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## Yields of the Field Experiments 1990

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### Experiments - Classics

#### Rothamsted Research

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90/R/BK/1

**BROADBALK**

**Object:** To study the effects of organic and inorganic manures on continuous w. wheat. From 1968 two three-year rotations were included: potatoes, beans, w. wheat and fallow, w. wheat, w. wheat. In 1979 the first rotation was changed to fallow, potatoes, w. wheat. In 1980 the second rotation reverted to continuous w. wheat. Since 1985 part of the second rotation has been added to the first to extend the rotation to fallow, potatoes, w. wheat, w. wheat, w. wheat.

The 147th year, w. wheat, fallow, potatoes.

For previous years see 'Details' 1967 and 1973, Station Report for 1966, pp. 229-231, Station Report for 1968, Part 2, and 74-89/R/BK/1.

**Areas harvested:**

Wheat:	Section	
	0	0.00311
	1	0.00572
	2,3,6 and 7	0.00473
	8 and 9	0.00497
Potatoes:	4	0.00348

**Treatments:**

Whole plots

PLOT	Fertilizers and organic manures:-			
	Plot	Treatments until 1967	Treatments from 1968	Treatments from 1985
01DN4PK	01	-	D N2 P K	D N4 P K
21DN2	21	D	D N2	D N2
22D	22	D	D	D
030	03	None	None	None
05F	05	P K Na Mg	P K (Na) Mg	PK Mg
06N1F	06	N1 P K Na Mg	N1 P K (Na) Mg	N1 P K Mg
07N2F	07	N2 P K Na Mg	N2 P K (Na) Mg	N2 P K Mg
08N3F	08	N3 P K Na Mg	N3 P K (Na) Mg	N3 P K Mg
09N4F	09	N*1 P K Na Mg	N4 P K (Na) Mg	N4 P K Mg
10N2	10	N2	N2	N2
11N2P	11	N2 P	N2 P	N2 P
12N2PNA	12	N2 P Na	N2 P Na	N2 P Na
13N2PK	13	N2 P K	N2 P K	N2 P K
14N2PKMG	14	N2 P Mg	N2 P K Mg	N2 P K Mg
15N5F	15	N2 P K Na Mg	N3 P K (Na) Mg	N5 P K Mg
16N6F	16	N*2 P K Na Mg	N2 P K (Na) Mg	N6 P K Mg
17N1+3FH	17	N2 (A)	N2 1/2 (P K (Na) Mg)	N1+3 1/2 (PK Mg) +
18N0+3FH	18	P K Na Mg (A)	N2 1/2 (P K (Na) Mg)	N0+3 1/2 (PK Mg) +
19C	19	C	C	C
20NKMG	20	N2 K Na Mg	N2 K (Na) Mg	N2 K Mg

(A) Alternating

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+ This change since 1980. Treatments shown are those to w. wheat; autumn N alternates. Potatoes receive N3 1/2 (PK Mg) on both Plots 17 and 18.

N1,N2,N3,N4,N5,N6: 48, 96, 144, 192, 240, 288 kg N (as sulphate of ammonia until 1967, except N\* which was nitrate of soda. All as 'Nitro-Chalk' in spring from 1968 to 1985, as 'Nitram' since 1986.)  
 N0+3; N1+3: None in autumn + 144 kg N in spring; 48 kg N in autumn + 144 kg N in spring  
 P: 35 kg P as single superphosphate until 1987, triple superphosphate in 1974 and since 1988  
 K: 90 kg K as sulphate of potash  
 Na: 55 kg Na as sulphate of soda  
 (Na): 16 kg Na as sulphate of soda until 1973  
 Mg: 30 kg Mg annually to Plot 14, 35 kg Mg every third year to other plots since 1974. All as kieserite since 1974, previously as sulphate of magnesia annually  
 D: Farmyard manure at 35 tonnes  
 C: Castor meal to supply 96 kg N until 1988, none since  
 F: P K (Na) Mg      H: Half rate

Strips of sub plots: Until 1967 wheat alone was grown on the experiment, with some bare fallowing on strips of sub plots. From 1968, ten sub plots were started with the following cropping:-

		70,	71,	72,																
		73,	74,	75,																
		and	and	and																
SECTION	Section	68	69	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90		
0/39B	0*	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
1/24B	1	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
2/2B	2	BE	W	P	BE	W	F	P	W	F	P	W	W	W	F	P	W	W	W	W
3/3B	3	W	W	F	W	W	F	W	W	W	W	W	W	F	P	W	W	W	W	W
POTATOES	4	W	P	BE	W	P	P	W	F	P	W	F	P	W	W	W	F	P		
-	5	W	F	W	W	F	W	W	W	W	W	W	W	F	P	W	W	W	W	F
6/13B	6**	F	W	W	F	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
6/13S	6**	F	W	W	F	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
7/1B	7	P	BE	W	P	BE	W	F	P	W	F	P	W	W	W	F	P	W		
7/1S	7	P	BE	W	P	BE	W	F	P	W	F	P	W	W	W	F	P	W		
8/2B	8+	W	W	W	W	W	W	W	F	W	W	W	W	W	W	F	W	W		
9/32B	9	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W		
9/32S	9	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W		

W = w. wheat, P = potatoes, BE = s. beans, F = fallow

\* Straw incorporated since 1987. \*\* No sprays except weedkillers since 1985. + No weedkillers.

B = Brimstone, S = Squareheads Master



90/R/BK/1

- NOTES:** (1) For a fuller record of treatments see 'Details' etc.  
(2) From autumn 1975 to autumn 1986, chalk was applied at 2.9 t each autumn to all plots in sets of Sections on a three-year cycle. Year 1: Sections 1,2,3. Year 2: Sections 6,7,8,9. Year 3: Sections 0,4,5. Since autumn 1988 a five-year cycle has been used. Year 1: Sections 1,3. Year 2: Sections 2,8. Year 3: Sections 7,9. Year 4: Sections 4,6. Year 5: Sections 0,5.

