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## Rothamsted Report for 1936

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### Other Experiments at Woburn

#### Rothamsted Research

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## WHEAT

### WOBURN

#### Effect of sulphate of ammonia applied at five different times

WW—Stackyard, 1936

Plan and yields in lb., total produce wet

	<b>1</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>5</b>	
	98.8	111.0	114.8	118.2	58.0	130.5	
NW	<b>3</b>	<b>1</b>	<b>4</b>	<b>0</b>	<b>5</b>	<b>2</b>	
	113.0	89.5	115.0	79.5	96.8	129.0	
↑	<b>0</b>	<b>3</b>	<b>1</b>	<b>5</b>	<b>2</b>	<b>4</b>	
	79.0	107.8	101.5	104.5	103.0	118.5	
↑	<b>5</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>1</b>	
	109.2	78.5	106.2	113.8	103.0	98.5	
↑	<b>4</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>3</b>	<b>0</b>	
	105.8	107.5	103.8	90.2	113.0	72.5	
↑	<b>2</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>3</b>	
31	102.0	97.0	70.8	104.8	93.2	121.2	36

SYSTEM OF REPLICATION : 6 × 6 Latin square.

AREA OF EACH PLOT :  $\frac{1}{100}$  acre (16.7 lks. × 60.0 lks.).

TREATMENTS : No sulphate of ammonia (0) and sulphate of ammonia at the rate of 0.4 cwt. N per acre applied on Nov. 5 (1), Jan. 25 (2), Mar. 13 (3), April 24 (4) and May 25 (5).

CULTIVATIONS ETC. : Ploughed : Sept. 10. Harrowed : Oct. 23. Drilled : Oct. 25. Cambridge rolled : March 25. Harrowed : March 27. Hand hoed : April 15 and succeeding days. Harrowed : April 24. Harvested : Aug. 19. Variety : Victor. Previous crop : Bare fallow.

SPECIAL NOTE : Plots harvested by weighing total produce and sampling for grain-straw ratio. The number of samples taken was however, too small, and the resulting grain yields are somewhat irregular. Bulked replicates of the treatments, were, however, also threshed and these are the results shown in the table.

STANDARD ERROR PER PLOT : Total produce : 3.93 cwt. per acre or 7.48 %.

#### Summary of results, cwt. per acre.

	Dates of application of sulphate of ammonia (0.4 cwt. N per acre)						Mean of all N	St. error
	No N	Nov. 5	Jan. 25	Mar. 13	Apr. 24	May 25		
GRAIN ..	13.4	17.7	19.3	20.5	21.6	18.9	19.6	
Increase ..		+4.3	+5.9	+7.1	+8.2	+5.5	+6.2	
STRAW ..	22.4	31.3	38.4	40.8	36.1	34.9	36.3	
Increase ..		+8.9	+16.0	+18.4	+13.7	+12.5	+13.9	
TOTALPRO- DUCE ..	35.8	49.0	57.7	61.3	57.7	53.8	55.9	±0.716
(±1.60)..								
Increase ..		+13.2	+21.9	+25.5	+21.9	+18.0	+20.1	±1.76
(±2.26)..								

#### Conclusions

The average response to sulphate of ammonia was 6.2 cwt. of grain and 13.9 cwt. of straw per acre. For both grain and straw the yields increased to a maximum and then decreased with later applications, the maximum straw yield occurring with an earlier application than the maximum grain yield.

## SUGAR BEET

### WOBURN

Effect of sowing date, of sulphate of ammonia and of time of application of mineral fertilisers

WS—Lansome, 1936  
Plan and yields in lb.

