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

Rothamsted Research

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86/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 49th year, leys, s. barley, w. beans, w. wheat.

For previous years see 'Details' 1967 & 1973 and 74-85/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. 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
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. FYMRES64 Farmyard manure residues, last applied 1964:

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 1963 to 1st and 6th year leys, 1962 to 2nd and 7th year leys, 1966 to 3rd and 8th year leys, 1965 to 4th year leys, 1964 to 5th year leys

Corrective K dressings (kg K₂O) 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	264	264
LC	264	113
AF	552	573
AB	573	502

Ex-alternating rotations

LN 8 ploughed for w. wheat	276	264
LN 8 not ploughed	238	364
LC 8 ploughed for w. wheat	0	63
LC 8 not ploughed	226	314

Standard applications:-

Grass ley and clover/grass ley, 1st year: Manures: (0:18:36) at 410 kg. N at 75 kg to grass ley and 50 kg to clover/grass as 'Nitram'. Weedkillers: MCPA at 0.16 kg and MCPB at 1.1 kg in 240 l.

Grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Manures: Magnesian limestone at 7.5 t to 5th year only. (0:18:36) at 410 kg. (25:0:16) at 300 kg in spring and after the first cut. Weedkillers: MCPA at 0.16 kg and MCPB at 1.1 kg in 240 l.

Clover/grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Magnesian limestone at 7.5 t to 5th year only. (0:18:36) at 410 kg. K₂O at 48 kg as muriate of potash in spring and after the first cut. Weedkillers: MCPA at 0.16 kg and MCPB at 1.1 kg in 240 l.

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- S. barley, 1st and 2nd treatment crops: Manures: (20:10:10) at 400 kg. Weedkillers: Clopyralid at 0.07 kg with bromoxynil octanoate at 0.34 kg and mecoprop at 2.1 kg applied with the fungicide in 250 l. Fungicide: Tridemorph at 0.52 kg.
- W. beans: 3rd treatment crop: Manures: (0:24:24) at 170 kg. Weedkillers: Trietazine at 0.72 kg with simazine at 0.10 kg in 250 l. Desiccant: Diquat at 0.42 kg ion in 200 l.
- W. wheat: 1st test crop: Manures: (0:24:24) at 260 kg. Weedkillers: Glyphosate at 1.5 kg in 280 l. Dicamba with mecoprop and MCPA (as 'Herrisol' at 5.0 l) in 250 l. Nematicide: Aldicarb at 10 kg.
- S. barley, 2nd test crop: Manures: Magnesian limestone at 7.5 t. (0:24:24) at 260 kg. Weedkillers: Clopyralid at 0.07 kg with bromoxynil octanoate at 0.34 kg and mecoprop at 2.1 kg applied with the fungicide in 250 l. Fungicide: Tridemorph at 0.52 kg. Nematicide: Aldicarb at 10 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: 13.5 kg, meadow fescue at 13.5 kg and Huia white clover at 6.7 kg, mixture sown at 34 kg.
S. barley: Klaxon, sown at 160 kg.
W. beans: Banner, sown at 250 kg.
W. wheat: Avalon, sown at 190 kg.

Cultivations, etc.:— Treatment crops:

- Grass ley and clover/grass ley, 1st year: Ploughed: 16 Dec, 1985. Rotary harrowed: 10 Apr, 1986. PK and N applied, spike harrowed with crumbler attached for clover/grass ley only, seeds sown: 7 May. Topped: 7 July, 15 Aug. Weedkiller applied: 15 July. Cut: 12 Nov.
- Grass ley and clover/grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Corrective K applied to 4th year only: 22 Oct, 1985. Magnesian limestone applied to 5th year only: 29 Nov. PK applied: 29 Nov. NK applied to grass ley: 17 Apr, 1986, 25 June. K applied to clover/grass ley: 17 Apr, 25 June. Weedkiller applied: 15 July. Cut: 16 June, 17 Sept, 12 Nov.
- S. barley, 1st and 2nd treatment years: Ploughed: 16 Dec, 1985. Rotary harrowed, NPK applied, rotary harrowed, seed sown: 10 Apr, 1986. Weedkillers and fungicide applied: 19 May. Combine harvested: 18 Aug.
- Fallow, 1st and 2nd treatment years: Ploughed: 16 Dec, 1985. Rotary harrowed: 10 Apr, 1986. Cultivated with thistlebar: 24 June, 18 July.
- W. beans, 3rd treatment crop: Rotary cultivated: 30 Oct, 1985. Power harrowed, seed broadcast: 31 Oct. Seed ploughed in, rotary harrowed: 1 Nov. PK applied: 4 Nov. Rolled: 7 Nov. Trietazine and simazine applied: 14 Nov. Desiccant applied: 30 Aug, 1986. Combine harvested: 7 Sept.

