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Other Experiments at Woburn

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SUGAR BEET

WOBURN

Effect of agricultural salt, muriate of potash and of superphosphate, ploughed in in December, or broadcast in January, broadcast in March, broadcast at sowing, and of dung
 WS—Butt Close, 1938
 Plan and yields in lb.

					Roots (dirty)	Tops	Sugar per cent.				Roots (dirty)	Tops	Sugar per cent.					
1	—	—	—	—	M ₃	494	442	16.56	—	Na	—	K	M ₃	530	513	16.50	33	
	D	—	—	K	M ₄	576	565	16.85	—	—	P	K	M ₄	421	430	16.76		
	D	Na	—	—	M ₁	570	594	16.67	D	—	—	—	K	M ₁	556	619	16.07	
	D	Na	—	—	M ₃	568	538	17.34	—	—	—	—	M ₂	524	410	16.82		
	—	Na	—	K	M ₂	518	450	16.79	—	Na	—	K	M ₁	606	512	16.76		
	—	Na	P	—	M ₄	525	449	16.64	—	—	P	K	M ₂	508	399	16.79		
	D	—	P	—	M ₂	538	535	16.82	D	—	—	K	M ₃	548	533	16.82		
	—	Na	P	—	M ₂	520	418	17.02	—	Na	P	—	M ₁	520	402	16.93		
	—	—	P	K	M ₃	518	467	16.85	D	—	P	—	M ₃	550	609	16.01		
	D	—	—	K	M ₂	571	500	16.79	D	Na	—	—	M ₄	561	554	16.39		
	—	Na	—	K	M ₄	469	459	16.62	D	Na	P	K	M ₂	570	653	16.33		
	D	Na	P	K	M ₃	537	539	17.31	D	—	P	—	M ₁	554	527	16.56		
	D	—	P	—	M ₄	566	533	17.19	D	Na	—	—	M ₂	568	597	17.28		
	—	—	P	K	M ₁	474	421	16.79	—	Na	P	—	M ₃	502	430	17.77		
	D	Na	P	K	M ₁	523	570	16.70	—	—	—	—	M ₄	431	392	16.24		
	—	—	—	—	M ₁	418	380	17.04	D	Na	P	K	M ₄	460	520	16.04		
	—	Na	—	—	M ₁	507	556	16.68	—	Na	—	—	M ₂	466	520	16.90		
	D	Na	—	K	M ₄	572	567	16.36	—	Na	P	K	M ₄	485	385	16.73		
	D	Na	P	—	M ₂	512	599	16.07	D	—	—	—	M ₄	502	527	16.87		
	—	—	P	—	M ₄	438	457	15.90	D	Na	P	—	M ₃	487	530	16.10		
	D	—	P	K	M ₃	512	544	16.24	D	—	—	—	M ₂	481	476	16.50		
	—	Na	P	K	M ₁	491	439	15.92	—	Na	—	—	M ₄	394	362	16.68		
	—	—	—	K	M ₂	472	453	16.82	D	Na	P	—	M ₁	459	507	16.42		
	D	—	P	K	M ₁	525	552	16.33	D	—	P	K	M ₂	466	496	16.73		
	—	—	—	K	M ₄	498	479	16.59	—	—	P	—	M ₁	427	385	16.33		
	—	Na	—	—	M ₃	460	451	17.02	D	Na	—	K	M ₁	438	461	16.50		
	D	Na	P	—	M ₄	498	450	15.75	—	—	P	—	M ₃	424	377	16.33		
	—	Na	P	K	M ₃	486	464	16.39	—	Na	P	K	M ₂	476	341	17.02		
	D	—	—	—	M ₃	488	509	16.85	—	—	—	K	M ₃	393	401	16.58		
	D	Na	—	K	M ₂	531	577	16.88	D	Na	—	K	M ₃	398	474	16.10		
	—	—	P	—	M ₂	469	425	16.36	D	—	P	K	M ₄	438	449	15.84		
32	D	—	—	—	M ₁	518	534	16.53	—	—	—	K	M ₁	391	367	17.05	64	

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

AREA OF EACH PLOT (after rejecting two edge rows of each plot) : 1/60 acre. Plots actually 1/40 acre. (183.8 lks. × 13.6 lks.).