		Roots (dirty)	Tops	Sugar Plant per cent.	Plant ber		Roots (dirty)	Tops	Sugar Plant per cent.	Plant ber	
1	3 O M <sub>0</sub>	230	130	17.92	374	25	2 N M <sub>1</sub>	413	190	18.55	354
	1 O M <sub>2</sub>	309	167	17.83	362		1 N M <sub>3</sub>	473	258	17.60	367
	2 N M <sub>0</sub>	425	218	17.63	367		3 N M <sub>0</sub>	348	214	16.79	370
	1 O M <sub>1</sub>	334	168	17.80	359		1 N M <sub>0</sub>	422	267	17.22	359
	2 O M <sub>2</sub>	286	138	17.77	360		2 O M <sub>0</sub>	275	136	17.02	368
	1 N M <sub>3</sub>	455	243	17.63	365		1 O M <sub>2</sub>	327	156	17.66	376
	1 N M <sub>0</sub>	483	280	17.25	367		3 N M <sub>3</sub>	348	283	17.97	361
	3 N M <sub>2</sub>	373	279	17.60	359		2 O M <sub>3</sub>	293	141	18.00	352
	2 O M <sub>1</sub>	357	188	17.60	372		2 N M <sub>2</sub>	459	267	18.61	369
	3 N M <sub>1</sub>	430	291	18.18	345		3 O M <sub>2</sub>	241	134	17.28	362
24	3 O M <sub>3</sub>	297	178	17.28	362	3 O M <sub>1</sub>	206	115	17.34	369	
	2 N M <sub>3</sub>	444	261	17.08	370	1 O M <sub>1</sub>	326	150	17.77	360	
	1 O M <sub>0</sub>	395	192	17.19	361	36	3 O M <sub>2</sub>	222	112	17.22	384
	2 N M <sub>2</sub>	438	300	17.66	370		1 N M <sub>1</sub>	420	189	16.82	337
	2 O M <sub>0</sub>	371	187	15.72	369		2 O M <sub>1</sub>	234	119	17.16	350
	3 O M <sub>1</sub>	297	184	16.47	375		3 N M <sub>3</sub>	313	177	17.42	361
	3 N M <sub>0</sub>	382	290	16.82	370		1 O M <sub>3</sub>	274	138	17.48	344
	1 O M <sub>3</sub>	359	200	19.76	350		3 N M <sub>0</sub>	319	178	17.16	370
	3 N M <sub>3</sub>	330	296	17.11	364		2 N M <sub>0</sub>	377	191	17.48	359
	2 N M <sub>1</sub>	435	259	17.57	365		1 N M <sub>2</sub>	421	202	17.51	326
1 N M <sub>2</sub>	493	277	17.51	354	2 O M <sub>2</sub>		237	112	17.28	356	
1 N M <sub>1</sub>	525	259	17.86	350	2 N M <sub>3</sub>		386	174	17.45	346	
37	2 O M <sub>3</sub>	332	170	17.54	375	3 O M <sub>1</sub>	153	77	16.76	355	
	3 O M <sub>2</sub>	296	195	17.31	384	1 O M <sub>0</sub>	268	120	17.45	337	
	2 N M <sub>3</sub>	401	262	18.26	363	49	2 N M <sub>1</sub>	437	201	17.25	364
	2 O M <sub>1</sub>	305	157	18.00	357		1 N M <sub>3</sub>	445	199	19.70	357
	1 O M <sub>3</sub>	314	153	17.97	365		2 N M <sub>2</sub>	411	221	16.79	361
	2 O M <sub>2</sub>	262	162	17.87	348		3 O M <sub>3</sub>	220	141	17.02	371
	3 O M <sub>0</sub>	263	145	17.92	372		2 O M <sub>3</sub>	295	140	17.40	363
	3 O M <sub>3</sub>	232	169	17.83	379		1 O M <sub>2</sub>	364	138	17.94	344
	1 N M <sub>2</sub>	524	266	18.41	380		3 O M <sub>0</sub>	237	131	17.28	375
	1 N M <sub>1</sub>	461	233	18.09	360		2 O M <sub>0</sub>	306	143	16.73	368
3 N M <sub>2</sub>	338	181	17.28	368	3 N M <sub>1</sub>		367	217	16.73	368	
1 O M <sub>0</sub>	324	165	17.05	372	1 O M <sub>1</sub>		347	145	17.50	338	
48	2 N M <sub>0</sub>	400	231	17.63	359	3 N M <sub>2</sub>	401	247	16.73	360	
	3 N M <sub>1</sub>	331	245	17.19	352	1 N M <sub>0</sub>	498	257	16.88	346	

NOTE: In the field the plots lay in three parallel strips, 1-24, 25-48, 49-72.

