ROTHAMSTED RESEARCH

Report for 1929

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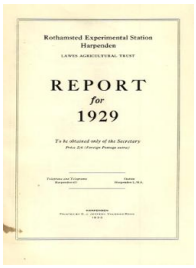

Experiments at Rothamsted

Rothamsted Research

Rothamsted Research (1930) *Experiments at Rothamsted ;* Report For 1929, pp 89 - 105 **- DOI: https://doi.org/10.23637/ERADOC-1-111**

Second Series: Replicated Experiments.

Barley: Comparison of Nitrogenous Fertilisers, Sulphate and Muriate of Ammonia, Urea and Cyanamide, each used in single and double dressings.

Effect of Superphosphate and Sulphate of Potash.

Long Hoos (Section 4), 1929.

A. Single Dressing. W. **B. Double Dressing.**

I.	N	C	O	M	S
II.	O	M	S	C	N
II.	S	O	C	N	M
IV.	M	S	N	O	C
V.	C	N	M	S	O

I.	N	U	M	S	C
II.	S	C	N	M	U
III.	M	S	U	C	N
IV.	C	N	S	U	M
V.	U	M	C	N	S

System of Replication: 2 Latin Squares.
Area of Each Plot: 1/40th acre.
Testing Sulphate (S) and Muriate (M) of Ammonia, Cyanamide (C), Urea (U) and Nitrate of Soda (N).
Rates: 0.2 and 0.4 cwt. of N per acre. Single Urea replaced by No Nitrogen.
Each Plot divided into 4 sub-plots each 1/160th acre, for the treatments—(1) No Potash or Phosphate, (2) Sulphate of Potash (.6 cwt. K_2O per acre), (3) Superphosphate (.4 cwt P_2O_5 per acre), (4) Sulphate of Potash and Superphosphate. Yields of sub-plots estimated by sampling method only.
Barley sown: March 12. Harvested: August 10.
Variety: "Plumage Archer" (3-4 bushels per acre). Manures applied: March 14-16.
Previous Crop: Barley.

Actual Weights in lb. Per Whole Plot.

	Grain.									
	Single Dressing.					Double Dressing.				
Row.	O	S	M	N	C	U	S	M	N	C
I.	51.50	64.50	62.25	75.50	56.75	64.25	59.50	66.00	79.25	63.00
II.	59.00	59.75	57.50	71.25	66.50	69.75	77.00	69.50	77.00	71.75
III.	55.75	66.25	75.25	64.50	69.75	75.50	71.50	82.75	72.75	75.50
IV.	63.00	61.75	66.50	76.50	75.00	66.00	77.50	69.50	80.50	79.25
V.	51.50	71.25	68.75	71.25	63.00	80.25	67.75	78.75	80.25	78.50
	Straw.									
I.	47.25	66.75	60.00	81.50	58.75	57.75	58.50	61.50	74.00	62.50
II.	62.00	57.50	57.25	79.75	65.50	70.25	70.75	71.50	81.75	71.75
III.	51.00	81.50	72.75	65.00	66.25	69.50	68.50	83.00	75.25	76.50
IV.	64.50	57.75	65.25	78.00	75.75	63.00	73.25	68.25	79.75	80.50
V.	59.75	70.75	68.25	70.00	62.75	76.00	77.75	72.75	73.00	67.75

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Barley: Long Hoos, 1929 (contd.)

Summary of Results by the usual Threshing Method.—Nitrogenous Comparisons.

A. Single Dressing.

	No Nitrogen.	Sulphate of Amm.	Muriate of Amm.	Nitrate of Soda.	Cyana-mide.	Mean.	Standard Error.
Grain, cwt. per acre	20.1	23.1	23.6	25.6	23.6	23.2	0.88
Grain, per cent. ..	86.4	99.6	101.6	110.5	101.9	100.0	3.79
Straw, cwt. per acre	20.3	23.9	23.1	26.7	23.5	23.5	1.06
Straw, per cent. ..	86.4	101.6	98.3	113.7	100.0	100.0	4.49

Significant response to all nitrogenous manures with both grain and straw. The yield on the Nitrate of Soda plots was significantly better than the mean yield of the plots receiving the other three dressings.

B. Double Dressing.

	Urea.	Sulphate of Amm.	Muriate of Amm.	Nitrate of Soda.	Cyana-mide.	Mean.	Standard Error.
Grain, cwt. per acre	25.4	25.2	26.2	27.8	26.3	26.2	0.44
Grain, per cent. ..	97.0	96.3	100.0	106.3	100.4	100.0	1.68
Straw, cwt. per acre	24.0	24.9	25.5	27.4	25.6	25.5	0.71
Straw, per cent. ..	94.3	97.7	100.0	107.5	100.6	100.0	2.80

Plots treated with Nitrate of Soda gave significantly higher yield than all the others.

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Summary of Results by Sampling Method.
Table of Separate Yields.

