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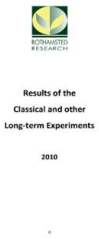
Yields of the Field Experiments 2010



Full Table of Content

W/RN/3 Ley Arable

Rothamsted Research

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10/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 73rd year, leys, w. beans, w. wheat, w. rye

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-09/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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10/W/RN/3

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).

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 will be 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.
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
   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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10/W/RN/3

3. **N** Nitrogen fertilizer as split dressings in spring 2009 (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 23 September 2009

Continuous rotations	No FYM	FYM Res
Before wheat	Half plots	Half plots
ABe	400	380
AM/AO	340	360
LLn/AO	140	90
None to other plots.		

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10/W/RN/3

Experimental Diary

Grass Ley and clover/grass ley (**ROTATION** LN1, LLN, LN1, LLC, LC1)

			Rate	Unit
23-Sep-09	f	Potassium Sulphate - 1st year leys in 2010	140.00	kg/ha
	f	TSP - 1st year leys in 2010	213.00	kg/ha
13-Oct-09	a	Plough - wheat, rye, oats and new ley plots		
14-Oct-09	a	Rotavate - Block 4		
20-Oct-09	s	Laura, fescue, promess timothy	30.00	kg/ha
15-Apr- 10	f	Nitram - Grass only, 200 lt water	217.00	kg/ha
23-Jun-10	a	Topped - paths		
24-Jun-10	a	Cut harvest strips, weighed and sampled - Ley plots		
26-Jun-10	a	Baled –Ley plots		
28-Jun-10	f	Nitram - Blocks 4&5 grass leys only	217.00	kg/ha
20-Jul-10	f	MOP - Ley plots on blocks 4 and 5	83.00	kg/ha

Grass leys and clover/grass leys (ROTATION LLN, Ln2-3, LLc, Lc2-3**)**

			Rate	Unit
19-Oct-09	a	Rotavate - blocks 2, 3, 5		
10-Apr-10	p	Duplosan KV - Grass only, 200 lt water	2.00	l/ha
15-Apr-10	f	Nitram - Grass only, 200 lt water	217.00	kg/ha
15-May-10	a	Harrowed - 2nd and 3rd year leys		
23-Jun-10	a	Topped - paths		
24-Jun-10	a	Cut harvest strips, weighed and sampled - Ley plots		
26-Jun-10	a	Baled – Ley-plots		
28-Jun-10	f	Nitram - Blocks 4&5 grass leys only	217.00	kg/ha
20-Jul-10	f	MOP - Ley plots on blocks 4 and 5	83.00	kg/ha
09-Aug-10	p	Glyphogan 360 - Leys on block 3, 200 lt water	4.00	l/ha

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10/W/RN/3

W. Beans (ROTATION)

			Rate	Unit
23-Sep-09	a	Broadcast		
19-Oct-09	a	Rotavate - blocks 2, 3, 5		
10-Dec-09	p	Stomp 400 SC - 200 l/ha water	3.00	l/ha
27-Jan-10	s	Wizzard	40.00	s/m2
	a	Plough - Beans		
17-Mar-10	p	Skirmish - 200 lt water on Beans	1.00	l/ha
23-Jun-10	a	Topped - paths		

W. Wheat (1st TEST CROP)

			Rate	Unit
21-Sep-09	p	Nufosate Ace - 200 lt water Pre wheat leys desiccated - plots 03, 04, 07, 08, 11,12 ,13, 14	4.00	l/ha
	p	Nufosate Ace - 200 lt water	4.00	l/ha
23-Sep-09	f	MOP - Plots 1,2,5,6,9,10 (as plan indicates)		
	f	TSP - Arable areas	127.00	kg/ha
13-Oct-09	a	Plough - wheat, rye, oats and new ley plots		
14-Oct-09	s	Drilled Glasgow - At 350 seeds per m2		
	a	Rotavate - Block 1		
10-Apr-10	p	Ally Max SX - Winter wheat, 200 lt water	42.00	g/ha
18-Apr-10	f	Nitrochalk - N1 plots	145.00	kg/ha
	f	Nitrochalk - N2 plots	436.00	kg/ha
	f	Nitrochalk - N3 plots	727.00	kg/ha
02-Jun-10	p	Opus - 200 lt water	0.60	l/ha
23-Jun-10	a	Topped - paths		
09-Aug-10	p	Glyphogan 360 - wheat on block 1, 200 lt water	4.00	l/ha
05-Sep-10	a	Combine harvest, plots for yield		
	a	Cut harvest strips, weighed and sampled		
	a	Swath straw		

