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Yields of the Field Experiments 2008

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Results of the
Classical and other
Long-term Experiments
2008

W/RN/3 Ley Arable

Rothamsted Research

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08/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 71st year, leys, w. beans, w. wheat, w. rye, forage maize

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-07/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).

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.

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

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:

LLN8

LN 3

LLC 8

LC 3

LLN/AO not yet in phase

LLC/ABe not yet in phase

AM

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:

3. N Nitrogen fertilizer as split dressings in spring 2008 (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

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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
- LLN/AO not yet in phase
- LLC/ABe not yet in phase
- AM
- 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 2008 (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 K₂O) as muriate of potash, applied where necessary to first test crop w. wheat and long-term leys in the wheat block, applied 14 October 2007.

Continuous rotations	No FYM	FYM Res
Before wheat	Half plots	Half plots
ABe	190	220
AM	220	210

None to other plots.

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Experimental Diary

Grass Ley and clover/grass ley (ROTATION LN1, LLN1, LC1 and LLC1)

			Rate	Unit
14-Oct-07	f	Triple Superphosphate plots 33, 34, 37, 38, & 41-44	213.00	kg/ha
	f	Sulphate of potash plots 33, 34, 37, 38, & 41-44	140.00	kg/ha
18-Oct-07	a	Plough plots for 1st year leys		
	a	Power harrowed plots for 1st year leys		
19-Oct-07	s	Laura fescue and Promesse timothy (50:50), Ln1 plots	30.00	kg/ha
	s	Laura fescue, Promesse timothy and Chieftain clover (44:44:12), Lc1 plots	30.00	kg/ha
20-Oct-07	a	Rolled wheat, rye, oat and new ley plots	1.00	
13-Dec-07	a	Ley plot 33/34 sprayed in error with Stomp		
15-Mar-08	f	Muriate of Potash plots 33, 34, 37, 38, 41- 44	167.00	kg/ha
18-Mar-08	f	Nitraprill plots 37, 38, 43, 44	217.00	kg/ha
25-Jun-08	a	Cut harvest strips, weighed and sampled ley plots		
	a	Mowed all grass discards		
26-Jun-08	a	Rowed up hay ley plots		
	a	Baled ley plots		
19-Nov-08	a	Cut harvest strips, weighed and sampled ley plots, 2nd cut		

Grass leys (ROTATION LN2-3 AND LLN2-8)

			Rate	Unit
14-Mar-08	f	Sulphate of Potash plots 3, 4, 7, 8, 11-14, 23-26, 29-32	140.00	kg/ha
15-Mar-08	f	Triple Superphosphate plots 3, 4, 7, 8, 11-14, 23-26, 29-32	213.00	kg/ha
	f	Muriate of Potash plots 3, 4, 7, 8, 11-14, 23-26, 29-32	167.00	kg/ha
18-Mar-08	f	Nitraprill plots 11-14, 25, 26, 31, 32	217.00	kg/ha
25-Jun-08	a	Cut harvest strips, weighed and sampled ley plots		
	a	Mowed all grass discards		
26-Jun-08	a	Rowed up hay ley plots		
	a	Baled ley plots		
27-Jun-08	p	Dow Agrosiences Glyphosate 360 grass plots 23, 24, 25, 26, 29, 30, 31, 32	4.00	l/200 l/ha
19-Nov-08	a	Cut harvest strips, weighed and sampled ley plots, 2nd cut		

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Clover/grass leys (ROTATION LC2-3 and LLC2-8)

			Rate	unit
14-Mar-08	f	Sulphate of Potash plots 3, 4, 7, 8, 11-14, 23-26, 29-32	140.00	kg/ha
15-Mar-08	f	Triple Superphosphate plots 3, 4, 7, 8, 11-14, 23-26, 29-32	213.00	kg/ha
	f	Muriate of Potash plots 3, 4, 7, 8, 11-14, 23-26, 29-32	167.00	kg/ha
25-Jun-08	a	Cut harvest strips, weighed and sampled ley plots		
	a	Mowed all grass discards		
26-Jun-08	a	Rowed up hay ley plots		
	a	Baled ley plots		
27-Jul-08	p	Dow Agrosiences Glyphosate 360 grass plots 23, 24, 25, 26, 29, 30, 31, 32	4.00	l/200 l/ha
19-Sep-08	a	Combine harvest discards all combinable crops, swath straw		
19-Nov-08	a	Cut harvest strips, weighed and sampled ley plots, 2 nd cut		