SYSTEM OF REPLICATION: 6 randomised blocks of 12 plots each. Certain interactions are partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge rows): 1/100 acre. Plots actually 24.2 yds × 3 yds.

TREATMENTS: 4 × 3 × 2 factorial design.

Minerals: None (M<sub>0</sub>), superphosphate at the rate of 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre and muriate of potash at the rate of 1.0 cwt. K<sub>2</sub>O per acre ploughed in (M<sub>1</sub>) broadcast immediately after ploughing (M<sub>2</sub>) and broadcast at sowing (M<sub>3</sub>).

Sowing: April 8 (1), April 27 (2) and May 15 (3).

Sulphate of ammonia: None, 0.6 cwt. N per acre (N).

BASAL MANURING: Nil.

CULTIVATIONS, ETC.: Ploughed: Feb. 21-26 and March 23-24. Double harrowed: March 28.

Harrowed, Cambridge rolled and manures applied to first sowing: April 8. Cambridge rolled

and manures applied to second sowing: April 27. Horse hoed first sowing: May 11. Harrowed:

and rolled for third sowing: May 12. Harrowed and manures applied to third sowing: May 15.

Horse hoed first and second sowing: May 19. Singled first and second sowing: May 20

and 21. Horse hoed first and second sowing: May 29. Singled third sowing: June 10.

Horse hoed first and second sowing: June 16. Hand hoed: July 29-Aug. 4. Lifted: Nov. 6-12.

Variety: Kleinwanzleben. Previous crop: Potatoes.

STANDARD ERRORS PER PLOT: Total sugar: 4.39 cwt. per acre or 9.36%. Tops: 0.860 tons per acre or 9.91%. Mean dirt tare: 0.150.

**Main effects : Interactions of sulphate of ammonia with minerals and sowing dates**

	Minerals				Dates of sowing			Mean	Increase
	None	Ploughed in	Broadcast at ploughing	Broadcast at sowing	April 8	April 27	May 15		
<b>TOTAL SUGAR : cwt. per acre</b>									
0.0 cwt. N	37.6 <sup>1</sup>	38.1 <sup>1</sup>	38.1 <sup>1</sup>	38.2 <sup>1</sup>	44.8 <sup>2</sup>	38.9 <sup>2</sup>	30.2 <sup>2</sup>	38.0 <sup>5</sup>	
0.6 cwt. N	54.1 <sup>1</sup>	56.8 <sup>1</sup>	57.1 <sup>1</sup>	55.4 <sup>1</sup>	63.7 <sup>2</sup>	57.5 <sup>2</sup>	46.4 <sup>2</sup>	55.9 <sup>5</sup>	+17.9 <sup>3</sup>
Mean	45.8 <sup>3</sup>	47.4 <sup>3</sup>	47.6 <sup>3</sup>	46.8 <sup>3</sup>	54.2 <sup>4</sup>	48.2 <sup>4</sup>	38.3 <sup>4</sup>	46.9	
Increase		+1.6 <sup>1</sup>	+1.8 <sup>1</sup>	+1.0 <sup>1</sup>		-6.0 <sup>2</sup>	-15.9 <sup>2</sup>		
Standard Errors	(1) ± 1.46* (2) ± 1.26 (3) ± 1.03 (4) ± 0.891 (5) ± 0.730.								
<b>ROOTS (washed) : tons per acre</b>									
0.0 cwt. N	11.00	10.94	10.83	10.67	12.60	11.24	8.74	10.86	
0.6 cwt. N	15.74	16.10	16.20	15.56	17.98	16.27	13.45	15.90	+5.04
Mean	13.37	13.52	13.52	13.12	15.29	13.76	11.10	13.38	
Increase		+0.15	+0.15	-0.25		-1.53	-4.19		
<b>TOPS : tons per acre</b>									
0.0 cwt. N	6.54 <sup>1</sup>	6.62 <sup>1</sup>	6.67 <sup>1</sup>	6.94 <sup>1</sup>	7.04 <sup>2</sup>	6.67 <sup>2</sup>	6.36 <sup>2</sup>	6.69 <sup>5</sup>	
0.6 cwt. N	10.69 <sup>1</sup>	10.18 <sup>1</sup>	10.96 <sup>1</sup>	10.83 <sup>1</sup>	10.90 <sup>2</sup>	10.32 <sup>2</sup>	10.78 <sup>2</sup>	10.67 <sup>5</sup>	+3.98 <sup>3</sup>
Mean	8.62 <sup>3</sup>	8.40 <sup>3</sup>	8.82 <sup>3</sup>	8.88 <sup>3</sup>	8.97 <sup>4</sup>	8.50 <sup>4</sup>	8.57 <sup>4</sup>	8.68	
Increase		-0.22 <sup>1</sup>	+0.20 <sup>1</sup>	+0.26 <sup>1</sup>		-0.47 <sup>2</sup>	-0.40 <sup>2</sup>		
Standard Errors	(1) ± 0.286* (2) ± 0.248 (3) ± 0.202 (4) ± 0.175 (5) ± 0.143.								
<b>SUGAR PERCENTAGE</b>									
0.0 cwt. N	17.14	17.38	17.57	17.81	17.78	17.34	17.30	17.47	
0.6 cwt. N	17.21	17.58	17.57	17.80	17.71	17.66	17.25	17.54	+0.07
Mean	17.18	17.48	17.57	17.80	17.74	17.50	17.28	17.51	
Increase		+0.30	+0.39	+0.62		-0.24	-0.46		
<b>PLANT NUMBER : thousands per acre</b>									
0.0 cwt. N	36.6	36.0	36.5	36.2	35.6	36.2	37.2	36.3	
0.6 cwt. N	36.3	35.4	36.0	36.2	35.6	36.2	36.2	36.0	-0.3
Mean	36.4	35.7	36.2	36.2	35.6	36.2	36.7	36.2	
Increase		-0.7	-0.2	-0.2		+0.6	+1.1		

