

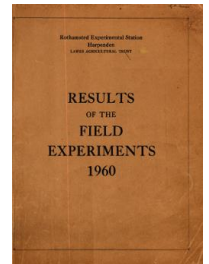
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Yields of the Field Experiments 1960

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60/R/B/3 and 60/W/B/3 Reference Plots

Rothamsted Research

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60/B/3.1

REFERENCE PLOTS

The effects of N,P,K and Dung on a sequence of five arable crops and on permanent grass - Rothamsted (R) Great Field IV and Woburn (W) Stackyard Series C 1960.

In 1960 additional plots were laid down at Rothamsted to provide information on the effects of Mg, Ca, S and trace elements in the presence of N,P,K (equivalent to N₂,P,K treatment of the original plots) on an unlimed continuation of the original site in Great Field IV. The same sequence of crops (wheat, kale, barley, clover-grass ley, potatoes) is followed. The turf was removed from the site before hand digging.

At Woburn soft fruit was also grown, and the site selected was old arable, shown by soil analysis to be acid and to be low in available P & K. The cultivated areas received 27 cwt per acre hydrated lime before digging on February 10, 1960. All arable crops are spring sown.

Great Field IV (R): Additional plots:-

Design: 5 rows of a 7 × 7 Latin square, one row in each crop.

Area of each plot: 0.0013 acres.

Treatments:-

1. Nil
2. N₂,P,K
3. N₂,P,K Ca Mg
4. N₂,P,K Ca - S
5. N₂,P,K - Mg S
6. N₂,P,K Ca Mg S
7. N₂,P,K Ca Mg S + trace elements.

Rates and forms of manuring:

All N as urea.

All P and part K as potassium dihydrogen phosphate.

Remaining K as muriate of potash where sulphur omitted or sulphate of potash where sulphur added.

Ca as calcium carbonate

Mg as magnesium chloride

S as potassium sulphate

Trace elements: Iron, manganese, copper, zinc, boron, molybdenum and cobalt applied as foliar spray to crops known to benefit; as under:

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Levels of application:

	Winter wheat	Kale	Barley	Grass & clover	Potatoes
			cwt per acre		
N*	1.2	2.0	0.9	0.3	1.2
P ₂ O ₅	1.0	1.0	1.0	1.0	1.0
K ₂ O	1.4	1.4	1.4	1.4	1.4
MgO	1.0	1.0	1.0	1.0	1.0
CaO	1.0	1.0	1.0	1.0	1.0
S	0.25	0.25	0.25	0.25	0.25
			lb per acre		
Fe ⁺	-	-	-	-	20
MnSO ₄	5	-	-	5	5
CuSO ₄	2	-	2	-	-
ZnSO ₄	2	-	2	-	2
NaB ₁₀ H ₇ O ₇	-	10	-	5	-
NaMoO ₄	-	0.5	-	0.125	-
CoSO ₄	-	-	-	0.125	-

*For winter wheat, potatoes and kale nitrogen divided into two equal applications - one early, one late.

⁺Iron applied as iron chelate (12% Fe).

Stackyard Series C (W)

Design: Each crop - 1 randomised block of 12 plots. Rotation: Oats, sugar beet, barley, clover-grass ley, potatoes.

Area of each plot: 0.0014 acres.

Treatments: All combinations of:-

Nitrogen: None, N₁ (for rates see below)

Phosphate: None, 0.5 cwt P₂O₅ per acre as triple superphosphate.

Potash: None, 1.0 cwt K₂O per acre as potassium bicarbonate, and the following additional treatments:

N₂,P,K; dung; dung and N₁,P,K; dung and N₂,P,K.

Rates of nitrogen (all as ammonium nitrate):

N₁: Potatoes and fruit bushes, 0.6; barley, 0.45; oats, 0.3; sugar beet, 0.75; grass and clover ley, 0.15; permanent grass, 1.0 cwt N per acre; N₂ double N₁ in each case.

Dung: 20 tons per acre to potatoes and beet; 10 tons to permanent grass and, in 1960 only, 7 tons to barley and oats and 3 tons to clover-grass ley.

Basal dressing, to permanent grass and fruit bushes only: 0.25 cwt N per acre as ammonium nitrate.

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Cultivations, etc.:

Great Field IV (R):- Original plots:

- Winter wheat: Dug by hand: Sept 14, 1959. P,K applied, seed drilled: Oct 23. First N dressing applied: Mar 7, 1960. Second N dressing applied: Apr 28. Harvested: Aug 10. Variety: Cappelle.
- Kale: Dung applied, plots dug by hand: Nov 11, 1959. N,P & K applied, seed sown: Apr 6, 1960. Harvested: Nov 24. Variety: Thousand Head.
- Barley: Dug by hand: Nov 23, 1959. N,P & K applied, seed sown: Mar 18, 1960. Harvested: Aug 5. Variety: Proctor.
- Grass-clover ley: Undersown in barley: Apr 2, 1959. N,P & K applied: Mar 7, 1960. Cut 3 times: May 16, July 27 and October 11, 1960. Varieties: S22 Ryegrass and S151 Late Flowering Red Clover.
- Potatoes: Dung applied, plots dug by hand: Nov 23, 1959. N, P&K applied on flat, setts planted: Apr 6, 1960. Harvested: Sept 12. Variety: King Edward.
- Permanent grass: Dung applied: Nov 23, 1959. First N dressing and P,K applied: Mar 7, 1960. Second N dressing: May 16. Cut twice: May 16 and Oct 10.

