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Yields of the Field Experiments 1976

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76/R/RN/1 and 75/R/RN/2 Ley Arable - Old Grass, Leys, Potatoes, Wheat

Rothamsted Research

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76/R/RN/1 and 76/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 28th year, old grass, leys, potatoes, wheat.

For previous years see 'Details' 1967, 68/B/1(t), 69/R/RN/1&2(t), 70/R/RN/1&2(t), 71/R/RN/1&2(t) and 72-75/R/RN/1&2.

The experiment is duplicated on:-

HIGHFIELD A site with much organic matter initially (ploughed out from permanent grass) (76/R/RN/1)

FOSTERS A site with little organic matter initially (76/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.

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.

In 1975 the barley test crop was changed to wheat.

RESEEDED 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.

Since 1975 the all-grass half plots of the reseeded grass plots have been used for a new experiment (see 76/R/CS/169).

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 1976:-

CEREAL 7 Wheat, 8th test crop, 7th cereal (P,W,B,W,W,W,W,W)
CEREAL 8 Wheat, 9th test crop, 8th cereal (P,W,B,W,W,W,W,W)
CEREAL 9 Wheat, 11th test crop, 9th cereal (W,P,B,W,W,W,W,W,W,W)

Blocks which would have been 12th test crop 1976 were fallowed

Treatments to 8th-11th test crops wheat:-

Sub plots

N 76 Nitrogen fertiliser (kg N) in 1976:-

75	75
126	126
176	176
225	225

Treatments to 1st test crop potatoes:-

Sub plots

FYMRES70 Farmyard manure residues, last applied 1970:-

NONE	None
FYM	30 tonnes on each occasion

Sub plots

N 76 Nitrogen fertiliser applied to potatoes 1976 (kg N):-

0	None
80	80
160	160
240	240

Standard applications:

1st Treatment Crops:

To all: Weedkiller: Glyphosate at 1.7 kg in 220 l. Manures: Chalk at 2.9 t, Highfield only.

All-grass ley: Manures: 75 kg P205, 150 kg K20 as (0:14:28), 75 kg N as 'Nitro-Chalk'.

Clover-grass ley: Manures: 75 kg P205, 150 kg K20 as (0:14:28).

Lucerne: Manures: 75 kg P205, 75 kg K20 as (0:20:20).

Hay: Manures: 75 kg P205, 150 kg K20 as (0:14:28). N at 75 kg as 'Nitro-Chalk'.

1st Test Crop: Potatoes: Manures: 300 kg P205, 300 kg K20 as (0:20:20).

Weedkillers: Linuron at 1.2 kg with paraquat at 0.42 kg ion in 220 l. Insecticide: Pirimicarb at 0.14 kg in 450 l. Fungicide: Mancozeb at 1.3

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kg in 450 l. Haulm desiccant: Diquat at 0.59 kg ion in 220 l.
8th, 9th and 11th Test Crops: Wheat: Manures: 75 kg P205, 75 kg K2O as (0:20:20), combine drilled. Weedkillers: Paraquat at 0.42 kg ion in 220 l applied in autumn. Dicamba with mecoprop and MCPA ('Banlene Plus' at 5.6 l in 220 l) in spring.
Reseeded Grass and Old Grass: Manures: Chalk at 8.7 t to all-grass half plots, at 2.9 t to clover-grass half plots on Highfield only. 75 kg P205, 150 kg K2O as (0:14:28).
All-grass half plots: (Excluding Reseeded grass): Manures: 75 kg N, 48 kg K2O as (25:0:16) for the first two cuts.
Clover-grass half plots: Manures: 48 kg K2O as muriate of potash for the first two cuts.

Seed: All-grass ley: Timothy S51 at 15 kg, Meadow Fescue at 19 kg. Mixture sown at 34 kg.
Clover-grass ley: Timothy S51 at 15 kg, Meadow Fescue at 19 kg. White Clover S100 at 3 kg. Mixture sown at 37 kg.
Lucerne: Europe, sown at 28 kg.
Hay: Italian RvP ryegrass, sown at 24 kg.
Potatoes: Pentland Crown.
Wheat: Cappelle, sown at 200 kg.

Cultivations, etc.:-

1st-year treatment crops:

To all: Weedkiller applied: 9 Oct, 1975. Chalk applied: 4 Dec.
All-grass ley: Ploughed: 8 Dec, 1975. Spring-time cultivated: 23 Mar, 1976. PK and N applied: 9 Apr. Power harrowed: 12 Apr. Seed sown: 20 Apr. Topped three times: 17 June, 9 July, 18 Aug.
Clover-grass ley: Ploughed: 8 Dec, 1975. Spring-time cultivated: 23 Mar, 1976. PK applied: 9 Apr. Power harrowed: 12 Apr. Seed sown: 20 Apr. Topped three times: 17 June, 9 July, 18 Aug.
Lucerne: Ploughed: 8 Dec, 1975. Spring-time cultivated: 23 Mar, 1976. PK applied: 9 Apr. Power harrowed and seed sown: 20 Apr. Cut twice: 16 Aug, 22 Dec.
Hay: Ploughed: 8 Dec, 1975. Spring-time cultivated: 23 Mar, 1976. PK and N applied: 9 Apr. Power harrowed and seed sown: 12 Apr. Topped three times: 17 June, 9 July, 18 Aug.