W. beans (ROTATION)

			Rate	Unit
02-Oct-07	p	Azural stubbles	4.00	l/200 l/ha
14-Oct-07	f	Triple Superphosphate plots 5, 6, 9, 10, 17, 18, 21, 22	127.00	kg/ha
31-Oct-07	a	Broadcast bean plots	1.00	
	s	Wizzard bean plots	21.00	seeds/m ²
	a	Plough bean plots, / NW	1.00	
	a	Power harrowed bean plots, to level	1.00	
16-Nov-07	p	Quaver Flo beans	2.00	l/220 l/ha
	p	Arelon 500 beans	2.00	l/220 l/ha
14-Mar-08	f	Sulphate of Potash plots 5, 6, 9, 10, 17, 18, 21, 22	150.00	kg/ha
19-May-08	p	Hallmark with Zeon Technology - bean plots	75.00	ml/220
	p	Folicur - bean plots	0.50	l/220 l/ha
	p	Bravo 500 - bean plots	1.00	l/220 l/ha
18-Sep-08	a	Combine harvest, plots for yield bean plots		
	a	Swath straw bean plots		
19-Sep-08	a	Combine harvest discards all combinable crops, swath straw		
21-Sep-08	a	Baled straw from all crops		

Forage maize (ROTATION)

			Rate	Unit
14-Oct-07	f	Triple Superphosphate plots 1, 2, 19, 20	127.00	kg/ha
18-Oct-07	a	Plough plots for maize		
	a	Power harrowed plots for maize		
14-Mar-08	f	Sulphate of Potash plots 1, 2, 19, 20	150.00	kg/ha
12-May-08	f	Nitraprill maize plots	290.00	kg/ha
14-May-08	a	Power harrowed maize plots	1.00	
	a	Nodet drilled maize plots	1.00	
	s	Hudson tr measurol maize plots	10.20	seeds/m ²
06-Jun-08	p	Samson - maize	1.50	l/200 l/ha
25-Jun-08	a	Hand sow gaps in maize rows, NE end.		

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25-Jun-08	s	Hudson tr measurolog gaps in maize rows, NE end.		
01-Jul-08	p	Callisto maize plots	1.00	l/220 l/ha
19-Sep-08	a	Combine harvest discards all combinable crops, swath straw		
21-Sep-08	a	Baled straw from all crops		
26-Sep-08	a	Cut harvest strips, weighed and sampled maize plots		
15-Oct-08	a	Mowed maize discards		
	a	Baled maize discards		

