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Results of the Classical and Other Long-term Experiments 2005

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2005

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05/W/RN/3 - Woburn Ley Arable

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Rothamsted Research (2006) *05/W/RN/3 - Woburn Ley Arable* ; Results Of The Classical And Other Long-Term Experiments 2005, pp 33 - 43 - DOI: <https://doi.org/10.23637/ERADOC-1-262>

05/W/RN/3

LEY/ARABLE

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

Sponsors: P.R. Poulton and A.J. Macdonald.

The 68th year, leys, w. beans, w. wheat, w. rye, forage maize.

For previous years see 'Details' 1967 & 1973 and 74-04/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) LN1, LN2, LN3, W, R
LC 3	(Previous CLO) LC1, LC2, LC3, W, R
AF	(Previous A) F, F, BE, W, R
AB	(Previous A H) B, B, BE, W, R

From 1998 rotations AF and AB are replaced by AM and ABe respectively. Phased in at the beginning of each treatment crop sequence.

AM	R, BE, M, W, R
ABe	R, M, BE, W, R

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ROTATION (continued)

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,
M = forage maize

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

LLN LLN1, LLN2, LLN3, LLN4, LLN5, LLN6, LLN7, LLN8, W, R
LLC LLC1, LLC2, LLC3, LLC4, LLC5, LLC6, LLC7, LLC8, W, R

LLN1 to LLN8 = eight year grass ley with nitrogen, first year to eighth
year, similarly for LLC - clover/grass ley, no nitrogen

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).

In 1992 w. rye (R) replaced s. barley (B) as the second test crop.

Yields are taken from the leys, arable treatment crops and the test crops.

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

Whole plots:

1. **ROTATION** Rotations before wheat:

LLN 8
LN 3
LLC 8
LC 3
AM
ABe

1/2 plots:

2. **NSPLIT(FYM res)** Farmyard manure residues, last applied 1960s:

Nsplit(noFYM)
Nsingle(FYM)

1/8 plots:

3. **N** Nitrogen fertilizer in spring 2005 (kg N) as 27% N:

0
70)as a 40 + 30)split dressings
140)single OR 40 + 100)late Feb/early Mar
210)dressing 40 + 170)and GS31 or mid-Apr

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Treatments to second test crop w. rye, all combinations of:

Whole plots:

1. **ROTATION** Rotations before first test crop:

LLN 8
LN 3
LLC 8
LC 3
AF
AB

1/2 plots:

2. **NSPLIT(FYM res)** Farmyard manure residues, last applied 1960s:

Nsplit to wheat in 2004(noFYM)
Nsingle to wheat in 2004 (FYM)

1/8 plots:

3. **N** Nitrogen fertilizer in spring 2005(kg N) as 27% N:

0
40
80
120

Treatments to leys:

FYM RES Farmyard manure residues:

NONE
FYM 38 t on each occasion, last applied 1960s.

NOTE: Corrective K dressings (kg K₂O) as muriate of potash, applied where necessary to first test crop w. wheat and long-term leys in the wheat block, applied 13 October 2004.

Continuous rotations before wheat	No FYM half plots	FYM Res half plots
ABe	360	420
AM	350	460

None to other plots.

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Experimental diary:

Grass ley and clover/grass ley, 1st year (ROTATION LN1, LLN1, LC1, and LLC1)

01-Oct-04 Glyphosate 360 @ 4.0 l in 200 l.
12-Oct-04 Ploughed 35cm wide furrows.
13-Oct-04 Triplesuperphosphate at 213 kg
26-Oct-04 Power harrowed. Drilled Promesse Timothy + Senu Fescue,
50:50, @ 30 kg and Promesse Timothy + Senu Fescue + Merwi
White Clover, 45:45:10 @ 30 kg with the Accord drill.
Rolled.
16-Nov-04 27.0% N at 93 kg, 1st year grass/clover leys; at 185 kg, 1st
year grass leys.
16-Mar-05 Potassium sulphate at 140 kg.
17-Mar-05 Muriate of potash at 167 kg.
27-May-05 Alistel at 3.0 l in 200 l to grass leys only.
12-Jul-05 Cut yield strips, weighed and sampled.
01-Aug-05 Topped to tidy.
03-Aug-05 Muriate of Potash at 83 kg to all leys.
34.5% N at 218 kg to grass leys only.
20-Dec-05 2nd cut yield strips, weighed and sampled.