1st Test Crop:

Potatoes: Ploughed: 8 Dec, 1975. Disced twice: 11 Mar, 1976. PK and N applied: 29 Mar. Rotary cultivated and potatoes planted: 30 Mar. Grubbed (Fosters only): 31 Mar. Weedkillers applied: 5 May. Grubbed and rotoridged: 2 June. Insecticide applied: 17 June. Fungicide applied: 28 July. Haulm mechanically destroyed: 23 Sept. Haulm desiccant applied: 28 Sept. Lifted: 12 Oct.

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8th, 9th and 11th Test Crops:

Winter wheat: Autumn weedkiller applied: 7 Oct, 1975. Ploughed:
15 Oct. Heavy spring-time cultivated: 16 Oct. Rotary harrowed:
20 Oct. Seed sown: 22 Oct. N applied: 2 Apr, 1976.

Spring weedkiller applied: 17 Apr. Combine harvested: 29 July.

Reseeded and Old Grass (Excluding all-grass half plots of reseeded grass):
Chalk applied, PK applied: 4 Dec, 1975. NK to all-grass half plots
and K to clover-grass half plots: 25 Feb, 1976, 24 May. Cut three times:
19 May, 29 June, 10 Nov.

Fallow after 11th test crop 1975: Ploughed: 28 Oct, 1975. Heavy spring-
time cultivated: 14 Apr, 1976. Rotary cultivated: 21 Apr.
Deep-time cultivated: 27 May. Heavy spring-time cultivated:
16 June. Rotary cultivated: 2 July.

NOTE: There was very little growth on 1st year treatment crops clover-
grass ley, all-grass ley and 1-year seeds hay because of drought.
Yields were not taken.

76/R/RN/1 AND 76/R/RN/2

DRY MATTER: TONNES/HECTARE

OLD GRASS

TOTAL OF 3 CUTS

	C	N
	HIGHFIELD	
28TH EXPTL YEAR		
BLOCKS 1 & 4	1.68	5.66
BLOCK 2	1.25	5.63
MEAN DM%	26.4	23.3

LUCERNE

TOTAL OF 2 CUTS

	HIGHFIELD	FOSTERS
1ST YEAR	2.02	1.26
MEAN DM%	24.7	24.4

RESEEDED GRASS

TOTAL OF 3 CUTS

	HIGHFIELD		FOSTERS	
	BLOCKS	RC	BLOCKS	RC
28TH EXPTL YEAR	1 & 4	1.40	1 & 3	2.33
28TH EXPTL YEAR (SEEDED 1949 RESEEDED 1973)	2 & 3	3.26	2 & 4	2.39
MEAN DM%		24.8		27.3

76/R/RN/1 HIGHFIELD

POTATOES 1ST TEST CROP

TOTAL TUBERS TONNES/HECTARE

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

N 76	0	80	160	240	MEAN
FYMRES70					
NONE	32.2	34.8	35.7	34.1	34.2
FYM	32.6	33.9	33.3	34.5	33.6
MEAN	32.4	34.3	34.5	34.3	33.9
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	33.0	35.4	37.2	31.3	34.2
FYM	31.0	35.0	37.0	31.3	33.6
MEAN	32.0	35.2	37.1	31.3	33.9
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 76					
0	31.6	34.9	36.1	26.9	32.4
80	31.6	36.5	37.4	31.7	34.3
160	32.6	34.9	37.2	33.3	34.5
240	32.2	34.4	37.6	33.2	34.3
MEAN	32.0	35.2	37.1	31.3	33.9
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 76				
	0	33.4	36.4	35.0	23.9
	80	31.7	38.3	37.7	31.4
	160	35.6	35.3	37.5	34.4
	240	31.2	31.4	38.4	35.5
FYM	0	29.9	33.4	37.2	29.9
	80	31.5	34.8	37.1	32.1
	160	29.6	34.4	36.9	32.2
	240	33.1	37.4	36.7	30.9

