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Yields of the Field Experiments 2012

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W/RN/3 Ley Arable

Rothamsted Research

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12/W/RN/3

LEY/ARABLE

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

Sponsors: A. J. Macdonald

The 75th year, leys, w. beans, w. wheat, w. rye

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-11/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 1988 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

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

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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.

From 2007 plots previously in the 1st cycle of testing eight-year leys followed by two arable test crops (i.e. those plots which were changed to eight-year ley treatments in 1976 or 1977) changed to a three-year arable rotation followed by two arable test crops. Plots were "phased in" but joined the relevant point in the rotation. From 2008 the second cycle 8-yr grass and grass/clover leys changed to 3-yr grass or grass/clover leys respectively. They were phased in between 2008 and 2012.
LLN/AO (Previously 1st cycle, 8-yr grass ley) R, BE, O, W, R
LLC/ABe (Previously 1st cycle, 8-yr grass/clover ley) R, O, BE, W, R
LLC/LC3 (Previously 2nd cycle, 8-yr grass ley) Lc 1, Lc 2, Lc 3, W, R
LLN/LN3 (Previously 2nd cycle, 8-yr grass/clover ley) Ln 1, Ln 2, Ln 3, W, R

From 2009 W oats (O) replaced forage maize (M) in the AM and ABe rotations on block III and were phased in on blocks V, IV, II and I in subsequent years. The AM treatment was re-named AM/AO.

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
   LLC/LC3 not yet in phase
   LLN/LN3 not yet in phase
   LLN/AO not yet in phase
   LLC/ABe not yet in phase
   AM/AO
   ABe

1/ 2 plots:

2. **NSPLIT(FYM res)** Farmyard manure residues, last applied 1960s:
   Split N v single N dressing to wheat, tested 2001-5

   Nsplit (noFYM)
   Nsingle(FYM)

1/8 plots:

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3. **N** Nitrogen fertilizer as split dressings in spring 2012 (kg N) as 34.5% N:

0	0	
80	40 + 40	) to be applied
160	40 + 120	) late-February/early-March
240	40+ 200	) and mid-April

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

Whole plots:

1. **ROTATION** Rotations before first test crop:
   LLN8
   LN 3
   LLC 8
   LC 3
   LLC/LC3 not yet in phase
   LLN/LN3 not yet in phase
   LLN/AO not yet in phase
   LLC/ABe not yet in phase
   AM/AO
   ABe

1/ 2 plots:

2. **NSPLIT(FYM res)** Farmyard manure residues, last applied 1960s:
   Nsplit to wheat (no FYM)
   Nsingle to wheat (FYM)

   1/8 plots:

3. **N** Nitrogen fertilizer in spring 2009 (kg N) as 34.5%:
   0
   50
   100
   150

Treatments to leys:

FYM RES Farmyard manure residues:

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

NOTE: Corrective K dressings (kg K_2O ha^{-1}) as muriate of potash, applied where necessary to first test crop w. wheat and long-term leys in the wheat block, applied 2011 (actual date not recorded).

Continuous rotations	No FYM	FYM Res
Before wheat	Half plots	Half plots
Abe/Be	270	340
AO/O	200	270
LLn/AO	0	30
Ln/Ln	90	70
None to other plots.		

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Experimental Diary

Date		Application	Rate	Units
All				
18-Oct-11	a	Plough all plots at 14" except those remaining in grass.	-	
18-Oct-11	a	Ploughed - thrown east on 14" furrows. Grass plots not ploughed.	-	
01-Nov-11	a	Cambridge Rolled - block 1 only.	-	
23-Apr-12	a	Cut Paths	-	
22-May-12	a	Cut paths	-	
16-Jul-12	a	Cut paths	-	
Grass ley and clover/grass leys (first year leys)				
21-Oct-11	f	Applied Nitram - applied to plots 11,12 and 13,14 only - new grass plots.	50	kg N/ha
21-Oct-11	f	Applied Nitram - applied to plots 3,4 and 7,8 only - new grass plots	25	kg N/ha
21-Oct-11	f	Applied Triple Super Phosphate - applied to 1st year leys plots 3,4,7,8,11,12,13,14	213	kg/ha
21-Oct-11	f	Applied Potassium Sulphate - applied to first year leys plots 3,4,7,8,11,12,13,14	140	kg/ha
01-Nov-11	s	Drilled Grass plots - Ln1 plots only, plots 11, 12, 13 and 14.	30	kg/ha
01-Nov-11	s	Drilled Grass plots - Lc1 plots only; plots 3, 4, 7 and 8.	30	kg/ha
24-Nov-11	a	Cut and weighed grass for yield (Yield cut 2 in 2011)	-	
30-Nov-11	a	Cut and removed grass (yield cut 2 in 2011)	-	
01-Dec-11	a	Topped a second time to tidy up.	-	
17-Jul-12	a	First cut - cut and weighed grass plots for yield	-	
24-Jul-12	a	Grass areas topped	-	
25-Jul-12	a	Turned hay	-	
28-Jul-12	a	Rowed up hay	-	
28-Jul-12	a	Baled and Removed	-	
18-Aug-12	a	Sprayed Samurai - Ln3 & Lc3 plots	4	l/ha
05-Nov-12	a	Second cut - cut and weighed grass plots for yield	-	
Grass ley and clover/grass leys (second and third year leys)				
21-Oct-11	f	Applied Triple Super Phosphate to 2nd and 3rd year leys plots 23,24,25,26,29,30,31,32	213	kg/ha
21-Oct-11	f	Applied Potassium Sulphate to 2nd and 3rd year leys plots 23,24,25,26,29,30,31,32,55,59,57,58,56,60,51,62	140	kg/ha

