ROTHAMSTED RESEARCH

Report for 1934

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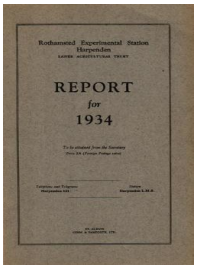

Other Experiments at Rothamsted

Rothamsted Research

Rothamsted Research (1935) *Other Experiments at Rothamsted ;* Report For 1934, pp 181 - 194 **-**
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WHEAT

Effect of sulphate of ammonia applied at seven different times

RW—Long Hoos VII, 1934

Plan and sample weights in grammes, grain above, straw below

1								8
5 1,552 2,693	**7** 1,870 2,579	**1** 1,716 2,998	**2** 1,695 2,474	**3** 1,667 2,465	**0** 1,604 2,141	**4** 1,483 2,020	**6** 1,435 2,060	
6 1,408 2,154	**3** 1,879 3,026	**0** 1,821 2,666	**7** 1,727 2,339	**2** 1,797 2,585	**1** 1,696 2,298	**5** 1,698 2,236	**4** 1,588 2,270	
0 1,778 2,825	**6** 1,701 2,561	**2** 1,587 2,407	**1** 1,663 2,732	**4** 1,636 2,626	**7** 1,454 2,072	**3** 1,536 2,137	**5** 1,883 2,569	
N ↑ **3** 1,816 2,848	**4** 1,730 2,990	**7** 1,595 2,492	**5** 1,814 2,653	**1** 1,585 2,332	**6** 1,894 2,617	**2** 2,077 2,769	**0** 1,134 1,786	
1 1,634 2,411	**2** 1,909 2,987	**4** 1,834 3,098	**6** 1,794 2,833	**0** 1,387 2,015	**5** 1,472 2,067	**7** 1,693 2,270	**3** 1,609 2,425	
4 1,801 2,668	**0** 1,579 2,674	**5** 1,838 2,858	**3** 1,944 3,034	**6** 1,530 2,099	**2** 1,578 2,640	**1** 1,688 2,640	**7** 1,798 2,851	
7 1,917 2,954	**1** 1,776 2,637	**6** 1,753 2,484	**4** 1,567 2,508	**5** 1,685 3,031	**3** 1,879 2,601	**0** 1,715 2,399	**2** 1,780 2,726	
2 1,641 2,504	**5** 1,661 2,438	**3** 1,519 1,561	**0** 1,856 2,694	**7** 1,885 2,689	**4** 1,728 2,566	**6** 1,329 1,894	**1** 1,870 2,840	
57								64

SYSTEM OF REPLICATION : 8 × 8 Latin square.
AREA OF EACH PLOT : 0.01928 acre (30 ft. × 28 ft.).
TREATMENTS : No sulphate of ammonia (O) and sulphate of ammonia at the rate of 0.3 cwt. N per acre, applied on October 12 (1), December 7 (2), January 18 (3), March 1 (4), April 12 (5), May 10 (6), and June 7 (7).
CULTIVATIONS, ETC. : Ploughed : September 26-30. Harrowed : October 10. Seed sown : October 12. Harrowed : April 7. Rolled : April 16. Harvested : August 6. Plots harvested by sampling method (24 metre lengths per plot, drills set 6 ins. apart). Variety : Victor. Previous crop : Beans.
STANDARD ERRORS PER PLOT : Grain : 3.94 cwt. per acre or 10.7%. Straw : 7.07 cwt. per acre or 12.9%.

Summary of results : cwt. per acre

	No N	Oct. 12	Dec. 7	Jan. 18	Mar. 1	Apr. 12	May 10	June 7	*Mean of all N*	*St. error*
GRAIN (±1.39) ..	35.0	37.1	38.3	37.7	36.4	37.0	35.0	37.9	*37.1*	*±0.525*
Increase (±1.97)		*+2.1*	*+3.3*	*+2.7*	*+1.4*	*+2.0*	*0.0*	*+2.9*		
STRAW (±2.50) ..	52.3	56.9	57.4	54.7	56.5	55.9	50.9	55.1	*55.3*	*±0.945*
Increase (±3.54)		*+4.6*	*+5.1*	*+2.4*	*+4.2*	*+3.6*	*−1.4*	*+2.8*		

Conclusions

The average increase due to sulphate of ammonia is not significant, nor is there any evidence that the effect varies with time of application.

https://doi.org/10.23637/ERADOC-1-66

POTATOES

Effect of time of ploughing and dung application
Comparison of fresh and rotted dung
Effect of sulphate of ammonia

RP—Long Hoos III, 1934

Plan and yields in lb.