Grain, cwt. per acre.	A. Single Dressing. No Nitrogen.	Sulphate of Ammonia.	Muriate of Ammonia.	Nitrate of Soda.	Cyana-mide.	Standard Errors.
Without Phosphate and Potash	19.5	25.4	24.2	23.5	22.9	1.40
With Superphosphate	21.5	24.3	23.9	26.0	19.1	
With Sulphate of Potash ..	21.5	20.5	22.6	25.2	23.8	
With Potash and Phosphate ..	20.1	24.3	23.4	24.1	22.5	
Mean	20.7	23.6	23.5	24.7	22.1	0.57
Straw, cwt. per acre.						
Without Phosphate and Potash	19.1	25.7	25.7	23.6	23.7	1.57
With Superphosphate	21.6	24.3	23.3	26.4	19.6	
With Sulphate of Potash ..	21.6	20.5	22.6	27.2	24.0	
With Potash and Phosphate ..	20.4	24.3	24.7	25.7	23.1	
Mean	20.7	23.7	24.1	25.7	22.6	1.42

Grain, cwt. per acre.	B. Double Dressing. Urea.	Sulphate of Ammonia.	Muriate of Ammonia.	Nitrate of Soda.	Cyana-mide.	Standard Errors.
Without Phosphate and Potash	25.8	26.0	26.8	28.3	29.6	1.26
With Superphosphate	25.0	29.1	25.5	29.6	27.6	
With Sulphate of Potash ..	23.7	24.2	27.6	26.6	26.5	
With Potash and Phosphate ..	25.1	24.8	25.8	27.2	26.3	
Mean	24.9	26.0	26.4	27.9	27.5	0.83
Straw, cwt. per acre.						
Without Phosphate and Potash	25.5	25.4	25.9	28.9	32.1	1.41
With Superphosphate	25.1	29.3	24.4	29.6	30.9	
With Sulphate of Potash ..	24.0	23.2	27.1	28.3	27.9	
With Potash and Phosphate ..	26.3	24.3	24.3	27.6	27.4	
Mean	25.3	25.6	25.4	28.6	29.6	0.91

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Barley : Long Hoos, 1929 (contd.)

Potassic and Phosphatic Comparisons.—(Yields Estimated by Sampling).

A. Single Dressing (including No Nitrogen).

GRAIN.	Average Yield in cwt. per acre.		Average Yield per cent.	
	Without Phosphate.	With Phosphate.	Without Phosphate.	With Phosphate.
Without Sulphate of Potash	23.1	23.0	100.8	100.2
With Sulphate of Potash	22.7	22.9	99.1	99.9

Mean—22.9.
Standard Error—0.63 or 2.74%

STRAW.	Average Yield in cwt. per acre.		Average Yield per cent.	
	Without Phosphate.	With Phosphate.	Without Phosphate.	With Phosphate.
Without Sulphate of Potash	23.6	23.0	100.8	98.6
With Sulphate of Potash	23.2	23.7	99.2	101.3

Mean—23.4. Standard Error—0.70 or 3.00%.

No significant effects of Phosphate or Potash with grain or straw.

B. Double Dressing.

GRAIN.	Average Yield in cwt. per acre.		Average Yield per cent.	
	Without Phosphate.	With Phosphate.	Without Phosphate.	With Phosphate.
Without Sulphate of Potash	27.3	27.4	102.8	103.0
With Sulphate of Potash	25.7	25.8	96.8	97.3

Mean—26.6. Standard Error—0.57 or 2.13%.

STRAW	Average Yield in cwt. per acre.		Average Yield per cent.	
	Without Phosphate.	With Phosphate.	Without Phosphate.	With Phosphate.
Without Sulphate of Potash	27.6	27.9	102.5	103.6
With Sulphate of Potash	26.1	26.0	97.1	96.8

Mean—26.9. Standard Error—0.63 or 2.34%.

With both grain and straw Potash has depressed the yield significantly, while Phosphate has been ineffective.

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Winter Oats : Comparison of Nitrogenous Fertilisers, Sulphate of Ammonia and Cyanamide, in all combinations of Autumn and Spring dressings.

Long Hoos (Section 2), 1929.

W

A								B								C							
4	2	13	16	3	11	9	1	2	3	4	5	9	1	11	7	5	8	7	13	3	12	10	9
10	7	5	6	14	12	15	8	12	6	10	15	14	13	16	8	2	14	16	6	4	11	15	1

System of Replication :—3 randomised blocks of 16 plots each.

Area of Each Plot : 1/40th acre.

Unit dressing at a rate equivalent to ¾ cwt. Cyanamide per acre.

System of Manuring : All combinations of Sulphate of Ammonia and equivalent Cyanamide, applied in Autumn and Spring, as shown in key to treatments.

Sulphate of Ammonia applied : September 24, March 19.

Cyanamide applied : September 14, March 18.

Variety : Grey Winter.

Sown : September 24.

Harvested : August 7.

Previous Crop : Barley.

Key to Treatments.

Spring Dressings.

Autumn Dressings	None.	Sulphate.	Cyanamide.	Both.
None ..	1	4	5	10
Sulphate	2	6	7	12
Cyanamide	3	9	11	15
Both ..	8	13	14	16

Actual Weight in lb.—Total Grain.

Blocks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	37.75	34.75	34.75	32.50	35.75	37.25	34.50	31.50	43.00	25.00	41.50	26.00	37.00	34.00	32.50	40.50
B	42.50	40.75	39.50	36.75	40.25	30.75	44.50	45.00	38.50	32.50	51.25	31.00	37.25	29.75	41.50	40.50
C	39.25	42.75	34.75	38.25	40.50	30.75	37.50	37.75	31.00	27.00	40.50	31.25	38.00	44.00	32.50	37.25

Actual Weight in lb.—Total Straw.

Blocks.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	63.75	68.75	57.75	53.50	66.25	71.00	74.25	71.00	78.50	62.50	76.75	69.75	86.50	69.75	73.25	83.75
B	66.75	61.50	66.25	68.75	75.00	68.00	87.50	73.25	86.75	73.50	81.25	78.25	79.75	79.25	77.50	81.25
C	58.50	69.75	53.75	71.50	77.50	78.25	68.00	64.75	72.00	62.75	65.75	63.25	73.00	74.25	72.25	76.25

Summary of Results.