**Standard applications:**

W. wheat: Manure: Chalk at 2.9 t (to sections 2 and 8 only).  
Weedkillers: Glyphosate at 1.4 kg in 200 l (except to sections 7 and 8). Isoproturon at 1.7 kg with mecoprop at 2.0 kg in 200 l (except to section 8). Mecoprop at 2.2 kg, bromoxynil at 0.28 kg and ioxynil at 0.28 kg in 200 l (to sections 0, 1, 2 and 3). Mecoprop at 3.6 kg, bromoxynil at 0.45 kg and ioxynil at 0.45 kg in 200 l (to sections 6, 7 and 9). Fluroxypyr at 0.40 kg in 200 l (except to section 8). Fungicides (except to section 6): Prochloraz at 0.40 kg applied with the growth regulator in 200 l. Chlorothalonil at 1.0 kg with fenpropimorph at 0.75 kg in 200 l. Propiconazole at 0.12 kg with carbendazim at 0.25 kg and maneb at 1.6 kg in 200 l. Growth regulator (except to section 6): Chlormequat chloride at 1.6 kg.

Potatoes: Weedkillers: Glyphosate at 1.4 kg in 200 l. Linuron at 1.6 kg in 200 l. Fungicides: Maneb at 0.96 kg and zinc oxide at 0.022 kg applied with the insecticide in 200 l. Maneb at 0.96 kg and zinc oxide at 0.022 kg with a wetting agent, 'Bond' at 0.20 l, in 200 l. Mancozeb at 1.0 kg in 200 l on two occasions. Fentin hydroxide at 0.27 kg in 200 l on two occasions. Insecticide: Demeton-S-methyl at 0.24 kg in 200 l.

Fallow: Weedkiller: Glyphosate at 1.4 kg in 200 l.

**Seed:** W. wheat: Brimstone, dressed fonofos, and Squarehead's Master, both sown at 180 kg.

Potatoes: Pentland Crown.

**Cultivations, etc.:-**

All Sections:

K, Na and Mg applied: 14 Sept, 1989. P applied: 15 Sept. FYM applied: 27 Sept. Ploughed: 28 Sept. Spiked rotary cultivated: 7 Oct. Spiked rotary cultivated, rotary harrowed: 9 Oct.

Cropped Sections:

W. wheat: Straw chopped (section 0): 16 Aug, 1989. Glyphosate applied (except to sections 7 and 8): 29 Aug. Chalk applied (sections 2 and 8): 13 Sept. Autumn N treatments applied: 15 Sept. Rotary harrowed, all seed sown. 11 Oct. Isoproturon with mecoprop applied (except to section 8): 17 Nov. Spring N treatments applied: 9 Apr, 1990. Prochloraz with the growth regulator applied (except to section 6): 24 Apr. Mecoprop, bromoxynil and ioxynil applied to sections 0, 1, 2 and 3 and separately to sections 6, 7 and 9: 25 Apr. Chlorothalonil with fenpropimorph (except to section 6) and fluroxypyr (except to section 8) applied: 17 May. Propiconazole with carbendazim and maneb applied (except to section 6): 14 June. Combine harvested: 8 Aug.

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**Cultivations, etc.:-**

Potatoes: Glyphosate applied: 29 Aug, 1989. Deep-tine cultivated: 24 Nov. N treatments applied, rotary harrowed, potatoes planted, rotary ridged: 5 Apr, 1990. Linuron applied: 6 Apr. Maneb and zinc oxide with demeton-S-methyl applied: 15 June. Mancozeb applied: 29 June and 13 July. Maneb and zinc oxide with the wetting agent applied: 27 July. Fentin hydroxide applied: 13 Aug and 28 Aug. Haulm mechanically destroyed: 6 Sept. Lifted: 21 Sept.

Fallow: Glyphosate applied: 29 Aug, 1989. Deep-tine cultivated: 24 Nov. Heavy spring-tine cultivated: 23 Apr, 1990. Cultivated by rotary grubber: 17 May. Heavy spring-tine cultivated: 29 June and 17 July.

**W.WHEAT**

**GRAIN TONNES/HECTARE**

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

SECTION PLOT	7/1B	7/1S	2/2B	8/2B	3/3B	6/13B	6/13S	1/24B	9/32B	9/32S	0/39B
01DN4PK	9.43	*	9.08	*	7.25	8.39	*	*	*	*	*
21DN2	10.02	*	9.17	5.25	7.45	8.36	*	7.22	8.21	*	7.23
22D	7.94	*	6.91	5.38	6.05	6.29	*	5.64	6.44	*	5.88
030	2.70	2.18	1.62	1.67	1.15	1.36	1.39	1.12	1.06	1.33	1.60
05F	1.71	1.38	1.70	2.64	1.75	1.63	1.43	1.41	1.72	1.24	1.88
06N1F	5.52	4.12	5.13	4.61	4.22	4.12	2.77	3.26	4.72	3.48	5.05
07N2F	8.51	5.09	6.99	6.35	4.94	6.55	3.88	5.45	6.36	4.50	6.37
08N3F	9.49	5.26	8.10	7.35	6.44	7.72	4.31	6.74	7.84	4.69	7.36
09N4F	9.42	4.72	8.41	7.77	6.56	7.48	4.25	6.74	6.96	4.80	6.98
10N2	6.99	4.58	6.73	4.71	4.64	4.85	3.30	4.73	4.70	3.01	5.28
11N2P	8.28	5.75	7.10	5.58	5.87	5.19	3.77	4.87	5.37	3.41	5.87
12N2PNA	8.55	5.65	7.58	6.14	6.76	5.51	3.98	6.81	6.26	3.54	7.18
13N2PK	7.67	5.22	7.35	5.69	5.83	4.44	3.48	6.55	6.46	4.20	6.62
14N2PKMG	8.25	5.31	7.28	6.02	6.40	5.40	3.43	6.76	6.60	4.22	7.08
15N5F	9.19	5.05	9.11	7.12	7.19	8.00	4.03	7.60	7.16	4.34	8.07
16N6F	9.53	4.74	9.20	7.43	7.70	8.32	3.76	7.03	8.27	4.38	6.63
17N1+3FN	9.59	5.16	9.04	6.91	6.70	8.15	4.35	7.59	7.82	5.00	7.66
18N0+3FN	9.79	5.35	8.49	6.65	5.48	7.58	4.23	7.33	7.41	4.61	7.78
19C	3.64	3.43	2.71	1.57	1.52	2.14	1.81	2.58	1.84	1.94	2.12
20NKMG	*	*	*	*	*	*	*	3.82	*	*	4.52

