ROTHAMSTED RESEARCH

Yields of the Field Experiments 1987

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87/W/RN/3 Ley/ARABLE - Leys, S. Barley, W. Beans, W. Wheat

Rothamsted Research

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87/W/RN/3

LEY/ARABLE

Object: To compare the effects on soil fertility of rotations with or without leys - Woburn Stackyard D.

Sponsor: A.E. Johnston.

The 50th year, leys, w. beans, w. wheat, s. barley.

For previous years see 'Details' 1967 & 1973 and 74-86/W/RN/3.

Design: 5 series of 8 plots, split for treatments other than rotations.

Whole plot dimensions: 8.53 x 40.7.

Treatments: All phases of four five-course rotations were originally present:

ROTATION

LEY	Clover/grass ley:	L, L, L, P, W
CLO	All legume ley:	SA, SA, SA, P, W until 1971 then CL, CL, CL, P, W
A	Arable with roots:	P, R, C, P, W until 1971 then P, B, B, P, W
A H	Arable with hay:	P, R, H, P, W until 1971 then P, B, H, P, W

P = potatoes, R = w. rye, C = carrots, W = w. wheat, B = s. barley, H = hay, L = clover/grass ley, SA = sainfoin ley, CL = red clover ley

Rotations themselves followed different cycles:

On four plots in each block the rotations were repeated

On four plots in each block arable rotations alternated each five years with ley rotations

From 1976 all the rotations were changed on all phases except for the first and second test crops in 1976:

LN 3	(Previous LEY) LN, LN, LN, W, B
LC 3	(Previous CLO) LC, LC, LC, W, B
AF	(Previous A) F, F, BE, W, B
AB	(Previous A H) B, B, BE, W, B

LN1 to LN3 = three year grass ley with N, 1st year to 3rd year, LC = clover/grass ley no N, BE = beans (s. oats until 1980), F = fallow

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Plots hitherto in alternating rotations were changed to test eight-year leys:

LLN	LN, LN, LN, LN, LN, LN, LN, LN, W, B
LLC	LC, LC, LC, LC, LC, LC, LC, LC, W, B

LLN1 to LLN8 = eight year grass ley with N, first year to eighth year, similarly for LLC

The new scheme started by sowing these new leys in spring 1976 on four phases and in spring 1977 on the fifth phase (2nd test crop in 1976).

Yields are taken only from the leys and the test crops.

Treatments to first test crop w. wheat, all combinations of:

Whole plots

1. ROTATION — Rotations:

   LN 8
   LN 3
   LC 8
   LC 3
   AF
   AB

1/2 plots

2. FYMRES66 — Farmyard manure residues, last applied 1966:

   NONE — None
   FYM — 38 tonnes on each occasion

1/8 plots

3. N — Nitrogen fertilizer (kg N) as 'Nitro-Chalk':

   0
   70
   140
   210

Treatments to second test crop s. barley, all combinations of:

Whole plots

1. ROTATION — Rotations:

   LN 8
   LN 3
   LC 8
   LC 3
   AF
   AB

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1/2 plots

2. FYMRES65 Farmyard manure residues, last applied 1965:

NONE	None
FYM	38 tonnes on each occasion

1/8 plots

3. N Nitrogen fertilizer (kg N) as 'Nitro-Chalk':

0
60
120
180

Treatments to leys:

FYM RES Farmyard manure residues:

NONE	None
FYM	38 tonnes on each occasion, last applied 1964 to 1st and 6th year leys, 1963 to 2nd and 7th year leys, 1962 to 3rd and 8th year leys, 1966 to 4th year leys, 1965 to 5th year leys

Corrective K dressings (kg K20) as muriate of potash, applied to first test crop w. wheat and long-term leys in the wheat block:

Continuous rotations	No FYM half plots	FYM half plots
LN	339	276
LC	126	75
AF	540	552
AB	452	527
Ex-alternating rotations		
LN 8 ploughed for w. wheat	163	213
LN 8 not ploughed	301	351
LC 8 ploughed for w. wheat	100	213
LC 8 not ploughed	0	100

Standard applications:-

Grass ley and clover/grass ley, 1st year: Manures: (0:18:36) at 410 kg. N at 77 kg to grass ley and 50 kg to clover/grass as 'Nitram'. (25:0:16) at 300 kg to grass ley, K20 at 48 kg as muriate of potash to clover/grass ley. Weedkillers: Glyphosate at 1.4 kg in 200 l. Paraquat at 0.40 kg ion in 200 l.

Grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Manures: Magnesian limestone at 5.0 t to 5th year only. (0:18:36) at 410 kg. (25:0:16) at 300 kg in spring and after each cut except the last.

