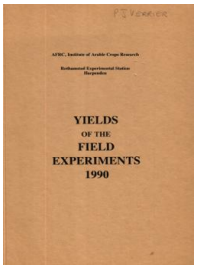
ROTHAMSTED RESEARCH

Yields of the Field Experiments 1990

Full Table of Content



Rotations

Rothamsted Research

Rothamsted Research (1991) *Rotations ;* Yields Of The Field Experiments 1990, pp 34 - 53 **- DOI: https://doi.org/10.23637/ERADOC-1-42**

90/R/RN/1 and 90/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 - Highfield and Fosters.

Sponsor: P.R. Poulton.

The 42nd year, old grass, leys, s. oats, w. wheat.

For previous years see 'Details' 1967 and 1973 and 74-89/R/RN/1 and 2.

The experiment is duplicated on:-

HIGHFIELD — A site with much organic matter initially (ploughed out from permanent grass) (90/R/RN/1)

FOSTERS — A site with little organic matter initially (90/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 1983 the test crops have been W, W, W.

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 1968 only two phases on each field continued in the six-course rotation (the museum blocks). The four other phases (the new sequence blocks) were used for studies on take-all (Gaeumannomyces graminis) in wheat. These studies ended in 1985 and these phases are no longer included in the experiment.

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90/R/RN/1 and 90/R/RN/2

Additional treatments to 3rd test crop w. wheat:-

Sub plots

FYMRES70 Farmyard manure residues, last applied 1970:

NONE None
FYM 30 tonnes on each occasion

Sub plots

N Nitrogen fertilizer in 1990 (kg N) as 'Nitram':

0
50
100
150

Standard applications:

3rd Treatment crops:

Lucerne: Manures: (0:24:24) at 940 kg.

All-grass ley: Manures: (0:24:24) at 620 kg. (25:0:16) at 300 kg on two occasions.

Clover-grass ley: Manures: (0:24:24) at 620 kg.

S. oats: Manures: (20:10:10) at 350 kg. Weedkillers: Mecoprop at 1.6 kg, bromoxynil at 0.20 kg and ioxynil at 0.20 kg with the fungicide in 200 l. Fungicide: Fenpropimorph at 0.75 kg.

3rd Test crop:

W. wheat: Weedkillers: Isoproturon at 1.7 kg in 200 l. Mecoprop at 2.2 kg, bromoxynil at 0.28 kg and ioxynil at 0.28 kg with the fungicide in 200 l. Fungicide: Prochloraz at 0.40 kg.

Reseeded grass and old grass: Manures: (0:24:24) at 620 kg. All-grass half plots: (25:0:16) at 300 kg in spring and after each cut except the last.

Seed: S. oats: Dula, sown at 190 kg.
W. wheat: Avalon, sown at 180 kg.

Cultivations, etc.:-

3rd Treatment crops:

Lucerne: PK applied: 28 Nov, 1989 (Highfield), 29 Nov (Fosters). First cut: 31 May, 1990. Second cut: 10 July.

All-grass ley and clover-grass ley: PK applied: 28 Nov, 1989 (Highfield), 29 Nov (Fosters). NK applied to all-grass ley: 1 Mar, 1990 and 4 June. Cut: 31 May, 10 July.

S. oats: Ploughed: 4 Jan, 1990. Spring-tine cultivated twice, rotary harrowed, seed sown: 9 Mar. NPK applied: 12 Apr. Weedkillers with the fungicide applied: 14 May. Combine harvested: 7 Aug.

3rd Test crop w. wheat: Ploughed: 29 Aug, 1989. Rotary harrowed: 3 Oct. Rotary harrowed, seed sown: 4 Oct. Isoproturon applied: 23 Nov. N treatments applied: 11 Apr, 1990. Remaining weedkillers with the fungicide applied: 25 Apr. Combine harvested: 9 Aug.

Reseeded grass and old grass: PK applied: 28 Nov, 1989 (Highfield), 29 Nov (Fosters). NK applied to all-grass half plots: 1 Mar, 1990 and 4 June. Cut: 31 May, 14 Nov.

