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Yields of the Field Experiments 2015

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R/PG/5 Park Grass

Rothamsted Research

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15/R/PG/5

PARK GRASS

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

The 160th year, hay.
For previous years see 'Details' 1977 and 1973 and Yield Books for 74-14/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*, N3*:	48, 96, 144 kg N as nitrate of soda (30 kg N to plot 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.	**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 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
10/11/2014	a	Topped surrounding paths	-	-
19/01/2015	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
19/01/2015	f	Applied TSP Fertilizer - plot 20	73	kg/ha
23/01/2015	f	Completed applying Fertilizer Powders	-	-
23/01/2015	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
23/01/2015	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
23/01/2015	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
23/01/2015	f	Completed applying Fertilizer Powders - Silicate of Soda - plot 11-2	450	kg/ha
27/01/2015	f	Applied Poultry manure - plot 13-2	2	t/ha

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09/02/2015	f	Applied Chalk including paths - ALL Plots in Section d + Plots 2/2c, 3c, 4/1c, 8c, 12c, 13/2c, 14/1c, 14/2b, 14/2c, 16b, 16c, 17b, 17c, 18/2, 19/1, 19/2, 19/3, 20/1, 20/2, 20/3	0	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 2/1c, 2/2a, 2/2b, 3b, 4/1b, 7/1c, 7/2c, 13/1c, 13/2b, 15c	0.3	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 3a, 4/2c, 7/1b, 7/2b, 8b, 9/1b, 9/1c, 14/1b, 15b	0.5	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 1b, 1c, 2/1b, 10c, 12b, 13/1b, 18c	0.75	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 2/1a, 4/2b, 10b	1	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 9/1a, 9/2b, 11/1b, 11/1c, 11/2c, 18b	1.5	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 12a, 13/1a, 17a	1.75	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 1a, 4/1a, 9/2c, 11/2b, 13/2a, 14/1a, 14/2a	2	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 6b, 7/1a, 7/2a, 8a, 9/2a, 10a, 15a, 16a	2.5	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 11/2a	3	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 6a, 11/1a, 18a	3.5	t/ha
09/02/2015	f	Applied Chalk including paths - Plots 4/2a	4	t/ha
22/04/2015	f	Applied Sodium Nitrate 16%N -plot 20	188	kg/ha
22/04/2015	f	Applied Sodium Nitrate 16%N -plots 16, 17	300	kg/ha
22/04/2015	f	Applied Sodium Nitrate 16%N -plot 14/2	600	kg/ha
22/04/2015	f	Applied Sodium Nitrate 16%N -plot 15	900	kg/ha
22/04/2015	f	Applied Ammonia Sulphate 21%N - plot 1	229	kg/ha
22/04/2015	f	Applied Ammonia Sulphate 21%N - plots 6a, 6b	229	kg/ha
22/04/2015	f	Applied Ammonia Sulphate 21%N - plots 4-2, 9-2, 10, 18	457	kg/ha
22/04/2015	f	Applied Ammonia Sulphate 21%N - plots 11-1, 11-2	686	kg/ha
28/04/2015	a	Cut Paths	-	-
26/05/2015	a	Cut Paths between and surrounding plots	-	-
28/05/2015	a	Cut paths around plots 19 + 20	-	-
16/06/2015	a	Mowed all Paths	-	-
23/06/2015	a	Cut plots for yield (1st Cut)	-	-
24/06/2015	a	Completed cutting all plots for yield (1st Cut)	-	-
25/06/2015	a	Completed mowing all discards all grass on field, trial and surrounds	-	-
25/06/2015	a	Turned/spread all cuttings went over all field twice.	-	-
26/06/2015	a	Rowed up all grass cuttings	-	-
26/06/2015	a	Baled and moved all grass on field	-	-
20/10/2015	a	Harvested all Plots for Yield - Cut, Weighed and Sampled (2nd Cut)	-	-

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

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***** TABLES OF MEANS

1ST CUT (23-24/6-15) DRY MATTER TONNES/HECTARE

Grand mean 3.56

Manure	Lime	a	b	c	d	Mean
N1	1	2.08	1.61	1.28	0.86	1.46
K	2/1	2.20	2.44	1.13	1.27	1.76
None(FYM)	2/2	2.40	2.38	1.85	2.04	2.17
None	3	2.00	2.28	0.96	2.12	1.84
P	4/1	3.13	3.57	2.65	2.28	2.91
N2P	4/2	3.15	3.54	3.63	2.23	3.14
N1PKNaMg	6	4.85	5.47			5.16
(P)KNaMg	7/1	4.49	4.89	4.62	2.99	4.25
PKNaMg	7/2	4.51	4.74	4.46	3.34	4.26
PNaMg	8	2.79	2.90	2.41	2.37	2.61
PKNaMg(N2)	9/1	5.03	4.89	3.92	0.91	3.69
N2PKNaMg	9/2	5.24	5.69	4.65	4.46	5.01
N2PNaMg	10	3.78	4.12	4.11	3.19	3.80
N3PKNaMg	11/1	5.91	5.04	5.69	5.40	5.51
N3PKNaMgSi	11/2	5.86	5.52	4.71	5.55	5.41
None	12	2.51	1.82	1.45	1.34	1.78
(FYM/F)	13/1	3.59	3.32	3.30	2.94	3.29
FYM/PM	13/2	4.04	4.63	5.03	4.61	4.58
PKNaMg(N2*)	14/1	4.66	4.52	4.45	3.60	4.31
N2*PKNaMg	14/2	4.38	4.11	3.98	3.95	4.11
N3*PKNaMg(N2*)	15	5.64	5.17	4.95	4.82	5.14
N1*PKNaMg	16	5.15	4.97	4.79	3.62	4.63
N1*	17	2.16	2.33	1.83	1.84	2.04
N2KNaMg	18	2.41	2.67	2.49	1.03	2.15
N2KNaMg	18/2					3.20
FYM	19/1					4.34
FYM	19/2					4.69
FYM	19/3					4.06
FYM/N*PK	20/1					4.91
FYM/N*PK	20/2					5.18
FYM/N*PK	20/3					4.32

