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## Yields of the Field Experiments 1978

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### **78/R/RN/1 and 78/R/RN/2 Ley/ARABLE - Old Grass, Leys, Potatoes, Wheat, Oats, Barley**

#### **Rothamsted Research**

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78/R/RN/1 and 78/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. From 1968, continuous wheat was grown on some blocks after the three test crops to study the build-up and decline of take-all (*Gaeumannomyces graminis*) after the different cropping sequences. From 1977 new crop sequences were introduced on these blocks - Highfield and Fosters.

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

The 30th year, old grass, leys, potatoes, wheat, oats, barley.

For previous years see 'Details' 1967 & 1973 and 74-77/R/RN/1&2.

The experiment is duplicated on:-

HIGHFIELD A site with much organic matter initially (ploughed out from permanent grass) (78/R/RN/1)

FOSTERS A site with little organic matter initially (78/R/RN/2)

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

	Treatment crops	Test crops
LUCERNE	LU, LU, LU,	W, P, B
CLOGRA	LC, LC, LC,	W, P, B
GRASS	LN, LN, LN,	W, P, B
ARABLE	H, SB, O,	W, P, B

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.

From 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.

From 1975 the barley test crop was changed to wheat.

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

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

In 1962 and 1963 some of the old and reseeded grass plots were divided for management identical to:-

C Clover-grass ley  
N All-grass ley

78/R/RN/1 and 78/R/RN/2

From 1963 (reseeded) and 1968 (old grass) some grass plots were ploughed and cropped with the same test crops as above, thereafter 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 continued in the original six-course rotation (the museum blocks). The four other phases (the new sequence blocks) were sown to wheat every year at the end of the test-crop cycle. In both 1977 and 1978 one phase, fallowed in the previous year started a new sequence of treatment cropping. In 1978 one of the remaining phases was fallowed and the other remained in wheat (no yields). The new sequences will be introduced progressively on these remaining phases. The new sequences are:

SEQUENCE		Treatment crops	Test crops
LUCERNE	(previously LUCERNE)	LU, LU, LU	W, W, W, W
CLOGRA	(previously CLOGRA)	LC, LC, LC	W, W, W, W
GRASS/G	(previously GRASS)	R, R, R	W, W, W, W
ARABLE/A	(previously ARABLE)	O, P, BE	W, W, W, W
ARABLE/R	(previously RESEDED)	B, B, W	W, W, W, W
GRASS/OG	(previously OLDGRASS)	R, R, R	W, W, W, W

R = ryegrass, BE = beans. Other symbols as above. All ploughed at the end of the treatment crop cycle except GRASS/OG - direct drilled to wheat. Treatment crop cycles start after nine previous cereals followed by one fallow. In treatment years yields are taken only from barley and wheat.

Additional treatments to 3rd test crop wheat in the original rotation:-

Sub plots

FYMRES70 Farmyard manure residues, last applied 1970:

NONE None

FYM 30 tonnes on each occasion

Sub plots

N 78 Nitrogen fertiliser (kg N as 'Nitro-Chalk 26'):

0  
50  
100  
150

Standard applications:

Museum blocks:

3rd Treatment Crops:

All-grass ley: Manures: (0:14:28) at 540 kg. (25:0:16) at 300 kg in spring, and after each cut except the last.

Clover-grass ley: Manures: (0:14:28) at 540 kg.

Lucerne: Manures: (0:14:28) at 810 kg.

Oats: Manures: (20:14:14) at 350 kg, combine drilled. Weedkillers:

Dicamba with mecoprop and MCPA (as 'Banlene Plus' at 4.9 l in 220 l).



78/R/RN/1 and 78/R/RN/2

3rd Test Crop: Wheat: Manures: (0:20:20) at 380 kg, combine drilled.  
Weedkillers: Methabenzthiazuron at 3.1 kg in 220 l. Dicamba with  
mecoprop and MCPA (as 'Banlene Plus' at 4.9 l in 220 l).  
Reseeded Grass and Old grass: (0:14:28) at 540 kg.  
All-grass half plots: (25:0:16) at 300 kg in spring, and after each  
cut except the last.