Test crops:

- W. wheat, 1st test crop: Glyphosate applied to leys: 10 Oct, 1985. Ploughed, corrective K applied: 22 Oct. PK applied, aldicarb applied: 23 Oct. Power harrowed, harrowed, seed sown: 26 Oct. N applied: 23 Apr, 1986. 'Herrisol' applied: 6 May. Combine harvested: 1 Sept.
- S. barley, 2nd test crop: Magnesian limestone applied: 29 Nov, 1985. Ploughed: 16 Dec. PK applied, aldicarb applied, rotary harrowed, seed sown: 10 Apr, 1986. N applied: 22 Apr. Weedkillers and fungicide applied: 19 May. Combine harvested: 18 Aug.

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LEYS

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

FYM RES	NONE	FYM	MEAN
LEY			
LC1	0.00	0.00	0.00
LC2	4.40	4.16	4.28
LC3	4.82	4.50	4.66
LN1	0.00	0.00	0.00
LN2	5.63	5.14	5.38
LN3	5.35	7.14	6.24
LLC1	0.00	0.00	0.00
LLC2	5.56	4.12	4.84
LLC3	4.83	4.86	4.84
LLC4	4.75	4.50	4.62
LLC5	5.79	5.81	5.80
LLC6	5.01	5.18	5.09
LLC7	4.50	5.71	5.10
LLC8	4.13	4.81	4.47
LLN1	0.00	0.00	0.00
LLN2	5.80	5.72	5.76
LLN3	5.15	5.47	5.31
LLN4	5.87	6.08	5.97
LLN5	4.88	4.90	4.89
LLN6	6.05	5.85	5.95
LLN7	5.91	6.60	6.25
LLN8	6.48	5.87	6.18
MEAN	5.27	5.36	5.31

1ST CUT MEAN DM% 25.5

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LEYS

2ND AND 3RD CUTTING OCCASIONS (17 SEP AND 12 NOV) DRY MATTER TONNES/HECTARE

FYM RES	NONE	FYM	MEAN
LEY			
LC1	0.97	1.22	1.09
LC2	1.03	1.06	1.04
LC3	0.52	0.44	0.48
LN1	1.42	1.24	1.33
LN2	2.52	2.83	2.68
LN3	2.00	2.10	2.05
LLC1	1.54	1.74	1.64
LLC2	1.39	1.63	1.51
LLC3	0.42	0.55	0.48
LLC4	2.17	2.79	2.48
LLC5	1.75	1.33	1.54
LLC6	2.27	1.47	1.87
LLC7	1.76	2.09	1.93
LLC8	0.55	0.59	0.57
LLN1	1.88	1.78	1.83
LLN2	2.90	2.63	2.77
LLN3	2.51	2.54	2.52
LLN4	2.80	2.27	2.53
LLN5	2.17	3.05	2.61
LLN6	1.59	2.46	2.02
LLN7	2.70	3.19	2.94
LLN8	2.31	2.30	2.31
MEAN	1.78	1.88	1.83

2ND CUT MEAN DM% 28.1

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LEYS

TOTAL OF 3 CUTTING OCCASIONS DRY MATTER TONNES/HECTARE

FYM RES	NONE	FYM	MEAN
LEY			
LC1	0.97	1.22	1.09
LC2	5.43	5.22	5.32
LC3	5.34	4.94	5.14
LN1	1.42	1.24	1.33
LN2	8.15	7.97	8.06
LN3	7.35	9.24	8.30
LLC1	1.54	1.74	1.64
LLC2	6.95	5.76	6.35
LLC3	5.24	5.41	5.33
LLC4	6.92	7.30	7.11
LLC5	7.54	7.13	7.33
LLC6	7.28	6.64	6.96
LLC7	6.26	7.81	7.03
LLC8	4.68	5.40	5.04
LLN1	1.88	1.78	1.83
LLN2	8.70	8.36	8.53
LLN3	7.66	8.01	7.83
LLN4	8.67	8.34	8.51
LLN5	7.05	7.95	7.50
LLN6	7.64	8.31	7.97
LLN7	8.61	9.78	9.20
LLN8	8.80	8.17	8.48
MEAN	6.09	6.26	6.18

