

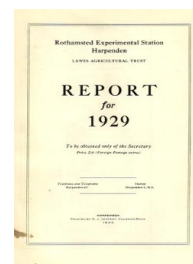
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### Experiments at Woburn

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## REPLICATED EXPERIMENTS AT WOBURN: MALTING BARLEY.

**Nitrogenous Fertilisers:** Sulphate and Muriate of Ammonia.  
**Potassic Fertiliser:** Sulphate of Potash.  
**Superphosphate.**

Butt Furlong, 1929.

B				S	D			
M	M	K	S	M	K	K	M	
K	K		K	K	P		K	
	P	S	S	S	S	S	S	
			K	K	P	P	K	
O	S	K	M	M	O	M	P	
	P	P	P		P	P		
S	S	M	M	M	K	K	S	
K	P	P	K	K	P	P	K	
P	P	K	O	M	S	O	M	
P	M	M	S	M	S	S	P	
	P	K	K	P	P	K	P	
A				C				

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

AREA OF EACH PLOT : 1/60th acre.

O = No Manure.

Sulphate (S) or Muriate (M) of Ammonia at the rate of 0.2 cwt. of Nitrogen per acre; Sulphate of Potash (K) at the rate of 0.6 cwt. K<sub>2</sub>O per acre, and Superphosphate (P) at the rate of 0.4 cwt. Phosphoric acid per acre, in all combinations.

Manures applied : March 22.

Barley sown : March 21. Harvested : Aug. 1-3.

VARIETY : Plumage Archer (3 bushels per acre).

Previous Crop : Sugar Beet.

### Actual Weights in lb.—Total Grain.

Blocks.	O	P	K	K+P	S	S+P	S+K	S+K+P	M	M+P	M+K	M+K+P
A	47.75	52.75	53.00	55.50	60.50	54.50	56.50	52.00	60.75	64.50	64.75	54.50
B	52.50	51.00	68.00	66.75	63.25	54.25	60.00	60.50	59.50	59.50	63.50	67.25
C	35.75	40.00	43.00	41.75	34.50	43.75	47.25	44.50	37.25	50.00	47.25	51.00
D	52.50	35.75	62.00	62.75	59.50	59.00	62.50	43.00	54.25	53.25	58.75	62.00

### Actual Weights in lb.—Total Straw.

Blocks.	O	P	K	K+P	S	S+P	S+K	S+K+P	M	M+P	M+K	M+K+P
A	59.50	67.00	65.75	75.25	81.00	82.00	72.25	81.50	79.75	82.25	85.00	68.25
B	80.00	71.75	89.00	89.75	89.50	91.75	84.25	84.50	86.00	74.25	87.00	86.75
C	51.25	50.25	54.50	53.75	47.25	60.75	67.00	62.75	54.75	70.25	63.75	64.25
D	68.50	45.75	93.50	72.50	78.50	74.25	81.00	56.50	71.25	71.00	76.25	103.25

(a) **Summary of Results.—Separate Treatments.**

Average Yield per acre.	No P or K	P	K	P+K	Sulph. Amm.	S+P	S+K	S+P+K	Mur. Amm.	M+P	M+K	M+P+K
Grain (cwt.) ..	25.2	24.0	30.3	30.4	29.2	28.3	30.3	26.8	28.4	30.4	31.4	31.4
Straw (cwt.) ..	34.7	31.4	40.5	39.0	39.7	41.4	40.8	38.2	39.1	39.9	41.8	43.2

(b) **Summary of Significant Results.—Averaging for Phosphate.**

	Grain—cwt. per acre.			Grain—per cent.		
	No Nitrogen.	S/Amm.	M/Amm.	No Nitrogen.	S/Amm.	M/Amm.
No Potash ..	24.6	28.7	29.4	85.4	99.7	101.9
Sulphate of Potash	30.3	28.5	31.4	105.1	99.0	108.9

Mean—28.8 cwt. Standard Error—0.98 cwt. or 3.39 per cent.

	Straw—cwt. per acre.			Straw—per cent.		
	No Nitrogen.	S/Amm.	M/Amm.	No Nitrogen.	S/Amm.	M/Amm.
No Potash .. ..	33.1	40.5	39.5	84.5	103.5	100.9
Sulphate of Potash ..	39.8	39.5	42.5	101.6	100.9	108.6

Mean—39.1 cwt. Standard Error—1.70 cwt. or 4.33 per cent.