\*For interactions multiply by 1.060.

**Interaction of minerals and sowing dates**

Dates of sowing	Minerals				Minerals			
	None	Ploughed in	Broadcast at ploughing	Broadcast at sowing	None	Ploughed in	Broadcast at ploughing	Broadcast at sowing
<b>TOTAL SUGAR : cwt. per acre (<math>\pm 1.79</math>)</b>					<b>ROOTS (washed) : tons per acre</b>			
April 8 .. ..	52.2	54.8	55.7	54.4	15.20	15.54	15.62	14.80
April 27 .. ..	47.0	49.6	47.6	48.6	13.76	14.00	13.45	13.81
May 15 .. ..	38.5	37.8	39.6	37.4	11.16	11.02	11.48	10.72
<b>TOPS : tons per acre (<math>\pm 0.351</math>)</b>					<b>SUGAR PERCENTAGE</b>			
April 8 .. ..	9.53	8.51	8.98	8.86	17.18	17.64	17.81	18.36
April 27 .. ..	8.22	8.28	8.93	8.54	17.04	17.69	17.66	17.62
May 15 .. ..	8.10	8.40	8.54	9.26	17.32	17.12	17.24	17.44
<b>PLANT NUMBER : thousands per acre</b>								
April 8 .. ..	35.7	35.0	35.7	35.8				
April 27 .. ..	36.5	36.0	36.1	36.2				
May 15 .. ..	37.2	36.0	37.0	36.6				

**Conclusions**

The yield of total sugar decreased by 6.0 cwt. from the first sowing (April 8) to the second (April 27) and by a further 9.9 cwt. from the second sowing to the third (May 15), both roots and sugar percentage falling with later sowing.

The differences in the yield of tops were not significant, though the two later sowings gave somewhat lower yields than the first sowing.

Sulphate of ammonia produced large increases in total sugar and tops. The average response in total sugar to minerals was significant, and was mainly due to the relatively large increase they produced in sugar percentage. The differences due to time and method of application were small and not significant. The effects of minerals on the tops were negligible.

# KALE

WOBURN

The effect of roots and tops of mustard, tares and lupins used as green manures

WK—Lansome, 1935-1936

Plan and yields in lb.