New sequence blocks:

1st Treatment Crops:

All crops: Manures: Chalk at 8.7 t, Highfield only.  
Lucerne: Manures: (0:14:28) at 720 kg in seedbed.  
Clover-grass ley: Manures: (0:14:28) at 720 kg in seedbed. (25:0:16)  
at 300 kg after clover established.  
Ryegrass: (0:14:28) at 720 kg to seedbed. (25:0:16) at 300 kg to  
seedbed and after each cut except the last. On Highfield both  
ryegrass plots in one block received (13:13:20) at 1500 kg in error  
before the planned seedbed application of (0:14:28) and (25:0:16).  
Accordingly on these plots only the planned seedbed dressings were  
omitted.  
Oats and Barley: Manures: (20:14:14) at 350 kg, combine drilled.  
Weedkillers: Dicamba with mecoprop and MCPA (as 'Banlene Plus' at  
4.9 l in 220 l) except Barley on Fosters which received ioxynil at  
0.53 l and mecoprop at 1.6 l in 220 l. Fungicide (to Barley only):  
Tridemorph at 0.53 kg in 220 l.

2nd Treatment Crops:

Lucerne: Manures: (0:14:28) at 720 kg.  
Clover-grass leys and Ryegrass: Manures: (0:14:28) at 720 kg. (25:0:16)  
at 300 kg in spring, repeated (Ryegrass only) after each cut except  
the last.  
Potatoes: Manures: (13:13:20) at 1500 kg. Weedkillers: Linuron at  
1.1 kg in 220 l. Paraquat at 0.42 kg ion in 220 l. Fungicides:  
Mancozeb at 1.3 kg in 220 l. Fentin acetate and maneb (as 'Fentin A'  
at 1.7 kg in 220 l). Insecticide: Pirimicarb at 0.14 kg in 220 l.  
Barley: Manures: (20:14:14) at 350 kg. Weedkillers: Dicamba with  
mecoprop and MCPA (as 'Banlene Plus' at 4.9 l in 220 l). Fungicide:  
Tridemorph at 0.53 kg in 220 l.

Preparatory Crop:

Wheat: Manures: (0:20:20) at 380 kg. 'Nitra-Shell 34' at 360 kg.  
Weedkillers: Methabenzthiazuron at 3.1 kg in 220 l. Dicamba with  
mecoprop and MCPA (as 'Banlene Plus' at 4.9 l in 220 l).

Seed:

Museum blocks:

All-grass ley: Pecora Timothy at 15 kg, Meadow Fescue S.215 at 19 kg.  
Mixture sown at 34 kg.  
Clover-grass ley: Pecora Timothy at 15 kg, Meadow Fescue S.215 at 19 kg,  
White Clover S.100 at 3 kg. Mixture sown at 37 kg.  
Oats: Manod, sown at 130 kg.  
Wheat: Cappelle, sown at 200 kg.

New Sequence blocks:

Lucerne: Vertus, sown at 28 kg.  
Clover-grass leys: Timothy RvP Erecta (Pecora on 2nd treatment crops) at  
15 kg, Meadow Fescue S.215 at 19 kg, Clover New Zealand Huia at 3 kg.  
Mixture sown at 37 kg.  
Ryegrass: S.24 sown at 22 kg.  
Oats: Manod, sown at 130 kg.  
Barley: Porthos, sown at 160 kg.  
Potatoes: Pentland Crown.  
Wheat: Cappelle, sown at 200 kg.



78/R/RN/1 and 78/R/RN/2

Cultivations, etc.:-

Museum blocks:

All-grass ley and clover-grass ley: PK applied: 9 Dec, 1977 (Highfield), 12 Dec, 1977 (Fosters). NK applied three times (all-grass ley only): 17 Mar, 1978, 8 June, 28 July. Cut three times: 2 June, 25 July, 31 Oct.