		Grain—cwt. per acre.					Grain—per cent.				
	Average Yield.	Spring Dressings.				Mean.	Spring Dressings.				Mean.
		None.	Sulphate.	Cyanamide.	Both.		None.	Sulphate.	Cyanamide.	Both.	
Autumn Dressings.	None ..	14.2	12.8	13.9	10.1	12.7	108.4	97.5	105.7	76.7	97.1
	Sulphate ..	14.1	11.8	13.9	10.5	12.5	107.3	89.6	105.7	80.1	95.7
	Cyanamide ..	13.0	13.4	15.9	12.7	13.7	98.9	102.1	120.9	96.6	104.6
	Both ..	13.6	13.4	12.8	14.1	13.5	103.7	101.8	97.8	107.3	102.6
	Mean ..	13.7	12.8	14.1	11.8	13.1	104.6	97.8	107.5	90.2	100.0

Standard Error—0.84 cwt. or 6.39 per cent.

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Winter Oats : Long Hoos, 1929 (contd.)

Average Yield.		Straw—cwt. per acre.					Straw—per cent.				
		Spring Dressings.				Mean.	Spring Dressings.				Mean.
		None.	Sulphate.	Cyanamide.	Both.		None.	Sulphate.	Cyanamide.	Both.	
Autumn Dressings.	None ..	22.5	23.1	26.0	23.7	23.8	88.1	90.3	102.0	92.6	93.2
	Sulphate ..	23.8	25.9	27.3	25.1	25.5	93.2	101.3	107.1	98.5	100.0
	Cyanamide	21.2	28.2	26.6	26.5	25.6	82.8	110.6	104.3	103.9	100.4
	Both ..	24.9	28.5	26.6	28.7	27.2	97.4	111.5	104.0	112.4	106.4
	Mean ..	23.1	26.4	26.6	26.0	25.5	90.4	103.4	104.3	101.9	100.0

Standard Error—1.16 cwt. or 4.56 per cent.

With grain there was a significant depression where Sulphate of Ammonia was applied in Spring, which was materially less on the plots that had had Autumn Cyanamide. The yield was depressed by the application of Spring Cyanamide to those plots which did not receive Cyanamide in the Autumn; those which had Autumn Cyanamide responded moderately to the Spring Cyanamide.

With straw there were significant responses to all four single dressings, but no further response to the double dressing. The interaction of Autumn Cyanamide and Spring Sulphate was significant, in that the response to Autumn Cyanamide only appeared on the plots that were dressed with Sulphate in the Spring, while on the other hand, the response to Spring Sulphate was only evident on the plots that had been previously dressed with Autumn Cyanamide.

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WHEAT.

VARIETY TRIAL.

Nitrogenous Fertilisers as Top Dressing: Sulphate of Ammonia. Muriate of Ammonia.

Each in single and double dressings.

Long Hoos (Section 6), 1929.

W

	Ml, Sq, Y, Sw	Sw, Y, Sq, Ml	Sq, Y, Ml, Sw	Sq, Sw, Ml, Y	Ml, Sq, Y, Sw	Sw, Ml, Sq, Y	Y, Ml, Sw, Sq	Ml, Y, Sw, Sq
C	S, E & L	O1	O2	M, L	M, E & L	M, E	S, L	S, E
B	M, L	S, E	S, L	S, E & L	M, E	O1	O2	M, E & L
A	S, E	M, E & L	S, L	S, E & L	M, L	M, E	O1	O2

SYSTEM OF REPLICATION: 3 randomised blocks of 32 plots each.
AREA OF EACH PLOT: 6/325th acre.
S=Sulphate of Ammonia } at the rate of 0.2 cwt.
M=Muriate of Ammonia } Nitrogen per acre.
O1, O2=No Top Dressing.
E=Early Application (March 18).
L=Late Application (May 13).
E & L=Early and Late Application, thus giving double dressing.

Strips running across the blocks were allotted to 4 varieties as indicated in plan.
Ml=Million III.
Y=Yeoman II.
Sq=Square-Head's Master.
Sw=Swedish Iron.
Wheat Sown: October 3, 1928.
Harvested: August 26, 1929.
Previous Crop: Barley.

Actual Weights in lb.—Total Grain.

Variety.	Blocks.	O1.	O2.	S.E.	S.L.	M.E.	M.L.	S. E. & L.	M. E & L.
Million III. ..	A	31.25	28.75	51.00	32.75	36.00	34.00	29.25	47.25
	B	29.50	25.75	43.50	35.75	35.75	52.00	32.25	29.00
	C	39.25	31.75	27.00	30.75	35.25	31.00	59.25	30.25
Average in cwt. per acre		15.0		19.6	16.0	17.2	18.9	19.5	17.2
Yeoman II ..	A	29.50	28.00	53.50	40.25	35.25	33.25	31.00	44.25
	B	26.50	25.00	42.50	40.75	33.50	49.75	32.50	33.75
	C	40.50	37.25	28.00	27.00	25.50	30.75	57.00	31.25
Average in cwt. per acre		15.1		20.0	17.4	15.2	18.3	19.4	17.6
Square-Head's Master ..	A	29.75	29.50	44.50	40.25	36.25	32.50	38.25	41.25
	B	25.25	28.00	41.50	39.00	36.25	46.75	37.00	36.75
	C	35.00	37.75	35.75	27.25	22.50	35.50	49.00	32.25
Average in cwt. per acre		14.9		19.6	17.2	15.3	18.5	20.0	17.8
Swedish Iron ..	A	34.00	34.00	54.50	40.00	35.25	31.50	37.50	56.75
	B	32.25	31.50	47.00	43.75	31.25	51.25	36.75	35.25
	C	41.00	35.25	34.00	35.00	32.00	36.75	55.50	25.75
Average in cwt. per acre		16.8		21.8	19.1	15.9	19.3	20.9	19.0

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Wheat : Long Hoos, 1929 (contd.).