GRAIN MEAN DM% 89.7

90/R/BK/1 W.WHEAT

STRAW TONNES/HECTARE

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

SECTION PLOT	7/1B	7/1S	1/24B
01DN4PK	6.71	*	*
21DN2	6.28	*	4.65
22D	2.57	*	2.66
030	0.49	1.23	0.39
05F	0.25	0.67	0.39
06N1F	1.44	2.28	1.24
07N2F	2.50	5.05	2.53
08N3F	3.87	7.07	2.68
09N4F	2.87	7.59	2.75
10N2	1.71	4.61	1.82
11N2P	2.11	4.69	1.82
12N2PNA	2.73	4.97	2.52
13N2PK	1.81	4.95	1.79
14N2PKMG	2.24	4.23	2.20
15N5F	3.19	7.16	2.83
16N6F	5.13	8.04	2.75
17N1+3FN	3.44	7.00	2.18
18N0+3FN	3.73	7.27	2.30
19C	0.68	1.72	0.57
20NKMG	*	*	1.22

STRAW MEAN DM% 88.9

POTATOES

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

PLOT	TOTAL TUBERS	% WARE
	TONNES/ HECTARE	3.81 CM (1.5 INCH) RIDDLE
01DN4PK	14.5	71.8
21DN2	20.5	89.1
22D	19.6	87.4
030	3.7	41.4
05F	7.2	53.6
06N1F	13.7	79.8
07N2F	12.4	74.9
08N3F	17.9	85.2
09N4F	18.9	86.4
10N2	5.1	59.7
11N2P	6.0	64.9
12N2PNA	7.1	64.5
13N2PK	9.4	73.2
14N2PKMG	16.9	82.8
15N5F	20.9	86.9
16N6F	20.9	86.7
17N3FH	7.1	64.2
18N3FH	14.0	82.3
19C	6.2	55.3



90/R/HB/2

HOOS BARLEY

**Object:** To study the effects of organic and inorganic manures on continuous s. barley. From 1968 to 1978 a rotation of potatoes, beans and s. barley was practised. The rotation was discontinued in 1979 and the experiment reverted to continuous s. barley.

The 139th year, s. barley.

For previous years see 'Details' 1967 and 1973, Station Report for 1966 and 74-89/R/HB/2.

**Treatments:** All combinations of:-

1. **MANURE** Fertilizers and organic manures:

	Form of N 1852-1966	Additional treatments 1852-1979	Changes since 1980
---	None	-	-
-P-	None	P	-
--K	None	K (Na) Mg	-
-PK	None	PK (Na) Mg	-
A--	A	-	-
AP-	A	P	-
A-K	A	K (Na) Mg	-
APK	A	PK (Na) Mg	-
N----	N	-	-
NP---	N	P	-
N-K--	N	K (Na) Mg	-
NPK--	N	PK (Na) Mg	-
N--S-	N	Si	Si omitted
NP-S-	N	P Si	"
N-KS-	N	K (Na) MgSi	"
NPKS-	N	PK (Na) MgSi	"
N---S	N	-	Si added
NP--S	N	P	"
N-K-S	N	K (Na) Mg	"
NPK-S	N	PK (Na) Mg	"
N--SS	N	Si	-
NP-SS	N	P Si	-
N-KSS	N	K (Na) MgSi	-
NPKSS	N	PK (Na) MgSi	-
C(--)	C	-	PKMg omitted
C(P-)	C	P	"
C(-K)	C	K (Na) Mg	"
C(PK)	C	PK (Na) Mg	"
D	None	D	-
(D)	(D)	-	-
(A)	(Ashes)	-	-
-	None	-	-

90/R/HB/2

Form of N: A, sulphate of ammonia: N, nitrate of soda - each to supply 48 kg N: C, castor meal to supply 96 kg N

P: 35 kg P as single superphosphate (triple superphosphate in 1974, 1988 and 1989)

K: 90 kg K as sulphate of potash

(Na): 16 kg Na as sulphate of soda until 1973

Mg: 35 kg Mg, as kieserite every third year since 1974 (sulphate of magnesia annually until 1973)

Si: Silicate of soda at 450 kg

D: Farmyard manure at 35 tonnes. (D): until 1871 only

(Ashes): Weed ash 1852-1916, furnace ash 1917-1932, none since

2. **N** Nitrogen fertilizer (kg N), as 'Nitro-Chalk' (27% N in 1990), since 1968 (cumulative N applications until 1973, on a cyclic system since 1974):

0  
48  
96  
144

Plus extra plots testing all combinations of:-

1. **MANURE** Fertilizers other than magnesium:

551AN2PK	Plot 551 AN2PK
561--PK	Plot 561 --PK
571NN2--	Plot 571 NN2
581NN2--	Plot 581 NN2

N2: 96 kg N as 'Nitro-Chalk' since 1968. Other symbols as above.