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90/R/RN/1 and 90/R/RN/2

DRY MATTER: TONNES/HECTARE

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

	HIGHFIELD	FOSTERS
CLOVER-GRASS LEY		
TOTAL OF 2 CUTS	4.25	3.45
MEAN DM%	28.8	29.5
ALL-GRASS LEY		
TOTAL OF 2 CUTS	4.47	4.28
MEAN DM%	29.9	29.0

	HIGHFIELD	FOSTERS
LUCERNE		
TOTAL OF 2 CUTS	2.85	10.29
MEAN DM%	25.3	21.9

	HIGHFIELD	
OLD GRASS		
TOTAL OF 2 CUTS	C	N
42ND EXPTL YEAR		
BLOCKS 1 & 4	1.69	6.31
BLOCK 2	1.78	5.63
MEAN DM%	31.3	29.9

RESEEDED GRASS

TOTAL OF 2 CUTS		**HIGHFIELD**			**FOSTERS**	
	BLOCKS	C	N	BLOCKS	C	N
42ND EXPTL YEAR	1 & 4	1.76	6.48	1 & 3	1.65	4.51
42ND EXPTL YEAR (SEEDED 1949 RESEEDED 1973)	2 & 3	1.95	6.42	2 & 4	2.08	4.72
MEAN DM%		31.3	29.5		28.4	27.8

WINTER OATS: TONNES/HECTARE

	HIGHFIELD	FOSTERS
GRAIN	3.77	3.80
MEAN DM%	82.8	83.8

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90/R/RN/1 HIGHFIELD W.WHEAT (3RD TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES70	NONE	FYM	Mean
ROTATION			
LUCERNE	4.21	4.50	4.36
CLOGRA	4.11	4.15	4.13
GRASS	4.44	4.40	4.42
ARABLE	3.25	3.23	3.24
Mean	4.00	4.07	4.04

N	0	50	100	150	Mean
ROTATION					
LUCERNE	2.41	4.24	4.79	6.00	4.36
CLOGRA	2.49	4.08	4.81	5.14	4.13
GRASS	2.40	4.18	5.45	5.63	4.42
ARABLE	1.52	3.34	3.47	4.63	3.24
Mean	2.20	3.96	4.63	5.35	4.04

N	0	50	100	150	Mean
FYMRES70					
NONE	2.16	4.02	4.61	5.22	4.00
FYM	2.25	3.90	4.65	5.48	4.07
Mean	2.20	3.96	4.63	5.35	4.04

N	0	50	100	150
ROTATION	**FYMRES70**				
LUCERNE	NONE	2.32	3.72	5.06	5.76
	FYM	2.50	4.75	4.51	6.24
CLOGRA	NONE	2.46	4.84	4.41	4.74
	FYM	2.52	3.31	5.20	5.55
GRASS	NONE	2.26	4.32	5.32	5.84
	FYM	2.54	4.05	5.58	5.42
ARABLE	NONE	1.61	3.18	3.63	4.56
	FYM	1.42	3.49	3.31	4.70

GRAIN MEAN DM% 90.3

PLOT AREA HARVESTED 0.00571

https://doi.org/10.23637/ERADOC-1-42

90/R/RN/2 FOSTERS W.WHEAT (3RD TEST CROP)

GRAIN TONNES/HECTARE

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

FYMRES70	NONE	FYM	Mean
ROTATION			
LUCERNE	3.80	3.53	3.67
CLOGRA	3.91	3.96	3.93
GRASS	3.57	3.86	3.72
ARABLE	3.66	3.66	3.66
Mean	3.74	3.75	3.75

N	0	50	100	150	Mean
ROTATION					
LUCERNE	2.21	3.59	3.85	5.02	3.67
CLOGRA	2.18	3.76	4.58	5.20	3.93
GRASS	2.08	3.48	4.52	4.79	3.72
ARABLE	1.83	3.81	4.27	4.73	3.66
Mean	2.08	3.66	4.31	4.94	3.75

N	0	50	100	150	Mean
FYMRES70					
NONE	2.19	3.45	4.40	4.92	3.74
FYM	1.97	3.87	4.22	4.96	3.75
Mean	2.08	3.66	4.31	4.94	3.75

	N	0	50	100	150
ROTATION	**FYMRES70**				
LUCERNE	NONE	2.87	3.34	4.16	4.85
	FYM	1.55	3.84	3.54	5.19
CLOGRA	NONE	2.25	3.75	4.86	4.78
	FYM	2.12	3.78	4.31	5.63
GRASS	NONE	1.59	3.32	4.33	5.04
	FYM	2.58	3.63	4.72	4.53
ARABLE	NONE	2.04	3.39	4.23	4.99
	FYM	1.62	4.23	4.31	4.47

GRAIN MEAN DM% 90.4

PLOT AREA HARVESTED 0.00571

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/3

LEY/ARABLE

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

Sponsor: P.R. Poulton.

The 53rd year, leys, w. beans, w. wheat, s. barley.

For previous years see 'Details' 1967 & 1973 and 74-89/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) LN, LN, LN, W, B
LC 3	(Previous CLO) LC, LC, LC, W, B
AF	(Previous A) F, F, BE, W, B
AB	(Previous A H) B, B, BE, W, B

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

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/3

Plots hitherto in alternating rotations were changed to test eight-year leys:

LLN	LN, LN, LN, LN, LN, LN, LN, LN, W, B
LLC	LC, LC, LC, LC, LC, LC, LC, LC, W, B

LLN1 to LLN8 = eight year grass ley with N, first year to eighth year, similarly for LLC

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).