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10/W/RN/3

W. Rye (2ND TEST CROP AND ROTATION)

			Rate	Unit
23-Sep-09	f	TSP - Arable areas	127.00	kg/ha
12-Oct-09	f	Limestone - block 2	5.00	t/ha
13-Oct-09	a	Plough - wheat, rye, oats and new ley plots		
14-Oct-09	a	Rotavate - Block 4		
19-Oct-09	a	Rotavate - blocks 2, 3, 5		
20-Oct-09	s	Drilled Protector - at 325 seeds per m2		
15-Apr-10	f	Nitram - Rye and Oats	290.00	kg/ha
26-Apr-10	f	Nitrochalk - Rye, N1 plots	182.00	kg/ha
	f	Nitrochalk - Rye, N2 plots	364.00	kg/ha
	f	Nitrochalk - Rye, N3 plots	545.00	kg/ha
02-Jun-10	p	Opus - 200 lt water	0.60	l/ha
23-Jun-10	a	Topped - paths		
06-Sep-10	a	Swath straw - rye and oats		
	a	Cut harvest strips, weighed and sampled - rye and oats		
09-Sep-10	a	Combine harvest, plots for yield		
21-Sep-10	a	Baled - and removed		

W. Oats (ROTATION)

			Rate	Unit
23-Sep-09	f	TSP - Arable areas	127.00	kg/ha
13-Oct-09	a	Plough - wheat, rye, oats and new ley plots		
19-Oct-09	a	Rotavate - blocks 2, 3, 5		
20-Oct-09	s	Drilled Gerald - at 325 seeds per m2		
11-Dec-09	p	Lexus Class on oats - 200 lt water	60.00	g/ha
15-Apr-10	f	Nitram - Grass only, 200 lt water	217.00	kg/ha
	f	Nitram - Rye and Oats	290.00	kg/ha
23-Jun-10	a	Topped - paths		
24-Jun-10	a	Cut harvest strips, weighed and sampled - Ley plots		
28-Jun-10	f	Nitram - Blocks 4&5 grass leys only	217.00	kg/ha
20-Jul-10	f	MOP - Ley plots on blocks 4 and 5	83.00	kg/ha
06-Sep-10	a	Cut harvest strips, weighed and sampled - rye and oats		
	a	Swath straw - rye and oats		
09-Sep-10	a	Combine harvest, plots for yield		
21-Sep-10	a	Baled - and removed		

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10/W/RN/3

LEYS

1st AND ONLY CUT (24/06/10) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	3.10	2.98	3.04
LC2	5.32	3.85	4.58
LC3	6.39	5.48	5.94
LN1	4.78	3.90	4.34
LN2	4.27	4.47	4.37
LN3	4.77	4.08	4.42
(LLC/LC) LC1	2.65	2.93	2.79
(LLC/LC) LC2	5.33	5.17	5.25
(LLC/LC) LC3	4.02	4.82	4.42
(LLC/LC) LN1	5.20	5.73	5.47
(LLC/LC) LN2	5.27	4.67	4.97
(LLC/LC) LN3	4.93	5.56	5.25
MEAN	4.67	4.47	

1ST CUT MEAN DM%	30.8	
1ST CUT Units AREA HARVESTED		0.00200

10/W/RN/3

ARABLE TREATMENT CROPS
10/W/RN/3

BEANS

GRAIN TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
AO (Be)	2.29	3.23	2.76
(LLn/AO) Be	4.07	3.65	3.86
(LLc/ABe) Be	2.50	1.67	2.09
(ABe) Be	1.45	2.58	2.02
MEAN	2.58	2.78	

Grain mean DM%	81.7
Plot area harvested	0.00393

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OATS

GRAIN TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
ABe	6.86	5.74	6.30
AO	2.77	2.96	2.87
LLc/ABe	7.01	7.19	7.10
LLn/AO	4.38	4.14	4.26
Mean	5.25	5.01	5.13

Grain mean DM%	86.7
Plot area harvested	0.00393

RYE

GRAIN TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
ABe	5.04	4.64	4.84
AO	4.99	5.26	5.12
LLn/AO	5.34	6.03	5.69
LLc/ABe	4.61	4.41	4.51
MEAN	4.99	5.08	5.04

