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# Results of the Classical and Other Long-term Experiments 2006

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Classical  
and other  
Long-term Experiments  
2006

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## 06/R/PG/5 - Park Grass

### Rothamsted Research

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06/R/PG/5

# PARK GRASS

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

The 151<sup>st</sup> year, hay.

For previous years see 'Details' 1977 and 1973 and 74-05/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                 |
| PKNaMg       | Plot 7                                                                                                                                              | 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                |
| PKNaMg (N2*) | Plot 15                                                                                                                                             | P K Na Mg (N2* until 1875)   |
| 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 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                                                                                                                          |                              |
| FYM:         | Farmyard manure at 35 t every fourth year                                                                                                           |                              |

F: Fishmeal every fourth year to supply 63 kg N (stopped  
1999; replaced by PM)

**06/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)
- 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 1920-1964. 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 97-05/R/PG/5 Yield book entries.]

**Experimental diary:**

The amount of chalk applied in t/ha.

| Plot | a    | b    | c    |
|------|------|------|------|
| 1    | 1.5  | 0.75 | 0.75 |
| 2/1  | 0.75 | 0.75 | 0.3  |
| 2/2  | 0    | 0.3  | 0    |
| 3    | 0.5  | 0    | 0    |
| 4/1  | 1.5  | 0.3  | 0    |
| 4/2  | 4.0  | 1.0  | 1.0  |
| 6    | 3.0  | 2.0  | 0    |
| 7    | 2.0  | 1.5  | 0.3  |
| 8    | 2.0  | 0.5  | 0    |
| 9/1  | 3.0  | 0.75 | 0    |
| 9/2  | 3.0  | 3.0  | 1.0  |
| 10   | 3.0  | 0    | 0.5  |
| 11/1 | 5.0  | 1.0  | 1.5  |
| 11/2 | 4.0  | 1.0  | 1.5  |
| 12   | 1.5  | 0.75 | 0    |

|      |     |      |     |
|------|-----|------|-----|
| 13/1 | 1.5 | 0.75 | 0.3 |
| 13/2 | 2.0 | 0.3  | 0   |
| 14/1 | 2.0 | 1.5  | 0   |
| 14/2 | 2.0 | 0    | 0   |
| 15   | 3.0 | 1.5  | 0.3 |
| 16   | 3.0 | 0    | 0   |
| 17   | 1.5 | 0    | 0   |
| 18   | 4.0 | 1.0  | 1.0 |

21-Nov-05 : T : : Chalk applied  
 22-Nov-05 : T : : P applied.  
 29-Nov-05 : T : : K, Si, Na, Mg applied.  
 07-Feb-06 : B : : Rolled.  
 12-Apr-06 : T : : N applied (except to plots 14/2, 16 and 17).  
 13-Apr-06 : T : : Remaining N applied.  
 26-Apr-06 : : : Cut paths.  
 23-May-06 : : : Cut paths.  
 12-Jun-06 : T : : Cut sample areas for yield, sampled and weighed,  
 and carted cut grass.  
 13-Jun-06 : T : : Finished cutting sample areas for yield, sampled  
 and weighed. Cut discards.  
 14-Jun-06 : B : : Turned hay.  
 15-Jun-06 : B : : Turned hay.  
 16-Jun-06 : B : : Turned hay.  
 17-Jun-06 : B : : Turned hay, rowed up and baled hay.  
 04-Sep-06 : B : : Cut paths.  
 07-Nov-06 : B : : Cut paths.  
 13-Nov-06 : T : : Cut sample areas for yield, sampled and weighed.  
 14-Nov-06 : T : : Finished cutting sample areas for yield, sampled  
 and weighed, cut discards and rowed up  
 15-Nov-06 : B : : Rowed up and baled.

**NOTE:** Samples of herbage from both cuts weres taken for chemical analysis.  
 Unground samples of herbage from all plots from both cuts were  
 archived.

