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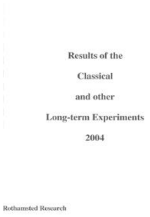
Results of the Classical and Other Long-term Experiments 2004



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Results of the

Classical

and other

Long-term Experiments

2004

Rothamsted Research

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List of Experiments in the 2004 Yield Book

R/BK/1	Broadbalk
R/HB/2	Hoos Barley
R/WF/3	Wheat and Fallow
R/EX/4	Exhaustion Land
R/PG/5	Park Grass
R/GC/8	Garden Clover
R/CS/326	Amounts of Straw
R/CS/477	Continuous Maize
W/RN/3	Ley Arable
W/RN/12	Organic Manuring
W/CS/326	Amounts of Straw
W/CS/478	Continuous Maize

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CONVENTIONS

For each experiment current treatments are shown with the factor and level names which are used in the tables.

For each experiment references are given to previous years. These refer to the '(Numerical)(Results)' previous editions of 'Yields of the Field Experiments'.

For the classical and some long-term experiments reference is made to 'Details' - separate publications, giving full descriptions of treatments until 1977 & 1973, with full titles 'Details of the Classical and Long Term Experiments up to 1977' and 'Details of the Classical and Long Term Experiments up to 1973'.

The following conventions are observed unless otherwise stated.

All areas are in hectares. All plot dimensions are in metres.

All rates of application of fertilizers, sprays etc. are per hectare.

All yields are per hectare.

For any other crop, details of abbreviations are given as necessary.

Fertilizers

27% N or 34.5% N means nitrogen as ammonium nitrate

Epsom salts	$MgSO_4.7H_2O$ 10% magnesium and 13% sulphur
Fishmeal	approximately 6.5% nitrogen
FYM	Farmyard manure (from bullocks)
Gypsum	17.5% sulphur
Kieserite	$MgSO_4H_2O$ 17.7% magnesium and 23.3% sulphur
Manganese sulphate	$Mn_2(SO_4)_3$ 27% manganese and 24% sulphur
Muriate of potash	60% K_2O
Nitrate of soda	$NaNO_3$ 16% nitrogen and 27% sodium
Rhodoman	A seed dressing containing 500 g/l inorganic manganese
Silicate of soda	Na_2SiO_3 37% sodium and 23% silica
Sulphur Gold	30% nitrogen and 7.6% sulphur
Sulphate of ammonia	$(NH_4)_2SO_4$ 21% nitrogen 24% sulphur
Sulphate of potash	K_2SO_4 50% K_2O and 18.4% sulphur
Triple superphosphate (TSP)	47% P_2O_5

Cereal straw is removed unless otherwise stated.

GS: Growth stage.

tm): Tank mix; two or more products applied together.

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tr.: means seed dressing

Machinery definitions as used in the diary.

Accord	Pneumatic drill with Suffolk coulters 12.5 cm apart.
Combine drilled	Drill mounted behind a rotary harrow.
Dutch harrow	Rigid tine harrow
Flexitine	Heavy spring-tine cultivator.
Nodet Gougis	Pneumatic precision drill with variable spacing.
Nordsten	Drill with Suffolk coulters 12 cm apart.
Oyjord	Drill with Suffolk coulters 14.2 cm apart.
Shakerator	Deep tine cultivator with vibrating tines 60 cm apart and 45 cm deep.
Subsoiler	Deep tine cultivator with vibrating tines 60 cm apart and 45 cm deep

Tables of means

The following abbreviations are used in variate headings:

Wheat, barley, oats, beans, lupins etc.
Grain: Grain (at 85% dry matter)
Straw: Straw (at 85% dry matter)

All crops
Mean D.M. %: Mean dry matter % as harvested

Standard errors

NOTES: (1) This report gives standard errors of differences, not of means.
(2) Annotations (e.g. * min rep, max-min, max rep) to S.E.Ds are only explained the first time they occur in any experiment.

PESTICIDES USED

The following list of pesticides is based on The UK Pesticides Guide, CAB International and The British Crop Protection Council. CABI Publishing

KEY TO ABBREVIATIONS

A Acaricide
D Desiccant
GR Growth regulator
I Insecticide
N Nematicide
Ad Adjuvant
F Fungicide
H Herbicide
M Molluscicide

TRADE NAME	FUNCTION	ACTIVE INGREDIENT
Acanto	F	250 g/l picoxystrobin
Ally	H	20% w/w metsulfuron-methyl
Alpha Simazine 50 SC	H	500 g/l simazine
Amber	Ad	95% methylated vegetable oil
Amistar	F	250 g/l azoxystrobin
Aphox	I	50% w/w pirimicarb
Arelon 500	H	500 g/l isoproturon
Avadex Excel	H	15% tri-allate
Aventis Manganse 500		500 g/l manganese
Biotril 24/16	H	240:160 g/l bromoxynil + ioxynil
Carbetamex	H	70% carbetamide
Crystal	H	360 g/l flufenacet + pendimethalin
Cutonic Copper Ultra		250 g/l copper
Decoy Wetex	M	2% methiocarb
Duplosan KV	H	600 g/l mecoprop-P
Dursban 4	I	480 g/l chlorpyrifos
Egret	H	360 g/l glyphosate

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Enhance Low Foam	**Ad**	900 g/l alkyl phenol ethylene oxide condensate with silicone anti-foaming agent
Folicur	**F**	250 g/l tebuconazole
Glydate	**H**	360 g/l glyphosate
Hallmark with Zeon Technology	**I**	100 g/l lambda-cyhalothrin
Harmony M	**H**	75% metsulphuron-methyl + thifensulfuron-methly
Harvest	**H**	150 g/l glufosinate-ammonium
Landmark	**F**	125:125 g/l epoxiconazole + kresoxim-methyl
Lexus Class WSB	**H**	33.3:16.7% w/w carfentrazone-ethyl + flupyrsulfuron-methyl
Mesurol	**M,I**	methiocarb seed treatment
Moddus	**GR**	250 g/l trinexapac-ethyl
Opera	**F**	50:133 g/l epoxyconazole + pyraclostrobin
Opus	**F**	125 g/l epoxiconazole
Oxytril CM	**H**	400 g/l bromoxynil + ioxynil
PDQ	**H**	80:120 g/l diquat + paraquat
Phase II	**AD**	95% w/w esterified rapeseed oil
Quantum 75 DF	**H**	75% tribenuron-methyl
Raxil S	**F**	20:20 g/l tebuconazole + triazoxide
Samson	**H**	4% nicosulphuron
Sibutol	**F**	375:23 g/l biteranol + fuberidazole
Sibutol Secur		140:8.6:87.5 g/l bitertanol + fuberidazole + imidacloprid
Starane 2	**H**	200 g/l fluroxypyr
Starane XL	**H**	2.5:100 g/l florasulam + fluroxypyr
Stomp 400 SC	**H**	400 g/l pendimethalin
Topik	**H**	240 g/l clodinafop-propargyl
Touchdown	**H**	330 g/l glphosate
Treflan	**H**	480 g/l trifluralin
Twist	**F**	125 g/l trifloxystrobin
Unix	**F**	75% w/w cyprodinil
Weedazol-TL	**H**	225 g/l amitrole

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04/R/BK/1

BROADBALK

Object: To study the effects of organic manures and inorganic fertilisers 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 was added to the first to extend the rotation to fallow, potatoes, w. wheat, w. wheat, w. wheat, in 1996 the fallow was replaced by w. oats and potatoes replaced by maize in 1997.

The 160th year, w. wheat, w. oats and forage maize.

For previous years see 'Details' 1967 and 1973, Station Report for 1966, pp. 229-231; Station Report for 1968, Part 2; Station Report for 1982, Part 2, pp. 5-44 and 74-03/BK/1.

Areas harvested:

	Section	
Wheat:	1	0.00589
	2,3,5 and 6	0.00487
	8,9	0.00512
Oats:	4	0.00487
Maize:	7	0.00162

Treatments:

In 2001 a number of the treatments were changed. The treatments are now: -

Whole plots

PLOT	Fertilizers and organic manures Treatments Plot	from 2001
01(FYM)N4	01	N4
21FYMN2	2.1	FYM N2
22FYM	2.2	FYM
03Nil	03	None
05(P)KMg	05	(P) K Mg
06N1(P)KMg	06	N1 (P) K Mg
07N2(P)KMg	07	N2 (P) K Mg
08N3(P)KMg	08	N3 (P) K Mg
09N4(P)KMg	09	N4 (P) K Kg
10N4	10	N4
11N4PMg	11	N4 P Mg
12N1+3+1(P)K2Mg2	12	N1+3+1 (P) K2 Mg2
13N4PK	13	N4 P K
14N4PK*(Mg*)	14	N4 P K* (Mg*)
15N5(P)KMg	15	N5 (P) K Mg
16N6(P)KMg	16	N6 (P) K Mg
17N1+4+1PKMg	17	N1+4+1 P K Mg
18N1+2+1PKMg	18	N1+2+1 P K Mg
19N1+1+1KMg	19	N1+1+1 K Mg
20N4KMg	20	N4 K Mg

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W. oats; Nitrogen and farmyard manure were not applied.

N1,N2,N3,N4,N5,N6: 48, 96, 144, 192, 240, 288 kg N as 33.5% N; to be applied at the same time as the second dressings in the split nitrogen plots for wheat and to the seedbed for forage maize.

Split N to wheat

N1+1+1, 1+2+1 etc: Rates as above. Timings: first two weeks of March, GS31 or mid-April (whichever comes first) and GS37/mid-May.

Split N to forage maize

N2+1,2+2,2+3,2+4: Rates as above. Timings: to the seedbed and post-emergence.

P: 35 kg P as triple superphosphate.

(P): (none), to be reviewed in 2004/5.

K: 90 kg K as potassium sulphate.

K2: 180 kg K as potassium sulphate (plus 450 kg K autumn 2000 only).

K*: 90 kg K as potassium chloride.

Mg: 12 kg Mg as kieserite.

Mg2: 24 kg Mg as kieserite (plus 60 kg Mg, autumn 2000 only).

(Mg*): (none), to be reviewed in 2004/5.

FYM: Farmyard manure at 35 t

Previous treatment: -

Whole plots

PLOT		Fertilizers and organic manures:-		
	Plot	Treatments until 1967	Treatments from 1968	Treatments from 1985 - 2000
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 ½[P K (Na) Mg]	N1+3 ½[PK Mg] (A)+
18N0+3FH	18	P K Na Mg(A)	N2 ½[P K (Na) Mg]	N0+3 ½[PK Mg] (A)+
19(C)	19	C	C	(C) (since 1989)
20N2KMG	20	N2 K Na Mg	N2 K (Na) Mg	N2 K Mg

(A) Alternating each year

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\+ This change since 1980. Treatments shown are those to w. wheat; autumn N alternates. Maize received N3 ½[PK Mg] on both plots 17 and 18. These treatments shown incorrectly in 1999-02 Yield books.