55				28				1
—	F	ASL 208		—	F	ASL 224		— — ASE 178
N_2	—	SL 168		N_1	R	ASL 274		N_1 R SL 233
N_1	F	SL 247		N_2	—	ASL 248		N_2 — SL 235
N_2	R	ASL 249		N_1	—	SL 219		N_2 R ASE 256
N_1	R	ASE 264		N_2	R	ASE 292		N_1 F ASE 282
N_2	F	ASE 295		—	R	SL 233		— R ASL 241
N_1	—	ASL 232		N_1	F	ASE 269		N_2 F ASL 260
—	R	SL 251		N_2	F	SL 238		N_1 — ASL 209
—	—	ASE 205		—	—	ASE 200		— F SL 235
N_2	R	ASE 306		N_1	F	ASL 282		N_2 F ASE 304
W —	F	ASE 237		N_2	R	ASL 296		N_1 — ASE 221
—	R	ASL 243		N_2	—	SL 251		N_2 — ASL 239
—	—	SL 188		N_1	—	ASE 231		— R ASE 238
N_2	—	ASL 262		N_2	F	ASE 303		N_1 F SL 288
N_1	—	ASE 249		—	F	SL 263		— F ASL 254
N_1	F	ASL 341		N_1	R	SL 301		N_1 R ASL 280
N_2	F	SL 325		—	—	ASL 241		N_2 R SL 308
N_1	R	SL 317		—	R	ASE 298		— — SL 200
N_2	—	ASE 233		N_2	—	ASE 251		— R SL 245
N_2	R	SL 284		N_1	F	SL 269		N_2 F SL 265
N_1	F	ASE 278		N_1	—	ASL 220		— — ASL 191
—	F	SL 252		—	F	ASE 252		N_1 F ASL 296
N_1	R	ASL 292		—	R	ASL 257		— F ASE 250
—	—	ASL 197		N_1	R	ASE 280		N_2 — ASE 249
—	R	ASE 259		N_2	F	ASL 312		N_1 — SL 245
N_1	—	SL 251		N_2	R	SL 297		N_2 R ASL 313
81 N_2	F	ASL 300	54	—	—	SL 204	27	N_1 R ASE 292

→ Bouts

SYSTEM OF REPLICATION : 9 randomised blocks of 9 plots each. Certain high order interactions partially confounded with block differences.

AREA OF EACH PLOT : 1/100th acre (95.2 lks. × 17.5 lks., 5 rows per plot, of which the 3 middle rows were harvested).

TREATMENTS : All combinations of :

(*a*) Land ploughed in autumn and spring, dung applied in autumn (ASE), ploughed in autumn and spring, dung in spring (ASL) and ploughed in spring, dung in spring (SL).

(*b*) No dung (—), 20 tons per acre fresh dung (F) and rotted dung derived from 20 tons of fresh dung (R).

(*c*) No sulphate of ammonia (—), sulphate of ammonia at the rate of 0.4 cwt. N per acre (N_1) and 0.8 cwt. N per acre (N_2).

BASAL MANURING : 0.5 cwt. P_2O_5 per acre as superphosphate and 1.0 cwt. K_2O per acre as sulphate of potash.

CULTIVATIONS, ETC. : Autumn fresh and rotted dung applied : November 22. Autumn ploughed: November 24-25. Spring rotted dung applied : April 10. Spring fresh dung applied : April 12. Spring ploughed : April 13-14. Disc harrowed : April 19. Tooth harrowed : April 19. Rolled : April 25. Ridged : April 28 and 30. Artificials applied : April 30 and May 1. Potatoes planted : May 1-2. Harrowed : May 19. Grubbed : May 28, June 6 and July 6. Earthed up : June 18 and July 10. Lifted : October 12, 13 and 15. Variety : Ally. Previous crop : Oats.

STANDARD ERROR PER PLOT : 0.824 tons per acre, or 7.21 %.

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Yields of separate treatments (block effects eliminated) : tons per acre

Times of ploughing	Dung applied	No dung			Fresh dung			Rotted dung		
		Sulph.amm. (cwt.N)			Sulph.amm. (cwt.N)			Sulph.amm. (cwt.N)		
		0.0	0.4	0.8	0.0	0.4	0.8	0.0	0.4	0.8
Autumn & spring	Autumn	9.28	10.06	10.85	10.47	12.88	13.41	11.54	12.56	12.88
	Spring				10.66	13.00	13.20	10.88	12.77	12.74
Spring ..	Spring	8.30	10.80	10.08	11.23	12.10	12.11	11.29	12.37	13.09

Main effects and interaction of dung and sulphate of ammonia, tons per acre (±0.275)

Sulphate of Ammonia	None	Dung Fresh	Rotted	*Mean (±0.159)*	*Increase (±0.225)*
0.0 cwt. N	8.95	10.79	11.24	*10.32*	
0.4 cwt. N	10.30	12.66	12.56	*11.84*	*+1.52*
0.8 cwt. N	10.60	12.91	12.90	*12.14*	*+0.30*
Mean (±0.159) ..	*9.95*	*12.12*	*12.23*	*11.43*	
Increase (±0.225) ..		*+2.17*	*+2.28*		

Main effects of times of ploughing and interaction with dung, tons per acre (±0.275)

Times of Ploughing	Dung applied	No dung	Dung Fresh	Dung Rotted	*Mean of dung (±0.194)*
Autumn and Spring ..	Autumn	10.06[1]	12.25	12.33	*12.29*
..	Spring		12.29	12.13	*12.21*
Spring	Spring	9.73	11.82	12.25	*12.04*

[1] Standard error : ±0.194.

Interaction of times of ploughing with sulphate of ammonia, tons per acre

Times of ploughing	Sulphate of Ammonia 0.0 cwt. N	0.4 cwt. N	0.8 cwt. N	Standard error
Autumn and spring	10.35	11.88	12.32	±0.194
Spring	10.27	11.76	11.76	±0.275

Conclusions

There was a significant increase of 1.52 tons per acre to the first dressing (0.4 cwt. N per acre) of sulphate of ammonia. The small additional increase of 0.30 tons per acre to the second dressing was not significant and was significantly less than the response to the first dressing. The dressing of dung (20 tons per acre) gave a significant increase of 2.23 tons per acre, but there was no difference in effect of fresh and rotted dung, or of the autumn and spring applications. The additional ploughing in autumn had little effect either in the presence or absence of dung, the weighted mean of the increases due to it being 0.23 tons per acre with a standard error of ±0.213.