2. **MAGNESIUM** Magnesium fertilizer (kg Mg) as kieserite every third year since 1974:

0  
35

**NOTE:** For a fuller record see 'Details' etc.

**Basal applications:** Weedkillers: Glyphosate at 1.4 kg in 200 l. Mecoprop at 1.6 kg, bromoxynil at 0.20 kg and ioxynil at 0.20 kg applied with the fungicide in 200 l. Fungicide: Fenpropimorph at 0.75 kg. Insecticide: Demeton-s-methyl at 0.24 kg in 200 l.

**Seed:** Triumph, seed dressed triadimenol and fuberidazole, sown at 160 kg.

**Cultivations, etc.:-** Glyphosate applied: 2 Oct, 1989. P and silicate of soda applied: 29 Nov. K applied: 30 Nov. FYM applied: 4 Dec. Ploughed: 6 Dec. Spring-tine cultivated three times, seed sown: 5 Mar, 1990. N applied: 10 Apr. Insecticide applied: 10 May. Remaining weedkillers applied with the fungicide: 14 May. Combine harvested: 6 Aug.



90/R/HB/2

MAIN PLOTS

GRAIN TONNES/HECTARE

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

N	0	48	96	144	Mean
<b>MANURE</b>					
---	0.84	0.88	1.49	1.35	1.14
-P-	1.87	2.19	2.08	1.82	1.99
--K	1.70	2.38	2.40	2.26	2.19
-PK	1.89	3.50	3.58	3.84	3.20
A--	1.38	1.04	1.53	1.38	1.33
AP-	1.80	1.88	1.97	1.88	1.88
A-K	1.60	2.07	2.06	2.07	1.95
APK	2.52	3.68	4.48	4.39	3.77
N----	1.52	1.74	0.93	1.46	1.41
NP----	1.82	2.65	2.96	2.56	2.50
N-K--	1.94	2.24	2.20	2.04	2.11
NPK--	2.61	3.97	4.24	4.43	3.81
N--S-	1.59	2.13	2.47	1.71	1.98
NP-S-	2.30	3.05	2.48	2.56	2.60
N-KS-	2.38	2.75	3.16	2.99	2.82
NPKS-	2.08	3.89	4.31	4.36	3.66
N---S	1.86	1.99	1.85	1.92	1.91
NP--S	1.90	2.81	3.08	2.84	2.66
N-K-S	2.13	2.52	2.89	2.97	2.63
NPK-S	2.88	3.91	4.71	4.33	3.96
N--SS	1.93	1.53	1.85	1.78	1.77
NP-SS	1.79	2.32	3.06	2.50	2.42
N-KSS	2.20	2.88	3.22	2.91	2.80
NPKSS	3.03	3.90	4.67	4.23	3.96
C(--)	1.89	2.41	2.64	2.25	2.30
C(P-)	1.94	2.79	3.40	2.94	2.77
C(-K)	2.22	3.03	3.19	3.02	2.87
C(PK)	2.62	3.75	4.49	3.89	3.69
D	5.71	6.34	6.00	6.39	6.11
(D)	2.15	2.28	3.90	2.48	2.70
(A)	1.38	2.40	2.06	1.82	1.91
-	1.43	1.56	2.09	1.72	1.70
Mean	2.09	2.70	2.98	2.79	2.64

GRAIN MEAN DM% 86.7

90/R/HB/2

**STRAW TONNES/HECTARE**

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

N	0	48	96	144	Mean
<b>MANURE</b>					
---	0.26	0.30	0.57	0.40	0.38
-P-	0.61	0.83	0.87	0.84	0.79
--K	0.60	0.97	0.92	1.04	0.88
-PK	0.52	1.17	1.56	1.39	1.16
A--	0.43	0.17	0.47	0.40	0.37
AP-	0.71	0.66	0.74	0.75	0.72
A-K	0.56	0.72	0.58	0.73	0.65
APK	0.65	1.48	1.52	1.17	1.20
D	2.61	2.86	2.67	2.44	2.64
(D)	0.78	1.08	1.75	1.00	1.15
(A)	0.49	0.81	0.83	0.65	0.70
-	0.66	0.49	0.80	0.53	0.62
Mean	0.74	0.96	1.11	0.94	0.94

STRAW MEAN DM% 84.1

PLOT AREA HARVESTED 0.00154

**EXTRA PLOTS**

**GRAIN TONNES/HECTARE**

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

MANURE	551AN2PK	561--PK	571NN2--	581NN2--	Mean
<b>MAGNESIUM</b>					
0	3.85	1.22	2.88	1.59	2.39
35	4.13	1.26	2.76	1.55	2.43
Mean	3.99	1.24	2.82	1.57	2.41

GRAIN MEAN DM% 85.3

PLOT AREA HARVESTED 0.00329

90/R/WF/3

**WHEAT AND FALLOW**

**Object:** To study the effects of fallowing on unmanured w. wheat - Hoosfield.

The 135th year, w. wheat.

For previous years see 'Details' 1967, 1973 and 74-89/R/WF/3.

**Whole plot dimensions:** 9.60 x 211.

**Treatments:**

Each year there are two plots, one is sown to w. wheat, one is fallow; they alternate in successive years.

**Seed:** Brimstone, dressed fonofos, sown at 180 kg.

**Cultivations, etc.:-**

Wheat plot: Heavy spring-tine cultivated, rotary harrowed, seed sown: 12 Oct, 1989. Combine harvested: 9 Aug, 1990.

Fallow plot: Ploughed: 8 Dec, 1989. Heavy spring-tine cultivated: 23 Apr, 1990. Cultivated by rotary grubber: 15 June. Cultivated with 'thistle bar': 17 July.