Actual Weights in lb.—Total Straw.

Variety.	Blocks.	O1	O2.	S.E.	S.L.	M.E.	M.L.	S. E & L.	M. E & L.
Million III ..	A	43.25	37.25	65.75	48.00	52.50	49.00	52.75	66.50
	B	43.25	36.50	62.25	50.00	54.00	66.75	55.75	48.75
	C	60.75	47.75	43.75	51.50	58.50	51.75	86.25	59.25
Average in cwt. per acre		21.7		27.7	24.1	26.6	27.0	31.4	28.1
Yeoman II ..	A	34.50	37.50	69.00	54.00	51.50	46.00	52.00	46.75
	B	34.50	36.25	56.50	57.50	51.25	62.50	54.50	57.50
	C	55.00	53.00	44.75	43.00	45.00	50.75	84.50	64.75
Average in cwt. per acre		20.2		27.4	24.9	23.8	25.7	30.8	27.2
Square-Head's Master ..	A	41.75	45.25	63.00	56.50	55.75	57.25	63.50	63.00
	B	35.25	40.50	64.75	63.25	54.75	62.75	64.00	57.75
	C	55.25	60.75	62.75	43.75	58.75	61.75	80.00	62.25
Average in cwt. per acre		22.5		30.7	26.4	27.3	29.3	33.4	29.5
Swedish Iron ..	A	45.75	47.25	81.00	55.25	50.00	40.75	61.25	79.75
	B	43.00	41.25	66.50	60.00	48.00	69.50	63.75	58.00
	C	57.25	52.25	54.25	57.25	56.50	59.50	86.50	56.50
Average in cwt. per acre		23.1		32.5	27.8	24.9	27.4	34.1	31.3

Summary of Results.—(a) Effect of Top Dressing.

Grain.	No Nitrogen	Sulphate Early	Sulphate Late.	Muriate Early.	Muriate Late.	Sulphate Early and Late.	Muriate Early and Late.	Mean.	Standard Error.
Cwt. per acre	15.4	20.3	17.4	15.9	18.7	20.0	17.9	17.6	2.29
Per cent. ..	87.6	114.9	98.9	90.2	106.3	113.2	101.4	100.0	12.98
Straw.									
Cwt. per acre	21.9	29.6	25.8	25.6	27.3	32.4	29.0	26.7	2.33
Per cent. ..	81.9	110.8	96.6	96.1	102.4	121.5	108.8	100.0	8.74

Summary of Results.—(b) Varietal Response.

Grain.	Million III.	Yeoman II.	Square-Head's Master.	Swedish Iron.	Mean.	Standard Error.
Cwt. per acre ..	17.3	17.3	17.3	18.7	17.6	0.35
Per cent. ..	98.1	97.9	98.0	106.0	100.0	1.98
Straw.						
Cwt. per acre ..	26.0	25.0	27.7	28.0	26.7	0.54
Per cent. ..	97.5	93.8	103.7	105.0	100.0	2.04

Yield of Swedish Iron significantly greater than that of other varieties in grain, while Square-Head's Master and Swedish Iron are superior in straw. Significant responses to both early and late top dressings in the case of straw, but with grain, while numerically large, the responses are insignificant on account of the high Standard Error. Sulphate appears to do better than Muriate, but the difference is not significant.

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CULTIVATION EXPERIMENT.

Barley, Great Harpenden, 1929.

OLD SET.

E

I.				II.				III.				IV.			
A	B	C	D	B	D	A	C	C	A	D	B	D	C	B	A

TREATMENTS :—
A = Ridged Seed bed.
B = Simar rototiller, then ridged.
C = Simar rototiller, but left flat.
D = Simar rototiller, left flat, and Simar implement used again between rows in July.

SYSTEM OF REPLICATION : 4 randomised blocks of 4 plots each.
Area harvested of each Plot : 1/40th acre.
Barley sown : March 14.
Harvested : August 7-8.
VARIETY : " Standwell," 3-4 bushels per acre.

These were treatments in 1928—no further treatments in 1929. Whole ploughed March 12-13. All plots had dressing of 1 cwt. Sulphate of Ammonia, 2 cwt. Superphosphate and 1 cwt. Muriate of Potash per acre, applied March 27.
Previous Crop : Swedes.

Actual Weights in lb.

Blocks.	Grain.				Straw.			
	A	B	C	D	A	B	C	D
I. ..	74.50	69.75	76.25	79.00	97.50	85.25	102.75	125.00
II. ..	70.75	74.75	59.25	82.50	95.25	109.25	90.75	115.50
III. ..	75.00	75.50	69.25	83.25	97.50	111.50	85.75	114.25
IV. ..	84.50	85.25	73.50	73.25	101.50	111.25	96.50	106.75
Total ..	304.75	305.25	278.25	318.00	391.75	417.25	350.75	461.50

Summary of Results.

Average Yield.	1928 Treatment.				Mean.	Standard Error.
	Ridged.	Simar and Ridged.	Simar and Flat.	Simar flat and Simar.		
Grain, cwt. per acre ..	27.2	27.2	24.8	28.4	26.9	1.11
Grain, per cent. ..	101.1	101.2	92.3	105.5	100.0	4.13
Straw, cwt. per acre ..	35.0	37.2	33.5	41.2	36.7	1.71
Straw, per cent. ..	95.2	101.4	91.3	112.1	100.0	4.67

The plots doubly Simared in 1928 have given a significantly higher yield of straw than the others, but the advantage in grain is not significant.

https://doi.org/10.23637/ERADOC-1-111

CULTIVATION EXPERIMENT.

