ROTHAMSTED RESEARCH

Report for 1933

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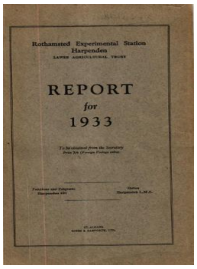

Other Experiments at Rothamsted

Rothamsted Research

Rothamsted Research (1934) *Other Experiments at Rothamsted ;* Report For 1933, pp 122 - 147 **- DOI: https://doi.org/10.23637/ERADOC-1-3**

BARLEY

The fertiliser values of sulphate of ammonia and ammonium bicarbonate, applied early and late.

RB—PASTURES 1933

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

	BEL	**SL**	**SE**	**O**	**SE**	**BE**	**SL**	**O**	**O**	**SEL**	**SL**	**BE**	
1	42.1	39.5	32.5	27.8	29.0	35.2	44.3	47.8	46.4	52.0	51.6	49.6	12
	63.9	58.8	50.0	39.0	43.8	51.3	61.0	64.2	62.6	73.2	71.2	68.6	
N	**BL**	**SEL**	**O**	**BE**	**BEL**	**O**	**SEL**	**BL**	**O**	**BEL**	**SE**	**BL**	
↑	47.1	44.0	42.4	45.4	40.0	41.1	47.2	55.0	45.3	48.9	51.2	53.3	
	72.6	67.0	53.4	60.6	53.5	53.2	66.0	53.2	60.2	66.6	70.6	74.7	
	O	**SL**	**BE**	**SE**	**O**	**BL**	**SEL**	**SL**	**O**	**BE**	**SE**	**O**	
	36.8	38.0	35.0	41.2	39.6	38.5	37.2	35.0	39.8	49.8	49.0	35.7	
	55.7	57.0	57.2	68.0	57.9	54.5	60.0	54.8	56.7	72.0	72.2	58.8	
	O	**SEL**	**BEL**	**BL**	**SE**	**BE**	**O**	**BEL**	**SEL**	**BEL**	**BL**	**SL**	
37	33.4	36.0	42.0	36.5	34.8	37.9	34.9	42.0	42.9	42.2	37.4	32.0	48
	45.4	60.5	68.5	60.2	62.2	59.4	45.6	62.8	62.8	58.0	51.1	50.5	

SYSTEM OF REPLICATION : 6 randomised blocks of 8 plots each.
AREA OF EACH PLOT : 1/50th acre (35 by 57.1 links).
TREATMENTS : All combinations of :

(a) **S** Sulphate of Ammonia
B Ammonium bicarbonate
} at the rate of 0.2 cwt. N per acre.

(b) **O** No application.
E Early application (in the seed-bed).
L Late application (as a top dressing).
EL Both early and late applications (double dressing).

CULTIVATIONS, ETC. : Harrowed : March 24th, 27th, and May 15th. Seed sown : March 25th. Early manures applied : March 27th. Late manures applied : May 11th. Rolled : April 1st Harvested : August 16th. Variety : Plumage Archer. Previous crop : Beans.

STANDARD ERRORS PER PLOT : Grain : ±2.36 cwt. per acre or ± 12.8 per cent. Straw : 3.19 cwt. per acre or ±12.0 per cent.

https://doi.org/10.23637/ERADOC-1-3

SEPARATE TREATMENTS—COMPARISON OF BICARBONATE AND SULPHATE

Grain, cwt. per acre. (±0.967; no N, ± 0.683.)
Mean yield = 18.4.

	No Nitrogen	Nitrogen early	Nitrogen late	Nitrogen early and late
Ammonium bicarbonate	17.5	18.8	19.9	19.1
Sulphate of Ammonia ..		17.7	17.9	19.3
Diff. (Bic.-Sul.) (±1.37)	—	*+1.1*	*+2.0*	*−0.2*

Straw, cwt. per acre. (± 1.304; no N, ±0.922).
Mean yield = 26.7.

	No Nitrogen	Nitrogen early	Nitrogen late	Nitrogen early and late
Ammonium bicarbonate	24.3	27.5	27.2	27.8
Sulphate of Ammonia ..		27.3	26.3	29.0
Diff. (Bic.-Sul.) (±1.84)	—	*+0.2*	*+0.9*	*−1.2*

OTHER EFFECTS—MEAN OF BICARBONATE AND SULPHATE

	Grain : cwt. per acre (±0.683)			Straw : cwt. per acre (±0.922)		
	No N.	Single N.	Double N.	No N.	Single N.	Double N.
Early ..	17.5	18.2	19.2	24.3	27.4	28.4
Late ..		18.9			26.8	
Mean ..	*17.5*[1]	*18.6*[2]	*19.2*[1]	*24.3*[4]	*27.1*[5]	*28.4*[4]
Increase	—	*+1.1*[3]	*+0.6*[3]	—	*+2.8*[6]	*+1.3*[6]

Standard Errors : (1) ±0.683, (2) ±0.483, (3) ±0.837, (4) ±0.922, (5) ±0.652, (6) ±1.13.

CONCLUSIONS

The response to nitrogen is significant in the case of the straw, but barely so in the case of the grain. There is no significant difference between the two times of application, nor is the additional response to the double dressing significantly less than the response to the single dressing. The differences between ammonium bicarbonate and sulphate of ammonia are not significant.

https://doi.org/10.23637/ERADOC-1-3

WHEAT

Effect of full year's fallow, summer fallow and of temporary leys of clover and ryegrass, the increase due to top dressing with sulphate of ammonia being used as a standard for comparison. (See 1931 report, p. 142, and 1932 report, p. 136, for previous stages of this experiment).

RW—FOSTERS, 1933
Plan and yields in lb., grain above, straw below.

Arrangement of treatments in the third year.

101	S_3 18.1 24.4	O 16.5 22.2	S_3 45.4 69.8	O 36.6 52.6	S_3 33.6 50.6	O 31.6 45.9	S_3 23.6 35.9	O 19.8 27.2	108
	O 21.3 25.2	S_3 23.2 28.0	O 38.1 59.2	S_3 36.3 53.2	O 34.4 42.8	S_3 32.8 43.7	O 27.3 34.7	S_3 28.5 33.2	
	S_3 22.1* 33.8*	O 25.4 31.1	S_3 39.9 63.1	S_3 40.0 53.5	S_3 39.3 45.7	S_3 35.6 41.6	S_3 25.5 30.2	S_3 35.0 45.2	
	O 22.7* 32.6*	S_3 21.0 33.2	O 41.0 61.2	O 35.4 49.6	O 35.1 43.2	O 34.2 40.3	O 22.3 26.0	O 34.1 41.4	
N ↑	S_3 36.1 63.6	O 47.2 71.0	S_3 15.9 28.4	S_3 23.0 30.0	S_3 29.3 37.7	O 30.3 37.2	O 35.6 40.9	O 38.2 45.0	
	O 51.9 70.8	S_3 45.7 65.8	O 26.2 32.6	O 27.9 31.6	O 28.3 33.4	S_3 37.2 45.6	S_3 37.3 44.0	S_3 39.1 46.9	
	S_3 45.7 73.0	S_3 46.8 65.2	O 22.0 22.8	S_3 25.1 28.6	O 26.1 27.9	O 29.9 32.6	S_3 40.6 56.4	O 41.8 53.0	
	O 36.7 68.8	O 49.3 63.4	S_3 25.5 28.0	O 19.8 20.0	S_3 28.6 31.9	S_3 28.8 31.2	O 39.0 46.2	S_3 40.3 51.2	
	O 31.3 39.7	S_3 28.6 32.4	S_3 37.2 49.8	S_3 36.1 47.9	S_3 23.5 27.2	O 15.3 16.4	S_3 44.4 56.8	S_3 47.6 65.9	
	S_3 34.1 53.2	O 29.4 33.4	O 37.5 50.5	O 39.5 50.0	O 21.4 23.4	S_3 20.3 24.2	O 40.2 52.6	O 48.0 65.0	
	S_3 29.0 34.0	S_3 26.6 40.9	S_3 42.5 51.0	S_3 44.7 53.8	S_3 31.2 38.3	S_3 26.0 32.0	O 47.7 63.8	S_3 48.0 65.5	
	O 28.0 29.0	O 24.4 40.6	O 40.1 47.2	O 38.6 43.2	O 23.2 31.0	O 23.2 26.6	S_3 42.3 59.4	O 42.8 57.4	
	S_3 32.9 47.6	S_3 25.4 53.6	O 29.6 40.4	S_3 31.3 36.7	O 47.2 66.8	S_3 38.0 56.5	O 21.1 24.2	O 27.0 35.8	
	O 29.2 39.6	O 32.8 48.7	S_3 34.1 47.9	O 31.2 33.8	S_3 44.4 61.6	O 39.3 51.4	S_3 22.7 26.6	S_3 27.8 36.4	
	S_3 30.3 39.2	O 28.7 35.3	O 25.3 27.4	O 34.0 41.0	O 43.7 60.6	S_3 40.5 58.8	O 27.3 33.7	S_3 25.3 30.2	
221	O 30.3 33.7	S_3 35.2 43.6	S_3 26.5 29.5	S_3 30.3 37.7	S_3 39.0 52.5	O 40.7 56.8	S_3 28.7 39.0	O 17.4 20.1	228

* Estimated.

Arrangement of treatments in the first and second years.

Ryegrass 2 2 S_1 O 1 1	Fallow L I O S_1 I L	Clover 1 1 O S_1 2 2	Cl. & Ryegr. 1 2 S_1 O 2 1
Fallow L L O S_1 I I	Ryegrass 1 1 S_1 O 2 2	Cl. & Ryegr. 1 1 S_1 O 2 2	Clover 2 2 S_1 O 1 1
Cl. & Ryegr. 1 2 O S_1 2 1	Clover 1 1 O S_1 2 2	Ryegrass 2 2 S_1 O 1 1	Fallow L I S_1 O I L
Clover 1 1 S_1 O 2 2	Cl. & Ryegr. 1 2 S_1 O 2 1	Fallow I L S_1 O L I	Ryegrass 2 1 O S_1 1 2

SYSTEM OF REPLICATION : 4×4 Latin Square, each plot subsequently split into 8 sub-plots by three successive divisions into halves.

AREA OF EACH EIGHTH PLOT : 1/80 acre (21 links × 59.5 links).

TREATMENTS: First year : Leys sown under barley. No ley, clover, ryegrass, and clover and ryegrass. Half plots received no nitrogen (**O**) or sulphate of ammonia ($\mathbf{S_1}$) at the rate of 0.2 cwt. N per acre.

Second year : Half plots subdivided for leys cut once and summer fallowed (1), or cut twice (2). The plots without leys were subdivided for light fallow (**L**) or intensive fallow (**I**).

