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# Yields of the Field Experiments 1980

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## 80/R/RN/1 and 80/R/RN/2 Ley Arable

### Rothamsted Research

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80/R/RN/1 and 80/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 w. 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.

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The 32nd year, old grass, leys, s. oats, potatoes, sugar beet, s. beans, s. barley, w. wheat.

For previous years see 'Details' 1967 & 1973 and 74-79/R/RN/1&2.

The experiment is duplicated on:-

HIGHFIELD A site with much organic matter initially (ploughed out from permanent grass) (80/R/RN/1)

FOSTERS A site with little organic matter initially (80/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 = s. oats, W = w. wheat, P = potatoes, B = s. 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 s. barley test crop was changed to w. 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

80/R/RN/1 and 80/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 w. wheat every year at the end of the test-crop cycle. In 1977, 1978, 1979 and 1980 one phase, fallowed in the previous year started new sequences of treatment cropping:

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

Additional treatments to 2nd test crop w. wheat in the museum blocks:-

Sub plots

FYMRES68 Farmyard manure residues, last applied 1968:

NONE None  
FYM 30 tonnes on each occasion

Sub plots

N Nitrogen fertiliser in 1980 (kg N as 'Nitro-Chalk'):

0  
50  
100  
150

Additional treatments to 1st test crop w. wheat in the new sequence blocks:

Sub plots

N Nitrogen fertiliser in 1980 (kg N as 'Nitro-Chalk'):

0  
50  
100  
150

80/R/RN/1 and 80/R/RN/2

Standard applications:

Museum blocks:

2nd Treatment crops:

Lucerne: Manures: (0:14:28) at 810 kg.  
All-grass ley and clover-grass ley: Manures: (0:14:28) at 540 kg.  
All-grass ley only: Manures: (25:0:16) at 300 kg in spring and after each cut except the last.  
Sugar beet: Manures: (13:13:20) at 1260 kg.

2nd Test crop:

Wheat: Manures: (0:20:20) at 250 kg, combine drilled.  
Weedkillers: Mecoprop with bromoxynil and ioxynil (as 'Brittox' at 3.5 l) in 250 l.  
Reseeded grass and Old grass: Manures: (0:14:28) at 540 kg.  
All-grass half plots: Manures: (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. Chalk at 5.8 t to all crops on Fosters except ryegrass which received 8.7 t.  
Lucerne: Manures: (0:14:28) at 720 kg.  
Clover-grass ley: Manures: (0:14:28) at 720 kg. (25:0:16) at 300 kg applied once when clover established.  
Ryegrass: Manures: (0:14:28) at 720 kg. (25:0:16) to seedbed and after each productive cut except the last.  
S. oats and s. barley: Manures: (20:10:10) at 350 kg, combine drilled. Weedkiller: Mecoprop at 2.7 kg in 900 l applied with the fungicide. Fungicide: Tridemorph at 0.53 kg.

2nd Treatment crops:

Lucerne: Manures: (0:14:28) at 720 kg.  
Clover-grass ley and ryegrass: Manures: (0:14:28) at 720 kg. (25:0:16) at 300 kg in spring, and, to ryegrass only, after each cut except the last.  
Potatoes: Manures: (13:13:20) at 1500 kg. Weedkiller: Linuron at 1.1 kg in 900 l. Fungicide: Mancozeb at 1.4 kg in 250 l applied six times, with the pirimicarb on the first five occasions.  
Insecticides: Phorate at 1.7 kg with the seed. Pirimicarb at 0.14 kg.  
S. barley: Manures: (20:10:10) at 350 kg. Weedkiller: Mecoprop at 2.7 kg in 900 l applied with the fungicide. Fungicide: Tridemorph at 0.53 kg.

3rd Treatment crops:

Lucerne: Manures: (0:14:28) at 720 kg.  
Clover-grass ley and ryegrass: Manures: (0:14:28) at 720 kg. (25:0:16) at 300 kg in spring, and, to ryegrass only, after each cut except the last.  
S. beans: None.  
W. wheat: Manures: (0:20:20) at 250 kg, combine drilled. 'Nitro-Chalk' at 390 kg. Weedkillers: Mecoprop with bromoxynil and ioxynil (as 'Brittox' at 3.5 l) in 250 l.

1st Test crops:

W. wheat:  
After all sequences: Manures: (0:20:20) at 250 kg. Weedkillers: Mecoprop with bromoxynil and ioxynil (as 'Brittox' at 3.5 l) in 250 l.  
After GRASS/OG: Weedkillers: Paraquat at 0.84 kg ion in 220 l. Glyphosate at 1.5 kg in 220 l.