Barley, Great Harpenden, 1929.

NEW SET.

I.				II.				III.				IV.			
E	F	G	H	F	H	E	G	G	E	H	F	H	G	F	E

TREATMENTS :—
E and G = Ordinary Spring Cultivation, March 11.
F and H = Simar Spring Cultivation, March 11.
All plots had dressing of 1 cwt. Sulphate of Ammonia, 2 cwt. Superphosphate and 1 cwt. Muriate of Potash per acre applied March 27.
Previous Crop : Swedes.

SYSTEM OF REPLICATION :—4 randomised blocks of 4 plots each.
Area harvested of each plot : 1/40th acre.
Barley sown : March 14.
Harvested : August 7-8.
VARIETY : "Standwell," (3-4 bushels per acre).

Actual Weights in lb.

Blocks.	Grain.				Straw.			
	E	G	F	H	E	G	F	H
I. ..	91.75	83.25	80.50	77.75	128.25	134.75	109.00	137.75
II. ..	80.50	90.75	83.00	83.75	143.50	120.25	126.00	127.25
III. ..	84.50	76.50	84.25	85.25	122.00	109.50	111.25	122.75
IV. ..	89.75	86.50	90.75	85.25	124.25	124.00	129.25	116.25
Total ..	346.50	337.00	338.50	332.00	518.00	488.50	475.50	504.50
	683.5		670.5		1006.5		980.0	

Summary of Results.

Average Yield.	Ordinary Spring Cultivation.	Simar Spring Cultivation	Mean.	Standard Error.
Grain, cwt. per acre ..	30.5	29.9	30.2	0.57
Grain, per cent.	101.0	99.0	100.0	1.90
Straw, cwt. per acre ..	44.9	43.7	44.3	1.19
Straw, per cent.	101.3	98.7	100.0	2.69

The difference in yield is not significant.

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POTATOES.

Nitrogenous Fertiliser: Sulphate of Ammonia.

Potassic Fertilisers: Sulphate and Muriate of Potash and Potash Manure Salts (30%).

Each in single and double dressings.

Superphosphate.

Long Hoos (Section 1), 1929.

	G			W D			A		
	— / 5M	9P / —	— / 8S	— / 6M	— / 8P	— / 5P	9S / —	4M / —	— / 7P
	3 / —	— / 2	4P / —	— / 3	9M / —	7S / —	3 / —	— / 1	2 / —
	7M / —	6S / —	— / 1	1 / —	— / 2	4S / —	— / 8M	6P / —	5S / —
	— / 4M	5S / —	— / 6P	— / 6S	9P / —	— / 2	8P / —	— / 4S	3 / —
H	3 / —	— / 9S	8M / —	— / 8S	— / 4P	— / 5M	— / 5P	1 / —	— / 6M
	— / 2	7P / —	1 / —	— / 3	1 / —	7M / —	2 / —	— / 7S	9M / —
	4S / —	— / 1	8P / —	— / 8M	— / 3	— / 6P	— / 5M	8S / —	2 / —
	5P / —	9M / —	6M / —	— / 1	— / 9S	— / 2	1 / —	— / 9P	— / 4P
	— / 7S	— / 2	3 / —	— / 4M	7P / —	5S / —	— / 7M	3 / —	6S / —
	I			F			C		

B

SYSTEM OF REPLICATION: 9 randomised blocks of 9 plots each. Each plot divided into 2 sub-plots.

AREA OF EACH SUB-PLOT: 1/90th acre.

TREATMENTS: Sulphate of Ammonia at the rate of 0, 0.3 and 0.6 cwt. Nitrogen per acre, and Potash at the rate of 0, 0.5 and 1.0 cwt. K_2O per acre in all combinations as shown in Key to Treatments.

S = Sulphate of Potash.

M = Muriate of Potash.

P = Potash Manure Salts (30%).

Superphosphate at the rate of 0.4 cwt. P_2O_5 per acre is applied to one out of each pair of sub-plots, indicated by the treatment symbol occurring on that half.

All plots received Farmyard Manure at the rate of 14 tons per acre, approximately, ploughed in January 5-9.

Artificials applied: April 12-15.

Potatoes planted: April 16-24. Lifted: September 23-25.

VARIETY: Ally.

Previous Crop: Barley.

Key to Treatments.

Treatment No.	1	2	3	4	5	6	7	8	9
S/Ammonia	0	1	2	0	1	2	0	1	2
Potash ..	0	0	0	1	1	1	2	2	2

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Potatoes : Long Hoos, 1929 (contd.)

Actual Weights in lb.—Sub-Plots with Phosphate.

S/Amm.	Potash.	A	B	C	D	E	F	G	H	I
Quantities										
0	0	111.00	121.00	127.00	123.75	106.00	124.75	121.25	105.50	133.25
0	1	105.75	110.75	117.50	140.25	123.00	118.50	128.00	140.50	138.75
0	2	89.25	126.25	109.25	119.25	112.00	153.50	133.50	112.25	141.00
1	0	121.25	138.25	118.00	137.75	155.50	118.75	148.50	154.50	144.00
1	1	140.00	145.50	153.00	121.75	152.50	140.00	170.00	145.50	154.00
1	2	153.25	164.00	145.50	131.25	141.25	152.25	125.75	144.00	136.25
2	0	131.50	150.25	156.00	149.75	125.00	148.75	164.25	155.50	150.00
2	1	159.75	162.00	136.75	131.00	140.50	181.50	164.25	168.25	161.75
2	2	153.75	157.75	162.50	160.50	170.75	158.75	146.25	169.00	178.00

Actual Weights in lb.—Sub-Plots without Phosphate.