Yields are taken only from the leys and the test crops.

Treatments to first test crop w. wheat, all combinations of:

Whole plots

1. **ROTATION** Rotations:

   LN 8
   LN 3
   LC 8
   LC 3
   AF
   AB

1/2 plots

2. **FYMRES64** Farmyard manure residues, last applied 1964:

NONE	None
FYM	38 tonnes on each occasion

1/8 plots

3. **N** Nitrogen fertilizer (kg N) as 'Nitro-Chalk' (27% N):

   0
   70
   140
   210

Treatments to second test crop s. barley, all combinations of:

Whole plots

1. **ROTATION** Rotations:

   LN 8
   LN 3
   LC 8
   LC 3
   AF
   AB

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/3

1/2 plots

2. **FYMRES63** Farmyard manure residues, last applied 1963:

NONE	None
FYM	38 tonnes on each occasion

1/8 plots

3. **N** Nitrogen fertilizer (kg N) as 'Nitro-Chalk' (27% N):

0
60
120
180

Treatments to leys:

FYM RES Farmyard manure residues:

NONE	None
FYM	38 tonnes on each occasion, last applied 1962 to 1st and 6th year leys, 1966 to 2nd and 7th year leys, 1965 to 3rd and 8th year leys, 1964 to 4th year leys, 1963 to 5th year leys

Corrective K dressings (kg K2O) as muriate of potash, applied to first test crop w. wheat and long-term leys in the wheat block:

Continuous rotations	No FYM half plots	FYM half plots
LN	125	145
LC	0	0
AF	200	220
AB	155	155
Ex-alternating rotations		
LN 8 ploughed for w. wheat	0	0
LN 8 not ploughed	60	120
LC 8 ploughed for w. wheat	0	0
LC 8 not ploughed	20	0

Standard applications:-

Grass ley and clover/grass ley, 1st year: Manures: (0:18:36) at 420 kg. (25:0:16) at 300 kg to grass ley in spring and after the first cut. K2O at 54 kg to clover/grass ley in spring and after the first cut.

Grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Manures: Chalk at 5.0 t to 5th year only. (25:0:16) at 300 kg in spring and after the first cut. (0:24:24) at 620 kg.

Clover/grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Manures: Chalk at 5.0 t to 5th year only. K2O at 54 kg in spring and after the first cut. (0:24:24) at 620 kg.

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/3

Standard applications:-

S. barley, 1st and 2nd treatment crops: Manures: (20:10:10) at 400 kg. Weedkillers: Bromoxynil at 0.24 kg and clopyralid at 0.05 kg with mecoprop at 1.7 kg in 220 l. Fungicide: Fenpropimorph at 0.75 kg in 220 l.

W. beans, 3rd treatment crop: Manures: (0:24:24) at 170 kg. Mn at 0.19 kg in 220 l and later at 0.096 kg in 220 l. Weedkillers: Propyzamide at 0.85 kg with simazine at 0.85 kg in 220 l. Fungicide: Fenpropimorph at 0.75 kg in 220 l. Insecticide: Deltamethrin at 7.5 g in 220 l applied on two occasions.

Fallow, 1st and 2nd treatment years: No applications.

W. wheat, 1st test crop: Manures: (0:24:24) at 260 kg. Weedkillers: Glyphosate at 1.4 kg in 220 l. Bromoxynil at 0.34 kg and clopyralid at 0.07 kg, with isoproturon at 2.1 kg and with fluroxypyr at 0.15 kg in 220 l. Fungicides: Propiconazole at 0.12 kg with chlorothalonil at 0.50 kg in 300 l. Insecticide: Carbofuran at 7.5 kg.

S. barley, 2nd test crop: Manures: Chalk at 5.0 t. (0:24:24) at 260 kg. Weedkillers: Bromoxynil at 0.24 kg and clopyralid at 0.05 kg with mecoprop at 1.7 kg in 220 l. Fungicide: Fenpropimorph at 0.75 kg in 220 l. Insecticide: Carbofuran at 7.5 kg.

Seed: Grass ley: Climax timothy at 15 kg and meadow fescue at 15 kg, mixture sown at 30 kg.

Clover/grass ley: Climax timothy at 15 kg, meadow fescue at 12 kg and Huia white clover at 3.4 kg, mixture sown at 30 kg.