W. oats; Nitrogen and dung were not applied.

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 34.5% N 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 triple superphosphate in 1974 and since 1988, single superphosphate in other years
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 (applied at 26 kg 1990 to 2000), 35 kg Mg every third year to other plots since 1974 (applied at 30 kg in 1991, 1994, 1997 and 2000 and at 15 kg on half rate treatments). All as kieserite since 1974, previously as sulphate of magnesia annually
D:	Farmyard manure at 35 t
(C):	Castor meal to supply 96 kg N until 1988, none since
F:	Full rate P K (Na) Mg as above H: Half rate of above

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

SECTION										
Section	1	9	0*	8+	6**	5	3	7	4	2
Year										
1968	W	W	W	W	F	W	W	P	W	BE
1969	W	W	W	W	W	F	W	BE	P	W
1970	W	W	W	W	W	W	F	W	BE	P
1971	W	W	W	W	F	W	W	P	W	BE
1972	W	W	W	F	W	F	W	BE	P	W
1973	W	W	W	W	W	W	F	W	BE	P
1974	W	W	W	W	F	W	W	P	W	BE
1975	W	W	W	W	W	F	W	BE	P	W
1976	W	W	W	W	W	W	F	W	BE	P
1977	W	W	W	W	F	W	W	P	W	BE
1978	W	W	W	W	W	F	W	BE	P	W
1979	W	W	W	W	W	W	F	W	P	F
1980	W	W	W	W	W	W	W	F	W	P
1981	W	W	W	F	W	W	W	P	F	W
1982	W	W	W	W	W	W	W	W	P	F
1983	W	W	W	W	W	W	W	F	W	P
1984	W	W	W	W	W	W	W	P	F	W
1985	W	W	W	W	W	F	W	W	P	W
1986	W	W	W	W	W	P	F	W	W	W
1987	W	W	W	W	W	W	P	W	W	F
1988	W	W	W	F	W	W	W	F	W	P

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SECTION

Section	1	9	0*	8+	6**	5	3	7	4	2
Year										
1989	W	W	W	W	W	W	W	P	F	W
1990	W	W	W	W	W	F	W	W	P	W
1991	W	W	W	W	W	P	F	W	W	W
1992	W	W	W	W	W	W	P	W	W	F
1993	W	W	W	W	W	W	W	F	W	P
1994	W	W	W	F	W	W	W	P	F	W
1995	W	W	W	W	W	F	W	W	P	W
1996	W	W	W	W	W	P	O	W	W	W
1997	W	W	W	W	W	W	M	W	W	O
1998	W	W	W	W	W	W	W	O	W	M
1999	W	W	W	W	W	W	W	M	O	W
2000	W	W	W	W	W	O	W	W	M	W
2001	W	W	W	F	W	M	O	W	W	W
2002	W	W	W	W	W	W	M	W	W	O
2003	W	W	F	W	W	W	W	O	W	M
2004	W	W	F	W	W	W	W	M	O	W

W = w. wheat, O = w. oats (spring oats 2001), P = potatoes, BE = s. beans, F = fallow, M = forage maize

* Straw incorporated since autumn 1986. ** No sprays except weedkillers since 1985. + No weedkillers.

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. From autumn 1988 until autumn 1992 a five-year cycle was 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. None applied since autumn 1991.

(3) In 2003 and 2004 section 0 was used for an experiment (CS/595) investigating different herbicides to control *Equisetum arvense*

Experimental diary:

All sections:

03-Sep-03		Rolled (excluding section 0).
03-Sep-03		Harvest at 3.0 l in 200 L (excluding section 0 & 8).
23-Sep-03	K*	Muriate of potash at 181 kg, strip 14.
	P	TSP at 170 kg, strips 11, 13, 14, 17, & 18.
25-Sep-03	FYM	FYM at 35.0 tonnes, strips 2.1 & 2.2, not to Section 0 or 4.
27-Sep-03		Ploughed 25 cm wide furrows, cultipressed, not to section 0.
29-Sep-03		Cultipressed, not to section 0.
23-Feb-04	MG	Kieserite at 80 kg, strips 5, 6, 7, 8, 9, 11, 15, 16, 17, 18, 19, & 20.
	MG2	Kieserite at 160 kg, strip 12.
	K	Sulphate of potash at 217 kg, strips 5, 6, 7, 8, 9, 13, 15, 16, 17, 18, 19 & 20.
	K2	Sulphate of potash at 434 kg, strip 12.
24-May-04		Rotavate paths.
22 Jun-04		Rotavate paths.
29-Jun-04		Power harrowed discards.
30-Jun-04		Rogued wild oats.
02-Sep-04		Topped fallow areas.

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04/R/BK/1

Experimental diary:

Cropped sections:

Winter wheat

30-Sep-03	Combination drilled, Hereward, tr. Sibutol Secur, at 350 seeds/m^2 with the Accord drill. Rolled.
05-Dec-03	tm) Lexus Class WSB at 60 g in 200 l, excluding section 8.
	tm) Hallmark with Zeon Technology at 50 ml in 200 l, excluding section 8.
18-Dec-03	Arelon 500 at 3.5 l in 200 l, excluding section 8.
09-Apr-04	tm) Topik at 3.5 l in 200 l, excluding section 8.
	tm) Amber at 0.5 l in 200 l, excluding section 8.
17-Mar-04	1st split N applied.
06-May-04	tm) Ally at 30 g in 200 l, excluding section 8.
	tm) Starane 2 at 0.7 l in 200 l, excluding section 8.
07-May-04	Main N and 2nd split N applied.
13-May-04	Landmark at 1.0 l in 200 l, excluding Section 6.
25-May-04	3rd split N applied.
10-Jun-04	tm) Opera at 1.0 l in 200 l, excluding Section 6.
	tm) Hallmark with Zeon Technology at 50 ml in 200 l, excluding section 6.
16-Aug-04	Combine harvested discards, swathed straw.
02-Sep-04	Combine harvested plots for yield. Swathed straw. (except section 8).
	Combine harvested discards, swathed straw.
03-Sep-04	Combine harvested section 8. (Wheat badly laid, not all plots harvested).
	Sampled and weighed straw.
	Combine harvested discards.
04-Sep-04	Baled straw.

W. oats

30-Sep-03	Combination drilled, Gerald, tr. Sibutol Secur, at 350 seeds/m^2 with the Accord drill. Rolled.
05-Dec-03	tm) Lexus Class WSB at 60 g in 200 l.
	tm) Hallmark with Zeon technology at 50 ml in 200 l.
06-May-04	tm) Ally at 30 g in 200 l
	tm) Starane 2 at 0.7 l in 200 l
13-May-04	Landmark at 1.0 l in 200 l.
03-Sep-04	Combine harvested discards, swathed straw.
	Combine harvested plots for yield. Swathed straw.
	Sampled and weighed straw.
04-Sep-04	Baled straw.

Forage maize

09-Apr-04	Glydate at 3.0 l in 200 l.
13-May-03	Main N and 1st split N applied.
14-May-04	Flexitined.
19-May-04	Power harrowed.
20-May-04	Drilled, Hudson, tr. Mesurol at 10.2 seeds/m^2, with the Nodet Gougis drill.
17-Jun-04	2nd split N applied.
22-Jun-04	Samson at 1.5 l in 200 l.
20-Sep-04	Cut sample areas by hand, weighed, and sampled.
21-Sep-04	Cleared maize.

Section 0

06-Jul-04	Weedazol-TL at 30 l in 200 l to plots not being used for CS/595 Control of Equisetum.
06-Jul-04	Treatments applied to CS/595.
09-Sep-04	Treatments applied to CS/595.

NOTE: Straw on Section 0 was baled and removed at harvest 2002 (usually incorporated) as this section will remain unploughed to test control of *Equisetum*. Samples of wheat and oat grain and straw, and forage maize were taken for chemical analysis. Unground wheat grain and straw and maize samples from selected treatments were archived.

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04/R/BK/1

WHEAT

GRAIN TONNES/HECTARE

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

SECTION PLOT	2/W1	3/W2	5/W3	8/W3	6/W27	1/W38	9/W46
01(FYM)N4	9.20	7.33	6.84	*	7.25	*	*
21FYMN2	9.06	7.30	7.06	nh	6.92	6.09	5.93
22FYM	6.44	4.40	4.17	nh	4.38	4.04	4.29
03Nil	1.29	1.09	1.27	0.52	1.26	0.71	0.13
05(P)KMg	1.52	1.47	0.97	0.82	1.29	1.11	0.85
06N1(P)KMg	3.76	2.85	2.23	1.32	2.84	2.83	2.73
07N2(P)KMg	5.61	4.25	2.85	1.75	3.84	4.09	3.72
08N3(P)KMg	7.35	4.73	2.57	1.32	3.73	4.50	4.17
09N4(P)KMg	8.35	6.54	5.50	2.04	6.03	5.78	5.82
10N4	5.45	2.35	4.10	0.68	0.79	2.26	0.12
11N4PMg	6.98	5.23	4.33	1.44	5.22	4.86	5.07
12N1+3+1(P)K2Mg2	8.05	7.02	6.17	0.90	7.68	5.78	6.08
13N4PK	7.25	5.85	3.28	1.64	6.32	5.17	3.91
14N4PK*(Mg*)	7.05	5.47	3.36	1.60	6.44	5.17	4.88
15N5(P)KMg	8.62	5.95	4.02	1.09	5.61	3.43	4.29
16N6(P)KMg	8.45	6.68	6.47	1.50	7.45	6.43	6.92
17N1+4+1PKMg	8.80	7.94	7.23	nh	8.06	6.06	7.37
18N1+2+1PKMg	8.08	6.61	6.72	nh	7.12	5.27	6.23
19N1+1+1KMg	6.74	5.67	5.03	nh	4.62	4.03	3.93
20N4KMg	*	*	*	*	*	1.86	*

GRAIN MEAN DM% 87.2

STRAW TONNES/HECTARE

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

SECTION PLOT	2/W1	8/W3	1/W38
01(FYM)N4	3.71	*	*
21FYMN2	4.71	nh	2.62
22FYM	3.45	nh	2.35
03Nil	0.25	0.17	0.11
05(P)KMg	0.52	1.02	0.28
06N1(P)KMg	1.37	1.62	1.50
07N2(P)KMg	1.78	2.23	1.32
08N3(P)KMg	2.45	1.60	1.60
09N4(P)KMg	3.19	3.45	2.02
10N4	1.88	0.99	1.14
11N4PMg	1.95	2.49	1.88
12N1+3+1(P)K2Mg2	3.74	2.94	3.28
13N4PK	2.72	2.48	1.93
14N4PK*(Mg*)	2.48	2.97	2.01
15N5(P)KMg	3.15	2.78	1.38
16N6(P)KMg	2.92	5.98	2.73
17N1+4+1PKMg	3.89	nh	3.44
18N1+2+1PKMg	3.75	nh	2.83
19N1+1+1KMg	2.83	nh	2.71
20N4KMg	*	*	0.48