Significant responses to Nitrogenous and Potassic fertilisers, but no response to Phosphate. The interaction of Nitrogen and Potash was significant in the case of grain and suggestive with straw—in the absence of one fertiliser the other increased the yield significantly, but in the presence of one, no further effect was produced by adding the other. The grain appears to respond better to Muriate than to Sulphate, but the difference falls short of significance.

### 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.**

Butt Close, 1929.

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

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

AREA OF EACH SUB-PLOT : 1/80th acre.

TREATMENTS : Sulphate of Ammonia at the rate of 0, 0.3 and .6 cwt. Nitrogen per acre, and Potash at the rate of 0, 0.5 and 1.0 cwt. K<sub>2</sub>O 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 .4 cwt. P<sub>2</sub>O<sub>5</sub> 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 2 tons Lime per acre, applied in January, and 12 tons Bedford Corporation Manure per acre applied April 20-21. Artificials applied: April 29-30.

Potatoes planted May 1-6. Lifted : September 14-18.

VARIETY : Ally. Blocks C, F, I, once grown. 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

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

S/Ammonia	Potash	A	B	C	D	E	F	G	H	I
Quantities										
0	0	165.25	120.75	67.00	154.50	132.50	115.50	164.50	156.50	120.50
0	1	176.75	130.50	94.50	148.00	141.00	118.50	211.75	130.50	122.25
0	2	182.00	161.50	85.75	181.75	162.50	99.00	162.75	184.25	111.00
1	0	198.00	146.50	90.50	187.00	130.00	96.75	176.00	152.00	79.00
1	1	223.50	165.00	96.00	182.00	132.00	103.00	164.00	157.50	117.50
1	2	157.50	130.50	89.00	163.75	161.00	89.00	164.25	162.50	97.75
2	0	201.25	133.00	99.50	190.50	134.50	75.50	149.75	159.00	104.75
2	1	183.00	150.00	79.00	147.00	127.50	85.00	166.00	146.00	115.00
2	2	160.50	174.75	120.00	198.00	160.25	93.50	205.00	98.00	141.25

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

S/Amm.	Potash	A	B	C	D	E	F	G	H	I
<b>Quantities</b>										
0	0	160.75	121.00	53.00	148.00	136.50	129.50	141.75	107.00	96.00
0	1	136.00	119.00	98.50	123.00	118.00	123.00	186.25	155.50	118.00
0	2	198.50	154.50	99.00	171.75	114.00	114.25	160.00	154.50	90.00
1	0	162.25	152.00	74.00	191.25	128.50	91.50	185.50	179.25	104.50
1	1	206.75	158.50	114.00	167.50	162.50	97.50	184.00	159.50	114.75
1	2	155.00	148.00	94.00	192.00	145.00	68.00	207.00	169.00	103.00
2	0	163.50	150.50	80.00	200.00	122.50	99.00	131.25	195.25	106.00
2	1	154.00	169.00	88.00	182.00	127.50	91.00	170.25	156.50	118.50
2	2	208.00	174.75	130.00	183.50	206.00	95.00	197.50	172.00	142.00

**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	..	..	..	4.34	5.03	4.95	4.75	4.98	4.95
Single Potash	Sulphate	..	..	5.10	5.25	4.76	5.49	5.18	5.07
	Muriate	..	..	4.43	5.24	5.08	5.24	5.14	4.43
Double Potash	Potash Salts	..	..	4.49	5.76	5.12	4.44	5.63	4.77
	Sulphate	..	..	5.06	5.04	6.62	5.38	4.57	5.50
	Muriate	..	..	5.10	4.80	5.78	5.04	4.96	4.95
	Potash Salts	..	..	4.79	5.42	5.56	5.42	4.94	5.63

**Summary of Significant Results.**

		Average Yield in tons per acre.						Standard Error.
		Without Superphosphate.			With Superphosphate.			
		No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	
No Potash	..	4.34	5.03	4.95	4.75	4.98	4.95	0.181
Single Potash	..	4.67	5.42	4.99	5.05	5.32	4.76	
Double Potash	..	4.99	5.08	5.99	5.28	4.82	5.36	

**Potatoes : Butt Close, 1929 (contd.)**

	Average Yield per cent.						Standard Error.
	Without Superphosphate.			With Superphosphate.			
	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	No Sulph. Amm.	Single Sulph. Amm.	Double Sulph. Amm.	
No Potash .. ..	86.1	99.9	98.2	94.2	98.9	98.2	3.60
Single Potash .. ..	92.7	107.5	98.9	100.3	105.5	94.3	
Double Potash .. ..	98.9	100.8	118.8	104.7	95.7	106.4	

General Mean—5.04 tons.

