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Yields of the Field Experiments 2009

Full Table of Content

W/RN/3 Ley Arable

Rothamsted Research

Rothamsted Research (2010) *W/RN/3 Ley Arable ;* Yields Of The Field Experiments 2009, pp 34 - 46 **- DOI: https://doi.org/10.23637/ERADOC-1-219**

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09/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 72nd year, leys, w. beans, w. wheat, w. rye, forage maize

For previous years see 'Details' 1967 & 1973 and Yield Books for 74-08/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. 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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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 16 October 2008.

Continuous rotations	No FYM	FYM Res
Before wheat	Half plots	Half plots
ABe	370	400
AM	210	290
None to other plots.		

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09/W/RN/3

Experimental Diary

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

			Rate	Unit
16-Oct-08	a	Plough/ S, Rye plots		
	f	Sulphate of Potash - 1st year leys, plots 65, 66, 69, 70 and, 77-80.	140.00	kg/ha
	f	Triple Superphosphate- 1st year leys, plots 65, 66, 69, 70 and 77-80.	213.00	kg/ha
17-Oct-08	a	Power Harrowed		
18-Oct-08	a	Accord Drilled		
	s	Rothamsted Special Mix 1 (Laura 50%, Promesse Timothy 50%) Plots 65, 66, 69 and 70 Ley plots (seed bed N applied)	30.00	kg/ha
	s	Rothamsted Special Mix 2 (Avoca 12%, Laura 44%, Promesse Timothy 44%) Plots77, 78, 79 and 80 Ley with Clover plots (seed bed N applied)	30.00	kg/ha
	a	Rolled - wheat, rye, oat and ley plots		
13-Mar-09	f	Nitraprill - plots 65, 66, 69 and 70	217.00	kg/ha
16-Mar-09	f	Muriate of Potash - plots 65, 66, 69, 70, 77, 78, 79 and 80	167.00	kg/ha
24-Jun-09	a	Cut harvest strips, weighed and sampled		
	a	Mown - Leys harvested for yield		
28-Jun-09	a	Baled		
30-Jun-09	f	Muriate of Potash - Leys only, plots 65, 66,69, 70,77, 78, 79 and 80	83.00	kg/ha
	f	Nitram – plots 65, 66, 69 and 70	217.00	kg/ha
17-Jul-09	a	Topped Ley plots		
30-Oct-09	a	Cut harvest strips, weighed and sampled ley plots, 2nd cut		

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

			Rate	Unit
13-Mar-09	f	Nitraprill - plots 11, 12, 13, 14, 37, 38, 43 and 44	217.00	kg/ha
16-Mar-09	f	Muriate of Potash - plots 11, 12, 13, 14, 37, 38, 43 and 44	167.00	kg/ha
17-Mar-09	f	Triple Superphosphate - plots 11-14, 37, 38, 43 and 44	213.00	kg/ha
20-May-09	p	Duplosan KV Grass leys only	1.50	L in 200 l/ha
24-Jun-09	a	Cut harvest strips, weighed and sampled		
	a	Mown - Leys harvested for yield		
28-Jun-09	a	Baled		
17-Jul-09	a	Topped Ley plots		
13-Aug-09	p	Slingshot 200 lt water (Desiccated crop due to high population of grass weeds) plots 11, 12, 13 and 14	4.00	lt/ha
09-Sep-09	a	Cut harvest strips, weighed and sampled, block 1 ley plots only		
30-Oct-09	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
16-Mar-09	f	Muriate of Potash - plots 3, 4, 7, 8, 14, 33, 34, 41 and 42	167.00	kg/ha
17-Mar-09	f	Triple Superphosphate plots 3, 4, 7 and 8	213.00	kg/ha
24-Jun-09	a	Cut harvest strips, weighed and sampled		
	a	Mown - Leys harvested for yield		
28-Jun-09	a	Baled		
17-Jul-09	a	Topped Ley plots		
13-Aug-09	p	Slingshot 200 lt water (Desiccated crop due to high population of grass weeds) plots 3, 4, 7 and 8	4.00	lt/ha
09-Sep-09	a	Cut harvest strips, weighed and sampled Block 1 ley plots only		
30-Oct-10	a	Cut harvest strips, weighed and sampled ley plots, 2nd cut		

W. beans (**ROTATION)**

			Rate	Unit
08-Oct-08	p	Roundup Metro	4.00	l/200 l/ha
16-Oct-08	f	Triple Superphosphate - Arable crops, plots 1, 2, 15, 16, 35, 36, 39 and 40	127.00	kg/ha
14-Nov-08	a	Plough/ S, bean plots		
	a	Broadcast bean plots		
	s	Wizard	35.00	seeds/m2
18-Nov-08	a	Power Harrowed - bean plots		
08-Dec-08	p	Landgold Propyzamide 400 SC -winter beans	2.10	l/220 l/ha
	p	Stomp 400 SC - winter beans	3.30	l/220 l/ha
17-Mar-09	f	Potassium Sulphate	150.00	kg/ha
24-Aug-09	a	Combine harvest, plots for yield		
	a	Combine harvest discards		
26-Aug-09	a	Baled		
03-Sep-09	a	Remove bales		