Third year : Each quarter plot subdivided for no nitrogen (**O**) or sulphate of ammonia ($\mathbf{S_3}$) at the rate of 0.2 cwt. N. per acre.

CULTIVATIONS, ETC. : Ploughed : October 1st-5th. Harrowed : October 5th, 6th, 7th and April 8th. Seed sown : October 6th and 7th. Variety : Victor. Top dressed : March 13th. Harvested : July 31st. Previous crop : Hay.

STANDARD ERRORS PER PLOT

	Grain		Straw	
	Cwt. per acre	Per cent.	Cwt. per acre	Per cent.
Per whole plot	±1.73	±7.4	±2.24	±7.3
Per half plot	±1.34	±5.7	±1.87	±6.1
Per quarter plot	±1.63	±7.0	±2.08	±6.8
Per eighth plot	±2.36	±10.1	±2.36	±7.7

https://doi.org/10.23637/ERADOC-1-3

YIELDS OF SEPARATE TREATMENTS

		Fallow		Ryegrass		Clover		Clover and Ryegrass	
		No Nitrogen	Nitrogen (1931)	No Nitrogen	Nitrogen (1931)	No Nitrogen	Nitrogen (1931)	No Nitrogen	Nitrogen (1931)
		GRAIN : cwt. per acre							
1 cut or light fallow	No nitrogen ..	30.7	29.7	18.5	17.7	26.2	24.9	23.2	19.6
	Nitrogen (1933)	29.9	30.2	17.6	17.3	24.4	25.4	24.4	20.3
2 cuts or intensive fallow	No Nitrogen ..	29.7	32.3	13.0	14.7	25.4	24.8	19.4	18.4
	Nitrogen (1933)	31.0	30.3	16.3	16.5	27.9	26.4	21.0	19.5
		STRAW : cwt. per acre							
1 cut or light fallow	No Nitrogen ..	42.6	41.7	22.0	23.6	34.8	32.4	28.4	26.6
	Nitrogen (1933)	45.6	40.8	24.0	24.4	36.6	34.9	32.4	29.0
2 cuts or intensive fallow	No Nitrogen ..	45.0	44.0	14.8	16.3	30.5	28.2	21.9	20.5
	Nitrogen (1933)	46.6	42.7	19.2	19.6	33.4	31.9	24.1	22.1

EFFECT OF LEYS, FALLOW AND NITROGEN WITH BARLEY
(Mean of one and two cuts, N and no N with wheat)

	Fallow	Ryegrass	Clover	Clover and Ryegrass	*Mean*
	GRAIN : cwt. per acre				
No Nitrogen with Barley	30.3	16.4	25.9	22.0	*23.6*
Nitrogen with Barley	30.6	16.5	25.4	19.4	*23.0*
Mean (±0.472)	*30.4*	*16.4*	*25.6*	*20.7*	*23.3*
Difference (±0.943)	*+0.3*	*+0.1*	*−0.5*	*−2.6*	*−0.6* (±0.472)
	STRAW : cwt. per acre				
No Nitrogen with Barley	44.9	20.0	33.8	26.7	*31.4*
Nitrogen with Barley	42.3	21.0	31.9	24.6	*30.0*
Mean (±0.661)	*43.6*	*20.5*	*32.8*	*25.6*	*30.7*
Difference (±1.32)	*−2.6*	*+1.0*	*−1.9*	*−2.1*	*−1.4* (±0.661)

EFFECT OF CUTS AND FALLOWS
(Mean of Nitrogen and No Nitrogen with wheat and barley)

	Fallow	Ryegrass	Clover	Clover and Ryegrass	*Mean of all leys*
	GRAIN : cwt. per acre				
1 cut (or light fallow)	30.1	17.8	25.2	21.8	*21.6*
2 cuts (or intensive fallow) ..	30.8	15.1	26.1	19.6	*20.3*
Difference (±0.817)	*+0.7*	*−2.7*	*+0.9*	*−2.2*	*−1.3* (±0.472)
	STRAW : cwt. per acre				
1 cut (or light fallow)	42.7	23.5	34.7	29.1	*29.1*
2 cuts (or intensive fallow) ..	44.6	17.5	31.0	22.2	*23.6*
Difference (±1.04)	*+1.9*	*−6.0*	*−3.7*	*−6.9*	*−5.5* (±0.599)

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EFFECT OF NITROGEN APPLIED WITH WHEAT

		Fallow	Ryegrass	Clover	Clover and Ryegrass	*Mean of all leys*
		GRAIN : cwt. per acre				
1 cut or light fallow	No Nitrogen..	30.2	18.1	25.5	21.4	*21.7*
	Nitrogen 1933	30.0	17.5	24.9	22.3	*21.6*
Difference (±1.18)		−0.2	−0.6	−0.6	+0.9	−0.1 (±0.681)
2 cuts or intensive fallow	No Nitrogen..	31.0	13.8	25.1	18.9	*19.3*
	Nitrogen 1933	30.7	16.4	27.1	20.2	*21.2*
Difference (±1.18)		−0.3	+2.6	+2.0	+1.3	+1.9 (±0.681)
Mean Difference (±0.834).. ..		−0.2	+1.0	+0.7	+1.1	+0.9 (±0.482)
		STRAW : cwt. per acre				
1 cut or light fallow	No Nitrogen..	42.2	22.8	33.6	27.5	*28.0*
	Nitrogen 1933	43.2	24.2	35.8	30.7	*30.2*
Difference (±1.18)		+1.0	+1.4	+2.2	+3.2	+2.2 (±0.681)
2 cuts or intensive fallow	No Nitrogen	44.5	15.6	29.4	21.2	*22.1*
	Nitrogen 1933	44.7	19.4	32.7	23.1	*25.1*
Difference (±1.18)		+0.2	+3.8	+3.3	+1.9	+3.0 (±0.681)
Mean Difference (±0.834) ..		+0.6	+2.6	+2.8	+2.6	+2.6 (±0.482)

CONCLUSIONS

The previous leys produce large differences of yield in the wheat crop, both of grain and of straw. The yield following fallow is greatest, that following clover alone next, that following the mixture of clover and ryegrass next, and that following ryegrass alone least, the difference between fallow and ryegrass alone being no less than 14.0 cwt. of grain and 23.1 cwt. of straw.

The nitrogen applied to the barley shows no fully significant effects either on the wheat grain or straw, though there is some indication of a depression in yield of straw on all plots except those following the ley of ryegrass alone.

On the leys with ryegrass the taking of a second cut of the ley significantly depresses the subsequent yield of the grain (−2.4 cwt.), and straw (−6.4 cwt.), there being little difference between the clover and ryegrass and ryegrass alone.

On the clover ley the second cut depresses the yield of the straw only, this depression (−3.7 cwt.) being significant. The depression is less than that of the other leys, though not quite significantly so.

The differences between the light and intensive fallow are not significant.

After the three leys the nitrogen applied to the wheat increases the average yield of grain by 0.9 cwt., and that of the straw by 2.6 cwt., both increases being significant. In the case of the grain, but not of the straw, the increase only appears on the plots with two cuts, this increase being 1.9 cwt. The effects of the nitrogen after fallow are small and not significant.

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WHEAT

Seed-bed preparation by deep and shallow ploughing or rotary cultivation. Effect of spring rolling and harrowing, and of top-dressing with sulphate of ammonia.

RW—Pastures, 1933

Plan and yields in grammes

24					48				72				96
Treatment.	Grain.	Straw.	Grain.	Straw.					Treatment.	Grain.	Straw.	Grain.	Straw.
S Dp—H	N 557	866	O 715	1,154					S Sh——	N 804	1,419	O 869	1,202
S Sh——	O 640	880	N 682	1,153					S DpR —	N 881	1,366	O 798	1,088
P DpR —	O 576	1,056	N 650	1,609					P Dp——	O 840	1,120	N 854	1,082
P Sh ——	N 574	1,094	O 597	1,072					S Sh R H	O 667	918	N 843	1,256
P Sh R H	O 510	686	N 777	1,088					P Sh —H	O 778	1,092	N 918	1,349
S DpR —	O 478	696	N 541	869					P Sh R —	N 781	1,218	O 787	1,112
P Dp—H	O 671	1,021	N 870	1,246					S Dp—H	O 714	975	N 898	1,327
S Sh R H	O 475	632	N 486	794					P DpR H	N 824	1,275	O 869	1,150
P Sh ——	O 588	823	N 676	1,044					S Sh —H	O 734	1,186	N 890	1,348
P Dp—H	O 653	896	N 730	1,099					P DpR H	O 970	1,380	N 1,044	1,572
S Sh —H	N 495	590	O 679	952					S Sh R —	N 808	1,363	O 741	940
P DpR —	O 780	1,121	N 636	1,096					S DpR —	N 916	1,335	O 802	1,103
S DpR H	N 591	834	O 758	974					P Sh R H	N 859	1,269	O 739	680
S Sh R —	N 771	1,376	O 726	1,050					S Dp—H	N 716	1,030	O 671	890
P Sh R H	O 801	1,081	N 792	1,264					P Dp——	O 758	1,043	N 724	1,045
S Dp——	O 741	1,097	N 907	1,152					P Sh——	O 655	1,058	N 728	1,029
S Sh R H	O 709	1,098	N 729	1,005					S Sh —H	O 704	936	N 662	943
S DpR H	N 784	1,026	O 816	1,009					S DpR H	O 889	1,064	N 582	782
P Sh R —	N 732	1,166	O 826	1,058					S Dp——	O 703	999	N 588	911
S Dp——	O 682	940	N 658	896					P Sh—H	N 650	976	O 665	887
P Sh—H	N 586	943	O 614	712					P DpR H	N 634	905	O 606	703
S Sh——	N 436	646	O 669	983					S Sh R —	N 494	880	O 524	778
P DpR —	O 606	861	N 642	950					P Dp——	N 616	1,081	O 773	1,114
P Dp—H	N 700	979	O 716	978					P Sh R —	O 615	820	N 888	1,290
1				25					49				73

N ↑

SYSTEM OF REPLICATION : 6 randomised blocks of 8 plots each, the plots being split for sulphate of ammonia. The following interactions (using symbols as above) are partially confounded : (P—S) × R × H, (Dp—Sh) × R × H, (P—S) × (Dp—Sh) × R × H.

AREA OF EACH SUB-PLOT : 1/80 acre (62.5 links × 20 links).

TREATMENTS : All combinations of :

(a) Seed-bed prepared by ploughing (P), or rotary cultivation with simar rototiller (S).
(b) Deep cultivation (7-8 ins.) (Dp), and shallow cultivation (3½-4 ins.) (Sh).
(c) Not rolled (—), and rolled (R).
(d) Not harrowed (—), and harrowed (H).
(e) No sulphate of ammonia (O), and sulphate of ammonia (N) at the rate of 0.2 cwt. N. per acre.