76/R/RN/1 HIGHFIELD

POTATOES 1ST TEST CROP

PERCENTAGE WARE 3.81 CM (1.5 INCH) RIDDLE

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

N 76	0	80	160	240	MEAN
FYMRES70					
NONE	95.0	93.9	95.4	95.6	95.0
FYM	95.1	94.8	94.9	95.3	95.0
MEAN	95.0	94.4	95.1	95.4	95.0
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	93.5	95.6	96.0	94.8	95.0
FYM	94.2	95.5	95.2	95.1	95.0
MEAN	93.9	95.5	95.6	95.0	95.0
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 76					
0	94.3	95.0	96.0	94.7	95.0
80	93.3	95.3	94.8	94.1	94.4
160	93.5	95.9	96.0	95.1	95.1
240	94.4	95.8	95.6	95.9	95.4
MEAN	93.9	95.5	95.6	95.0	95.0
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 76				
	0	94.4	94.9	96.5	94.0
	80	92.6	94.7	94.9	93.4
	160	93.1	96.5	96.7	95.2
	240	94.1	96.1	95.9	96.5
FYM	0	94.3	95.1	95.5	95.4
	80	94.0	95.9	94.7	94.7
	160	93.9	95.3	95.3	95.0
	240	94.7	95.6	95.3	95.4

PLOT AREA HARVESTED 0.00351

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POTATOES 1ST TEST CROP

TOTAL TUBERS TONNES/HECTARE

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

N 76	0	80	160	240	MEAN
FYMRES70					
NONE	29.0	31.0	33.8	32.1	31.5
FYM	31.7	31.0	31.3	35.9	32.5
MEAN	30.3	31.0	32.5	34.0	32.0
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	29.3	33.8	34.1	28.7	31.5
FYM	32.1	34.6	35.1	28.1	32.5
MEAN	30.7	34.2	34.6	28.4	32.0
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 76					
0	32.3	31.6	32.6	24.8	30.3
80	30.4	32.7	33.7	27.3	31.0
160	30.7	34.2	36.1	29.2	32.5
240	29.5	38.3	35.8	32.4	34.0
MEAN	30.7	34.2	34.6	28.4	32.0
FYMRES70	ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE
NONE	N 76				
	0	29.7	29.0	31.9	25.3
	80	29.2	33.3	32.9	28.7
	160	31.7	34.3	38.8	30.3
	240	26.6	38.7	32.7	30.4
FYM	0	34.8	34.2	33.4	24.3
	80	31.5	32.0	34.6	25.9
	160	29.6	34.1	33.3	28.1
	240	32.4	37.9	39.0	34.3

76/R/RN/2 FOSTERS

POTATOES 1ST TEST CROP

PERCENTAGE WARE 3.81 CM (1.5 INCH) RIDDLE

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

N 76	0	80	160	240	MEAN
FYMRES70					
NONE	93.4	92.8	93.1	93.4	93.2
FYM	93.8	94.0	92.3	93.7	93.4
MEAN	93.6	93.4	92.7	93.5	93.3
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
FYMRES70					
NONE	91.2	93.3	93.9	94.2	93.2
FYM	92.0	94.1	94.5	93.1	93.4
MEAN	91.6	93.7	94.2	93.6	93.3
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	MEAN
N 76					
0	93.1	93.9	94.3	93.1	93.6
80	91.8	93.0	95.2	93.6	93.4
160	90.7	93.3	93.4	93.4	92.7
240	91.0	94.7	93.9	94.5	93.5
MEAN	91.6	93.7	94.2	93.6	93.3
ROTATION	LUCERNE	CLOGRA	GRASS	ARABLE	
FYMRES70	N 76				
NONE	0	92.0	92.1	94.6	94.7
	80	91.0	92.7	93.6	93.9
	160	91.4	92.8	94.8	93.4
	240	90.7	95.6	92.7	94.7
FYM	0	94.1	95.6	93.9	91.4
	80	92.7	93.2	96.8	93.2
	160	90.0	93.8	92.1	93.4
	240	91.4	93.7	95.1	94.4

PLOT AREA HARVESTED 0.00351

76/R/RN/1 HIGHFIELD

WHEAT 8TH TEST CROP CEREAL 7

GRAIN TONNES/HECTARE

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

N 76	75	126	176	226	MEAN
ROTATION					
LUCERNE	4.59	5.09	4.97	5.27	4.98
CLOGRA	5.38	5.13	5.35	5.35	5.30
GRASS	4.55	4.89	4.73	4.79	4.74
ARABLE	4.67	4.90	4.82	4.68	4.77
RESEDED	4.87	4.96	5.39	5.02	5.06
OLDGRASS	5.17	5.13	5.47	5.53	5.32
MEAN	4.87	5.02	5.12	5.11	5.03

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

TABLE	BLOCK	ROTATION	N 76	ROTATION N 76
SED	0.095	0.165	0.088	0.250
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
ROTATION				0.216

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

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.165	3.3
BLOCK.WP.SP	18	0.216	4.3