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SUGAR BEET

Effect of spring ploughing in addition to autumn ploughing, of potassium and sodium chlorides applied before spring ploughing and at sowing, and of intensive inter-row cultivation.

RS—LONG HOOS 1, 1934
Plan and yields in lb.

		Roots (dirty)	Tops	Sugar per cent.	Plant number
32	S — — L —	605	582	17.48	466
	— — Na L C	542	525	17.25	500
	S K — E C	577	508	17.74	466
	S K Na L —	610	554	17.89	451
	— K — L C	539	475	17.86	460
	— K Na E —	631	490	17.94	496
	— — — E —	568	418	18.45	469
	S — Na E C	533	411	17.71	444
	— K Na L —	662	535	18.12	506
	S — — E —	562	492	17.05	455
	— — — L —	621	502	17.80	479
	S — Na L C	597	552	17.14	494
	S K Na E —	656	538	17.94	458
	S K — L C	608	582	16.93	467
	— — Na E C	585	532	17.51	468
	— K — E C	561	510	17.86	488
	— K — E —	632	544	17.94	487
	— K Na L C	542	451	17.16	456
	S K — L —	566	454	18.12	473
	S — — E C	524	390	17.14	435
	S — Na L —	608	482	17.68	479
	— — Na E —	499	546	18.06	462
	— — — L C	514	453	17.48	424
	S K Na E C	555	447	18.20	434
	— — Na L —	499	438	17.48	401
	S K — E —	558	417	17.97	436
	— — — E C	524	386	17.77	421
	— K — L —	579	435	18.35	400
	— K Na E C	500	430	17.71	451
	S — Na E —	587	494	17.71	435
	S — — L C	483	454	17.71	408
1	S K Na L C	535	550	17.14	456

E

		Roots (dirty)	Tops	Sugar per cent	Plant number
	— — — E —	566	551	16.73	471
	— — Na L C	581	518	17.74	438
	S — — L C	527	474	17.57	414
	— K Na L —	777	440	17.86	455
	S K — L —	616	486	17.86	431
	S — Na E —	630	478	18.06	470
	— K — E C	555	473	17.86	435
	S K Na E C	596	512	17.48	461
	— — — L C	545	535	17.34	422
	S K Na L —	672	584	17.40	429
	— — Na E —	610	462	17.89	446
	— K Na E C	553	469	17.63	471
	S — — E —	648	478	17.92	474
	— K — L —	667	581	17.84	482
	S K — E C	632	538	17.37	492
	S — Na L C	610	541	17.40	458
	S — Na E C	547	466	17.74	517
	— K — E —	600	499	17.02	484
	S K — L C	516	458	17.40	517
	— K Na L C	551	480	17.97	502
	S K Na E —	564	456	18.32	517
	— — — E C	486	430	17.08	511
	S — — L —	565	538	17.42	478
	— — Na L —	555	526	17.94	492
	— K Na E —	534	416	18.58	468
	S K — E —	545	402	18.35	467
	— — Na E C	351	358	18.00	485
	— — — L —	553	446	18.32	469
	S K Na L C	369	488	18.46	477
	S — Na L —	684	458	17.89	478
	— K — L C	471	385	17.60	493
64	S — — E C	500	379	17.74	465
33					

https://doi.org/10.23637/ERADOC-1-66

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

AREA OF EACH PLOT : 0.015 acre after rejecting edge rows. Plots actually 12.6 links × 198.4 links rows.

TREATMENTS : All combinations of :

{Not spring ploughed (—) / Spring Ploughed (S)} × {No potassium chloride (—) / Potassium Chl. (0.75 cwt. Cl) (K)} × {No sodium chloride (—) / Sodium chloride (0.75 cwt. Cl) (Na)}

× {Minerals applied early (E) / Minerals applied late (L)} × {Ordinary cultivation (—) / Intensive cultivation (C)}

BASAL MANURING : 0.5 cwt. P_2O_5 as superphosphate and 0.6 cwt. N as sulphate of ammonia, per acre.

CULTIVATIONS, ETC. : Ploughed : November 4th-7th. Early manures applied : March 28th. Spring ploughed : April 3rd-4th. Drag-harrowed : April 24th. Cultivated with tractor : May 2nd. Late manures applied : May 8th. Harrowed : May 9th. Rolled : May 10th. Seed sown : May 10th. Harrowed : May 12th. Rolled : May 15th. Hoed : June 4th. Singled : June 29th-July 3rd. Plants 10 inches apart. Motor-hoed (intensive cultivation plots) : July 7th, 17th and 27th, August 8th, 18th and 31st. Hoed : July 31st. Lifted : November 16th-27th. Variety : Kleinwanzleben E. Previous crop : Spring oats.

STANDARD ERRORS PER PLOT : Roots (washed) : 1.07 tons per acre or 6.99%. Tops : 1.24 tons per acre or 8.64%. Sugar percentage : 0.385. Plant number : 1.35 thousands per acre or 4.38%. Mean dirt tare : 0.0909.