TA <sub>R</sub>	MR	LO	TA <sub>2</sub> TR	LR	MTR	F	LR	F	MR
79.6	53.9	70.7	127.9	71.7	57.8	62.7	57.8	52.1	50.2
M <sub>2</sub> TR	L <sub>2</sub> TR	TA <sub>1</sub> TR	F	F	LO	M <sub>2</sub> TR	F	TA <sub>O</sub>	TA <sub>R</sub>
86.4	95.3	116.7	76.3	71.7	67.8	80.3	70.3	65.3	72.8
TA <sub>O</sub>	L <sub>2</sub> TR	F	MO	MTR	MO	L <sub>2</sub> TR	L <sub>2</sub> TR	TA <sub>2</sub> TR	TA <sub>1</sub> TR
90.9	112.2	94.2	59.5	57.2	52.7	85.4	101.1	114.3	115.5
L <sub>2</sub> TR	TA <sub>O</sub>	LR	MO	F	L <sub>2</sub> TR	TA <sub>1</sub> TR	F	F	TA <sub>2</sub> TR
108.5	81.1	90.7	63.2	70.9	96.9	114.6	85.8	54.3	149.1
F	MTR	LO	F	TA <sub>1</sub> TR	LO	TA <sub>O</sub>	TA <sub>R</sub>	LR	MO
72.7	68.5	78.7	81.1	93.0	71.4	68.7	87.3	55.4	59.7
TA <sub>2</sub> TR	M <sub>2</sub> TR	MR	L <sub>2</sub> TR	TA <sub>R</sub>	M <sub>2</sub> TR	MR	MTR	F	L <sub>2</sub> TR
157.4	82.3	62.6	115.7	66.8	68.1	44.7	69.8	57.0	108.7

SYSTEM OF REPLICATION : 4 randomised blocks of 15 plots each.

AREA OF EACH PLOT ; 0.00478 acre (242.4 lks. x 118.2 lks.)

TREATMENTS; Green manures ; Fallow (F), tares (TA), lupins (L), mustard (M) Plants pulled up after growing (O), plants cut and removed, but roots left in ground (R), plants ploughed in as grown (TR), plants ploughed in and additional tops from (R) plots also buried (2TR).

BASAL MANURING : Nil.

CULTIVATIONS, ETC. ; Ploughed, rolled and harrowed ; March. Tares drilled ; March 24. Lupins drilled : March 25. Mustard drilled ; April 14. Ploughed in green manures ; June 16. Rolled : June 19. Harrowed and rolled ; June 23. Kale drilled ; June 24. Thinned ; July 22. Hoed ; July 27 and Aug. 10. Harvested ; Jan. 9-15. Variety ; Thousand head. Previous crop ; Sugar beet.

SPECIAL NOTE : This experiment was started with green manures in 1935. The 1935 kale crop was eaten by pigeons and green manures were grown again on the same plots in 1936, followed by kale.

STANDARD ERROR PER PLOT : 0.933 tons per acre or 12.3 per cent.

## Nitrogen buried lb. per acre (1936)

	R	TR	2TR
Mustard ..	2.5	37.4	66.4
Lupins ..	6.0	41.3	77.3
Tares ..	5.7	53.4	105.6

## Summary of results : tons per acre : ±0.466

	Fallow	O	R	TR	2TR	Mean (±0.233)	Increase (±0.329)
Mustard ..	..	5.50	4.94	5.92	7.41	5.94	
Lupins ..	6.62 <sup>1</sup>	6.75	6.44	9.02	10.23	8.11	+2.17
Tares ..	..	7.15	7.16	10.28	12.82	9.35	+3.41
Mean (±0.269)	..	6.62	6.47	6.18	8.41	10.15	7.57
Increase (±0.380)	..	-0.15	-0.44	+1.79	+3.53		

Standard error ; <sup>(1)</sup>±0.269.

## Conclusions

Compared with a fallow, the growing of a green manure crop of mustard, removing the whole plant, produced a significant decrease in the yield of kale of 1.12 tons per acre. The growth of lupins also removing the plant produced little effect and that of tares gave a small increase which was not significant.

