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Yields of the Field Experiments 1973

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73/R/RN/1&2 - Ley/ARABLE - Old Grass, Leys, Potatoes, Wheat

Rothamsted Research

Rothamsted Research (1974) *73/R/RN/1&2 - Ley/ARABLE - Old Grass, Leys, Potatoes, Wheat ; Yields Of The Field Experiments 1973*, pp 66 - 83 - DOI: <https://doi.org/10.23637/ERADOC-1-98>

73/R/RN/1 and 73/R/RN/2

LEY/ARABLE

Object: To study the effects of three-year leys on the fertility of the soil as measured by a sequence of three arable test crops. Since 1968, continuous wheat has been grown after the three test crops to study the build-up and decline of take-all (*Gaeumannomyces graminis*) after the different cropping sequences - Highfield and Fosters.

Sponsors: A.E. Johnston, D.B. Slope.

The 25th year, old grass, leys, potatoes, wheat.

For previous years see 'Details' 1967, 68/R/1(t), 69/R/RN/1&2(t), 70/R/RN/1&2(t), 71/R/RN/1&2(t) and 72/R/RN/1&2.

The experiment is duplicated on:-

A site with much organic matter initially (ploughed out from permanent grass)

HIGHFIELD

A site with little organic matter initially

FOSTERS

Treatments: The experiment originally tested four six-course rotations, with all phases present each year. In recent years these rotations were:-

ROTATION

Treatment crops	Test crops	
LU, LU, LU,	W, P, B	Lucerne
LC, LC, LC,	W, P, B	GloGra
LN, LN, LN,	W, P, B	Grass
H, SB, O,	W, P, B	Arable

LU = lucerne, LC = clover/grass ley, no nitrogen fertiliser, LN = all grass ley with much nitrogen fertiliser, H = 1 year seeds hay, SB = sugar beet, O = oats, W = wheat, P = potatoes, B = barley.

In 1968 the order of test crops was changed to P, W, B except for those phases that had already started the sequence W, P, B.

On both fields in the first three years other plots were sown with longer-term reseeded grass

Reseeded

On Highfield plots of the old turf were left initially unploughed, for comparison with the three-year leys

OldGrass

73/R/RN/1 and 73/R/RN/2

In 1962 and 1963 some of the old and reseeded grass plots were divided for management identical to:- Clover/grass ley C
All grass ley N

From 1963 (reseeded) and 1968 (old grass) some grass plots were ploughed and cropped with the same test crops as above there- after these plots followed the Arable rotation. In 1973 some of these plots were returned to reseeded grass.

From 1968 only two phases on each field have continued in the original six-course rotation. All other phases have been sown to wheat every year at the end of the test-crop cycle. In 1973:-

Wheat, 5th test crop, 4th cereal (P,W,B,W,W)	CEREAL4
Wheat, 6th test crop, 5th cereal (P,W,B,W,W,W)	CEREAL5
Wheat, 8th test crop, 6th cereal (W,P,B,W,W,W,W,W)	CEREAL6
Wheat, 9th test crop, 7th cereal (W,P,B,W,W,W,W,W,W)	CEREAL7

Treatments to wheat:-

Sub plots: Nitrogen fertiliser (kg N) in 1973: N73

75	75
126	126
176	176
226	226

Treatments to potatoes:-

Sub plots: Farmyard manure residues, last applied 1968:- FYMRES68

None	None
30 tonnes on each occasion	FYM

Sub sub plots: Nitrogen fertiliser (kg N):- N73

None	0
80	80
160	160
240	240

Seed: Wheat: Cappelle sown at 200 kg.

Potatoes: King Edward, Rothamsted once grown

Hay: Perennial ryegrass S24 (64% by weight), Late flowering

Red Clover S123 (29%), Canadian Alsike clover (7%).

Mixture sown at 31 kg.

73/R/RW/1 and 73/R/RW/2

All grass ley: Timothy S51 (45%), Meadow Fescue S215 (55%),
Mixture sown at 34 kg.

Clover/grass ley and reseeded grass (1973): Timothy S51 (42%),
Meadow Fescue S215 (50%), White Clover S100 (8%).
Mixture sown at 37 kg.

Cultivations, etc. (Highfield and Fosters):-

1st year treatment crops:

All grass ley: Ploughed: 15 Sept, 1972. Reploughed: 14 Nov. PK
applied: 21 Mar, 1973. Seed sown: 29 Mar. N applied: 30 Mar.
Sprayed with benazolin, 2,4-DB and MCPA ('Legumex Extra' at
7.0 l in 220 l): 31 May. Topped: 15 June. Cut once: 20 July.
NK applied: 23 July.

