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# Yields of the Field Experiments

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## R/PG/5 Park Grass

### Rothamsted Research

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PARK GRASS

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

The 161<sup>st</sup> year, hay.

For previous years see 'Details' 1977 and 1973 and Yield Books for 74-15/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)
None (FYM)	Plot 2/2	None (FYM until 1863)
None	Plot 3	None
P	Plot 4/1	P
N2P	Plot 4/2	N2 P
N1PKNaMg	Plot 6	N1 P K Na Mg
(P)KNaMg	Plot 7/1	K Na Mg (+P until 2012)
PKNaMg	Plot 7/2	P K Na Mg
PNaMg	Plot 8	P Na Mg
PKNaMg(N2)	Plot 9/1	P K Na Mg (+ N2 until 1989)
N2PKNaMg	Plot 9/2	N2 P K Na Mg
N2PNaMg	Plot 10	N2 P Na Mg
N3PKNaMg	Plot 11/1	N3 P K Na Mg
N3PKNaMgSi	Plot 11/2	N3 P K Na Mg Si
None	Plot 12	None
(FYM/F)	Plot 13/1	None (FYM/F until 1993/1995)
FYM/PM	Plot 13/2	FYM/PM (FYM/F until 1999)
PKNaMg (N2*)	Plot 14/1	P K Na Mg (+ N2* until 1989)
N2*PKNaMg	Plot 14/2	N2* P K Na Mg
N3*PKNaMg (N2*)	Plot 15	N3*P K Na Mg (N2* until 1875; P K Na Mg 1876-2012)
N1*PKNaMg	Plot 16	N1* P K Na Mg
N1*	Plot 17	N1*
N2KNaMg	Plot 18	N2 K Na Mg
FYM	Plot 19	FYM
FYM/N*PK	Plot 20	FYM/N*P K

N1, N2, N3: 48, 96, 144 kg N as sulphate of ammonia  
 N1\*, N2\*, 48, 96, 144 kg N as nitrate of soda (30 kg N to plot  
 N3\*: 20 in years with no farmyard manure). In 2013 plot  
 15 started to receive 144 kg N/ha as nitrate of  
 soda to provide a comparison with plot 11/1, which  
 receives 144 kg N/ha as sulphate of ammonia.  
 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  
 (P): In 2013 plot 7 was split into 7/1 & 7/2. P was  
 withheld from plot 7/1 to evaluate the effect of  
 withholding P on plant biodiversity in 2013-2015.  
 7/2 continues to receive P as above.

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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
FYM:	Farmyard manure at 35 t every fourth year
F:	Fishmeal every fourth year to supply 63 kg N (stopped 1999; replaced by PM)
PM	Pelleted poultry manure at 2 t, every fourth year to supply 63 kg N (started 2003)

### Sub-plots

2.	<b>Lime</b>	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 2014-2015; the eighth 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.]

**NOTE:** Differential rates of lime were applied to sub-plots 2 and 3 regularly 1920-1964. 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

Date	Application	Rate	Units
23/10/2015	a Mowed all discards and leftover grass.	-	-
23/10/2015	a Rowed up all mowing across field	-	-
23/10/2015	a Baled and removed all grass on field	-	-
02/12/2015	f Applied TSP Fertilizer - plots 11/2, 11/1, 10, 9/2, 9/1, 8, 7/2, 6, 4/2, 4/1, 14/2, 14/1, 15 + 16	171	kg/ha
02/12/2015	f Applied TSP Fertilizer - plot 20	73	kg/ha
20/01/2016	f Started to apply Fertilizer Powders to designated plots	-	-
21/01/2016	f Completed applying Fertilizer Powders - Sulphate of Potash - plots 2-1, 6, 7-1, 7-2, 9-1, 9-2, 11-1, 11-2, 14-1, 14-2, 15, 16, 18, 20...	542	kg/ha
21/01/2016	f Completed applying Fertilizer Powders - Sulphate of Magnesia - plots 6, 7-1, 7-2, 8, 9-1, 9-2, 10, 11-1, 11-2, 14-1, 14-2, 15, 16, 18	111	kg/ha
21/01/2016	f Completed applying Fertilizer Powders - Sulphate of Soda - plots 6, 7-1, 7-2, 8, 9-1, 9-2, 10, 11-1, 11-2, 14-1, 14-2, 15, 16, 18	43	kg/ha