Lucerne: PK applied: 9 Dec, 1977 (Highfield), 12 Dec (Fosters). Cut three times: 27 June, 1978, 17 Aug and 7 Nov.

Oats: Ploughed: 2 Dec, 1977 (Fosters), 5 Dec (Highfield). Rotary harrowed, seed sown: 8 Apr. Weedkiller applied: 26 May. Combine harvested: 18 Sept.

Wheat: Ploughed: 11 Oct, 1977. Power harrowed: 18 Oct. Seed sown: 20 Oct. Methabenzthiazuron applied: 25 Oct. N applied: 8 May, 1978. 'Banlene Plus' applied: 10 May. Combine harvested: 4 Sept.

Reseeded Grass and Old Grass: PK applied: 12 Dec, 1977. NK applied (to N sub plots only): 17 Mar, 1978, 8 June and 28 July. Cut three times: 1 June, 25 July, 31 Oct.

New sequence blocks:

1st Treatment Crops:

All crops: Ploughed: 11 Oct, 1977. Chalk applied (Highfield only): 30 Nov. Chisel ploughed (Highfield only): 2 Dec.

Lucerne: Heavy spring-tine cultivated, PK applied, rotary harrowed: 18 May, 1978. Seed sown: 23 May. Topped: 27 July. Cut: 1 Nov.

Clover-grass ley: Heavy spring-tine cultivated, PK applied and rotary harrowed: 18 May, 1978. Seed sown: 22 May. Topped: 27 July. NK applied: 28 July. Cut: 1 Nov.

Ryegrass: Heavy spring-tine cultivated, PK and NK applied, rotary harrowed: 18 May, 1978. Seed sown: 22 May. Topped: 1 Aug. Cut: 1 Nov.

Oats and Barley: Rotary harrowed, seed sown: 8 Apr, 1978. Weedkillers and fungicide applied: 26 May. Combine harvested: 18 Sept.

2nd Treatment Crops:

Lucerne: PK applied: 9 Dec, 1977. Cut three times: 27 June, 1978, 17 Aug, 1 Nov.

Clover-grass leys: PK applied: 9 Dec, 1977. NK applied: 17 Mar, 1978. Cut three times: 1 June, 26 July, 1 Nov.

Ryegrass: PK applied: 12 Dec, 1977. NK applied three times: 17 Mar, 1978, 8 June, 28 July. Cut three times: 1 June, 26 July, 1 Nov.

Potatoes: Ploughed: 2 Dec, 1977. NPK applied: 25 Apr, 1978. Spike rotary cultivated, seed sown: 9 May. Weedkillers applied: 15 May. Grubbed and rotary ridged: 19 June. Mancozeb applied: 5 July. Mancozeb and pirimicarb applied twice: 17 July, 4 Aug. 'Fennite A' applied twice: 17 Aug, 8 Sept. Haulm pulverized: 22 Sept. Lifted: 18 Oct.

Barley: Rotary harrowed, seed sown: 2 Apr, 1978. Weedkillers and fungicide applied: 26 May. Combine harvested: 10 Sept.

Preparatory Crop:

Wheat: Ploughed: 11 Oct, 1977. Power harrowed: 18 Oct. Seed sown: 20 Oct. Methabenzthiazuron applied: 25 Oct. N applied: 5 May, 1978. 'Banlene Plus' applied: 10 May. Combine harvested: 5 Sept.

Fallow: Ploughed: 1 Dec, 1977. Rotary cultivated three times: 17 May, 1978, 13 June, 7 Aug. Spring-tine cultivated: 26 June. Chisel ploughed: 16 Aug. Discd: 1 Nov.