Grass leys 2nd to 8th year (ROTATION LN2-3 and LLN2-8)

16-Mar-05 Potassium sulphate at 140 kg,
34.5% N at 218 kg
17-Mar-05 Muriate of potash at 167 kg.
Triple superphosphate at 213 kg.
27-May-05 Alistel at 3.0 l in 200 l to grass leys only.
12-Jul-05 Cut yield strips, weighed and sampled.
01-Aug-05 Topped to tidy.
03-Aug-05 Muriate of Potash at 83 kg
34.5% N at 218 kg.
10-Aug-05 Azural at 4.0 l in 200 l to ley plots going into wheat.
20-Dec-05 2nd cut yield strips, weighed and sampled (all other long
ley plots).
21-Dec-05 Discards mown and cuttings removed.

Clover/grass leys 2nd to 8th year (ROTATION LC2-3 and LLC2-8)

16-Mar-05 Potassium sulphate at 140 kg,
17-Mar-05 Muriate of potash at 167 kg.
Triple superphosphate at 213 kg.
12-Jul-05 Cut yield strips, weighed and sampled.
01-Aug-05 Topped to tidy.
03-Aug-05 Muriate of Potash at 83 kg.
10-Aug-05 Azural at 4.0 l in 200 l to ley plots going into wheat.
20-Dec-05 2nd cut yield strips, weighed and sampled (all other long
ley plots).
21-Dec-05 Discards mown and cuttings removed.

W. beans, 2nd and 3rd treatment crop (ROTATION AM and ABe)

13-Oct-04 Triple superphosphate at 127 kg.
23-Nov-04 Broadcast, Clipper, recleaned at 30 seeds/m².
24-Nov-04 Ploughed 35 cm wide furrows.
16-Mar-05 Potassium sulphate at 140 kg.
25-Apr-05 Basagran SG at 1.65 kg in 200 l.
11-May-05 tm)Bravo at 1.0 l in 200 l.
tm)Folicur at 0.5 l in 200 l.
tm)Hallmark with Zeon Technology at 0.75 l in 200 l.
03-Sep-05 Combine harvested plots for yield. Straw swathed.
04-Sep-05 Combine harvested discards. Straw swathed.
08-Sep-05 Straw baled and removed.

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Forage maize, 2nd and 3rd treatment crop (**ROTATION** ABe and AM)

13-Oct-04 Triple superphosphate at 127 kg.
24-Nov-04 Ploughed 35 cm wide furrows.
16-Mar-05 Potassium sulphate at 140 kg.
18-Apr-05 Flexitined.
04-May-05 Power harrowed. Drilled, Hudson, tr. Thiram + Methiocarb +
fludioxonil + metalaxyl M, at 10.2 seeds/m² with the
Nodet drill.
14-May-05 34.5% N at 290 kg.
08-Jun-05 tm)Gesaprim at 3.0 l in 220 l.
tm)Phase 2 at 3.0 l in 220 l.
22-Sep-05 Cut sampled and weighted.

W. wheat, 1st test crop (W)

12-Oct-04 Ploughed 35 cm wide furrows.
13-Oct-04 Triple superphosphate at 127 kg.
Muriate of potash (corrective K) at 420 kg K₂O to plot 1,
360 kg to 2, 460 kg to 5 and 350 kg to 6.
26-Oct-04 Power harrowed. Drilled Hereward, tr. Sibutol Secur, at 375
seeds/m² with the Accord drill. Rolled.
16-Mar-05 Potassium sulphate at 140 kg
24-Mar-05 1st N (27% N) applied to split N sub-plots.
14-Apr-05 27% N to single application plots
07-May-05 2nd N (27% N) applied to split N sub-plots.
15-May-05 tm)Starane 2 at 0.5 l in 200 l.
tm)Amistar Opti at 1.5 L in 200 l.
tm)Opus at 0.75 l in 200 l.
09-Jun-05 Opus at 0.5 l in 200 l.
03-Sep-05 Combine harvested plots for yield. Straw swathed.
04-Sep-05 Combine harvested discards. Straw swathed.
08-Sep-05 Straw baled and removed.