TREATMENTS : 4 × 2⁴ 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 cwt. K₂O per acre (K).
 Superphosphate : None, 0.5 cwt. P₂O₅ per acre (P).
 Minerals ploughed in in December (M₁), broadcast in January (M₂), broadcast in March (M₃), broadcast at sowing (M₄).

BASAL MANURING : Sulphate of ammonia at the rate of 0.6 cwt. N per acre.
 CULTIVATIONS, ETC. : Dung applied : Dec. 1. Minerals (M₁) applied : Dec. 1. Ploughed : Dec. 8. Minerals (M₂) applied : Jan. 3. Minerals (M₃) applied : March 29. Harrowed : April 13. Drilled and minerals (M₄) applied : April 13. Rolled : April 13. Harrowed : April 14. Sulphate of ammonia applied : April 14. Hand hoed : May 12-18. Singled : May 19-June 7 and June 15-30. Lifted : Oct. 17-31. Variety : Kleinwanzleben E. Previous crop : Barley.

STANDARD ERRORS PER PLOT : Total sugar : 3.15 cwt. per acre or 7.99%. Tops : 1.14 tons per acre or 8.73%. Mean dirt tare : 0.112.

Effects of mineral manures

	None	Salt	Mur. of pot.	Minerals Salt and mur. of pot.	Super.	Salt and super.	Mur. of pot. and super.	All	Mean
TOTAL SUGAR : cwt. per acre (± 2.23)									
M ₁	..	42.5	37.3	41.0	38.5	39.3	39.5	40.0	39.7 ²
M ₂	..	42.1	41.9	42.4	39.5	40.7	38.4	41.8	41.0 ²
M ₃	..	38.6 ¹	42.9	37.6	36.1	36.2	38.2	41.4	39.2 ²
M ₄	..	37.8	43.0	39.7	39.1	39.2	33.2	37.2	38.5 ²
ROOTS (washed) : tons per acre									
M ₁	..	12.72	11.32	12.31	11.69	11.77	11.93	12.25	12.00
M ₂	..	12.31	12.48	12.59	11.88	12.28	11.44	12.55	12.22
M ₃	..	11.58	12.47	11.25	11.06	11.21	11.25	12.50	11.73
M ₄	..	11.46	12.86	12.04	11.75	12.08	10.17	11.36	11.67
TOPS : tons per acre (± 0.802)									
M ₁	..	15.40	13.21	13.03	12.21	12.17	13.03	13.51	13.22 ⁴
M ₂	..	14.96	12.76	13.75	12.86	13.62	11.99	13.31	13.32 ⁴
M ₃	..	12.29 ³	13.25	12.51	13.22	13.21	12.86	13.54	13.14 ⁴
M ₄	..	12.27	13.98	13.74	13.26	12.04	11.77	12.12	12.74 ⁴
SUGAR PERCENTAGE									
M ₁	..	16.68	16.56	16.63	16.44	16.68	16.56	16.31	16.55
M ₂	..	17.09	16.80	16.84	16.59	16.54	16.76	16.68	16.76
M ₃	..	16.68	17.18	16.70	16.30	16.17	16.94	16.54	16.67
M ₄	..	16.54	16.72	16.49	16.54	16.20	16.30	16.38	16.45

Standard errors : (1) ± 1.12 , (2) ± 0.843 , (3) ± 0.401 , (4) ± 0.303 .

M₁=Minerals ploughed in in December.

M₂=broadcast in January.

M₃=broadcast in March.

M₄=broadcast at sowing.