Yields of Separate Treatments (block effects eliminated)

ROOTS washed—tons per acre

	No potassium chloride				Potassium chloride			
	No sodium chloride		Sodium Chloride		No sodium chloride		Sodium chloride	
	Ordinary cultivation.	Intensive cultivation.	Ordinary cultivation.	Intensive cultivation.	Ordinary cultivation.	Intensive cultivation.	Ordinary cultivation.	Intensive cultivation.
Not spring ploughed—								
Minerals early	15.58	14.03	14.60	13.20	17.47	14.08	16.71	13.52
Minerals late			14.73	14.58	16.13	14.61	18.45	15.59
Spring ploughed—								
Minerals early	15.59	14.26	16.03	14.91	16.05	15.45	16.40	15.46
Minerals late . .			18.93	15.02	15.88	15.10	16.44	13.35

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Responses to Treatments

MEAN YIELDS: Roots (washed): *15.36 tons*; Tops: *14.36 tons*; Sugar percentage: *17.72*; Total sugar: *54.5 cwt.*; Plant number: *30.9 thousands.*

	Mean response	Differential responses							
		Potassium chloride		Sodium chloride		Spring ploughing		Cultivation	
		Absent	Present	Absent	Present	Absent	Present	Ordinary	Intensive
ROOTS (washed): tons per acre (±0.379. *Means: ±0.268*)									
Potassium chloride	*+0.61*	—	—	+0.73	+0.49	+1.28	−0.06	+0.86	+0.36
Sodium chloride	*+0.26*	+0.38	+0.14	—	—	−0.02	+0.54	+0.55	−0.03
Spring ploughing	*+0.36*	+1.03	−0.31	+0.09	+0.64	—	—	+0.21	+0.52
Intensive cultivation ..	*−1.79*	−1.54	−2.04	−1.50	−2.08	−1.95	−1.63	—	—
TOPS: tons per acre (±0.438. *Means: ±0.310*)									
Potassium chloride	*+0.27*	—	—	+0.45	+0.10	−0.02	+0.57	−0.11	+0.66
Sodium chloride	*+0.34*	+0.52	+0.17	—	—	−0.01	+0.70	+0.13	+0.56
Spring ploughing	*+0.38*	+0.08	+0.67	+0.02	+0.73	—	—	+0.12	+0.64
Intensive cultivation ..	*−0.53*	−0.94	−0.14	−0.73	−0.31	−0.78	−0.26	—	—
SUGAR PERCENTAGE (±0.136. *Means: ±0.096*)									
Potassium chloride	*+0.18*	—	—	+0.19	+0.16	+0.15	+0.20	+0.23	+0.13
Sodium chloride	*+0.12*	+0.14	+0.10	—	—	+0.10	+0.14	+0.13	+0.11
Spring ploughing	*−0.07*	−0.10	−0.04	−0.09	−0.05	—	—	−0.08	−0.06
Intensive cultivation ..	*−0.27*	−0.22	−0.32	−0.26	−0.28	−0.28	−0.26	—	—
TOTAL SUGAR: cwt. per acre									
Potassium chloride	*+2.7*	—	—	+3.1	+2.3	+5.0	+0.4	+3.8	+1.6
Sodium chloride	*+1.3*	+1.7	+0.9	—	—	+0.3	+2.4	+2.4	+0.2
Spring ploughing	*+1.1*	+3.4	−1.2	0.0	+2.1	—	—	+0.5	+1.7
Intensive cultivation ..	*−7.2*	−6.1	−8.3	−6.1	−8.3	−7.8	−6.6	—	—
PLANT NUMBER: thousands per acre (±0. 478. *Means: ±0.338*)									
Potassium chloride	*+0.5*	—	—	+0.9	+0.1	+0.7	+0.3	0.0	+0.9
Sodium chloride	*+0.4*	+0.9	−0.1	—	—	+0.4	+0.4	+0.1	+0.8
Spring ploughing	*−0.2*	0.0	−0.4	−0.2	−0.2	—	—	−0.3	−0.1
Intensive cultivation ..	*−0.1*	−0.5	+0.4	−0.4	+0.3	−0.2	0.0	—	—

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Main Effects and Interactions of Times of Application of Minerals

Minerals applied	No spring Plough-ing	Spring plough-ing	Ordinary cultiva-tion	Inten-sive cultiva-tion	Sodium chloride	Potas-sium chloride	Both chlorides	*Mean*	*Increase*
ROOTS (washed) : tons per acre									
Early	14.81	15.58	15.88	14.51	14.68	15.76	15.52	*15.32*	
Late ..	15.56	15.51	16.64	14.42	15.82	15.43	15.96	*15.74*	*+0.42*
St. error	±0.268				±0.379			*±0.219*	*±0.310*
TOPS : tons per acre									
Early	13.98	13.78	14.29	13.46	13.94	14.48	13.98	*14.13*	
Late ..	14.37	15.32	14.96	14.73	15.03	14.34	15.19	*14.85*	*+0.72*
St. error	±0.310				±0.438			*±0.253*	*±0.358*
SUGAR PERCENTAGE									
Early	17.74	17.78	17.87	17.66	17.84	17.76	17.98	*17.86*	
Late ..	17.77	17.59	17.84	17.51	17.56	17.74	17.75	*17.68*	*−0.18*
St. error	±0.096				±0.136			*±0.078*	*±0.111*
TOTAL SUGAR : cwt. per acre									
Early	52.5	55.4	56.8	51.2	52.4	56.0	55.8	*54.7*	
Late ..	55.3	54.6	59.4	50.5	55.6	54.7	56.7	*55.7*	*+1.0*
PLANT NUMBER : thousands per acre.									
Early	31.2	31.0	31.2	31.0	31.0	31.3	31.3	*31.2*	
Late ..	30.8	30.7	30.7	30.8	31.2	31.0	31.1	*31.1*	*−0.1*
St. error	±0.338				±0.478			*±0.276*	*±0.390*

In the above table, the effects of early and late application of minerals have been estimated as straight means over the plots receiving NaCl, KCl and both chlorides. The interactions of the effect of time of application with spring ploughing and intensive cultivation are partially confounded with blocks. In showing these effects in the above tables the method of adjustment for block differences has been to include the plots receiving neither chloride. To estimate the interactions, the values obtained by the usual process should therefore be multiplied by four-thirds.