W. rye, 2nd test crop and 1st treatment crop (**ROTATION** ABe and AM)

16-Sep-04 Chalk at 5.0 t, (not to ROTATION ABe and AM plots).
01-Oct-04 Glyphosate 360 @ 4.0 l in 200 l.
12-Oct-04 Ploughed 35 cm wide furrows.
13-Oct-04 Triple superphosphate at 127 kg.
27-Oct-04 Power harrowed. Drilled, Protector, tr. Beret Gold, at 300
seeds/m² with the Accord drill. Rolled.
16-Mar-05 Potassium sulphate at 140 kg
18-Apr-05 27% N to 2nd test crop only.
14 May-05 34.5% N at 232 kg to 1st treatment crops.
09-Jun-05 Opus at 0.5 l in 200 l.
03-Sep-05 Combine harvested plots for yield. Straw swathed.
04-Sep-05 Combine harvested discards. Straw swathed.
88-Sep-05 Straw baled and removed.

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LEYS

1ST CUT (12/7/05) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	5.21	4.80	5.01
LC2	5.01	3.97	4.49
LC3	3.63	3.87	3.75
LN1	6.94	5.81	6.37
LN2	5.12	5.11	5.12
LN3	4.93	4.93	4.93
LLC1	3.63	4.21	3.92
LLC2	4.40	4.15	4.28
LLC3	4.34	4.04	4.19
LLC4	3.67	2.50	3.08
LLC5	3.40	2.73	3.07
LLC6	5.52	4.79	5.15
LLC7	3.53	3.78	3.65
LLC8	2.37	3.08	2.72
LLN1	6.34	5.25	5.79
LLN2	5.58	5.40	5.49
LLN3	5.07	5.08	5.08
LLN4	4.86	5.11	4.98
LLN5	5.16	5.60	5.38
LLN6	4.47	4.14	4.31
LLN7	5.21	5.58	5.40
LLN8	3.83	4.10	3.97
Mean	4.65	4.46	4.55

1ST CUT MEAN DM% 40.6

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LEYS

2ND CUT (20/12/05) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	0.00	0.00	0.00
LC2	0.53	1.01	0.77
LN1	1.28	1.28	1.28
LN2	1.28	1.18	1.23
LLC1	0.00	0.00	0.00
LLC2	0.89	0.65	0.77
LLC3	0.18	0.10	0.14
LLC4	0.05	0.30	0.17
LLC5	0.15	0.11	0.13
LLC6	0.39	0.74	0.56
LLC7	1.32	0.69	1.00
LLN1	0.41	0.47	0.44
LLN2	1.60	1.86	1.73
LLN3	1.63	1.08	1.36
LLN4	0.80	0.76	0.78
LLN5	0.74	1.02	0.88
LLN6	0.88	0.92	0.90
LLN7	1.76	1.65	1.71
Mean	0.77	0.77	0.77

2ND CUT MEAN DM% 26.3

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LEYS

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	5.21	4.80	5.01
LC2	5.54	4.98	5.26
LC3	3.63	3.87	3.75
LN1	8.22	7.09	7.65
LN2	6.40	6.30	6.35
LN3	4.93	4.93	4.93
LLC1	3.63	4.21	3.92
LLC2	5.29	4.81	5.05
LLC3	4.53	4.14	4.33
LLC4	3.72	2.79	3.25
LLC5	3.55	2.84	3.20
LLC6	5.91	5.53	5.72
LLC7	4.85	4.47	4.66
LLC8	2.37	3.08	2.72
LLN1	6.75	5.72	6.23
LLN2	7.18	7.26	7.22
LLN3	6.70	6.16	6.43
LLN4	5.66	5.87	5.77
LLN5	5.90	6.61	6.26
LLN6	5.35	5.07	5.21
LLN7	6.97	7.24	7.10
LLN8	3.83	4.10	3.97
Mean	5.28	5.08	5.18

TOTAL OF 2 CUTS MEAN DM% 35.0

PLOT AREA HARVESTED 0.00200

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ARABLE TREATMENT CROPS

RYE

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
AM	2.47	2.72	2.60
ABe	2.65	2.66	2.65
Mean	2.56	2.69	2.63

GRAIN MEAN DM% 86.8

PLOT AREA HARVESTED 0.00413

MAIZE

WHOLE CROP (100% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
AM	17.14	15.31	16.23
ABe	17.85	14.33	16.09
Mean	17.50	14.82	16.16

GRAIN MEAN DM% 39.3

PLOT AREA HARVESTED 0.00108

W. BEANS

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
AM	2.37	3.11	2.74
ABe	1.02	1.90	1.46
Mean	1.70	2.51	2.10