CULTIVATIONS, ETC. : Ploughed : October 5th and 6th. Harrowed : October 6th, 7th, and March 15th. Rolled : March 15th. Manures applied : March 11th. Seed sown : October 7th. Harvested : July 31st. Plots harvested by sampling method (16 metre lengths per sub-plot, drills set 6 ins. apart). Variety : Victor. Previous crop : Beans.

STANDARD ERRORS : Grain : Per whole plot : 2.72 cwt. or 11.7%. Per sub-plot : 2.79 cwt. or 12.0%. Straw : Per whole plot : 5.14 cwt. or 15.1%. Per sub-plot : 4.54 cwt. or 13.4%.

https://doi.org/10.23637/ERADOC-1-3

YIELDS OF SEPARATE TREATMENTS (BLOCK EFFECTS ELIMINATED)

		Ploughed				Simared			
		Shallow		Deep		Shallow		Deep	
		No Nitrogen	Nitrogen	No Nitrogen	Nitrogen	No Nitrogen	Nitrogen	No Nitrogen	Nitrogen
		GRAIN—cwt. per acre							
Not Harrowed	Not Rolled	20.0	21.4	24.3	22.4	23.9	21.1	24.5	24.8
	Rolled	24.3	26.2	22.8	22.5	21.5	22.4	21.2	24.1
Harrowed	Not Rolled	22.5	23.5	23.7	26.5	22.8	22.1	21.5	22.3
	Rolled	22.2	26.4	25.1	25.8	20.3	22.6	28.2	22.7
		STRAW—cwt. per acre							
Not Harrowed	Not Rolled	31.4	33.7	33.9	33.1	33.2	34.8	35.8	35.0
	Rolled	33.3	40.8	34.9	41.6	30.3	39.6	28.7	36.1
Harrowed	Not Rolled	30.1	36.4	33.3	38.0	33.7	31.6	30.1	32.3
	Rolled	25.8	38.6	33.4	39.0	28.6	33.1	35.9	31.5

For standard errors see next table.

RESPONSES TO TREATMENTS

	Mean response	Differential Responses									
		Plough	Simar	Cultivating Shallow	Cultivating Deep	Harrowing Absent	Harrowing Present	Rolling Absent	Rolling Present	Sulph. Amm. Absent	Sulph. Amm. Present
		GRAIN—cwt. per acre									
Simar *minus* plough	-0.8^{1}	—	—	-1.2^{3}	-0.4^{3}	-0.1^{3}	-1.6^{3}	-0.2^{3}	-1.5^{3}	-0.0^{4}	-1.6^{4}
Deep *minus* shallow	$+1.2^{1}$	$+0.8^{3}$	$+1.6^{3}$	—	—	$+0.7^{3}$	$+1.6^{3}$	$+1.6^{3}$	$+0.8^{3}$	$+1.8^{4}$	$+0.7^{4}$
Harrowing	$+0.6^{1}$	$+1.4^{3}$	-0.1^{3}	$+0.2^{3}$	$+1.1^{3}$	—	—	$+0.3^{3}$	$+1.0^{3}$	$+0.5^{4}$	$+0.8^{4}$
Rolling	$+0.8^{1}$	$+1.5^{3}$	$+0.0^{3}$	$+1.2^{3}$	$+0.3^{3}$	$+0.4^{3}$	$+1.1^{3}$	—	—	$+0.3^{4}$	$+1.0^{4}$
Sulphate of Ammonia	$+0.5^{2}$	$+1.2^{4}$	-0.3^{4}	$+1.0^{4}$	0.0^{4}	$+0.4^{4}$	$+0.7^{4}$	$+0.1^{4}$	$+1.0^{4}$	—	—
		STRAW—cwt. per acre									
Simar *minus* plough	-1.7^{5}	—	—	-0.7^{7}	-2.7^{7}	-1.2^{7}	-2.2^{7}	-0.4^{7}	-3.0^{7}	0.0^{8}	-3.4^{8}
Deep *minus* shallow	$+1.1^{5}$	$+2.1^{7}$	$+0.1^{7}$	—	—	$+0.2^{7}$	$+2.0^{7}$	$+0.8^{7}$	$+1.4^{7}$	$+2.4^{8}$	-0.2^{8}
Harrowing	-1.5^{5}	-1.0^{7}	-2.0^{7}	-2.4^{7}	-0.7^{7}	—	—	-0.7^{7}	-2.4^{7}	-1.3^{8}	-1.8^{8}
Rolling	$+0.9^{5}$	$+2.2^{7}$	-0.3^{7}	$+0.7^{7}$	$+1.2^{7}$	$+1.8^{7}$	$+0.1^{7}$	—	—	-1.3^{8}	$+3.2^{8}$
Sulphate of Ammonia	$+3.9^{6}$	$+5.6^{8}$	$+2.2^{8}$	$+5.3^{8}$	$+2.6^{8}$	$+4.2^{8}$	$+3.7^{8}$	$+1.7^{8}$	$+6.2^{8}$	—	—

STANDARD ERRORS: (1) ±0.785, (2) ±0.569, (3) ±1.11, (4) ±0.805, (5) ±1.48, (6) ±0.926, (7) ±2.10, (8) ±1.31.

https://doi.org/10.23637/ERADOC-1-3

INTERACTION BETWEEN CULTIVATIONS AND NITROGEN

	Ploughed		Simared		*Mean*
	Not harrowed	Harrowed	Not harrowed	Harrowed	
GRAIN—cwt. per acre					
No Sulph. Amm. ..	22.9	23.4	22.8	23.2	*23.1*
Sulph. Amm. ..	23.1	25.5	23.1	22.4	*23.5*
Diff. (±*1.14*)	+*0.2*	+*2.1*	+*0.3*	−*0.8*	+*0.4* (±*.570*)
STRAW—cwt. per acre					
No Sulph. Amm. ..	33.4	30.7	32.0	32.1	*32.0*
Sulph. Amm. ..	37.3	38.0	36.4	32.1	*36.0*
Diff. (±*1.85*)	+*3.9*	+*7.3*	+*4.4*	*0.0*	+*4.0* (±*0.925*)

CONCLUSIONS

There are no significant effects of any of the treatments on the grain. Nor are there any significant effects of the cultivations on the straw. The application of nitrogen, on the other hand, has significantly increased the yield of straw, this increase being significantly greater in the presence of rolling. The average difference in response to nitrogen by the straw for the ploughed and simared plots is barely significant but there is a significant interaction between this effect and harrowing, the response to nitrogen being considerably greater on the ploughed than on the simared plots which are harrowed, but somewhat less on the ploughed than on the simared plots which are not harrowed.

https://doi.org/10.23637/ERADOC-1-3

FORAGE MIXTURE

Variation in proportion of oats and vetches.
Effect of nitrogen on yield and composition of different mixtures.

RF—PASTURES—1933

Plan and yields in lb.—Green weights.

N ↑

1										10
C O 31.6	C N 36.2	D N 55.7	D O 56.2	E O 53.7	E N 60.6	B N 33.3	B O 34.5	A O 33.0	A N 28.2	
A O 36.8	A N 35.6	B N 41.6	B O 40.2	C N 53.7	C O 42.6	E N 48.6	E O 66.0	D N 61.8	D O 57.4	
E O 8.9	E N 31.5	A O 39.8	A N 44.6	D N 59.0	D O 51.2	C N 61.5	C O 60.1	B O 52.6	B N 52.8	
D N 56.5	D O 48.5	E O 49.2	E N 76.0	B O 52.3	B N 54.2	A O 47.8	A N 49.2	C O 51.8	C N 58.6	
B O 43.4	B N 42.6	C N 47.1	C O 44.1	A N 47.3	A O 42.8	D O 62.9	D N 63.7	E O 61.7	E N 71.7	
41										50

SYSTEM OF REPLICATION : 5 × 5 Latin square. Each plot divided for nitrogen comparison.
AREA OF EACH SUB-PLOT : 0.0113 acre (40 links × 28.25 links).
TREATMENTS : All combinations of :

(a) Seedings (1 unit = 50 lb. per acre)

	A	B	C	D	E
Oats (units)	4	3	2	1	0
Vetches (units)	0	1	2	3	4

(b) No nitrogen **(O)**. 0.3 cwt. N. per acre as sulphate of ammonia **(N)**.

BASAL MANURING : Muriate of potash at the rate of 0.5 cwt. K_2O per acre, and superphosphate at the rate of 0.5 cwt. P_2O_5 per acre.
CULTIVATIONS, ETC. : Ploughed : March 25th. Manures applied : March 25th. Seed sown : March 25th. Harrowed : March 25th. Rolled : April 1st. The first crop failed and the seed was resown. Ploughed : May 16th. Seed sown : May 17th and 18th. Harrowed : May 17th and 18th. Rolled : May 17th and 18th. Top-dressed : May 22nd. Harvested : August 16th. Previous crop : Beans.
STANDARD ERRORS PER WHOLE PLOT : (Total dry matter) ±2.53 cwt. per acre or ±15.6 per cent. PER SUB-PLOT : ±1.54 cwt. per acre or ±9.5 per cent.
SAMPLING : Two grab samples, comprising from ten to fifteen handfuls, taken when the crop was in swathes. Weighed and separated, after sampling, into oats and vetches. Components weighed when air dry.
DRY MATTER : Each plot chaffed separately and equal volumes of chaffed material from replicates bulked. Whole thoroughly mixed and duplicate samples taken for dry matter.
SAMPLING ERRORS (per single sample) : Of air dry weight as percentage of green weight : ±1.75 of percentage of oats in air dry material : ±2.16.

https://doi.org/10.23637/ERADOC-1-3

SUMMARY OF RESULTS

GREEN MATERIAL

Cwt. per acre	4 Oats 0 Vetches	3 Oats 1 Vetches	2 Oats 2 Vetches	1 Oats 3 Vetches	0 Oats 4 Vetches	*Mean*
Without Nitrogen ..	31.6	35.2	36.4	43.6	37.8	*36.9*
With Nitrogen ..	32.4	35.5	40.6	46.9	45.6	*40.2*
Mean	*32.0*	*35.4*	*38.5*	*45.2*	*41.7*	*38.6*
Difference	*+0.8*	*+0.3*	*+4.2*	*+3.3*	*+7.8*	*+3.3*

TOTAL DRY MATTER

Determined on duplicate samples from each plot, oats and vetches being separated in the sample.