**GRAIN AND STRAW TONNES/HECTARE**

	GRAIN	STRAW
YIELD	1.94	0.61
MEAN DM%	88.8	84.7
PLOT AREA HARVESTED	0.04309	



90/R/EX/4

**EXHAUSTION LAND**

**Object:** To study the residual effects of manures applied 1876-1901, and of additional phosphate applied since 1986, on the yield of continuous s. barley - Hoosfield.

The 135th year, s. barley.

For previous years see 'Details' 1967, 1973 and 74-89/R/EX/4.

**Treatments:** All combinations of:-

Whole plots

1. **OLD RES** Residues of manures applied annually 1876-1901:
- |         |  |
|---------|--|
| O       | None   |
| D       | Farmyard manure at 35 tonnes   |
| N       | 96 kg N as ammonium salts  |
| P       | 34 kg P as superphosphate  |
| NPKNAMG | N and P as above plus 137 kg K as sulphate of potash, 16 kg Na as sulphate of soda, 11 kg Mg as sulphate of magnesia |
2. **P** Phosphate applied annually from 1986 as superphosphate until 1987, triple superphosphate since:
- |    |          |
|----|----------|
| O  | None     |
| P1 | 44 kg P  |
| P2 | 87 kg P  |
| P3 | 131 kg P |

plus all combinations of:-

1. **OLD RES** Residues of manures applied annually 1876-1901:
- |      |   |
|------|---|
| O    | None  |
| D    | Farmyard manure at 35 tonnes                              |
| N*   | 96 kg N as nitrate of soda                                |
| PK   | 34 kg P as superphosphate, 137 kg K as sulphate of potash |
| N*PK | N, P and K as above                                       |
2. **N90** Nitrogen fertilizer (kg N) as 'Nitro-Chalk' until 1985, as 'Nitram' since 1986 (basal until 1975, on a cyclic system since 1976):
- |     |
|-----|
| 0   |
| 48  |
| 96  |
| 144 |

**NOTE:** All plots of the combination OLD RES, P were given N at 144 kg as 'Nitram' and K at 83 kg as muriate of potash.

90/R/EX/4

**Basal applications:** Weedkillers: Glyphosate at 1.4 kg in 200 l. Mecoprop at 1.6 kg, bromoxynil at 0.20 kg and ioxynil at 0.20 kg applied with the fungicide in 200 l. Fungicide: Fenpropimorph at 0.75 kg. Insecticide: Demeton-s-methyl at 0.24 kg in 200 l.

**Seed:** Triumph, seed dressed triadimenol and fuberidazole, sown at 160 kg.

**Cultivations, etc.:-** Glyphosate applied: 2 Oct, 1989. P and K applied: 1 Dec. Ploughed: 8 Dec. Spring-tine cultivated twice, rotary harrowed, seed sown: 9 Mar, 1990. N applied: 11 Apr. Insecticide applied: 10 May. Remaining weedkillers applied with the fungicide: 14 May. Combine harvested: 3 Aug.

**PHOSPHATE PLOTS**

**GRAIN TONNES/HECTARE**

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

	P	O	P1	P2	P3	Mean
<b>OLD RES</b>						
O	1.91	3.79	3.90	4.42	3.50	
D	3.42	4.35	4.66	4.10	4.13	
N	1.97	3.96	4.53	4.45	3.73	
P	2.96	4.19	4.17	4.07	3.85	
NPKNAMG	2.90	3.96	4.62	4.29	3.94	
Mean	2.63	4.05	4.38	4.26	3.83	

GRAIN MEAN DM% 87.1

**STRAW TONNES/HECTARE**

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

	P	O	P1	P2	P3	Mean
<b>OLD RES</b>						
O	0.36	1.30	1.31	1.30	1.07	
D	1.20	1.40	1.60	1.59	1.45	
N	0.46	1.31	1.41	1.40	1.15	
P	0.93	1.68	1.40	1.77	1.45	
NPKNAMG	1.11	1.48	1.79	1.49	1.47	
Mean	0.81	1.44	1.50	1.51	1.32	

STRAW MEAN DM% 93.2

PLOT AREA HARVESTED 0.00589

90/R/EX/4

NITROGEN PLOTS

GRAIN TONNES/HECTARE

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

	N90	0	48	96	144	Mean
OLD RES						
O	1.18	1.39	1.23	0.82	1.16	
D	1.92	2.40	2.26	2.33	2.23	
N*	1.57	1.74	1.75	1.47	1.63	
PK	2.26	2.13	2.68	2.48	2.39	
N*PK	1.80	2.06	2.64	2.35	2.22	
Mean	1.75	1.95	2.11	1.89	1.92	

GRAIN MEAN DM% 86.1

STRAW TONNES/HECTARE

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

	N90	0	48	96	144	Mean
OLD RES						
O	0.29	0.28	0.28	0.28	0.28	0.28
D	0.65	0.65	0.66	0.75	0.68	
N*	0.57	0.56	0.47	0.37	0.49	
PK	0.56	0.56	0.93	0.83	0.72	
N*PK	0.47	0.75	0.75	0.74	0.68	
Mean	0.51	0.56	0.62	0.59	0.57	

STRAW MEAN DM% 93.7

PLOT AREA HARVESTED 0.00589



90/R/PG/5

PARK GRASS

**Object:** To study the effects of organic and inorganic manures and lime on old grass (for hay).

The 135th year, hay.

For previous years see 'Details' 1967 and 1973 and 74-89/R/PG/5.

