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## Yields of the Field Experiments 1977

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### 77/R/RN/1 and 77/R/RN/2 Ley/ARABLE - Old Grass, Leys, Barley, Oats, Sugar Beet, Wheat

#### Rothamsted Research

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77/R/RN/1 and 77/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 are being introduced on these blocks - Highfield and Fosters.

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

The 29th year, old grass, leys, sugar beet, wheat, oats, barley.

For previous years see 'Details' 1967 & 1973 and 74-76/R/RN/1&2.

The experiment is duplicated on:-

HIGHFIELD A site with much organic matter initially (ploughed out from permanent grass) (77/R/RN/1)

FOSTERS A site with little organic matter initially (77/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

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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 1977 one phase, fallowed in 1976, started a new sequence of treatment cropping, one phase was fallowed and the other two remained in wheat (no yields). The new sequences will be introduced progressively on these other 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 2nd 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 77 Nitrogen fertiliser (kg N):

0  
50  
100  
150

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Standard applications:

Museum blocks:

2nd 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.

Sugar beet: Manures: (13:13:20) at 1260 kg. Insecticide: Pirimicarb at 0.14 kg in 220 l.

2nd Test Crop: Wheat: Manures: (0:20:20) at 380 kg, combine drilled.

Weedkillers: Dicamba with mecoprop and MCPA ('Banlene Plus' at 4.9 l in 220 l). Insecticide: Pirimicarb at 0.14 kg in 280 l.

Reseeded Grass and Old Grass: Manures: (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:

All crops (except wheat): Manures: Chalk at 8.7 t, Highfield only.

Lucerne: Manures: (0:14:28) at 720 kg. Weedkiller: 2,4-DB at 2.5 kg in 340 l.

Clover-grass ley and Ryegrass: Manures: (0:14:28) at 720 kg. (25:0:16) at 300 kg. Weedkiller: MCPB ('Tropotox' at 7.0 l in 340 l).

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

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

Wheat: Manures: (0:20:20) at 380 kg. 'Nitro-Chalk' at 500 kg. Weedkillers:

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

Insecticide: Pirimicarb at 0.14 kg in 280 l.

Seed:

Museum blocks:

All-grass ley: Pecora Timothy at 15 kg, Meadow Fescue S215 at 19 kg. Mixture sown at 34 kg.

Clover-grass ley: Pecora Timothy at 15 kg, Meadow Fescue S215 at 19 kg, White Clover S100 at 3 kg. Mixture sown at 37 kg.

Sugar beet: Klein E, sown at 9 kg.

Wheat: Cappelle, sown at 200 kg.

New sequence blocks:

Lucerne: Vertus, sown at 28 kg.

Clover-grass ley: Timothy S48 at 15 kg, Meadow Fescue S215 at 19 kg, New Zealand Huia Clover at 3 kg. Mixture sown at 37 kg.

Ryegrass: S24, sown at 22 kg.

Oats: Manod, sown at 200 kg.

Barley: Julia, sown at 160 kg.

Wheat: Cappelle, sown at 200 kg.

Cultivations, etc.:-

Museum blocks:

All-grass ley and clover-grass ley: Ploughed: 20 Aug, 1976. Spring-tine cultivated, harrowed, seed sown: 21 Sept. PK applied: 23 Dec. NK applied (all-grass ley only): 3 Mar, 1977, 26 May, 1 July, 5 Aug. Cut: 24 May, 30 June, 4 Aug, 23 Nov.

Lucerne: PK applied: 23 Dec, 1976. Cut: 29 June, 1977, 16 Aug, 1 Dec.

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Sugar beet: Ploughed: 20 Aug, 1976. Rotary harrowed: 7 Apr, 1977.  
NPK applied: 9 Apr. Spring-tine cultivated, chain harrowed, rolled,  
seed sown: 12 Apr. Tractor hoed: 27 May, 16 June. Plants singled:  
2 June. Insecticide applied: 6 July. Lifted by hand: 11 Nov.  
Wheat: Heavy spring-tine cultivated twice: 23 Nov, 1976. Sown: 24 Nov.  
Test N applied: 28 Apr, 1977. Weedkillers applied: 2 May. Insecticide  
applied: 15 July. Combine harvested: 9 Sept.  
Reseeded Grass and Old Grass: PK applied: 23 Dec, 1976. NK applied (to  
N sub plots only): 3 Mar, 1977, 26 May, 1 July, 5 Aug. Cut:  
24 May, 30 June, 4 Aug, 23 Nov.

