

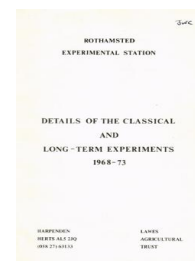
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Details of the Classical and Long-term Experiments 1968-73

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W/RN/3 Ley/ARABLE - Leys, Barley, Potatoes, Wheat, Rye, Carrots

Rothamsted Research

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LEY-ARABLE ROTATION WOBURN, STACKYARD FIELD (W/RN/3)

This experiment, which was started in 1938, was designed to test the effects on soil fertility of a three-year grazed ley, three years of lucerne and a three course arable rotation including one year hay in comparison with a rotation without leys measured by the yields of two successive test crops. (*Details* 1967, pp. 105-114).

Large differences in the yields of potatoes grown in contrasting conditions in 1966 led to the introduction of a number of studies in soil pathogens. Initially the tests were applied to the treatment crops of potatoes but in 1971 potatoes were re-introduced as the first test crop. A number of other changes were made including the substitution of S123 red clover for sainfoin which had often failed to survive three years. These are summarised below and set out in detail in table 2.

Treatment crops

	1st year	2nd year	3rd year
Ley (L)	Grazed to 1968 Cut from 1969 Till 1971	Grazed to 1968 Cut from 1969 Till 1971	Grazed to 1969 Cut from 1970 Till 1971
Sainfoin (cut) (S)			
S123 Clover (cut (C1))	1972-	Sown July 1971	Sown July 1971
Arable (roots) (A)	Potatoes (P)	1968-71 Rye (R)	1968-71 Carrots (C)
Arable (hay) (AH)	Potatoes	1972 - Barley (B) 1968-71 Rye 1972 - Barley	1972 - Barley Hay* (H)

*the seeds were undersown in the preceding cereals in some seasons.

Test crops

	1st	2nd
1968-70	Barley	Barley
1971	Potatoes	Barley
1972 & 1973	Potatoes	Wheat

Treatments

(i) Potatoes

(a) Treatment crops

1968 None v. thiram (approx. 8 kg a.i.) applied to tuber

NOTE: Thiram-dressed seed was chitted, untreated seed was not chitted (on 1/24 plots)

1968-70 (a) None v. 448 kg chloropicrin (on 1/4 plots)

(b) 125 v. 188 v. 251 kg N (on 1/12 plots)

1969 & 1970 None v. 11 kg aldicarb (on 1/24 plots)

1972 None v. 448 kg chloropicrin plus 5.6 kg aldicarb (on 1/4 plots)

- 1973 None v. 448 kg chloropicrin plus 6.7 kg aldicarb (applied also in error to the 1/4 plots of the 1st year ley and 1st year clover on 'alternating' rotations.
- (b) *Test crops* (Note: FYM no longer applied to test crop)
- 1971 None v. 448 kg chloropicrin plus 11.2 kg aldicarb
Varieties: Maris Piper v. Pentland Crown
On 1/2 plots after ley and sainfoin and 1/4 plots after arable and arable with ley (1971 only; other years Maris Piper only).
- 1972 & 1973 None v. 448 chloropicrin plus:
1972 5.6 kg aldicarb,
1973 6.7 kg aldicarb.
- (ii) *Other test crops*
- (a) Barley as first test crop 1968-70 (on 1/8 plots) after A and AH rotations: 50 v. 100 v. 150 v. 200 kg N. After L and S rotations: 0 v. 50 v. 100 v. 150 kg N.
- (b) Wheat as second test crop 1972 and 73. (on 1/8 plots)
0 v. 63 v. 126 v. 188 kg N.

Residual effects of the farmyard manure applied prior to 1968 and of fumigants from 1968 have been tested in a number of crops as shown in Table 2.