Conclusions

Potassium chloride gave a significant increase in the roots and an almost significant increase in sugar percentage. Both increases were quite small, however, the corresponding increase in total sugar being 2.7 cwt. per acre or 5 per cent. The interaction between potassium chloride and the additional spring ploughing was significant, spring ploughing having apparently nullified any increase given by potassium chloride. This effect, however, appeared only in a small group of plots —those receiving sodium chloride applied late—so that its reality is doubtful.

There were no significant responses to sodium chloride.

The application of manures at sowing instead of before the spring ploughing significantly decreased the sugar percentage but produced very little difference in the yield of total sugar.

The additional spring ploughing had no effect.

Intensive cultivation proved much inferior to ordinary, giving significant decreases in both roots and sugar percentage. The resultant decrease in total sugar was 7.2 cwt. per acre or 12 per cent.

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SUGAR BEET

Effect of spacing of rows, of application of sulphate of ammonia and dung, and of additional heavy rolling of the seed-bed.

RS—LONG HOOS I, 1934

Plan and yields in lb.

		Roots (dirty)	Tops	Sugar per cent.	Plant number			Roots (dirty)	Tops	Sugar per cent.	Plant number	
88	S_{15} N D —	427	492	16.99	548		S_{15} N D —	475	450	16.82	589	112
	S_{20} — D R	408	294	17.05	419		S_{20} N — —	426	351	16.93	373	
	S_{10} N — —	494	453	16.39	1,051		S_{10} N — R	490	408	16.88	1,019	
	S_{15} N — R	424	364	17.08	632		S_{20} — — R	339	198	17.17	370	
	S_{20} — — —	376	231	17.02	410		S_{15} N — R	445	372	17.54	591	
	S_{10} — — R	423	319	17.17	1,082		S_{10} — D R	467	378	17.05	1,052	
	S_{15} — D R	446	322	17.42	634		S_{15} — D R	486	322	17.22	583	
	S_{20} N — R	419	326	16.36	384		S_{15} — — —	424	248	17.17	536	
	S_{10} — D —	501	404	17.17	1,072		S_{20} N D R	470	446	17.02	370	
	S_{15} — — —	472	320	17.34	589	E	S_{10} N D —	669	625	16.65	1,017	
	S_{10} N D R	602	558	16.68	1,083	↑	S_{20} — D —	489	298	17.37	364	
	S_{20} N D —	448	424	16.65	401		S_{10} — — —	543	353	17.14	987	
	S_{15} — D —	427	302	17.11	626		S_{20} — — —	435	256	18.00	366	
	S_{10} N — R	504	407	17.28	1,041		S_{20} N D —	553	424	17.17	365	
	S_{20} — — R	416	184	16.53	403		S_{15} — — R	491	276	17.66	587	
	S_{20} N D R	494	402	16.27	384		S_{15} — D —	542	344	17.42	589	
	S_{15} N D R	503	418	17.11	617		S_{10} N D R	627	483	17.02	1,134	
	S_{10} N D —	511	435	16.73	1,013		S_{10} — — R	470	282	17.42	1,137	
	S_{10} — D R	406	298	17.17	1,059		S_{20} — D R	465	233	17.40	584	
	S_{20} — D —	376	200	16.73	373		S_{10} — D —	566	322	16.91	1,046	
	S_{15} N — —	450	352	16.73	542		S_{15} N D R	564	413	17.25	580	
	S_{10} — — —	462	294	17.34	969		S_{10} N — —	641	468	16.96	957	
65	S_{15} — — R	324	178	17.76	525		S_{15} N — —	534	348	16.73	498	89
	S_{20} N — —	381	332	16.27	324		S_{20} N — R	529	438	17.00	346	

SYSTEM OF REPLICATION : 4 randomised blocks of 12 plots each. Certain high order interactions are partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge rows) : 10 inch spacing : 0.01515 acre ; 15 inch spacing : 0.01364 acre ; 20 inch spacing : 0.01212 acre. Plots actually 15.2 lks. x 120 lks. rows.

TREATMENTS : All combinations of :

{10 inch spacing (S_{10}) / 15 inch spacing (S_{15}) / 20 inch spacing (S_{20})} × {No sulph. amm. / Sulph. Amm. (0.6 cwt. N) (N)} × {No additional heavy rolling. / Additional heavy rolling (R)} × {No dung (—) / 10 tons dung (D)}

BASAL MANURING : 1.0 cwt. K_2O per acre as 30% potash manure salt and 0.5 cwt. P_2O_5 as superphosphate.

CULTIVATIONS, ETC. : Dung and basal manures applied : Feb. 14. Ploughed : Feb. 15-16. Sulphate of ammonia applied : May 8. Harrowed : May 9. Seed sown : May 14. Harrowed : May 14. Rolled : May 15. Horse-hoed (wide rows) : June 2. Singled : July 3-11. Plants 10 ins. apart. Hoed : July 31. Lifted : Nov. 28-Dec. 7. Variety : Kleinwanzleben E. Previous crop : Spring oats.

