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# Yields of the Field Experiments 2009

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# R/PG/5 Park Grass

## Rothamsted Research

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**09/R/PG/5**

**PARK GRASS**

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

The 154th year, hay.

For previous years see 'Details' 1977 and 1973 and Yield Books for 74-08/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 |



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**09/R/PG/5**

1. Manure, fertilisers and organic manures (cont'd)

| | |
|---|---|
| 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 2007; the sixth 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 97-01/R/PG/5 Yield book entries.]



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**09/R/PG/5**

**Experimental diary**

| | | | Rate | Unit |
|---|---|---|---|---|
| 02-Dec-08 | f | Triple Superphosphate - Plots 4/1, 4/2, 6, 7, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15 and 16 | 171.00 | kg/ha |
| 08-Dec-08 | f | Sulphate of Potash - Plots 2/1 ,6, 7, 9/1, 9/2, 11/1, 11/2, 14/1, 14/2, 15, 16 and 18, completed 09-Dec-08 | 542.00 | kg/ha |
| | f | Sodium Sulphate - plots 6, 7, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16 and 18, completed 09-Dec-08 | 43.00 | kg/ha |
| | f | Manganese Sulphate - plots 6, 7, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16 and 18, completed 09/12/08 | 111.00 | kg/ha |
| | f | Silicate of Soda- plot 11-2, completed 09-Dec-08 | 450.00 | kg/ha |
| 11-Dec-08 | f | Chalk - plot 13/2a | 2.00 | t/ha |
| | f | Chalk - plot 13/2b | 0.50 | t/ha |
| | f | Farm Yard Manure - plots 13/2, 19 and 20 | 35.00 | t/ha |
| | a | Mow paths | | |
| 14-Jan-09 | f | Chalk plots - 13/1a, 12a, 11/1c, 9/2b, 9/2c and 9/1a | 2.00 | t/ha |
| | f | Chalk plots - 13/1b, 12b, 9/1c, 7b, 4/2b and 4/2c | 1.00 | t/ha |
| | f | Chalk plots - 13/1c, 12c and 8c | 0.30 | t/ha |
| | f | Chalk plots - 11/2b, 11/2c, 11/1b and 10b | 1.50 | t/ha |
| | f | Chalk plots - 11/2a, 9/2a, 8a, 7a and 6b | 3.00 | t/ha |
| | f | Chalk - plot 11/1a | 5.00 | t/ha |
| | f | Chalk - plots 10a, 6a and 4/2a | 4.00 | t/ha |
| | f | Chalk - plot 9/1b | 0.75 | t/ha |
| | f | Chalk - plots 8b and 7c | 0.50 | t/ha |
| 20-Jan-09 | f | Chalk - plots 2/2c, 4/1b, 15c and 18c | 0.30 | t/ha |
| | f | Chalk - plots 1b and 1c | 0.75 | t/ha |
| | f | Chalk - plots 2/1c, 2/2b, 3a, 3b and 3c, | 0.50 | t/ha |
| | f | Chalk - plots 2/1a, 2/1b and 15b | 1.00 | t/ha |
| | f | Chalk - plots 1a and 18/b | 1.50 | t/ha |
| | f | Chalk - plots 4/1a, 14/1a, 14/2a and 17a | 2.00 | t/ha |
| | f | Chalk - plots 15a and 16a | 3.00 | t/ha |
| | f | Chalk - plot 18a | 4.00 | t/ha |
| 29-Apr-09 | f | Ammonium Sulphate Plots 1, 6a and b) | 229.00 | kg/ha |
| | f | Ammonium Sulphate Plots 4/2, 9/2, 10 18 | 457.00 | kg/ha |
| | f | Ammonium Sulphate Plots 11/1, 11/2 | 686.00 | kg/ha |
| 30-Apr-09 | f | Nitrate of Soda - Plots 16, 17 | 300.00 | kg/ha |
| | f | Nitrate of Soda - Plot 14/2 | 600.00 | kg/ha |
| 19-May-09 | a | Cut paths | | |
| 15-Jun-09 | a | Mow paths | | |
| 17-Jun-09 | a | Cut harvest strips, weighed and sampled | | |
| 18-Jun-09 | a | Cut harvest strips, weighed and sampled | | |
| | a | Mown discards | | |
| 19-Jun-09 | a | Turned hay | | |
| 21-Jun-09 | a | Turned hay | | |