GRAIN MEAN DM% 88.3

PLOT AREA HARVESTED 0.00413

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W. WHEAT

GRAIN TONNES/HECTARE

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

NSPLITFYM	Nsplit(noFYM)	Nsingle(FYM)	Mean		
ROTATION					
LLN 8	1.80	3.39	2.59		
LN 3	4.71	4.95	4.83		
LLC 8	4.84	4.95	4.89		
LC 3	4.84	4.52	4.68		
AM	3.59	3.71	3.65		
ABe	4.07	3.64	3.85		
Mean	3.97	4.19	4.08		
N	0	70	140	210	Mean
ROTATION					
LLN 8	1.54	2.33	2.79	3.72	2.59
LN 3	3.14	4.88	5.39	5.91	4.83
LLC 8	3.38	4.56	5.59	6.04	4.89
LC 3	2.65	4.71	5.25	6.10	4.68
AM	0.91	3.80	4.57	5.32	3.65
ABe	1.76	3.68	4.48	5.49	3.85
Mean	2.23	3.99	4.68	5.43	4.08
N	0	70	140	210	Mean
NSPLITFYM					
Nsplit(noFYM)	2.27	3.99	4.57	5.05	3.97
Nsingle(FYM)	2.19	3.99	4.78	5.81	4.19
Mean	2.23	3.99	4.68	5.43	4.08
N	0	70	140	210	
ROTATION					
LLN 8	Nsplit(noFYM)	1.07	1.92	1.59	2.61
	Nsingle(FYM)	2.00	2.74	3.99	4.84
LN 3	Nsplit(noFYM)	2.90	4.98	5.46	5.49
	Nsingle(FYM)	3.39	4.78	5.31	6.32
LLC 8	Nsplit(noFYM)	3.91	4.42	5.42	5.59
	Nsingle(FYM)	2.85	4.71	5.75	6.50
LC 3	Nsplit(noFYM)	3.01	4.77	5.41	6.15
	Nsingle(FYM)	2.30	4.65	5.10	6.04
AM	Nsplit(noFYM)	0.94	3.66	4.70	5.05
	Nsingle(FYM)	0.88	3.94	4.43	5.58
ABe	Nsplit(noFYM)	1.80	4.21	4.87	5.39
	Nsingle(FYM)	1.73	3.15	4.09	5.59

GRAIN MEAN DM% 85.5

PLOT AREA HARVESTED 0.00169

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W. RYE

GRAIN TONNES/HECTARE

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

NSPLITFYM	NONE	FYM	Mean		
ROTATION					
LLN 8	3.84	4.13	3.99		
LN 3	4.61	4.26	4.44		
LLC 8	3.75	3.47	3.61		
LC 3	4.24	3.93	4.08		
AM	3.11	3.18	3.15		
ABe	3.14	3.10	3.12		
Mean	3.78	3.68	3.73		
N	0	40	80	120	Mean
ROTATION					
LLN 8	3.38	4.39	4.10	4.07	3.99
LN 3	3.77	4.12	4.84	5.02	4.44
LLC 8	2.37	3.35	3.83	4.89	3.61
LC 3	3.24	3.80	4.63	4.66	4.08
AM	1.35	2.52	3.91	4.81	3.15
ABe	1.36	2.81	4.04	4.27	3.12
Mean	2.58	3.50	4.22	4.62	3.73
N	0	40	80	120	Mean
NSPLITFYM					
NONE	2.46	3.54	4.32	4.81	3.78
FYM	2.70	3.45	4.13	4.43	3.68
Mean	2.58	3.50	4.22	4.62	3.73
ROTATION	N	0	40	80	120
NSPLITFYM					
LLN 8	NONE	2.81	4.18	3.87	4.49
	FYM	3.96	4.59	4.33	3.64
LN 3	NONE	3.66	4.41	5.49	4.90
	FYM	3.87	3.84	4.19	5.14
LLC 8	NONE	2.49	3.65	3.80	5.05
	FYM	2.25	3.05	3.85	4.73
LC 3	NONE	3.16	3.70	4.98	5.12
	FYM	3.33	3.89	4.27	4.21
AM	NONE	1.36	2.59	3.78	4.71
	FYM	1.34	2.44	4.04	4.90
ABe	NONE	1.27	2.73	3.98	4.58
	FYM	1.46	2.89	4.10	3.95

GRAIN MEAN DM% 86.8

PLOT AREA HARVESTED 0.00192