STANDARD ERRORS PER PLOT : Roots (washed) : 1.10 tons per acre or 7.86%. Tops : 1.23 tons per acre or 10.6%. Sugar percentage : 0.281. Plant number : 2.95 thousands per acre or 6.15%. Mean dirt tare : 0.1005.

https://doi.org/10.23637/ERADOC-1-66

Yields of Separate Treatments (block effects eliminated)

ROOTS (washed) : tons per acre

Spacing	No sulphate of ammonia. No additional heavy rolling. No dung.	No sulphate of ammonia. No additional heavy rolling. Dung.	No sulphate of ammonia. Additional heavy rolling. No dung.	No sulphate of ammonia. Additional heavy rolling. Dung.	Sulphate of ammonia. No additional heavy rolling. No dung.	Sulphate of ammonia. No additional heavy rolling. Dung.	Sulphate of ammonia. Additional heavy rolling. No dung.	Sulphate of ammonia. Additional heavy rolling. Dung.
10 inches ..	13.81	13.65	11.34	12.06	14.55	16.13	13.66	15.80
15 inches ..	13.47	13.99	11.72	14.00	14.21	13.56	13.08	15.43
20 inches..	12.82	14.94	13.12	13.85	13.98	15.97	15.09	16.58

Responses to Treatments

MEAN YIELDS : Roots (washed) : 14.03 tons ; Tops : 11.62 tons ; Sugar percentage : 17.05 ; Total sugar : 47.8 cwt. ; Plant number : 47.9 thousands.

	Mean response.	Differential responses. Sulphate of ammonia. Absent.	Sulphate of ammonia. Present.	Additional rolling. Absent.	Additional rolling. Present.	Dung. Absent.	Dung. Present.	Spacing (inches). 10	15	20
ROOTS (washed)—tons per acre										
Sulphate of Ammonia	*+1.61*	—	—	+0.96	+2.26	+1.38	+1.83	+2.32	+0.78	+1.72
Additional rolling	*—0.45*	−1.10	+0.20	—	—	−0.80	−0.09	−1.32	−0.25	+0.23
Dung	*+1.26*	+1.04	+1.48	+0.90	+1.62	—	—	+1.07	+1.12	+1.58
Standard errors	*±0.318*	±0.450						±0.550		
TOPS—tons per acre										
Sulphate of Ammonia	*+4.60*	—	—	+4.34	+4.86	+4.10	+5.10	+4.38	+3.67	+5.76
Additional rolling	*−0.53*	−0.79	−0.26	—	—	−0.66	−0.39	−0.82	−0.78	+0.02
Dung	*+2.08*	+1.59	+2.58	+1.95	+2.22	—	—	+1.92	+2.47	+1.86
Standard errors	*±0.355*	±0.502						±0.615		
SUGAR PERCENTAGE										
Sulphate of Ammonia	*−0.38*	—	—	−0.46	−0.30	−0.46	−0.30	−0.35	−0.36	−0.45
Additional rolling	*+0.11*	+0.02	+0.20	—	—	+0.15	+0.08	+0.17	+0.34	−0.17
Dung	*−0.06*	−0.14	+0.02	−0.03	−0.10	—	—	−0.15	−0.09	+0.04
Standard errors	*±0.081*	±0.115						±0.140		
TOTAL SUGAR—cwt. per acre										
Sulphate of Ammonia	*+4.4*	—	—	+1.9	+6.8	+3.4	+5.3	+6.9	+1.7	+4.5
Additional heavy rolling	*−1.2*	−3.7	+1.2	—	—	−2.4	−0.2	−4.0	0.0	+0.3
Dung	*+4.1*	+3.2	+5.1	+3.0	+5.2	—	—	+3.2	+3.8	+5.5
PLANT NUMBER—thousands per acre										
Sulphate of Ammonia	*−1.6*	—	—	−1.5	−1.8	−1.2	−2.0	−0.7	−0.7	−3.5
Additional heavy rolling	*+3.0*	+3.2	+2.9	—	—	+3.0	+3.1	+4.1	+2.1	+2.9
Dung	*+2.4*	+2.8	+2.1	+2.4	+2.5	—	—	+2.0	+2.5	+2.9
Standard errors..	*±0.852*	±1.20						±1.48		

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Main Effects and Interactions of Spacing

Spacing	*Mean Response*	Sulphate of Ammonia Absent	Sulphate of Ammonia Present	Additional rolling Absent	Additional rolling Present	Dung Absent	Dung Present
ROOTS (washed) : tons per acre ($\pm$0.389. *Means:* $\pm$0.275)							
10 inches ..	*13.87*	12.71	15.03	14.53	13.21	13.34	14.40
15 inches ..	*13.68*	13.30	14.07	13.81	13.56	13.12	14.24
20 inches ..	*14.54*	13.68	15.40	14.43	14.66	13.75	15.34
TOPS : tons per acre ($\pm$0.436. *Means:* $\pm$0.308)							
10 inches ..	*11.95*	9.76	14.13	12.35	11.54	10.99	12.90
15 inches ..	*11.30*	9.46	13.13	11.69	10.91	10.06	12.53
20 inches ..	*11.60*	8.72	14.47	11.58	11.61	10.66	12.53
SUGAR PERCENTAGE ($\pm$0.099. *Means:* $\pm$0.070)							
10 inches ..	*17.00*	17.17	16.82	16.91	17.08	17.07	16.92
15 inches ..	*17.21*	17.39	17.03	17.04	17.38	17.25	17.17
20 inches ..	*16.93*	17.16	16.71	17.02	16.85	16.91	16.96
TOTAL SUGAR : cwt. per acre							
10 inches ..	*47.1*	43.6	50.6	49.1	45.2	45.5	48.7
15 inches ..	*47.0*	46.3	47.9	47.1	47.1	45.3	48.9
20 inches ..	*49.2*	46.9	51.5	49.1	49.4	46.5	52.0
PLANT NUMBER : thousands per acre ($\pm$1.04. *Means:* $\pm$0.738)							
10 inches ..	*69.0*	69.3	68.6	66.9	71.0	68.0	69.9
15 inches ..	*42.5*	42.8	42.1	41.4	43.5	41.3	43.7
20 inches ..	*32.2*	33.9	30.4	30.7	33.6	30.7	33.6

Conclusions

The variation of spacing produced no significant results in roots, tops or sugar percentage.