Clover/grass ley: Ploughed: 15 Sept, 1972. Reploughed: 14 Nov.
PK applied: 21 Mar, 1973. Seed sown: 28 Mar. Sprayed with
benazolin, 2,4-DB and MCPA ('Legumex Extra' at 7.0 l in 220 l):
31 May. Topped: 15 June. Cut twice: 20 July and 13 Sept. K
applied: 23 July.

Lucerne: Ploughed: 15 Sept, 1972. Reploughed: 14 Nov. PK applied:
21 Mar, 1973. Seed sown: 28 Mar. Sprayed with 2,4-DB and MCPA
(('Embutox' at 8.4 l in 220 l): 4 June. Topped: 15 June. Cut:
30 July.

Hay: Ploughed: 15 Sept, 1972. PK applied: 18 Sept. Seed sown:
21 Sept. N applied: 21 Feb, 1973. Cut twice: 22 May and
26 June. NK applied after 1st cut.

1st Test Crop, Potatoes:

Ploughed: 14 Nov, 1972. PK applied: 6 Apr, 1973. N applied: 9 Apr.
Rotary cultivated, potatoes planted: 10 Apr. Sprayed with linuron
at 1.9 kg plus paraquat at 0.42 kg ion in 450 l: 12 May. Grubbed:
7 June. Rotary ridged: 9 June. Sprayed with mancozeb at 1.35 kg
plus demeton-s-methyl at 0.25 kg in 370 l: 2 July. Sprayed with
mancozeb at 1.35 kg in 370 l: 18 July and 9 Aug. Haulm destroyed
mechanically: 14 Sept. Sprayed with undiluted BCV at 220 l:
20 Sept. Lifted: 26 Sept.

5th, 6th, 8th and 9th Test Crops. Wheat:

Ploughed: 15 Sept, 1972. Seed sown: 23 Oct. N applied, sprayed with
dicamba, mecoprop and MCPA ('Tetralex Plus' at 7.0 l in 220 l):
16 Apr, 1973. Combine harvested: 18 Aug.

Permanent Grasses:

The 25th experimental year: PK applied: 17 Nov, 1972. NK applied to 'all-
grass' half plots, K to 'clover/grass' half plots: 21 Feb, 1973.
Cut 4 times: 22 May, 16 June, 8 Aug, 13 Sept. NK applied to
'all-grass' half plots and K to clover/grass half plots after
each cut except the last. Resown plots (reseeded in 1973) ('all-
grass' and 'clover/grass'). Ploughed: 15 Sept, 1972. Reploughed:
14 Nov. PK applied: 21 Mar, 1973. Seed sown: 28 Mar. Sprayed
with benazolin 2,4-DB and MCPA ('Legumex Extra' at 7.0 l in 220 l):
31 May. Topped: 15 June. Cut twice: 20 July, 13 Sept. NK and K
applied after first cut.

73/R/RN/1 and 73/R/RN/2

Standard errors per plot.

Potatoes, total tubers, tonnes/hectare:

1st Test Crop: H. Sub plot: 3.22 or 6.4% (28 d.f.)

1st Test Crop: F. Sub plot: 2.59 or 5.4% (28 d.f.)

Wheat, Grain, tonnes/hectare:

5th Test Crop: H. Whole plot: 0.239 or 4.6% (5 d.f.)

Sub plot: 0.336 or 6.5% (18 d.f.)

F. Whole plot: 0.191 or 3.2% (4 d.f.)

Sub plot: 0.366 or 6.1% (15 d.f.)

6th Test Crop: H. Whole plot: 0.144 or 2.6% (5 d.f.)

Sub plot: 0.292 or 5.2% (18 d.f.)

F. Whole plot: 0.260 or 4.6% (4 d.f.)

Sub plot: 0.470 or 8.2% (15 d.f.)

8th Test Crop: H. Whole plot: 0.557 or 9.7% (5 d.f.)

Sub plot: 0.458 or 8.0% (18 d.f.)

F. Whole plot: 0.289 or 4.9% (4 d.f.)

Sub plot: 0.486 or 8.3% (15 d.f.)

9th Test Crop: H. Whole plot: 0.521 or 9.0% (5 d.f.)

Sub plot: 0.429 or 7.4% (18 d.f.)

F. Whole plot: 0.205 or 3.3% (4 d.f.)

Sub plot: 0.276 or 4.5% (15 d.f.)