Cwt. per acre		4 Oats 0 Vetches	3 Oats 1 Vetches	2 Oats 2 Vetches	1 Oats 3 Vetches	0 Oats 4 Vetches	*Mean*
Oats	Without Nitrogen	17.9	16.2	10.5	5.2	—	*12.4*
	With Nitrogen	18.1	15.9	11.5	6.2	—	*12.9*
Vetches	Without Nitrogen	—	2.0	5.6	10.1	11.0	*7.2*
	With Nitrogen	—	2.4	6.3	10.8	13.0	*8.1*
Total Dry Matter	Without Nitrogen	17.9	18.2	16.1	15.3	11.0	*15.7*
	With Nitrogen	18.1	18.3	17.8	17.0	13.0	*16.8*
	Mean (±*1.14*)	*18.0*	*18.2*	*17.0*	*16.2*	*12.0*	*16.2*
	Diff. (±*0.980*)	*+0.2*	*+0.1*	*+1.7*	*+1.7*	*+2.0*	*+1.1*

CONCLUSIONS

The yields of dry matter are significantly different for the different mixtures, the optimum yield being that of 3 of oats to 1 of vetches. The response in dry matter yields to nitrogen is significant, but not significantly different for the different mixtures.

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POTATOES

The fertiliser value of poultry manure in terms of equivalent sulphate of ammonia and superphosphate.

The fertiliser values of ammonium bicarbonate and sulphate of ammonia.

RP—PASTURES, 1933

Plan and yields in lb.

W ↑ (1 … 6)

B 172	P 161	SP 231	O 166	MP 208	MBP 144
M 192	S 145	BP 204	MP 253	MS 190	B 104
MBP 227	MSP 232	MS 231	MB 214	O 113	SP 131
S 176	MB 186	MS 238	M 198	S 158	MSP 171
O 132	MSP 242	P 180	B 175	M 171	BP 135
MP 196	BP 178	MBP 230	SP 216	MB 146	P 103

Bouts. ↑ (31 … 36)

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

AREA OF EACH PLOT : 1/65 acre (45.5 links × 33.8 links).

TREATMENTS : All combinations of :

(a) No poultry manure. M, poultry manure at the rate of 0.6 cwt. N per acre, with additional superphosphate (0.005 cwt. P_2O_5 per acre) to give with the P_2O_5 of the poultry manure 0.6 cwt. P_2O_5 per acre.

(b) No sulphate or bicarbonate of ammonia.
S, Sulphate of ammonia
B, Ammonium bicarbonate
} At the rate of 0.6 cwt. N per acre.

(c) No superphosphate. P, superphosphate at the rate of 0.6 cwt. P_2O_5 per acre.

CULTIVATIONS, ETC. : Ploughed : April 20th. Harrowed April 26th. Ridged : April 28th. Manures applied : April 28th. Potatoes planted : May 1st and 2nd. Grubbed : May 24th and June 26th. Earthed up : July 1st. Potatoes lifted : Oct. 3rd. Variety : Ally. Previous crop : Beans.

STANDARD ERROR PER PLOT : ± 0.531 tons per acre or ± 10.1%.

https://doi.org/10.23637/ERADOC-1-3

YIELDS OF SEPARATE TREATMENTS (BLOCK EFFECTS ELIMINATED)

Tons per acre	Neither	Super.	Poultry Manure	Both	*Mean*
Neither	4.01	4.26	5.40	6.38	*5.01*
Sulph. Amm.	4.83	5.39	6.17	6.44	*5.71*
Bicarb. Amm.	4.38	4.99	5.27	5.82	*5.12*
Mean	*4.41*	*4.88*	*5.61*	*6.21*	*5.28*

Standard error (of a single yield) applicable to second order interactions (which are partially confounded) ±0.412 tons. For other standard errors see below.

DIFFERENTIAL RESPONSES

Tons per acre	*Mean response*	Poultry Manure		Superphosphate		Ammonium		
		Absent	Present	Absent	Present	None	Sulphate	Bicarb.
Poultry manure..	*+1.26*[1]	—	—	+1.20[3]	+1.33[3]	+1.76[4]	+1.20[4]	+0.86[4]
Superphosphate..	*+0.54*[1]	+0.47[3]	+0.60[3]	—	—	+0.62[4]	+0.42[4]	+0.58[4]
Sulph. Amm. ..	*+0.70*[2]	+0.98[4]	+0.42[4]	+0.80[4]	+0.60[4]	—	—	—
Bicarb. Amm. ..	*+0.11*[2]	+0.55[4]	−0.34[4]	+0.12[4]	+0.08[4]	—	—	—

STANDARD ERRORS : ([1]) ±0.177, ([2]) ±0.217, ([3]) ±0.266, ([4]) ±0.307.

MEAN OF NO SUPERPHOSPHATE AND SUPERPHOSPHATE

T.p.a. (±0.217)	Neither	Sulph. Amm.	Bicarb. Amm.	*Mean (±0.125)*
No P.M. ..	4.14	5.11	4.68	*4.64*
Poultry manure	5.89	6.31	5.55	*5.92*
Mean (±0.154)	*5.01*	*5.71*	*5.12*	*5.28*

CONCLUSIONS

The responses to poultry manure, to superphosphate, and to sulphate of ammonia are all significant. The response to ammonium bicarbonate is small and not significant and is significantly less than the response to sulphate of ammonia. The extra response to poultry manure in the absence of the nitrogenous fertilisers over that in their presence is not large enough to be significant.

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SUGAR BEET

Effect of dung and mineral fertilisers, applied in the surface soil and in the subsoil.

RS—PASTURES, 1933

Plan and yields in lb., roots (dirty) above, tops centre, sugar percentage below.

73	**NA0** 35.5 30.0 15.17	**OA3** 55.9 50.0 16.58	**OA2** 51.0 39.5 15.86	**OD0** 32.2 28.5 15.28	**OA2** 39.0 36.0 15.83	**NA1** 46.4 72.4 15.68	**OD1** 66.4 74.5 15.88	**NA3** 52.6 65.0 15.94	**ND1** 53.1 51.0 15.48	**NA3** 52.0 53.5 15.97	**OA3** 61.9 44.5 16.43	**OA1** 50.6 41.0 16.20	117
S ↑	**NA2** 55.9 51.0 15.68	**ND0** 30.9 30.5 14.93	**OA0** 37.3 31.5 15.31	**ND1** 58.0 62.0 14.84	**ND1** 57.5 63.5 15.54	**OD0** 32.7 35.5 15.39	**ND0** 30.9 40.5 15.02	**OD2** 56.1 50.5 15.57	**OD3** 73.3 73.0 15.90	**ND3** 70.8 71.0 15.13	**NA2** 47.0 44.0 15.9 1	**NA1** 40.9 43.5 15.86	
	ND3 71.5 77.5 15.45	**OD2** 55.9 62.5 16.20	**OD1** 46.4 54.0 15.91	**NA1** 35.0 36.5 15.77	**OA0** 27.5 28.5 15.05	**NA0** 36.1 42.0 15.08	**OD3** 69.5 86.0 15.25	**NA2** 46.0 46.5 16.06	**OD2** 62.3 53.0 16.09	**ND0** 36.3 39.0 15.77	**ND2** 57.7 54.5 15.16	**OD0** 42.9 35.5 16.26	
76	**NA3** 45.4 44.0 16.86	**ND2** 42.4 49.0 16.32	**OD3** 38.3 53.5 15.34	**OA1** 24.6 25.5 16.17	**OA3** 27.9 24.0 16.29	**OA1** 36.7 33.0 15.94	**ND3** 59.8 77.5 15.45	**ND2** 63.6 64.0 15.54	**OD1** 64.3 63.0 15.68	**OA2** 52.7 39.5 16.86	**OA0** 44.3 37.0 15.88	**NA0** 44.2 42.0 15.84	120

SYSTEM OF REPLICATION : 3 Randomised blocks of 16 plots each.
AREA OF EACH PLOT : 0.0029 acre (10 ft. × 12½ ft. rows).
TREATMENTS : All combinations of :

(a) O=No nitrogen.
N=0.6 cwt. N per acre as sulphate of ammonia.

(b) A=0.5 cwt. P_2O_5 per acre as superphosphate and 1.0 cwt. K_2O per acre as 30% potash salt.
D=20 tons dung per acre, and potash salt and superphosphate as in (A).

(c) 0=No minerals or dung and minerals.
1=Minerals or dung and minerals applied in the surface soil.
2=Minerals or dung and minerals applied in the sub-soil.
3=Minerals or dung and minerals applied in both surface and subsoil (double dressing).

The whole area was hand dug two spits deep. Manures applied in the surface were incorporated with the first spit, those in the subsoil with the second spit.

CULTIVATIONS, ETC. : Dug : May 2nd-8th. Manures applied : May 2nd-9th. Seed sown : May 19th. Harrowed : May 16th and 19th. Rolled : May 16th, 18th and 19th. Hoed : July 20th and 21st. Singled June 27th-29th. Rows 15 ins. apart. Plants 10 ins. apart. Lifted : November 9th and 10th. Variety : Kuhn. Previous crop : Beans.

STANDARD ERRORS PER PLOT : Roots (washed) : ±1.13 tons per acre or 17.5%. Tops : ±1.34 tons per acre or 17.5%. Sugar percentage : ±0.355. Mean dirt tare : 0.1415.

https://doi.org/10.23637/ERADOC-1-3

SUMMARY OF RESULTS

	No Super., Potash or Dung	Super. and Potash only			Super, Potash & Dung			*Mean*	Standard Errors
		Shallow	Deep	Shallow and Deep	Shallow	Deep	Shallow and Deep		
				ROOTS (washed)—tons per acre					
No Sulph.Amm.	4.82[2]	4.99[1]	6.37[1]	6.50[1]	7.88[1]	7.74[1]	8.06[1]	*6.40*	[1] ±0.653
Sulph. Amm. . .	4.76[2]	5.43[1]	6.64[1]	6.68[1]	7.52[1]	7.30[1]	9.00[1]	*6.51*	[2] ±0.462
Mean . .	*4.79*[3]	*5.21*[2]	*6.51*[2]	*6.59*[2]	*7.70*[2]	*7.52*[2]	*8.53*[2]	*6.46*	[3] ±0.325 [4] ±0.923 [5] ±0.336
Diff. . .	*−0.06*[1]	*+0.44*[4]	*+0.27*[4]	*+0.18*[4]	*−0.36*[4]	*−0.44*[4]	*+0.94*[4]	*+0.11*[5]	
				TOPS—tons per acre					
No Sulph.Amm.	5.10[2]	5.16[1]	5.96[1]	6.14[1]	9.93[1]	8.60[1]	11.02[1]	*7.13*	[1] ±0.772
Sulph. Amm.	5.80[2]	7.90[1]	7.34[1]	8.43[1]	9.15[1]	8.69[1]	11.72[1]	*8.10*	[2] ±0.546
Mean . .	*5.45*[3]	*6.53*[2]	*6.65*[2]	*7.28*[2]	*9.54*[2]	*8.64*[2]	*11.37*[2]	*7.61*	[3] ±0.386 [4] ±1.092 [5] ±0.398
Diff.	*+0.70*[1]	*+2.74*[4]	*+1.38*[4]	*+2.29*[4]	*−0.78*[4]	*+0.09*[4]	*+0.70*[4]	*+0.97*[5]	
				SUGAR PERCENTAGE					
No Sulph. Amm.	15.53[2]	16.10[1]	16.18[1]	16.43[1]	15.82[1]	15.95[1]	15.50[1]	*15.88*	[1] ±0.205
Sulph. Amm.	15.30[2]	15.77[1]	15.88[1]	16.26[1]	15.29[1]	15.67[1]	15.34[1]	*15.60*	[2] ±0.145
Mean . .	*15.42*[3]	*15.94*[2]	*16.03*[2]	*16.34*[2]	*15.56*[2]	*15.81*[2]	*15.42*[2]	*15.74*	[3] ±0.102 [4] ±0.290 [5] ±0.106
Diff.	*−0.23*[1]	*−0.33*[4]	*−0.30*[4]	*−0.17*[4]	*−0.53*[4]	*−0.28*[4]	*−0.16*[4]	*−0.28*[5]	
				TOTAL SUGAR—cwt. per acre					
No Sulph. Amm.	15.0	16.1	20.6	21.4	24.9	24.7	25.0	*20.3*	—
Sulph. Amm.	14.6	17.1	21.1	21.7	23.0	22.9	27.6	*20.3*	—
Mean . .	*14.8*	*16.6*	*20.8*	*21.6*	*24.0*	*23.8*	*26.3*	*20.3*	—
Diff.	*−0.4*	*+1.0*	*+0.5*	*+0.3*	*−1.9*	*−1.8*	*+2.6*	*0*	—