Clover/grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Manures: Magnesian limestone at 5.0 t to 5th year only. (0:18:36) at 410 kg. K20 at 48 kg as muriate of potash in spring and after each cut except the last.

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S. barley, 1st and 2nd treatment crops: Manures: (20:10:10) at 400 kg. Weedkillers: Glyphosate at 1.4 kg in 200 l. Clopyralid at 0.05 kg, bromoxynil at 0.24 kg with mecoprop at 2.5 kg in 200 l applied with the tridemorph. Fungicides: Tridemorph at 0.52 kg. Triadimenol at 0.062 kg with tridemorph at 0.37 kg in 200 l.
W. beans, 3rd treatment crop: Manures: (0:20:20) at 200 kg. Weedkillers: Glyphosate at 1.4 kg in 200 l. Trietazine at 0.72 kg with simazine at 0.10 kg in 240 l.
Fallow, 1st treatment year only: Weedkiller: Glyphosate at 1.4 kg in 200 l.
W. wheat, 1st test crop: Manures: (0:24:24) at 260 kg. Weedkillers: Glyphosate at 1.5 kg in 200 l. Clopyralid at 0.07 kg, bromoxynil at 0.34 kg with mecoprop at 2.5 kg in 240 l. Fungicides: Fenpropimorph at 0.75 kg with chlorothalonil at 0.75 kg in 200 l. Propiconazole at 0.12 kg with carbendazim and maneb (as 'Septal' at 2.5 kg) in 200 l. Insecticide: Carbofuran at 7.5 kg.
S. barley, 2nd test crop: Manures: Magnesian limestone at 5.0 t, (0:20:20) at 310 kg. Weedkillers: Glyphosate at 1.4 kg in 200 l. Clopyralid at 0.05 kg, bromoxynil at 0.24 kg with mecoprop at 2.5 kg in 200 l applied with the tridemorph. Fungicides: Tridemorph at 0.52 kg. Triadimenol at 0.062 kg with tridemorph at 0.38 kg in 200 l. Insecticide: Carbofuran at 7.5 kg.

Seed: Grass ley: Climax timothy at 17 kg and meadow fescue at 17 kg, mixture sown at 34 kg.
Clover/grass ley: Climax timothy at 16 kg, meadow fescue at 14 kg and Huia white clover at 4.0 kg, mixture sown at 34 kg.
S. barley: Klaxon, sown at 160 kg.
W. beans: Bourdon, sown at 250 kg.
W. wheat: Mercia, sown at 190 kg.

Cultivations, etc.:- Treatment crops:
Grass ley and clover/grass ley, 1st year: Glyphosate applied: 19 Sept, 1986. Ploughed: 4 Dec. Spring-tine cultivated: 6 May, 1987 and 12 May. N and PK applied: 29 May. Paraquat applied, spike harrowed with crumbler attached, seed sown and rolled: 1 June. NK applied to grass ley, K applied to clover/grass ley: 17 Aug. Cut: 12 Aug and 15 Dec.
Grass ley and clover/grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Magnesian limestone applied to 5th year only: 28 Nov, 1986. Corrective K applied to 4th year only: 26 Jan, 1987. PK applied: 10 Mar. NK applied to grass ley and K applied to clover/grass ley: 2 Apr, 26 June and 17 Aug. Cut: 16 June, 12 Aug and 15 Dec.
S. barley, 1st and 2nd treatment crops: Glyphosate applied: 19 Sept, 1986. Ploughed: 1st treatment crop: 4 Dec, 2nd treatment crop: 1 Dec. Spike harrowed with crumbler attached, NPK applied, seed sown: 17 Mar, 1987. Clopyralid, bromoxynil, mecoprop and tridemorph applied: 29 May. Triadimenol and tridemorph applied: 4 July. Combine harvested: 21 Aug.
W. beans, 3rd treatment crop: Glyphosate applied: 19 Sept, 1986. PK applied, seed sown, ploughed, harrowed: 12 Nov. Trietazine and simazine applied: 13 Nov. Combine harvested: 26 Sept, 1987.
Fallow, 1st and 2nd treatment years: Glyphosate applied to 1st year only: 19 Sept, 1986. Ploughed; 1st year: 4 Dec, 2nd year: 1 Dec. Spring-tine cultivated: 6 and 12 May, 1987. Cultivated with thistlebar: 29 June.