Forage maize (**ROTATION**)

			Rate	Unit
16-Oct-08	f	Triple Superphosphate - plots 5 and 6	127.00	kg/ha
17-Mar-09	f	Potassium Sulphate	150.00	kg/ha
21-May-09	a	Rotavate		
	a	Drilled		
	s	Hudson	10.20	seeds/m2
30-May-09	f	Nitram	290.00	kg/ha
18-Jun-09	p	Callisto	0.75	l/ha
	p	Samson	0.50	l/ha
03-Sep-09	a	Hand Cut - maize plots		

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09/W/RN/3

W. wheat (1st TEST CROP)

			Rate	Unit
08-Oct-08	p	Roundup Metro	4.00	l/200 l/ha
16-Oct-08	a	Plough/ S, plots 17 - 32		
	f	Muriate of Potash - Corrective K to plot 17 (11.06 kg/plot)	370.00	kg/ha
	f	Muriate of Potash - Corrective K to plot 18 (11.96 kg/plot)	400.00	kg/ha
	f	Muriate of Potash - Corrective K to plot 19 (8.67 kg/plot)	290.00	kg/ha
	f	Muriate of Potash - Corrective K to plot 20 (6.28 kg/plot)	210.00	kg/ha
	f	Triple Superphosphate - Arable crops, plots 17-32	127.00	kg/ha
17-Oct-08	a	Power Harrowed		
18-Oct-08	a	Accord Drilled		
	s	Glasgow tr Redigo Deter - wheat plots 17-32	350.00	seeds/m2
	a	Rolled - wheat plots		
11-Dec-08	p	Avadex Excel 15G	15.00	kg/ha
17-Dec-08	p	Alpha Pendimethalin 330 EC	4.00	lt/ha
	p	Hallmark with Zeon Technology	50.00	ml/ha
	p	Headland Manganese 500	1.00	lt/ha
	f	Potasium Sulphate	150.0	kg/ha
21-Mar-09	f	Nitraprill – plots N1, N2 and N3	116.00	kg/ha
22-Apr-09	f	Nitro-chalk - N1 plots	145.00	kg/ha
	f	Nitro-chalk – N2 plots	436.00	kg/ha
	f	Nitro-chalk – N3 plots	727.00	kg/ha
10-May-09	p	Landgold Lambda-Z	75.00	L in 200 l/ha
03-Jun-09	p	Amistar - winter wheat	1.00	L in 200 l/ha
	p	Opus	0.80	L in 200 l/ha
11-Aug-09		The wheat on some plots was laid flat (probably by badgers or deer). Plots most affected were 321, 322, 323, 282, 284 and 204. The nil N plots are relatively unaffected		
24-Aug-09	a	Combine harvest, plots for yield		
	a	Combine harvest discards		
26-Aug-09	a	Baled		
03-Sep-09	a	Remove bales		

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09/W/RN/3

W. rye (2nd TEST CROP AND ROTATION)

			Rate	Unit
08-Oct-08	p	Roundup Metro	4.00	l/200 l/ha
16-Oct-08	a	Plough/ S, plots 49-64, 67, 68, 71-76		
	f	Chalk - Block 4	5.00	t/ha
	f	Triple Superphosphate - plots 49-64, 67, 68 71-76	127.00	kg/ha
17-Oct-08	a	Power Harrowed		
18-Oct-08	a	Accord Drilled		
	s	Organic Matador - Rye plots	350.00	seeds/m2
	a	Rolled		
17-Dec-08	p	Alpha Pendimethalin 330 EC -rye plots	3.30	lt/ha
	p	Hallmark with Zeon Technology - rye plots	50.00	ml/ha
	p	Headland Manganese 500 - rye plots	5.00	lt/ha
17-Mar-09	f	Potasium Sulphate – plots 49-64, 67, 68, 71-76	150.00	kg/ha
30-Apr-09	f	Nitram, plots 67-68, 71-76 (rotation crop)	290.00	kg/ha
05-May-09	f	Nitrochalk – N1, plots 49-64 (test crop)	182.00	kg/ha
	f	Nitrochalk – N2, plots 49-64 (test crop)	364.00	kg/ha
	f	Nitrochalk – N3, plots 49-64 (test crop)	545.00	kg/ha
03-Jun-09	p	Amistar - rye	0.40	L in 200 l/ha
	p	Opus - rye	0.40	L in 200 l/ha
24-Aug-09	a	Combine harvest, plots for yield		
	a	Combine harvest discards		
26-Aug-09	a	Baled		
03-Sep-09	a	Remove bales		