Significant response on the average of all Nitrogenous and Superphosphate comparisons to both dressings of Potash. Evidence of response to Sulphate of Ammonia, which, however, was masked by lower plant numbers. No qualitative differences in the kind of Potash supplied. No response to Superphosphate, an apparent benefit in the case of the plots without Nitrogen being offset by a depression on those plots receiving high dressings of Sulphate of Ammonia and of Potash.

**POTATOES :  
Effect of Potash.**

Butt Close, 1929.

S

K	S	O
O	K	S
S	O	K

SYSTEM OF REPLICATION : Latin Square.

AREA OF EACH PLOT : 1/40th acre.

TREATMENTS : Testing Potash Mineral (K) and an equivalent dressing of Sulphate of Potash (S) at the rate of 0.5 cwt. of K<sub>2</sub>O per acre. Basal Dressing, 12 tons of Bedford Corporation Manure per acre, applied April 19-21.

Artificially applied : April 29-30.

VARIETY : Majestic.

Potatoes planted : May 1-5. Lifted : September 14-18.

Previous Crop : Barley.

**Actual Yield in lb.**

Row.	O	S	K
I.	276.50	239.00	236.00
II.	223.50	235.00	203.75
III.	188.75	174.00	216.25

**Summary of Results.**

	No Potash.	Sulphate of Potash.	Potash Mineral.	Mean.	Standard Error.
Tons per acre .. ..	4.10	3.86	3.90	3.95	0.076
Per cent. .. ..	103.7	97.6	98.8	100.0	1.93

No response to either dressing of Potash on very low yield.

## SUGAR BEET.

### Effect of Nitrogenous Fertilisers:

Sulphate of Ammonia, with seed.

Nitrate of Soda (a) with seed.

(b) as top dressing.

Lansome, 1929.

N.W.

A				B				C			
Ns+Nt	S+N <sub>s</sub> +N <sub>t</sub>	O	S+N <sub>t</sub>	O	S+N <sub>s</sub> +N <sub>t</sub>	Ns+N <sub>t</sub>	N <sub>t</sub>	Ns	Ns+N <sub>t</sub>	S	S+N <sub>s</sub>
S	N <sub>t</sub>	N <sub>s</sub>	S+N <sub>s</sub>	S+N <sub>s</sub>	S+N <sub>t</sub>	N <sub>s</sub>	S	S+N <sub>t</sub>	O	N <sub>t</sub>	S+N <sub>s</sub> +N <sub>t</sub>
S+N <sub>s</sub> +N <sub>t</sub>	N <sub>s</sub>	S+N <sub>t</sub>	Ns+N <sub>t</sub>	N <sub>t</sub>	S	S+N <sub>s</sub> +N <sub>t</sub>	N <sub>s</sub>	S	Ns+N <sub>t</sub>	O	N <sub>s</sub>
N <sub>t</sub>	S+N <sub>s</sub>	S	O	S+N <sub>t</sub>	Ns+N <sub>t</sub>	S+N <sub>s</sub>	O	S+N <sub>t</sub>	S+N <sub>s</sub>	N <sub>t</sub>	S+N <sub>s</sub> +N <sub>t</sub>
D				E				F			

SYSTEM OF REPLICATION: 48 plots in 6 randomised blocks.

AREA OF EACH PLOT: 1/40th acre.

TREATMENTS:

S = Sulphate of Ammonia with seed  
 N<sub>s</sub> = Nitrate of Soda with seed  
 N<sub>t</sub> = Nitrate of Soda as top dressing } in all combinations.

Rate: 0.4 cwt. Nitrogen per acre in all cases.

Basal Manure: Bedford Corporation Manure (10 tons per acre).