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Test crops:
W. wheat, 1st test crop: Glyphosate applied: 19 Sept, 1986. Ploughed: 30 Sept. Rolled, PK applied: 1 Oct. Carbofuran applied, rotary cultivated with crumbler attached, seed sown, harrowed: 2 Oct. Corrective K applied: 26 Jan, 1987. N applied, clopyralid, bromoxynil and mecoprop applied: 14 Apr. Fenpropimorph and chlorothalonil applied: 15 June. Propiconazole, carbendazim and maneb applied: 29 June. Combine harvested: 7 Sept.
S. barley, 2nd test crop: Glyphosate applied: 19 Sept, 1986. Magnesian limestone applied: 28 Nov. Ploughed: 1 Dec. Spike harrowed with crumbler attached, PK applied, carbofuran applied, harrowed, seed sown: 17 Mar, 1987. N applied: 8 Apr. Clopyralid, bromoxynil, mecoprop and tridemorph applied: 29 May. Triadimenol and tridemorph applied: 4 July. Combine harvested: 21 Aug.

LEYS

1ST CUTTING OCCASION (16/6/87) DRY MATTER TONNES/HECTARE

***** Tables of means *****

FYM RES	NONE	FYM	Mean
LEY			
LC1	*	*	*
LC2	5.80	6.34	6.07
LC3	5.06	5.22	5.14
LN1	*	*	*
LN2	6.69	6.56	6.63
LN3	5.37	5.54	5.45
LLC1	*	*	*
LLC2	6.07	4.99	5.53
LLC3	4.67	4.65	4.66
LLC4	5.86	6.05	5.95
LLC5	5.71	6.50	6.10
LLC6	5.43	5.01	5.22
LLC7	4.21	5.33	4.77
LLC8	5.13	5.25	5.19
LLN1	*	*	*
LLN2	7.93	7.72	7.82
LLN3	7.30	6.87	7.08
LLN4	7.27	6.53	6.90
LLN5	6.02	6.89	6.46
LLN6	6.90	7.60	7.25
LLN7	6.81	6.78	6.80
LLN8	7.30	6.32	6.81
Mean	6.08	6.12	6.10

1ST CUT MEAN DM% 22.0

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LEYS

2ND CUTTING OCCASION (12/8/87) DRY MATTER TONNES/HECTARE

***** Tables of means *****

FYM RES LEY	NONE	FYM	Mean
LC1	2.96	3.24	3.10
LC2	1.23	1.34	1.28
LC3	2.62	2.70	2.66
LN1	2.98	2.59	2.78
LN2	2.82	3.06	2.94
LN3	2.36	3.41	2.88
LLC1	1.75	1.86	1.80
LLC2	2.03	2.43	2.23
LLC3	2.65	2.62	2.63
LLC4	2.95	2.91	2.93
LLC5	1.97	2.02	1.99
LLC6	1.01	0.94	0.98
LLC7	1.08	1.01	1.04
LLC8	2.11	2.07	2.09
LLN1	2.20	2.18	2.19
LLN2	2.61	2.53	2.57
LLN3	2.83	2.84	2.83
LLN4	2.46	2.31	2.38
LLN5	2.84	2.85	2.84
LLN6	4.00	3.88	3.94
LLN7	3.30	3.47	3.38
LLN8	2.87	3.62	3.25
Mean	2.44	2.54	2.49

2ND CUT MEAN DM% 18.7

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LEYS

3RD CUTTING OCCASION (15/12/87) DRY MATTER TONNES/HECTARE

***** Tables of means *****

FYM RES	NONE	FYM	Mean
LEY			
LC1	1.12	1.56	1.34
LC2	1.45	1.03	1.24
LC3	*	*	*
LN1	1.62	2.33	1.97
LN2	2.39	2.31	2.35
LN3	*	*	*
LLC1	2.22	1.16	1.69
LLC2	2.27	1.77	2.02
LLC3	1.48	1.18	1.33
LLC4	1.02	0.77	0.89
LLC5	1.07	1.73	1.40
LLC6	0.54	0.77	0.65
LLC7	1.97	0.77	1.37
LLC8	*	*	*
LLN1	2.60	2.63	2.62
LLN2	2.67	2.34	2.51
LLN3	0.84	1.15	1.00
LLN4	1.45	1.86	1.66
LLN5	1.79	1.83	1.81
LLN6	3.51	4.01	3.76
LLN7	3.49	4.48	3.99
LLN8	*	*	*
Mean	1.86	1.87	1.87

3RD CUT MEAN DM% 29.9

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LEYS

TOTAL OF 3 CUTTING OCCASIONS DRY MATTER TONNES/HECTARE

***** Tables of means *****

FYM RES LEY	NONE	FYM	Mean
LC1	4.08	4.80	4.44
LC2	8.48	8.71	8.59
LC3	7.68	7.92	7.80
LN1	4.59	4.92	4.76
LN2	11.90	11.93	11.91
LN3	7.73	8.94	8.34
LLC1	3.97	3.03	3.50
LLC2	10.36	9.19	9.78
LLC3	8.80	8.45	8.63
LLC4	9.83	9.73	9.78
LLC5	8.74	10.25	9.49
LLC6	6.97	6.72	6.84
LLC7	7.26	7.11	7.18
LLC8	7.24	7.32	7.28
LLN1	4.81	4.81	4.81
LLN2	13.21	12.59	12.90
LLN3	10.96	10.86	10.91
LLN4	11.18	10.70	10.94
LLN5	10.65	11.58	11.11
LLN6	14.41	15.48	14.94
LLN7	13.60	14.73	14.17
LLN8	10.16	9.94	10.05
Mean	8.94	9.08	9.01