S. barley: Klaxon, dressed triadimenol and fuberidazole, sown at 160 kg.

W. beans: Banner, sown at 18 seeds per square metre.

W. wheat: Mercia, sown at 150 kg.

Cultivations, etc.:-

Treatment crops:

Grass ley and clover/grass ley, 1st year: Ploughed: 31 Aug, 1989. Rolled: 1 Sept. PK applied: 6 Sept. Rotary cultivated with crumbler attached, seed sown: 7 Sept. NK applied to grass ley and K applied to clover/grass ley: 2 March, 1990 and 15 June. Cut: 6 June.

Grass ley and clover/grass ley, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th years: Corrective K applied to 4th year only: 16 Feb, 1990. NK applied to grass ley and K applied to clover grass ley: 2 Mar and 15 June. PK applied: 6 Mar. Cut: 6 June.

S. barley, 1st and 2nd treatment crops: Ploughed: 5 Mar, 1990. NPK applied, rotary harrowed with crumbler attached, seed sown and harrowed: 7 Mar. Weedkiller applied: 23 May. Fungicide applied: 24 May. Combine harvested: 2 Aug.

W. beans, 3rd treatment crop: Subsoiled with vibrating tines 50 cm apart and 40 cm deep: 14 Sept, 1989. PK applied: 19 Sept. Disced twice: 11 Oct. Seed broadcast by drill then ploughed: 13 Oct. Rolled: 14 Oct. Weedkillers applied: 15 Oct. Mn applied: 5 Apr, 1990 and 30 Apr. Insecticide applied: 23 Apr and 18 May. Fungicide applied: 11 July. Combine harvested: 10 Aug.

Fallow, 1st and 2nd treatment years: Ploughed: 5 Mar, 1990. Spring-tine cultivated: 9 May. Cultivated with thistle bar: 21 June.

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/3

Cultivations, etc.:-
Test crops:
W. wheat, 1st test crop: Glyphosate applied: 1 Sept, 1989. Subsoiled with vibrating tines 50 cm apart and 40 cm deep: 13 Sept. Disced twice: 15 Sept. PK applied, ploughed: 19 Sept. Carbofuran applied, rotary harrowed with crumbler attached: 25 Sept. Seed sown: 26 Sept. Corrective K applied: 16 Feb, 1990. N treatments applied: 23 Mar. Remaining weedkillers applied: 24 Apr. Fungicides applied: 22 May. Combine harvested: 7 Aug.
S. barley, 2nd test crop: Chalk applied: 16 Jan, 1990. Ploughed: 5 Mar. PK applied: 6 Mar. Carbofuran applied, power harrowed with crumbler attached, seed sown and harrowed: 7 Mar. N treatments applied: 14 Mar. Weedkillers applied: 23 May. Fungicide applied: 24 May. Combine harvested: 2 Aug.

LEYS

1ST AND ONLY CUTTING OCCASION (6/6/90) DRY MATTER TONNES/HECTARE

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

FYM RES LEY	NONE	FYM	Mean
LC1	2.93	2.58	2.76
LC2	5.21	4.79	5.00
LC3	1.23	1.84	1.54
LN1	4.09	3.39	3.74
LN2	5.89	5.10	5.49
LN3	2.81	1.90	2.35
LLC1	2.97	2.58	2.78
LLC2	5.31	5.13	5.22
LLC3	2.63	2.05	2.34
LLC4	1.81	1.21	1.51
LLC5	1.39	1.09	1.24
LLC6	2.56	2.61	2.58
LLC7	4.50	3.51	4.01
LLC8	2.68	2.13	2.41
LLN1	3.39	3.56	3.47
LLN2	5.96	4.37	5.17
LLN3	4.13	3.18	3.65
LLN4	1.95	2.45	2.20
LLN5	3.18	3.43	3.31
LLN6	3.65	3.37	3.51
LLN7	5.09	4.77	4.93
LLN8	4.03	4.11	4.07
Mean	3.52	3.14	3.33

1ST CUT MEAN DM% 27.3

PLOT AREA HARVESTED 0.00200

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/3

W.WHEAT 1ST TEST CROP

GRAIN TONNES/HECTARE

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

FYMRES64	NONE	FYM	Mean
ROTATION			
LN 8	4.36	5.01	4.69
LN 3	4.43	4.71	4.57
LC 8	6.11	5.62	5.87
LC 3	6.12	5.52	5.82
AF	4.80	4.49	4.65
AB	5.01	4.27	4.64
Mean	5.14	4.94	5.04

N	0	70	140	210	Mean
ROTATION					
LN 8	2.62	5.79	5.08	5.25	4.69
LN 3	1.73	4.94	5.43	6.17	4.57
LC 8	3.31	6.51	6.65	6.99	5.87
LC 3	3.59	6.06	7.20	6.42	5.82
AF	1.38	5.72	6.30	5.18	4.65
AB	1.47	4.94	5.83	6.33	4.64
Mean	2.35	5.66	6.08	6.06	5.04