New sequence blocks:

Fallow: Ploughed: 22 Sept, 1976. Deep-tine cultivated: 26 Nov. Rotary  
cultivated: 3 May, 1977, 21 June, 14 July. Ploughed: 10 Oct.  
Lucerne: Chalk applied: 17 Sept, 1976. Deep-tine cultivated: 26 Nov.  
Rotary harrowed: 8 Mar, 1977. Rotary cultivated, (Highfield only):  
5 Apr. Spring-tine cultivated: 7 Apr. PK applied: 19 May. Power  
harrowed, seed sown: 1 June. Weedkiller applied: 4 Aug. Topped:  
13 Aug, 1 Dec.  
Clover-grass ley and ryegrass: Chalk applied: 17 Sept, 1976. Deep-tine  
cultivated: 26 Nov. Rotary harrowed: 8 Mar, 1977. Rotary cultivated,  
(Highfield only): 5 Apr. Spring-tine cultivated: 7 Apr. NK (ryegrass  
only) and PK applied: 19 May. Spring-tine cultivated, seed sown:  
20 May. NK applied (clover-grass only): 8 July. Weedkiller applied:  
27 July. Topped: 13 Aug, 1 Dec.  
Oats: Chalk applied: 17 Sept, 1976. Deep-tine cultivated: 26 Nov.  
Rotary harrowed: 8 Mar, 1977. Rotary cultivated, (Highfield only):  
5 Apr. Spring-tine cultivated: 7 Apr. Sown: 8 Apr. Weedkillers  
applied: 30 May. Combine harvested: 6 Sept.  
Barley: Chalk applied: 17 Sept, 1976. Deep-tine cultivated: 26 Nov.  
Rotary harrowed: 8 Mar, 1977. Rotary cultivated, (Highfield only):  
5 Apr. Spring-tine cultivated: 7 Apr. Sown: 8 Apr. Weedkillers  
applied: 30 May. Combine harvested: 26 Aug.  
Wheat: Ploughed: 22 Sept, 1976. Deep-tine cultivated: 23 Nov. Sown:  
24 Nov. 'Nitro-Chalk' applied: 15 Apr, 1977. Weedkillers applied:  
2 May. Insecticide applied: 15 July. Combine harvested: 11 Sept.

- NOTES: (1) Soils from the new sequence blocks were bioassayed for *Gaeumannomyces*  
in March before sowing.  
(2) Barley was sampled in July to assess take-all.  
(3) Test wheat in the museum blocks was sampled in July to assess take-  
all and *Phialophora*.  
(4) The yields of oats were not recorded.

77/R/RN/1 AND 77/R/RN/2

MUSEUM BLOCKS

DRY MATTER: TONNES/HECTARE

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

	HIGHFIELD	FOSTERS
CLOVER-GRASS LEY		
TOTAL OF 4 CUTS	5.81	6.55
MEAN DM%	21.2	19.0
ALL GRASS LEY		
TOTAL OF 4 CUTS	12.16	10.91
MEAN DM%	22.0	22.4
LUCERNE		
TOTAL OF 3 CUTS	11.62	11.31
MEAN DM%	19.8	20.5
SUGAR BEET		
ROOTS (WASHED)	39.3	38.2
SUGAR PERCENTAGE	17.2	17.4
TOTAL SUGAR	6.77	6.66
TOPS	45.5	37.4
OLD GRASS		
TOTAL OF 4 CUTS		
	C	HIGHFIELD N
29TH EXPTL YEAR		
BLOCKS 1 & 4	4.52	9.85
BLOCK 2	4.34	10.66
MEAN DM%	26.0	22.2

77/R/RN/1 AND 77/R/RN/2

RESEDED GRASS

TOTAL OF 4 CUTS

	HIGHFIELD			FOSTERS		
	BLOCKS	C	N	BLOCKS	C	N
29TH EXPTL YEAR	1 & 4	4.15	10.36	1 & 3	3.40	9.69
29TH EXPTL YEAR (SEDED 1949 RESEDED 1973)	2 & 3	7.69	11.00	2 & 4	6.88	11.07
MEAN DM%		22.7	22.5		22.8	22.4