CONCLUSIONS

The roots show a significant response to dung and to minerals applied deep, but not to minerals applied shallow. On the other hand the difference between minerals applied deep and applied shallow, though suggestive, is not significant. The tops while responding significantly to dung and minerals show no difference between minerals applied deep and applied shallow.

The response to sulphate of ammonia is significant for the tops but not the roots.

The sugar percentage is significantly greater on the plots receiving minerals only, than on the plots with no minerals and the plots with minerals and dung. The depression with sulphate of ammonia is also significant.

The experiment as a whole is marred by low yields and very high standard errors.

https://doi.org/10.23637/ERADOC-1-3 *pp 16*

SUGAR BEET

Effect of varying spacing of rows, of sulphate of ammonia and of ploughing or harrowing in mineral fertilisers.

RS—Pastures—1933

Plan and yields in lb.

		Roots (dirty)	Tops	Sugar Percentage		Roots (dirty)	Tops	Sugar Percentage	
1	$N_2S_{20}B_P$	148.7	169.9	15.05	$N_1S_{10}B_H$	278.2	300.0	16.12	37
	$-S_{15}B_H$	168.6	199.8	15.13	$N_2S_{15}B_P$	254.8	261.5	16.29	
	$-S_{10}B_P$	302.4	276.5	16.06	$N_2S_{20}B_H$	143.2	155.0	15.71	
	$N_1S_{20}B_H$	146.7	177.0	15.86	$N_1S_{20}B_P$	179.4	169.5	16.29	
	$N_1S_{15}B_P$	216.9	208.5	16.12	$-S_{10}B_P$	318.0	253.5	17.07	
	$N_2S_{10}B_H$	227.5	258.5	15.53	$-S_{15}B_H$	200.9	178.5	16.03	
	$N_2S_{15}B_H$	175.7	211.1	15.39	$N_1S_{10}B_P$	329.6	297.5	16.40	
	$N_1S_{10}B_H$	266.3	253.2	15.77	$N_2S_{10}B_H$	302.9	322.5	16.37	
	$-S_{15}B_P$	247.3	201.0	16.37	$-S_{15}B_P$	247.6	200.5	16.26	
	$N_2S_{10}B_P$	323.7	323.7	16.89	$N_1S_{15}B_H$	211.7	210.5	15.86	
	$N_1S_{20}B_P$	191.6	204.7	15.59	$-S_{20}B_H$	132.1	125.0	15.77	
	$-S_{20}B_H$	159.4	194.0	15.71	$N_2S_{20}B_P$	163.2	151.0	16.17	
	$-S_{20}B_P$	182.6	173.9	15.94	$-S_{10}B_H$	281.8	254.0	16.72	
	$N_1S_{10}B_P$	311.9	279.5	16.92	$-S_{20}B_P$	173.3	153.0	16.49	
	$N_2S_{15}B_P$	226.4	230.5	16.37	$N_1S_{15}B_P$	252.8	251.0	16.00	
	$-S_{10}B_H$	230.8	224.0	16.98	$N_1S_{20}B_H$	165.6	166.0	16.61	
	$N_2S_{20}B_H$	136.3	166.0	16.17	$N_2S_{15}B_H$	239.3	264.5	15.91	
	$N_1S_{15}B_H$	196.2	210.0	16.29	$N_2S_{10}B_P$	321.2	346.0	16.12	
	$N_1S_{10}B_H$	268.5	251.5	16.92	$-S_{10}B_P$	310.6	279.5	16.58	
	$-S_{20}B_H$	154.4	165.5	16.37	$N_2S_{10}B_H$	299.3	338.5	15.68	
	$N_2S_{20}B_P$	185.2	191.5	15.91	$-S_{20}B_H$	165.0	156.0	16.55	
	$N_1S_{15}B_P$	263.3	241.5	16.63	$N_1S_{20}B_P$	197.9	183.5	16.63	
	$N_2S_{15}B_H$	244.6	265.0	16.00	$N_1S_{15}B_H$	258.0	288.0	16.64	
	$-S_{10}B_P$	288.7	226.0	17.18	$N_2S_{15}B_P$	285.0	233.5	15.71	
	$N_2S_{10}B_P$	304.9	279.0	16.66	$-S_{15}B_P$	279.8	263.0	16.84	
	$N_1S_{15}B_H$	210.2	213.5	16.08	$N_1S_{20}B_H$	184.5	190.5	16.43	
	$-S_{10}B_H$	328.4	266.5	17.12	$N_2S_{15}B_H$	248.4	295.0	15.83	
	$N_1S_{20}B_P$	174.9	200.5	16.52	$N_1S_{10}B_P$	327.1	324.0	16.26	
	$N_2S_{20}B_H$	151.1	195.0	15.45	$-S_{10}B_H$	307.1	283.5	16.23	
	$-S_{15}B_P$	219.2	230.0	15.83	$N_2S_{20}B_P$	186.9	188.0	16.26	
	$-S_{20}B_P$	176.0	198.5	15.80	$N_2S_{10}B_P$	307.2	330.5	15.80	
	$N_1S_{20}B_H$	148.7	186.0	15.60	$N_2S_{20}B_H$	150.6	181.0	15.42	
	$N_1S_{10}B_P$	292.9	333.5	16.35	$N_1S_{15}B_P$	226.5	255.5	16.00	
	$-S_{15}B_H$	186.0	209.0	15.48	$-S_{20}B_P$	164.7	156.5	16.17	
	$N_2S_{10}B_H$	256.6	319.0	15.65	$N_1S_{10}B_H$	275.5	337.5	15.60	
36	$N_2S_{15}B_P$	200.4	242.0	16.00	$-S_{15}B_H$	170.3	183.0	15.42	72

N ↑

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

AREA OF EACH PLOT : (After rejecting edge-rows). 10 inch spacing : 0.01515 acres ; 15 inch spacing : 0.01363 acres ; 20 inch spacing : 0.01212 acres. Plots actually 120 links rows × 15.15 links.

TREATMENTS : All combinations of :

(a) Rows spaced 10 inches (S_{10}), 15 inches (S_{15}) and 20 inches (S_{20}) apart.

(b) No sulphate of ammonia (—), sulphate of ammonia at the rate of 0.3 cwt. N per acre (N_1) and 0.6 cwt. N per acre (N_2).

(c) Basal mineral fertilisers (superphosphate at the rate of 0.5 cwt. P_2O_5 per acre and 30% potash salt at the rate of 1.0 cwt. K_2O per acre) ploughed in (BP) and harrowed in (BH).

CULTIVATIONS, ETC. : Ploughed : April 20th. Early manures applied : April 6th. Late manures applied : May 11th. Seed sown : May 9th and 10th. Harrowed : April 26th. May 8th, 9th and 10th. Rolled : May 9th, 10th and 12th. Hoed : June 14th, 15th, 27th and 30th, July 12th and 13th. Singled : June 29th-July 5th. Lifted : October 31st-November 9th. Plants 10 inches apart. Variety : Kuhn. Previous crop : Beans.

STANDARD ERRORS PER PLOT : Roots : ±0.500 tons per acre or ±7.65%. Tops : ±0.781 tons per acre or ±10.39%. Sugar percentage : ±0.346. Mean dirt tare : 10 inch spacing : 0.1291, 15 inch spacing : 0.1228, 20 inch spacing : 0.0947.

SUMMARY OF RESULTS

Yields of Separate Treatments (Block effects eliminated)

	Basal minerals ploughed under			Basal minerals harrowed in		
	Spacing of 10 ins.	Spacing of 15 ins.	Spacing of 20 ins.	Spacing of 10 ins.	Spacing of 15 ins.	Spacing of 20 ins.
ROOTS (washed)—tons per acre (±0.316)*						
No Nitrogen	7.67	6.96	6.15	7.32	5.55	4.78
0.3 cwt. Nitrogen ..	8.18	7.02	5.97	6.95	6.22	5.50
0.6 cwt. Nitrogen ..	8.13	6.97	5.59	7.05	6.26	5.03
TOPS—tons per acre (±0.498)*						
No Nitrogen	7.70	7.38	6.12	7.49	6.19	6.13
0.3 cwt. Nitrogen ..	9.05	7.85	7.04	8.50	7.76	6.26
0.6 cwt. Nitrogen ..	9.40	7.85	6.56	9.10	8.36	6.55
SUGAR PERCENTAGE (±0.219)*						
No Nitrogen	16.66	16.32	16.17	16.64	15.74	15.99
0.3 cwt. Nitrogen ..	16.45	16.27	16.20	16.07	16.09	16.28
0.6 cwt. Nitrogen ..	16.46	16.01	15.83	15.96	15.68	15.64
TOTAL SUGAR—cwt. per acre						
No Nitrogen	25.6	22.7	19.9	24.4	17.5	15.3
0.3 cwt. Nitrogen ..	26.9	22.8	19.3	22.3	20.0	17.9
0.6 cwt. Nitrogen ..	26.8	22.3	17.7	22.5	19.6	15.7

*For second order interactions only.

MAIN EFFECTS

MEAN YIELDS: Roots, 6.52 tons; Tops, 7.52 tons; Sugar percentage, 16.14; Total Sugar, 21.0 cwt.