S/Amm.	Potash.	A	B	C	D	E	F	G	H	I
Quantities										
0	0	111.50	119.25	115.25	121.75	96.00	111.00	121.50	97.75	117.50
0	1	107.00	118.50	98.75	119.75	126.75	133.25	123.75	125.00	136.75
0	2	84.25	117.00	111.00	123.25	109.50	119.75	116.50	114.25	138.75
1	0	101.00	129.25	113.25	142.25	136.25	113.50	133.75	132.25	141.25
1	1	142.00	141.25	126.50	105.50	131.75	120.25	140.75	125.75	145.00
1	2	142.50	139.25	134.75	126.25	132.75	110.75	121.50	135.00	145.25
2	0	128.00	148.00	119.00	133.75	125.00	128.25	152.50	138.25	132.75
2	1	146.50	135.25	108.00	138.50	122.75	137.50	146.75	137.00	138.50
2	2	131.00	128.25	139.75	134.75	152.50	142.00	136.50	153.25	135.00

Summary of Average Yields.—Separate Treatments.

Tons per acre.		Without Superphosphate.			With Superphosphate.		
		No S/Amm.	Single S/Amm.	Double S/Amm.	No S/Amm.	Single S/Amm.	Double S/Amm.
No Potash		4.52	5.10	5.38	4.79	5.52	5.94
Single Potash	Sulphate	5.02	5.20	5.06	5.22	5.70	5.91
	Muriate	4.89	5.34	5.52	4.89	6.37	6.09
	Potash Salts	4.68	5.25	5.64	4.94	5.64	6.82
Double Potash	Sulphate	5.08	5.21	5.71	5.18	5.52	6.45
	Muriate	4.51	5.20	5.33	4.75	6.02	6.65
	Potash Salts	4.26	5.50	5.74	4.75	5.78	6.42

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Summary of Significant Results.

	Average Yield, tons per acre.						
	Without Superphosphate.			With Superphosphate.			Standard Error.
	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	
No Potash	4.52	5.10	5.38	4.79	5.52	5.94	0.105
Single Potash	4.86	5.26	5.41	5.01	5.90	6.28	
Double Potash ..	4.62	5.30	5.59	4.89	5.77	6.51	

	Average Yield per cent.						
	Without Superphosphate.			With Superphosphate.			Standard Error.
	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	
No Potash	84.1	95.0	100.2	89.2	102.8	110.6	1.96
Single Potash	90.6	98.0	100.6	93.4	109.9	116.9	
Double Potash ..	86.0	98.8	104.2	91.1	107.5	121.1	

Average Yield.	Without Super.	With Super.	Mean.	Standard Error.
Tons per acre ..	5.12	5.62	5.37	0.035
Per cent. ..	95.3	104.7	100.0	0.65

Significant responses to single and double dressings of Sulphate of Ammonia, and to single dressing of Potash. The double dressing of Potash produced no further increase in yield. Significant response to Superphosphate, the benefit being moderate on the plots without Nitrogen and Potash, but large on those plots receiving the highest dressings. No qualitative differences in the kind of Potash supplied.

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SUGAR BEET.

MANURING.

Nitrogenous Fertilisers: Sulphate of Ammonia, Nitrate of Soda.
Chloride Dressings: Muriate of Potash, Salt.
Superphosphate.

VARIETAL TEST.

Klein Wanzleben—Kuhn (Johnson's Perfection).

Long Hoos (Section 5), 1929.

	J	K	J	K	K	N J	K	J	J	K	J	K	
I.	9	10	11	6	8	3	2	7	5	1	12	4	P
II.	3	5	1	12	11	7	9	6	2	4	8	10	O
III.	1	9	7	2	6	10	4	12	3	8	5	11	O
IV.	8	2	12	3	4	6	10	1	7	5	11	9	P
V.	4	3	10	9	1	5	7	8	12	11	2	6	O
VI.	6	4	3	7	5	9	12	2	11	10	1	8	P
VII.	12	8	5	10	2	11	1	9	4	7	6	3	O
VIII.	2	1	4	8	9	12	11	10	6	3	7	5	P
IX.	10	11	8	1	7	4	6	5	9	2	3	12	P
X.	11	7	6	4	10	2	5	3	8	12	9	1	O
XI.	7	12	9	5	3	1	8	11	10	6	4	2	O
XII.	5	6	2	11	12	8	3	4	1	9	10	7	P

SYSTEM OF REPLICATION: Latin Square.

AREA OF EACH PLOT: 1/90th acre.

TREATMENTS: Sulphate of Ammonia and Nitrate of Soda with seed at the rate of 0.4 cwt. N per acre. Muriate of Potash at the rate of 0.8 cwt. Cl, and Salt in equivalent amount, alone and in combination.

J, K = Pairs of strips one way allotted at random to varieties Kuhn (Johnson's Perfection) and Klein Wanzleben respectively.

O, P = Pairs of strips the other way allotted at random to No Superphosphate and Superphosphate at the rate of 0.6 cwt. P_2O_5 per acre.

The 12 plots of each Nitrogenous and Potassic treatment had 6 allotted to each variety, of which half had no Superphosphate and half had Superphosphate.

All plots had Basal dressing of St. Albans refuse (14 tons per acre) applied March 11-13.

Manures applied: May 2-3.

Seed sown: May 4 (13-16 lb. per acre).