Differential responses to fertilizers

	Mean response	Differential responses							
		Dung		Salt		Muriate of potash		Superphosphate	
		Absent	Present	Absent	Present	Absent	Present	Absent	Present
TOTAL SUGAR : cwt. per acre (± 1.11 . Means : ± 0.788)									
Dung	+3.0	—	—	+5.4	+0.6	+3.9	+2.1	+4.2	+1.8
Salt	+1.4	+3.8	-1.0	—	—	+1.8	+1.0	+1.2	+1.6
Muriate of potash ..	+0.1	+1.0	-0.8	+0.6	-0.4	—	—	-0.1	+0.3
Superphosphate ..	-1.0	+0.3	-2.2	-1.1	-0.8	-1.2	-0.8	—	—
ROOTS (washed) : tons per acre									
Dung	+1.00	—	—	+1.65	+0.34	+1.25	+0.74	+1.28	+0.71
Salt	+0.38	+1.04	-0.27	—	—	+0.44	+0.33	+0.34	+0.42
Muriate of potash ..	+0.08	+0.34	-0.18	+0.13	+0.03	—	—	+0.08	+0.08
Superphosphate ..	-0.17	+0.12	-0.46	-0.21	-0.13	-0.17	-0.16	—	—
TOPS : tons per acre (± 0.402 . Means : ± 0.284)									
Dung	+2.85	—	—	+3.05	+2.64	+2.95	+2.74	+2.48	+3.22
Salt	+0.58	+0.78	+0.37	—	—	+0.74	+0.42	+1.00	+0.15
Muriate of potash ..	+0.10	+0.20	0.00	+0.26	-0.06	—	—	+0.14	+0.06
Superphosphate ..	-0.39	-0.76	-0.02	+0.03	-0.82	-0.35	-0.44	—	—
SUGAR PERCENTAGE									
Dung	-0.16	—	—	-0.05	-0.26	-0.12	-0.20	-0.05	-0.26
Salt	+0.06	+0.16	-0.04	—	—	+0.17	-0.06	+0.03	+0.08
Muriate of potash ..	-0.05	-0.01	-0.09	+0.06	-0.16	—	—	-0.14	+0.04
Superphosphate ..	-0.17	-0.07	-0.28	-0.20	-0.14	-0.26	-0.08	—	—

Conclusions

Dung produced significant increases of 3.0 cwt. per acre in sugar and 2.85 tons per acre in tops. The response to dung was 5.4 cwt. per acre of sugar in the absence of salt and only 0.6 cwt. per acre in the presence of salt, there being a significant negative interaction.

Minerals gave no significant results in either sugar or tops, though the responses to salt almost reached significance in both cases. The times and methods of application of the minerals had no apparent effect.

SUGAR BEET

WOBURN

Effect of sulphate of ammonia, dung, treated town refuse, superphosphate and muriate of potash

WS—Butt Close, 1938

Plan and yields in lb.

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

67 W ↑ 1 65	H1M1	D1M0	S1M2	D2M0	S0M0	D1M2	D0M0	D2M2	H0M1	91
	252	287	263	257	222	251	208	230	215	
	174	195	200	170	133	167	118	145	122	
	17.83	17.51	17.97	16.99	17.60	17.74	17.28	17.89	18.18	
	353	368	352	358	368	362	361	343	368	
	7.4	1.6	1.7	3.9	4.1	2.5	2.2	3.8	1.9	
	H0M0	S0M1	D2M1	H1M0	H0M2	H2M1	D1M1	H1M2	H2M0	
	237	273	277	275	227	308	257	243	244	
	154	166	199	184	143	221	161	142	184	
	17.60	17.16	18.03	17.37	17.08	17.34	17.80	18.06	17.22	
380	378	357	354	365	345	354	340	324		
4.2	1.3	5.6	4.5	4.4	5.5	3.1	4.7	6.2		
H2M2	S2M0	D0M2	S1M1	D0M1	S2M2	S1M0	S2M1	S0M2		
310	323	252	258	233	304	270	266	210		
243	279	166	190	157	265	197	211	132		
17.54	17.08	17.83	17.63	17.97	17.05	18.03	17.25	17.28		
353	348	370	350	355	339	357	354	345		
6.8	5.5	3.0	4.9	2.5	7.4	2.2	3.1	2.6		

SYSTEM OF REPLICATION : 3 randomized blocks of 9 plots each.

AREA OF EACH PLOT (after rejecting edge-rows) : 0.0101 acre. Plots actually 0.0108 acre.

