots above, tops centre, plant number below

1	S K D	P D	S	K N A D	S P	D	S K N A	K	8
	1168	908	896	968	736	804	1204	676	
	263	226	254	266	252	234	318	222	
	424	408	407	365	340	314	336	285	
SW	S P N A D	P K	N A	S P K N A	S P K D	P N A	S N A D	P K N A D	
↑	1208	836	824	1100	776	880	1244	812	
	294	214	205	276	217	248	298	264	
	347	341	335	344	247	295	304	305	
	N A D	S P N A	S P K N A D	S K	S P D	S K N A D	P K N A	S P K	
	972	1268	1252	848	828	1240	900	952	
	286	300	306	263	244	310	244	270	
	365	374	405	385	294	369	384	397	
	P K D	P	S D	K N A	N i l	S N A	P N A	K D	
	876	740	812	728	508	1108	920	836	
	230	204	195	216	166	269	248	232	
25	392	386	363	319	262	356	369	374	32

SYSTEM OF REPLICATION : 4 randomised block of 8 plots each. Certain high order interactions are partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge rows) : 0.019444 acre. Plots actually 1/45 acre (48.5 lks. × 45.8 lks.)

TREATMENTS : 2<sup>5</sup> factorial design.

Sulphate of ammonia : None, 0.6 cwt. N per acre (S).  
 Superphosphate : None, 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre (P).  
 Muriate of potash : None, 1.0 cwt. K<sub>2</sub>O per acre (K).  
 Agricultural salt : None, 5 cwt. per acre (Na).  
 Dung : None, 10 tons per acre (D).

BASAL MANURING : Nil.

CULTIVATIONS, ETC. : Dung applied : Dec. 9. Ploughed : Dec. 30 and 31. Cultivated : April 12. Springtine harrowed : April 13 and May 6. Manures applied : May 8. Drilled : May 18. Harrowed : May 18. Rolled : May 18 and 31. Singled : June 29 and 30. Horse hoed : July 20 and Aug. 7. Hand hoed : Aug. 6. Lifted : Oct. 29-Nov. 1. Variety Yellow Globe. Previous crop : Wheat.

STANDARD ERROR PER PLOT : Roots : 1.94 tons per acre or 9.07%.

### Response to fertilisers

MEAN YIELDS : Roots : 21.40 tons ; Tops : 5.77 tons ; Plant number : 18.0 thousands.

	Mean response	Differential responses									
		Sulphate of ammonia		Dung		Salt		Muriate of potash		Superphosphate	
		Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present
ROOTS : tons per acre ( $\pm 0.970$ . Means : $\pm 0.686$ )											
Sulphate of ammonia	+4.95	—	—	+5.80	+4.11	+2.39	+7.52	+4.43	+5.48	+6.33	+3.58
Dung .. .. .	+2.04	+2.88	+1.19	—	—	+2.34	+1.73	+2.11	+1.96	+3.59	+0.48
Salt .. .. .	+4.92	+2.35	+7.48	+5.22	+4.61	—	—	+6.29	+3.54	+4.99	+4.84
Muriate of potash ..	+0.74	+0.22	+1.26	+0.82	+0.66	+2.11	-0.63	—	—	+1.43	+0.05
Superphosphate ..	+0.22	+1.60	-1.15	+1.78	-1.33	+0.30	+0.15	+0.92	-0.47	—	—
TOPS : tons per acre											
Sulphate of ammonia	+0.90	—	—	+1.39	+0.41	+0.66	+1.14	+0.83	+0.96	+0.99	+0.81
Dung .. .. .	+0.27	+0.76	-0.22	—	—	-0.02	+0.56	+0.36	+0.19	+0.49	+0.05
Salt .. .. .	+0.95	+0.71	+1.19	+0.67	+1.24	—	—	+1.07	+0.83	+0.98	+0.93
Muriate of potash ..	+0.27	+0.20	+0.33	+0.35	+0.18	+0.39	+0.15	—	—	+0.53	+0.01
Superphosphate ..	+0.06	+0.14	-0.03	+0.28	-0.17	+0.08	+0.03	+0.31	-0.20	—	—
PLANT NUMBER : thousands per acre											
Sulphate of ammonia	+0.6	—	—	+2.1	-0.9	+0.6	+0.6	+0.3	+0.9	+2.1	-0.9
Dung .. .. .	+0.3	+1.8	-1.2	—	—	+0.1	+0.6	0.0	+0.6	+1.2	-0.6
Salt .. .. .	-0.2	-0.2	-0.2	-0.4	+0.1	—	—	-0.2	-0.1	-0.4	+0.1
Muriate of potash ..	+0.5	+0.2	+0.8	+0.2	+0.8	+0.4	+0.5	—	—	+1.0	0.0
Superphosphate ..	+0.2	+1.7	-1.3	+1.1	-0.7	-0.1	+0.5	+0.7	-0.3	—	—