W. Oats (ROTATION)

			Rate	Unit
08-Oct-08	p	Roundup Metro	4.00	l/200 l/ha
16-Oct-08	a	Plough/ S, plots 9, 10, 45-48		
	f	Triple Superphosphate - plots 9, 10 and 45 - 48	127.00	kg/ha
17-Oct-08	a	Power Harrowed		
18-Oct-08	a	Accord Drilled -oat plots		
	s	Gerald tr Beret Gold - Oat Plots	350.00	seeds/m2
	a	Rolled		
19-Dec-08	p	Lexus Class	60.00	g/ha
	p	Landgold Lambda-Z	50.00	ml/ha
17-Mar-09	f	Potasium Sulphate	150.00	kg/ha
30-Apr-09	f	Nitram	290.00	kg/ha
03-Jun-09	p	Amistar	0.20	L in 200 l/ha
	p	Flexity	0.20	L in 200 l/ha
24-Aug-09	a	Combine harvest, plots for yield		
	a	Combine harvest discards		
26-Aug-09	a	Baled		
03-Sep-09	a	Remove bales		

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09/W/RN/3

LEYS

1st CUT (24/06/09) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYM	Mean
LEY			
LC1	2.63	2.49	2.56
LC2	4.89	4.08	4.48
LC3	5.31	5.59	5.45
LN1	2.19	2.28	2.23
LN2	5.84	6.44	6.14
LN3	3.26	3.32	3.29
(LLC/LC) LC1	2.53	2.59	2.56
(LLC/LC) LC2	3.07	3.34	3.20
LLC8	4.57	4.48	4.53
(LLN/LN) LN1	4.20	4.14	4.17
(LLN/LN) LN2	6.05	5.85	5.95
LLN8	4.35	4.97	4.66
Mean	4.07	4.13	4.10

1ST CUT MEAN DM% 33.3

1ST CUT AREA HARVESTED 0.00200

2ND CUT (30/10/09) DRY MATTER TONNES/HECTARE

FYM_RES	NONE	FYM	Mean
LEY			
LC1	0.00	0.00	0.00
LC2	0.00	0.00	0.00
LC3	0.71	0.87	0.79
LN1	0.00	0.00	0.00
LN2	0.00	0.00	0.00
LN3	1.01	0.89	0.95
(LLC/LC) LC1	0.00	0.00	0.00
(LLC/LC) LC2	0.00	0.00	0.00
LLC8	1.48	1.11	1.30
(LLN/LN) LN1	0.00	0.00	0.00
(LLN/LN) LN2	0.00	0.00	0.00
LLN8	1.76	2.11	1.93
Mean	0.41	0.41	0.41

2ND CUT MEAN DM% 32.7

2ND CUT AREA HARVESTED 0.00200

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09W/RN/3

LEYS

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FYM_RES LEY	NONE	FYM	Mean
LC1	2.63	2.49	2.56
LC2	4.89	4.08	4.48
LC3	6.03	6.46	6.24
LN1	2.19	2.28	2.23
LN2	5.84	6.44	6.14
LN3	4.28	4.22	4.25
(LLC/LC) LC1	2.53	2.59	2.56
(LLC/LC) LC2	3.07	3.34	3.20
LLC8	6.06	5.59	5.82
(LLN/LN) LN1	4.20	4.14	4.17
(LLN/LN) LN2	6.05	5.85	5.95
LLN8	6.11	7.08	6.59
Mean	4.49	4.54	4.52

TOTAL OF 2 CUTS MEAN DM% 32.9

ARABLE TREATMENT CROPS

MAIZE

WHOLE CROP (100% DRY MATTER) TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
AO	8.41	7.76	8.09

Mean DM% 22.9

Plot area harvested 0.00108

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09/W/RN/3

BEANS

GRAIN TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
AO	2.10	2.20	2.15
LLn/AO	3.68	3.90	3.79
LLc/ABe	2.16	1.11	1.63
ABe	0.54	0.46	0.50
Mean	2.12	1.92	2.02

Grain mean DM% 88.0

Plot area harvested 0.00413

OATS

GRAIN TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYM	Mean
ABe	5.86	6.64	6.25
LLc/ABe	7.01	6.70	6.86
LLn/AO	4.14	4.59	4.37
Mean	5.67	5.98	5.83