The burial of the roots of the green crops produced little effect on the yields of kale, giving on the average a slight but not significant decrease. The burial of the tops gave a significant response, the increase to the double dressing being 1.91 tons per acre for mustard, 3.48 tons for lupins, and 5.67 tons for tares. The response per unit of nitrogen buried was significantly greater for tares, and lupins than for mustard, and was slightly but not significantly greater for tares than for lupins.

**KALE**  
**WOBURN**

**Effect of sulphate of ammonia, poultry manure, soot and rape dust**  
**WK—Lansome, 1936 (3rd year)**  
**Plan and yields in lb.**

1	S <sub>1</sub> 92	N <sub>0</sub> 80	R <sub>1</sub> 122	N <sub>1</sub> 129	S <sub>2</sub> 149	R <sub>1</sub> 113	R <sub>2</sub> 126	S <sub>0</sub> 85	8
	R <sub>2</sub> 80	N <sub>2</sub> 167	M <sub>2</sub> 97	S <sub>2</sub> 96	N <sub>2</sub> 187	M <sub>0</sub> 103	S <sub>1</sub> 127	M <sub>1</sub> 89	
NW	S <sub>0</sub> 75	M <sub>0</sub> 69	R <sub>0</sub> 76	M <sub>1</sub> 76	N <sub>0</sub> 108	R <sub>0</sub> 112	N <sub>1</sub> 133	M <sub>2</sub> 88	
	S <sub>1</sub> 101	M <sub>2</sub> 112	M <sub>0</sub> 84	M <sub>1</sub> 95	N <sub>0</sub> 127	M <sub>1</sub> 123	R <sub>2</sub> 142	S <sub>2</sub> 121	
	R <sub>2</sub> 130	N <sub>0</sub> 105	N <sub>2</sub> 183	S <sub>2</sub> 120	N <sub>2</sub> 207	S <sub>0</sub> 102	M <sub>0</sub> 101	R <sub>0</sub> 105	
41	N <sub>1</sub> 118	R <sub>0</sub> 93	S <sub>0</sub> 93	R <sub>1</sub> 107	S <sub>1</sub> 152	M <sub>2</sub> 125	N <sub>1</sub> 144	R <sub>1</sub> 144	48

SYSTEM OF REPLICATION : 4 randomised blocks of 12 plots each.  
AREA OF EACH PLOT (after rejecting edge rows) : 0.005682 acre. Plots actually 1/160 acre (25 lks. × 25 lks).

TREATMENTS : 1936—No nitrogen (N<sub>0</sub>), 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 (N<sub>1</sub>) or 0.8 cwt. N per acre (N<sub>2</sub>). Plots receiving treatment O in 1936 had treatment 2 in 1935 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 1935 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 : Ploughed in April. Harrowed in April. Seed sown : May 8. Manures applied (sulphate of ammonia at half-rate) : May 8. Singled : June 19. Second half of sulphate of ammonia applied : July 20. Planet hoed : July 27. Harvested : Dec. 28-31.

Variety : Thousand head. Previous crop : Carrots. (See 1935 Report, p.199).  
STANDARD ERROR PER PLOT : 0.934 tons per acre or 10.4%.

**Summary of Results : tons per acre (±0.467)**

Quantity (cwt. N.p.a.)			Sulph. amm.	Soot	Poultry manure	Rape dust	Mean (±0.234)
1934	1935	1936					
0.0	0.8	0.0	8.25	6.97	7.01	7.58	7.45
0.4	0.4	0.4	10.29	9.27	7.52	9.55	9.16
0.8	0.0	0.8	14.61	9.55	8.29	9.39	10.46
Mean (±0.270)			11.05	8.60	7.61	8.84	9.02

**Conclusions**

All four treatments gave a significant response to the 1936 application, the yield with the double dressing of sulphate of ammonia being significantly above those with the double dressings of soot, poultry manure or rape dust. There was no apparent difference in the residual effects of the 1935 applications. Poultry manure was, however, significantly below soot and rape dust on the average of all three types of application.