Spacing

	Roots (washed) tons p.a.	*Diff.*	Tops tons p.a.	*Diff.*	Sugar Percentage Actual	*Diff.*	Total Sugar cwt. p.a.	*Diff.*
10 in. Spacing ..	7.55		8.54		16.37		24.7	
15 in. Spacing ..	6.50	*−1.05*	7.56	*−0.98*	16.02	*−0.35*	20.8	*−3.9*
20 in. Spacing ..	5.50	*−1.00*	6.44	*−1.12*	16.02	*0*	17.6	*−3.2*
Standard Error	±0.102	*±0.144*	±0.161	*±0.228*	±0.071	*±0.100*	—	—

Basals

	Roots (washed) tons p.a.	*Diff.*	Tops tons p.a.	*Diff.*	Sugar Percentage Actual	*Diff.*	Total Sugar cwt. p.a.	*Diff.*
Basals ploughed under ..	6.96		7.66		16.26		22.6	
Basals harrowed in	6.08	*−0.88*	7.37	*−0.29*	16.01	*−0.25*	19.5	*−3.1*
Standard Error	±0.083	*±0.117*	±0.131	*±0.185*	±0.058	*±0.082*	—	—

Nitrogen

	Roots (washed) tons p.a.	*Diff.*	Tops tons p.a.	*Diff.*	Sugar Percentage Actual	*Diff.*	Total Sugar cwt. p.a.	*Diff.*
No Nitrogen ..	6.40		6.83		16.26		20.8	
0.3 cwt. Nitrogen	6.64	*+0.24*	7.75	*+0.92*	16.23	*−0.03*	21.5	*+0.70*
0.6 cwt. Nitrogen	6.51	*−0.13*	7.96	*+0.21*	15.93	*−0.30*	20.7	*−0.80*
Standard Error	±0.102	*±0.144*	±0.161	*±0.228*	±0.071	*±0.100*	—	—

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INTERACTION OF SPACING AND SULPHATE OF AMMONIA. MEAN OF BOTH BASALS

	Roots (washed) tons per acre (±0.188)			Tops tons per acre (±0.298)			Sugar Percentage (±0.130)			Total Sugar cwt. per acre		
	Nitrogen			Nitrogen			Nitrogen			Nitrogen		
	None	0.3cwt	0.6cwt	None	0.3cwt	0.6cwt	None	0.3cwt	0.6cwt	None	0.3cwt	0.6cwt
Spacing												
10 ins.	7.50	7.56	7.59	7.60	8.78	9.25	16.65	16.26	16.21	25.0	24.6	24.6
15 ins.	6.26	6.62	6.62	6.78	7.80	8.10	16.03	16.18	15.84	20.1	21.4	21.0
20 ins.	5.46	5.74	5.31	6.12	6.65	6.56	16.08	16.24	15.74	17.6	18.6	16·7

INTERACTION OF SPACINGS AND BASALS. MEAN OF ALL LEVELS OF NITROGEN

	Roots (washed) tons per acre (± 0.144)		Tops tons per acre (± 0.228)		Sugar Percentage (± 0.100)		Total Sugar cwt. per acre	
	Basal minerals		Basal minerals		Basal minerals		Basal minerals	
	ploughed under	harrowed in	ploughed under	harrowed in	ploughed under	harrowed in	ploughed under	harrowed in
10 in. Spacing . .	8.00	7.11	8.72	8.37	16.52	16.22	26.4	23.1
15 in. Spacing . .	6.99	6.02	7.69	7.44	16.20	15.84	22.6	19.0
20 in. Spacing . .	5.90	5.11	6.57	6.31	16.07	15.97	19.0	16.3

INTERACTION OF NITROGEN AND BASALS. MEAN OF ALL SPACINGS.

	Roots (washed) tons per acre (± 0.144)		Tops tons per acre (± 0.228)		Sugar Percentage (± 0.100)		Total Sugar cwt. per acre	
	Basal minerals		Basal minerals		Basal minerals		Basal minerals	
	ploughed under	harrowed in	ploughed under	harrowed in	ploughed under	harrowed in	ploughed under	harrowed in
No Nitrogen . .	6.92	5.89	7.07	6.59	16.38	16.13	22.7	19.1
0.3 cwt. Nitrogen	7.06	6.22	7.97	7.53	16.31	16.15	23.0	20.1
0.6 cwt. Nitrogen	6.90	6.12	7.93	8.00	16.10	15.76	22.3	19.3

CONCLUSIONS

The effect of varying the spacing of the rows is very marked, the 10 inch spacing giving 31 per cent. greater yield than the 20 inch spacing. The sugar percentage of the 10 inch spacing is also significantly higher than that of the 20 inch spacing, so that the yield of sugar for the narrowest spacing is no less than 35 per cent. greater than that of the widest spacing. The yield of tops is also considerably greater for the narrowest spacing. The spacing effects do not show any significant departure from proportionality to differences between the row widths except for the sugar percentage which (perhaps somewhat surprisingly) shows no increase from 20 inch to 15 inch spacing but a considerable increase from 15 inch to 10 inch, the difference of the increases being significant.

The sulphate of ammonia produces no significant effects on the yield of roots but significantly lowers the sugar percentage, particularly in the higher dressing, and significantly increases the yield of tops.

Basals ploughed under produce significantly greater yields of roots and tops and significantly higher sugar percentage than basals harrowed in.

There are no significant interactions.

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KALE

Comparison of Marrow-stem and Thousand-head. Effect of thinning, and of heavy nitrogen dressings.

RK—GREAT KNOTT, 1933.
Plan and yields in lb.—Green material (Total of all Harvestings)

N ↑

1								8
M T N_3 306.0	H U N_0 180.0	M T N_2 387.4	H T N_1 391.7	H T N_1 345.2	H T N_0 317.5	M T N_2 421.9	H U N_1 494.5*	
M U N_0 395.5	H T N_2 350.2	M T N_1 449.6	M T N_0 406.1	H U N_0 325.6	M U N_0 435.3	H U N_2 507.3	M T N_1 429.2	
H T N_3 385.7	H U N_1 495.9	M U N_3 583.9	M U N_1 585.5	M T N_0 331.4	H T N_2 411.7	M T N_3 402.7	M U N_1 503.1	
H U N_2 468.7	H U N_3 510.2	M U N_2 576.8	H T N_0 364.3	M U N_2 597.7	M U N_3 547.0	H T N_3 356.2	H U N_3 488.7	
M U N_1 497.2	H U N_1 507.7	M U N_3 572.9	H T N_2 465.3	H T N_1 409.4	M U N_1 535.5	H U N_0 318.1	M T N_2 427.3	
M T N_0 340.1	H U N_0 396.3	M T N_3 500.5	H T N_0 370.1	H U N_1 506.3	M U N_0 438.0	H T N_0 289.1	M T N_3 424.3	
H U N_3 460.3	M T N_1 415.6	M T N_2 476.5	M U N_0 481.4	M T N_0 383.4	M U N_2 559.1	H T N_3 387.1	M U N_3 522.1	
H U N_2 428.7	M U N_2 506.2	H T N_3 427.6	H T N_1 420.7	H U N_3 524.1	H U N_2 509.3	M T N_1 398.6	H T N_2 368.6	
57								64

* Fourth harvesting of this plot estimated.

SYSTEM OF REPLICATION : 4 randomised blocks of 16 plots each.

AREA OF EACH PLOT : .0178 acre. (36.3 links × 49.1 links.)

TREATMENTS : All combinations of :
(*a*) Marrow-stem (M) and Thousand-head (H).
(*b*) Unthinned (U) and Thinned to 18 ins. apart in the rows (T).
(*c*) No nitrochalk (N_0), and nitrochalk at the rate of 1 cwt. N. per acre (N_1), 2 cwt. N per acre (N_2) and 3 cwt. N. per acre (N_3) (all applied in three equal dessings).

BASAL MANURING : Superphosphate at the rate of 0.5 cwt. P_2O_5 per acre and muriate of potash at the rate of 0.8 cwt. K_2O per acre (applied with seed).

CULTIVATIONS, ETC. : Tractor cultivate : May 15th. Harrowed : June 7th, 8th, 9th and 23rd. Rolled : May 16th, June 8th, 9th, 12th, 23rd and July 7th. Hoed : July 31st—August 2nd, August 21st, 22nd and 25th. Thinned : August 21st and 22nd. Manures applied : May 19th, 20th, July 25th, 26th, August 23rd and 24th. Seed sown : May 16th. Re-sown : June 26th. Harvested : December 3rd, 11th, 18th, January 1st, 8th, 15th, 22nd, 29th, February 5th, 12th, 19th and 26th. (One twelfth of each plot was harvested on each date.) Rows spaced 2 ft. apart. Previous crop : Wheat.

STANDARD ERRORS PER PLOT : Total of all harvestings : Green material : 1.10 tons or 10.0 per cent. Dry matter : 1.70 cwt. or 5.52 per cent.

https://doi.org/10.23637/ERADOC-1-3

SUMMARY OF RESULTS

Yield of individual Harvestings.