GRAIN MEAN DM% 88.3

SUB PLOT AREA HARVESTED 0.00663

76/R/RN/2 FOSTERS

WHEAT 8TH TEST CROP CEREAL 7

GRAIN TONNES/HECTARE

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

N 76	75	126	176	225	MEAN
ROTATION					
LUCERNE	3.88	4.36	4.35	4.16	4.19
CLOGRA	3.91	3.84	4.12	4.03	3.98
GRASS	3.96	3.76	4.03	3.76	3.88
ARABLE	3.74	4.30	4.37	4.06	4.12
RESEEDED	4.19	4.60	4.27	4.28	4.33
MEAN	3.93	4.17	4.23	4.06	4.10

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

TABLE	ROTATION	N 76	ROTATION N 76
SED	0.135	0.068	0.189
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
ROTATION			0.152

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

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.135	3.3
BLOCK.WP.SP	15	0.152	3.7

GRAIN MEAN DM% 87.9

PLOT AREA HARVESTED 0.00663

76/R/RN/1 HIGHFIELD

WHEAT 9TH TEST CROP CEREAL 8

GRAIN TONNES/HECTARE

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

N 76	75	126	176	225	MEAN
ROTATION					
LUCERNE	3.80	4.55	5.13	4.44	4.48
CLOGRA	4.25	4.37	5.01	4.63	4.56
GRASS	4.06	4.51	4.43	3.98	4.24
ARABLE	4.14	4.40	4.72	4.77	4.51
RESEDED	4.50	5.31	4.94	4.80	4.89
OLDGRASS	4.63	4.78	4.95	5.06	4.85
MEAN	4.23	4.65	4.86	4.61	4.59

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

TABLE	BLOCK	ROTATION	N 76	ROTATION N 76
SED	0.130	0.225	0.156	0.400
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
ROTATION				0.382

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

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.225	4.9
BLOCK.WP.SP	18	0.382	8.3

GRAIN MEAN DM% 87.4

SUB PLOT AREA HARVESTED 0.00663

76/R/RN/2 FOSTERS

WHEAT 9TH TEST CROP CEREAL 8

GRAIN TONNES/HECTARE

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

N 76	75	126	176	225	MEAN
ROTATION					
LUCERNE	3.73	4.26	3.90	4.05	3.99
CLOGRA	3.75	3.93	4.06	3.75	3.87
GRASS	3.11	3.00	3.78	3.67	3.39
ARABLE	3.36	3.72	4.20	3.95	3.81
RESEDED	3.74	4.33	4.32	4.01	4.10
MEAN	3.54	3.85	4.05	3.89	3.83

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

TABLE	ROTATION	N 76	ROTATION N 76
SED	0.345	0.123	0.419
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
ROTATION			0.275

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

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.345	9.0
BLOCK.WP.SP	15	0.275	7.2

GRAIN MEAN DM% 87.6

PLOT AREA HARVESTED 0.00663

76/R/RN/1 HIGHFIELD

WHEAT 11TH TEST CROP CEREAL 9

GRAIN TONNES/HECTARE

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

N 76	75	126	176	225	MEAN
ROTATION					
LUCERNE	3.67	4.90	4.84	5.17	4.65
CLOGRA	3.55	3.50	4.63	4.64	4.08
GRASS	3.54	4.49	4.50	4.17	4.18
ARAELE	3.70	4.48	4.80	4.85	4.46
RESEDED	4.24	4.76	4.59	5.28	4.72
OLDGRASS	4.51	4.93	5.12	5.08	4.91
MEAN	3.87	4.51	4.75	4.86	4.50

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

TABLE	BLOCK	ROTATION	N 76	ROTATION N 76
SED	0.281	0.486	0.142	0.571
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
ROTATION				0.347

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

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.486	10.8
BLOCK.WP.SP	18	0.347	7.7

GRAIN MEAN DM% 88.3

SUB PLOT AREA HARVESTED 0.00663

76/R/RN/2 FOSTERS

WHEAT 11TH TEST CROP CEREAL 9

GRAIN TONNES/HECTARE

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

N 76	75	126	176	225	MEAN
ROTATION					
LUCERNE	3.02	3.27	3.78	3.88	3.49
CLOGRA	3.52	3.70	4.03	3.81	3.77
GRASS	3.58	4.03	3.89	3.98	3.87
ARABLE	3.09	4.01	4.03	3.82	3.74
RESEEDDED	3.48	3.60	3.77	3.78	3.65
MEAN	3.34	3.72	3.90	3.85	3.70

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

TABLE	ROTATION	N 76	ROTATION N 76
SED	0.157	0.086	0.229
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
ROTATION			0.193

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

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.157	4.2
BLOCK.WP.SP	15	0.193	5.2

GRAIN MEAN DM% 88.2

PLOT AREA HARVESTED 0.00663