ROTHAMSTED RESEARCH

Details of the Classical and Long-term Experiments Up to 1967

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Residual Phosphate Rotation - Rothamsted

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RESIDUAL PHOSPHATE ROTATIONS, GREAT FIELD IV AND SAWYERS I, 1960 ONWARDS

These experiments were designed to study the immediate and residual effects of a variety of phosphate fertilisers on three crops grown in rotation. Both sites had acid soils deficient in soluble P; Great Field IV, an old grass field, had more organic matter than Sawyers I, which had long been in arable cultivation.

First period, 1960-65

Cropping, etc. The crop rotation was: potatoes (Majestic), spring barley (Proctor), swedes (Wilhelmsburger). Each crop occupied one series on each field. On Great Field IV each series comprised one randomised block of 12 plots, on Sawyers I two blocks of 12. Swede tops were spread on their respective plots and ploughed in.

Size of plots. The area of each plot was 0·0193 acres (Great Field IV), 0·0212 acres (Sawyers I).

Treatments 1960–65

1. No phosphate.
2. 0·25 cwt P_2O_5 each year as superphosphate.
3. 0·50 cwt P_2O_5 each year as superphosphate.
4. 0·75 cwt P_2O_5 in 1962 and again in 1965 as superphosphate.
5. 1·50 cwt P_2O_5 in 1962 and again in 1965 as superphosphate.
6. 3·00 cwt P_2O_5 in 1960 as nitrophosphate-5* (17·1% P_2O_5).
7. 3·00 cwt P_2O_5 in 1960 as nitrophosphate-26* (18·8% P_2O_5).
8. 3·00 cwt P_2O_5 in 1960 as nitrophosphate-50* (22·4% P_2O_5).
9. 3·00 cwt P_2O_5 in 1960 as Gafsa rock phosphate (28·9% P_2O_5).
10. 3·00 cwt P_2O_5 in 1960 as Bessemer basic slag (15·2% P_2O_5).
11. 3·00 cwt P_2O_5 in 1960 as potassium metaphosphate (57·9% P_2O_5, 38·8% K_2O).
12. 3·00 cwt P_2O_5 in 1960 as superphosphate (20·4% P_2O_5).

* -5, etc., indicates percentage total P soluble in water.

The initial dressings of treatments 6 to 12 were applied in September 1959 and all plots were then ploughed. All plots except treatment 11 received after this ploughing sulphate of potash to supply 2 cwt K_2O, the equivalent of the K_2O in treatment 11. All plots were re-ploughed in autumn 1959 and twice rotary-cultivated in spring 1960. The superphosphate of treatments 2, 3, 4 and 5 and the basal dressings (see below) were applied in the seedbed for barley and swedes, to the flat land before planting potatoes.

Basal dressings

(i) *Nitrogen as 'Nitro-Chalk 21'*
Potatoes 1·2 cwt N, swedes 0·5 cwt N, barley 0·6 cwt N (on the Great Field site only, no nitrogen was applied for barley from 1963 to 1965).

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(ii) *Potash as sulphate of potash*
1·0 cwt K_2O to all crops.

Liming

1961 9 cwt chalk Sawyers
1962 20 cwt chalk Sawyers and Great Field
1963 23 cwt chalk Sawyers blocks 1 and 2 (before swedes, 1963)
1964 23 cwt chalk both fields except Sawyers blocks 1 and 2.

TABLE 40

Residual phosphate rotations, Sawyers I (S) and Great Field IV (G)

Mean yields: 1960–65 (six seasons)

Treatment	Applied	Total P_2O_5 cwt 1960–65	Potatoes total tubers, tons S	Potatoes total tubers, tons G	Barley Grain, cwt S	Barley Grain, cwt G	Swedes Total roots, tons S	Swedes Total roots, tons G
No phosphate	—	0	10·02	11·95	35·1	34·1	7·53	8·20
Superphosphate	Annually	1·5	10·90	13·15	37·5	36·4	15·88	17·55
	Annually	3·0	11·74	14·46	36·8	34·0	17·60	21·05
Superphosphate	1962, 1965	1·5	11·10	13·39	36·2	33·7	13·52	17·35
	1962, 1965	3·0	11·23	13·88	37·4	34·8	15·75	18·84
Nitrophosphate-5	1960	3·0	11·78	14·28	36·7	36·4	19·77	19·89
Nitrophosphate-26	1960	3·0	12·02	13·82	37·4	36·8	18·12	21·32
Nitrophosphate-50	1960	3·0	11·80	13·78	38·8	33·5	19·02	20·21
Gafsa rock phosphate	1960	3·0	11·04	13·54	39·4	38·3	16·75	21·05
Basic slag	1960	3·0	11·43	13·71	39·3	35·0	17·70	19·10
Potassium metaphosphate	1960	3·0	11·77	13·94	39·0	36·8	17·45	19·68
Superphosphate	1960	3·0	11·97	13·87	39·2	36·2	17·92	21·09
Mean			11·40	13·65	37·7	35·5	16·42	18·78
S.E.			±0·262	—	±0·78	—	±0·632	—

Second period, commencing 1967 after fallow 1966

The sites were fallowed in 1966 and certain treatments (see below) were applied during the fallow period. In 1967 the same crop rotation was restarted (barley 1967 following potatoes 1965). The experiment is planned to continue until 1972.

Treatments

1960–65 All superphosphate granular			1967–72 All treatments as granular superphosphate		
Material and season applied	Total P_2O_5 cwt	Old symbol	When applied	Total P_2O_5 cwt	New symbol
None	0	(1)	None	0	(0)
Superphosphate annually	1·5	(2)	Annually	1·5	(A1)
Superphosphate annually	3·0	(3)	Annually	3·0	(A2)
Nitrophosphate-5 in 1960	3·0	(6)	Annually	6·0*	(A3)
Nitrophosphate-26 in 1960	3·0	(7)	Annually	9·0*	(A4)
Superphosphate in 1962, 1965	1·5	(4)	1969, 1972	1·5	(T1)
Superphosphate in 1962, 1965	3·0	(5)	1969, 1972	3·0	(T2)
Nitrophosphate-50 in 1960	3·0	(8)	1967	3·0*	(R2)
Basic slag in 1960	3·0	(10)	1967	6·0*	(R3)
Potassium metaphosphate in 1960	3·0	(11)	1967	9·0*	(R4)
Gafsa rock phosphate in 1960	3·0	(9)	None	0	(G1)
Superphosphate in 1960	3·0	(12)	None	0	(S1)

* Allocated at random to the plots of old treatments 6, 7, 8, 10, 11 within each block.

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RESIDUAL PHOSPHATE

Superphosphate dressings to treatments A1, A2, A3, A4 are applied broadcast in spring before sowing or planting (with basal manures).

Basal manures (broadcast in spring before sowing or planting)

N as 'Nitro-Chalk': to potatoes 1·2 cwt
to swedes 0·5 cwt
to barley 0·6 cwt (Sawyers I)
none (Great Field IV).

K_2O as muriate of potash: to potatoes 1·5 cwt
to barley 1·0 cwt
to swedes 1·0 cwt.

Varieties

Potatoes	Majestic
Barley	Maris Badger
Swedes	Wilhelmsburger.

Reference

For results 1960–65 see: Mattingly, G. E. G. (1968) Evaluation of phosphate fertilisers, II. *J. agric. Sci.* **70**, 139–156.

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