**KALE**  
**WOBURN**  
**The residual effects of Lupins as green manure**  
**WK—Lansome, 1936**  
**Plan and yields in lb. (green weights)**

	1					4
NW	↑	R	PT	P	O	
		113	156	130	104	
		P	O	PT	R	
		108	120	139	108	
		O	P	R	PT	
		108	129	128	125	
		PT	R	O	P	
		132	132	141	140	16
13						

SYSTEM OF REPLICATION : 4 × 4 Latin square.

AREA OF EACH PLOT (after rejecting edge-rows) : 0.00973 acre. Plots actually 0.0107 acre.

TREATMENTS : Lupins were grown over the whole area in 1934.

O= Whole plant removed.

R= Tops removed, roots only buried.

P= Whole plants buried.

PT= Whole plants and additional tops from plots receiving treatment (R) buried. These treatments were applied to kale sown in 1934. Kale was grown again in 1935 and 1936 without further treatment.

CULTIVATIONS, ETC. : Ploughed : March 13. Harrowed : March 13. Kale sown : Rows 18 inches apart : May 7. Thinned : July 22. Plants 6 inches apart in the rows. Hoed : July 27 and August 10. Harvested : Jan. 5 and 7. Variety : Thousand head. Previous crop : Kale (see 1935 Report, p. 198).

STANDARD ERROR PER PLOT : 0.383 tons per acre or 6.63%.

Treatment.	Nitrogen added per acre (lb.), 1934	
	As tops.	As Roots.
O	—	—
R	—	11.31
P	122.34	11.31
PT	244.77	11.31

**Summary of Results**

Lupins dug in	Yield, tons per acre.	<i>Increase over no dressing.</i>
<i>Mean</i> .. .. .	5.77	
None .. .. .	5.42	
Roots only .. .. .	5.52	+0.10
Whole plant .. .. .	5.82	+0.40
Whole plant and extra tops ..	6.33	+0.91
St. errors.	±0.192	±0.271

**Conclusions**

The yields of kale show a small residual effect of the tops dug in in 1934, there being an increase of 0.4 tons per acre with single tops and 0.9 tons per acre with double tops. Roots had no apparent effect.



## PYRETHRUM

WOBURN

The effect of lime, fish manure and artificial fertilisers on the yield of flowers and their content of Pyrethrins.

ROADPIECE, 1936 (4th year)

Plan and yields—Dry stalkless heads (grammes) above, Pyrethrin 1 content per cent. centre, total Pyrethrins per cent below

1	LOA1	LFO2	OFO2	LOO1	OOA1	LOO1	OOA2	OOO2	8
	838	662	698	809	627	974	561	644	
	0.43	0.43	0.54	0.43	0.41	0.46	0.40	0.47	
	1.03	0.89	1.17	1.04	0.90	1.05	0.92	0.96	
NW	LFO1	OOA2	OOA1	OFA2	OFO1	LOA2	LOA1	LFA1	
	1477	1373	1460	1710	1684	1580	1890	1524	
	0.49	0.49	0.32	0.47	0.39	0.48	0.40	0.43	
	1.00	1.03	0.70	0.92	0.86	0.98	0.90	0.98	
	LFA2	OFO1	LFA1	LOA2	LFO1	LOO2	LFO2	OFA2	
	1791	2175	2471	2279	1913	1949	1889	1790	
	0.51	0.44	0.36	0.51	0.27	0.41	0.39	0.45	
	1.16	0.91	0.84	1.07	0.66	0.91	0.84	1.01	
	OOO1	LOO2	OOO2	OFA1	OFA1	LFA2	OOO1	OFO2	
	1235	1657	1766	1534	1329	1446	1409	1305	
	0.35	0.36	0.33	0.39	0.28	0.36	0.31	0.45	
25	0.78	0.75	0.69	0.80	0.65	0.79	0.68	0.90	32

SYSTEM OF REPLICATION : 2 randomised blocks of 16 plots each.

AREA OF EACH PLOT (after rejecting edge rows) ; 0.00560 acre. Plots actually 29.6 lks. × 22.7 lks.

TREATMENTS :

Lime ; None (O), 2.88 tons equivalent to 4 tons CaCO<sub>3</sub> applied in first year only (L).

Fish manure : None (O), 5 cwt. per acre (0.4 cwt. N) applied in first year only, half this dressing applied every year (F).