N	0	70	140	210	Mean
FYMRES64					
NONE	2.27	5.94	6.07	6.27	5.14
FYM	2.43	5.39	6.09	5.84	4.94
Mean	2.35	5.66	6.08	6.06	5.04

N		0	70	140	210
ROTATION	FYMRES64				
LN 8	NONE	2.07	5.47	5.56	4.35
	FYM	3.17	6.12	4.59	6.15
LN 3	NONE	1.67	4.71	4.82	6.51
	FYM	1.79	5.18	6.03	5.83
LC 8	NONE	3.42	7.04	6.92	7.08
	FYM	3.21	5.99	6.38	6.91
LC 3	NONE	3.44	6.44	7.56	7.02
	FYM	3.74	5.69	6.85	5.82
AF	NONE	1.21	5.89	5.77	6.34
	FYM	1.55	5.56	6.83	4.01
AB	NONE	1.84	6.09	5.79	6.32
	FYM	1.09	3.78	5.86	6.34

GRAIN MEAN DM% 90.1

PLOT AREA HARVESTED 0.00183

https://doi.org/10.23637/ERADOC-1-42 *pp 12*

90/W/RN/3

S.BARLEY 2ND TEST CROP

GRAIN TONNES/HECTARE

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

FYMRES63	NONE	FYM	Mean
ROTATION			
LN 8	3.01	3.09	3.05
LN 3	3.50	3.83	3.66
LC 8	3.60	3.85	3.72
LC 3	2.50	2.96	2.73
AF	2.73	2.75	2.74
AB	1.40	1.66	1.53
Mean	2.79	3.02	2.91

N	0	60	120	180	Mean
ROTATION					
LN 8	2.14	3.29	3.43	3.34	3.05
LN 3	2.64	4.08	3.65	4.29	3.66
LC 8	2.52	4.01	4.39	3.99	3.72
LC 3	1.47	2.91	3.20	3.33	2.73
AF	0.92	2.78	3.61	3.64	2.74
AB	0.55	1.79	2.29	1.50	1.53
Mean	1.71	3.14	3.43	3.35	2.91

N	0	60	120	180	Mean
FYMRES63					
NONE	1.60	3.06	3.28	3.22	2.79
FYM	1.81	3.23	3.57	3.47	3.02
Mean	1.71	3.14	3.43	3.35	2.91

N		0	60	120	180
ROTATION	**FYMRES63**				
LN 8	NONE	1.79	3.56	3.31	3.37
	FYM	2.49	3.02	3.55	3.30
LN 3	NONE	2.56	3.61	3.67	4.15
	FYM	2.72	4.55	3.62	4.43
LC 8	NONE	2.31	3.95	4.29	3.83
	FYM	2.72	4.06	4.48	4.15
LC 3	NONE	1.61	2.75	2.49	3.15
	FYM	1.33	3.08	3.90	3.50
AF	NONE	0.80	2.96	3.72	3.42
	FYM	1.04	2.61	3.50	3.85
AB	NONE	0.52	1.51	2.20	1.38
	FYM	0.57	2.08	2.37	1.62

GRAIN MEAN DM% 90.2

PLOT AREA HARVESTED 0.00183

https://doi.org/10.23637/ERADOC-1-42

90/R/RN/8

CULTIVATION/WEEDKILLER

Object: To study the long-term effects of different methods of primary cultivation on a sequence of crops; weedkillers were also tested until 1981 - Great Harpenden I.

Sponsor: R. Moffitt.

The 30th year, w. barley.

For previous years see 'Details' 1967 and 1973 and 74-89/R/RN/8.

Design: 2 randomised blocks of 12 plots.

Whole plot dimensions: 12.8 x 12.2.

Treatments: All combinations of:-

Whole plots

1. **CLT CHOP** — Primary cultivations annually; straw chopped since 1985:

PLOUGH	Ploughed: 17 Aug, 1989
ROTA DIG	Cultivated by rotary digger: 17 Aug
DEEPTINE	Deep-tine cultivated, twice: 17 Aug

2. **SUBSOIL[82]** — Subsoiling in September 1982:

NONE	None
CNVNTIAL	Conventional vertical tine
PARAPLOW	'Paraplow'

XTR BURN — plus three extra treatments with straw burnt since 1985, direct drilled until 1984, heavy spring-tine cultivated on 19 July, 1989, in addition to basal cultivating, differing in subsoiling in September 1982:

NONE	None
CNVNTIAL	Conventional vertical tine
PARAPLOW	'Paraplow'

NOTES: (1) Straw was chopped on 18 July, 1989 and was burnt on XTR BURN on 19 July.
(2) The conventional vertical tine subsoiler had tines 76 cm apart and worked at a depth of about 50 cm.
(3) The 'Paraplow' had rigid tines set at a 45 degree angle. The tip of each tine was in line with the attachment of an adjacent tine. The tines were 51 cm apart and worked at a depth of about 38 cm.

