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Yields of the Field Experiments 1983

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83/R/RN/1 and 83/R/RN/2 Ley Arable - Old Grass, Leys, Sugar Beet, W. Wheat

Rothamsted Research

Rothamsted Research (1984) *83/R/RN/1 and 83/R/RN/2 Ley Arable - Old Grass, Leys, Sugar Beet, W. Wheat* ; Yields Of The Field Experiments 1983, pp 46 - 60 - DOI:
<https://doi.org/10.23637/ERADOC-1-44>

83/R/RN/1 and 83/R/RN/2

LEY ARABLE

Object: To study the effects of three-year leys on the fertility of the soil as measured by a sequence of three arable test crops. From 1968, continuous w. wheat was grown on some blocks after the three test crops to study the build-up and decline of take-all (*Gaeumannomyces graminis*) after the different cropping sequences. From 1977 new crop sequences were introduced on these blocks - Highfield and Fosters.

Sponsors: A.E. Johnston, D.B. Slope.

The 35th year, old grass, leys, sugar beet, w. wheat.

For previous years see 'Details' 1967 and 1973 and 74-82/R/RN/1 and 2.

The experiment is duplicated on:-

HIGHFIELD A site with much organic matter initially (ploughed out from permanent grass) (83/R/RN/1)

FOSTERS A site with little organic matter initially (83/R/RN/2)

ROTATION Treatments: The experiment originally tested four six-course rotations, with all phases present each year. For many years these rotations were:-

	Treatment crops	Test crops
LUCERNE	LU, LU, LU	W, P, B
CLOGRA	LC, LC, LC	W, P, B
GRASS	LN, LN, LN	W, P, B
ARABLE	H, SB, O	W, P, B

LU = lucerne, LC = clover-grass ley, no nitrogen fertilizer,
LN = all-grass ley with nitrogen fertilizer, H = 1-year seeds hay,
SB = sugar beet, O = s. oats, W = w. wheat, P = potatoes, B = s. barley.

From 1968 the order of test crops was changed to P, W, B except for those phases that had already started the sequence W, P, B.

From 1975 the s. barley test crop was changed to w. wheat.

RESEEDED On both fields in the first three years other plots were sown with long-term reseeded grass

OLDGRASS On Highfield plots of the old turf were left initially unploughed, for comparison with the three-year leys

In 1962 and 1963 some of the old and reseeded grass plots were divided for management identical to:-

C	Clover-grass ley
N	All-grass ley

From 1963 (reseeded) and 1968 (old grass) some grass plots were ploughed and cropped with the same test crops as above, thereafter these plots followed the ARABLE rotation. In 1973 some of these plots were returned to reseeded grass.

83/R/RN/1 and 83/R/RN/2

From 1968 only two phases on each field continued in the original six-course rotation (the museum blocks). The four other phases (the new sequence blocks) were sown to w. wheat every year at the end of the test-crop cycle. In 1977, 1978, 1979 and 1980 one phase, fallowed in the previous year started new sequences of treatment cropping:

SEQUENCE		Treatment crops	Test crops
LUCERNE	(previously LUCERNE)	LU, LU, LU	W, W, W, W
CLOGRA	(previously CLOGRA)	LC, LC, LC	W, W, W, W
GRASS/G	(previously GRASS)	R, R, R	W, W, W, W
ARABLE/A	(previously ARABLE)	O, P, BE	W, W, W, W
ARABLE/R	(previously RESEEDED)	B, B, W	W, W, W, W
GRASS/OG	(previously OLDGRASS)	R, R, R	W, W, W, W

R = ryegrass, BE = s. beans. Other symbols as above. All ploughed at the end of the treatment crop cycle except GRASS/OG - direct drilled to 1st and 2nd w. wheats, ploughed thereafter. Treatment crop cycles started after nine previous cereals followed by one fallow.

Additional treatments to 2nd test crop w. wheat in the museum blocks:-

Sub plots

FYMRES70 Farmyard manure residues, last applied 1970:

NONE None
FYM 30 tonnes on each occasion

Sub plots

N Nitrogen fertilizer in 1983 (kg N) as 'Nitro-Chalk':

0
50
100
150

Additional treatments to 1st, 2nd, 3rd and 4th test crops w. wheat in the new sequence blocks:

Sub plots

N Nitrogen fertilizer in 1983 (kg N) as 'Nitro-Chalk':

0
50
100
150

83/R/RN/1 and 83/R/RN/2

Standard applications:

Museum blocks:

2nd Treatment crops:

Lucerne: Manures: (0:18:36) at 620 kg.