80/R/RN/1 and 80/R/RN/2

Seed:

Museum blocks:

Sugar beet: Bush Mono G, sown at 5.6 kg.

Wheat: Flanders, sown at 200 kg.

New sequence blocks:

Lucerne: Vertus, sown at 28 kg.

Clover-grass ley: S215 meadow fescue at 15 kg, climax timothy at 17 kg, Huia white clover at 4 kg. Mixture sown at 36 kg.

Ryegrass: S24 perennial ryegrass, sown at 22 kg.

Oats: Manod, sown at 200 kg.

Barley: Georgie, sown at 160 kg.

Potatoes: Pentland Crown.

Beans: Minden, sown at 180 kg.

Wheat: Flanders, sown at 200 kg.

Cultivations, etc.:-

Museum blocks:

2nd Treatment crops:

Lucerne: PK applied: 20 Nov, 1979. Cut: 2 June, 1980, 23 July, 3 Nov.

Clover-grass ley and all-grass ley: PK applied: 20 Nov, 1979. NK applied (to all-grass ley only): 11 Mar, 1980, 3 June, 29 July. Cut: 28 May, 21 July, 24 Oct.

Sugar beet: Ploughed: 23 Nov, 1979. Disc harrowed: 12 Apr, 1980. NPK applied, rotary harrowed, seed sown: 15 Apr. Tractor hoed: 21 May, 9 June. Singled: 3 June. Hand harvested: 6 Nov.

2nd Test crops:

W. wheat: Heavy spring-tine cultivated, seed sown: 19 Oct, 1979. Test N applied: 11 Apr, 1980. Weedkillers applied: 16 Apr. Combine harvested: 21 Aug.

Reseeded grass and old grass: PK applied: 20 Nov, 1979. NK applied to all grass half-plots only: 11 Mar, 1980, 3 June, 29 July. Cut: 28 May, 21 July, 24 Oct.

New sequence blocks:

1st Treatment crops:

All crops: Chalk applied: 3 Jan, 1980 (Highfield), 11 Jan (Fosters).

Lucerne and Clover-grass ley: Chisel ploughed twice: 18 Jan, 1980 (Highfield). Chisel ploughed once: 25 Jan (Fosters). Spring-tine cultivated, PK applied, rotary harrowed, seed sown: 21 Apr. NK applied: 4 July (Clover-grass ley only). Cut: 25 July, 24 Oct.

Ryegrass: Chisel ploughed: 18 Jan, 1980 (Highfield), 25 Jan (Fosters). Spring-tine cultivated, PK applied, rotary harrowed, seed sown: 21 Apr. Topped: 25 July, 24 Oct.

S. oats and s. barley: Chisel ploughed: 18 Jan, 1980 (Highfield), 25 Jan (Fosters). Rotary harrowed: 6 Mar (s. barley on Highfield only). Rotary harrowed, seed sown: 9 Apr. Weedkiller and fungicide applied: 30 May. Combine harvested: 1 Sept, (s. barley, Fosters only), 2 Sept, (remaining crops).

2nd Treatment crops:

All forage crops: PK applied: 20 Nov, 1979.

Lucerne: Cut: 4 June, 1980, 23 July, 24 Oct.

Clover-grass ley, and ryegrass: NK applied: 11 Mar, 1980. Cut: 29 May, 23 July, 24 Oct. NK applied (to ryegrass only): 3 June, 29 July.

80/R/RN/1 and 80/R/RN/2

Potatoes: Ploughed: 22 Nov, 1979. Spring-tine cultivated, NPK applied: 17 Apr, 1980. Rotary harrowed, seed planted: 18 Apr. Grubbed: 25 Apr. Rotary ridged: 26 Apr, (Fosters), 29 Apr, (Highfield). Weedkillers applied: 19 May. Fungicide applied: 18 June, 30 June, 11 July, 24 July, 5 Aug, 18 Aug with pirimicarb on the first five occasions. Haulm mechanically destroyed: 2 Sept. Lifted: 8 Oct.

S. barley: Ploughed: 21 Nov, 1979. Rotary harrowed (Highfield only): 6 Mar, 1980. Rotary harrowed, seed sown: 9 Apr. Weedkiller and fungicide applied: 30 May. Combine harvested: 1 Sept.

3rd Treatment crops:

All forage crops: PK applied: 20 Nov, 1979.

Lucerne: Cut: 4 June, 1980, 23 July. Topped: 5 Aug.