TOTAL OF 3 CUTTING OCCASIONS MEAN DM% 22.9

PLOT AREA HARVESTED 0.00204

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WINTER WHEAT 1ST TEST CROP

GRAIN TONNES/HECTARE

***** Tables of means *****

FYMRES66	NONE	FYM	Mean
ROTATION			
LN 8	6.79	6.41	6.60
LN 3	6.40	6.43	6.42
LC 8	7.16	7.43	7.30
LC 3	7.13	6.92	7.02
AF	5.18	5.62	5.40
AB	5.84	6.74	6.29
Mean	6.42	6.59	6.50

N	0	70	140	210	Mean
ROTATION					
LN 8	4.80	6.74	7.86	7.00	6.60
LN 3	4.41	6.55	7.59	7.13	6.42
LC 8	5.26	7.48	8.31	8.13	7.30
LC 3	5.51	7.24	7.74	7.61	7.02
AF	3.02	5.56	6.60	6.43	5.40
AB	4.39	6.18	6.75	7.84	6.29
Mean	4.56	6.62	7.47	7.36	6.50

N	0	70	140	210	Mean
FYMRES66					
NONE	4.56	6.30	7.29	7.52	6.42
FYM	4.57	6.95	7.66	7.19	6.59
Mean	4.56	6.62	7.47	7.36	6.50

	N	0	70	140	210
ROTATION	FYMRES66				
LN 8	NONE	4.93	6.76	7.75	7.72
	FYM	4.66	6.71	7.97	6.28
LN 3	NONE	4.52	6.32	7.43	7.33
	FYM	4.29	6.79	7.74	6.92
LC 8	NONE	4.94	6.84	8.59	8.27
	FYM	5.58	8.12	8.04	7.98
LC 3	NONE	5.55	7.06	8.01	7.91
	FYM	5.47	7.41	7.47	7.32
AF	NONE	2.82	5.15	6.20	6.57
	FYM	3.22	5.98	7.01	6.28
AB	NONE	4.58	5.67	5.77	7.32
	FYM	4.19	6.68	7.73	8.35

GRAIN MEAN DM% 73.7

PLOT AREA HARVESTED 0.00251

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SPRING BARLEY 2ND TEST CROP

GRAIN TONNES/HECTARE

***** Tables of means *****

FYMRES65	NONE	FYM	Mean
ROTATION			
LN 8	6.24	6.10	6.17
LN 3	5.75	5.42	5.58
LC 8	6.23	6.13	6.18
LC 3	5.78	5.86	5.82
AF	4.73	4.94	4.84
AB	5.01	4.94	4.98
Mean	5.63	5.57	5.60

N	0	60	120	180	Mean
ROTATION					
LN 8	4.81	6.77	7.03	6.07	6.17
LN 3	4.06	5.91	6.56	5.80	5.58
LC 8	5.22	6.61	6.41	6.48	6.18
LC 3	4.83	6.59	6.31	5.57	5.82
AF	2.10	4.77	6.12	6.34	4.84
AB	2.49	5.31	6.06	6.05	4.98
Mean	3.92	6.00	6.42	6.05	5.60

N	0	60	120	180	Mean
FYMRES65					
NONE	3.89	5.96	6.48	6.18	5.63
FYM	3.95	6.03	6.35	5.92	5.57
Mean	3.92	6.00	6.42	6.05	5.60

N	FYMRES65	0	60	120	180
ROTATION					
LN 8	NONE	4.63	6.42	7.56	6.36
	FYM	4.99	7.12	6.49	5.78
LN 3	NONE	4.28	6.10	6.64	5.98
	FYM	3.84	5.73	6.47	5.62
LC 8	NONE	5.11	6.69	6.68	6.46
	FYM	5.34	6.54	6.15	6.50
LC 3	NONE	4.93	6.78	6.17	5.26
	FYM	4.73	6.40	6.45	5.87
AF	NONE	2.26	4.33	5.71	6.62
	FYM	1.95	5.22	6.53	6.06
AB	NONE	2.13	5.42	6.09	6.42
	FYM	2.84	5.20	6.04	5.69

GRAIN MEAN DM% 86.1

PLOT AREA HARVESTED 0.00251

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