**Treatments:** Combinations of:-

Whole plots

1. **MANURE** Fertilizers and organic manures:

N1	Plot 1	N1
O(D)	Plot 2	None (D until 1863)
O/PLOT3	Plot 3	None
P	Plot 4/1	P
N2P	Plot 4/2	N2 P
N1MN	Plot 6	N1 P K Na Mg
MN	Plot 7	P K Na Mg
PNAMG	Plot 8	P Na Mg
MN(N2)	Plot 9/1	P K Na Mg (N2 until 1989)
N2MN	Plot 9/2	N2 P K Na Mg
N2PNAMG	Plot 10	N2 P Na Mg
N3MN	Plot 11/1	N3 P K Na Mg
N3MNSI	Plot 11/2	N3 P K Na Mg Si
O/PLOT12	Plot 12	None
D/F	Plot 13	D/F
MN(N2*14)	Plot 14/1	P K Na Mg (N2* until 1989)
N2*MN	Plot 14/2	N2* P K Na Mg
MN(N2*15)	Plot 15	P K Na Mg (N2* until 1875)
N1*MN	Plot 16	N1* P K Na Mg
N1*	Plot 17	N1*
N2KNAMG	Plot 18	N2 K Na Mg
D	Plot 19	D
D/N*PK	Plot 20	D/N*P K

N1, N2, N3:	48, 96, 144 kg N as sulphate of ammonia
N1*, N2*:	48, 96 kg N as nitrate of soda (30 kg N to Plot 20, only in years with no farmyard manure)
P:	35 kg P (15 kg P to Plot 20, only in years with no farmyard manure) as single superphosphate until 1986, triple superphosphate in 1974, and since 1987
K:	225 kg K (45 kg K to Plot 20, only in years with no farmyard manure) as sulphate of potash
Na:	15 kg Na as sulphate of soda
Mg:	10 kg Mg as sulphate of magnesia
Si:	Silicate of soda at 450 kg
D:	Farmyard manure at 35 tonnes every fourth year
F:	Fish meal every fourth year to supply 63 kg N
MN:	P K Na Mg

90/R/PG/5

Sub plots

2. LIME Liming:

- A a Ground chalk applied as necessary to achieve pH7
- B b Ground chalk applied as necessary to achieve pH6
- C c Ground chalk applied as necessary to achieve pH5
- D d None

**NOTE:** Lime was applied regularly, and at the same rate, to all a and b sub plots of Plots 1 to 17 (except 12) from 1924. Differential liming started in 1965 on certain b and c sub plots (except on Plot 12) and in 1976 on certain a sub plots (including Plot 12) and 12b. Liming ceased on plots 9/1 and 14/1 after 1989.

Chalk applied 1990 (tonnes CaCO<sub>3</sub>):

Plot	A	B	C
1	8.7	5.9	6.7
2	6.4	-	1.0
3	6.5	4.7	1.1
4/1	4.5	-	-
4/2	7.6	5.4	3.8
6	4.6	-	-
7	4.1	-	2.3
8	4.0	-	-
9/2	9.5	6.4	4.3
10	4.4	3.3	2.7
11/1	3.8	8.5	3.7
11/2	6.2	4.2	3.2
12	3.2	4.3	-
13	5.1	-	-
14/2	0.9	-	-
15	2.9	-	-
16	2.0	-	-
17	4.0	-	-
18	7.3	-	9.4

Additional sub plots (Plots 18, 19 and 20 only) (tonnes CaCO<sub>3</sub> applied every fourth year 1920-1964):

N2KNAMG0	18-1	None
N2KNAMG2	18-2	13.5
N2KNAMG1	18-3	7.9
DO	19-1	None
D2	19-2	6.3
D1	19-3	1.1
D/N*PK0	20-1	None
D/N*PK2	20-2	5.6
D/N*PK1	20-3	1.1

Since 1965 Plot 18-1 has been split into two for treatments 'c' and 'd' above and Plot 18-3 split into two for treatments 'a' and 'b'. The remaining sub plots of Plots 18, 19 and 20 are treated as 'a'.

**NOTE:** For a fuller record of treatments see 'Details' etc.

90/R/PG/5

Cultivations, etc.:— P applied: 5 Dec, 1989. K, Na, Mg and Si applied:  
8 Jan, 1990. Chalk applied: 12 Jan – 2 Mar. N applied: 9 Apr. Cut:  
2 July, 20 Nov.

1ST CUT (2/7/90) DRY MATTER TONNES/HECTARE

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

LIME	A	B	C	D	MEAN
<b>MANURE</b>					
N1	2.18	1.77	0.76	0.20	1.23
O(D)	1.56	1.96	0.99	1.14	1.41
O/PLOT3	1.40	1.73	0.82	0.88	1.21
P	2.03	2.02	1.44	1.40	1.72
N2P	2.62	2.45	1.87	1.35	2.07
N1MN	4.27	4.45			4.36
MN	3.83	3.73	2.61	1.97	3.03
PNAMG	1.46	1.72	1.88	2.04	1.77
MN(N2)	2.21	2.09	0.96	1.07	1.58
N2MN	4.00	4.33	2.32	1.48	3.03
N2PNAMG	2.77	2.77	2.09	1.01	2.16
N3MN	5.21	4.99	5.03	3.71	4.74
N3MNSI	4.75	4.45	3.23	4.15	4.15
O/PLOT12	1.27	1.14	0.89	0.94	1.06
D/F	4.54	3.35	2.53	2.48	3.22
MN(N2*14)	2.51	3.71	3.37	3.34	3.23
N2*MN	4.99	5.59	4.12	4.82	4.88
MN(N2*15)	4.29	2.70	2.03	2.25	2.82
N1*MN	5.12	4.68	3.10	3.20	4.02
N1*	1.99	2.20	2.58	2.67	2.36
N2KNAMG0			0.17	0.06	0.12
N2KNAMG2	2.55				2.55
N2KNAMG1	2.46	2.17			2.31
D0	2.87				2.87
D2	3.35				3.35
D1	2.76				2.76
D/N*PK0	3.56				3.56
D/N*PK2	3.83				3.83
D/N*PK1	4.32				4.32