1ST CUT MEAN DM% 26.9

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***** Tables of means

2ND CUT (22/10/2015) DRY MATTER TONNES/HECTARE

Grand mean 0.89

Manure	Lime	a	b	c	d	Mean
N1	1	1.27	0.94	1.02	0.51	0.93
K	2/1	1.39	1.50	0.89	0.85	1.15
None(FYM)	2/2	1.64	1.63	1.45	0.99	1.43
None	3	1.20	1.47	0.74	1.65	1.26
P	4/1	1.85	2.12	1.72	1.93	1.90
N2P	4/2	1.15	1.57	1.33	0.91	1.24
N1PKNaMg	6	2.81	3.06			2.94
(P)KNaMg	7/1	2.89	3.15	2.33	1.59	2.49
PKNaMg	7/2	2.96	3.03	2.51	1.81	2.58
PNaMg	8	2.01	1.96	1.51	2.12	1.90
PKNaMg(N2)	9/1	3.13	3.12	2.43	0.30	2.24
N2PKNaMg	9/2	3.27	3.13	2.65	1.42	2.62
N2PNaMg	10	1.76	1.66	2.15	1.22	1.70
N3PKNaMg	11/1	2.61	2.24	2.27	3.43	2.64
N3PKNaMgSi	11/2	3.08	3.36	2.50	3.48	3.11
None	12	1.94	1.58	1.29	1.46	1.57
(FYM/F)	13/1	2.57	2.60	1.96	1.51	2.16
FYM/PM	13/2	2.13	2.96	3.09	2.90	2.77
PKNaMg(N2*)	14/1	2.69	3.01	2.76	3.03	2.87
N2*PKNaMg	14/2	2.71	2.76	2.70	2.89	2.77
N3*PKNaMg(N2*)	15	3.06	2.91	3.17	2.96	3.03
N1*PKNaMg	16	2.89	3.09	2.78	2.09	2.71
N1*	17	1.04	1.71	1.14	1.26	1.29
N2KNaMg	18	1.46	1.58	1.31	0.25	1.15
N2KNaMg	18/2					1.93
FYM	19/1					3.15
FYM	19/2					3.39
FYM	19/3					2.75
FYM/N*PK	20/1					3.21
FYM/N*PK	20/2					3.17
FYM/N*PK	20/3					2.63

2ND CUT MEAN DM% 22.82

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***** Tables of means

TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

Grand mean 5.70

Manure	Lime	a	b	c	d	Mean
N1	1	3.35	2.54	2.30	1.37	2.39
K	2/1	3.59	3.94	2.02	2.12	2.92
None(FYM)	2/2	4.05	4.01	3.30	3.03	3.60
None	3	3.19	3.75	1.70	3.77	3.10
P	4/1	4.98	5.68	4.37	4.22	4.81
N2P	4/2	4.31	5.11	4.96	3.15	4.38
N1PKNaMg	6	7.66	8.52			8.09
(P)KNaMg	7/1	7.38	8.04	6.95	4.59	6.74
PKNaMg	7/2	7.47	7.76	6.98	5.14	6.84
PNaMg	8	4.80	4.86	3.92	4.48	4.51
PKNaMg(N2)	9/1	8.16	8.01	6.34	1.21	5.93
N2PKNaMg	9/2	8.52	8.82	7.30	5.88	7.63
N2PNaMg	10	5.55	5.78	6.26	4.41	5.50
N3PKNaMg	11/1	8.52	7.29	7.95	8.83	8.15
N3PKNaMgSi	11/2	8.95	8.88	7.20	9.03	8.51
None	12	4.45	3.40	2.74	2.81	3.35
(FYM/F)	13/1	6.16	5.92	5.26	4.46	5.45
FYM/PM	13/2	6.17	7.59	8.12	7.51	7.35
PKNaMg(N2*)	14/1	7.35	7.53	7.21	6.63	7.18
N2*PKNaMg	14/2	7.09	6.87	6.68	6.84	6.87
N3*PKNaMg(N2*)	15	8.70	8.07	8.12	7.78	8.17
N1*PKNaMg	16	8.04	8.06	7.57	5.71	7.34
N1*	17	3.20	4.05	2.97	3.10	3.33
N2KNaMg	18	3.86	4.25	3.80	1.28	3.30
N2KNaMg	18/2					5.14
FYM	19/1					7.49
FYM	19/2					8.08
FYM	19/3					6.81
FYM/N*PK	20/1					8.12
FYM/N*PK	20/2					8.35
FYM/N*PK	20/3					6.95

TOTAL OF 2 CUTS MEAN DM% 24.84

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