STRAW MEAN DM% 89.2

Note: nh = not harvested

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04/R/BK/1

W. OATS

GRAIN TONNES/HECTARE

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

PLOT	GRAIN	STRAW
01(FYM)[N4]	6.07	2.80
21[FYMN2]	6.52	3.38
22[FYM]	6.69	3.11
03Nil	1.75	0.29
05(P)KMg	2.37	0.34
06[N1](P)KMg	3.06	0.71
07[N2](P)KMg	3.48	0.89
08[N3](P)KMg	3.80	0.91
09[N4](P)KMg	4.03	1.27
10[N4]	4.64	1.65
11[N4]PMg	5.41	2.02
12[N2](P)K2Mg2	4.75	1.51
13[N4]PK	4.41	1.45
14[N4]PK*(Mg*)	4.43	1.37
15[N5](P)KMg	5.55	2.24
16[N6](P)KMg	6.12	2.65
17[N1+4+1]PKMg	5.77	2.43
18[N1+2+1]PKMg	4.09	1.23
19[N1+1+1]KMg	3.47	0.98
MEAN DM%	85.5	91.7

FORAGE MAIZE

WHOLE CROP (100% DM) TONNES/HECTARE

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

PLOT	WHOLE CROP
01(FYM)N4	23.13
21FYMN2	17.55
22FYM	16.78
03Nil	1.56
05(P)KMg	0.97
06N1(P)KMg	3.27
07N2(P)KMg	11.97
08N3(P)KMg	15.13
09N4(P)KMg	16.12
10N4	5.33
11N4PMg	9.31
12N2+3(P)K2Mg2	13.67
13N4PK	13.65
14N4PK*(Mg*)	13.76
15N5(P)KMg	13.67
16N6(P)KMg	13.60
17N2+4PKMg	13.00
18N2+2PKMg	16.89
19N2+1KMg	5.86

CROP MEAN DM% 27.5

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04/R/HB/2

HOOS BARLEY

Object: To study the effects of organic manures and inorganic fertilisers 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 continued in s. barley. The experiment was modified for 2003. The Main plots continue as previously. The Silicate Test plots continue but are not split to test rates of N (basal N is applied). The remaining plots are to be used to study the effect on yield of P residues, (basal N applied).

The 153rd year, s. barley.

For previous years see 'Details' 1967 and 1973, Station Report for 1966 and 74-03/HB/2.

Main plots

Treatments:

Whole plots

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

		Form of N 1852-1966	Additional treatments 1852-2002	Treatments since 2003
---	11	None	-	-
-P-	21	None	P	(P)
--K	31	None	K(Na)Mg	K(Mg)
-PK	41	None	PK(Na)Mg	(P)K(Mg)
A--	12	A	-	-
AP-	22	A	P	(P)
A-K	32	A	K(Na)Mg	K(Mg)
APK	42	A	PK(Na)Mg	(P)K(Mg)
D1852	72	None	D	D
(D)	71	None	(D)	(D)
(A)	62	None	(Ashes)	(Ashes)
-	61	None	-	-
D2001[a]	73[a]	-	D	D
P2KMg[a]	63[a]	-	P2KMg	P2KMg

[a] Plots 63 and 73 started in 2001

Form of N: A, sulphate of ammonia to supply 48kg N
P: 35 kg P as triple superphosphate in 1974 and from 1988 to 2002, single superphosphate in other years
(P): (none), P application to be reviewed for 2008
P2: 44 kg P as triple superphosphate since 2001.
K: 90 kg K as sulphate of potash
(Na): (none)16 kg Na as sulphate of soda until 1973
Mg: 35 kg Mg as kieserite every third year since 1974 (applied at 30 kg in 1992, 1995 and 1998)(sulphate of magnesia annually until 1973). Annually to new plot 63.
(Mg): (none), Mg application to be reviewed for 2008
D1852: Farmyard manure at 35 t since 1852.
D2001: Farmyard manure at 35 t since 2001
(D): Farmyard manure 1852 - 1871 only
(Ashes): Weed ash 1852-1916, furnace ash 1917-1932, none since

Sub-plots

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

0

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48
96
144

Silicate Test plots

Treatments :

Whole plots
MANURE Plot Fertilizers:

		Additional treatment 1852-1979	Changes since 1980	Treatments since 2003
N----	131	-	-	N3
NP---	231	P	-	N3(P)
N-K--	331	K(Na)Mg	-	N3 K(Mg)
NPK--	431	PK(Na)Mg	-	N3(P)K(Mg)
N--S-	134	Si	Si omitted	N3 (Si)
NP-S-	234	P Si	"	N3(P) (Si)
N-KS-	334	K(Na)MgSi	"	N3 K(Mg)(Si)
NPKS-	434	PK(Na)MgSi	"	N3(P)K(Mg)(Si)
N---S	132	-	Si added	N3 Si
NP--S	232	P	"	N3(P) Si
N-K-S	332	K(Na)Mg	"	N3 K(Mg) Si
NPK-S	432	PK(Na)Mg	"	N3(P)K(Mg) Si
N--SS	133	Si	-	N3 Si
NP-SS	233	P Si	-	N3(P) Si
N-KSS	333	K(Na)MgSi	-	N3 K(Mg) Si
NPKSS	433	PK(Na)MgSi	-	N3(P)K(Mg) Si

N: From 1852-1966 whole plots received 48kg N as nitrate of soda. Between 1968-2002 whole plots were split to test 4 rates of N as "Nitro-chalk"(cumulative applications until 1973, on a cyclic system from 1974).
N3: Basal N, 144kg as "Nitro-chalk" since 2003
Si: Silicate of soda at 450kg (Note: S also refers to silicate of soda)
(Si): Silicate of soda omitted since 1980
P, (P), K, Mg, (Mg), (Na): as above

P Test plots

Treatments:

Since 2003 the remaining plots [ex-Castor meal (plots 14, 24, 34 & 44) and those testing combinations of NPK with and without Mg (plots 55, 56, 57 & 58)] have been used to study the effect of P residues on yield. Previous treatments have resulted in different levels of available P in the soil. Large dressings of K were applied to some plots to increase levels of exchangeable K in the soil such that K should not limit yield; plots 141 and 241 were sacrificed and used as discard areas so that the K applications did not encroach on adjacent no K plots on the Silicate Test. Other plots received the normal rate of K. The level of exchangeable Mg in the soil is such that Mg should not limit yield; the need to apply Mg will be reviewed for 2008.

Whole plots
Manure

Plot	Treatment since 2003
142	N3K*
143	N3K*
144	N3K*
242	N3K*
243	N3K*
244	N3K*
341	N3K
342	N3K

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343	N3K
344	N3K
441	N3K
442	N3K
443	N3K
444	N3K
551	N3K
552	N3K
561	N3K
562	N3K
571	N3K*
572	N3K*
581	N3K*
582	N3K*

N3: Basal N, 144kg as "Nitro-chalk"
K : 90kg K as sulphate of potash
K*: 450kg K as sulphate of potash

Experimental diary:

27-Nov-03	**T**	:	K, K*, Si, Mg (to plot 63) applied.
28-Nov-03	T	:	P applied
10-Dec-03	**T**	:	FYM, applied.
	B	:	Ploughed 30 cm wide furrow.
12-Feb-04	B	:	Combination drilled, Optic, tr. Raxil S, at 350 seeds/m^2 with the Accord drill.
21-Feb-04	B	:	Rolled.
01-Mar-04	B	:	Avadex Excel 15G at 15 kg.
14-Apr-04	B	:	tm) Ally at 30 g in 200 l.
	B	:	tm) Oxytril CM at 0.5 l in 200 l.
20-Apr-04	**T**	:	N (27% N).
26-Apr-04	B	:	tm) Acanto at 0.4 l in 200 l.
	B	:	tm) Unix at 0.4 kg in 200 l.
06-Aug-04	B	:	Combine harvested plots for yield.
	B	:	Combine harvested discards.
	B	:	Sampled and weighed straw.
01-Sep-04	B	:	Baled straw.

NOTE: Samples of grain and straw were taken for chemical analysis. Unground grain and straw samples from selected treatments were archived.

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04/R/HB/2

MAIN PLOTS

GRAIN TONNES/HECTARE

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

N	0	48	96	144	Mean
MANURE					
---	0.75	0.85	0.75	1.12	0.87
-P-	1.37	2.16	2.68	2.96	2.29
--K	0.52	1.51	1.76	1.75	1.38
-PK	0.63	2.67	4.48	4.84	3.16
A--	0.55	0.85	0.75	1.36	0.88
AP-	1.56	2.13	2.12	2.16	1.99
A-K	0.64	1.02	1.51	1.43	1.15
APK	0.98	3.14	4.53	5.06	3.43
D1852	6.20	7.78	8.00	8.06	7.51
(D)	1.42	2.27	2.41	2.48	2.14
(A)	1.26	1.76	2.59	3.27	2.22
-	0.49	1.43	1.61	1.23	1.19
D2001	3.70	5.95	7.28	7.53	6.12
P2KMg	1.52	3.78	4.54	6.11	3.99
Mean	1.54	2.66	3.22	3.53	2.74

GRAIN MEAN DM% 87.3

STRAW TONNES/HECTARE

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

N	0	48	96	144	Mean
MANURE					
---	0.42	0.16	0.17	0.39	0.29
-P-	0.55	0.76	1.23	0.17	0.68
--K	0.91	0.41	0.71	0.46	0.62
-PK	0.17	0.90	1.99	1.75	1.20
A--	0.17	0.30	0.16	0.29	0.23
AP-	0.58	0.93	0.94	1.09	0.88
A-K	0.15	0.16	0.61	0.36	0.32
APK	0.16	1.17	2.05	2.06	1.36
D1852	2.87	3.17	4.05	4.04	3.53
(D)	0.22	0.83	0.72	0.85	0.65
(A)	0.21	0.71	0.89	1.41	0.81
-	0.22	0.22	0.52	0.44	0.35
D2001	1.30	2.60	3.38	4.14	2.86
P2KMg	0.33	1.66	1.95	2.48	1.60
Mean	0.59	1.00	1.38	1.42	1.10

STRAW MEAN DM% 80.9

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04/R/HB/2

SILICATE PLOTS

GRAIN TONNES/HECTARE

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

PK Silicate	N3--	N3P-	N3-K	N3PK	Mean
(-)-	1.85	2.44	1.62	5.38	2.82
(Si)-	2.04	3.91	3.42	6.43	3.95
(-)Si	2.29	3.74	2.85	5.75	3.66
(Si)Si	2.25	3.33	3.44	5.76	3.70
Mean	2.11	3.36	2.83	5.83	3.53

GRAIN MEAN DM% 82.6

PHOSPHATE PLOTS

GRAIN TONNES/HECTARE

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

PLOTS	
142	3.48
143	3.55
144	3.63
242	5.67
243	5.54
244	5.04
341	4.13
342	4.68
343	4.22
344	4.26
441	6.01
442	5.50
443	5.02
444	5.05
551	5.10
552	4.80
561	4.46
562	4.29
571	3.45
572	3.82
581	1.78
582	1.48
Mean	4.32

GRAIN MEAN DM% 83.6

PLOT AREA HARVESTED 0.00256

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04/R/WF/3

WHEAT AND FALLOW

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

The 149th year, w. wheat.

For previous years see 'Details' 1967, 1973 and 74-03/R/WF/3.