Applied: February 3—March 10.

Artificial Applied: Basal, May 21-22.

Top Dressing: July 10.

VARIETY: "Klein Wanzleben."

Beet sown: May 23 (16 lb. per acre).

Lifted: October. 24-26.

Previous Crop: Clover and Grasses.

#### Actual Yield in lb.—Roots.

Block.	O	S	N <sub>s</sub>	N <sub>t</sub>	S+N <sub>s</sub>	S+N <sub>t</sub>	Ns+N <sub>t</sub>	S+N <sub>s</sub> +N <sub>t</sub>
A	359.0	140.0	377.0	251.0	492.5	477.5	176.5	340.0
B	433.0	448.0	461.0	301.5	530.0	469.5	410.5	460.5
C	470.0	456.5	322.5	522.5	343.0	530.0	354.0	448.5
D	560.5	512.0	444.5	364.5	527.5	513.5	516.5	241.0
E	501.0	565.0	562.0	535.5	620.0	554.0	550.5	602.0
F	491.5	468.0	413.5	517.5	570.5	503.5	510.5	478.5

#### Actual Yield in lb.—Tops.

Block.	O	S	N <sub>s</sub>	N <sub>t</sub>	S+N <sub>s</sub>	S+N <sub>t</sub>	Ns+N <sub>t</sub>	S+N <sub>s</sub> +N <sub>t</sub>
A	389	220	218	345	530	460	237	502
B	405	463	451	190	562	557	410	502
C	307	416	318	398	231	572	483	406
D	455	504	392	341	480	485	507	255
E	535	504	555	511	513	481	542	548
F	476	419	448	524	465	540	578	526

**Sugar Beet : Lansome, 1929 (contd.)**

**Summary of Results.**

ROOTS.	Average Yield—tons per acre.				Average Yield—per cent.			
	Without S/Amm.		With S/Amm.		Without S/Amm.		With S/Amm.	
	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.
Without Top Dressing ..	8.38	7.68	7.71	9.18	103.8	95.1	95.5	113.7
With Top Dressing ..	7.42	7.50	9.07	7.65	91.9	92.9	112.4	94.8

Mean—8.07 tons. Standard Error—0.592 tons or 7.34 per cent.

TOPS.	Average Yield —tons per acre.				Average Yield—per cent.			
	Without S/Amm.		With S/Amm.		Without S/Amm.		With S/Amm.	
	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.
Without Top Dressing ..	7.64	7.09	7.52	8.28	97.1	90.1	95.5	105.2
With Top Dressing ..	6.87	8.21	9.21	8.15	87.3	104.3	117.0	103.6

Mean=7.87 tons. Standard Error=0.676 tons or 8.58 per cent.

**Sugar Percentage.**

	Average Sugar Percentage.			
	Without Sulphate of Ammonia.		With Sulphate of Ammonia.	
	Without N/Soda with seed.	With N/Soda with seed.	Without N/Soda with seed.	With N/Soda with seed.
Without Top Dressing	16.91	16.42	16.68	16.63
With Top Dressing ..	15.98	16.30	16.33	16.00

Mean—16.41. Standard Error—0.261 or 1.59 per cent.

There is evidence of a response to Sulphate of Ammonia on those plots which were also treated with Nitrate of Soda, either with the seed or as a top dressing, but on the plots which had all three dressings there was no response. Application of top dressing of Nitrate of Soda has depressed the sugar percentage significantly, while the Nitrogenous dressings applied at time of sowing had no effect.



### SUGAR BEET.

**Potassic Fertilisers :** Muriate of Potash, Potash Manure Salts, Potash Mineral.

**Phosphatic Fertilisers :** Slag, Superphosphate.

Lansome, 1929.

A				B				C				
Sl	S	S	O	Sl	S	O	Sl	S	O	O	S	
K	M	O	O	O	O	P	P	M	O	M	P	
Sl	S	O	Sl	O	S	S	S	O	Sl	Sl	Sl	
P	P	M	M	O	M	K	P	K	O	P	K	
Sl	O	S	O	Sl	Sl	O	O	S	S	O	Sl	
O	K	K	P	M	K	M	K	K	O	P	M	

SYSTEM OF REPLICATION : 36 plots in 3 randomised blocks.