Grain mean DM%	86.8
Plot area harvested	0.00393

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10/W/RN/3

W.WHEAT (1st TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES	None	FYM	Mean
ROTATION			
LLn/Ln	2.93	3.71	3.32
Ln	3.86	3.90	3.88
LLc/ABe	6.15	5.51	5.83
Lc	4.92	4.68	4.80
AM/AO	4.12	3.56	3.84
ABe	4.46	3.73	4.10
LLn/AO	4.05	4.42	4.23
LLc/Lc	5.24	4.49	4.86
MEAN	4.47	4.25	4.36

N	0	80	160	240
ROTATION				
LLn/Ln	2.58	3.35	4.54	2.81
Ln	2.85	3.74	4.75	4.18
LLc/ABe	3.22	5.67	6.77	7.68
Lc	3.90	4.89	5.20	5.21
AM/AO	1.52	4.18	4.74	4.90
ABe	1.98	4.17	4.70	5.55
LLn/AO	2.60	4.32	4.91	5.09
LLc/Lc	3.58	4.95	5.85	5.07
MEAN	2.78	4.41	5.18	5.06

N	0	80	160	240
FYMRES				
None	2.92	4.52	5.17	5.26
FYM	2.63	4.30	5.20	4.87

N		0	80	160	240
FYMRES					
ROTATION					
LLn/Ln	none	2.38	3.18	2.91	3.25
	FYM	2.77	3.52	6.18	2.38
Ln	none	2.93	3.62	4.88	4.03
	FYM	2.77	3.87	4.63	4.34
LLc/ABe	none	3.16	6.23	7.05	8.17
	FYM	3.27	5.11	6.48	7.19
Lc	none	3.73	5.18	5.39	5.38
	FYM	4.07	4.59	5.01	5.03
AM/AO	none	1.79	4.55	5.00	5.13
	FYM	1.26	3.82	4.49	4.68
ABe	none	2.52	4.48	4.93	5.90
	FYM	1.43	3.85	4.46	5.19
LLn/AO	none	2.59	3.94	4.88	4.77
	FYM	2.61	4.70	4.94	5.41
LLc/Lc	none	4.26	4.95	6.33	5.44
	FYM	2.90	4.96	5.38	4.70

Plot area harvested	0.00192
Grain mean DM%	87.6

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10/W/RN/3

RYE (2nd TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES	none	FYM	MEAN
ROTATION			
LLn	3.57	3.60	3.58
Ln	3.74	3.55	3.65
LLc	4.03	4.00	4.02
Lc	3.67	3.60	3.63
AM/AO	3.31	3.62	3.46
ABe	3.18	2.95	3.07
LLn/AO	4.41	4.78	4.59
LLc/ABe	3.82	3.71	3.77

N	0	50	100	150
ROTATION				
LLn	2.54	3.57	4.14	4.09
Ln	2.13	3.65	4.18	4.63
LLc	2.77	3.64	4.70	4.96
Lc	2.40	3.34	4.24	4.55
AM/AO	1.51	3.33	4.35	4.66
ABe	1.70	2.87	3.79	3.91
LLn/AO	2.81	4.20	5.69	5.67
LLc/ABe	2.43	3.44	4.57	4.62
MEAN	2.29	3.51	4.46	4.64

N	0	50	100	150	Mean
FYMRES					
none	2.29	3.50	4.44	4.63	3.72
FYM	2.28	3.51	4.47	4.64	3.73

N		0	50	100	150
ROTATION					
FYMRES					
LLn	none	2.63	3.47	3.98	4.20
	FYM	2.44	3.67	4.31	3.97
Ln	none	2.19	3.99	4.16	4.63
	FYM	2.07	3.31	4.20	4.63
LLc	none	2.87	3.47	4.56	5.23
	FYM	2.67	3.81	4.83	4.69
Lc	none	2.49	3.34	4.12	4.72
	FYM	2.32	3.35	4.36	4.38
AM/AO	none	1.41	3.11	4.32	4.33
	FYM	1.61	3.54	4.33	4.99
ABe	none	1.62	2.91	4.11	4.09
	FYM	1.78	2.82	3.47	3.73
LLn/AO	none	2.72	4.27	5.50	5.14
	FYM	2.90	4.13	5.88	6.21
LLc/ABe	none	2.40	3.46	4.74	4.70
	FYM	2.46	3.42	4.40	4.55

Plot area harvested	0.00183
Grain mean DM%	87.2

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