TREATMENTS : 3 × 3 × 3 factorial design.

Nitrogenous fertilisers : None (0), single dressing (1), double dressing (2), of sulphate of ammonia (S), treated town refuse*(H), dung (D).

The single dressing was 0.4 cwt. N per acre for sulphate of ammonia and 0.8 cwt. for treated town refuse and dung.

Minerals : None (M0), single dressing (M1), double dressing (M2), the single dressing being 0.4 cwt. P₂O₅ and 0.5 cwt. K₂O per acre.

Basal manuring : Nil.

CULTIVATIONS, ETC. : Ploughed : December, 1937 and April 1. Town refuse and dung applied : April 1. Harrowed : April 13. Rolled : April 13. Drilled : April 13. Artificials applied : April 14. Hand-hoed : May 19. Singled : May 26-30 and June 30. Horse-hoed : June 20-30. Lifted : Nov. 2. Variety : Kleinwanzleben E. Previous crop : Barley.

SPECIAL NOTE : * Town refuse screened, and fermented in silos.

STANDARD ERRORS PER PLOT : Total sugar : 2.57 cwt. per acre or 7.45%. Tops : 0.597 tons per acre or 7.60%. Mean dirt tare : 0.133.

Main effects and interactions of amount of nitrogen with kind of nitrogenous manures and minerals

Amount of nitrogen	Sulph. of amm.	Treated town refuse	Dung	None	Minerals Single dressing	Double dressing	Mean	Increase
TOTAL SUGAR : cwt. per acre (± 1.49)								
None		30.5 ¹		29.6	32.7	29.3	30.5 ¹	
Single dressing	36.8	35.3	36.3	38.7	34.8	35.0	36.1 ¹	+ 5.6 ²
Double dressing	37.7	38.0	34.9	35.8	38.0	36.8	36.9 ¹	+ 0.8 ²
Mean	37.2 ³	36.7 ³	35.6 ³	34.7 ¹	35.1 ¹	33.7 ¹	34.5	
Increase		- 0.5 ⁴	- 1.6 ⁴		+ 0.4 ²	- 1.4 ²		
Standard errors : (1) ± 0.857 , (2) ± 1.21 , (3) ± 1.06 , (4) ± 1.48 .								
ROOTS (washed) : tons per acre								
None		8.69		8.46	9.21	8.40	8.69	
Single dressing	10.28	9.95	10.28	10.96	9.80	9.75	10.17	+ 1.48
Double dressing	11.00	10.94	9.90	10.47	10.83	10.55	10.62	+ 0.45
Mean	10.64	10.44	10.09	9.96	9.95	9.58	9.83	
Increase		- 0.20	- 0.55		- 0.01	- 0.37		
TOPS : tons per acre (± 0.345)								
None		6.31 ⁵		5.94	6.53	6.47	6.31 ⁵	
Single dressing	8.61	7.33	7.67	8.45	7.70	7.47	7.87 ⁵	+ 1.56 ⁶
Double dressing	11.07	9.51	7.54	9.29	9.26	9.58	9.37 ⁵	+ 1.50 ⁶
Mean	9.84 ⁷	8.42 ⁷	7.61 ⁷	7.89 ⁵	7.83 ⁵	7.84 ⁵	7.85	
Increase		- 1.42 ⁸	- 2.23 ⁸		- 0.06 ⁶	+ 0.01 ⁶		
Standard errors : (5) ± 0.199 , (6) ± 0.281 , (7) ± 0.244 , (8) ± 0.345 .								
SUGAR PERCENTAGE								
None		17.55		17.49	17.77	17.40	17.55	
Single dressing	17.88	17.75	17.68	17.64	17.75	17.92	17.77	+ 0.22
Double dressing	17.13	17.37	17.64	17.10	17.54	17.49	17.38	- 0.39
Mean	17.50	17.56	17.66	17.41	17.69	17.60	17.57	
Increase		+ 0.06	+ 0.16		+ 0.28	- 0.09		
PLANT NUMBER : thousands per acre								
None		36.0		36.4	36.2	35.5	36.0	
Single dressing	34.8	34.4	35.6	35.5	34.7	34.6	34.9	- 1.1
Double dressing	34.2	33.6	34.8	33.8	34.7	34.0	34.2	- 0.7
Mean	34.5	34.0	35.2	35.2	35.2	34.7	35.0	
Increase		- 0.5	+ 0.7		0.0	- 0.5		
PERCENTAGE OF BOLTERS (± 0.852)								
None		2.91 ⁹		3.50	1.90	3.33	2.91 ⁹	
Single dressing	2.93	5.53	2.40	2.77	5.13	2.97	3.62 ⁹	+ 0.71 ¹⁰
Double dressing	5.33	6.17	4.43	5.20	4.73	6.00	5.31 ⁹	+ 1.69 ¹⁰
Mean	4.13 ¹¹	5.85 ¹¹	3.42 ¹¹	3.82 ⁹	3.92 ⁹	4.10 ⁹	3.95	
Increase		+ 1.72 ¹²	- 0.71 ¹²		+ 0.10 ¹⁰	+ 0.18 ¹⁰		
Standard errors : (9) ± 0.492 , (10) ± 0.696 , (11) ± 0.603 , (12) ± 0.853								