Roots lifted: Oct. 29—Nov. 6.

Previous Crop: Barley.

Key to Treatments.

Manure.	1	2	3	4	5	6	7	8	9	10	11	12
S/Amm.		×			×			×			×	
N/Soda			×			×			×			×
M/Potash . .				×	×	×				×	×	×
Salt							×	×	×	×	×	×

Actual Weights in lb.—Roots.

Row.	1	2	3	4	5	6	7	8	9	10	11	12
I.	174.25	193.25	239.75	116.75	214.75	223.75	203.00	229.00	210.50	190.25	240.25	212.75
II.	187.25	200.00	179.25	153.75	197.50	207.00	183.25	200.75	207.00	117.25	220.50	198.75
III.	160.25	214.75	209.50	169.75	184.75	220.50	196.75	180.75	193.50	165.75	123.00	217.00
IV.	203.00	159.25	216.50	178.25	176.00	199.25	208.00	182.75	123.00	166.50	204.25	222.50
V.	169.25	163.00	161.25	142.75	196.25	114.25	184.25	208.25	207.25	190.75	164.25	211.25
VI.	190.00	229.75	229.50	154.50	195.25	181.25	198.00	130.50	211.50	155.25	242.50	218.00
VII.	169.25	183.25	131.25	179.50	194.50	213.00	164.25	167.00	189.50	194.25	184.25	172.00
VIII.	137.50	170.00	171.75	192.00	150.00	200.50	200.50	205.75	180.50	168.00	192.50	194.00
IX.	172.75	188.00	194.25	170.25	175.50	183.00	179.00	195.00	196.50	160.75	167.00	164.25
X.	135.25	198.75	179.25	197.25	164.50	186.75	137.50	195.00	206.00	187.00	185.25	187.50
XI.	149.75	143.25	172.25	194.00	204.00	197.50	191.00	176.50	196.00	172.00	175.25	177.50
XII.	174.25	200.50	169.50	159.50	243.00	183.50	150.00	194.25	179.75	201.00	210.00	188.00

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Actual Weights in lb.—Tops.

Row.	1	2	3	4	5	6	7	8	9	10	11	12
I.	103.75	128.50	172.50	85.75	151.25	158.25	124.50	183.25	156.75	122.00	185.00	172.25
II.	124.75	132.50	136.75	97.75	136.75	140.75	121.75	159.25	125.75	86.75	173.75	165.00
III.	114.00	146.75	156.50	102.00	149.25	170.50	133.75	127.25	170.50	111.50	107.50	148.75
IV.	111.00	114.75	158.75	113.25	113.25	145.50	132.75	142.75	108.50	97.00	149.25	185.00
V.	104.25	122.50	120.25	95.50	143.00	110.00	101.50	134.75	163.50	132.75	117.00	164.25
VI.	121.25	135.50	176.00	99.75	136.75	137.25	132.25	108.75	162.75	93.75	169.50	139.50
VII.	99.25	126.50	115.50	114.50	146.50	159.00	96.75	140.75	133.75	128.50	141.25	138.25
VIII.	97.75	121.25	116.50	130.50	118.25	142.50	124.50	152.00	146.75	97.25	123.50	154.00
IX.	114.75	125.00	145.75	119.00	108.75	148.00	118.50	138.75	146.25	125.25	118.00	143.25
X.	104.25	140.25	134.75	136.75	139.00	154.00	94.25	143.25	160.25	133.00	162.00	157.00
XI.	114.50	110.25	141.00	131.50	148.25	152.75	157.50	150.25	161.00	111.50	133.00	152.25
XII.	103.75	153.75	150.50	98.75	211.75	147.50	112.00	167.00	144.50	127.25	180.50	167.25

Summary of Results.—(a) Separate Treatments.

Klein Wanzleben.—Roots, tons per acre.

		No Nitrogen.		Sulphate of Amm.		Nitrate of Soda.	
		Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.
Without Phosphate	Without Salt ..	6.34	6.97	7.25	7.58	6.22	7.13
	With Salt ..	6.51	6.68	7.02	6.80	8.14	7.55
With Phosphate	Without Salt ..	6.49	6.02	7.24	6.98	7.47	7.91
	With Salt ..	7.06	6.86	7.57	7.63	6.47	7.64
		Standard Error=0.271 tons or 3.65 per cent.*					
		Tops, tons per acre.					
Without Phosphate	Without Salt ..	4.12	4.51	5.14	5.68	5.05	5.80
	With Salt ..	3.92	4.66	5.60	5.33	6.16	6.35
With Phosphate	Without Salt ..	4.24	4.00	4.93	4.93	5.70	6.08
	With Salt ..	4.86	4.19	5.95	5.65	5.35	6.03
		Standard Error=0.162 tons or 2.99 per cent.*					

*For comparisons other than Phosphate *versus* No Phosphate.

Kuhn (Johnson's Perfection).—Roots, tons per acre.

		No Nitrogen.		Sulphate of Amm.		Nitrate of Soda.	
		Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.
Without Phosphate	Without Salt ..	6.66	6.91	7.52	7.71	7.61	8.13
	With Salt ..	7.65	7.08	8.09	7.30	7.92	8.04
With Phosphate	Without Salt ..	7.60	6.99	8.04	8.48	8.89	7.78
	With Salt ..	8.19	7.09	7.66	9.20	8.28	8.43
		Standard Error=0.271 tons or 3.65 per cent.*					
		Tops, tons per acre.					
Without Phosphate	Without Salt ..	4.73	4.57	5.29	5.88	5.73	6.08
	With Salt ..	5.53	4.76	5.86	5.84	6.09	6.04
With Phosphate	Without Salt ..	4.50	4.66	5.50	6.32	6.62	5.70
	With Salt ..	5.11	4.68	6.00	6.75	6.24	6.85
		Standard Error=0.162 tons or 2.99 per cent.*					

*For comparisons other than Phosphate *versus* No Phosphate.