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24-Nov-11	a	Cut and weighed grass for yield (yield cut 2 in 2011)	-	
30-Nov-11	a	Cut and removed grass (yield cut 2 in 2011)	-	
01-Dec-11	a	Topped a second time to tidy up.	-	
17-Jul-12	a	First cut - cut and weighed grass plots for yield	-	
24-Jul-12	a	Grass areas topped	-	
25-Jul-12	a	Turned hay	-	
28-Jul-12	a	Rowed up hay	-	
28-Jul-12	a	Baled and Removed	-	
18-Aug-12	p	Sprayed Samurai - Ln3, Lc3 plots only	4	l/ha
05-Nov-12	a	Second cut - cut and weighed grass plots for yield	-	
W Beans				
21-Oct-11	f	Applied Triple Super Phosphate in accordance with plan	127	kg/ha
26-Oct-11	s	Drill W Bean - Wizzard	25	seed/m^2
28-Nov-11	p	Sprayed Crawler	3.5	kg/ha
18-Aug-12	p	Sprayed Samurai	4	l/ha
03-Sep-12	a	Combined for yields	-	
11-Sep-12	a	Baled and Removed	-	
W Wheat				
21-Oct-11	f	Applied Muriate of Potash to plots 65, 66, 67, 68, 72, 73 and 74, as per plan	-	
21-Oct-11	f	Applied Triple Super Phosphate in accordance with plan	127	kg/ha
22-Oct-11	a	Cultivate using pigtail cultivator to 13cm to incorporate fertilisers	-	
26-Oct-11	s	Drill Wheat - Solstice @ 400 seeds/m2 (Solstice substituted the Glasgow, ok'd with AM)	-	
30-Dec-11	p	Sprayed Lexus class @ 200 lt/ha water volume.	60	g/ha
23-Apr-12	f	Applied 1st Nitrochalk 27%N according to plan	148	kg/ha
3-May-12	f	Applied remaining Nitrochalk 27%N by hand to blocks 5 according to plan.	-	
		N1 plots	148	kg/ha
		N2 plots	444	kg/ha
		N3 plots	740	kg/ha
17-May-12	p	spray fungicide T1 + herbicide; Thor @20g/ha + Ignite @1l/ha in 200l water	ha	g/ha
24-May-12	p	spray fungicides T2; Rubric @0.8l + Comet @0.5l + Rover @1l/ha in 200l water RN3 - wheat only	ha	l/ha
03-Sep-12	a	Combined for yields	-	
11-Sep-12	a	Baled and Removed	-	
W Rye				
21-Oct-11	a	Applied Chalk to plots 33 - 48.	174	
21-Oct-11	f	Applied Triple Super Phosphate	127	kg/ha

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26-Oct-11	s	Drill W.Rye - Humbolt	400	seed/m^2
01-Nov-11	s	Drilled Rye - Humbolt - Block 1 - plots 1, 2, 5, 6, 9, 10, 15 and 16.	400	seed/m^2
30-Dec-11	p	Sprayed Lexus class in 200 l/ha of water	60	g/ha
23-May-12	a	Nitrochalk 27%N applied by hand to block 3	-	
		N1 plots	180	kg/ha
		N2 plots	364	kg/ha
		N3 plots	545	kg/ha
03-Sep-12	a	Combined for yields	-	
11-Sep-12	a	Baled and Removed	-	
W Oats				
21-Oct-11	f	Applied Triple Super Phosphate in accordance with plan	127	kg/ha
28-Oct-11	s	Drilled oat plots with Mascani @400seeds/m2	400	seed/m^2
30-Dec-11	p	Sprayed Lexus class in 200 l/ha of water	60	g/ha
03-Sep-12	a	Combined for yields	-	
11-Sep-12	a	Baled and Removed	-	