Whole plot dimensions: 9 x 211.

Treatments:
Two plots, one sown to w. wheat, one fallow; alternating in successive years.

Experimental diary:

17-Sep-03	:	Flexitine
26-Sep-03	:	Ploughed, 30 cm wide furrows.
30-Sep-03	:	Combination drilled, Hereward, tr. Sibutol Secur, at 350 seeds/m^2 with the Accord drill.
	:	Rolled.
16-Dec-04	:	tm)Arelon 500 at 4 l in 200 l to wheat plot.
	:	tm)Stomp 400 SC at 2.5 l in 200 l to wheat plot.
14-Apr-04	:	tm)Ally at 30 g in 200 l to fallow plot.
	:	tm)Oxytril CM at 0.5 l in 200 l to fallow plot.
13-May-04	:	tm)Opus at 0.75 l in 200 l to wheat plot.
	:	tm)Moddus at 0.15 l in 200 l to wheat plot.
07-Jun-04	:	tm)Opus at 0.75 l in 200 l to wheat plot.
	:	tm)Twist at 0.75 l in 200 l to wheat plot.
02-Sep-04	:	Combine harvested, plot for yield.
03-Sep-04	:	Sampled and weighed straw.
07-Sep-04	:	Combine harvested discards. Swathed and baled straw.

NOTE: Unground grain and straw was archived.

GRAIN AND STRAW TONNES/HECTARE

	GRAIN	STRAW
YIELD	1.29	0.80
MEAN DM%	87.0	92.0

PLOT AREA HARVESTED 0.04431

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04/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 up to 1991, w. wheat since - Hoosfield.

The 149th year, w. wheat.

For previous years see 'Details' 1977, 1973 and 74-03/EX/4.

Treatments: All combinations of:-

Whole plots (P test)

1. **OLD RES** — Residues of manures applied annually 1876-1901:

O	None
D	Farmyard manure at 35 t
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** — Maintenance P (20 kg P) applied annually from 2000 to maintain existing levels of available P in the soil. (P1) (P2) and (P3) are residues of P applied annually 1986-1992:

	2000-04	1986-92
O	None	None
P(P1)	20 kg P	44 kg P
P(P2)	20 kg P	87 kg P
P(P3)	20 kg P	131 kg P

NOTE: P treatments were applied at 61.5 kg P in error in 2000.

plus

Whole plots (K test, previously N test until 1991)

OLD RES — Residues of manures applied annually 1876-1901:

O	None
D	Farmyard manure at 35 t
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

Whole plots
Nitrogen: 50 kg N as ammonium sulphate (to supply sufficient S) during first two weeks in March, 200kg N as ammonium nitrate at GS31/mid-April (whichever comes first) and 50 kg N as ammonium nitrate at GS37 (not later than mid-May)

Experimental diary:

K test:

26-Sep-03	**T**	P	P basal:(triple superphosphate at 98 kg), plots 2, 4, 6, 8 & 10.

P test:

26-Sep-03	**T**	K	K basal/100 kg (muriate of potash at 250 kg), plots 1, 3, 5, 7 & 9.
	T	P	P test:(triple superphosphate at 98 kg), plots 011-013, 031-033, 051-053, 071-073, & 091-093.

All plots

26-Sep-03	B		Ploughed 30 cm wide furrows.
27-Sep-03	B		Cultipress.