Table 2
Cropping Sequences and Residuals Tested

Phase 1

		Continuous			Alternating rotations			
1967	L1	S1	P	P	P	P	L1	S1
1968	L2	S2+	R+	R+	R+	R+	L2	S2+
1969	L3	S3	H	C	H	C	L3	S3
1970				BARLEY+				
1971				BARLEY				
1972	L1	C11	P*+	P*+	C11	L1	P*+	P*+
1973	L2	C12	B+F	B+F	C12	L2	B+F	B+F

- NOTES:** (1) FYM at 38 t last applied to 1st test crop (Sugar beet) 1965
Residual effect measured in crops marked (+)
- (2) Fumigant test applied to potato crops (*)
Residual effect measured in crops marked (F)

Phase 2

		Continuous			Alternating rotations			
1967	L2	S2	R	R	R	R	S2	L2
1968	L3	S3+	H+	C+	C+	H+	S3+	L3
1969				BARLEY+				
1970				BARLEY				
1971	L1	S/C1	P+	P+	S/C1	L1	P+	P+
1972	L2	C12	B	B	C12	L2	B	B
1973	L3	C13	H	B+	C13	L3	B+	H

- NOTES:** (1) FYM at 38 t last applied to 1st test crop (Sugar beet) 1964
Residual effect measured in crops marked (+)

Phase 3

		Continuous			Alternating rotations			
1967				BARLEY				
1968	L1	S1+	P*	P*	S1+	L1	P*	P*
1969	L2	S2	R+F	R+F	S2	L2	R+F	R+F
1970	L3	S3	H	C+F	S3	L3	H	C+F
1971				POTATOES*+				
1972				WHEAT+F				
1973	L1	C11	P*+	P*+	P*+	P*+	C11	L1

- NOTES: (1) FYM at 38 t last applied to 1st test crop (Sugar beet) 1966
Residual effect measured in crops marked (+)
(2) Fumigants applied to potatoes (*)
Residual effect measured in crops marked (F)

Phase 4

		Continuous			Alternating rotations			
1967	L3	S3	H	C	H	C	L3	S3
1968				BARLEY+				
1969				BARLEY				
1970	L1	S1	P*+	P*+	S1	L1	P*+	P*+
1971	L2	S2/Cl	R+F	R+F	S2/Cl	L2	R+F	R+F
1972	L3	Cl3	H	B	Cl3	L3	B	H
1973				POTATOES*+				

- NOTES: (1) FYM at 38 t last applied to 1st test crop (Sugar beet) 1963
Residual effect measured in crops marked (+)
(2) Fumigants applied to potatoes (*)
Residual effect measured in crops marked (F)

Phase 5

		Continuous			Alternating rotations			
1967				SUGAR BEET				
1968				BARLEY+				
1969	L1	S1	P*+	P*+	S1	L1	P*+	P*+
1970	L2	S2	R+F	R+F	S2	L2	R+F	R+F
1971	L3	S3	H	C+F	S3	L3	C+F	H
1972				POTATOES*+				
1973				WHEAT+F				

- NOTES: (1) FYM at 38 t last applied to 1st crop (Sugar beet) 1967
Residual effect measured in crops marked (+)
(2) Fumigant test applied to potato crops (*)
Residual effect measured in crops marked (F)

Standard manurial dressings (kg)

Treatment crops

	N	P ₂ O ₅	K ₂ O	Material	Application
Potatoes					
1968-70	—	115	225	(0-14-28)	On the flat
1971-	251	251	387	(13-13-20)	On the flat

<i>Rye</i>					
1968	75	40	75	'N-Chalk, & (0-14-28)	Top-dressed combine drilled
1969-	40	40	75	'N-Chalk' & (0-14-28)	Top-dressed combine drilled
<i>Barley</i>					
1972-	63	63	63	(15-15-15)	Combine drilled
<i>Carrots</i>					
1968-71	75	75	225	'N-Chalk', Super & Muriate	Seedbed
<i>One year ley (hay)</i>					
1968	125	75	150	'N-Chalk' & (0-14-28)	In spring
	75	—	75	(16-0-16)	After 1st cut
1969-73	Spring dressing as 1968				
	75	—	50	(25-0-16)	After 1st cut
<i>Ley—first year</i>					
1968-73	50	188	125	'N-Chalk', Super & Muriate	Seedbed
1968 (grazed)	75	—	75	(16-0-16)	1 top dressing
1969, 1970, 1972 & 1973 (cut)	100	—	63	(25-0-16)	2 dressings
1971 (cut)	50	—	32	(25-0-16)	1 dressing
	N	P ₂ O ₅	K ₂ O	Material	Application
<i>Ley-second & third years</i>					
1968 (cut)	100	—	100	(16-0-16)	2 dressings
2nd year					
1969 (cut)	100	—	63	(25-0-16)	2 dressings
3rd year					
1969 (grazed)	150	—	93	(25-0-16)	3 dressings
2nd & 3rd year					
1970-73 (cut)	150	—	93	(25-0-16)	3 dressings
<i>Sainfoin 1st year</i>					
1968-71	63	188	126	'N-Chalk', Super & Muriate	Seedbed
2nd & 3rd year					
1968-71	63	—	188	'N-Chalk' & Muriate	1 dressing
<i>Clover</i>					
1st year 1972	63	188	126	'N-Chalk', Super & Muriate	To Seedbed
2nd & 3rd years					
1972-	63	—	188	'N-Chalk' & Muriate	1 dressing
Magnesium sulphate (as Epsom salts) was applied to first treatment crops in the seedbed:—					
1968 and 1969	620 kg (62 kg Mg)				
1970	375 kg (37 kg Mg) — the smaller quantity applied in error.				