21/01/2016	f	Completed applying Fertilizer Powders - Silicate of Soda - plot 11-2	450	kg/ha
9/04/2016	f	Applied Ammonium Sulphate 21%N - plot 1, 6a, 6b	229	kg/ha
19/04/2016	f	Applied Ammonium Sulphate 21%N - plots 4-2, 9-2, 10, 18	457	kg/ha
19/04/2016	f	Applied Ammonium Sulphate 21%N - plots 11-1, 11-2	686	kg/ha
19/04/2016	f	Applied Sodium Nitrate 16%N - plots 16, 17	300	kg/ha
19/04/2016	f	Applied Sodium Nitrate 16%N - plot 14/2	600	kg/ha
19/04/2016	f	Applied Sodium Nitrate 16%N - plot 15	900	kg/ha
20/04/2016	f	Applied Sodium Nitrate 16%N - plot 20	188	kg/ha
10/05/2016	a	Cut paths in and around experiment using Iseki and mower	-	-
03/06/2016	a	Cut Paths within Trial	-	-
16/06/2016	a	Cut Paths.	-	-
04/07/2016	a	Started Harvest Yields to be completed (1 <sup>st</sup> Cut)	-	-
04/07/2016	a	Cut Paths Before starting yields Iseki and Mower	-	-
05/07/2016	a	Completed plots yields (1 <sup>st</sup> Cut).	-	-
05/07/2016	a	Cut discards and surrounds.	-	-
06/07/2016	a	Teddered all mowed grass on field	-	-
07/07/2016	a	Rowed up all grass on field	-	-
19/10/2016	a	Started cutting plots for Yield (2 <sup>nd</sup> Cut)	-	-
20/10/2016	a	Completed grass yields (2 <sup>nd</sup> Cut).	-	-

**NOTE:** Samples of herbage (1<sup>st</sup> and 2<sup>nd</sup> Cut) were taken for chemical analysis. Unground herbage samples from all plots were archived.

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

1ST CUT (04-05/07/2016) DRY MATTER TONNES/HECTARE

Grand mean 4.44

Manure	Lime	a	b	c	d	Mean
N1	1	3.48	2.88	2.23	1.74	2.58
K	2/1	3.24	3.88	3.02	2.50	3.16
None (FYM)	2/2	3.88	3.69	2.53	3.09	3.30
None	3	3.22	3.35	2.10	3.02	2.92
P	4/1	4.12	4.71	4.09	3.53	4.11
N2P	4/2	3.21	3.62	3.85	2.16	3.21
N1PKNaMg	6	5.43	5.40			5.42
(P)KNaMg	7/1	5.59	6.34	5.57	4.21	5.43
PKNaMg	7/2	5.67	5.57	5.68	4.75	5.42
PNaMg	8	4.37	4.45	4.06	3.92	4.20
PKNaMg (N2)	9/1	5.19	5.82	5.19	2.50	4.68
N2PKNaMg	9/2	6.00	6.22	5.66	4.60	5.62
N2PNaMg	10	4.95	5.20	5.17	3.39	4.68
N3PKNaMg	11/1	5.79	5.90	5.93	4.99	5.65
N3PKNaMgSi	11/2	6.22	6.09	6.26	5.38	5.99
None	12	3.41	3.03	2.55	2.66	2.91
(FYM/F)	13/1	4.43	4.61	4.44	4.24	4.43
FYM/PM	13/2	4.05	4.31	5.04	5.13	4.63
PKNaMg (N2*)	14/1	5.55	5.19	5.13	5.31	5.30
N2*PKNaMg	14/2	4.90	4.53	4.48	4.49	4.60
N3*PKNaMg (N2*)	15	5.79	5.70	5.95	5.35	5.70
N1*PKNaMg	16	5.52	4.80	4.93	4.57	4.96
N1*	17	3.51	3.42	2.52	2.89	3.08
N2KNaMg	18	3.48	4.01	4.09	3.62	3.80
N2KNaMg	18/2					4.73
FYM	19/1					5.27
FYM	19/2					5.47
FYM	19/3					4.73
FYM/N*PK	20/1					5.40
FYM/N*PK	20/2					5.50
FYM/N*PK	20/3					5.47