NOTE: Herbage and grain samples taken for chemical analyses

LEYS

1ST CUT (17 /6/12) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	4.89	4.67	4.78
LC2	3.25	3.68	3.46
LC3	5.89	6.80	6.35
LN1	3.17	3.48	3.32
LN2	3.96	3.80	3.88
LN3	4.04	4.06	4.05
(LLC/LC) LC1	5.57	4.30	4.93
(LLC/LC) LC2	4.73	4.23	4.48
(LLC/LC) LC3	5.73	5.05	5.39
(LLN/LN) LN1	4.96	6.25	5.60
(LLN/LN) LN2	4.39	3.29	3.84
(LLN/LN) LN3	3.86	4.78	4.32
Mean	4.54	4.53	4.53

1ST CUT MEAN DM% 31.2

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12/W/RN/3

LEYS 2ND CUT (05/11/12) DRY MATTER TONNES/HECTARE

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

FYM_RES LEY	NONE	FYM	Mean
LC1	0.22	0.40	0.31
LC2	0.42	0.68	0.55
LC3	0.00	0.00	0.00
LN1	0.55	0.61	0.58
LN2	0.36	0.28	0.32
LN3	0.00	0.00	0.00
(LLC/LC) LC1	0.25	0.20	0.22
(LLC/LC) LC2	1.05	1.01	1.03
(LLC/LC) LC3	0.00	0.00	0.00
(LLN/LN) LN1	1.10	1.56	1.33
(LLN/LN) LN2	0.60	0.19	0.40
(LLN/LN) LN3	0.00	0.00	0.00
Mean	0.38	0.41	0.40

2ND CUT MEAN DM% 33.4

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FYM_RES LEY	NONE	FYM	Mean
LC1	5.11	5.07	5.09
LC2	3.67	4.35	4.01
LC3	5.89	6.80	6.35
LN1	3.72	4.08	3.90
LN2	4.32	4.09	4.20
LN3	4.04	4.06	4.05
(LLC/LC) LC1	5.82	4.49	5.15
(LLC/LC) LC2	5.78	5.24	5.51
(LLC/LC) LC3	5.73	5.05	5.39
(LLN/LN) LN1	6.05	7.81	6.93
(LLN/LN) LN2	5.00	3.49	4.24
(LLN/LN) LN3	3.86	4.78	4.32
Mean	4.92	4.94	4.93

TOTAL OF 2 CUTS MEAN DM% 32.2

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12/W/RN/3

W. WHEAT (1ST TEST CROP)

Grain tonnes/hectare

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

FYMRES	none	FYM	Mean
ROTATION			
(AO)W	5.73	6.88	6.31
(ABe)W	7.02	7.31	7.16
(LLn/AO)W	6.92	7.03	6.97
(LLc/ABe)W	8.28	8.91	8.60
(Ln)W	7.16	7.05	7.10
(LLN/Ln)W	7.13	7.24	7.19
(Lc)W	8.18	8.04	8.11
(LLc/Lc)W	8.46	8.37	8.42
Mean	7.36	7.60	7.48

N	0	80	160	240	Mean
ROTATION					
(AO)W	4.40	6.04	7.52	7.27	6.31
(ABe)W	3.92	6.57	8.73	9.44	7.16
(LLn/AO)W	3.45	7.45	8.20	8.79	6.97
(LLc/ABe)W	5.28	9.18	10.13	9.80	8.60
(Ln)W	4.39	7.52	8.38	8.13	7.10
(LLN/Ln)W	4.20	7.75	8.46	8.33	7.19
(LC)W	7.28	7.72	8.08	9.37	8.11
(LLc/Lc)W	6.61	9.17	8.91	8.98	8.42
Mean	4.94	7.68	8.55	8.76	7.48

N	0	80	160	240	Mean
FYMRES					
none	4.52	7.79	8.50	8.62	7.36
FYM	5.36	7.56	8.60	8.90	7.60
Mean	4.94	7.68	8.55	8.76	7.48