https://doi.org/10.23637/ERADOC-1-42 *pp 14*

90/R/RN/8

Basal applications: Manure: 'Nitram' at 460 kg. Weedkillers: Glyphosate at 0.27 kg in 200 l. Isoproturon at 1.7 kg with mecoprop at 2.0 kg in 200 l. Mecoprop at 2.2 kg, bromoxynil at 0.28 kg and ioxynil at 0.28 kg applied with the carbendazim and prochloraz in 200 l. Fungicides: Carbendazim at 0.15 kg and prochloraz at 0.40 kg. Propiconazole at 0.12 kg in 200 l. Insecticide: Deltamethrin at 5.0 g in 200 l.

Seed: Magie, sown at 160 kg.

Cultivations, etc.:- Glyphosate applied: 14 Sept, 1989. Heavy spring-tine cultivated, rotary harrowed twice, (CLT CHOP - PLOUGH plots rotary harrowed three times), seed sown: 26 Sept. Isoproturon with mecoprop applied: 17 Nov. Deltamethrin applied: 23 Nov. N applied: 22 Mar, 1990. Mecoprop, bromoxynil, ioxynil with carbendazim and prochloraz applied: 9 Apr. Propiconazole applied: 4 May. Combine harvested: 24 July.

GRAIN TONNES/HECTARE

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

SUBSOIL[82]	NONE	CNVNTIAL	PARAPLOW	Mean
CLT CHOP				
PLOUGH	7.19	6.82	6.47	6.83
ROTA DIG	7.73	7.07	7.61	7.47
DEEPTINE	7.53	7.49	7.46	7.49
Mean	7.49	7.13	7.18	7.26

XTR BURN	NONE	CNVNTIAL	PARAPLOW	Mean
	8.14	7.75	7.25	7.71

Grand mean 7.38

*** Standard errors of differences of means ***

XTR BURN	**CLT CHOP**	**SUBSOIL[82]**	**CLT CHOP SUBSOIL[82]**
0.370	0.214	0.214	0.370

***** Stratum standard errors and coefficients of variation *****

Stratum	d.f.	s.e.	cv%
BLOCK.WP	11	0.370	5.0

GRAIN MEAN DM% 89.5

PLOT AREA HARVESTED 0.00280

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/12

ORGANIC MANURING

Object: To study, from crop yields and soil analyses, the effects of a range of types of organic matter - Woburn, Stackyard B.

Sponsor: P.R. Poulton.

The 26th year, w. wheat, w. beans.

For previous years see 'Details' 1973 and 74-89/W/RN/12.

Design for each crop: 2 blocks of 8 plots split into 6

Whole plot dimensions: 8.53 x 30.5.

Treatments: From 1966 to 1971 the experiment had a preliminary period designed to build up organic matter, derived from different sources. An arable rotation was started on two blocks in 1972 and the remaining two blocks in 1973. After a period of testing the residues built up, a further period of accumulation was started; on two blocks (which included ley sown in 1979) in 1981 and on the other two (which included ley sown in 1980) in 1982. On the first pair leys were ploughed for 1st test crop in 1987, on the second pair for 1st test crop in 1988.

3rd test crop w. wheat, after w. wheat 1988, potatoes 1989, tested all combinations of:

Whole plots

1. **TREATMNT** Previous treatments:

LC 8 GM	Eight-year clover/grass ley until 1987, green manure in the preliminary period
LC 8 PT	As above, peat in the preliminary period
LC 6 LC	Six-year clover/grass ley until 1987, clover/grass ley in the preliminary period
LC 6 LN	As above, grass ley with N in the preliminary period
FYM	Farmyard manure annually 1981 to 1986 and in the preliminary period
STRAW	Straw in both periods
FERT-FYM	Fertilizers only in both periods, rates of P, K & Mg equivalent to amounts in FYM
FERT-STR	Fertilizers only in both periods, rates of P, K & Mg equivalent to amounts in straw (+P)

Sub plots

2. **N** Nitrogen fertilizer in 1990 (kg N) as 'Nitro-Chalk':

0
50
100
150
200
250

https://doi.org/10.23637/ERADOC-1-42 *pp 16*

90/W/RN/12

4th test crop w. beans, after w.wheat 1987, potatoes 1988, w. wheat 1989, tested all combinations of:

Whole plots

1. **TREATMNT** Previous treatments:

LC 8 GM	Eight-year clover/grass ley until 1986, green manure in the preliminary period
LC 8 PT	As above, peat in the preliminary period
LC 6 LC	Six-year clover/grass ley until 1986, clover/grass ley in the preliminary period
LC 6 LN	As above, grass ley with N in the preliminary period
FYM	Farmyard manure annually 1981 to 1985 and in the preliminary period
STRAW	Straw in both periods
FERT-FYM	Fertilizers only in both periods, rates of P, K and Mg equivalent to amounts in FYM
FERT-STR	Fertilizers only in both periods rates of P, K and Mg equivalent to amounts in straw (+P)

Sub plots

2. **N RES** Residues of nitrogen fertilizer to w. wheat in 1989 (kg N):

(0)
(50)
(100)
(150)
(200)
(250)

Standard applications:

3rd test crop:

W. wheat: Manures: (0:18:36) at 560 kg. Weedkillers: Bromoxynil at 0.34 kg and clopyralid at 0.07 kg with isoproturon at 2.1 kg and fluroxypyr at 0.15 kg in 220 l. Fungicides: Propiconazole at 0.12 kg with chlorothalonil at 0.50 kg in 300 l. Insecticide: Carbofuran at 7.5 k. Molluscicide: Methiocarb at 0.20 kg applied with seed.

4th test crop:

W. beans: Manures: (0:24:24) at 420 kg. Muriate of potash at 170 kg. Manganese at 0.19 kg in 220 l. Weedkillers: Paraquat at 0.80 kg ion in 220 l. Propyzamide at 0.85 kg with simazine at 0.85 kg in 220 l. Fungicide: Fenpropimorph at 0.75 kg in 220 l. Insecticide: Deltamethrin at 7.5 g in 220 l applied on two occasions.

Seed: W. wheat: Mercia, sown at 180 kg with methiocarb pellets.
W. beans: Banner, sown at 18 seeds per square metre.

Cultivations, etc.:-

W. wheat: Ploughed: 20 Oct, 1989. Carbofuran applied, spring-tine cultivated: 30 Oct. PK applied: 31 Oct. Seed sown: 1 Nov. N applied: 27 Mar, 1990. Weedkillers applied: 24 Apr. Fungicides applied: 22 May. Combine harvested: 3 Aug.

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/12

Cultivations, etc.:-

W. beans: Subsoiled with tines, 50 cm apart and 40 cm deep: 13 Sept, 1989. Disced: 15 Sept. PK and K applied: 19 Sept. Paraquat applied: 10 Oct. Disced: 11 Oct. Seed broadcast by drill, ploughed in and rolled: 13 Oct. Propyzamide and simazine applied: 15 Oct. Mn applied: 5 Apr, 1990. Deltamethrin applied: 23 Apr and 18 May. Fenpropimorph applied: 11 July. Combine harvested: 10 Aug.

NOTES: (1) W. wheat. Because of bird damage and errors in harvesting, the yields of one whole plot and 2 sub plots were lost, with treatment combinations **TREATMNT** FERT-STR **N** 100 FERT-STR 150 and FERT-FYM whole plot (6 sub plots) Estimated values were used in the analysis.

(2) W. beans. Because of bird damage the yields of one block were treated as lost. The means presented are those of the remaining block.

W.WHEAT

GRAIN TONNES/HECTARE

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

N / **TREATMNT**	0	50	100	150	200	250	Mean
LC 8 GM	3.00	4.53	5.65	4.95	5.53	5.68	4.89
LC 8 PT	3.11	5.47	7.02	6.63	6.38	6.53	5.86
LC 6 LC	3.65	5.65	7.00	6.41	6.28	6.63	5.94
LC 6 LN	3.72	5.88	6.70	6.79	6.37	6.32	5.96
FYM	3.23	5.17	5.02	6.13	6.02	5.25	5.14
STRAW	3.18	5.20	6.25	6.63	6.08	6.23	5.59
FERT-FYM	2.99	4.62	5.97	6.81	5.10	5.61	5.18
FERT-STR	2.53	4.87	5.15	4.74	6.38	5.68	4.89
Mean	3.18	5.17	6.09	6.14	6.02	5.99	5.43

*** Standard errors of differences of means ***

TREATMNT	**N**	**TREATMNT** **N**
0.419	0.150	0.570

Except when comparing means with the same level(s) of **TREATMNT** 0.424

***** Stratum standard errors and coefficients of variation *****

Stratum	d.f.	s.e.	cv%
BLOCK.WP	6	0.419	7.7
BLOCK.WP.SP	33	0.424	7.8

GRAIN MEAN DM% 90.4

SUB PLOT AREA HARVESTED 0.00183

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/12

W.BEANS

GRAIN TONNES/HECTARE

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

N RES TREATMNT	(0)	(50)	(100)	(150)	(200)	(250)	Mean
LC 8 GM	5.60	4.87	4.61	4.48	5.64	4.32	4.92
LC 8 PT	5.43	5.38	4.74	4.64	4.75	5.31	5.04
LC 6 LC	4.98	4.58	3.83	5.10	3.56	4.41	4.41
LC 6 LN	3.72	5.63	5.58	3.25	4.43	4.65	4.54
FYM	3.73	3.14	3.60	2.30	1.99	3.56	3.05
STRAW	4.41	2.46	2.57	3.79	2.30	2.31	2.97
FERT-FYM	4.51	3.88	4.46	3.68	4.41	3.52	4.08
FERT-STR	6.05	3.67	3.61	3.16	1.78	2.10	3.40
Mean	4.80	4.20	4.13	3.80	3.61	3.77	4.05