**Interaction of kind of nitrogenous manures with minerals
(adjusted for block differences)**

	None	Minerals Single dressing	Double dressing	None	Minerals Single dressing	Double dressing
	TOTAL SUGAR : cwt. per acre (± 1.66)			ROOTS (washed) : tons per acre		
Sulphate of Ammonia ..	39.6	36.0	36.2	11.26	10.32	10.32
Treated Town Refuse ..	36.2	37.4	36.4	10.46	10.64	10.24
Dung	35.8	35.7	35.1	10.41	9.98	9.88
	TOPS : tons per acre (± 0.385)			SUGAR PERCENTAGE		
Sulphate of Ammonia ..	10.48	9.24	9.81	17.55	17.43	17.52
Treated Town Refuse ..	8.50	8.26	8.49	17.28	17.60	17.80
Dung	7.60	7.94	7.28	17.26	17.91	17.80
	PLANT NUMBER : thousands per acre			PERCENTAGE OF BOLTERS (± 0.955)		
Sulphate of Ammonia ..	34.6	35.2	33.8	4.24	3.94	4.20
Treated Town Refuse ..	33.9	34.0	34.0	5.30	6.09	6.15
Dung	35.4	35.0	35.2	2.40	4.74	3.09

Conclusions

It should be noted that sulphate of ammonia was applied at half rate per unit of N as compared with town refuse and dung.

The nitrogenous fertilizers produced significant increases in total sugar and tops. For sulphate of ammonia and treated town refuse, the double dressing proved as effective as the single dressing per unit of N applied in tops, but somewhat less effective in sugar. For dung, there was no additional response to the double dressing either in sugar or tops.

The average responses in sugar to sulphate of ammonia and treated town refuse were about the same, the response to dung being lower, though not significantly so. The average response in tops to sulphate of ammonia was significantly greater than the responses to the other two fertilizers, and the response to town refuse was significantly greater than that to dung.

All three nitrogenous fertilizers produced significant increases in the percentage of bolters, the average increase being significantly greater with treated town refuse than with sulphate of ammonia or dung.

There were no significant effects of minerals.

KALE

WOBURN

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

WK—Lansome, 1937

Plan and yields in lb.

I	TAR	MR	LO	TA2TR	LR	MTR	F	LR	F	MR	10
	28	48	57	84	62	36	26	20	30	12	
I	M2TR	LTR	TATR	F	F	LO	M2TR	F	TAO	TAR	II
	38	84	78	42	45	17	33	16	10	10	
	TAO	L2TR	F	MO	MTR	MO	LTR	L2TR	TA2TR	TATR	
	44	105	69	51	51	28	90	73	59	28	
	LTR	TAO	LR	MO	F	LTR	TATR	F	F	TA2TR	
	55	14	46	37	37	68	60	44	35	30	
III	F	MTR	LO	F	TATR	LO	TAO	TAR	LR	MO	IV
	26	19	28	14	38	30	26	41	21	6	
	TA2TR	M2TR	MR	L2TR	TAR	M2TR	MR	MTR	F	L2TR	
51	19	14	15	62	12	37	17	24	14	44	60

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

AREA OF EACH PLOT : 0.00478 acre.