### Conclusions

Sulphate of ammonia and salt both gave increases of about 4.9 tons per acre in the yield of roots, while dung increased the roots by 2.0 tons per acre. There was also a significant positive interaction between the effects of sulphate of ammonia and salt, the response to each fertiliser being about 7.5 tons in the presence of the other fertiliser and 2.4 tons in its absence.

The responses in roots to muriate of potash and superphosphate were smaller and not significant.

The effects on tops were in general similar to those on roots.

**BEANS**

Effect of dung, nitro-chalk, superphosphate, muriate of potash and of spacing of the rows

RE—Great Knott, 1937

Plan and yields in lb., grain above, straw below

1	$S_1 - - P -$	$S_1 - N - K$	$S_1 D N P -$	$S_1 D - - K$	4
	35.3	34.6	45.1	53.7	
	37.2	37.9	47.9	55.3	
	$S_2 - N - K$	$S_2 - - P -$	$S_2 D N P -$	$S_2 D - - K$	
	36.2	21.0	33.4	40.6	
	37.3	24.5	38.1	47.9	
	$S_2 D N - K$	$S_2 - - - K$	$S_2 - N P -$	$S_2 D - P -$	
	39.3	20.1	33.9	44.0	
	40.2	25.4	36.1	42.0	
	$S_1 D N - K$	$S_1 - N P -$	$S_1 D - P -$	$S_1 - - - K$	
	46.1	38.4	46.7	48.0	
	48.9	39.6	47.8	47.5	
	$S_2 - - P K$	$S_2 D N P K$	$S_2 - N - -$	$S_2 D - - -$	
	35.0	42.7	32.4	29.5	
	36.5	39.3	32.6	31.0	
	$S_1 - N - -$	$S_1 D - - -$	$S_1 D N P K$	$S_1 - - P K$	
	46.7	49.0	53.6	55.1	
	44.8	47.0	51.9	50.9	
NW	$S_1 D - P K$	$S_1 - N P K$	$S_1 - - - -$	$S_1 D N - -$	
	59.1	50.9	47.7	57.3	
	57.4	48.6	42.8	54.7	
	$S_2 D - P K$	$S_2 - N P K$	$S_2 - - - -$	$S_2 D N - -$	
	39.0	26.8	16.0	25.0	
	42.5	30.2	23.5	31.0	
	$S_1 D - P K$	$S_1 D N P -$	$S_1 - N - K$	$S_1 - - - -$	
	47.5	41.9	36.5	33.4	
	49.5	44.6	43.5	36.1	
	$S_2 - - - -$	$S_2 D N P -$	$S_2 D - P K$	$S_2 - N - K$	
	55.6	44.5	46.6	53.6	
	53.4	46.5	46.9	47.9	
	$S_1 D N P K$	$S_1 - - - K$	$S_1 D - P -$	$S_1 - N - -$	
	66.9	47.5	48.1	56.7	
	67.1	47.5	46.9	55.3	
	$S_2 D N P K$	$S_2 D - P -$	$S_2 - N - -$	$S_2 - - - K$	
	52.6	36.4	35.4	30.5	
	52.4	39.1	35.6	36.5	
	$S_1 - - P -$	$S_1 - N P K$	$S_1 D N - -$	$S_1 D - - K$	
	65.9	52.0	45.8	46.3	
	65.1	54.0	49.2	49.2	
	$S_2 - - P -$	$S_2 D N - -$	$S_2 D - - K$	$S_2 - N P K$	
	43.9	27.9	26.2	37.2	
	45.1	34.1	39.8	36.3	
	$S_2 - - P K$	$S_2 D - - -$	$S_2 - N P -$	$S_2 D N - K$	
	42.6	22.6	26.4	29.1	
	46.9	30.4	33.6	36.4	
61	$S_1 - N P -$	$S_1 D - - -$	$S_1 D N - K$	$S_1 - - P K$	64
	30.3	28.3	28.5	29.6	
	44.7	35.2	45.0	39.4	

SYSTEM OF REPLICATION : 16 randomised blocks of 4 plots each, spacing treatments being applied to blocks of 4 plots. Certain interactions partially confounded with block differences.