Complete artificials ; None (O), sulphate of ammonia (0.4 cwt. N), superphosphate (0.4 cwt. P<sub>2</sub>O<sub>5</sub>) and muriate of potash (0.5 cwt. K<sub>2</sub>O) applied in first year only, half this dressing applied every year (A).

Manures applied : 1st year only 1933 (1), every year (2).

CULTIVATIONS, ETC. ; Hand hoed ; early June. Manures applied ; April 15. Harvested ; July 7-10. Previous crop : Pyrethrum (See 1935 Report, p.201).

STANDARD ERROR PER PLOT : Pyrethrin I. content per cent. 0.0653.

**Summary of results  
Yields of separate treatments**

Manures applied		Neither	Artificials	Fish manure	Artificials and fish manure	Mean
DRY STALKLESS HEADS ;* cwt. per acre						
No lime ..	First year ..	5.04	4.72	5.54	4.99	5.08
	All years ..	5.04	4.45	4.78	4.91	4.71
	Mean ..	5.04	4.58	5.16	4.95	4.90
Lime ..	First year ..	5.50	5.84	4.71	5.78	5.44
	All years ..	5.50	5.54	4.75	4.65	4.98
	Mean ..	5.50	5.69	4.73	5.22	5.21

\* Adjusted for differences between strips 1-8, 9-16 etc. No single standard error is applicable to this table.

PYRETHRIN I. Content per cent.						
No lime ..	First year ..	0.36 <sup>2</sup>	0.36 <sup>1</sup>	0.42 <sup>1</sup>	0.34 <sup>1</sup>	0.37 <sup>3</sup>
	All years ..	0.36 <sup>2</sup>	0.44 <sup>1</sup>	0.50 <sup>1</sup>	0.46 <sup>1</sup>	0.47 <sup>3</sup>
	Mean ..	0.36 <sup>2</sup>	0.40 <sup>2</sup>	0.46 <sup>2</sup>	0.40 <sup>2</sup>	0.42 <sup>4</sup>
Lime ..	First year ..	0.41 <sup>2</sup>	0.42 <sup>1</sup>	0.38 <sup>1</sup>	0.40 <sup>1</sup>	0.40 <sup>3</sup>
	All years ..	0.41 <sup>2</sup>	0.50 <sup>1</sup>	0.41 <sup>1</sup>	0.44 <sup>1</sup>	0.45 <sup>3</sup>
	Mean ..	0.41 <sup>2</sup>	0.46 <sup>2</sup>	0.40 <sup>2</sup>	0.42 <sup>2</sup>	0.43 <sup>4</sup>

Standard errors ; (1) ±0.0462, (2) ±0.0327, (3) ±0.0267, (4) ±0.0189.

TOTAL PYRETHRINS per cent.						
No lime ..	First year ..	0.78	0.80	0.88	0.72	0.80
	All years ..	0.78	0.98	1.04	0.96	0.99
	Mean ..	0.78	0.89	0.96	0.84	0.90
Lime ..	First year ..	0.94	0.96	0.83	0.91	0.90
	All years ..	0.94	1.02	0.86	0.98	0.95
	Mean ..	0.94	0.99	0.84	0.94	0.92

**Effects of artificials and fish manure**

Manures applied	Neither	Artificials	Fish manure	Artificials and fish manure	Mean	Increase
DRY STALKLESS HEADS ; cwt. per acre						
First year .. ..	5.27	5.28	5.12	5.38	5.26	
All years .. ..	5.27	5.00	4.76	4.78	4.85	-0.41
PYRETHRIN I. CONTENT per cent.						
First year .. ..	0.38	0.39	0.40	0.37	0.39	
All years .. ..	0.38	0.47	0.46	0.45	0.46	+0.07
Standard errors ..	±0.0231	±0.0327			±0.0189	±0.0267
TOTAL PYRETHRINS per cent.						
First year .. ..	0.86	0.88	0.86	0.82	0.85	
All Years .. ..	0.86	1.00	0.95	0.97	0.97	+0.12

**Conclusions**

There were no significant effects on the yields of heads. Fish manure and artificials applied in the present year gave a significant increase in pyrethrin I content per cent.