Great Field IV (R):- Additional plots:

- Winter wheat: Dug by hand: Oct 2, 1959. Seed drilled: Oct 23. P,K,Ca and S applied to wheat: Nov 17. Mg and half N applied: Mar 7, 1960. Half N applied: Apr 28. Trace element spray applied: May 18. Harvested: Aug 10. Variety: Cappelle.
- Kale: Dug by hand: Jan 4, 1960. Half N and P,K,S,Mg and Ca applied: Mar 14. Rotovated and seed sown: Apr 6. Half N applied: Apr 28. Trace element spray applied: May 25. Harvested: Nov 24. Variety: Thousand Head.
- Barley: Dug by hand: Jan 5, 1960. N, P,K,S,Mg and Ca applied: Mar 14. Rotovated, seed sown: Mar 18. Trace element spray applied: May 18. Harvested: Aug 5. Variety: Proctor.
- Grass-clover ley: Dug by hand: Jan 4, 1960. N,P,K,S,Mg and Ca applied: Mar 14. Rotovated and seed sown: Mar 18. Trace element spray applied: May 25. Cut twice: July 26 and Oct 11. Varieties: S22 Ryegrass and Dorset Marl Broad Red Clover.
- Potatoes: Dug by hand: Jan 5, 1960. Half N and P,K,S,Mg and Ca applied: Mar 14. Rotovated, setts planted: Apr 6. Half N applied: Apr 28. Trace element spray applied: May 25. Harvested: tops - Aug 2, tubers - Aug 15. Variety: King Edward.

Stackyard Series C (W):-

- Oats: Hand dug, dung applied: Feb 15, 1960. N,P,K applied, seed sown: Mar 23. Harvested: Aug 9. Variety: Condor.
- Sugar beet: Hand dug, dung applied: Feb 15, 1960. N,P,K applied, seed sown: Mar 25. Harvested: Oct 13. Variety: Klein E.

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Barley: Hand dug, dung applied: Feb 15, 1960. N,P,K applied, seed sown: Mar 23. Harvested: Aug 9. Variety: Proctor.
Grass-clover ley: Hand dug, dung applied: Feb 16, 1960. N,P,K applied, seed sown: Mar 24. Cut twice: July 26 and Oct 5. Varieties: S22 Italian Ryegrass and Dorset Marl Broad Red Clover.
Potatoes: Hand dug, dung applied: Feb 16, 1960. N,P,K applied, potatoes planted: Mar 25. Harvested: Sept 15. Variety: King Edward.
Permanent grass: Hand dug, dung applied: Feb 16, 1960. P,K and three-quarters of N applied, seed sown: Mar 24. Basal N applied: May 26. One-quarter N applied: July 26. Cut twice: July 26 and Oct 5. Variety: Complex grass and clover mixture.
Fruit bushes: Blackcurrants planted: Feb 8, 1960. Hand dug: Feb 16. Gooseberries planted: Mar 2. Lime applied to surface soil: Mar 15. N,P,K applied: Mar 24. Strawberries planted: Apr 22. Dung applied to surface soil: Apr 29. Basal N applied: June 2. Varieties: Blackcurrants - Wellington XXX; Gooseberry - Careless; Strawberry - Cambridge Vigour.

For details of the previous years results for Great Field IV (R) see "Results of the Field Experiments" 59/Bc/1 and 58/Bc/1, in which the rates of N, P & K are given.

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Summary of Results
Great Field IV (R): Original plots

Treatment	cwt per acre		tons per acre Kale total weight	Barley Grain Straw (at 85% D.M)		cwt per acre Ley: dry matter			tons per acre Potatoes total tubers		cwt per acre Permanent grass: dry matter		
	Winter Grain (at 85% D.M)	wheat Straw (at 85% D.M)		1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	Total	1st cut	2nd cut	Total
None	40.6	45.8	6.04	20.8	17.8	13.7	17.6	7.1	38.4	4.30	6.8	34.9	41.7
N ₁	47.1	50.5	13.11	27.3	24.0	19.5	14.5	4.9	38.9	4.47	13.1	31.9	45.0
P	48.4	58.0	7.77	28.0	21.2	17.7	19.9	15.7	53.3	4.12	6.0	31.8	37.8
N ₁ P	49.1	55.1	13.16	42.0	36.5	23.7	15.2	9.7	48.6	4.90	19.8	40.1	59.9
K	47.2	55.9	5.88	19.2	16.5	21.3	29.6	14.2	65.1	10.62	7.5	31.8	39.3
N ₁ K	53.5	61.3	9.14	31.8	28.9	25.8	23.0	15.4	64.2	10.29	20.2	37.4	57.6
PK	48.0	63.2	6.75	27.4	22.8	26.8	37.0	20.1	83.9	10.51	11.4	40.0	51.4
N ₁ PK	58.9	73.2	14.26	40.6	38.1	24.4	28.3	17.6	70.3	14.96	22.6	34.2	56.8
N ₂ PK	59.1	76.4	21.92	50.0	46.7	33.9	24.2	20.0	78.1	14.08	33.0	40.5	73.5
D	51.4	67.9	14.00	35.6	35.4	23.3	32.5	16.5	72.3	19.04	17.4	33.4	50.8
N ₁ PKD	59.6	80.6	20.18	46.2	44.8	31.5	29.6	20.2	81.3	22.68	34.0	38.5	72.5
N ₂ PKD	56.5	82.7	25.80	48.5	55.8	34.5	22.1	20.3	76.9	25.60	38.9	42.8	81.7
Mean dry matter % as harvested:	78.7	66.2		78.3	46.8	22.8	28.2	18.2	23.1		24.2	26.8	25.5