Plot area harvested 0.00413

Grain mean DM% 87.3

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09/W/RN/3

W.WHEAT (1st TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES	None	FYM	Mean
ROTATION			
LLN	4.36	3.33	3.85
LN	5.98	3.49	4.74
LLc/ABe	5.40	5.51	5.45
LC	5.27	6.35	5.81
AM	5.43	5.47	5.45
ABe	4.34	4.97	4.65
LLn/AO	4.87	6.61	5.74
LLc	7.21	5.58	6.39
Mean	5.36	5.16	5.26

N	0	80	160	240
ROTATION				
LLN	2.09	3.01	5.23	5.07
LN	2.98	5.06	5.57	5.35
LLc/ABe	3.01	7.13	5.57	6.11
LC	3.26	6.57	6.83	6.60
AM	1.43	5.72	7.75	6.90
ABe	1.91	5.47	6.28	4.96
LLn/AO	3.19	4.61	8.24	6.92
LLc	5.00	6.69	5.97	7.90
Mean	2.86	5.53	6.43	6.22

N	0	80	160	240
FYMRES	2.84	5.90	6.58	6.11
FYM	2.88	5.17	6.27	6.34

ROTATION	**N** / **FYMRES**	0	80	160	240
LLN	none	2.12	4.03	5.92	5.38
	FYM	2.06	1.99	4.54	4.75
LN	none	3.27	7.88	6.29	6.48
	FYM	2.69	*2.25	*4.84	*4.21
LLc/ABe	none	2.78	6.66	5.86	6.32
	FYM	3.24	7.61	5.27	5.90
LC	none	3.18	6.60	5.38	5.92
	FYM	3.33	6.53	8.27	7.27
AM	none	1.51	5.95	7.59	6.67
	FYM	1.35	5.48	7.91	7.12
ABe	none	1.99	5.68	6.35	3.35
	FYM	1.83	5.26	6.21	6.57
LLn/AO	none	3.11	*1.89	7.42	7.05
	FYM	3.27	7.34	9.06	6.78
LLc	none	4.75	8.51	7.85	7.73
	FYM	5.26	4.87	4.10	8.08

Plot area harvested 0.00192
Grain mean DM% 88.1

Note: No yields available for plots 204 and 282 because of pest damage. The shaded values shown were estimated by Genstat. Yields on plots 284,321,322 & 323 were also affected by pest damage (see values marked *).

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09/W/RN/3

RYE (2nd TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES	none	FYM	Mean
ROTATION			
LLn	4.49	4.98	4.74
Ln	4.63	4.19	4.41
LLc	4.86	4.58	4.72
Lc	4.62	4.86	4.74
AM	3.41	3.47	3.44
ABe	3.84	3.82	3.83
LLn/AO	4.65	4.55	4.60
LLc/ABe	4.28	4.27	4.27
Mean	4.35	4.34	4.34

N	0	50	100	150
ROTATION				
LLn	3.23	4.58	5.85	5.28
Ln	3.09	4.24	4.99	5.31
LLc	4.13	4.40	5.02	5.32
Lc	3.53	4.68	5.23	5.50
AM	2.13	3.19	4.05	4.39
ABe	2.33	3.69	4.61	4.67
LLn/AO	3.28	4.03	5.20	5.89
LLc/ABe	3.28	3.98	4.69	5.14
Mean	3.13	4.10	4.95	5.19

N	0	50	100	150
FYMRES				
none	3.13	4.17	4.90	5.19
FYM	3.12	4.03	5.01	5.18

	N	0	50	100	150
ROTATION	**FYMRES**				
LLn	none	2.99	4.27	5.41	5.30
	FYM	3.48	4.89	6.28	5.27
Ln	none	3.25	4.48	5.18	5.61
	FYM	2.94	4.00	4.80	5.01
LLc	none	4.32	4.33	5.20	5.59
	FYM	3.94	4.47	4.83	5.05
Lc	none	3.32	4.92	5.17	5.06
	FYM	3.75	4.45	5.30	5.94
AM	none	2.02	3.41	3.83	4.40
	FYM	2.23	2.98	4.28	4.39
ABe	none	2.35	3.79	4.53	4.67
	FYM	2.32	3.59	4.68	4.68
LLn/AO	none	3.26	4.29	5.21	5.83
	FYM	3.30	3.78	5.18	5.94
LLc/ABe	none	3.52	3.89	4.64	5.09
	FYM	3.03	4.08	4.75	5.20

Plot area harvested 0.00192

Grain mean DM% 86.6

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09/W/RN/3

RYE

GRAIN TONNES/HECTARE

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

FYMRES	NONE	FYM	Mean
ROTATION			
ABe	4.55	4.46	4.50
AM	4.50	4.97	4.74
LLn/AO	4.89	5.13	5.01
LLc/ABe	4.90	5.04	4.97
Mean	4.71	4.90	4.81

GRAIN MEAN DM% 86.6

PLOT AREA HARVESTED 0.00413

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