Harvesting.	Marrow Stem.								Thousand Head.							
	Unthinned.				Thinned.				Unthinned.				Thinned.			
	No N	1 cwt. N	2 cwt. N	3 cwt. N	No N	1 cwt. N	2 cwt. N	3 cwt. N	No N	1 cwt. N	2 cwt. N	3 cwt. N	No N	1 cwt. N	2 cwt. N	3 cwt. N
Green weights—tons per acre.																
1	11.93	15.43	17.85	17.69	9.44	11.16	12.96	11.69	7.31	14.28	13.84	15.15	9.26	11.65	12.62	11.53
2	11.96	13.87	15.01	15.89	9.72	10.71	10.92	10.20	7.59	13.43	11.54	13.20	8.18	9.84	10.04	10.35
3	10.52	14.24	14.40	14.10	8.48	10.14	11.00	10.98	8.00	13.25	13.54	12.16	8.32	9.52	9.54	9.74
4	12.38	15.22	16.11	16.21	10.69	12.23	12.59	11.79	9.61	14.33	15.33	14.43	8.91	12.20	11.98	11.95
5	10.50	15.07	15.94	14.94	10.12	12.02	12.45	12.64	7.87	14.04	13.32	13.77	8.44	10.74	11.22	10.25
6	11.56	14.23	14.23	14.34	8.67	11.65	11.59	9.08	8.69	13.17	11.14	12.83	8.32	9.76	11.09	9.90
7	10.60	13.49	13.56	12.29	9.38	10.36	9.24	9.90	7.96	12.01	11.91	12.50	8.18	9.06	9.46	10.29
8	10.41	12.26	11.88	12.56	8.68	10.41	10.03	10.63	7.27	11.90	10.55	11.56	8.90	8.66	8.30	8.38
9	11.00	11.74	12.44	12.19	9.26	8.91	9.52	10.07	7.56	11.58	10.95	11.03	7.78	9.25	8.87	8.00
10	11.24	12.10	14.56	14.27	9.32	10.32	10.40	9.68	7.34	10.96	10.68	11.57	9.90	10.14	9.52	10.29
11	10.30	12.41	11.54	12.25	8.62	9.66	9.56	8.85	6.90	11.07	11.44	11.12	7.71	8.60	9.78	8.17
12	9.12	9.33	10.78	10.53	7.40	9.65	8.46	7.24	5.58	10.60	9.60	9.70	6.86	8.32	7.48	8.13
Mean ..	*10.96*	*13.28*	*14.02*	*13.94*	*9.15*	*10.60*	*10.73*	*10.23*	*7.64*	*12.55*	*11.99*	*12.42*	*8.40*	*9.81*	*9.99*	*9.75*
Dry Matter—cwt. per acre.																
1	34.9	40.0	45.4	44.6	27.0	29.0	34.7	29.9	23.0	40.6	38.5	42.4	28.8	33.1	34.3	32.0
2	36.4	38.3	41.2	43.0	30.0	30.4	31.4	29.6	25.7	42.4	34.9	39.4	26.1	30.6	31.1	31.9
3	31.1	41.0	41.2	39.2	25.5	28.4	30.0	31.1	26.8	40.7	40.3	36.7	26.4	29.3	30.4	29.6
4	31.7	35.9	39.4	38.9	26.9	29.9	30.5	29.0	26.1	36.7	39.8	36.1	23.4	31.7	31.4	30.4
5	26.4	39.8	39.2	37.6	27.5	31.0	32.6	33.1	22.5	36.5	37.0	37.7	23.6	28.6	30.5	28.1
6	31.0	35.6	35.9	35.3	23.7	30.0	30.4	23.0	25.4	36.4	29.8	34.9	23.3	26.1	30.4	26.8
7	31.0	35.6	36.8	33.4	27.2	28.8	24.2	27.0	24.8	34.9	35.0	36.5	24.0	26.6	27.6	29.8
8	30.6	33.5	32.3	34.1	25.7	28.7	27.4	30.6	23.7	36.7	32.0	34.3	28.1	26.1	25.5	26.0
9	31.0	30.8	32.6	31.7	27.0	24.0	25.1	27.0	23.6	34.6	31.7	33.5	22.7	27.2	26.1	22.7
10	31.7	32.5	39.1	36.5	27.0	26.9	27.2	26.4	22.5	32.6	32.2	33.5	31.2	28.7	28.4	30.0
11	29.2	34.7	31.6	33.8	24.9	25.8	26.9	25.1	22.5	33.2	35.2	32.5	23.7	25.7	29.3	24.8
12	27.2	26.1	30.6	30.0	22.7	27.8	24.3	20.6	18.8	34.6	29.8	31.6	21.6	26.0	23.1	25.5
Mean ..	*31.0*	*35.3*	*37.1*	*36.5*	*26.3*	*28.4*	*28.7*	*27.7*	*23.8*	*36.7*	*34.7*	*35.8*	*25.2*	*28.3*	*29.0*	*28.1*

RATIO OF LEAVES TO STEMS—INDIVIDUAL HARVESTINGS

Harvesting	Marrow Stem								Thousand Head							
	Unthinned				Thinned				Unthinned				Thinned			
	No N	1 cwt. N	2 cwt. N	3 cwt. N	No N	1 cwt. N	2 cwt. N	3 cwt. N	No N	1 cwt. N	2 cwt N	3 cwt. N	No N	1 cwt. N	2 cwt. N	3 cwt. N
							Green weights									
1	1.87	1.42	1.47	1.23	2.06	2.09	1.71	2.13	3.58	2.88	2.59	2.34	4.14	3.92	3.79	3.73
2	1.50	1.14	1.22	1.24	1.80	1.63	1.76	1.81	3.05	2.50	2.20	2.51	3.74	3.21	3.12	3.34
3	1.41	1.41	1.14	1.20	1.72	1.93	1.81	1.70	3.26	2.42	2.15	2.40	4.09	3.23	3.57	3.22
4	1.60	1.34	1.46	1.34	2.13	1.71	1.83	1.98	3.46	2.60	2.74	2.70	3.81	3.82	3.64	3.68
5	1.76	1.43	1.42	1.33	1.90	2.10	1.73	1.71	4.22	2.37	2.78	2.20	4.65	3.74	3.66	3.97
6	1.54	1.35	1.36	1.38	2.03	2.21	1.80	2.09	3.65	2.27	2.87	2.66	4.62	4.18	3.65	4.02
7	1.42	1.00	1.00	1.11	1.77	1.75	1.61	1.78	3.07	2.20	2.39	1.98	3.23	3.26	3.09	3.06
8	1.28	1.07	0.99	1.07	1.56	1.33	1.56	1.53	2.83	2.14	2.23	2.23	3.16	3.28	2.97	3.66
9	1.11	1.02	0.93	0.97	1.44	1.59	1.62	1.34	3.13	1.88	2.25	2.14	3.46	2.83	3.35	2.93
10	1.28	1.11	1.04	0.98	1.47	1.51	1.30	1.50	2.97	2.17	2.24	2.07	3.70	3.36	3.35	2.95
11	1.15	1.02	0.99	1.02	1.53	1.41	1.48	1.51	3.02	1.88	2.34	1.82	3.18	3.28	2.96	3.54
12	1.08	0.99	0.82	0.92	1.17	1.38	1.11	1.28	2.81	2.00	1.88	1.86	2.88	2.72	2.52	2.59
Mean .. .	*1.42*	*1.19*	*1.15*	*1.15*	*1.72*	*1.72*	*1.61*	*1.70*	*3.25*	*2.28*	*2.39*	*2.24*	*3.72*	*3.40*	*3.31*	*3.39*
							Dry Matter									
1	1.94	1.50	1.62	1.29	2.03	2.26	1.79	2.29	3.27	2.63	2.51	2.29	3.59	3.64	3.54	3.38
2	1.66	1.41	1.51	1.52	1.97	1.92	2.13	1.98	2.76	2.50	2.53	2.62	3.54	3.12	3.28	3.33
3	1.50	1.70	1.41	1.46	1.89	2.21	1.99	1.99	3.01	2.37	2.16	2.40	3.78	3.21	3.48	3.17
4	1.51	1.37	1.57	1.43	1.85	1.64	1.79	1.97	2.72	2.20	2.41	2.34	3.07	3.04	2.98	3.09
5	1.43	1.57	1.52	1.50	1.75	2.13	1.75	1.66	3.48	2.14	2.67	2.05	3.97	3.28	3.33	3.55
6	1.52	1.42	1.44	1.53	2.03	2.23	1.84	2.19	3.10	2.01	2.70	2.54	3.77	3.72	3.24	3.66
7	1.47	1.20	1.18	1.37	1.77	1.99	2.32	1.90	2.74	2.14	2.40	2.03	2.91	3.08	2.97	2.94
8	1.39	1.22	1.28	1.29	1.70	1.56	1.75	1.64	2.56	2.06	2.22	2.26	2.87	3.15	2.88	3.50
9	1.22	1.29	1.21	1.22	1.56	1.84	1.76	1.50	2.89	1.91	2.30	2.37	3.08	2.66	3.23	3.16
10	1.34	1.39	1.24	1.20	1.72	1.69	1.42	1.69	2.70	2.12	2.27	2.13	3.58	3.04	3.25	2.87
11	1.26	1.16	1.20	1.32	1.62	1.54	1.71	1.74	2.78	1.88	2.36	1.95	2.96	3.09	2.91	3.38
12	1.25	1.24	1.04	1.18	1.37	1.58	1.34	1.53	2.67	2.12	2.07	2.08	2.68	2.78	2.60	2.74
Mean .. .	*1.46*	*1.37*	*1.35*	*1.36*	*1.77*	*1.88*	*1.80*	*1.84*	*2.89*	*2.17*	*2.38*	*2.26*	*3.32*	*3.15*	*3.14*	*3.23*

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TOTAL YIELDS

Varieties and Thinning

	Green Material (tons per acre) (±0.275, Means ± 0.195)			Dry Matter (cwt. per acre) (±0.424, Means ± 0.300)		
	Marrow Stem	Thousand Head.	*Mean.*	Marrow Stem.	Thousand Head.	*Mean.*
Thinned ..	10.18	9.49	*9.84*	27.8	27.7	*27.8*
Unthinned ..	13.05	11.15	*12.10*	35.0	32.7	*33.8*
Mean ..	*11.62*	*10.32*	*10.97*	*31.4*	*30.2*	*30.8*

Nitrogen and Thinning

	Green Material (tons per acre) (±0.389, Means ±0.275)				Dry Matter (cwt. per acre) (±0.601, Means ±0.424)			
	No N	1 cwt. N	2 cwt. N	3 cwt. N	No N	1 cwt. N	2 cwt. N	3 cwt. N
Thinned ..	8.77	10.21	10.36	9.99	25.8	28.4	28.9	27.9
Unthinned ..	9.30	12.91	13.00	13.18	27.4	36.0	35.9	36.1
Mean	*9.04*	*11.56*	*11.68*	*11.58*	*26.6*	*32.2*	*32.4*	*32.0*

CHANGES OF YIELD WITH TIME

Decrease per week

Varieties and Thinning

	Green Material (tons per acre) (±0.0284, Means ±0.0201)			Dry Matter (cwt. per acre) (±0.0472, Means ±0.0334)		
	Marrow Stem	Thousand Head	*Mean*	Marrow Stem	Thousand Head	*Mean*
Thinned	0.20	0.20	*0.20*	0.47	0.46	*0.46*
Unthinned	0.36	0.27	*0.32*	0.83	0.60	*0.72*
Mean	*0.28*	*0.24*	*0.26*	*0.65*	*0.53*	*0.59*

Nitrogen and Thinning

	Green Material (tons per acre) (±0.0402, Means ±0.0284)				Dry Matter (cwt. per acre) (±0.0668, Means ±0.0472)			
	No. N	1 cwt. N	2 cwt. N	3 cwt N	No N	1 cwt. N	2 cwt N	3 cwt N
Thinned	0.10	0.18	0.28	0.26	0.22	0.41	0.66	0.57
Unthinned ..	0.14	0.35	0.37	0.39	0.39	0.80	0.82	0.85
Mean	*0.12*	*0.26*	*0.32*	*0.32*	*0.30*	*0.60*	*0.74*	*0.71*

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MEAN RATIO OF LEAVES TO STEMS

Varieties and Thinning

	Green Material (±0.0307) (Means ±0.0217)			Dry Matter (±0.0350) (Means ±0.0247)		
	Marrow Stem	Thousand Head	*Mean*	Marrow Stem	Thousand Head	*Mean*
Thinned	1.69	3.46	*2.58*	1.82	3.21	*2.52*
Unthinned	1.23	2.54	*1.88*	1.38	2.42	*1.90*
Mean	*1.46*	*3.00*	*2.23*	*1.60*	*2.82*	*2.21*

Nitrogen and Thinning, Nitrogen and Varieties

	Green Material (±0.0433) (Means ±0.0307)				Dry Matter (±0.0494) (Means ±0.0350)			
	No N.	1 cwt. N.	2 cwt. N.	3 cwt. N.	No N.	1 cwt. N.	2 cwt. N.	3 cwt. N.
	Nitrogen and Thinning							
Thinned	2.72	2.56	2.46	2.54	2.54	2.52	2.47	2.54
Unthinned ..	2.34	1.74	1.77	1.70	2.18	1.77	1.86	1.81
	Nitrogen and Varieties							
Marrow Stem ..	1.56	1.46	1.38	1.42	1.61	1.63	1.58	1.60
Thousand Head	3.49	2.84	2.85	2.82	3.10	2.66	2.76	2.74
Mean	*2.53*	*2.15*	*2.12*	*2.12*	*2.36*	*2.14*	*2.16*	*2.18*

RATIO OF LEAVES TO STEMS—CHANGES WITH TIME

Varieties and Thinning. Decrease per week.