H = Highfield F = Fosters

73/R/RN/1 and 73/R/RN/2

POTATOES 1ST TEST CROP

TOTAL TUBERS: TONNES/HECTARE

HIGHFIELD

	ROTATION				N73				Mean
	Lucerne	CloGra	Grass	Arable	0	80	160	240	
FYMRES68									
None	49.2	47.0	50.1	52.7	45.9	48.7	51.7	52.6	49.7
FYM	50.1	54.3	47.5	49.5	49.3	52.3	49.7	50.1	50.4
				ROTATION					
				Lucerne	48.0	48.9	54.2	47.5	49.7
				CloGra	48.3	53.3	49.1	51.8	50.6
				Grass	47.5	48.0	49.7	49.9	48.8
				Arable	46.7	51.7	50.0	56.0	51.1
Mean					47.6	50.5	50.7	51.3	50.0
FYMRES68									
N73	0	80	None 160	240	0	80	FYM 160	240	
ROTATION									
Lucerne	46.3	47.1	52.8	50.4	49.7	50.7	55.6	44.7	
CloGra	44.2	48.4	46.6	48.7	52.4	58.3	51.6	55.0	
Grass	47.2	47.4	53.8	51.9	47.9	48.6	45.6	48.0	
Arable	45.9	51.8	53.8	59.3	47.4	51.7	46.2	52.7	

STANDARD ERRORS OF DIFFERENCES

FYMRES68	N73	ROTATION* FYMRES68	ROTATION* N73	FYMRES68 N73	ROTATION* FYMRES68 N73
0.80	1.14	1.61	2.27	1.61	3.28

* Within the same level of ROTATION only

73/R/RN/1 and 73/R/RN/2

POTATOES 1ST TEST CROP

PERCENTAGE WARE: 3.81 CM (1.5 INCH) RIDDLE

HIGHFIELD

	ROTATION				N73				Mean
	Lucerne	CloGra	Grass	Arable	0	80	160	240	
FYMRES68									
None	91.4	90.1	91.9	92.1	89.7	90.6	92.2	93.1	91.4
FYM	91.5	92.9	91.1	91.3	91.4	91.7	92.6	91.1	91.7
				ROTATION					
				Lucerne	90.7	91.2	92.9	90.9	91.5
				CloGra	91.9	91.1	91.6	91.4	91.5
				Grass	91.1	91.0	91.6	92.5	91.5
				Arable	88.6	91.1	93.5	93.5	91.7
Mean					90.6	91.1	92.4	92.1	91.5

FYMRES68 N73	None				FYM			
	0	80	160	240	0	80	160	240
ROTATION								
Lucerne	90.2	90.5	92.8	92.2	91.2	91.9	93.1	89.7
CloGra	89.5	89.5	90.0	91.4	94.2	92.8	93.1	91.3
Grass	89.6	91.2	92.1	94.9	92.6	90.7	91.1	90.1
Arable	89.6	91.1	93.8	93.7	87.6	91.1	93.2	93.3

73/R/RN/1 and 73/R/RN/2

POTATOES 1ST TEST CROP

TOTAL TUBERS: TONNES/HECTARE

POSTERS

	ROTATION				N73				Mean
	Lucerne	CloGra	Grass	Arable	0	80	160	240	
FYMRES68									
None	49.0	47.7	44.9	45.4	40.4	47.2	48.3	51.3	46.8
FYM	51.1	51.4	47.9	43.8	43.8	48.6	51.5	50.3	48.5
				ROTATION					
				Lucerne	44.5	49.5	54.1	52.3	50.1
				CloGra	46.5	50.0	51.2	50.5	49.5
				Grass	40.2	46.1	48.5	50.8	46.4
				Arable	37.2	46.0	45.7	49.5	44.6
Mean					42.1	47.9	49.9	50.8	47.7
FYMRES68				None					
N73	0	80	160	240	0	80	160	240	
ROTATION									
Lucerne	42.7	47.7	51.4	54.4	46.2	51.3	56.8	50.2	
CloGra	44.4	49.0	48.3	49.1	48.5	50.9	54.1	51.9	
Grass	37.1	45.0	46.3	51.3	43.4	47.2	50.8	50.2	
Arable	37.2	47.1	47.2	50.2	37.2	44.9	44.3	48.8	

STANDARD ERRORS OF DIFFERENCES

ROTATION	FYMRES68	N73	ROTATION*	ROTATION*	FYMRES68	ROTATION
			FYMRES68	N73	N73	FYMRES68
						N73
	1.57	0.65	0.91	1.29	1.83	1.29
2.88						
Except when comparing means with same level of						
ROTATION			1.29	1.83		2.59
ROTATION.FYMRES68						2.59
ROTATION.N73						2.59