AREA OF EACH SUB-PLOT : 1/80 acre (68.7 lks. × 18.2 lks.).

TREATMENTS : 2<sup>5</sup> factorial design.

Spacing : 16 ins. (S<sub>1</sub>), 24 ins. (S<sub>2</sub>).

Dung : None, 10 tons per acre (D).

Nitro-chalk : None, 0.4 cwt. N per acre (N).

Superphosphate : None, 0.6 cwt. P<sub>2</sub>O<sub>5</sub> per acre (P).

Muriate of potash : None, 1.0 cwt. K<sub>2</sub>O per acre (K).

BASAL MANURING : Nil.

CULTIVATIONS, ETC. : Dung applied : Nov. 25. Ploughed in beans : Nov. 26. Artificials applied : Dec. 1. Nitro-chalk applied : April 12. Horse hoed : May 5 and 6. Harvested : Aug. 13. Previous crop : Wheat.

STANDARD ERRORS : Grain : per block : 11.9 cwt. per acre or 41.0% ; per plot : 5.34 cwt. per acre or 18.4%.

### Responses to treatments

Mean yields : GRAIN, 29.0 cwt. ; STRAW, 30.7 cwt.

Mean response	Differential responses										
	Spacing		Dung		Nitro-chalk		Superphosphate		Muriate of potash		
	16 ins.	24 ins.	Absent	Present	Absent	Present	Absent	Present	Absent	Present	
GRAIN : cwt. per acre (±1.89. Means : ±1.34)											
Spacing 24 ins.- 16 ins. ..	-7.7 <sup>1</sup>	—	—	-7.2 <sup>2</sup>	-8.2 <sup>2</sup>	-8.5 <sup>2</sup>	-6.9 <sup>2</sup>	-8.3 <sup>2</sup>	-7.2 <sup>2</sup>	-8.4 <sup>2</sup>	-7.0 <sup>2</sup>
Dung .. ..	+2.0	+2.5	+1.4	—	—	+1.6	+2.3	+1.6 <sup>3</sup>	+2.4 <sup>3</sup>	+0.3	+3.6
Nitro-chalk ..	+0.4	-0.4	+1.2	0.0	+0.7	—	—	+1.6	-0.9	-0.1	+0.8
Superphosphate	+3.3	+2.7	+3.8	+2.9 <sup>3</sup>	+3.7 <sup>3</sup>	+4.5	+2.0	—	—	+1.3 <sup>3</sup>	+5.3 <sup>3</sup>
Mur. pot. ..	+2.4	+1.8	+3.1	+0.8	+4.1	+2.0	+2.9	+0.4 <sup>3</sup>	+4.3 <sup>3</sup>	—	—
STRAW : cwt. per acre											
Spacing 24 ins.- 16ins. ..	-7.0	—	—	-6.8	-7.1	-6.4	-7.6	-7.0	-7.0	-7.2	-6.7
Dung .. ..	+2.6	+2.8	+2.5	—	—	+2.2	+3.1	+2.7	+2.6	+0.7	+4.6
Nitro-chalk ..	+0.4	+1.0	-0.2	0.0	+0.9	—	—	+1.2	-0.3	+1.0	-0.1
Superphosphate	+2.4	+2.3	+2.4	+2.5	+2.4	+3.1	+1.6	—	—	+1.9	+2.9
Mur. pot. ..	+2.7	+2.4	+2.9	+0.7	+4.6	+3.2	+2.2	+2.2	+3.1	—	—
Standard errors : (1) ± 2.97, (2) ± 4.20, (3) ± 2.67.											

### Conclusions

Superphosphate produced a significant increase in yield of grain of 3.3 cwt. per acre. The increases in grain produced by dung and muriate of potash were not significant, while the response to nitro-chalk was negligible.

In half the blocks the rows were spaced 16 inches apart and in the other half 24 inches apart. The narrow spacing gave 7.7 cwt. of grain per acre more than the wide spacing, the difference being significant.