	N	0	80	160	240
ROTATION	**FYMRES**				
(AO)W	none	2.27	6.63	7.07	6.97
	FYM	6.53	5.46	7.97	7.57
(ABe)W	none	3.82	6.07	8.27	9.90
	FYM	4.01	7.07	9.19	8.97
(LLn/AO)W	none	3.19	7.10	8.40	8.98
	FYM	3.70	7.81	8.00	8.61
(LLc/ABe)W	none	4.72	8.99	10.03	9.38
	FYM	5.83	9.38	10.23	10.21
(Ln)W	none	4.66	7.41	8.57	8.00
	FYM	4.12	7.62	8.19	8.25
(LLN/Ln)W	none	4.17	7.87	7.95	8.52
	FYM	4.22	7.64	8.97	8.15
(Lc)W	none	7.29	8.93	7.93	8.56
	FYM	7.27	6.51	8.22	10.18
(LLc/Lc)W	none	6.01	9.36	9.78	8.70
	FYM	7.21	8.98	8.03	9.25

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12/W/RN/3

W.WHEAT - GRAIN MEAN DM% 85.3

PLOT AREA HARVESTED 0.00192

RYE EXTRA

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
(ABe)R	1.99	1.65	1.82
(AO)R	1.49	1.24	1.36
(LLn/AO)R	2.31	2.65	2.48
(LLc/ABe)R	2.99	2.55	2.77
Mean	2.19	2.02	2.11

GRAIN MEAN DM% 81.8

PLOT AREA HARVESTED 0.00413

W. RYE (2ND TEST CROP)

12/W/RN/3 W. RYE

Grain tonnes/hectare

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

FYMRES	none	FYM	Mean
ROTATION			
(AO)R	2.37	2.74	2.55
(ABe)R	2.37	2.91	2.64
(LLn/AO)R	2.83	2.96	2.89
(LLc/ABe)R	3.07	2.67	2.87
(Ln)R	3.38	2.97	3.17
(LLn/Ln)R	3.27	3.44	3.36
(Lc)R	3.33	3.45	3.39
(LLc/Lc)R	3.17	3.07	3.12
Mean	2.98	3.03	3.00

N	0	50	100	150	Mean
ROTATION					
(AO)R	2.03	2.55	2.76	2.88	2.55
(ABe)R	2.02	2.65	3.01	2.89	2.64
(LLn/AO)R	2.19	3.12	2.93	3.33	2.89
(LLc/ABe)R	2.37	3.06	3.00	3.06	2.87
(Ln)R	3.36	3.07	3.31	2.96	3.17
(LLn/Ln)R	3.21	3.63	3.18	3.41	3.36
(Lc)R	3.52	3.16	3.76	3.12	3.39
(LLc/Lc)R	3.13	3.06	3.18	3.11	3.12
Mean	2.73	3.04	3.14	3.09	3.00

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12/W/RN/3

N	0	50	100	150	Mean
FYMRES					
none	2.59	3.08	3.16	3.07	2.98
FYM	2.87	2.99	3.12	3.12	3.03
Mean	2.73	3.04	3.14	3.09	3.00

	N	0	50	100	150
ROTATION	**FYMRES**				
(AO)R	none	1.71	2.35	2.58	2.85
	FYM	2.35	2.74	2.95	2.90
(ABe)R	none	1.73	2.31	2.73	2.73
	FYM	2.32	2.99	3.29	3.04
(LLn/AO)R	none	1.98	3.00	2.99	3.34
	FYM	2.40	3.24	2.87	3.32
(LLc/ABe)R	none	2.35	2.95	3.45	3.53
	FYM	2.39	3.16	2.54	2.59
(Ln)R	none	3.42	3.62	3.39	3.10
	FYM	3.30	2.51	3.23	2.82
(LLn/Ln)R	none	2.87	3.87	3.15	3.21
	FYM	3.55	3.40	3.22	3.61
(Lc)R	none	3.56	3.27	3.82	2.68
	FYM	3.48	3.05	3.69	3.56
(LLc/Lc)R	none	3.12	3.25	3.22	3.08
	FYM	3.15	2.86	3.15	3.13

GRAIN MEAN DM% 83.9 PLOT AREA HARVESTED 0.00192

BEANS

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
(AO)Be	*	*	*
(LLn/AO)Be	*	*	*
(LLc/ABe)Be	0.12	0.36	0.24
(ABe)Be	0.40	1.62	1.01
Mean	0.26	0.99	0.63

GRAIN MEAN DM% 80.2

PLOT AREA HARVESTED 0.00413

Note: Due to wet weather and severe weed infestation no yields were obtained for (AO)Be and (LLn/AO)Be treatment plots.

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12/W/RN/3

OATS

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
ABe	1.28	1.42	1.35
AO	2.36	2.07	2.21
LLc/ABe	1.71	1.73	1.72
LLn/AO	3.30	3.18	3.24
Mean	2.16	2.10	2.13

GRAIN MEAN DM% 82.9

PLOT AREA HARVESTED 0.00413

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