AREA OF EACH PLOT : 1/40th acre.

TREATMENTS : (a) No Potash (O) and Potash in the form of Muriate of Potash (M), Potash Manure Salts (P), and Potash Mineral (K). (Rate 0.8 cwt. K<sub>2</sub>O per acre). (b) No Phosphate (O), and Phosphate in the form of Slag (Sl), and Superphosphate (S). (Rate 0.6 cwt. P<sub>2</sub>O<sub>5</sub> per acre.) (a) and (b) in all combinations.

Basal Manure : Bedford Corporation Manure, 10 tons per acre, February 3-March 10.

Artificially applied : May 21-22.

Beet sown : May 23 (16 lb. per acre).

Singled : June 20-24.

Lifted : October 23-24.

Previous Crop : Clover and Grasses.

Upper letters refer to dressings of Phosphate.  
Lower letters refer to dressings of Potash.

#### Actual yield in lb.—Roots.

Blocks.	No Potash.			Muriate of Potash.			Potash Manure Salts.			Potash Mineral.		
	No Phosphate.	Slag.	Super.	No Phosphate.	Slag.	Super.	No Phosphate.	Slag.	Super.	No Phosphate.	Slag.	Super.
A	490.5	422.5	490.0	469.5	467.5	455.5	527.0	453.5	506.5	439.0	474.5	497.0
B	432.0	476.5	432.5	482.0	523.0	402.5	480.0	495.0	428.5	506.0	460.0	418.5
C	462.5	438.5	519.0	492.0	473.5	414.5	517.5	409.5	458.5	371.5	343.5	468.5

#### Actual yield in lb.—Tops.

Blocks.	No Potash.			Muriate of Potash.			Potash Manure Salts.			Potash Mineral.		
	No Phosphate.	Slag.	Super.	No Phosphate.	Slag.	Super.	No Phosphate.	Slag.	Super.	No Phosphate.	Slag.	Super.
A	450	483	409	462	496	452	493	524	500	403	436	495
B	418	356	455	412	441	390	529	441	693	391	342	428
C	458	431	452	420	178	175	378	539	175	376	233	420

#### Summary of Results.—Roots.

	Average Yield in tons per acre.				Average Yield per cent.			
	No Potash.	Muriate of Potash.	Potash Manure Salts.	Potash Mineral.	No Potash.	Muriate of Potash.	Potash Manure Salts.	Potash Mineral.
No Phosphate ..	8.24	8.59	9.07	7.84	100.1	104.4	110.2	95.2
Slag .. ..	7.96	8.71	8.08	7.61	96.7	105.8	98.2	92.4
Superphosphate	8.58	7.57	8.29	8.24	104.2	92.0	100.7	100.1

Mean—8.23 tons. Standard Error—0.422 tons or 5.13 per cent.

**Sugar Beet: Lansome, 1929 (contd.)**

**Tops.**

	Average Yield in tons per acre.				Average Yield per cent.			
	No Potash.	Muriate of Potash.	Potash Manure Salts.	Potash Mineral.	No Potash.	Muriate of Potash.	Potash Manure Salts.	Potash Mineral.
No Phosphate ..	7.89	7.70	8.33	6.96	105.1	102.6	111.0	92.8
Slag .. ..	7.56	6.64	8.95	6.02	100.7	88.4	119.3	80.2
Superphosphate	7.83	6.05	8.14	7.99	104.3	80.6	108.5	106.5

Mean—7.51 tons. Standard Error—0.996 tons or 13.27 per cent.

**Sugar Percentage.**

	No Potash.	Muriate of Potash.	Potash Manure Salts	Potash Mineral.	Mean.
No Phosphate ..	17.88	17.72	17.66	17.74	17.75
Slag .. ..	17.50	17.53	17.84	17.42	17.57
Superphosphate ..	17.89	18.28	17.92	17.57	17.91

Mean—17.74 Standard Error—0.251 or 1.41 per cent.

There has been no response whatever to the Phosphatic dressing, while the effect of Potash was insignificant, there being only a slight indication of a depression due to Potash Mineral in the case of roots and tops, and also a depression due to Muriate of Potash with tops only. The plots treated with Superphosphate have given a significantly higher sugar percentage than those treated with Slag. No significant differences in sugar percentage due to the Potassic treatments.