Sulphate of ammonia significantly increased the yields of roots and tops and significantly decreased the sugar percentage, the net result being an increase in total sugar by 4.4 cwt. per acre or 10 per cent.

The dressing of dung also gave significant increases in roots and tops, but had no appreciable effect on sugar percentage. The increase in total sugar was 4.1 cwt. per acre or 9 per cent.

The additional heavy rolling produced small but not significant decreases in the yields of roots and tops.

Plant number was significantly raised by the dung and the heavy rolling.

There was a significant interaction in roots between sulphate of ammonia and rolling, the increase due to sulphate of ammonia being significantly greater with the additional heavy rolling than without. This effect also shows up strongly in total sugar, the increase due to sulphate of ammonia being 6.8 cwt. per acre with the additional heavy rolling, as against 1.9 cwt. without.

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BRUSSEL SPROUTS

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

FOSTER'S—RD, 1934

Plan and yields in lb. saleable sprouts

Total of all Pickings.

1 — 8

R_1 235	O 213	O 216	M_1 273	M_2 268	R_1 243	R_2 240	N_1 243
O 214	S_1 238	N_1 237	M_2 243	S_2 240	M_1 255	O 204	O 220
R_2 237	S_2 245	O 237	N_2 251	O 255	O 250	N_2 260	S_1 246
R_2 257	O 258	M_1 254	S_1 266	R_2 263	O 234	R_1 240	M_1 253
N_2 266	O 266	M_2 256	S_2 254	M_2 259	O 249	N_1 265	O 227
R_1 260	O 248	O 228	N_1 235	S_2 248	N_2 270	S_1 250	O 236

SW ↑

41 — 48

SYSTEM OF REPLICATION : 4 randomised blocks of12 plots each.

AREA OF EACH PLOT (after rejecting edge rows) : 0.024174 acre. Plots actually 10 yds. × 14 yds.

TREATMENTS : No nitrogen (O), sulphate of ammonia (N) half applied in seed bed and remainder as a top dressing, poultry manure (M), soot (S) and rape dust (R), applied at the rate of 0.4 cwt. N per acre (1) or 0.8 cwt. N per acre (2).

BASAL MANURING : Superphosphate at the rate of 1.0 cwt. P_2O_5 and muriate of potash at the rate of 1.0 cwt. K_2O per acre. (An allowance was made for the P_2O_5 contained in the organic manures.)

CULTIVATIONS, ETC. : Ploughed : Apr. 6 and 7. Cultivated with tractor : May 23. Manures applied (sulphate of ammonia at half-rate) : May 23 and 24. Harrowed : May 25 and 26. Rolled : May 26. Brussels planted : June 8. Horse hoed : July 12 and 13. Hand hoed : July 17. Second half of sulphate of ammonia applied : July 28. Horse hoed : Aug. 8, 9 and 13. Hand hoed : Aug. 14. Harvested : First picking : Oct. 24, 25 and 29. Second picking : Dec. 18-20. Third picking : Feb. 13 and 14. Previous crop : Wheat.

STANDARD ERRORS PER PLOT total of all pickings (saleable sprouts) : 4.67 cwt. per acre or 5.14%; first picking (saleable sprouts) : 4·02 cwt. per acre or 19·4%.

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INDIVIDUAL TREATMENTS

Saleable sprouts: cwt per acre

Mean yield: 90.8 *cwt.*

Pickings	O	N_1	N_2	M_1	M_2	S_1	S_2	R_1	R_2
1st ..	20.6	21.4	21.4	22.7	19.8	22.3	19.4	21.1	18.2
2nd ..	47.7	50.5	55.9	53.3	55.7	50.4	52.5	51.1	55.9
3rd ..	18.3	18.6	19.5	19.6	19.3	19.6	19.3	18.1	17.9
Total..	*86.6*	*90.5*	*96.8*	*95.6*	*94.8*	*92.3*	*91.2*	*90.3*	*92.0*

Saleable Sprouts — total of all pickings: cwt. per acre

Nitrogen, cwt. p.a.	Sulph. amm.	Poultry manure.	Soot.	Rape dust.	*Mean.*	*Increase.*
0.0		86.6[1]			*86.6*[1]	
0.4	90.5[3]	95.6[3]	92.3[3]	90.3[3]	*92.2*[1]	*+5.6*[2]
0.8	96.8[3]	94.8[3]	91.2[3]	92.0[3]	*93.7*[1]	*+1.5*[2]
Mean ..	*93.6*[2]	*95.2*[2]	*91.7*[2]	*91.2*[2]	*90.8*	
Difference		*+1.6*[3]	*−1.9*[3]	*−2.4*[3]		

STANDARD ERRORS: ([1]) ±1.16, ([2]) ±1.64, ([3]) ±2.33.

CONCLUSIONS

There was a significant response to nitrogen in the total yield of all three pickings, the double dressing (0.8 cwt. N per acre) giving an increase of 7.1 cwt per acre. The falling-off in response at the higher level of manuring, though striking, was not in itself significant.

There were no significant differences between the effects of the four qualities of nitrogen.

None of the treatments had a significant effect on the yields of the first picking, but it is worth noting that for three of the four types of nitrogen, the yield from the double dressing in the first picking was below that from the single, while for the fourth (sulphate of ammonia) the two were equal.