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```
10-Oct-03 : B :     : Combination drilled, Xi 19, tr. Sibutol Secur at
                      380 seeds/m².
          : B :     : Rolled.
16-Dec-03 : B :     : tm)Arelon 500 at 4.0 l in 200 l.
          : B :     : tm)Stomp 400 SC at 2.5 l in 200 l.
30-Mar-04 : B :     : Ammonium sulphate (21% N) at 238 kg
14-Apr-04 : B :     : tm)Ally at 30 g in 200 l.
            B :     : tm)Oxytril CM at 0.5 l in 200 l.
29-Apr-04 : B :     : 34.5% N at 580 kg.
13-May-03 : B :     : tm)Opus at 0.75 l in 200 l.
          : B :     : tm)Moddus at 0.15 l in 200 l.
24-May-04 :           Rotavate down paths.
25-May-04 : B :     : 34.5% N at 145 kg.
07-Jun-04 : B :     : tm)Opus at 0.75 l in 200 l.
          : B :     : tm)Twist at 0.75 l in 200 l.
14-Jun-04 : B :     : Dursban 4 at 0.45 l in 200 l.
02-Sep-04 : B :     : Combine harvested, plots for yield.
03-Sep-04 : B :     : Straw sampled and weighed.
07-Sep-04 : B :     : Combine harvested discards, Swathed and baled
                      straw.
```

NOTE: Samples of grain and straw were taken for chemical analysis.

P TEST

GRAIN TONNES/HECTARE

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

P	O	P(P1)	P(P2)	P(P3)	Mean
OLD_RES					
O	1.35	6.18	7.38	6.80	5.43
D	2.89	7.31	7.70	7.92	6.46
N	0.88	6.99	7.98	7.07	5.73
P	3.14	7.51	8.32	7.92	6.72
NPKNAMG	2.82	7.54	7.76	8.59	6.68
Mean	2.22	7.11	7.82	7.66	6.20

GRAIN MEAN DM% 87.6

STRAW TONNES/HECTARE

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

P	O	P(P1)	P(P2)	P(P3)	Mean
OLD_RES					
O	0.50	3.04	4.15	3.74	2.86
D	1.22	3.73	3.79	4.24	3.25
N	0.16	3.50	3.80	3.66	2.78
P	1.25	3.79	3.90	3.85	3.20
NPKNAMG	0.92	3.85	3.31	4.07	3.04
Mean	0.81	3.58	3.79	3.91	3.02

STRAW MEAN DM% 92.8

PLOT AREA HARVESTED 0.00538

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04/R/EX/4

K TEST

GRAIN TONNES/HECTARE

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

OLD_RES	
O	5.77
D	6.87
N*	5.93
PK	6.92
N*PK	6.70
Mean	6.44

GRAIN MEAN DM% 87.7

STRAW TONNES/HECTARE

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

OLD_RES	
O	3.42
D	3.72
N*	3.55
PK	4.03
N*PK	3.62
Mean	3.67

STRAW MEAN DM% 92.9

PLOT AREA HARVESTED 0.00538

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04/R/PG/5

PARK GRASS

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

The 149th year, hay.

For previous years see 'Details' 1977 and 1973 and 74-03/R/PG/5.

Treatments: Combinations of:-

Whole plots

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

N1	Plot 1	N1
K	Plot 2/1	K since 1996 (as 2/2 before)
0(D)	Plot 2/2	None (D until 1863)
0	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
0	Plot 12	None
(D/F)	Plot 13/1	None (D/F until 1993/1995)
D/PM(F)	Plot 13/2	D/PM (F until 1999)
MN(N2*)	Plot 14/1	P K Na Mg (N2* until 1989)
N2*MN	Plot 14/2	N2* P K Na Mg
MN(N2*)	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 in years with no farmyard manure)
P:	35 kg P (15 kg P to plot 20 in years with no farmyard manure) as triple superphosphate in 1974 and since 1987, single superphosphate in other years
K:	225 kg K (45 kg K to plot 20 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 t every fourth year
F:	Fishmeal every fourth year to supply 63 kg N (stopped 1999; replaced by PM)

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04/R/PG/5

1. **MANURE** Fertilizers and organic manures(cont.)

PM	Pelleted poultry manure at 2 t, every fourth year to supply 63 kg N (started 2003)
MN:	P K Na Mg as above

Sub-plots

2. **LIME** Liming plots 1-18 (excluding 18/2):

A	Ground chalk applied as necessary to achieve pH7
B	Ground chalk applied as necessary to achieve pH6
C	Ground chalk applied as necessary to achieve pH5
D	None

NOTE: Lime was applied regularly 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. Lime was applied in 2003, the fourth application in a triennial scheme of soil pH analysis and remedial chalk applications.

[This note was incorrect in 97-01/R/PG/5 Yield book entries.]

LIME Liming plots 18-20:

NOTE: Differential rates of lime were applied to sub-plots 2 and 3 regularly 1920-1974. Since 1975 plot 18-1 has been split into two for treatments 'C' and 'D' as above and plot 18-3 split into two for treatments 'A' and 'B'. Plots 19 and 20 received no further chalk after 1968; plot 18/2 no further chalk after 1972.

[This note was incorrect in 97-01/R/PG/5 Yield book entries.]

Experimental diary:

16-Feb-04	**T**	P applied.
04-Mar-04	**T**	K, Si, Na, Mg applied.
27-Apr-04	**T**	N applied.
01-May-03	P	Cut paths.
14-Jun-04	**T**	Cut sample areas for yield, sampled and weighed, and carted cut grass.
15-Jun-04	**T**	Cut sample areas for yield, sampled and weighed, and carted cut grass. Cut discards.
16-Jun-04	B	Tedded hay.
17-Jun-04	B	Rowed up and baled hay.
22-Jun-04	B	Topped headlands.
29-Jun-04	B	Topped SW corner.
11-Nov-04	**T**	Cut sample areas for yield, sampled and weighed, and carted cut grass.
12-Nov-04	B	Cut discards.

NOTE: Samples of herbage from cut was taken for chemical analysis. Unground samples of herbage from all plots were archived.

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04/R/PG/5

1ST CUT (14-17/6/04) DRY MATTER TONNES/HECTARE

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

LIME / MANURE		A	B	C	D	MEAN
N1	1	2.48	2.66	1.94	0.82	1.97
K	2/1	2.36	2.90	2.20	2.30	2.44
O(D)	2/2	2.16	2.56	1.54	2.80	2.27
O	3	2.42	2.79	1.73	2.37	2.33
P	4/1	3.05	3.64	3.35	3.15	3.30
N2P	4/2	3.91	3.44	4.29	1.57	3.30
N1MN	6	5.52	5.69			5.60
MN	7	5.08	6.11	4.98	3.81	4.99
PNAMG	8	3.16	3.92	3.06	3.35	3.37
MN(N2)	9/1	4.70	4.87	5.42	2.22	4.30
N2MN	9/2	6.69	5.97	5.87	4.38	5.73
N2PNAMG	10	4.38	4.35	4.94	2.79	4.11
N3MN	11/1	6.99	7.14	6.70	5.21	6.51
N3MNSI	11/2	6.39	7.06	6.65	6.46	6.64
O	12	2.53	2.11	2.13	1.66	2.11
(D/F)	13/1	4.70	5.20	4.83	4.30	4.76
D/PM	13/2	3.91	6.06	5.91	5.78	5.42
MN(N2*)	14/1	4.42	5.13	5.00	5.17	4.93
N2*MN	14/2	4.99	6.19	6.59	5.22	5.75
MN(N2*)	15	3.88	4.35	4.50	3.45	4.05
N1*MN	16	5.14	5.66	4.29	4.16	4.81
N1*	17	3.00	3.55	2.87	3.14	3.14
N2KNAMG0	18/1			4.46	1.32	2.89
N2KNAMG2	18/2					4.08
N2KNAMG1	18/3	3.31	3.75			3.53
D0	19/1					4.96
D2	19/2					5.90
D1	19/3					5.06
D/N*PK0	20/1					5.97
D/N*PK2	20/2					6.36
D/N*PK1	20/3					5.95

1ST CUT MEAN DM% 29.3

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04/R/PG/5

2ND CUT (11/11/04) DRY MATTER TONNES/HECTARE

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

LIME / MANURE		A	B	C	D	MEAN
N1	1	1.31	1.44	0.90	0.27	0.98
K	2/1	0.91	1.03	0.70	0.91	0.89
O(D)	2/2	0.82	1.51	1.02	1.42	1.19
O	3	0.84	1.55	0.99	1.59	1.25
P	4/1	1.19	1.38	1.59	1.58	1.44
N2P	4/2	1.13	1.16	1.28	0.69	1.06
N1MN	6	1.40	1.59			1.49
MN	7	1.58	2.14	1.71	1.35	1.69
PNAMG	8	1.18	1.38	1.51	1.61	1.42
MN(N2)	9/1	1.98	1.89	1.20	0.16	1.31
N2MN	9/2	2.25	2.17	1.68	2.51	2.15
N2PNAMG	10	0.50	1.81	2.19	1.89	1.60
N3MN	11/1	2.36	2.37	2.08	3.14	2.49
N3MNSI	11/2	3.10	2.69	2.33	2.68	2.70
O	12	1.89	2.13	2.66	2.15	2.21
(D/F)	13/1	2.39	2.50	2.31	1.48	2.17
D/PM	13/2	2.15	3.63	3.50	3.29	3.14
MN(N2*)	14/1	2.03	2.25	1.64	1.97	1.97
N2*MN	14/2	1.36	2.16	2.11	2.09	1.93
MN(N2*)	15	1.82	2.11	1.57	1.16	1.67
N1*MN	16	2.08	2.52	2.21	1.91	2.18
N1*	17	1.49	1.88	1.75	1.68	1.70
N2KNAMG0	18/1			1.86	0.57	1.22
N2KNAMG2	18/2					2.28
N2KNAMG1	18/3	1.76	2.32			2.04
D0	19/1					2.38
D2	19/2					2.81
D1	19/3					2.83
D/N*PK0	20/1					2.87
D/N*PK2	20/2					3.07
D/N*PK1	20/3					2.72

2ND CUT MEAN DM% 27.6

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04/R/PG/5

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

LIME / MANURE		A	B	C	D	MEAN
N1	1	3.79	4.10	2.83	1.09	2.95
K	2/1	3.27	3.93	2.90	3.20	3.33
O(D)	2/2	2.98	4.07	2.55	4.23	3.46
O	3	3.26	4.35	2.72	3.96	3.57
P	4/1	4.24	5.02	4.94	4.73	4.73
N2P	4/2	5.03	4.60	5.56	2.26	4.36
N1MN	6	6.92	7.27			7.10
MN	7	6.65	8.25	6.68	5.16	6.69
PNAMG	8	4.34	5.31	4.57	4.97	4.79
MN(N2)	9/1	6.68	6.76	6.62	2.38	5.61
N2MN	9/2	8.94	8.14	7.55	6.90	7.88
N2PNAMG	10	4.87	6.17	7.12	4.68	5.71
N3MN	11/1	9.35	9.51	8.78	8.35	9.00
N3MNSI	11/2	9.50	9.75	8.98	9.14	9.34
O	12	4.43	4.23	4.79	3.81	4.31
(D/F)	13/1	7.08	7.69	7.14	5.78	6.92
D/PM	13/2	6.06	9.69	9.41	9.07	8.56
MN(N2*)	14/1	6.45	7.38	6.63	7.14	6.90
N2*MN	14/2	6.35	8.35	8.70	7.30	7.68
MN(N2*)	15	5.71	6.46	6.07	4.62	5.71
N1*MN	16	7.21	8.18	6.50	6.08	6.99
N1*	17	4.49	5.43	4.62	4.81	4.84
N2KNAMG0	18/1			6.32	1.89	4.11
N2KNAMG2	18/2					6.36
N2KNAMG1	18/3	5.07	6.07			5.57
D0	19/1					7.34
D2	19/2					8.71
D1	19/3					7.89
D/N*PK0	20/1					8.84
D/N*PK2	20/2					9.43
D/N*PK1	20/3					8.67

TOTAL OF 2 CUTS MEAN DM% 28.4

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04/R/GC/8

GARDEN CLOVER

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

The 151st year, red clover.

For previous years see `Details' 1967 and 1973, and 74-03/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, last applied November 1989.

Experimental diary:

16-Jun-04	First Cut
22-Sep-04	Second Cut

04/R/GC/8

1ST CUT (16/6/04) DRY MATTER TONNES/HECTARE

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

FUNG_RES	NONE	BENOMYL	Mean
	9.17	6.47	7.82

1ST CUT MEAN DM% 21.7

1ST CUT PLOT AREA HARVESTED 0.00010

2ND CUT 22/09/04) DRY MATTER TONNES/HECTARE

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

FUNG_RES	NONE	BENOMYL	Mean
	4.80	3.17	3.98

2ND CUT MEAN DM% 48.0

2ND CUT PLOT AREA HARVESTED 0.00014

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FUNG_RES	NONE	BENOMYL	Mean
	13.97	9.64	11.81

TOTAL OF 2 CUTS MEAN DM% 34.8

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04/R/CS/326 and 04/W/CS/326