1ST CUT MEAN DM% 32.5



90/R/PG/5

2ND CUT (20/11/90) DRY MATTER TONNES/HECTARE

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

LIME MANURE	A	B	C	D	MEAN
N1	0.95	0.54	0.38	0.13	0.50
O(D)	0.36	0.41	0.29	0.55	0.40
O/PLOT3	0.31	0.45	0.31	0.49	0.39
P	0.65	0.33	0.39	0.78	0.54
N2P	0.72	0.56	0.38	0.46	0.53
N1MN	0.21	0.23			0.22
MN	0.30	0.27	0.19	0.19	0.24
PNAMG	0.10	0.13	0.30	0.25	0.20
MN(N2)	0.05	0.09	0.06	0.05	0.06
N2MN	0.08	0.23	0.10	0.30	0.18
N2PNAMG	0.22	0.51	0.22	0.37	0.33
N3MN	0.70	0.33	0.30	0.37	0.42
N3MNSI	0.91	0.51	0.38	0.48	0.57
O/PLOT12	0.14	0.14	0.14	0.19	0.16
D/F	1.05	0.74	0.30	0.37	0.61
MN(N2*14)	0.22	0.25	0.25	0.34	0.27
N2*MN	0.56	0.57	0.48	0.39	0.50
MN(N2*15)	0.26	0.15	0.11	0.18	0.18
N1*MN	0.54	0.56	0.34	0.43	0.47
N1*	0.25	0.26	0.28	0.54	0.33
N2KNAMG0			0.00	0.00	0.00
N2KNAMG2	0.42				0.42
N2KNAMG1	0.10	0.10			0.10
D0	0.23				0.23
D2	0.23				0.23
D1	0.13				0.13
D/N*PK0	0.28				0.28
D/N*PK2	0.28				0.28
D/N*PK1	0.39				0.39

2ND CUT MEAN DM% 27.0

90/R/PG/5

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

LIME MANURE	A	B	C	D	MEAN
N1	3.12	2.31	1.14	0.33	1.73
O(D)	1.93	2.37	1.29	1.68	1.82
O/PLOT3	1.72	2.18	1.13	1.37	1.60
P	2.69	2.35	1.83	2.18	2.26
N2P	3.35	3.01	2.24	1.80	2.60
N1MN	4.48	4.68			4.58
MN	4.13	3.99	2.80	2.16	3.27
PNAMG	1.56	1.85	2.18	2.29	1.97
MN(N2)	2.26	2.18	1.01	1.11	1.64
N2MN	4.08	4.56	2.41	1.78	3.21
N2PNAMG	2.99	3.28	2.30	1.38	2.49
N3MN	5.91	5.32	5.32	4.08	5.16
N3MNSI	5.67	4.96	3.61	4.64	4.72
O/PLOT12	1.41	1.28	1.04	1.13	1.22
D/F	5.59	4.09	2.82	2.84	3.84
MN(N2*14)	2.73	3.96	3.62	3.67	3.50
N2*MN	5.55	6.16	4.59	5.21	5.38
MN(N2*15)	4.55	2.85	2.14	2.43	2.99
N1*MN	5.65	5.23	3.44	3.63	4.49
N1*	2.24	2.46	2.86	3.22	2.69
N2KNAMG0			0.17	0.06	0.12
N2KNAMG2	2.97				2.97
N2KNAMG1	2.56	2.27			2.41
D0	3.10				3.10
D2	3.58				3.58
D1	2.89				2.89
D/N*PK0	3.84				3.84
D/N*PK2	4.12				4.12
D/N*PK1	4.71				4.71

TOTAL OF 2 CUTS MEAN DM% 29.7

PLOT AREA HARVESTED 0.00002

90/R/AG/6

**AGDELL**

**Object:** To study, the residual values of phosphate and potash applied in the period 1848-1951 and further dressings since 1964.

The 21st year of revised scheme, ley.

For previous years see 'Details' 1967 and 1973, and 74-89/R/AG/6.

**NOTE:** Yields were not taken and no new treatments were applied.

**Basal applications:** Manures: 'Nitram' at 350 kg and later at 220 kg.

**Cultivations, etc.:-** First N applied: 6 Mar, 1990. Cut: 30 May.  
Second N applied: 8 June. Cut: 1 Aug.

**NOTE:** The experiment ended after the second cut.

90/R/BN/7

**BARNFIELD**

**Object:** The experiment was designed to study the effects of organic and inorganic manures on continuous root crops. It was progressively modified to study effects on other crops.

Sections 1 and 2 the seventh year of grass/clover. The 16th year of grass on the rest of the experiment.

For previous years see 'Details' 1967 and 1973 and 74-89/R/BN/7.

**Plot dimensions:** 10.7 x 55.9.

**Treatments to grass:** All combinations of:-

Whole plots

1. **MANURE** Fertilizers and organic manures:

D	D
DPK	D P K
PKMG	P K (Na) Mg
P	P
PK	P K
PMG	P (Na) Mg
0	0

P: 35 kg P as single superphosphate until 1987, triple superphosphate since and in 1974

K: 225 kg K as sulphate of potash

(Na): 90 kg Na as sodium chloride until 1973

Mg: 90 kg Mg as kieserite every fourth year since 1974 (sulphate of magnesia until 1973)

D: Farmyard manure at 35 tonnes (until 1975).

Quarter plots

2. **N PERCUT** Nitrogen fertilizer in 1990 (kg N per cut) as 'Nitram', cumulative to previous dressings, and residues of forms of N previously each supplying 96 kg N per annum:

75	75, previously nitrate of soda, section 3
100	100, previously sulphate of ammonia, section 4
125	125, previously sulphate of ammonia + castor meal, section 5
150	150, previously castor meal, section 6

Castor meal last applied 1961, nitrate of soda and sulphate of ammonia until 1959.