06/R/PG/5

1ST CUT (12-13/6/06) DRY MATTER TONNES/HECTARE

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

| Manure            | Lime | a    | b    | c    | d    | Mean |
|-------------------|------|------|------|------|------|------|
| N1 1              |      | 2.00 | 1.91 | 1.72 | 1.17 | 1.70 |
| K 2/1             |      | 1.73 | 2.29 | 1.08 | 1.18 | 1.57 |
| None (FYM) 2/2    |      | 2.37 | 2.36 | 1.15 | 1.28 | 1.79 |
| None 3            |      | 2.22 | 1.95 | 1.18 | 1.21 | 1.64 |
| P 4/1             |      | 2.37 | 2.35 | 1.82 | 1.71 | 2.06 |
| N2P 4/2           |      | 2.50 | 2.74 | 2.52 | 1.16 | 2.23 |
| N1PKNaMg 6        |      | 4.70 | 4.19 |      |      | 4.45 |
| PKNaMg 7          |      | 3.80 | 3.98 | 3.56 | 2.54 | 3.47 |
| PNaMg 8           |      | 2.15 | 2.00 | 2.28 | 2.14 | 2.14 |
| PKNaMg (N2) 9/1   |      | 3.59 | 3.19 | 3.94 | 1.74 | 3.12 |
| N2PKNaMg 9/2      |      | 4.85 | 4.36 | 4.43 | 3.00 | 4.16 |
| N2PNaMg 10        |      | 2.71 | 2.81 | 2.86 | 1.43 | 2.45 |
| N3PKNaMg 11/1     |      | 5.89 | 5.23 | 4.95 | 1.94 | 4.50 |
| N3PKNaMgSi 11/2   |      | 5.73 | 5.36 | 5.83 | 3.62 | 5.14 |
| None 12           |      | 1.37 | 1.77 | 1.32 | 1.32 | 1.45 |
| (FYM/F) 13/1      |      | 1.96 | 2.37 | 1.83 | 1.95 | 2.03 |
| FYM/PM 13/2       |      | 2.92 | 3.46 | 3.53 | 2.78 | 3.17 |
| PKNaMg (N2*) 14/1 |      | 3.01 | 3.61 | 3.26 | 2.65 | 3.14 |
| N2*PKNaMg 14/2    |      | 3.15 | 4.18 | 4.32 | 4.32 | 3.99 |
| PKNaMg (N2*) 15   |      | 3.67 | 4.03 | 3.12 | 2.25 | 3.27 |
| N1*PKNaMg 16      |      | 3.59 | 3.17 | 2.73 | 3.00 | 3.12 |
| N1* 17            |      | 2.64 | 2.59 | 2.73 | 2.45 | 2.60 |
| N2KNaMg 18        |      | 1.74 | 2.61 | 2.07 | 0.28 | 1.67 |
| N2KNaMg 18/2      |      |      |      |      |      | 2.17 |
| FYM 19/1          |      |      |      |      |      | 3.02 |
| FYM 19/2          |      |      |      |      |      | 3.47 |
| FYM 19/3          |      |      |      |      |      | 3.11 |
| FYM/N*PK 20/1     |      |      |      |      |      | 3.63 |
| FYM/N*PK 20/2     |      |      |      |      |      | 4.52 |
| FYM/N*PK 20/3     |      |      |      |      |      | 3.77 |

1ST CUT MEAN DM% 25.9

06/R/PG/5

2ND CUT (13-14/11/06) DRY MATTER TONNES/HECTARE

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

| Manure            | Lime | a    | b    | c    | d    | Mean |
|-------------------|------|------|------|------|------|------|
| N1 1              |      | 1.11 | 1.23 | 0.87 | 0.34 | 0.89 |
| K 2/1             |      | 0.84 | 0.82 | 0.38 | 0.50 | 0.64 |
| None (FYM) 2/2    |      | 0.91 | 0.95 | 0.62 | 0.72 | 0.80 |
| None 3            |      | 0.86 | 1.07 | 0.68 | 1.14 | 0.94 |
| P 4/1             |      | 1.14 | 1.17 | 1.36 | 1.29 | 1.24 |
| N2P 4/2           |      | 1.16 | 1.32 | 0.94 | 0.94 | 1.09 |
| N1PKNaMg 6        |      | 1.48 | 1.56 |      |      | 1.52 |
| PKNaMg 7          |      | 1.80 | 2.03 | 1.34 | 0.81 | 1.49 |
| PNaMg 8           |      | 0.98 | 1.24 | 1.31 | 1.56 | 1.27 |
| PKNaMg (N2) 9/1   |      | 1.82 | 1.57 | 0.96 | 0.39 | 1.18 |
| N2PKNaMg 9/2      |      | 1.44 | 1.49 | 1.35 | 2.00 | 1.57 |
| N2PNaMg 10        |      | 1.19 | 1.59 | 1.55 | 1.90 | 1.56 |
| N3PKNaMg 11/1     |      | 2.19 | 2.08 | 2.00 | 1.97 | 2.06 |
| N3PKNaMgSi 11/2   |      | 2.56 | 2.07 | 1.87 | 2.52 | 2.26 |
| None 12           |      | 0.93 | 0.78 | 0.69 | 0.79 | 0.80 |
| (FYM/F) 13/1      |      | 1.90 | 2.10 | 1.46 | 0.88 | 1.59 |
| FYM/PM 13/2       |      | 1.64 | 2.45 | 1.99 | 2.02 | 2.03 |
| PKNaMg (N2*) 14/1 |      | 1.53 | 1.79 | 1.73 | 2.24 | 1.82 |
| N2*PKNaMg 14/2    |      | 1.53 | 1.88 | 1.85 | 2.08 | 1.83 |
| PKNaMg (N2*) 15   |      | 1.72 | 1.91 | 0.93 | 0.76 | 1.33 |
| N1*PKNaMg 16      |      | 3.02 | 1.63 | 1.41 | 1.10 | 1.79 |
| N1* 17            |      | 1.68 | 1.44 | 1.34 | 1.28 | 1.44 |
| N2KNaMg 18        |      | 1.08 | 1.01 | 0.72 | 0.17 | 0.74 |
| N2KNaMg 18/2      |      |      |      |      |      | 1.09 |
| FYM 19/1          |      |      |      |      |      | 1.65 |
| FYM 19/2          |      |      |      |      |      | 2.02 |
| FYM 19/3          |      |      |      |      |      | 1.84 |
| FYM/N*PK 20/1     |      |      |      |      |      | 1.80 |
| FYM/N*PK 20/2     |      |      |      |      |      | 2.02 |
| FYM/N*PK 20/3     |      |      |      |      |      | 1.80 |