1ST CUT MEAN DM% 26.5

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

2ND CUT (19-20/10/2016) DRY MATTER TONNES/HECTARE

Grand mean 1.34

Manure	Lime	a	b	c	d	Mean
N1	1	0.97	0.73	0.50	0.52	0.68
K	2/1	0.83	1.09	0.63	0.55	0.77
None (FYM)	2/2	1.27	1.21	0.87	0.69	1.01
None	3	0.77	0.93	0.56	0.56	0.71
P	4/1	1.29	1.67	1.25	0.87	1.27
N2P	4/2	0.75	0.86	0.63	0.48	0.68
N1PKNaMg	6	1.92	1.53			1.73
(P)KNaMg	7/1	1.87	2.05	1.41	0.74	1.52
PKNaMg	7/2	1.76	1.87	1.57	0.75	1.49
PNaMg	8	1.20	1.29	0.96	0.94	1.10
PKNaMg (N2)	9/1	1.69	1.79	1.38	0.26	1.28
N2PKNaMg	9/2	1.66	1.86	1.15	0.71	1.34
N2PNaMg	10	0.80	0.97	1.05	0.62	0.86
N3PKNaMg	11/1	1.63	1.67	1.35	1.45	1.53
N3PKNaMgSi	11/2	2.55	2.10	1.72	1.55	1.98
None	12	1.21	0.88	0.73	0.52	0.84
(FYM/F)	13/1	1.58	1.46	1.26	0.92	1.31
FYM/PM	13/2	1.64	2.40	2.27	1.75	2.02
PKNaMg (N2*)	14/1	2.28	3.12	2.71	2.62	2.68
N2*PKNaMg	14/2	1.62	1.89	1.85	2.17	1.88
N3*PKNaMg (N2*)	15	1.70	1.98	1.88	1.55	1.78
N1*PKNaMg	16	1.81	2.12	1.52	1.30	1.69
N1*	17	0.99	1.03	0.75	1.01	0.95
N2KNaMg	18	0.78	0.91	0.87	0.33	0.72
N2KNaMg	18/2					1.22
FYM	19/1					1.44
FYM	19/2					2.53
FYM	19/3					1.86
FYM/N*PK	20/1					1.85
FYM/N*PK	20/2					2.07
FYM/N*PK	20/3					1.57

2ND CUT MEAN DM% 28.97

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

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

Grand mean 5.78

Manure	Lime	a	b	c	d	Mean
N1	1	4.45	3.61	2.73	2.26	3.26
K	2/1	4.07	4.96	3.65	3.05	3.93
None (FYM)	2/2	5.15	4.90	3.40	3.78	4.31
None	3	3.99	4.28	2.66	3.58	3.63
P	4/1	5.41	6.39	5.34	4.40	5.39
N2P	4/2	3.96	4.48	4.47	2.64	3.89
N1PKNaMg	6	7.35	6.93			7.14
(P)KNaMg	7/1	7.46	8.39	6.98	4.95	6.94
PKNaMg	7/2	7.43	7.43	7.25	5.50	6.90
PNaMg	8	5.57	5.75	5.02	4.87	5.30
PKNaMg (N2)	9/1	6.88	7.61	6.57	2.76	5.95
N2PKNaMg	9/2	7.66	8.08	6.82	5.31	6.97
N2PNaMg	10	5.76	6.18	6.22	4.00	5.54
N3PKNaMg	11/1	7.42	7.57	7.28	6.45	7.18
N3PKNaMgSi	11/2	8.77	8.19	7.98	6.93	7.97
None	12	4.62	3.91	3.27	3.18	3.75
(FYM/F)	13/1	6.02	6.07	5.70	5.16	5.74
FYM/PM	13/2	5.69	6.71	7.31	6.88	6.65
PKNaMg (N2*)	14/1	7.84	8.31	7.84	7.93	7.98
N2*PKNaMg	14/2	6.51	6.42	6.33	6.66	6.48
N3*PKNaMg (N2*)	15	7.50	7.68	7.83	6.90	7.48
N1*PKNaMg	16	7.33	6.92	6.44	5.87	6.64
N1*	17	4.50	4.45	3.27	3.91	4.03
N2KNaMg	18	4.26	4.92	4.95	3.95	4.52
N2KNaMg	18/2					5.95
FYM	19/1					6.71
FYM	19/2					8.00
FYM	19/3					6.60
FYM/N*PK	20/1					7.25
FYM/N*PK	20/2					7.58
FYM/N*PK	20/3					7.05

TOTAL OF 2 CUTS MEAN DM% 27.73