Clover-grass ley and ryegrass: NK applied: 11 Mar, 1980, 3 June (to ryegrass only). Cut: 29 May, 23 July. Topped (except GRASS/OG): 5 Aug.

S. beans: Heavy spring-tine cultivated: 19 Oct, 1979. Rotary harrowed, seed sown: 5 Mar, 1980. Tractor hoed: 21 May, 9 June. Combine harvested: 17 Sept.

W. wheat: Ploughed: 12 Oct, 1979. Rotary harrowed, seed sown: 18 Oct. N applied: 11 Apr, 1980. Weedkillers applied: 16 Apr. Combine harvested: 21 Aug.

1st Test crop:

W. wheat:

After lucerne, clover-grass ley and ryegrass (except GRASS/OG): Ploughed: 20 Aug, 1979. Spring-tine cultivated: 3 Oct. Rotary harrowed: 16 Oct. Seed sown: 18 Oct.

After GRASS/OG: Paraquat applied: 22 Aug, 1979. Glyphosate applied: 27 Sept. Seed direct drilled and disc harrowed in: 18 Oct.

After w. wheat and s. beans: Ploughed: 12 Oct, 1979. Rotary harrowed: 16 Oct. Seed sown: 18 Oct.

Subsequent operations to all sequences: Test N applied: 11 Apr, 1980. Weedkillers applied: 16 Apr. Combine harvested: 21 Aug.

NOTE: In July w. wheat and s. barley on the new sequence blocks were sampled for take-all and *Phialophora*.

80/R/RN/1 AND 80/R/RN/2

MUSEUM BLOCKS

DRY MATTER: TONNES/HECTARE

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

	HIGHFIELD	FOSTERS
CLOVER-GRASS LEY		
TOTAL OF 3 CUTS	5.92	7.84
MEAN DM%	24.2	22.0
ALL GRASS LEY		
TOTAL OF 3 CUTS	13.76	11.74
MEAN DM%	22.1	23.7
LUCERNE		
TOTAL OF 3 CUTS	12.0	11.7
MEAN DM%	25.5	23.1
OLD GRASS		
TOTAL OF 3 CUTS		
	C	N
32ND EXPTL YEAR		
BLOCKS 1 & 4	4.61	9.74
BLOCK 2	3.87	10.24
MEAN DM%	25.5	22.3

80/R/RN/1 AND 80/R/RN/2

RESEDED GRASS

TOTAL OF 3 CUTS

	BLOCKS	HIGHFIELD		FOSTERS		
		C	N	BLOCKS	C	N
32ND EXPTL YEAR	1 & 4	4.99	10.52	1 & 3	6.66	10.61
32ND EXPTL YEAR (SEDED 1949 RESEDED 1973)	2 & 3	5.40	10.77	2 & 4	4.73	9.74
MEAN DM%		24.0	23.2		21.7	23.0

NEW SEQUENCE BLOCKS

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

BARLEY

GRAIN TONNES/HECTARE

	HIGHFIELD	FOSTERS
	6.88	6.09
MEAN DM%	82.2	82.3

SUGAR BEET

HIGHFIELD FOSTERS

MEAN MEAN

ROOTS (WASHED): TONNES/HECTARE

37.7 39.8

SUGAR PERCENTAGE

16.9 17.6

TOTAL SUGAR: TONNES/HECTARE

6.38 7.00

TOPS: TONNES/HECTARE

38.2 32.5



80/R/RN/1 HIGHFIELD  
 WINTER WHEAT 1ST TEST CROP  
 NEW SEQUENCE BLOCKS  
 GRAIN TONNES/HECTARE

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

SEQUENCE	N	0	50	100	150	MEAN
LUCERNE		6.37	7.09	7.31	7.92	7.17
CLOGRA		3.91	4.75	6.48	6.84	5.50
GRASS/G		3.60	5.70	6.67	7.30	5.82
ARABLE/A		4.61	7.06	7.37	8.28	6.83
ARABLE/R		4.42	6.16	6.73	7.58	6.22
GRASS/OG		3.67	5.40	6.37	6.52	5.49
MEAN		4.43	6.03	6.82	7.41	6.17

\*\*\*\*\* STANDARD ERRORS OF DIFFERENCES OF MEANS \*\*\*\*\*

TABLE	SEQUENCE	N	SEQUENCE	N
SED	0.393	0.174	0.539	
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
SEQUENCE			0.427	

\*\*\*\*\* STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION \*\*\*\*\*

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.393	6.4
BLOCK.WP.SP	18	0.427	6.9