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).

DUNG was applied at the rate of 10 tons per acre to blocks I and IV.

BASAL MANURING : Nil.

CULTIVATIONS, ETC.: Ploughed : Feb. 3, 10 and 11. Harrowed, mustard, tares or lupins drilled : April 12. Applied dung : April 13. Tares redrilled : April 21. Mustard redrilled : May 6. Additional mustard and tares drilled : May 10. Green manure crop cut : July 8 and 9. Ploughed : July 10. Harrowed : July 12. Rolled and kale drilled : July 16. Hoed : Aug. 24-31. Singled and transplanted : Sept. 10-13. Kale harvested : Feb. 3 and 4. Variety : Thousand head. Previous crop : Kale.

STANDARD ERRORS PER PLOT : Area with no dung : 1.19 tons per acre or 41.3%. Area with dung : 1.37 tons per acre or 31.8%.

Nitrogen buried : lb. per acre

	No dung				Dung			
	Fallow*	R	TR	2TR	Fallow*	R	TR	2TR
Mustard		2	20	44		2	31	61
Lupins	9	18	156	295	18	16	162	289
Tares		6	43	104		7	61	117

* Nitrogen content of weeds on fallow plots.

Summary of Results : Kale : tons per acre

	Fallow	O	R	TR	2TR	Mean
			No Dung (± 0.842)			
Mustard		3.04	1.26	2.58	2.20	2.27 ²
Lupins	2.34 ¹	2.10	3.08	6.78	6.31	4.57 ²
Tares		1.12	1.02	3.08	3.65	2.22 ²
Mean (± 0.486) ..	2.34	2.09	1.79	4.15	4.05	2.88
			Dung (± 0.969)			
Mustard		2.66	3.04	3.50	3.50	3.18 ⁴
Lupins	3.88 ³	4.06	3.88	7.10	6.96	5.50 ⁴
Tares		3.27	3.22	6.45	5.32	4.56 ⁴
Mean (± 0.559) ..	3.88	3.33	3.38	5.68	5.26	4.31

Standard errors : (1) ± 0.486 , (2) ± 0.421 , (3) ± 0.559 , (4) 0.484.

Conclusions

The yields of kale were very poor. Where whole plants or tops were removed, the growing of green manures produced a small though not significant decrease in yields. The burying of whole plants, with or without extra tops, gave significant increases over fallow of 3.7 tons per acre with lupins and 1.5 tons per acre with tares but no increase with mustard. There was, however, no extra response to the double dressing of tops with either lupins or tares.

Dung applied to whole blocks increased the yields by 1.4 tons per acre. There were no significant differences between the effects of the green manures on the dunged and undunged blocks.

KALE

WOBURN

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

WK—Butt Furlong, 1938
Plan and yields in lb.

1	TAR	MR	LO	TA2TR	LR	MTR	F	LR	F	MR	10
	98	68	94	97	116	75	108	101	94	74	
	M2TR	LTR	TATR	F	F	LO	M2TR	F	TAO	TAR	
	89	102	88	94	98	86	101	91	93	105	
	TAO	L2TR	F	MO	MTR	MO	LTR	L2TR	TA2TR	TATR	
93	(82)	107	91	83	61	124	(100)	92	110		
51	LTR	TAO	LR	MO	F	LTR	TATR	F	F	TA2TR	60
	91	86	101	78	94	118	92	90	97	108	
	F	MTR	LO	F	TATR	LO	TAO	TAR	LR	MO	
	94	76	89	94	90	104	107	101	94	78	
	TA2TR	M2TR	MR	L2TR	TAR	M2TR	MR	MTR	F	L2TR	
91	86	64	(71)	84	91	78	86	98	(102)		

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

AREA OF EACH PLOT : 0.00478 acre.