Test crops	N	P ₂ O ₅	K ₂ O	Material	Application
<i>Barley – 1st test</i>					
1968-70	—	63	63	(0-20-20)	Seedbed
<i>Barley – 2nd test</i>					
1968	75	40	0	'N-Chalk' & Super	Seedbed
1969-71	63	63	63	(15-15-15)	Seedbed
<i>Potatoes – 1st test</i>					
1971-73	250	250	385	(13-13-20)	Seedbed
<i>Wheat – 2nd test</i>					
1972-73		60	60	(0-20-20)	Seedbed

Table 3
Corrective K dressings (kg K₂O) applied to first test crop as
muriate of potash, half before ploughing and half after

<i>Continuous rotations</i>	1968	1969	1970	1971	1972	1973
	O D	O D	O D	O D	O D	O D
Leys (L)	0 126	188 0	200 0	126 126	251 251	502 502
Sainfoin (S) (Clover from 1972 (C1))	377 377	439 314	439 377	126 126	0 0	126 126
Arable with hay (AH)	628 502	502 439	628 628	188 188	314 251	314 376
Arable (A)	251 251	377 377	377 251	0 0	314 314	439 439
<i>Alternating rotations (Last two rotations in order)</i>	1968		1969		1970	
	O D		O D		O D	
AH/L	0 63	A/L	251 251	AH/L	251 63	
A/S	628 377	AH/S	377 251	A/S	439 314	
L/AH	628 377	LU/AH	502 502	L/AH	502 502	
LU/A	628 377	L/A	377 377	LU/A	439 439	
	1971		1972		1973	
	O D		O D		O D	
A/L	188 439	A/L	439 376	L/A	439 439	
AH/S	126 126	H/C1	126 126	S/AH	439 502	
L/AH	63 63	L/AH	251 251	A/L	502 502	
S/A	188 314	C/A	376 376	AH/C	251 0	

O = No FYM half plots D = FYM half plots

Liming

Lime was applied in the autumn to the plots intended for the second test crop.

1968	Ground Magnesium limestone at 5.6 t
1969	Ground Magnesium limestone at 5.0 t
1970	Ground Chalk at 5.0 t
1971-73	Ground Magnesium limestone at 5.0 t

Varieties

1968-70	Common Sainfoin	Maris Badger Barley	Maris Piper Potatoes	King II Rye	Autumn King Carrots
1971	S.123 Red Clover	Julia Barley	Maris Piper* Potatoes	King II Rye	Autumn King Carrots
1972 & 1973	S.123 Red Clover	Julia Barley	Maris Piper Potatoes	Capelle Wheat	

* Pentland Crown was also grown in the test crop plots.

Seeds mixtures

Hay	21 kg S.24 Perennial ryegrass, 10 kg Late flowering Red clover, 2 kg Alsike clover
Ley	22 kg S.23 Perennial ryegrass, 12 kg S.143 Cocksfoot, 7 kg Late flowering Red clover, 3 kg S.100 White clover.

Soil series Cottenham and Flitwick.

Reference

Johnston, A.E. (1973)

The effects of ley and arable cropping systems on the amounts of soil organic matter in the Rothamsted and Woburn ley arable experiments.

Rothamsted Experimental Station. Report for 1972, Part 2, 131-159.