Plus one plot **MANURE** KMG 100



90/R/BN/7

Treatments to grass/clover, sections 1 and 2 (not given nitrogen fertilizer):

**MANURE** Fertilizers and organic manures as for grass above, excluding KMG.

**NOTES:** (1) P K and D treatments were applied to Sections 1 and 2 until 1980. None were applied subsequently until the resumption of P and K treatments, only, from 1985.  
 (2) Yields were not taken from section 2.

**Cultivations, etc.:-**

All sections: P and K applied: 6 Dec, 1989. Mg applied: 7 Dec. Cut: 1 June, 1990 and 16 Nov.  
 Grass (Sections 3, 4, 5 and 6) only: N applied: 1 Mar, 1990 and 4 June.

**GRASS**

**1ST CUT (1/6/90) DRY MATTER TONNES/HECTARE**

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

N PERCUT	75	100	125	150	Mean
<b>MANURE</b>					
D	5.49	5.53	6.14	6.15	5.83
DPK	5.17	5.49	5.09	5.94	5.42
PKMG	4.28	5.30	5.44	4.84	4.96
P	1.38	1.47	1.95	1.78	1.64
PK	3.76	3.95	3.40	3.46	3.64
PMG	1.24	1.80	1.91	1.67	1.66
0	0.91	1.18	1.74	1.46	1.32
Mean	3.17	3.53	3.67	3.62	3.50

**MANURE KMG 100** 3.92

Grand mean 3.51

1ST CUT MEAN DM% 36.7

90/R/BN/7

2ND CUT (16/11/90) DRY MATTER TONNES/HECTARE

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

N PERCUT	75	100	125	150	Mean
<b>MANURE</b>					
D	1.57	1.72	2.18	1.90	1.84
DPK	1.54	1.79	1.73	2.29	1.84
PKMG	1.27	1.34	1.43	1.60	1.41
P	0.70	0.16	0.23	0.29	0.35
PK	1.24	1.03	0.94	1.75	1.24
PMG	0.35	0.18	0.18	0.46	0.29
0	0.50	0.20	0.39	0.60	0.42
Mean	1.02	0.92	1.01	1.27	1.06

MANURE KMG 100 1.27

Grand mean 1.06

2ND CUT MEAN DM% 24.3

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

N PERCUT	75	100	125	150	Mean
<b>MANURE</b>					
D	7.07	7.25	8.32	8.06	7.67
DPK	6.71	7.28	6.82	8.22	7.26
PKMG	5.55	6.63	6.87	6.44	6.37
P	2.08	1.63	2.18	2.07	1.99
PK	5.00	4.98	4.34	5.21	4.88
PMG	1.59	1.98	2.09	2.14	1.95
0	1.41	1.38	2.13	2.07	1.74
Mean	4.20	4.45	4.68	4.89	4.55

MANURE KMG 100 5.19

Grand mean 4.58

TOTAL OF 2 CUTS MEAN DM% 30.5

PLOT AREA HARVESTED 0.00568

90/R/BN/7

GRASS/CLOVER

1ST CUT (1/6/90) DRY MATTER TONNES/HECTARE

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

MANURE	D	DPK	PKMG	P	PK	PMG	0	Mean
	2.32	2.33	0.98	0.48	0.65	0.62	0.41	1.11

1ST CUT MEAN DM% 39.5

2ND CUT (16/11/90) DRY MATTER TONNES/HECTARE

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

MANURE	D	DPK	PKMG	P	PK	PMG	0	Mean
	0.45	0.33	0.13	0.18	0.20	0.17	0.27	0.25

2ND CUT MEAN DM% 37.2

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

MANURE	D	DPK	PKMG	P	PK	PMG	0	Mean
	2.77	2.66	1.11	0.65	0.86	0.79	0.67	1.36

TOTAL OF 2 CUTS MEAN DM% 38.3

PLOT AREA HARVESTED 0.00568

90/R/GC/8

GARDEN CLOVER

**Object:** To study yields and pathogens of red clover grown continuously - Manor Garden.

The 137th year, red clover.

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

**Design:** 2 blocks of 2 plots.

**Whole plot dimensions:** 1.00 x 1.40.

**Treatments:**

**FUNG RES** Residual effects of fungicide to control *Sclerotinia trifoliorum*:

**NONE** None

**BENOMYL** Benomyl sprays during previous winters including applications at 0.60 kg in 800 l on 13 Oct, 1989 and on 13 Nov

**Basal applications:** Manures: Chalk at 1.25 t. (0:18:36) at 420 kg. Mg at 50 kg, as Epsom Salts.

**NOTE:** Additional K was applied to replace that removed by the crop in 1989. **FUNG RES NONE** required 411 and 303 kg K2O to the first and second blocks respectively, **FUNG RES BENOMYL** 410 and 290 kg K2O. This was applied as muriate of potash, one third to the seedbed in 1990 and one third after the first and second cuts.

**Seed:** Hungaropoly, sown at 30 kg on 27 Mar, 1990.

**Cultivations, etc.:**- Chalk, PK and Mg applied: 25 Oct, 1989. Hand dug, root stumps carted: 14 Mar, 1990. K applied: 23 Mar. Cut and K applied: 23 July, 4 Sept.

**NOTE:** Irrigation was applied as follows (mm water):

30 Mar	10
9 May	10
24 May	10
24 July	10
8 Aug	10
	--
Total	50



90/R/GC/8

1ST CUT (23/7/90) DRY MATTER TONNES/HECTARE

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

FUNG RES	NONE	BENOMYL	Mean
	2.12	2.19	2.16

1ST CUT MEAN DM% 28.3

2ND CUT (4/9/90) DRY MATTER TONNES/HECTARE

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

FUNG RES	NONE	BENOMYL	Mean
	1.55	1.33	1.44

2ND CUT MEAN DM% 18.3

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FUNG RES	NONE	BENOMYL	Mean
	3.68	3.52	3.60

TOTAL OF 2 CUTS MEAN DM% 23.3

PLOT AREA HARVESTED 0.00010