AMOUNTS OF STRAW

Object: To study the effects of different amounts of straw, incorporated into the soil, on w. wheat - Rothamsted (R) Great Knott III, Woburn (W) Far Field I.

Sponsors: M.J. Glendining, P.C. Brookes.

The 17th year, w. wheat.

For previous years see 87-03/R & W/CS/326.

Design: 4 randomised blocks of 4 plots (R).
3 randomised blocks of 4 plots (W).

Whole plot dimensions: 3.0 x 13.5 (R). 0.004 ha
3.0 x 14.5 (W).

Treatments:

STRAW Amounts of straw incorporated into the seedbed, cumulative to previous annual dressings:

		R	W
NONE	None	-	-
NORMAL	Normal	2.04	2.70
2 NORMAL	Twice normal	4.08	5.41
4 NORMAL	Four times normal	8.16	10.82

Experimental diary:

Great Knott III (R):

18-Aug-03	**T**		Straw treatments applied.
18-Aug-03	**T**		Chopped straw.
24-Sep-03	B		Ploughed 35 cm furrows.
25-Sep-03	B		Cultipress
27-Sep-03	B		Cultipress
	B		Combination drilled, Hereward, tr. Sibutol Secur, at 350 seeds/m^2 with the Accord drill.
21-Oct-03	B		Decoy Wetex at 5 kg.
07-Nov-03	B		Crystal at 4.0 l in 200 l.
17-Mar-04	B		Sulphur Gold at 167 kg. (50 kg N).
09-Apr-04	B		tm)Topik at 0.125 l in 100 l.
	B		tm)Amber at 0.5 l in 100 l.
17-Apr-04	B		tm)Ally at 30 g in 200 l.
	B		tm)Starane XL at 1.5 l in 200 l.
06-May-04	B		Sulphur Gold at 467 kg. (140 kg N).
13-May-04	B		tm)Opus at 0.75 l in 200 l.
	B		tm)Moddus at 0.15 l in 200 l.
13-Jun-04	B		tm)Folicur at 0.7 l in 200 l.
	B		tm)Amistar at 0.5 l in 200 l.
	B		tm)Hallmark with Zeon Technology at 50 ml in 200 l.
31-Aug-04	B		Combine harvested plots for yield.
	T		Straw baled and weighed.

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04/R/CS/326 and 04/W/CS/326

Experimental diary:

Far Field I (W):

19-Aug-03	B		CleanCrop Egret applied at 4.0 l on 200 l.
29-Aug-03	**T**		Straw treatments applied.
29-Sep-03	B		Muriate of potash at 250 kg.
05-Oct-03	B		Ploughed 30 cm furrows.
06-Oct-03	B		Cultipress
07-Oct-03	B		Drilled, Consort, tr. Sibutol Secur at 300 seeds/m^2 with the Accord drill.
17-Dec-03	B		tm)Arelon 500 at 3.5 l in 200 l.
	B		tm)Treflan at 1.5 l in 200 l.
12-Mar-04	B		tm)Cutonic Copper Ultra at 0.25 l in 200 l.
	B		tm)Aventis Manganese 500 at 1.5 l in 200 l.
18-Mar-04	B		Sulphur Gold 30% N, 7.6% S at 167 kg.
29-Mar-04	B		Duplosan KV at 1.0 l in 200 l.
19-Apr-04	B		tm)Ally at 30 g in 200 l.
	B		tm)Biotril 24/16 at 0.5 l in 200 l.
	B		tm)Phase II at 1.0 l in 200 l.
03-May-04	B		Sulphur Gold 30% N, 7.6% S at 467 kg.
03-Jun-04	B		tm)Opus at 0.5 l in 200 l.
	B		tm)Twist at 0.75 l in 200 l.
05-Jul-04	B		Aphox at 280 g in 200 l.
05-Sep-04	**T**		Combine harvested plots for yield
	T		Swathed straw
07-Sep-04	**T**		Sampled, baled and weighed straw.

NOTE: (1) Grain and straw samples were taken for N analysis.
(2) Because of operational difficulties while harvesting the grain yield of one plot was lost, with treatment combination 4 NORMAL. An estimated value was used in the analysis.

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04/R/CS/326

GRAIN TONNES/HECTARE

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

STRAW	
NONE	7.59
NORMAL	7.54
2 NORMAL	7.40
4 NORMAL	7.16
Mean	7.42

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

STRAW
0.215

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

Stratum	d.f.	s.e.	cv%
Blocks.Plots	9	0.304	4.1

GRAIN MEAN DM% 82.1

STRAW TONNES/HECTARE

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

STRAW	
NONE	4.17
NORMAL	4.31
2 NORMAL	4.52
4 NORMAL	4.64
Mean	4.41

STRAW MEAN DM% 85.4

PLOT AREA HARVESTED 0.00284

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04/W/CS/326

GRAIN TONNES/HECTARE

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

STRAW	
NONE	5.38
NORMAL	5.58
2 NORMAL	5.63
4 NORMAL	5.51
Mean	5.53

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

STRAW
0.264

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

Stratum	d.f.	s.e.	cv%
Blocks.Plots	5	0.323	5.9

GRAIN MEAN DM% 89.3

04/W/CS/326

STRAW TONNES/HECTARE

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

STRAW	
NONE	1.85
NORMAL	1.68
2 NORMAL	1.98
4 NORMAL	2.15
Mean	1.92

STRAW MEAN DM% 90.4

PLOT AREA HARVESTED 0.00305

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04/R/CS/477

CONTINUOUS MAIZE

Object: To monitor the fate of organic carbon in the soil organic matter - Hoosfield.

Sponsors: P.R. Poulton.

The eighth year, forage maize and s. barley.

For previous years see 97-03/R/CS/477

Design: 3 randomised blocks of 6 plots.

Plot dimensions: 12.0 x 25.0.

Treatments:-

CROP	Crop and straw treatments:
M	Continuous maize, stubble incorporated
(M)B	S. barley after five years maize, stubble incorporated
MT	Maize, stubble plus 10 t maize tops incorporated
(B)M	Maize, after three years of s. barley with straw removed
BT	Continuous spring barley, straw removed plus 10 t maize tops incorporated
B	Continuous spring barley, straw removed

Experimental diary:

26-Sep-03	B		Muriate of potash at 180 kg.
	B		Triple superphosphate at 170 kg.
05-Nov-03	**T**	BT, MT:	Maize tops at 300 kg per plot
	B		Ploughed 30 cm wide furrows.
09-Apr-04	B		Glydate at 3.0 l in 200 l to maize plots.
14-Apr-04	B		Power harrow.
	T	(M)B, BT, B:	Combination drilled, Optic, tr. Raxil S, at 350 seeds/m^2 with the Accord 2 drill.
	T	(M)B, BT, B:	Rolled.
26-Apr-04	B		Sulphur Gold (30% N, 7.6% S) at 320 kg.
03-May-04	**T**	(M)B, BT, B:	Harmony M at 60 g in 200 l.
14-May-04	**T**	(B)M, MT, M:	Flexitined.
19-May-04	**T**	(B)M, MT, M:	Power harrowed.
20-May-04	**T**	(B)M, MT, M:	Drilled, Hudson, tr. Mesurol, at 10.2 seeds/m^2 with the Nodet Gougis drill.
22-Jun-04	**T**	(B)M, MT, M tm)Samson at 1.5 l in 200 l.	
26-Aug-04	**T**	(M)B, BT, B:	Combine harvested plots for yield, swathed straw.
01-Sep-04	**T**	(M)B, BT, B:	Baled.
20-Sep-04	**T**	(B)M, MT, M:	Cut sample areas by hand, weighed and sampled.

NOTE: Forage maize and barley grain samples were taken for N analysis.

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04/R/CS/477

MAIZE

Whole crop (at 100% dry matter) TONNES/HECTARE

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

CROP	
M	11.28
(B)M	12.26
MT	11.45
Mean	11.66

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

CROP
1.113

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

Stratum	d.f.	s.e.	cv%
Blocks.Plots	4	1.364	11.7

MEAN DM% 27.0

PLOT AREA HARVESTED 0.00108

SPRING BARLEY

GRAIN TONNES/HECTARE

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

CROP	
(M)B	4.46
BT	3.98
B	3.90
Mean	4.11

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

CROP
0.110

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

Blocks.Plots	4	0.134	3.3

GRAIN MEAN DM% 83.2

AVERAGE PLOT AREA HARVESTED 0.00512

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04/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 67th year, leys, w. beans, w. wheat, w. rye, forage maize.

For previous years see 'Details' 1967 & 1973 and 74-03/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 1998 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

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04/W/RN/3

ROTATION (continued)

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

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).

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
   AM
   ABe

1/2 plots:

2. **NSPLIT(FYM res)** Farmyard manure residues, last applied 1964:

   Nsplit(noFYM)
   Nsingle(FYM)

1/8 plots:

3. **N** Nitrogen fertilizer in spring 2004 (kg N) as 27% N:

0				
70	)as a		40 + 30	)split dressings
140	)single	OR	40 + 100	)late Feb/early Mar
210	)dressing		40 + 170	)and GS31 or mid-Apr

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04/W/RN/3

Treatments to second test crop w. rye, all combinations of:

Whole plots:

1. **ROTATION** Rotations before first test crop:

   LLN 8
   LN 3
   LLC 8
   LC 3
   AF
   AB

1/2 plots:

2. **NSPLIT(FYM res)** Farmyard manure residues, last applied 1963:

   Nsplit to wheat in 2003(noFYM)
   Nsingle to wheat in 2003 (FYM)

1/8 plots:

3. **N** Nitrogen fertilizer in spring 2004(kg N) as 27% N:

   0
   40
   80
   120

Treatments to leys:

FYM RES Farmyard manure residues:

NONE
FYM 38 t on each occasion, last applied 1967 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.

NOTE: Corrective K dressings (kg K_2O) as muriate of potash, applied where necessary to first test crop w. wheat and long-term leys in the wheat block, applied 2nd October 2003.

Continuous rotations before wheat	No FYM half plots	FYM Res half plots
ABe	460	520
AM	310	270
Ln3	50	60
LLc8	60	0
LLn3 (to be ploughed in 2008)	20	0

None to other plots.

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04/W/RN/3

Experimental diary:

Grass ley and clover/grass ley, 1st year (**ROTATION** LN1, LLN1, LC1, and LLC1)

02-Oct-03	Triplesuperphosphate at 213 kg Potassium sulphate at 140 kg.
07-Oct-03	Ploughed 30cm wide furrows and power harrowed.
08-Oct-03	Drilled Promesse Timothy + Senu Fescue, 50:50, @ 30 kg and Promesse Timothy + Senu Fescue + Merwi White Clover, 45:45:10 @ 30 kg with 4.0 m Accord drill. Rolled.
10-Oct-03	27.0% N at 93 kg, 1st year grass/clover leys; at 185 kg, 1st year grass leys.
24-Mar-04	Muriate of potash at 167 kg.
06-Jul-04	Cut yield strips, weighed and sampled.
14-Jul-04	Mowed for hay.
15-Jul-04	Tedded hay.
17-Jul-04	Tedded hay.
19-Jul-04	Tedded hay.
20-Jul-04	Rowed up hay and baled.
26-Jul-04	Muriate of Potash at 83 kg to all leys. 34.5% N at 217 kg to grass leys only.
03-Nov-04	2nd cut yield strips, weighed and sampled.

Grass leys 2nd to 8th year (**ROTATION** LN2-3 and LLN2-8)