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Great Field IV (R): Additional plots

Treatment	cwt per acre Winter wheat Grain (at 85% D.M)		cwt per acre Wheat Straw (at 85% D.M)		tons per acre Kale total weight		Barley Grain (at 85% D.M)		Straw (at 85% D.M)		cwt per acre Ley: 1st cut		dry matter 2nd cut		tons per acre Potatoes total tubers	
	Grain	Straw	Grain	Straw	Grain	Straw	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
None	15.6	18.5	10.42	12.2	18.1	12.2	14.3	14.2	14.3	14.2	28.5	5.28				
N ₂ PK	42.7	45.5	22.18	34.7	41.6	34.7	31.9	20.0	31.9	20.0	51.9	13.13				
N ₂ PK Mg Ca S	45.2	52.5	18.60	35.4	35.5	35.4	29.1	18.2	29.1	18.2	47.3	15.00				
N ₂ PK Mg Ca S TE	41.1	50.1	19.42	34.7	40.7	34.7	29.2	18.1	29.2	18.1	47.3	13.62				
N ₂ PK Mg Ca	39.6	49.8	21.16	34.2	40.7	34.2	28.7	18.3	28.7	18.3	47.0	14.45				
N ₂ PK Mg S	42.2	44.2	20.86	31.5	37.3	31.5	25.2	16.6	25.2	16.6	41.8	14.98				
N ₂ PK Ca S	52.1	63.8	21.10	37.4	39.2	37.4	30.6	17.9	30.6	17.9	48.5	14.93				
Mean dry matter % as harvested:	79.2	70.6	83.7	59.3	23.5	14.3	18.9									

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Stackyard Series C (W)

Treatment	cwt per acre Oats (at 85% D.M.)		tons per acre Sugar beet roots (washed)		Barley Grain Straw (at 85% D.M.)		cwt per acre Ley: dry matter			tons per acre Potatoes total tubers		cwt per acre Permanent grass: dry matter		Total
	Grain Straw (at 85% D.M.)	Oats	Sugar beet roots (washed)	tops	Grain Straw (at 85% D.M.)	Barley	1st cut	2nd cut	Total	Potatoes total tubers	1st cut	2nd cut		
None	8.8	12.8	14.96	7.10	12.2	10.2	25.5	21.1	46.6	6.65	16.7	13.1	29.8	
N ₁	19.2	23.3	17.52	12.96	17.9	18.9	25.0	23.8	48.8	12.12	23.9	16.2	40.1	
P	9.2	12.0	14.12	6.48	9.3	9.3	25.6	22.8	48.4	7.30	18.7	14.8	33.5	
N ₁ P	19.8	24.4	19.03	10.95	19.1	17.3	27.4	22.4	49.8	11.36	23.2	15.6	38.8	
K	9.8	13.5	12.82	6.17	10.4	9.2	28.1	27.3	55.4	6.56	14.1	13.6	27.7	
N ₁ K	24.6	28.4	20.81	11.72	20.7	18.9	25.3	22.8	48.1	11.07	25.7	16.4	42.1	
PK	13.2	20.0	13.47	6.02	9.6	10.1	30.3	23.2	53.5	7.70	19.6	15.9	35.5	
N ₁ PK	19.1	24.5	19.46	10.18	21.3	21.4	30.1	24.2	54.3	12.60	28.7	16.5	45.2	
N ₂ PK	22.1	29.4	18.84	18.20	22.7	27.9	29.0	22.4	51.4	16.16	36.2	23.7	59.9	
D	11.9	17.2	17.62	8.33	11.9	11.9	24.2	24.3	48.5	12.14	18.4	16.1	34.5	
N ₁ PKD	22.2	27.3	25.72	13.58	26.5	25.4	29.8	27.0	56.8	16.72	32.5	19.8	52.3	
N ₂ PKD	24.5	33.3	27.62	21.28	27.4	30.4	31.7	26.6	58.3	22.15	35.4	24.5	59.9	
Mean dry matter % as harvested:	68.0	38.6			74.5	50.3	15.2	12.5	13.8		18.8	15.4	17.1	