W. wheat (1st TEST CROP)

			Rate	Unit
02-Oct-07	p	Azural stubbles	4.00	l/200 l/ha
14-Oct-07	f	Muriate of Potash plot 53	190.00	Kg/ha
	f	Muriate of Potash plots 54, 64	220.00	kg/ha
	f	Muriate of Potash plot 63	210.00	kg/ha
	f	Triple Superphosphate plots 49 - 64	127.00	kg/ha
18-Oct-07	a	Plough plots for wheat		
	a	Power harrowed plots for wheat		
19-Oct-07	a	Accord Drilled		
	s	Glasgow tr redigo Twin wheat plots	350.00	seeds/m ²
20-Oct-07	a	Rolled wheat, rye, oat and new ley plots	1.00	
26-Nov-07	p	Avadex Excel 15G wheat block 4	15.00	kg/ha
13-Dec-07	p	Stomp 400 SC wheat block 4	3.30	l/200 l/ha
	p	Arelon 500 wheat block 4	1.00	l/200 l/ha
	p	Hallmark with Zeon Technology wheat block 4	50.00	ml/200 l/ha
11-Mar-08	f	Nitraprill wheat, N1, N2, N3 plots	116.00	kg/ha
14-Mar-08	f	Sulphate of Potash plots 49 - 64	150.00	kg/ha
01-May-08	f	Nitraprill N1 plots	116.00	kg/ha
	f	Nitraprill N2 plots	348.00	kg/ha
	f	Nitraprill N3 plots	580.00	kg/ha
02-May-08	p	Deuce wheat	1.00	l/200 l/ha
	p	Bravo 500 wheat	1.00	l/200 l/ha
	p	Flexity wheat	0.20	l/200 l/ha
	p	BASF 3C Chlormequat 720 wheat	2.00	l/200 l/ha
05-May-08	p	Manganese Sulphate 32% Premium wheat	5.00	kg/200 l/ha
	p	Activator 90 wheat	25.00	ml/200 l/ha
05-Jun-08	p	Amistar Opti - wheat plots	1.25	l/200 l/ha
	p	Opus - wheat plots	1.00	l/200 l/ha
	f	Manganese Sulphate - wheat plots	5.00	kg/200 l/ha
06-Aug-08	a	It has been noticed that the higher rate nitrogen wheat plots have become laid. Plot numbers affected: 491,511,521,523,524,562,564,583,591,592,601,603,604, 611,622,623,643,644. Plots with lesser damage: 494,501,504,512,531,542,553,574,581,612,613,614, 624,641.		
17-Sep-08	a	Combine harvest, plots for yield wheat plots		
	a	Swath straw wheat plots		
19-Sep-08	a	Combine harvest discards all combinable crops, swath straw		
21-Sep-08	a	Baled straw from all crops		

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W. rye (2nd TEST CROP AND ROTATION)

			Rate	Unit
02-Oct-07	p	Azural stubbles	4.00	l/200 l/ha
06-Oct-07	f	Chalk Block 5	5.00	t/ha
14-Oct-07	f	Triple Superphosphate plots 35, 36, 39, 40, 45 – 48, 65- 80	127.00	kg/ha
18-Oct-07	a	Plough plots for rye		
	a	Power harrowed plots for rye		
19-Oct-07	s	Drilled Matador recleaned rye plots	350.00	seeds/m ²
20-Oct-07	a	Rolled rye plots	1.00	
13-Dec-07	p	Stomp 400 SC rye plots	3.30	l/200 l/ha
14-Mar-08	f	Sulphate of Potash plots 35, 36, 39, 40, 45 – 48 and 65 - 80	150.00	kg/ha
02-May-08	p	Quantum SX rye plots	30.00	g/200 l/ha
06-May-08	f	Nitraprill N1, Rye Test Block	145.00	kg/ha
	f	Nitraprill N2, Rye Test Block	290.00	kg/ha
	f	Nitraprill N3, Rye Test Block	435.00	kg/ha
12-May-08	f	Nitraprill rye treatment plots	290.00	kg/ha
17-Sep-08	a	Combine harvest, plots for yield rye plots		
	a	Swath Straw rye plots		
19-Sep-08	a	Combine harvest discards all combinable crops, swath straw		
21-Sep-08	a	Baled straw from all crops		

W. Oats (ROTATION)

			Rate	Unit
02-Oct-07	p	Azural stubbles	4.00	l/200 l/ha
14-Oct-07	f	Triple Superphosphate plots 15, 16, 27, 28	127.00	kg/ha
18-Oct-07	a	Plough plots for oats		
18-Oct-07	a	Power harrowed plots for oats		
19-Oct-07	s	Drilled Gerald recleaned oat plots	350.00	seeds/m ²
20-Oct-07	a	Rolled oat plots	1.00	
19-Dec-07	p	Lexus Class oats	60.00	g/200 l/ha
	p	Hallmark with Zeon Technology oats	50.00	ml/200 l/ha
14-Mar-08	f	Sulphate of Potash plots 15, 16, 27, 28	150.00	kg/ha
02-May-08	p	Amistar oats	0.80	l/200 l/ha
	p	Opus, oats	0.50	l/200 l/ha
	p	Flexity oats	0.20	l/200 l/ha
	p	BASF 3C Chlormequat 720 oats	2.00	l/200 l/ha
05-May-08	p	Manganese Sulphate 32% Premium oats	5.00	kg/200 l/ha
	p	Activator 90 oats	25.00	ml/200 l/ha
12-May-08	f	Nitraprill oat plots	290.00	kg/ha
29-May-08	p	Ally Max SX - oats	42.00	g/200 l/ha
	f	Manganese Sulphate - oats	5.00	kg/200 l/ha
18-Sep-08	a	Combine harvest, plots for yield oat plots		
	a	Swath straw oat plots		
19-Sep-08	a	Combine harvest discards all combinable crops, swath straw		
21-Sep-08	a	Baled straw from all crops		