GRAIN MEAN DM% 82.9

SUB PLOT AREA HARVESTED 0.00322

80/R/RN/1 HIGHFIELD

WINTER WHEAT 2ND TEST CROP

MUSEUM BLOCKS

GRAIN TONNES/HECTARE

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

FYMRES68	NONE	FYM	MEAN		
ROTATION					
LUCERNE	6.56	6.43	6.49		
CLOGRA	6.82	7.60	7.21		
GRASS	6.30	6.59	6.44		
ARABLE	6.10	6.08	6.09		
MEAN	6.44	6.67	6.56		
N	0	50	100	150	MEAN
ROTATION					
LUCERNE	4.68	6.21	7.30	7.79	6.49
CLOGRA	5.10	6.84	8.03	8.87	7.21
GRASS	4.24	6.28	7.29	7.96	6.44
ARABLE	3.13	5.44	7.31	8.47	6.09
MEAN	4.29	6.19	7.48	8.27	6.56
N	0	50	100	150	MEAN
FYMRES68					
NONE	4.04	6.23	7.32	8.19	6.44
FYM	4.54	6.16	7.65	8.35	6.67
MEAN	4.29	6.19	7.48	8.27	6.56
N	0	50	100	150	
FYMRES68 ROTATION					
NONE LUCERNE	4.31	7.01	6.78	8.15	
CLOGRA	4.43	6.35	7.92	8.60	
GRASS	4.73	5.53	7.57	7.36	
ARABLE	2.69	6.03	7.00	8.67	
FYM LUCERNE	5.05	5.41	7.81	7.43	
CLOGRA	5.78	7.34	8.15	9.14	
GRASS	3.75	7.03	7.00	8.56	
ARABLE	3.57	4.85	7.63	8.27	

GRAIN MEAN DM% 82.7

PLOT AREA HARVESTED 0.00663

80/R/RN/2 FOSTERS

WINTER WHEAT 1ST TEST CROP

NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

SEQUENCE	N	0	50	100	150	MEAN
LUCERNE		5.47	6.96	7.78	7.77	7.00
CLOGRA		5.58	6.97	7.51	7.93	7.00
GRASS/G		3.30	4.82	6.23	6.88	5.30
ARABLE/A		3.68	4.60	5.86	6.87	5.25
ARABLE/R		3.40	3.92	4.89	6.03	4.56
MEAN		4.29	5.46	6.45	7.09	5.82

\*\*\*\*\* STANDARD ERRORS OF DIFFERENCES OF MEANS \*\*\*\*\*

TABLE	SEQUENCE	N	SEQUENCE
			N
SED	0.297	0.177	0.453
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
SEQUENCE			0.395

\*\*\*\*\* STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION \*\*\*\*\*

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.297	5.1
BLOCK.WP.SP	15	0.395	6.8

GRAIN MEAN DM% 81.7

SUB PLOT AREA HARVESTED 0.00322

80/R/RN/2 FOSTERS

WINTER WHEAT 2ND TEST CROP

MUSEUM BLOCKS

GRAIN TONNES/HECTARE

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

ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES68					
NONE	7.25	7.52	6.68	6.26	6.93
FYM	7.48	7.76	6.68	6.07	7.00
MEAN	7.36	7.64	6.68	6.17	6.96
N	0	50	100	150	MEAN
FYMRES68					
NONE	4.63	6.96	7.55	8.58	6.93
FYM	4.54	6.86	7.95	8.63	7.00
MEAN	4.59	6.91	7.75	8.61	6.96
N	0	50	100	150	MEAN
ROTATION					
LUCERNE	5.20	7.23	7.80	9.22	7.36
CLOGRA	5.26	8.17	8.56	8.58	7.64
GRASS	4.48	6.51	7.36	8.37	6.68
ARABLE	3.40	5.73	7.28	8.25	6.17
MEAN	4.59	6.91	7.75	8.61	6.96
	N	0	50	100	150
FYMRES68	ROTATION				
NONE	LUCERNE	5.50	6.74	7.68	9.08
	CLOGRA	4.92	8.43	8.17	8.56
	GRASS	4.67	6.67	7.28	8.11
	ARABLE	3.42	5.98	7.07	8.57
FYM	LUCERNE	4.91	7.71	7.93	9.37
	CLOGRA	5.60	7.91	8.95	8.60
	GRASS	4.29	6.34	7.43	8.64
	ARABLE	3.38	5.47	7.50	7.93

GRAIN MEAN DM% 80.8

PLOT AREA HARVESTED 0.00663