	Green Material (±0.00552) (Means ±0.00390)			Dry Matter (±0.00482) (Means ±0.00341)		
	Marrow Stem	Thousand Head	*Mean*	Marrow Stem	Thousand Head	*Mean*
Thinned	0.0528	0.0692	*0.0610*	0.0449	0.0471	*0.0460*
Unthinned	0.0410	0.0524	*0.0467*	0.0338	0.0341	*0.0340*
Mean	*0.0469*	*0.0608*	*0.0538*	*0.0394*	*0.0406*	*0.0400*

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RATIO OF LEAVES TO STEMS—CHANGES WITH TIME

Nitrogen and Thinning. Decrease per week.

	Green material (±0.00781) (Means ±0.00552)				Dry matter (± 0.00681) (Means ±0.00482)			
	No N.	1 cwt. N.	2 cwt. N.	3 cwt. N.	No N.	1 cwt. N.	2 cwt. N.	3 cwt. N.
Thinned	0.0759	0.0554	0.0562	0.0566	0.0542	0.0465	0.0444	0.0388
Unthinned ..	0.0537	0.0511	0.0391	0.0427	0.0392	0.0371	0.0332	0.0263
Mean	*0.0648*	*0.0532*	*0.0476*	*0.0496*	*0.0467*	*0.0418*	*0.0388*	*0.0326*

CONCLUSIONS

There is a significant response in yield of green material to the first dressing of nitrogen, this response being significantly greater on the unthinned plots. The further dressings of nitrogen produce no further increase in yield. The effect on the dry matter is substantially the same.

The thinned plots give significantly less yield than the unthinned plots, this difference being significantly greater where nitrogen was applied.

Marrow-stem gives significantly greater yield than Thousand-head, this difference being significantly greater on the unthinned plots.

The plots receiving nitrogen show a significantly greater decrease in yield with time than the plots without nitrogen. The unthinned plots show a significantly greater decrease than the thinned plots. Marrow-stem shows a significantly greater decrease of dry matter than Thousand-head, but not of green material.

The ratio of leaves to stems is significantly greater on the thinned than the unthinned plots. Thousand-head gives a significantly greater ratio than Marrow-stem, both for green material and dry matter, the varietal differences being significantly greater on the thinned plots, and on the plots without nitrogen. The ratios are significantly reduced by the application of nitrogen, there being no differences between the various levels of nitrogen. For dry matter this reduction only occurs on the unthinned plots and for green material the reduction is small (though significant) on the thinned plots.

The only significant changes of the ratio of leaves to stems with time are (1) a significantly greater decrease on the thinned plots for both green material and dry matter; (2) a significantly greater decrease with Thousand-head for green material only.

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BRUSSELS SPROUTS

Effect of poultry manure compared with that of sulphate of ammonia and superphosphate.

RD—Great Harpenden, 1933

Plan and yields in lb. Saleable Sprouts (Total of all pickings)

N ↑

1							8
MN_2 63.8	PN_1 70.1	P 68.5	MP 76.0	MPN_1 93.8	MPN_2 87.3	O 69.7	MN_2 72.4
MPN_1 83.7	PN_2 78.9	MN_1 82.0	O 82.6	PN_1 93.8	P 106.5	N_2 89.7	MN_1 82.5
M 70.2	MPN_2 77.4	N_1 64.3	N_2 71.0	M 68.3	MP 90.9	PN_2 63.2	N_1 64.3
PN_1 89.5	PN_2 77.1	MP 90.8	MPN_2 88.8	N_2 96.1*	P 105.8*	MP 90.9*	N_1 77.4*
P 77.7	N_1 81.3	M 84.9	MPN_1 89.6	MPN_1 77.2*	MN_1 74.7*	M 78.3*	O 73.1*
O 99.1	MN_2 96.2	MN_1 81.5	N_2 72.3	PN_2 56.9*	MN_2 60.3*	PN_1 55.4*	MPN_2 28.4*
41							48

*The results of this block were rejected owing to evidence of serious tree competition.

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

AREA OF EACH PLOT : 0.02417 acre (9 yards × 13 yards).

TREATMENTS : All combinations of :

(a) No poultry manure and poultry manure at the rate of 0.6 cwt. N per acre, with the addition of superphosphate at the rate of 0.005 cwt. per acre, to give a total of 0.6 cwt. P_2O_5 per acre (M).

(b) No sulphate of ammonia, sulphate of ammonia at the rate of 0.3 cwt. N per acre (N_1), and 0.6 cwt. N per acre (N_2).

(c) No superphosphate, and superphosphate at the rate of 0.6 cwt. P_2O_5 per acre (P).

CULTIVATIONS, ETC. : Spring ploughed. Rolled : May 22nd. Hoed : June 20th, July 7th, 11th and August 26th-28th. Manures applied : May 26th, 27th, 30th, 31st and June 8th. Planted : May 26th and 27th. Harvested : November 13th and 14th. December 11th and 12th, January 10th and February 6th and 7th. Previous crop : Kale.

STANDARD ERROR PER PLOT : Total of all pickings (saleable sprouts) : 3.73 cwt. or 12.55%.

INDIVIDUAL TREATMENTS

Saleable Sprouts—cwt. per acre.

Mean yield: 29.75 cwt.

Pickings	O	M	P	MP	N_1	MN_1	PN_1	MPN_1	N_2	MN_2	PN_2	MPN_2
1st ..	13.64	12.25	13.86	16.95	11.67	13.63	13.81	14.55	12.58	11.63	12.48	15.44
2nd ..	8.56	7.63	8.49	6.45	6.68	8.69	8.52	8.58	7.71	9.52	6.86	7.37
3rd ..	3.51	2.26	2.90	2.34	2.06	2.72	3.40	4.32	2.87	2.61	2.49	2.23
4th ..	5.24	5.36	5.85	5.98	5.43	5.24	5.47	5.43	5.53	4.85	5.16	6.17
Total	*30.95*	*27.50*	*31.10*	*31.72*	*25.84*	*30.28*	*31.20*	*32.88*	*28.69*	*28.61*	*26.99*	*31.21*

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INDIVIDUAL TREATMENTS—PERCENTAGE BLOWN TO TOTAL

Pickings	O	M	P	MP	N_1	MN_1	PN_1	MPN_1	N_2	MN_2	PN_2	MPN_2
1st ..	20.9	24.8	22.4	23.6	21.2	24.0	24.2	21.9	23.4	24.4	25.1	26.5
2nd ..	8.8	8.2	9.5	10.6	9.4	10.7	9.4	10.6	11.1	10.0	10.7	11.8
3rd ..	20.8	25.7	21.3	27.2	23.7	27.2	21.9	23.8	23.7	23.6	28.6	28.7
4th ..	No blown sprouts.											

INDIVIDUAL TREATMENTS—PERCENTAGE FIRSTS TO SECONDS

Firsts denote sprouts too large to pass through a $1\frac{1}{4}$ in. riddle (blown sprouts excluded).

Pickings.	O	M	P	MP	N_1	MN_1	PN_1	MPN_1	N_2	MN_2	PN_2	MPN_2
1st ..	224.4	233.8	275.3	221.0	207.2	212.6	312.1	266.7	244.4	223.1	175.9	212.9
2nd ..	50.3	71.6	48.0	52.8	45.6	56.3	68.8	68.8	79.8	50.2	85.3	59.3
3rd ..	21.9	34.5	47.0	40.8	33.1	31.8	28.6	42.6	37.7	31.5	33.6	37.3
4th ..	12.3	14.9	10.1	12.2	12.9	12.3	9.9	12.4	12.7	10.0	15.2	12.5

RESPONSES TO TREATMENTS

Saleable Sprouts—total of all pickings.

cwt. per acre	*Mean Response*	Differential Responses						
		Superphosphate		Poultry Manure		Sulphate of Ammonia		
		Absent	Present	Absent	Present	None	Single	Double
Superphosphate..	*+2.20*[1]	—	—	+1.27[3]	+3.14[3]	+2.18[4]	+3.98[4]	+0.45[4]
Poultry Manure..	*+1.24*[1]	+0.30[3]	+2.17[3]	—	—	−1.41[4]	+3.06[4]	+2.07[4]
Single sulph. Amm.	*−0.27*[2]	−1.16[4]	+0.63[4]	−2.50[4]	+1.97[4]	—	—	—
Double sulph. amm.	*−1.44*[2]	−0.58[4]	−2.31[4]	−3.18[4]	+0.30[4]	—	—	—

STANDARD ERRORS: (1) ±1.24, (2) ±1.53, (3) ±1.76, (4) ±2.16.

POULTRY MANURE, SULPHATE OF AMMONIA AND SUPERPHOSPHATE

SALEABLE SPROUTS—TOTAL OF ALL PICKINGS

cwt. per acre	Mean of Super and No Super (± 1.52)			Mean of all levels of N (±1.24)		*Mean*
	No N	0.3 cwt. N	0.6 cwt. N	No Super	Super.	
No Poultry Manure ..	31.03	28.52	27.83	28.49	29.76	*29.12*
Poultry Manure ..	29.61	31.58	29.91	28.80	31.94	*30.37*
Mean	*30.32*	*30.05*	*28.87*	*28.64*	*30.85*	*29.75*

CONCLUSIONS

There are no significant effects on the total of saleable sprouts for all pickings though there is some indication of a response to superphosphate, which becomes significant when the first picking only is considered; the effect of superphosphate, in fact, appears to be confined to the first picking.

The fertilisers produced no significant effects on the ratio of blown to saleable sprouts, or in the ratio of firsts to seconds.

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