78/R/RN/1 and 78/R/RN/2

- NOTES: (1) In July 1978 all spring barley on the New Sequence plots was sampled for take-all (*Gaeumannomyces graminis*) and *Phialophora*.  
 (2) In April and July all wheat plots on the museum blocks were sampled for take-all, *Phialophora* and eyespot (*Pseudocercospora herpotrichoides*).  
 (3) In September 1978 soil samples were taken from Wheat after LUCERNE, CLOGRA and ARABLE A rotations for assays of take-all and *Phialophora*.

MUSEUM BLOCKS

DRY MATTER: TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

	HIGHFIELD	FOSTERS
CLOVER-GRASS LEY		
TOTAL OF 3 CUTS	8.02	8.43
MEAN DM%	21.8	21.3
ALL GRASS LEY		
TOTAL OF 3 CUTS	12.99	11.82
MEAN DM%	26.4	26.6
LUCERNE		
TOTAL OF 3 CUTS	12.05	13.68
MEAN DM%	21.2	20.2
OLD GRASS		
TOTAL OF 3 CUTS		
	C	N
30TH EXPTL YEAR		
BLOCKS 1 & 4	6.16	10.60
BLOCK 2	6.48	11.09
MEAN DM%	23.6	22.7

78/R/RN/1 AND 78/R/RN/2

RESEDED GRASS

TOTAL OF 3 CUTS

	HIGHFIELD			FOSTERS		
	BLOCKS	C	N	BLOCKS	C	N
30TH EXPTL YEAR	1 & 4	6.12	10.97	1 & 3	5.98	10.62
30TH EXPTL YEAR (SEDED 1949 RESEDED 1973)	2 & 3	8.09	11.73	2 & 4	8.03	10.91
MEAN DM%		23.1	25.1		22.7	24.8

NEW SEQUENCE BLOCKS

DRY MATTER: TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

BARLEY

	HIGHFIELD	FOSTERS
	5.04	5.80
MEAN DM%	77.6	81.0

MUSEUM BLOCKS

78/R/RN/1 HIGHFIELD

WHEAT

GRAIN TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	4.80	6.30	6.09	5.51	5.68
FYM	5.38	6.43	6.23	5.44	5.87
MEAN	5.09	6.37	6.16	5.48	5.77
N 78	0	50	100	150	MEAN
FYMRES70					
NONE	4.29	5.84	6.22	6.35	5.68
FYM	4.24	6.13	6.35	6.76	5.87
MEAN	4.27	5.99	6.29	6.56	5.77
N 78	0	50	100	150	MEAN
ROTATION					
LUCERNE	3.37	5.59	5.30	6.09	5.09
CLOGRA	5.03	6.72	6.75	6.97	6.37
GRASS	5.06	6.12	6.71	6.76	6.16
ARABLE	3.60	5.51	6.39	6.41	5.48
MEAN	4.27	5.99	6.29	6.56	5.77
N 78	0	50	100	150	
FYMRES70	ROTATION				
NONE	LUCERNE	3.65	5.09	5.37	5.07
	CLOGRA	5.06	6.79	6.59	6.76
	GRASS	5.01	6.31	6.36	6.69
	ARABLE	3.45	5.16	6.57	6.87
FYM	LUCERNE	3.09	6.09	5.23	7.10
	CLOGRA	5.00	6.65	6.91	7.17
	GRASS	5.10	5.93	7.06	6.84
	ARABLE	3.75	5.86	6.21	5.95
GRAIN MEAN DM%	82.3				