* Within the same level of ROTATION only

73/R/RN/1 and 73/R/RN/2

POTATOES 1ST TEST CROP

PERCENTAGE WARE: 3.81 CM (1.5 INCH) RIDDLE

FOSTERS

	ROTATION				N73				Mean
	Lucerne	CloGra	Grass	Arable	0	80	160	240	
FYMRES68									
None	93.2	93.6	92.7	92.3	90.5	92.8	93.9	94.6	92.9
FYM	93.3	93.4	92.6	91.6	91.1	92.2	93.5	94.0	92.7
				ROTATION					
				Lucerne	90.8	93.6	94.3	94.3	93.2
				CloGra	94.4	92.6	93.5	93.3	93.5
				Grass	89.3	93.1	93.6	94.5	92.6
				Arable	88.9	90.5	93.3	95.1	91.9
Mean					90.8	92.5	93.7	94.3	92.8
FYMRES68									
N73	0	80	160	240	0	80	160	240	
ROTATION									
Lucerne	90.2	93.8	93.8	95.0	91.3	93.4	94.7	93.6	
CloGra	94.5	92.4	94.2	93.2	94.3	92.9	92.8	93.5	
Grass	88.3	93.6	93.8	95.0	90.3	92.5	93.4	94.0	
Arable	89.1	91.3	93.7	95.1	88.6	89.8	93.0	95.1	

73/R/RN/1 and 73/R/RN/2

WHEAT 5TH TEST CROP

GRAIN: TONNES/HECTARE

HIGHFIELD

	75	126	N73	176	226	Mean
ROTATION						
Lucerne	5.92	4.76		4.99	4.22	4.97
CloGra	5.56	5.06		5.09	4.94	5.16
Grass	5.60	5.66		5.25	4.71	5.30
Arable	6.02	5.65		6.15	5.63	5.86
Reseeded	5.54	5.57		5.20	5.05	5.34
OldGrass	5.36	4.61		4.17	4.04	4.55
Mean	5.67	5.22		5.14	4.76	5.20

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.239	0.137	0.376
Except when comparing means with same level of ROTATION		
		0.336

Mean D.M. % 86.3

73/R/RN/1 and 73/R/RN/2

WHEAT 5TH TEST CROP

GRAIN: TONNES/HECTARE

FUSTERS

	75	126	N73 176	226	Mean
ROTATION					
Lucerne	5.60	5.99	5.82	5.57	5.75
CloGra	7.13	6.57	5.55	5.46	6.18
Grass	6.58	6.60	5.54	5.12	5.96
Arable	6.54	6.81	6.20	5.26	6.21
Reseeded	6.33	6.32	5.51	5.39	5.89
Mean	6.44	6.46	5.73	5.36	6.00

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.191	0.164	0.370

Mean D.M. % 85.8

73/R/RN/1 and 73/R/RN/2

WHEAT 6TH TEST CROP

GRAIN: TONNES/HECTARE

HIGHFIELD

	75	126	N73	176	226	Mean
ROTATION						
Lucerne	6.75	5.97		5.81	5.51	6.01
OldGra.	6.35	5.48		5.64	5.16	5.66
Grass	6.27	6.23		5.34	4.96	5.70
Arable	6.70	6.32		5.27	5.01	5.83
Reseeded	6.21	5.54		4.91	4.63	5.32
OldGrass	5.78	5.07		4.98	4.80	5.16
Mean	6.34	5.77		5.32	5.01	5.61

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.144	0.119	0.291

Mean D.M. % 86.8

73/R/FN/1 and 73/R/FN/2

WHEAT 6TH TEST CROP

GRAIN: TONNES/HECTARE

FOSTERS

	75	126	N73	176	226	Mean
ROTATION						
Lucerne	6.14	6.04		5.46	5.14	5.69
CloGra	5.93	6.28		5.59	5.35	5.79
Grass	6.18	6.27		5.71	4.96	5.78
Arable	5.61	6.50		6.09	5.59	5.95
Reseeded	5.63	5.80		5.22	4.55	5.30
Mean	5.90	6.18		5.61	5.12	5.70

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.260	0.210	0.483
Except when comparing means with same level of		
ROTATION		0.470

Mean D.M. 87.2

73/R/RN/1 and 73/R/RN/2

WHEAT 8TH TEST CROP

GRAIN: TONNES/HECTARE

HIGHFIELD

	N73				
	75	126	176	226	Mean
ROTATION					
Lucerne	6.06	6.71	5.77	5.71	6.06
CloGra	5.57	5.29	5.55	4.50	5.23
Grass	6.07	6.32	6.00	5.79	6.05
Arable	6.31	6.72	6.27	5.96	6.32
Reseeded	5.75	5.37	5.16	4.73	5.25
OldGrass	6.40	6.03	5.11	4.98	5.63
Mean	6.03	6.07	5.64	5.28	5.76