2ND CUT MEAN DM% 26.9

06/R/PG/5

**TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE**

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

| Manure       | Lime | a    | b    | c    | d    | Mean |
|--------------|------|------|------|------|------|------|
| N1           | 1    | 3.11 | 3.14 | 2.60 | 1.51 | 2.59 |
| K            | 2/1  | 2.57 | 3.12 | 1.46 | 1.68 | 2.21 |
| None (FYM)   | 2/2  | 3.29 | 3.30 | 1.77 | 2.00 | 2.59 |
| None         | 3    | 3.07 | 3.02 | 1.86 | 2.35 | 2.57 |
| P            | 4/1  | 3.51 | 3.52 | 3.19 | 3.00 | 3.30 |
| N2P          | 4/2  | 3.66 | 4.06 | 3.46 | 2.10 | 3.32 |
| N1PKNaMg     | 6    | 6.18 | 5.75 |      |      | 5.96 |
| PKNaMg       | 7    | 5.60 | 6.01 | 4.90 | 3.35 | 4.96 |
| PNaMg        | 8    | 3.13 | 3.24 | 3.59 | 3.70 | 3.41 |
| PKNaMg (N2)  | 9/1  | 5.40 | 4.76 | 4.90 | 2.14 | 4.30 |
| N2PKNaMg     | 9/2  | 6.29 | 5.85 | 5.79 | 5.00 | 5.73 |
| N2PNaMg      | 10   | 3.89 | 4.40 | 4.41 | 3.33 | 4.01 |
| N3PKNaMg     | 11/1 | 8.08 | 7.31 | 6.94 | 3.91 | 6.56 |
| N3PKNaMgSi   | 11/2 | 8.29 | 7.43 | 7.70 | 6.14 | 7.39 |
| None         | 12   | 2.30 | 2.55 | 2.02 | 2.11 | 2.24 |
| (FYM/F)      | 13/1 | 3.86 | 4.47 | 3.29 | 2.84 | 3.61 |
| FYM/PM       | 13/2 | 4.57 | 5.91 | 5.52 | 4.80 | 5.20 |
| PKNaMg (N2*) | 14/1 | 4.55 | 5.40 | 4.99 | 4.89 | 4.96 |
| N2*PKNaMg    | 14/2 | 4.67 | 6.06 | 6.17 | 6.40 | 5.83 |
| PKNaMg (N2*) | 15   | 5.39 | 5.93 | 4.05 | 3.02 | 4.60 |
| N1*PKNaMg    | 16   | 6.61 | 4.80 | 4.13 | 4.10 | 4.91 |
| N1*          | 17   | 4.32 | 4.02 | 4.07 | 3.73 | 4.04 |
| N2KNaMg      | 18   | 2.81 | 3.62 | 2.79 | 0.45 | 2.42 |
| N2KNaMg      | 18/2 |      |      |      |      | 3.26 |
| FYM          | 19/1 |      |      |      |      | 4.67 |
| FYM          | 19/2 |      |      |      |      | 5.49 |
| FYM          | 19/3 |      |      |      |      | 4.95 |
| FYM/N*PK     | 20/1 |      |      |      |      | 5.44 |
| FYM/N*PK     | 20/2 |      |      |      |      | 6.54 |
| FYM/N*PK     | 20/3 |      |      |      |      | 5.56 |

TOTAL OF 2 CUTS MEAN DM% 26.4