78/R/RN/1 HIGHFIELD

WHEAT

STRAW TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	4.51	5.18	4.81	4.45	4.74
FYM	4.79	4.95	4.89	4.42	4.76
MEAN	4.65	5.07	4.85	4.43	4.75
N 78	0	50	100	150	MEAN
FYMRES70					
NONE	3.55	4.94	5.37	5.08	4.74
FYM	3.25	4.79	5.36	5.65	4.76
MEAN	3.40	4.87	5.36	5.37	4.75
N 78	0	50	100	150	MEAN
ROTATION					
LUCERNE	3.12	4.92	5.49	5.07	4.65
CLOGRA	3.94	5.33	5.64	5.36	5.07
GRASS	3.83	4.61	5.26	5.70	4.85
ARABLE	2.71	4.61	5.06	5.34	4.43
MEAN	3.40	4.87	5.36	5.37	4.75
N 78	0	50	100	150	
FYMRES70 ROTATION					
NONE LUCERNE	3.82	4.78	5.30	4.14	
CLOGRA	4.01	5.56	6.09	5.06	
GRASS	3.76	5.00	4.98	5.51	
ARABLE	2.63	4.43	5.09	5.63	
FYM LUCERNE	2.41	5.06	5.67	6.00	
CLOGRA	3.88	5.09	5.19	5.66	
GRASS	3.91	4.23	5.54	5.89	
ARABLE	2.80	4.79	5.03	5.06	

STRAW MEAN DM% 83.8

SUB PLOT AREA HARVESTED 0.00655

78/R/RN/2 FOSTERS

WHEAT

GRAIN TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	5.85	6.21	5.48	5.64	5.79
FYM	6.33	6.42	5.33	5.51	5.89
MEAN	6.09	6.31	5.40	5.57	5.84
N 78	0	50	100	150	MEAN
FYMRES70					
NONE	4.16	5.68	6.73	6.60	5.79
FYM	4.62	5.54	6.67	6.75	5.89
MEAN	4.39	5.61	6.70	6.67	5.84
N 78	0	50	100	150	MEAN
ROTATION					
LUCERNE	4.91	6.03	6.82	6.59	6.09
CLOGRA	4.95	6.11	7.19	7.01	6.31
GRASS	3.85	5.09	6.21	6.46	5.40
ARABLE	3.85	5.23	6.56	6.63	5.57
MEAN	4.39	5.61	6.70	6.67	5.84
N 78	0	50	100	150	
FYMRES70	ROTATION				
NONE	LUCERNE	4.68	5.71	6.56	6.44
	CLOGRA	4.29	6.50	7.18	6.87
	GRASS	3.71	5.42	6.19	6.59
	ARABLE	3.96	5.10	6.98	6.50
FYM	LUCERNE	5.15	6.34	7.08	6.74
	CLOGRA	5.61	5.71	7.19	7.15
	GRASS	3.99	4.75	6.24	6.33
	ARABLE	3.75	5.36	6.15	6.77
GRAIN MEAN DM%	80.9				

78/R/RN/2 FOSTERS

WHEAT

STRAW TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	4.69	4.13	4.27	3.89	4.24
FYM	4.84	4.57	4.04	4.00	4.36
MEAN	4.76	4.35	4.15	3.95	4.30
N 78	0	50	100	150	MEAN
FYMRES70					
NONE	2.70	3.88	4.91	5.49	4.24
FYM	3.13	3.91	4.97	5.44	4.36
MEAN	2.92	3.89	4.94	5.47	4.30
N 78	0	50	100	150	MEAN
ROTATION					
LUCERNE	3.60	4.32	5.34	5.80	4.76
CLOGRA	3.00	4.28	4.89	5.23	4.35
GRASS	2.85	3.46	4.78	5.53	4.15
ARABLE	2.22	3.52	4.74	5.31	3.95
MEAN	2.92	3.89	4.94	5.47	4.30
N 78	0	50	100	150	
FYMRES70 ROTATION					
NONE LUCERNE	3.58	4.11	4.95	6.12	
CLOGRA	2.25	4.75	4.32	5.21	
GRASS	2.70	3.61	5.14	5.62	
ARABLE	2.26	3.07	5.22	5.01	
FYM LUCERNE	3.62	4.53	5.73	5.47	
CLOGRA	3.74	3.81	5.46	5.25	
GRASS	3.00	3.31	4.43	5.44	
ARABLE	2.18	3.97	4.26	5.60	

STRAW MEAN DM% 86.7

SUB PLOT AREA HARVESTED 0.00655