All-grass ley: Manures: (0:18:36) at 420 kg. (25:0:16) at 300 kg in spring and after each cut except the last.

Clover-grass ley: Manures: (0:18:36) at 420 kg. (25:0:16) at 300 kg in spring (in error).

Sugar beet: Manures: (10:10:15+Mg) at 1640 kg. Weedkillers:

Glyphosate at 1.4 kg in 500 l. Chloridazon at 2.6 kg in 250 l.

Insecticide: Demeton-S-Methyl at 0.24 kg in 250 l.

2nd Test crop:

W. wheat: Manures: (0:20:20) at 250 kg. Weedkillers: Mecoprop, bromoxynil and ioxynil (as 'Brittox' at 3.5 l) with isoproturon at 2.0 kg in 250 l.

Reseeded grass and old grass: Manures: (0:18:36) at 420 kg. All-grass half plots: (25:0:16) at 300 kg in spring and after each cut except the last.

New sequence blocks:

1st, 2nd, 3rd and 4th Test crops:

W. Wheat: Manures: (0:20:20) at 250 kg, combine drilled.

Weedkillers: Glyphosate at 1.4 kg in 250 l, to all except 1st test after LUCERNE, CLOGRA and GRASS/G. Mecoprop, bromoxynil and ioxynil (as 'Brittox' at 3.5 l) with isoproturon at 2.0 kg in 250 l.

Seed:

Museum blocks:

Sugar beet: Monoire, sown at 490,000 seeds per ha.

W. wheat: Flanders, sown at 200 kg.

New sequence blocks:

W. wheat: Flanders, sown at 200 kg.

Cultivations, etc.:-

Museum blocks:

2nd Treatment crops:

Lucerne: PK applied: 11 Jan, 1983. Cut: 10 June, 1 Aug, 31 Oct.

All-grass ley and clover-grass ley: PK applied: 11 Jan, 1983.

NK applied: 25 Mar to both leys and on 17 June, 3 Aug to all-grass ley only. Cut: 6 June, 1 Aug, 31 Oct (Highfield), 1 Nov (Fosters).

Sugar beet: Glyphosate applied: 20 Nov, 1982. Ploughed: 11 Jan, 1983. NPK Mg applied: 14 Apr. Rotary harrowed, chloridazon applied, seed sown: 29 Apr. Singled: 14 June. Insecticide applied: 17 June. Lifted: 3 Nov.

2nd Test crop:

W. wheat: Spring-tine cultivated: 31 Oct, 1982. PK applied: 11 Nov. Rotary harrowed, seed sown, spring-tine cultivated: 18 Nov. N treatments applied: 14 Apr, 1983 (Fosters), 15 Apr (Highfield). Weedkillers applied: 28 Apr. Combine harvested: 11 Aug (Fosters), 13 Aug (Highfield).

Re-seeded grass and old grass: PK applied: 11 Jan, 1983. NK applied to all-grass half-plots: 25 Mar, 17 June, 3 Aug. Cut: 6 June, 1 Aug, 31 Oct (Highfield), 1 Nov (Fosters).

83/R/RN/1 and 83/R/RN/2

New sequence blocks:

1st Test crop:

W. wheat: After lucerne, clover-grass, and ryegrass (except GRASS/OG): Ploughed: 2 Aug, 1982. Glyphosate applied to GRASS/OG: 3 Aug. Spring-tine cultivated after lucerne, clover-grass and ryegrass (except GRASS/OG): 27 Aug. Glyphosate applied after wheat: 8 Sept. Glyphosate applied after beans: 10 Sept. Ploughed after beans and wheat: 27 Sept (Fosters), 28 Sept (Highfield). Spring-tine cultivated: 31 Oct (Fosters), 1 Nov (Highfield, except GRASS/OG). PK applied, rotary harrowed, seed sown: 11 Nov. GRASS/OG direct drilled: 17 Nov. N treatments applied: 14 Apr, 1983 (Fosters), 15 Apr (Highfield). 'Brittox' and isoproturon applied: 28 Apr. Combine harvested: 11 Aug (Fosters), 13 Aug (Highfield).