GRAIN MEAN DM% 89.7

SUB PLOT AREA HARVESTED 0.00202

https://doi.org/10.23637/ERADOC-1-42

90/W/RN/13

INTENSIVE CEREALS

Object: To study the effects of leys of different duration, following prolonged intensive cereal cropping, on a sequence of arable crops - Woburn Stackyard I.

Sponsor: J. McEwen.

The 25th year, w. beans.

For previous years see 'Details' 1973 and 74-89/W/RN/13.

Design: 4 randomised blocks of 6 plots split into 6.

Treatments: Until 1977 the experiment tested all phases of the five-course rotation: ley, potatoes, cereal, cereal, cereal and continous cereal. From 1977 to 1980 all phases were cropped with cereal. The experiment was in two halves, one in which the cereal was w. wheat, sown on part of the site of the classical continuous wheat experiment 1877-1954 and one in which the cereal was s. barley, sown on part of the site of the classical continuous barley experiment 1877-1954. From 1981 the experiment was used to establish grass/clover leys of different durations for tests on w. wheat in 1987. Plots not in ley were sown to w. wheat on both halves of the experiment. All leys were ploughed for 1987 and the site sown to w. wheat. This was followed by potatoes in 1988, w. wheat in 1989, and by w. beans in 1990, testing all combinations of the following treatments:

Whole plots

1. **LEY AGE** Length of ley (until ploughing in summer 1986):

   1 YEAR
   2 YEARS
   3 YEARS
   4 YEARS
   5 YEARS
   6 YEARS

Sub plots

2. **N RES** Residues of nitrogen fertilizer to w. wheat in 1989 (kg N):

   (0)
   (50)
   (100)
   (150)
   (200)
   (250)

Basal applications: Manures: (0:24:24) at 420 kg. Muriate of potash at 170 kg. Manganese at 0.19 kg in 220 l. Weedkillers: Paraquat at 0.80 kg ion in 220 l. Propyzamide at 0.85 kg with simazine at 0.85 kg in 220 l. Fungicide: Fenpropimorph at 0.75 kg in 220 l. Insecticide: Deltamethrin at 7.5 g in 220 l applied on two occasions.

https://doi.org/10.23637/ERADOC-1-42 *pp 20*

90/W/RN/13

Seed: Banner sown at 18 seeds per square metre.

Cultivations, etc.:- Subsoiled with tines 50 cm apart and 40 cm deep: 15 Sept, 1989. PK and K applied: 19 Sept. Paraquat applied: 10 Oct. Disced: 11 Oct. Seed broadcast by drill, ploughed in and rolled: 12 Oct. Propyzamide and simazine applied: 15 Oct. Mn applied: 5 Apr, 1990. Deltamethrin applied: 23 Apr and 18 May. Fenpropimorph applied: 11 July. Combine harvested: 11 Aug.

GRAIN TONNES/HECTARE

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

N RES / LEY AGE	(0)	(50)	(100)	(150)	(200)	(250)	Mean
1 YEAR	4.41	4.12	4.26	3.80	3.42	4.35	4.06
2 YEARS	4.96	4.17	4.48	4.03	4.87	5.06	4.60
3 YEARS	5.11	4.41	4.46	4.81	4.51	4.35	4.61
4 YEARS	5.02	4.11	4.62	4.51	4.31	4.51	4.51
5 YEARS	5.33	5.09	4.81	5.18	4.50	4.68	4.93
6 YEARS	4.83	4.58	4.55	4.47	4.23	4.41	4.51
Mean	4.94	4.41	4.53	4.47	4.31	4.56	4.54

*** Standard errors of differences of means ***

	LEY AGE	N RES	LEY AGE N RES
	0.270	0.148	0.428
Except when comparing means with the same level(s) of LEY AGE			0.364

***** Stratum standard errors and coefficients of variation *****

Stratum	d.f.	s.e.	cv%
BLOCK.WP	15	0.382	8.4
BLOCK.WP.SP	90	0.514	11.3

GRAIN MEAN DM% 89.9

SUB PLOT AREA HARVESTED 0.00132

https://doi.org/10.23637/ERADOC-1-42 *pp 21*