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Sugar Beet : Long Hoos, 1929 (contd.)

Klein Wanzleben.—Sugar Percentage.

		No Nitrogen.		Sulphate of Amm.		Nitrate of Soda.	
		Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.
Without Phosphate	Without Salt ..	18.32	18.54	18.20	18.56	18.05	17.81
	With Salt ..	18.82	18.51	18.42	18.09	18.43	18.35
With Phosphate	Without Salt ..	18.64	18.57	18.20	18.04	18.03	18.29
	With Salt ..	18.77	18.95	18.10	18.38	17.91	18.24
		Standard Error=0.103.*					

Kuhn.—Sugar Percentage.

Without Phosphate	Without Salt ..	18.45	18.55	17.92	18.32	18.35	18.28
	With Salt ..	18.63	18.71	17.97	18.53	18.16	18.51
With Phosphate	Without Salt ..	18.42	18.58	18.62	18.54	18.34	18.33
	With Salt ..	18.52	18.62	18.40	18.17	18.42	18.00
		Standard Error=0.103.*					

*For comparisons other than Phosphate *versus* No Phosphate.

(b) Effect of Nitrogenous Dressing, averaging for variety, Phosphate and Chloride.

Average Yield.	No Nitrogen.	Sulphate of Ammonia.	Nitrate of Soda.	Mean.	Standard Error.
Roots, tons per acre ..	6.94	7.63	7.72	7.43	0.068
Roots, per cent. ..	93.4	102.6	103.9	100.0	0.91
Tops, tons per acre ..	4.57	5.67	5.99	5.41	0.040
Tops, per cent. ..	84.4	104.8	110.8	100.0	0.75
Sugar percentage in Roots	18.60	18.28	18.22	18.36	0.026

Significant response to both Nitrogenous dressings in the case of roots and tops. The plots treated with Nitrate of Soda gave a significantly higher yield of tops. The application of a Nitrogenous dressing depressed the sugar percentage in the roots significantly, but this was more than offset by the increased yield. The net increases in sugar per acre were 7.6 per cent. for Sulphate of Ammonia plots and 8.5 per cent. for Nitrate of Soda plots.

(c) Effect of Chloride and Phosphatic Dressings, averaging for Variety and Nitrogen.

Average Yield.—Roots, tons per acre.

	Without Phosphate.		With Phosphate.		Standard Error.
	Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.	
Without Salt	6.93	7.41	7.62	7.36	0.111
With Salt	7.55	7.24	7.54	7.81	

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Average Yield.—Tops, tons per acre.

	Without Phosphate.		With Phosphate.		Standard Error.
	Without Mur./Pot.	With Mur./Pot.	Without Mur./Pot.	With Mur./Pot.	
Without Salt	5.01	5.42	5.25	5.28	0.066
With Salt	5.53	5.50	5.59	5.69	

The increases due to Muriate of Potash and Salt applied separately were 6.4 per cent. and 8.3 per cent. respectively in roots, with a standard error of 2.11; for tops 7.6 per cent. and 9.6 respectively, with a standard error of 1.73. For superphosphate alone the increase was 9.3 per cent. in roots, with a standard error of 3.76, this last being based on only 5 degrees of freedom. This increase should not be regarded as significant. There was no significant response to superphosphate in tops. No further increase was obtained when the Salts were applied in pairs, but the best yield of all resulted from an application of all three together.

(d) **Effect of Phosphatic Dressing in Relation to Variety; averaging for Nitrogen and Chloride.**

Average Yield.—Roots.

	Tons per acre.		Standard Error.	Per cent.		Standard Error.
	Kuhn.	Klein Wanzleben		Kuhn.	Klein Wanzleben	
Without Phosphate ..	7.55	7.02	0.078	101.6	94.4	1.05
With Phosphate ..	8.05	7.11		108.3	95.7	
Mean	7.80	7.06	0.283	105.0	95.0	3.81

Average Yield.—Tops.

	Tons per acre.		Standard Error.	Per cent.		Standard Error.
	Kuhn.	Klein Wanzleben		Kuhn.	Klein Wanzleben	
Without Phosphate ..	5.53	5.19	0.047	99.8	93.6	0.84
With Phosphate ..	5.74	5.16		103.6	93.0	
Mean	5.64	5.18	0.162	104.3	95.7	2.99

Of the varieties, only the Kuhn responded significantly to the dressing of Superphosphate, Klein Wanzleben showing on the average no significant response.

In addition to the simpler results already described, certain other significant results appeared. A significant depression followed an application of Muriate of Potash in the absence of a nitrogenous dressing, but only on the plots of Kuhn treated with Superphosphate. The crop, however, responded significantly to Muriate of Potash in the presence of the nitrogenous dressings and Superphosphate (*a*) on the plots of Kuhn treated with Sulphate of Ammonia, and (*b*) on the plots of Klein Wanzleben treated with Nitrate of Soda. Again, on the plots without a Nitrogenous dressing the beneficial effect of Salt appeared on Kuhn without Superphosphate, and on Klein Wanzleben with Superphosphate. No response to Salt occurred on the plots receiving Sulphate of Ammonia, but on those receiving Nitrate of Soda the yield of Klein Wanzleben was improved significantly by Salt in the absence of Superphosphate but depressed in presence of Superphosphate.

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