2nd, 3rd and 4th Test crops:

W. wheat: Glyphosate applied: 8 Sept, 1982. Ploughed: 27 Sept (Fosters), 28 Sept (Highfield, except 2nd test GRASS/OG). Spring-tine cultivated: 31 Oct (Fosters), 1 Nov (Highfield, except 2nd test GRASS/OG). PK applied, rotary harrowed, seed sown: 11 Nov. 2nd test GRASS/OG direct drilled, spring-tine cultivated: 17 Nov. N treatments applied: 14 Apr, 1983 (Fosters), 15 Apr (Highfield). 'Brittox' and isoproturon applied: 28 Apr. Combine harvested: 11 Aug (Fosters), 13 Aug (Highfield).

NOTE: Due to waterlogging two plots were lost on Highfield 2nd test crop, new sequence blocks wheat, those with treatment combinations:-

SEQUENCE	GRASS/OG	GRASS/OG
N	0	150

Also on 4th test crop one plot was lost with treatment combinations:-

SEQUENCE	CLOGRA
N	0

83/R/RN/1 AND 83/R/RN/2

MUSEUM BLOCKS

DRY MATTER: TONNES/HECTARE

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

	HIGHFIELD	FOSTERS
CLOVER-GRASS LEY		
TOTAL OF 3 CUTS	9.96	9.55
MEAN DM%	26.1	26.1

ALL GRASS LEY		
TOTAL OF 3 CUTS	13.64	11.98
MEAN DM%	24.6	24.1

LUCERNE		
TOTAL OF 3 CUTS	5.48	10.24
MEAN DM%	26.2	26.0

OLD GRASS

TOTAL OF 3 CUTS

	HIGHFIELD	
	C	N
35TH EXPTL YEAR		
BLOCKS 1 & 4	6.12	11.54
BLOCK 2	6.11	11.24
MEAN DM%	23.6	19.8

RESEEDED GRASS

TOTAL OF 3 CUTS

		HIGHFIELD			FOSTERS	
	BLOCKS	C	N	BLOCKS	C	N
35TH EXPTL YEAR	1 & 4	6.09	11.49	1 & 3	8.02	11.25
35TH EXPTL YEAR	2 & 3	6.70	12.52	2 & 4	7.71	9.54
(SEEDED 1949 RESEDED 1973)						
MEAN DM%		24.7	22.4		21.9	22.3

SUGAR BEET	HIGHFIELD	FOSTERS
ROOTS (WASHED)	45.5	39.4
SUGAR PERCENTAGE	17.5	16.7
TOTAL SUGAR	7.97	6.61
TOPS	23.6	26.7

83/R/RN/1 HIGHFIELD

W.WHEAT 2ND TEST CROP - MUSEUM BLOCKS

GRAIN TONNES/HECTARE

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

FYMRES70	NONE	FYM	MEAN		
SEQUENCE					
LUCERNE	5.31	5.22	5.27		
CLOGRA	4.53	4.93	4.73		
GRASS	4.72	4.59	4.66		
ARABLE	4.38	3.99	4.19		
MEAN	4.73	4.69	4.71		
N	0	50	100	150	MEAN
SEQUENCE					
LUCERNE	3.84	5.08	6.23	5.90	5.27
CLOGRA	3.53	5.08	5.26	5.06	4.73
GRASS	3.69	4.55	5.16	5.24	4.66
ARABLE	2.52	4.19	4.95	5.09	4.19
MEAN	3.40	4.73	5.40	5.32	4.71
N	0	50	100	150	MEAN
FYMRES70					
NONE	3.46	5.00	5.14	5.34	4.73
FYM	3.33	4.46	5.66	5.31	4.69
MEAN	3.40	4.73	5.40	5.32	4.71
N	0	50	100	150	
FYMRES70 SEQUENCE					
NONE LUCERNE	3.93	5.53	6.06	5.70	
CLOGRA	3.45	5.10	4.49	5.09	
GRASS	3.82	4.84	5.05	5.17	
ARABLE	2.65	4.52	4.96	5.39	
FYM LUCERNE	3.75	4.64	6.40	6.11	
CLOGRA	3.61	5.07	6.03	5.03	
GRASS	3.56	4.27	5.26	5.30	
ARABLE	2.40	3.85	4.94	4.78	