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.557	0.187	0.684
Except when comparing means with same level of ROTATION		
		0.458

Mean D.M. % 85.8

73/R/RN/1 and 73/R/RN/2

WHEAT 8TH TEST CROP

GRAIN: TONNES/HECTARE

FOSTERS

	75	126	N73	176	226	Mean
ROTATION						
Lucerne	5.52	6.48		5.85	5.81	5.91
CloGra	6.07	6.60		6.02	5.21	5.98
Grass	5.92	6.48		6.06	5.31	5.94
Arable	5.92	6.67		6.38	5.64	6.15
Reseeded	5.15	5.82		5.21	5.33	5.38
Mean	5.72	6.41		5.90	5.46	5.87

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.289	0.217	0.511
Except when comparing means with same level of		
ROTATION		0.486

Mean D.M. $\frac{1}{2}$ 86.0

73/R/RN/1 and 73/R/RN/2

WHEAT 9TH TEST CROP

GRAIN: TONNES/HECTARE

HIGHFIELD

	75	126	N73	176	226	Mean
ROTATION						
Lucerne	5.84	5.86		6.16	5.29	5.79
CloGra.	6.19	5.86		5.72	5.31	5.77
Grass	6.25	6.24		5.24	5.02	5.69
Arable	5.99	6.39		6.10	5.82	6.08
Reseeded	6.83	6.02		5.50	5.50	5.96
OldGrass	6.21	5.55		5.30	5.13	5.55
Mean	6.22	5.99		5.67	5.35	5.81

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION
		N73
0.521	0.175	0.640
Except when comparing means		
with same level of		
ROTATION		0.429

Mean D.M. $\bar{x}$ 86.4

73/R/RN/1 and 73/R/RN/2

WHEAT 9TH TEST CROP

GRAIN: TONNES/HECTARE

FOSTERS

	75	126	N73	176	226	Mean
ROTATION						
Lucerne	6.31	6.74		6.49	5.91	6.36
CloGra	6.36	6.47		5.98	5.54	6.09
Grass	6.04	6.60		6.02	5.26	5.98
Arable	5.92	6.62		6.16	5.68	6.09
Reseeded	6.48	6.36		5.97	5.34	6.04
Mean	6.22	6.56		6.12	5.55	6.11

STANDARD ERRORS OF DIFFERENCES

ROTATION	N73	ROTATION N73
0.205	0.123	0.314
Except when comparing means with same level of		
ROTATION		0.276

Mean D.M. % 87.2

73/R/RW/1 and 73/R/RW/2

HAY, DRY MATTER: TONNES/HECTARE

	1st cut	2nd cut	3rd cut	4th cut	Total
HIGHFIELD					
	4.74	1.40	3.08	1.09	10.31
Mean D.M. %	1st cut:	15.2			
	2nd cut:	20.3			
	3rd cut:	17.1			
	4th cut:	27.1			
	Total of 4 cuts:	19.9			
FOSTERS					
	3.62	2.01	3.16	0.74	9.53
Mean D.M. %	1st cut:	14.6			
	2nd cut:	19.0			
	3rd cut:	19.6			
	4th cut:	33.1			
	Total of 4 cuts:	21.6			

73/R/RN/1 and 73/R/RN/2

HIGHFIELD Mean		FOSTERS Mean
LUCERNE, DRY MATTER: TONNES/HECTARE		
TOTAL OF 2 CUTS		
1st year	6.60	5.66
ALL-GRASS LEY, DRY MATTER: TONNES/HECTARE		
TOTAL OF 2 CUTS		
1st year	5.98	4.52
CLOVER/GRASS LEY, DRY MATTER: TONNES/HECTARE		
1st year	4.85	3.73
RESEEDED GRASS, DRY MATTER: TONNES/HECTARE		
TOTAL OF 4 CUTS		
Blocks	HIGHFIELD RC RN	FOSTERS RC RN
25th Exptl year 1 & 4	4.49 9.33	5.92 8.86
25th Exptl year 2 & 3 (Reseeded 1973)	4.84 5.79	3.68 5.26
PERMANENT GRASS, DRY MATTER: TONNES/HECTARE		
TOTAL OF 4 CUTS		
	GC	GN
HIGHFIELD		
25th Exptl year Blocks 1 & 4	3.59	9.50
Block 2	4.37	8.82