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 : March 23. Harrowed, rolled and lupins drilled : March 25. Vetches drilled : March 26. Tares, lupins and mustard drilled : May 3-5. Green crops cut : July 11. Ploughed : July 12 and 13. Harrowed, rolled and kale drilled : July 16. Hoed : July 29. Singled and kale transplanted : Aug. 10 and 11. Kale harvested : March 7, 11 and April 14, 1939. Variety : Thousand head. Previous crop : Sugar beet.

SPECIAL NOTES : The yields in brackets in the above plan were seriously affected by heavy snow in December. The tares crop was a failure ; the yields of kale are given above, although all the tares plots received the same treatment.

STANDARD ERROR PER PLOT : 0.756 tons per acre or 8.85%.

Nitrogen added : lb. per acre

	Fallow*	R	TR	2TR
Mustard ..	12	3	40	83
Lupins..	..	11	104	186

* Nitrogen content of weeds on fallow plots.

Summary of Results : Kale : tons per acre (±0.378)

	Fallow	O	R	TR	2TR
Mustard ..	9.04 ¹	7.18	6.62	7.50	8.56
Lupins	8.68	9.64	10.17	†
Mean (±0.267)	9.04 ¹	7.93	8.13	8.84	8.56 ²

Standard errors : (1) ±0.218, (2) ±0.378

† Yields affected by heavy snow.

Conclusions

The growing of a green manure crop of mustard, removing the tops or whole plant, significantly reduced the yields of kale as compared with fallow. Where tops were buried the yields of kale were increased, but even with the burying of the double dressing of tops the yields did not equal those after fallow. Lupins gave about the same yields of kale as fallow when tops were carted off, but a significant increase of 1.1. tons per acre over fallow when tops were buried.

KALE

WOBURN

Effect of sulphate of ammonia, poultry manure, soot, rape dust and dung

WK—Lansome, 1938 (5th year)

Plan and yields in lb.

1	D ₄	N ₂	D ₂	N ₁	D ₂	D ₂	O	S ₂	8
	85	116	76	79	67	54	40	90	
NW	D ₂	O	O	O	O	M ₂	O	D ₄	8
	53	40	41	31	43	70	38	68	
↑	S ₂	M ₂	R ₂	O	N ₂	R ₂	N ₁	O	8
	88	78	84	41	107	90	66	27	
41	O	D ₂	M ₂	O	N ₂	D ₄	O	O	48
	31	52	89	43	139	84	45	39	
↑	O	N ₂	O	D ₂	O	S ₂	M ₂	R ₂	48
	23	109	47	53	54	103	89	112	
41	N ₁	R ₂	S ₂	D ₄	D ₂	O	N ₁	D ₂	48
	61	90	96	91	82	50	97	81	

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

AREA OF EACH PLOT (after rejecting edge rows) : 1/192 acre. Plots actually 1/160 acre (25 lks. x 25 lks.).

TREATMENTS, 1938 : None, sulphate of ammonia at 0.4 cwt. and 0.8 cwt. N per acre (N₁, N₂) half in seed bed and half as top dressing, poultry manure (M₂), soot (S₂), rape dust (R₂) all at 0.8 cwt. N per acre and applied in seed bed, and dung at 0.8 cwt. and 1.6 cwt. N per acre (D₂, D₄) ploughed in.

BASAL MANURING : Superphosphate and muriate of potash applied to every plot to give a total of 1.0 cwt. P₂O₅ and 1.0 cwt. K₂O per acre, including the P₂O₅ and K₂O in the organic fertilizers.

CULTIVATIONS, ETC. : Dung applied : Feb. 17. Ploughed : Feb. 21 and 22. Rolled and harrowed : June 7. Manures applied (sulphate of ammonia at half rate) : June 7. Seed sown : June 7. Second half sulphate ammonia applied as top dressing : July 12. Cut : Dec. 6, Jan. 10, 12 and 13. Variety : Thousand head. Previous crop : Kale (see 1937 Report, p. 167).

STANDARD ERROR PER PLOT : 0.700 tons per acre or 11.8%.