GRAIN MEAN DM% 85.8

PLOT AREA HARVESTED 0.00663

83/R/RN/2 FOSTERS

W.WHEAT 2ND TEST CROP - MUSEUM BLOCKS

GRAIN TONNES/HECTARE

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

FYMRES70	NONE	FYM	MEAN		
SEQUENCE					
LUCERNE	5.68	6.06	5.87		
CLOGRA	5.42	5.30	5.36		
GRASS	4.48	4.87	4.67		
ARABLE	4.51	4.46	4.48		
MEAN	5.02	5.17	5.10		
N	0	50	100	150	MEAN
SEQUENCE					
LUCERNE	5.03	6.40	6.15	5.90	5.87
CLOGRA	4.51	5.69	5.62	5.64	5.36
GRASS	3.51	4.58	5.29	5.31	4.67
ARABLE	2.64	4.23	5.77	5.30	4.48
MEAN	3.92	5.22	5.71	5.54	5.10
N	0	50	100	150	MEAN
FYMRES70					
NONE	3.78	5.20	5.50	5.61	5.02
FYM	4.06	5.24	5.92	5.46	5.17
MEAN	3.92	5.22	5.71	5.54	5.10
N	0	50	100	150	
FYMRES70 SEQUENCE					
NONE LUCERNE	4.72	6.19	5.30	6.51	
CLOGRA	4.18	6.48	5.24	5.80	
GRASS	3.42	4.36	5.00	5.14	
ARABLE	2.82	3.79	6.45	5.00	
FYM LUCERNE	5.34	6.61	7.00	5.29	
CLOGRA	4.83	4.90	6.00	5.47	
GRASS	3.60	4.80	5.58	5.48	
ARABLE	2.46	4.67	5.09	5.61	

GRAIN MEAN DM% 85.6

PLOT AREA HARVESTED 0.00663

83/R/RN/1 HIGHFIELD

W.WHEAT 1ST TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

N	0	50	100	150	MEAN
SEQUENCE					
LUCERNE	5.93	6.44	5.89	6.22	6.12
CLOGRA	5.47	6.23	5.90	4.86	5.62
GRASS/G	3.96	5.44	5.70	5.46	5.14
ARABLE/A	4.59	5.46	6.52	6.20	5.69
ARABLE/R	3.87	4.19	5.60	5.41	4.77
GRASS/OG	2.96	3.68	3.53	5.19	3.84
MEAN	4.46	5.24	5.52	5.56	5.20

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N

SED	0.327	0.186	0.512
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
SEQUENCE			0.455

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.327	6.3
BLOCK.WP.SP	18	0.455	8.8

GRAIN MEAN DM% 87.0

SUB PLOT AREA HARVESTED 0.00325

83/R/RN/1 HIGHFIELD

W.WHEAT 2ND TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

N	0	50	100	150	MEAN
SEQUENCE					
LUCERNE	3.56	5.65	5.94	5.98	5.28
CLOGRA	3.23	5.31	6.17	5.89	5.15
GRASS/G	4.38	5.91	6.55	6.40	5.81
ARABLE/A	3.21	4.52	5.69	6.19	4.90
ARABLE/R	3.89	5.50	6.25	6.03	5.42
GRASS/OG	3.47	4.19	4.58	5.29	4.39
MEAN	3.62	5.18	5.86	5.97	5.16

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.194	0.222	0.509
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
SEQUENCE			0.544

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.194	3.8
BLOCK.WP.SP	16	0.544	10.5

GRAIN MEAN DM% 86.6

SUB PLOT AREA HARVESTED 0.00322

83/R/RN/1 HIGHFIELD

W.WHEAT 3RD TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

	N	0	50	100	150	MEAN
SEQUENCE						
LUCERNE		2.90	4.43	5.72	5.03	4.52
CLOGRA		2.23	4.33	5.28	6.04	4.47
GRASS/G		2.78	4.30	5.08	5.22	4.34
ARABLE/A		2.58	3.84	5.16	5.51	4.27
ARABLE/R		3.64	4.57	6.12	5.85	5.04
GRASS/OG		4.24	5.89	5.81	5.78	5.43
MEAN		3.06	4.56	5.53	5.57	4.68

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.377	0.154	0.499
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF: SEQUENCE			
			0.378

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.377	8.0
BLOCK.WP.SP	18	0.378	8.1