18-Mar-04	34.5% N at 218 kg
24-Mar-04	Potassium sulphate at 140 kg, Triple superphosphate at 213 kg. Muriate of potash at 167 kg.
06-Jul-04	Cut yield strips, weighed and sampled.
14-Jul-04	Mowed for hay.
15-Jul-04	Tedded hay.
17-Jul-04	Tedded hay.
19-Jul-04	Tedded hay.
20-Jul-04	Rowed up hay and baled.
26-Jul-04	Muriate of Potash at 83 kg 34.5% N at 217 kg.
15-Sep-04	2nd cut, sampled, weighed and mowed plots due for wheat (ie. 9, 10, 13, 14).
16-Sep-04	Mowed plots cut previous day, baled and removed.
03-Nov-04	2nd cut yield strips, weighed and sampled (all other long ley plots).

Clover/grass leys 2nd to 8th year (**ROTATION** LC2-3 and LLC2-8)

24-Mar-04	Potassium sulphate at 140 kg, Triple superphosphate at 213 kg. Muriate of potash at 167 kg.
06-Jul-04	Cut yield strips, weighed and sampled.
14-Jul-04	Mowed for hay.
15-Jul-04	Tedded hay.
17-Jul-04	Tedded hay.
19-Jul-04	Tedded hay.
20-Jul-04	Rowed up hay and baled.
26-Jul-04	Muriate of Potash at 83 kg.
15-Sep-04	2nd cut, sampled, weighed and mowed plots due for wheat (ie. 3, 4, 15, 16).
16-Sep-04	Mowed plots cut previous day, baled and removed.
03-Nov-04	2nd cut yield strips, weighed and sampled (all other long ley plots)

W. beans, 2nd and 3rd treatment crop (**ROTATION** AM and ABe)

02-Oct-03	Triple superphosphate at 127 kg.
03-Nov-03	Broadcast, Clipper, recleaned at 25 seeds/m^2 by hand. Ploughed 30 cm furrows.

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08-Dec-03	tm) Carbetamex at 3.0 kg in 200 l.
	tm) Alpha Simazine 50 SC at 2.0 l in 200 l.
24-Mar-04	Potassium sulphate at 140 kg
25-May-04	tm) Amistar at 0.5 l in 200 l.
	tm) Folicur at 0.5 l in 200 l.
05-Sep-04	Combine harvested plots for yield, combined discards. Straw swathed.
18-Sep-04	Straw baled and removed.

Forage maize, 2nd and 3rd treatment crop (**ROTATION** Abe and AM)

02-Oct-03	Triple superphosphate at 127 kg.
03-Nov-03	Ploughed 30cm furrows.
24-Mar-04	Potassium sulphate at 140 kg
09-Apr-04	Glydate at 3.0 l in 200 l
12-May-04	Power harrowed. Drilled, Hudson, tr. Mesurol, at 10.2 seeds/m^2 with the Nodet drill.
24-May-04	34.5% N at 290 kg.
22-Sep-04	Cut sampled and weighted.
05-Oct-04	Cut and removed discards.

W. wheat, 1st test crop (W)

16-Sep-03	Touchdown at 4.0 l in 200 l (to previous ley plots: 21, 22, 27, 28, 29, 30, 31, 32.
02-Oct-03	Triple superphosphate at 127 kg.
	Muriate of potash (corrective K) at 460 kg K_2O to plot 17, 520 kg to 18, 310 kg to 19, 270 kg to 20, 60 kg to 22 and 32, 20 kg to 26 and 50 kg to 31.
07-Oct-03	Ploughed 30 cm wide furrows and power harrowed.
08-Oct-03	Drilled Hereward, tr. Sibutol Secur, at 350 seeds/m^2 with the Accord drill. Rolled.
17-Dec-03	Arelon 500 at 3.5 l in 200 l.
15-Mar-04	1st N (27% N) applied to split N sub-plots.
24-Mar-04	Potassium sulphate at 140 kg
10-Apr-04	27% N to single application plots
17-Apr-04	Quantum 75 DF at 20 g in 200 l.
05-May-04	2nd N (27% N) applied to split N sub-plots.
03-Jun-04	Opus at 0.75 l in 200 l.
04-Sep-04	Combine harvested plots for yield, combined discards. Straw swathed, sampled and weighed.
18-Sep-04	Straw baled and removed.

W. rye, 2nd test crop and 1st treatment crop (**ROTATION** Abe and AM)

02-Oct-03	Triple superphosphate at 127 kg.
03-Oct-03	Chalk at 5.0 t.
07-Oct-03	Ploughed 30cm wide furrows and power harrowed.
08-Oct-03	Drilled, Picasso/Nikita blend (90:10), tr. Baytan, at 306 seeds/m^2 with 4.0 m Accord drill. Rolled.
19-Dec-03	Lexus Class WSB at 60 g in 200 l.
24-Mar-04	Potassium sulphate at 140 kg
23-Apr-04	27% N at 296 kg to 2nd test crop only.
03-Jun-04	Opus at 0.75 l in 200 l.
04-Sep-04	Combine harvested plots for yield, combined discards. Straw swathed, sampled and weighed.
18-Sep-04	Straw baled and removed.

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04/W/RN/3

LEYS

1ST CUT (6/7/04) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYMRes	Mean
LEY			
LC1	1.40	2.18	1.79
LC2	3.46	3.53	3.50
LC3	5.79	5.28	5.53
LN1	4.55	3.49	4.02
LN2	6.58	6.08	6.33
LN3	5.98	5.83	5.91
LLC1	3.54	3.26	3.40
LLC2	4.52	5.00	4.76
LLC3	5.39	4.86	5.12
LLC4	6.62	5.69	6.16
LLC5	2.86	2.80	2.83
LLC6	6.52	6.76	6.64
LLC7	5.39	6.22	5.81
LLC8	4.46	2.75	3.61
LLN1	7.46	6.35	6.91
LLN2	7.24	6.97	7.10
LLN3	5.81	6.29	6.05
LLN4	7.26	6.99	7.12
LLN5	8.19	7.96	8.08
LLN6	5.99	6.45	6.22
LLN7	7.31	8.17	7.74
LLN8	5.27	5.98	5.63
Mean	5.53	5.40	5.47

1ST CUT MEAN DM% 43.9

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04/W/RN/3

LEYS

2ND CUT (15/9 & 3/11/04) DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYMRes	Mean
LEY			
LC1	1.48	1.61	1.55
LC2	0.58	0.23	0.40
LC3	0.64	0.45	0.54
LN1	2.48	2.44	2.46
LN2	2.64	2.55	2.59
LN3	1.90	1.70	1.80
LLC1	1.58	1.63	1.60
LLC2	1.05	0.93	0.99
LLC3	0.61	0.68	0.65
LLC4	0.90	0.56	0.73
LLC5	0.16	0.23	0.20
LLC6	1.77	1.23	1.50
LLC7	0.67	1.11	0.89
LLC8	0.94	0.61	0.78
LLN1	2.59	2.52	2.55
LLN2	2.88	2.65	2.76
LLN3	1.99	1.91	1.95
LLN4	3.04	3.64	3.34
LLN5	4.00	4.27	4.13
LLN6	3.15	3.22	3.19
LLN7	3.14	3.45	3.30
LLN8	2.10	1.78	1.94
Mean	1.83	1.79	1.81

2ND CUT MEAN DM% 22.7

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04/W/RN/3

LEYS

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

FYM_RES	NONE	FYMRes	Mean
LEY			
LC1	2.89	3.79	3.34
LC2	4.03	3.77	3.90
LC3	6.43	5.72	6.08
LN1	7.03	5.94	6.48
LN2	9.23	8.63	8.93
LN3	7.89	7.53	7.71
LLC1	5.12	4.89	5.00
LLC2	5.57	5.93	5.75
LLC3	6.00	5.53	5.77
LLC4	7.52	6.26	6.89
LLC5	3.02	3.03	3.03
LLC6	8.29	7.99	8.14
LLC7	6.06	7.33	6.70
LLC8	5.41	3.36	4.38
LLN1	10.05	8.87	9.46
LLN2	10.12	9.62	9.87
LLN3	7.80	8.20	8.00
LLN4	10.29	10.63	10.46
LLN5	12.19	12.23	12.21
LLN6	9.14	9.67	9.40
LLN7	10.45	11.62	11.04
LLN8	7.37	7.77	7.57
Mean	7.36	7.19	7.28

TOTAL OF 2 CUTS MEAN DM% 33.3

PLOT AREA HARVESTED 0.00200

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04/W/RN/3

MAIZE

WHOLE CROP (100% DRY MATTER) TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYMRes	Mean
AM	12.69	13.83	13.26
AB	15.23	14.43	14.83
Mean	13.96	14.13	14.05

MEAN DM% 40.6

PLOT AREA HARVESTED 0.00108

W. BEANS

GRAIN (85% DRY MATTER) TONNES/HECTARE

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

FYMRES ROTATION	NONE	FYMRes	Mean
ABe	0.10	0.10	0.10
(AM)BE	0.89	1.01	0.95
Mean	0.49	0.56	0.53

GRAIN MEAN DM% 78.0

PLOT AREA HARVESTED 0.01573

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04/W/RN/3

W. WHEAT

GRAIN TONNES/HECTARE

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

NSPLITFYM	Nsplit(noFYM)	Nsingle(FYMRes)	Mean
ROTATION			
LLN 8	2.67	3.19	2.93
LN 3	4.21	4.27	4.24
LLC 8	3.83	4.00	3.92
LC 3	4.62	4.62	4.62
AM	3.82	4.15	3.98
ABe	3.68	3.61	3.64
Mean	3.81	3.97	3.89

N	0	70	140	210	Mean
ROTATION					
LLN 8	2.01	3.08	3.07	3.56	2.93
LN 3	2.73	3.92	5.06	5.27	4.24
LLC 8	2.77	3.87	4.55	4.48	3.92
LC 3	2.95	4.38	5.32	5.84	4.62
AM	1.58	3.82	4.98	5.56	3.98
ABe	1.52	3.79	4.58	4.69	3.64
Mean	2.26	3.81	4.59	4.90	3.89

N	0	70	140	210	Mean
NSPLITFYM					
Nsplit(noFYM)	1.99	3.73	4.46	5.04	3.81
Nsingle(FYMRes)	2.52	3.89	4.73	4.75	3.97
Mean	2.26	3.81	4.59	4.90	3.89

N		0	70	140	210
ROTATION	**NSPLITFYM**				
LLN 8	Nsplit(noFYM)	0.84	3.34	2.63	3.87
	Nsingle(FYMRes)	3.18	2.82	3.50	3.25
LN 3	Nsplit(noFYM)	2.61	3.77	4.85	5.62
	Nsingle(FYMRes)	2.84	4.06	5.27	4.92
LLC 8	Nsplit(noFYM)	2.58	3.83	4.85	4.07
	Nsingle(FYMRes)	2.95	3.90	4.25	4.89
LC 3	Nsplit(noFYM)	3.05	4.18	5.07	6.17
	Nsingle(FYMRes)	2.85	4.57	5.57	5.51
AM	Nsplit(noFYM)	1.43	3.51	4.74	5.61
	Nsingle(FYMRes)	1.72	4.13	5.22	5.51
Abe	Nsplit(noFYM)	1.44	3.75	4.61	4.92
	Nsingle(FYMRes)	1.60	3.83	4.55	4.46

GRAIN MEAN DM% 86.2

PLOT AREA HARVESTED 0.00192

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04/W/RN/3

W. RYE

GRAIN TONNES/HECTARE

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

FYMRES	NONE	FYMRes	Mean
ROTATION			
LLN 8	5.49	5.53	5.51
LN 3	4.83	4.44	4.64
LLC 8	4.45	4.70	4.58
LC 3	5.35	5.35	5.35
AM	3.42	3.61	3.51
ABe	4.00	3.87	3.93
Mean	4.59	4.58	4.59

N	0	40	80	120	Mean
ROTATION					
LLN 8	4.35	5.27	5.64	6.78	5.51
LN 3	3.77	4.34	5.41	5.03	4.64
LLC 8	3.24	4.86	4.66	5.55	4.58
LC 3	4.35	4.75	5.76	6.55	5.35
AM	2.24	3.32	4.12	4.37	3.51
ABe	2.87	3.57	4.15	5.15	3.93
Mean	3.47	4.35	4.96	5.57	4.59

N	0	40	80	120	Mean
FYMRES					
NONE	3.36	4.35	5.02	5.64	4.59
FYM	3.58	4.36	4.89	5.50	4.58
Mean	3.47	4.35	4.96	5.57	4.59

	N	0	40	80	120
ROTATION	**FYMRES**				
LLN 8	NONE	4.35	5.62	5.12	6.86
	FYMRes	4.36	4.92	6.15	6.70
LN 3	NONE	3.76	4.19	6.03	5.36
	FYMRes	3.78	4.48	4.79	4.70
LLC 8	NONE	3.05	4.74	4.83	5.19
	FYMRes	3.44	4.97	4.48	5.92
LC 3	NONE	4.23	4.51	5.97	6.70
	FYMRes	4.47	4.99	5.55	6.40
AM	NONE	1.89	3.31	4.00	4.48
	FYMRes	2.60	3.33	4.25	4.26
ABe	NONE	2.87	3.71	4.16	5.26
	FYMRes	2.87	3.43	4.13	5.04

GRAIN MEAN DM% 86.8

PLOT AREA HARVESTED 0.00192

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04/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. A.J.Macdonald

The 40th year, s. barley, grass/clover ley.

For previous years see 'Details' 1973 and 74-03/W/RN/12.

Design: 4 blocks of 8 plots.

Whole plot dimensions: 8.0 x 29.5 (8.0 x 26.5 on Block III).

Treatments: From 1966 to 1971 the experiment had a preliminary period designed to build up organic matter 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, 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. A second test phase began when leys on the first pair of blocks were ploughed for the 1st test crop in 1987 and on the second pair for the 1st test crop in 1988. From 1988 two blocks, and 1989 the other two, to 1994, plots were split into 6 sub-plots to test five levels of nitrogen and nil. From 1995 to 1997 residual effects of that nitrogen were measured. In 1998 to 2000 yields were taken from whole plots only. In 2001 plots were split into half-plots to test two rates of N.