TOTAL OF 2 CUTS MEAN DM% 26.8

PLOT AREA HARVESTED 0.00204

86/W/RN/3

S. BARLEY 2ND TEST CROP

GRAIN TONNES/HECTARE

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

FYMRES64	NONE	FYM	MEAN		
ROTATION					
LN 8	4.76	4.23	4.50		
LN 3	5.24	5.38	5.31		
LC 8	5.31	5.09	5.20		
LC 3	4.87	5.29	5.08		
AF	3.15	3.49	3.32		
AB	4.01	3.74	3.88		
MEAN	4.56	4.54	4.55		
N	0	60	120	180	MEAN
ROTATION					
LN 8	3.63	4.21	5.64	4.51	4.50
LN 3	3.76	6.07	5.08	6.33	5.31
LC 8	3.92	5.70	5.86	5.32	5.20
LC 3	4.54	4.98	5.87	4.94	5.08
AF	1.03	4.00	4.15	4.08	3.32
AB	1.97	4.21	4.81	4.52	3.88
MEAN	3.14	4.86	5.24	4.95	4.55
N	0	60	120	180	MEAN
FYMRES64					
NONE	3.35	4.71	5.32	4.86	4.56
FYM	2.94	5.01	5.16	5.04	4.54
MEAN	3.14	4.86	5.24	4.95	4.55
ROTATION	N	0	60	120	180
	FYMRES64				
LN 8	NONE	4.02	4.69	5.58	4.75
	FYM	3.25	3.72	5.70	4.27
LN 3	NONE	4.02	5.88	5.00	6.08
	FYM	3.50	6.26	5.17	6.59
LC 8	NONE	4.40	5.49	6.09	5.28
	FYM	3.44	5.92	5.64	5.36
LC 3	NONE	4.45	4.06	5.96	5.02
	FYM	4.64	5.90	5.79	4.85
AF	NONE	1.01	3.61	4.31	3.66
	FYM	1.06	4.40	4.00	4.50
AB	NONE	2.18	4.54	4.97	4.37
	FYM	1.76	3.88	4.65	4.67

GRAIN MEAN DM% 82.9

PLOT AREA HARVESTED 0.00251

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WINTER WHEAT 1ST TEST CROP

GRAIN TONNES/HECTARE

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

FYMRES65 ROTATION	NONE	FYM	MEAN
LN 8	6.06	6.57	6.32
LN 3	6.03	4.82	5.42
LC 8	6.54	6.96	6.75
LC 3	6.27	6.91	6.59
AF	5.64	6.04	5.84
AB	6.77	6.64	6.70
MEAN	6.22	6.32	6.27

ROTATION	N 0	70	140	210	MEAN
LN 8	4.68	6.55	7.20	6.84	6.32
LN 3	3.36	5.65	6.62	6.05	5.42
LC 8	6.09	7.31	6.85	6.75	6.75
LC 3	6.14	7.15	6.89	6.20	6.59
AF	4.08	5.08	6.32	7.88	5.84
AB	4.17	6.91	7.21	8.53	6.70
MEAN	4.75	6.44	6.85	7.04	6.27

FYMRES65	N 0	70	140	210	MEAN
NONE	4.66	6.43	6.83	6.96	6.22
FYM	4.85	6.45	6.87	7.13	6.32
MEAN	4.75	6.44	6.85	7.04	6.27

ROTATION	FYMRES65	N 0	70	140	210
LN 8	NONE	4.36	5.80	7.26	6.82
	FYM	4.99	7.30	7.14	6.86
LN 3	NONE	4.28	6.67	6.75	6.40
	FYM	2.45	4.63	6.50	5.70
LC 8	NONE	5.71	7.26	6.88	6.32
	FYM	6.46	7.35	6.83	7.18
LC 3	NONE	5.88	6.83	6.09	6.30
	FYM	6.39	7.47	7.69	6.11
AF	NONE	4.32	5.30	5.79	7.14
	FYM	3.84	4.87	6.84	8.62
AB	NONE	3.41	6.73	8.20	8.75
	FYM	4.94	7.09	6.21	8.30

GRAIN MEAN DM% 80.7

PLOT AREA HARVESTED 0.00251