**KALE**

**Effect of sulphate of ammonia, poultry manure, soot and rape dust  
RK—FOSTER'S, 1937 (4th year)  
Plan and yields in lb.**

1 SW ↑ 41	R <sub>1</sub> 327	N <sub>2</sub> 429	M <sub>2</sub> 294	M <sub>1</sub> 278	M <sub>0</sub> 177	R <sub>1</sub> 180	R <sub>0</sub> 163	N <sub>1</sub> 277	8
	S <sub>2</sub> 340	S <sub>1</sub> 263	N <sub>1</sub> 293	M <sub>0</sub> 211	S <sub>0</sub> 169	M <sub>1</sub> 191	M <sub>2</sub> 231	N <sub>2</sub> 389	
	R <sub>0</sub> 261	S <sub>0</sub> 209	R <sub>2</sub> 363	N <sub>0</sub> 216	R <sub>2</sub> 384	S <sub>2</sub> 312	N <sub>0</sub> 144	S <sub>1</sub> 231	
	R <sub>0</sub> 217	N <sub>2</sub> 418	M <sub>1</sub> 216	S <sub>1</sub> 236	R <sub>0</sub> 185	R <sub>2</sub> 287	R <sub>1</sub> 185	M <sub>1</sub> 236	
	N <sub>0</sub> 203	M <sub>2</sub> 268	M <sub>0</sub> 216	S <sub>0</sub> 216	M <sub>0</sub> 145	N <sub>2</sub> 372	N <sub>1</sub> 233	S <sub>2</sub> 301	
	R <sub>1</sub> 235	S <sub>2</sub> 330	R <sub>2</sub> 337	N <sub>1</sub> 289	S <sub>0</sub> 140	N <sub>0</sub> 195	S <sub>1</sub> 165	M <sub>2</sub> 261	
									48

SYSTEM OF REPLICATION : 4 randomised blocks of 12 plots each.  
AREA OF EACH PLOT (after rejecting edge rows) : 0.025712 acre. Plots actually 0.028926 acre (14 yds. × 10 yds.)

TREATMENTS, 1937 : No nitrogen (0), and sulphate of ammonia (N) half applied in seed-bed and the remainder as a top-dressing, soot (S), poultry manure (M) and rape dust (R), applied in seed-bed at the rate of 0.4 cwt. N per acre (1), or 0.8 cwt. N per acre (2). Plots receiving treatment (0) in 1937 had treatment (2) in 1936 and vice versa. Plots receiving treatment (1) had this in both years. For N<sub>0</sub>, S<sub>0</sub>, M<sub>0</sub> and R<sub>0</sub> (see plan), the fertilizer symbols refer to the 1936 treatment.

BASAL MANURING : All plots were made up to 1.0 cwt. P<sub>2</sub>O<sub>5</sub> per acre and 1.0 cwt. K<sub>2</sub>O per acre, using superphosphate and muriate of potash (an allowance being made for the P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O contained in the organic manures).

CULTIVATIONS, ETC. : Ploughed : March 8-10. Spring tine harrowed : April 9. Manures applied : April 27. Applied first half of sulphate of ammonia : April 29. Rolled and harrowed : May 3. Seed sown : May 4. Rolled and harrowed : May 4. Horse hoed : June 3 and 21. Applied second half of sulphate of ammonia : July 2. Hand hoed : July 19. Hand hoed : July 29. Harvested : Jan. 5 and 15. Variety : Thousand head. Previous crop : Kale. (See 1936 Report, p. 223.)

STANDARD ERROR PER PLOT : 0.436 tons per acre or 9.86%.

**Summary of Results : tons per acre (±0.218)**

Nitrogen, cwt. per acre		Sulph. amm.	Poultry manure	Soot	Rape dust	Mean (±0.109)
1934	1935					
1936	1937					
0.8	0.0	3.29	3.25	3.19	3.59	3.33
0.4	0.4	4.74	4.00	3.88	4.02	4.16
0.0	0.8	6.98	4.58	5.57	5.95	5.77
Mean (±0.126)		5.00	3.94	4.21	4.52	4.42

**Conclusions**

The crop of kale was a poor one. The 1937 dressings produced significant increases in yield, the yield with the double dressing of sulphate of ammonia being significantly above that with any other types of fertilizer, while poultry manure gave a significantly lower yield than soot or rape dust.

There was no indication of any differences in the residual effects of the fertilizers.