For 2003 the experiment was modified to test further inputs of organic matter. An arable rotation (w. rye, s. barley, w. beans, w. wheat, forage maize) was started on seven plots within each block; the eighth was sown to a grass/clover ley.

Whole plots

1. **TREATMNT** (Not necessarily applied each year):

1966-1971/2	1979/82-1986/7	Since 2003
Fd	Fd	F
Ln	Lc6	F
St	St	St
Gm	Lc8	CC
Pt	Lc8	Co
Fs	Fs	Dg10
Dg	Dg	Dg25
Lc	Lc6	Lc

F: no organic amendment. St: chopped straw at 7.5t/ha. CC: cover crop prior to spring sown crops. Co: compost at 40t/ha. Dg10: FYM at 10t/ha. Dg25: FYM at 25t/ha. Dg: FYM at 50t/ha. Fd: fertilizers equivalent to FYM.
Fs: fertilizers equivalent to straw (+P). Lc/Lc6/Lc8: grass/clover leys. Ln: grass ley + N. Gm: green manure. Pt: peat.

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04/W/RN/12

1. **TREATMNT** (Not necessarily applied each year):(cont.)

Since 2003, all treatments, except Dg25, have also received PKS fertilizers : 20 kg P/ha, 83 kg K/ha, 36 kg S/ha.

In addition in 2003 F and CC treatments received 120 kg N/ha, St received 90 kg N/ha. Dg10 received 60 kg N/ha. No N was applied to Dg25, Co or Lc treatments.
In 2004 all plots, except Lc (permanent grass/clover), split into 6 at random and the following nitrogen range applied as Nitro-chalk:
N0, 1, 2, 3, 4, 5 as 0, 35, 70, 105, 140, 175 kg N.

Experimental diary:

14-Aug-03	T	:	Drilled Albatross, White mustard, at 10 kg with Moore Unidrill to CC plots.
22-Sep-03	T	:	Chopped straw applied at 7.5 t to St plots.
09-Mar-04	T	:	Compost applied at 40 t to CO plots.
10-Mar-04	T	:	FYM applied at 25 t to Dg25 plots and at 10 t to Dg10 plots.
12-Mar-04	B	:	tm)PDQ at 5.5 l in 200 l
	B	:	tm)Enhance Low Foam at 100 ml in 200 l.
22-Mar-04	B	:	Ploughed 35cm wide furrows
12-Apr-04	B	:	Power harrowed.
	B	:	Drilled, Optic, tr. Sibutol, at 400 seeds/m^2 with 4.0 m Accord drill.
	B	:	Rolled.
07-May-04	T	:	Nitrogen treatments applied as Nitro-chalk 27% N by hand.
24-May-04	T	:	Sulphate of Potash at 200 kg (not to Dg25)
	T	:	Triple Superphosphate at 97.5 kg (not to Dg25).
02-Jun-04	B	:	Harmony M at 60 6 in 200 l to barley plots.
03-Jun-04	B	:	tm)Opus at 0.4 l in 200 l to barley plots.
	B		tm)Acanto at 0.5 l in 200 l to barley plots.
06-Jul-04	**T**	:	Cut, samples and weighed grass/clover, Lc plots only.
14-Jul-04	T	:	Mowed Lc plots.
15-Jul-04	T	:	Turned hay Lc plots.
17-Jul-04	T	:	Turned hay Lc plots.
19-Jul-04	T	:	Turned hay Lc plots.
20-Jul-04	T	:	Rowed up hay and baled Lc plots.
04-Sep-04	**T**	:	Combine harvested, barley plots for yield.
	T	:	Swathed straw.
08-Aug-04	**T**	:	Baled straw.

NOTE: Samples of grain were taken for chemical analysis.

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04/W/RN/12

GRAIN TONNES/HECTARE

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

N TREATMNT	0	35	70	105	140	175	Mean
F(Fd)	1.31	2.14	2.32	2.62	2.45	2.61	2.24
F(Ln,Lc6)	1.78	2.73	3.19	3.51	3.60	3.72	3.09
St(St)	1.22	2.49	2.93	3.18	2.94	2.98	2.62
CC(Gm,Lc8)	1.57	2.39	2.83	3.40	3.14	3.29	2.77
Co(Pt,Lc8)	2.23	2.98	3.50	3.29	3.49	4.23	3.29
Dg10(Fs)	1.61	2.32	3.01	2.92	2.98	3.23	2.68
Dg25(Dg)	2.10	3.03	3.30	3.57	3.41	3.32	3.12
Mean	1.69	2.58	3.01	3.21	3.14	3.34	2.83

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

Table	TREATMNT	N	TREATMNT N
rep.	24	28	4
s.e.d.	0.262	0.107	0.368

Except when comparing means with the same level(s) of TREATMNT 0.283

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

Stratum	d.f.	s.e.	cv%
Blocks.Plots	18	0.371	13.1
Blocks.Plots.Subplots	105	0.401	14.2

GRAIN MEAN DM% 86.8

PLOT AREA HARVESTED 0.00192

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04/W/CS/478

CONTINUOUS MAIZE

Object: To monitor the fate of organic carbon in the soil organic matter - Woburn, Stackyard A I.

Sponsors: P.R. Poulton.

The eighth year, forage maize and s. barley.

For previous years see 97-03/W/CS/478.

Design: 3 randomised blocks of 6 plots.

Plot dimensions: 9.0 x 25.0.

Treatments:

CROP	Crop and straw treatments:
M	Continuous maize, stubble incorporated
(M)B	S. barley after five years maize, stubble incorporated
MT	Maize, stubble plus 10 t maize tops incorporated
(B)M	Maize after three years of spring barley, straw removed
BT	Continuous spring barley, straw removed plus 10 t maize tops incorporated
B	Continuous spring barley, straw removed

Experimental diary:

05-Sep-03	**T**	BT, MT:	Maize tops applied at 225 kg per plot.
02-Oct-03	B	:	Muriate of potash at 250 kg.
	B	:	Triple superphosphate at 180 kg.
07-Oct-03	B	:	Ploughed 30 cm wide furrows.
09-Apr-04	B	:	Glydate at 3.0 l in 200 l.
12-Apr-04	B	:	Power harrowed.
	T	: (M)B, BT, B:	Drilled, Optic, tr. Sibutol, at 400 seeds/m^2 with the Accord drill, rolled.
07-May-04	B	:	Sulphur Gold (30% N, 7.6% S) at 320 kg.
12-May-04	**T**	: (B)M, MT, M:	Rotary harrowed.
	T	: (B)M, MT, M:	Drilled, Hudson, tr. Mesurol, at 10.2 seeds/m^2 with the Nodet drill.
03-Jun-04	B	: (M)B, BT, B:	tm)Opus at 0.4 l in 200 l.
	B	:	tm)Acanto at 0.5 l in 200 l.
04-Sep-04	**T**	: (M)B, BT, B:	Combine harvested plots for yield.
	T	: (M)B, BT, B:	Swathed straw
08-Sep-04	T	: (M)B, BT, B:	Baled.
22-Sep-04	**T**	: (B)M, MT, M:	Cut sample areas, weighed, and sampled.
05-Oct-04	**T**	: (B)M, MT, M:	Cut discards.

NOTE: Forage maize and barley grain samples were taken for N analysis.

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04/W/CS/478

MAIZE

Whole Crop (at 100% dry matter) TONNES/HECTARE

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

CROP	
M	7.77
MT	7.26
(B)M	5.42
Mean	6.82

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

CROP
0.893

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

Stratum	d.f.	s.e.	cv%
Blocks.Plots	4	1.094	16.0

MEAN DM% 37.8

PLOT AREA HARVESTED 0.00108

SPRING BARLEY

GRAIN TONNES/HECTARE

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

CROP	
(M)B	3.54
BT	2.85
B	2.27
Mean	2.88

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

CROP
0.140

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

Stratum	d.f.	s.e.	cv%
Blocks.Plots	4	0.171	5.9

GRAIN MEAN DM% 86.5

PLOT AREA HARVESTED 0.00525

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Rothamsted Experimental Station

The Weather : Monthly Summary : 2004

(Departure from 30-year means (1971 - 2000) in brackets)

	Sunshine		Mean temperatures oC								Rain			Drainage	Wind
			Maximum		Minimum		Dew	Ground	In ground under grass		Total mm		Rain	20 inch	***
	Hours	( )		( )		( )	point	frosts *	30 cm	100 cm	5" turf wall		days **	mm	km/hr
January	54.0	(-1.1)	7.51	(+1.17)	1.81	(+0.95)	2.76	14	5.07	6.58	88.2	(+18.5)	23	78.5	8.7
February	77.7	(+7.0)	7.36	(+0.65)	2.57	(+1.83)	3.41	13	5.70	6.61	24.0	(-24.8)	14	15.8	10.9
March	101.2	(-6.0)	9.56	(+0.07)	2.75	(+0.42)	3.61	14	5.61	6.04	47.4	(-6.5)	19	13.4	11.3
April	152.9	(+6.1)	13.46	(+1.52)	4.67	(+1.05)	6.51	5	9.18	8.14	82.2	(+28.7)	18	28.6	9.4
May	187.1	(-7.8)	16.29	(+0.54)	7.68	(+1.36)	7.82	0	12.82	10.88	51.6	(+1.9)	12	21.8	7.3
June	203.2	(+12.9)	20.32	(+1.72)	10.54	(+1.33)	10.4	0	15.72	13.68	32.4	(-27.8)	12	0.0	9.0
July	175.2	(-28.1)	21.36	(-0.06)	11.31	(-0.05)	11.4	0	16.07	14.39	49.8	(+7.7)	19	0.0	7.0
August	165.0	(-31.8)	22.35	(+0.92)	13.84	(+2.49)	13.9	0	18.00	16.22	113.4	(+59.7)	24	33.2	7.9
September	166.9	(+24.6)	19.42	(+1.43)	11.05	(+1.61)	11.1	0	15.61	15.45	24.4	(-36.6)	17	0.2	10.6
October	85.6	(-26.5)	13.83	(+0.09)	7.48	(+0.83)	8.15	0	12.15	13.04	126.4	(+51.7)	26	71.7	10.4
November	70.3	(+0.02)	9.83	(+0.45)	4.93	(+1.60)	5.31	8	9.51	11.01	73.6	(+7.4)	21	40.0	8.4
December	61.0	(+12.9)	7.7	(+0.51)	1.93	(+0.01)	2.56	17	6.53	8.63	40.4	(-29.7)	16	26.3	9.2
Year	1500.1		14.08		6.71			71			753.8		221	329.4	

* Number of nights grass minimum was below 0.0 oC

** Number of days rain was 0.2 mm or more

*** At 2 metres above ground

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Woburn Experimental Farm

The Weather : Monthly Summary : 2004

(Departure from 30-year means (1971 - 2000) in brackets)

	Sunshine		Mean temperatures oC								Rain			Wind
			Maximum		Minimum		Dew	Ground	In ground under grass		Total mm		Rain	***
	Hours	( )		( )		( )	point	frosts *	30 cm	100 cm	Tipping bucket		days **	km/hr
												( )		
January	48.70	(+0.2)	7.89	(+1.17)	2.05	(+1.01)	2.84	10	5.63	7.45	76.0	(+20.7)	25	11.35
February	77.70	(+13.7)	7.82	(+0.73)	2.35	(+1.53)	2.54	13	6.14	7.31	34.6	(-6.0)	17	9.13
March	102.50	(+1.2)	10.07	(+0.19)	2.59	(+0.20)	3.92	12	5.83	6.55	40.4	(-9.6)	20	8.80
April	155.30	(+19.5)	13.87	(+1.62)	4.82	(-1.41)	6.06	0	9.11	8.15	101.2	(+48.5)	18	6.63
May	192.90	(+9.8)	17.15	(+1.11)	7.63	(+1.59)	8.26	1	11.53	9.95	11.4	(-41.3)	9	8.64
June	211.10	(+34.2)	20.90	(+0.96)	10.32	(+1.31)	10.84	0	13.64	11.70	24.2	(-34.6)	10	7.91
July	175.40	(-18.2)	21.72	0.00	10.75	(-0.43)	11.90	0	14.74	12.94	46.2	(+0.6)	18	6.29
August	176.70	(-7.9)	22.96	(+1.37)	13.43	(+2.33)	14.24	0	17.24	14.89	109.6	(+5.1)	21	6.10
September	161.10	(+29.9)	19.79	(+1.54)	10.35	(+1.06)	11.38	0	15.54	14.96	25.6	(-32.5)	13	9.40
October	91.60	(-12.2)	14.30	(+0.25)	7.18	(+0.70)	8.97	0	11.98	13.21	103.4	(+39.0)	25	8.09
November	49.40	(-14.0)	10.09	(+0.46)	4.47	(+1.08)	5.67	6	9.39	11.39	61.8	(+4.6)	21	5.48
December	55.90	(+14.3)	8.09	(+0.58)	1.69	(-0.22)	2.91	15	6.84	9.19	28.8	(-30.7)	13	7.90
Year	1498.3							57			663.2			

* Number of nights grass minimum was below 0.0 oC

** Number of days rain was 0.2 mm or more

*** At 2 metres above ground