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LEYS

1st CUT (25/6/08) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	2.67	2.30	2.48
LC2	5.34	6.47	5.91
LC3	5.47	5.84	5.65
LN1	6.28	6.33	6.30
LN2	7.48	7.65	7.56
LN3	7.36	6.82	7.09
(LLC/LC) LC1	3.23	3.18	3.20
LLC7	5.94	5.96	5.95
LLC8	5.32	5.63	5.47
(LLN/LN) LN1	5.38	5.87	5.63
LLN7	7.69	6.60	7.15
LLN8	6.01	6.64	6.32
Mean	5.68	5.77	5.73

1ST CUT MEAN DM% 29.9

1ST CUT AREA HARVESTED 0.00200

2ND CUT (19/11/08) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	0.63	1.02	0.83
LC2	1.45	1.58	1.51
LC3	-	-	-
LN1	2.22	2.44	2.33
LN2	3.03	1.51	2.27
LN3	-	-	-
(LLC/LC) LC1	0.93	1.18	1.05
LLC7	1.65	2.41	2.03
LLC8	-	-	-
(LLN/LN) LN1	2.94	2.42	2.68
LLN7	3.26	3.12	3.19
Mean	2.01	1.96	1.99

2ND CUT MEAN DM% 20.4

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LEYS

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FYM_RES LEY	NONE	FYM	Mean
LC1	3.30	3.32	3.31
LC2	6.80	8.05	7.42
LC3	5.47	5.84	5.65
LN1	8.50	8.77	8.63
LN2	10.51	9.15	9.83
LN3	7.36	6.82	7.09
(LLC/LC) LC1	4.16	4.36	4.26
LLC7	7.59	8.37	7.98
LLC8	5.32	5.63	5.47
(LLN/LN) LN1	8.32	8.29	8.30
LLN7	10.95	9.72	10.34
LLN8	6.01	6.64	6.32
Mean	7.02	7.08	7.05

TOTAL OF 2 CUTS MEAN DM% 26.8

Note: No second cuts taken for LC3, LN3, LLC8 & LLN8.

ARABLE TREATMENT CROPS

MAIZE

WHOLE CROP (100% DRY MATTER) TONNES/HECTARE

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

FYMRRES ROTATION	NONE	FYM	Mean
AO	3.35	3.02	3.19
ABe	2.93	3.00	2.97
Mean	3.14	3.01	3.08

Grain mean DM% 26.9

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BEANS

GRAIN TONNES/HECTARE

****Tables of means ****

FYMRES ROTATION	None	FYM	Mean
AO	1.29	1.51	1.40
Lln/AO	1.20	1.75	1.48
LLc/ABe	1.40	1.77	1.59
ABe	1.21	0.79	1.00
Mean	1.28	1.45	1.37