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BEANS

Effect of dung, nitro-chalk and muriate of potash

RE—Long Hoos I, 1934

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

1	$D_2N_2K_1$ 31.6 25.6	$D_1N_2K_2$ 40.1 32.6	$D_1N_1K_0$ 39.9 33.1	$D_2N_2K_2$ 43.6 33.6	$D_2N_0K_1$ 37.5 32.0	$D_0N_0K_0$ 35.2 29.6	$D_0N_0K_1$ 33.3 27.2	$D_2N_2K_0$ 39.2 32.8	$D_2N_0K_2$ 38.6 33.2	9
N ↑	$D_1N_0K_1$ 29.2 24.3	$D_2N_1K_2$ 40.3 30.0	$D_2N_0K_0$ 39.5 28.5	$D_0N_2K_1$ 34.6 25.9	$D_2N_1K_0$ 35.2 28.0	$D_0N_1K_2$ 38.5 29.0	$D_0N_1K_0$ 29.0 22.0	$D_1N_2K_1$ 35.4 28.1	$D_1N_0K_0$ 36.4 30. 4	
19	$D_0N_0K_2$ 21.9 18.4	$D_0N_2K_0$ 29.5 23.5	$D_0N_1K_1$ 31.0 25.2	$D_1N_0K_2$ 34.0 27.0	$D_1N_2K_0$ 34.1 27.6	$D_1N_1K_1$ 35.0 27.2	$D_0N_2K_2$ 35.8 26.7	$D_1N_1K_2$ 34.0 27.2	$D_2N_1K_1$ 32.1 25.6	27

SYSTEM OF REPLICATION : 3 randomised blocks of 9 plots each, with two degrees of freedom, representing second order interactions, confounded with block differences. Error estimated from high order interactions,

AREA OF EACH PLOT : 1/60th acre (52.1 lks. × 32 lks.).

TREATMENTS : All combinations of :

(*a*) No dung (D_0), and dung at the rate of 7½ tons per acre (D_1) and 15 tons per acre (D_2).

(*b*) No nitro-chalk (N_0), and nitro-chalk at the rates of 0.2 cwt. N per acre (N_1) and 0.4 cwt. N per acre (N_2).

(*c*) No muriate of potash (K_0), and muriate of potash at the rates of 0.5 cwt. K_2O per acre (K_1) and 1.0 cwt. K_2O per acre (K_2).

BASAL MANURING : Superphosphate at the rate of 0.5 cwt. P_2O_5 per acre.

CULTIVATIONS, ETC. : Dung applied : October 18. Ploughed : October 18-19. Rolled : October 20. Harrowed : October 24. Seed sown : October 24. Muriate of potash applied : October 25. Harrowed : October 25. Crop failed. Harrowed : February 9. Seed resown : February 9. Harrowed : February 10. Nitro-chalk applied : April 10. Horse-hoed : May 7, 8, 14, 25, 29 and 30. Hand-hoed : May 25, 29 and 30. Harvested : August 3. Previous crop : Oats.

STANDARD ERRORS PER PLOT : Grain : 1.94 cwt. per acre, or 10.4%. Straw : 1.65 cwt. per acre, or 11.0%.

N

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Main effects. Interactions of nitro-chalk with dung and potash

Nitro-chalk	Dung : tons per acre 0	7½	15	Potash : cwt. K_2O per acre 0.0	0.5	1.0	*Mean*	*Increase*
GRAIN : cwt. per acre (±1.12. *Means* : ±*0.647*. *Increases* : ±*0.915*)								
0.0 cwt. N ..	16.1	17.8	20.6	19.8	17.8	16.9	*18.2*	
0.2 cwt. N ..	17.6	19.4	19.2	18.6	17.5	20.1	*18.7*	*+0.5*
0.4 cwt. N ..	17.8	19.6	20.4	18.4	18.1	21.3	*19.3*	*+0.6*
Mean	*17.2*	*18.9*	*20.1*	*18.9*	*17.8*	*19.4*	*18.7*	
Increase		*+1.7*	*+1.2*		*−1.1*	*+1.6*		
STRAW : cwt. per acre (±0.951. *Means* : ±*0.549*. *Increases* : ±*0.776*)								
0.0 cwt. N ..	13.4	14.6	16.7	15.8	14.9	14.0	*14.9*	
0.2 cwt. N ..	13.6	15.6	14.9	14.8	13.9	15.4	*14.7*	*−0.2*
0.4 cwt. N ..	13.6	15.8	16.4	15.0	14.2	16.6	*15.3*	*+0.6*
Mean	*13.5*	*15.3*	*16.0*	*15.2*	*14.3*	*15.3*	*15.0*	
Increase		*+1.8*	*+0.7*		*−0.9*	*+1.0*		

Interaction of potash and dung

Potash	GRAIN : cwt. per acre — Dung : tons per acre 0	7½	15	STRAW : cwt. per acre — Dung : tons per acre 0	7½	15
0.0 cwt. K_2O	16.7	19.7	20.3	13.4	16.3	15.9
0.5 cwt. K_2O	17.7	17.8	18.1	14.0	14.2	14.8
1.0 cwt. K_2O	17.2	19.3	21.9	13.2	15.5	17.3

Conclusions

There is a significant response to dung both in grain and in straw, the response, in grain to the first 7½ tons of dung being 1.7 cwt., or 10.0 %, and to the second 7½ tons 1.2 cwt., or 6.3%. The responses to the second dressing are smaller than the responses to the first, but not significantly so. The response to nitro-chalk is not significant, and there is no sign of response to potash. There is, however, a positive interaction, significant in the case of grain, between potash and nitro-chalk.

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