Summary of results

cwt. N per acre	Nil	Sulphate of ammonia		Poultry manure	Soot	Rape dust	Dung	
		0.4	0.8	0.8	0.8	0.8	0.8	1.6
Kale : tons per acre	3.39 ¹	6.49 ³	10.09 ³	6.99 ³	8.08 ³	8.06 ³	5.55 ²	7.03 ³
Standard errors : (1) ±0.175, (2) ±0.247, (3) ±0.350.								

Conclusions

All dressings produced significant increases in yield. At the 0.8 cwt. N per acre level of dressing, sulphate of ammonia gave a significantly higher yield than any of the other manures ; soot and rape dust gave significantly higher yields than poultry manure and poultry manure gave a significantly higher yield than dung.

At both levels of application, sulphate of ammonia proved significantly more effective than a dressing of dung containing twice the amount of N per acre.

LUCERNE

WOBURN

Influence of dung on effectiveness of inoculation

Stackyard, 1938

Plan and yields of hay in lb. per plot

1	OD ₁	ID ₁	ID ₂	OD ₀	ID ₀	OD ₂	6
	60.4	56.8	38.4	56.1	44.7	35.6	
	OD ₀	ID ₂	ID ₀	OD ₁	ID ₂	OD ₁	
	70.8	62.9	45.6	51.7	39.9	25.0	
	OD ₂	ID ₀	ID ₁	OD ₂	ID ₁	OD ₀	
	64.7	61.2	57.4	50.9	24.1	24.2	
31	ID ₁	OD ₂	OD ₀	ID ₂	ID ₁	OD ₂	36
	76.3	87.0	71.3	64.4	40.9	64.5	
	ID ₀	OD ₀	OD ₁	ID ₀	ID ₂	OD ₀	
	65.6	76.3	74.4	68.6	72.9	65.8	
	ID ₂	OD ₁	OD ₂	ID ₁	ID ₀	OD ₁	
	59.9	67.4	69.6	61.9	44.6	55.5	

SYSTEM OF REPLICATION : 6 randomized blocks of 2 plots each, the plots being split for dung at the rates of 0, 5 and 20 tons per acre.

AREA OF EACH SUB-PLOT : 1/100 acre.

TREATMENTS : (applied in 1937). 3 × 2 factorial design.

Inoculated (I), not inoculated (O).

Dung : None, 5 tons, 20 tons per acre (D₀, D₁, D₂).

BASAL MANURING : 10 cwt. lime per acre, applied Feb. 25, 1938.

CULTIVATIONS, ETC. : 1937 : Ploughed : March 24 and April 22. Springtine harrowed : April 29, May 3 and 4. Rolled : May 3 and 4. Seed sown : May 4. Dung applied : May 4. Hoed : June 14-17, 20, 21 and July 7-20. Cut : Aug. 23. Variety : Provence. Previous crop : Wheat (1936).

1938 : Harrowed : Jan. 7 and Feb. 21. Lime applied : Feb. 25. Harrowed : March 2 and 28. 1st Cut : July 18. Harrowed : July 20. 2nd Cut : Sept. 15. Harrowed : Sept. 16 and 22. 3rd Cut : Nov. 24.

SPECIAL NOTE : A preliminary cut was taken in August, 1937, the average yield being 6 cwt. hay per acre.

STANDARD ERRORS : Per whole plot : 4.01 cwt. per acre or 8.02%. Per sub-plot : 7.62 cwt. per acre or 14.9%.

Summary of Results

HAY : cwt. per acre (±2.84*, ±3.11†).

	None	Dung 5 tons	20 tons	Mean (±1.64*)	Increase (±2.32*)
Not Inoculated	54.2	49.8	55.4	53.1	
Inoculated	49.2	47.2	50.4	48.9	- 4.2
Mean (±2.20†)	51.7	48.5	52.9	51.0	
Increase (±3.11†)		- 3.2	+ 4.4		

* For comparisons involving the mean of no dung and dung treatments.

† For comparisons involving the differences of no dung and dung treatments.

Conclusions

Inoculation resulted in a decrease of 4.2 cwt. of hay per acre though this amount was not quite significant. Dung produced no significant effects,