NEW SEQUENCE BLOCKS

DRY MATTER: TONNES/HECTARE

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

BARLEY

	HIGHFIELD	FOSTERS
	5.52	5.22
MEAN DM%	76.6	78.2

77/R/RN/1 HIGHFIELD

WINTER WHEAT 2ND TEST CROP

GRAIN TONNES/HECTARE

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

N 77	0	50	100	150	MEAN
FYMRES70					
NONE	4.31	5.55	5.60	6.13	5.40
FYM	4.28	5.29	5.96	5.88	5.35
MEAN	4.29	5.42	5.78	6.00	5.37
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	5.97	5.08	5.33	5.21	5.40
FYM	5.72	5.18	5.24	5.26	5.35
MEAN	5.84	5.13	5.28	5.24	5.37
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 77					
0	4.70	4.53	4.31	3.62	4.29
50	5.67	5.66	5.32	5.02	5.42
100	6.47	4.92	5.51	6.22	5.78
150	6.54	5.40	5.99	6.08	6.00
MEAN	5.84	5.13	5.28	5.24	5.37
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 77				
	0	4.83	4.60	4.42	3.37
	50	6.01	5.69	5.55	4.93
	100	6.50	4.44	5.38	6.09
	150	6.54	5.57	5.96	6.46
FYM	0	4.58	4.47	4.20	3.87
	50	5.32	5.64	5.09	5.11
	100	6.44	5.39	5.65	6.35
	150	6.54	5.24	6.03	5.69
GRAIN MEAN DM%	76.9				



77/R/RN/1 HIGHFIELD

WINTER WHEAT 2ND TEST CROP

STRAW TONNES/HECTARE

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

N 77	0	50	100	150	MEAN
FYMRES70					
NONE	2.85	4.18	4.49	4.95	4.12
FYM	2.87	3.70	4.63	4.87	4.02
MEAN	2.86	3.94	4.56	4.91	4.07
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	4.57	3.99	4.02	3.90	4.12
FYM	4.72	3.79	3.70	3.86	4.02
MEAN	4.64	3.89	3.86	3.88	4.07
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 77					
0	3.28	3.30	2.45	2.42	2.86
50	4.20	4.10	3.88	3.57	3.94
100	5.58	3.92	4.21	4.54	4.56
150	5.52	4.23	4.89	4.99	4.91
MEAN	4.64	3.89	3.86	3.88	4.07
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 77				
	0	3.42	3.25	2.45	2.28
	50	4.28	4.31	4.42	3.70
	100	5.54	4.11	4.18	4.14
	150	5.02	4.28	5.02	5.49
FYM	0	3.13	3.35	2.45	2.56
	50	4.12	3.89	3.34	3.44
	100	5.62	3.72	4.25	4.95
	150	6.03	4.18	4.77	4.49

STRAW MEAN DM% 87.9

SUB PLOT AREA HARVESTED 0.00659

77/R/RN/2 FOSTERS

WHEAT 2ND TEST CROP

GRAIN TONNES/HECTARE

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

N 77	0	50	100	150	MEAN
FYMRES70					
NONE	4.02	5.08	6.02	6.36	5.37
FYM	4.30	5.31	6.22	6.45	5.57
MEAN	4.16	5.20	6.12	6.41	5.47
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	5.69	5.51	4.98	5.31	5.37
FYM	6.05	5.67	5.23	5.33	5.57
MEAN	5.87	5.59	5.10	5.32	5.47
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 77					
0	4.53	4.73	3.94	3.45	4.16
50	6.04	5.30	4.75	4.71	5.20
100	6.35	5.92	5.81	6.40	6.12
150	6.58	6.41	5.91	6.73	6.41
MEAN	5.87	5.59	5.10	5.32	5.47
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 77				
	0	4.36	4.45	3.67	3.60
	50	5.87	5.56	4.45	4.46
	100	5.88	5.48	6.01	6.71
	150	6.66	6.55	5.77	6.47
FYM	0	4.70	5.01	4.21	3.29
	50	6.20	5.04	5.05	4.95
	100	6.82	6.37	5.60	6.10
	150	6.49	6.27	6.06	6.99

GRAIN MEAN DM% 80.3

77/R/RN/2 FOSTERS

WHEAT 2ND TEST CROP

STRAW TONNES/HECTARE

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

N 77	0	50	100	150	MEAN
FYMRES70					
NONE	2.12	3.53	4.26	4.88	3.70
FYM	2.37	3.77	4.74	5.27	4.04
MEAN	2.25	3.65	4.50	5.08	3.87
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	4.08	3.68	3.39	3.64	3.70
FYM	4.39	4.03	3.81	3.92	4.04
MEAN	4.23	3.86	3.60	3.78	3.87
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 77					
0	2.41	2.57	2.29	1.71	2.25
50	4.48	3.49	3.16	3.48	3.65
100	4.57	4.34	4.31	4.79	4.50
150	5.48	5.02	4.65	5.16	5.08
MEAN	4.23	3.86	3.60	3.78	3.87
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 77				
	0	2.20	2.41	2.07	1.79
	50	4.65	3.52	2.88	3.10
	100	3.89	3.92	4.57	4.67
	150	5.58	4.88	4.03	5.02
FYM	0	2.62	2.73	2.50	1.63
	50	4.31	3.47	3.44	3.86
	100	5.25	4.76	4.04	4.91
	150	5.38	5.16	5.26	5.29

STRAW MEAN DM% 89.1

SUB PLOT AREA HARVESTED 0.00659