Grain mean DM% 83.6

Plot area harvested 0.00413

OATS

GRAIN TONNES/HECTARE

**** Tables of means ****

FYMRES ROTATION	NONE	FYM	Mean
LLC/ABe	5.19	5.33	5.26
LLN/AO	5.59	6.15	5.87
Mean	5.39	5.74	5.56

Grain mean DM% 85.3

Plot area harvested 0.00413

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W.WHEAT (1st TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES		none	FYM	Mean	
ROTATION					
	LLN	4.65	5.19	4.92	
	LN	7.45	7.52	7.49	
	LLc/ABe	7.01	7.17	7.09	
	LC	1.62	6.69	4.16	
	AM	2.94	5.24	4.09	
	ABe	6.14	6.12	6.13	
	LLn/AO	5.51	2.66	4.09	
	LLc	7.60	7.70	7.65	
	Mean	5.37	6.04	5.70	
N	0	80	160	240	Mean
ROTATION					
	LLN	4.72	6.83	3.95	4.18
	LN	5.24	8.28	8.91	7.51
	LLc/ABe	5.50	7.89	7.68	7.28
	LC	4.24	5.76	5.37	1.26
	AM	1.51	5.34	3.68	5.84
	ABe	4.02	7.54	7.58	5.38
	LLn/AO	4.86	3.60	4.13	3.77
	LLc	5.97	8.24	8.57	7.82
	Mean	4.51	6.69	6.24	5.38
N	0	80	160	240	Mean
FYMRES					
	none	4.16	6.39	5.98	4.94
	FYM	4.85	6.99	6.49	5.82
	Mean	4.51	6.69	6.24	5.38
ROTATION	N	0	80	160	240
	FYMRES				
	LLN	none	3.86	6.56	3.90
		FYM	5.58	7.10	4.01
	LN	none	5.64	8.42	9.19
		FYM	4.84	8.15	8.63
	LLc/ABe	none	5.90	8.22	6.80
		FYM	5.09	7.56	8.55
	LC	none	2.54	2.41	2.92
		FYM	5.94	9.10	7.82
	AM	none	0.34	4.68	2.17
		FYM	2.67	6.01	5.20
	ABe	none	3.89	7.63	7.45
		FYM	4.15	7.45	7.71
	LLn/AO	none	4.91	5.26	6.80
		FYM	4.81	1.93	1.46
	LLc	none	6.23	7.90	8.60
		FYM	5.71	8.58	8.55

Grain mean DM% 81.6

Plot area harvested 0.00192

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RYE (TREATMENT CROP)

GRAIN TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
(ABe) R	4.31	4.69	4.50
(AO) R	3.79	3.71	3.75
(LLn/AO) R	4.69	4.96	4.83
(LLc/ABe) R	5.78	5.23	5.50
Mean	4.64	4.65	4.65
Grain mean DM%	81.2		
Plot area harvested	0.00413		

RYE (2nd TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean	
LLn	4.70	4.76	4.73	
Ln	4.74	4.64	4.69	
LLc	4.21	4.60	4.40	
Lc	4.54	5.11	4.82	
AM	3.54	3.68	3.61	
ABe	3.98	3.97	3.98	
LLn/AO	5.13	4.87	5.00	
LLc/ABe	4.35	4.77	4.56	
Mean	4.40	4.55	4.47	
N	0	50	100	150
ROTATION				
LLn	3.80	4.91	5.08	5.12
Ln	3.73	4.50	4.69	5.84
LLc	3.99	4.26	4.56	4.81
Lc	3.67	4.75	5.14	5.73
AM	2.05	4.00	4.14	4.25
ABe	2.63	3.82	5.13	4.33
LLn/AO	4.22	5.00	5.24	5.55
LLc/ABe	3.66	4.57	5.05	4.95
Mean	3.47	4.48	4.88	5.07

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RYE (2nd TEST CROP) Cont'd

N	0	50	100	150
FYMRES				
none	3.43	4.55	4.69	4.92
FYM	3.50	4.40	5.07	5.23

ROTATION	FYMRES		100	150	FYM			
	0	50			0	50	100	150
LLn	4.04	4.63	5.01	5.10	3.55	5.20	5.14	5.15
Ln	3.52	5.03	4.94	5.46	3.93	3.97	4.45	6.23
LLc	3.87	4.61	4.23	4.15	4.10	3.90	4.90	5.48
Lc	3.42	4.56	4.89	5.29	3.92	4.94	5.40	6.18
AM	2.06	4.10	3.92	4.07	2.04	3.91	4.36	4.43
ABe	2.73	4.11	4.61	4.47	2.53	3.52	5.65	4.19
LLn/AO	4.42	4.87	5.36	5.90	4.01	5.13	5.12	5.20
LLc/ABe	3.40	4.51	4.58	4.91	3.92	4.63	5.52	4.99

Plot area harvested 0.00192

Grain mean DM% 81.2