GRAIN MEAN DM% 86.6

SUB PLOT AREA HARVESTED 0.00322

83/R/RN/1 HIGHFIELD

W.WHEAT 4TH TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

	N	0	50	100	150	MEAN
SEQUENCE						
LUCERNE		2.86	3.37	4.82	4.69	3.93
CLOGRA		2.50	3.71	4.03	5.35	3.90
GRASS/G		2.39	4.26	4.79	5.15	4.15
ARABLE/A		2.50	4.33	5.43	5.82	4.52
ARABLE/R		3.19	4.76	6.08	5.78	4.95
GRASS/OG		3.75	4.63	5.88	6.15	5.10
MEAN		2.87	4.18	5.17	5.49	4.43

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.354	0.184	0.527
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF: SEQUENCE			0.451

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	5	0.354	8.0
BLOCK.WP.SP	17	0.451	10.2

GRAIN MEAN DM% 86.4

SUB PLOT AREA HARVESTED 0.00322

83/R/RN/2 FOSTERS

W.WHEAT 1ST TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

	N	0	50	100	150	MEAN
SEQUENCE						
LUCERNE		6.23	7.25	7.17	6.64	6.82
CLOGRA		5.69	6.60	6.60	6.26	6.29
GRASS/G		5.35	5.79	6.27	6.10	5.88
ARABLE/A		4.53	6.96	6.57	7.20	6.31
ARABLE/R		4.21	5.62	6.16	6.49	5.62
MEAN		5.20	6.45	6.55	6.54	6.19

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.283	0.108	0.352
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
SEQUENCE			0.240

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.283	4.6
BLOCK.WP.SP	15	0.240	3.9

GRAIN MEAN DM% 85.5

SUB PLOT AREA HARVESTED 0.00325

83/R/RN/2 FOSTERS

W.WHEAT 2ND TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

	N	0	50	100	150	MEAN
SEQUENCE						
LUCERNE		4.75	6.26	7.29	7.24	6.38
CLOGRA		4.31	6.13	6.20	7.25	5.97
GRASS/G		4.28	6.06	6.70	6.70	5.94
ARABLE/A		3.18	5.17	5.66	6.28	5.07
ARABLE/R		3.83	5.75	6.51	6.18	5.57
MEAN		4.07	5.87	6.47	6.73	5.79

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.160	0.186	0.394
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF: SEQUENCE			0.416

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.160	2.8
BLOCK.WP.SP	15	0.416	7.2

GRAIN MEAN DM% 85.7

SUB PLOT AREA HARVESTED 0.00322

83/R/RN/2 FOSTERS

WHEAT 3RD TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

	N	0	50	100	150	MEAN
SEQUENCE						
LUCERNE		3.35	4.74	6.19	6.20	5.12
CLOGRA		4.12	5.83	6.36	6.87	5.80
GRASS/G		3.71	5.20	6.90	6.69	5.62
ARABLE/A		3.12	4.40	6.48	6.14	5.03
ARABLE/R		3.97	4.77	6.22	6.17	5.28
MEAN		3.65	4.99	6.43	6.41	5.37

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.151	0.228	0.467
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
SEQUENCE			0.510

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.151	2.8
BLOCK.WP.SP	15	0.510	9.5

GRAIN MEAN DM% 85.8

SUB PLOT AREA HARVESTED 0.00322

83/R/RN/2 FOSTERS

WHEAT 4TH TEST CROP - NEW SEQUENCE BLOCKS

GRAIN TONNES/HECTARE

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

N	0	50	100	150	MEAN
SEQUENCE					
LUCERNE	3.28	5.38	6.59	6.74	5.50
CLOGRA	4.18	5.77	6.10	6.55	5.65
GRASS/G	4.01	5.29	6.69	6.51	5.63
ARABLE/A	3.69	4.89	6.38	6.96	5.48
ARABLE/R	3.68	4.75	6.50	6.62	5.39
MEAN	3.77	5.22	6.45	6.68	5.53

***** STANDARD ERRORS OF DIFFERENCES OF MEANS *****

TABLE	SEQUENCE	N	SEQUENCE N
SED	0.155	0.159	0.344
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:			
SEQUENCE			0.355

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

STRATUM	DF	SE	CV%
BLOCK.WP	4	0.155	2.8
BLOCK.WP.SP	15	0.355	6.4

GRAIN MEAN DM% 86.3

SUB PLOT AREA HARVESTED 0.00322