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**09/R/PG/5**

| | | |
|---|---|---|
| 22-Jun-09 | a | Turned hay |
| | a | Row up, baled and removed |
| 09-Jul-09 | a | Mow 1m path along fence |
| 28-Jul-09 | a | Put wooden marker posts in place - - |
| | a | Mow paths |
| 09-Nov-09 | a | Cut harvest strips, weighed and sampled - Started |
| 10-Nov-09 | a | Cut harvest strips, weighed and sampled - Finished |
| 11-Nov-09 | a | Mown, baled and bales removed |
| 23-Dec-09 | a | Fixed outer fence |

**1ST CUT (17-18/6/09) DRY MATTER TONNES/HECTARE**

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

Grand mean 3.24

| Lime | | a | b | c | d | Mean |
|---|---|---|---|---|---|---|
| Manure | | | | | | |
| N1 | 1 | 2.36 | 1.41 | 0.90 | 0.66 | 1.33 |
| K | 2/1 | 1.80 | 2.98 | 0.79 | 0.56 | 1.53 |
| None(FYM) | 2/2 | 2.31 | 2.07 | 0.89 | 0.95 | 1.56 |
| None | 3 | 2.29 | 2.33 | 0.82 | 0.88 | 1.58 |
| P | 4/1 | 3.02 | 3.19 | 1.65 | 1.64 | 2.38 |
| N2P | 4/2 | 1.84 | 2.11 | 2.05 | 1.42 | 1.86 |
| N1PKNaMg | 6 | 5.04 | 5.48 | | | 5.26 |
| PKNaMg | 7 | 5.27 | 5.73 | 5.13 | 3.18 | 4.83 |
| PNaMg | 8 | 2.53 | 2.51 | 2.25 | 2.12 | 2.35 |
| PKNaMg(N2) | 9/1 | 5.28 | 5.54 | 4.65 | 1.34 | 4.20 |
| N2PKNaMg | 9/2 | 5.37 | 5.49 | 4.20 | 3.26 | 4.58 |
| N2PNaMg | 10 | 2.49 | 2.65 | 3.58 | 1.65 | 2.59 |
| N3PKNaMg | 11/1 | 5.44 | 5.18 | 5.05 | 3.52 | 4.80 |
| N3PKNaMgSi | 11/2 | 4.75 | 5.17 | 4.79 | 3.34 | 4.51 |
| None | 12 | 1.97 | 2.03 | 0.85 | 1.14 | 1.50 |
| (FYM/F) | 13/1 | 3.10 | 3.29 | 2.25 | 2.13 | 2.69 |
| FYM/PM | 13/2 | 3.71 | 4.66 | 3.85 | 3.24 | 3.86 |
| PKNaMg(N2*) | 14/1 | 4.53 | 5.06 | 4.26 | 4.22 | 4.52 |
| N2*PKNaMg | 14/2 | 4.62 | 4.64 | 4.14 | 3.85 | 4.31 |
| PKNaMg(N2*) | 15 | 4.96 | 5.40 | 4.52 | 2.21 | 4.27 |
| N1*PKNaMg | 16 | 5.26 | 5.69 | 3.77 | 3.39 | 4.53 |
| N1* | 17 | 2.03 | 2.01 | 1.71 | 1.92 | 1.92 |
| N2KNaMg | 18 | 2.04 | 2.81 | 2.53 | 1.57 | 2.24 |
| N2KNaMg | 18/2 | | | | | 2.96 |
| FYM | 19/1 | | | | | 4.21 |
| FYM | 19/2 | | | | | 5.47 |
| FYM | 19/3 | | | | | 5.27 |
| FYM/N*PK | 20/1 | | | | | 4.77 |
| FYM/N*PK | 20/2 | | | | | 5.00 |
| FYM/N*PK | 20/3 | | | | | 5.55 |

1ST CUT MEAN DM% 28.1



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**09/R/PG/5**

## 2ND CUT (09 – 10/11/08) DRY MATTER TONNES/HECTARE

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

Grand mean 1.13

| Lime | | a | b | c | d | Mean |
|---|---|---|---|---|---|---|
| Manure | | | | | | |
| N1 | 1 | 0.95 | 0.84 | 0.52 | 0.20 | 0.63 |
| K | 2/1 | 0.57 | 0.64 | 0.35 | 0.30 | 0.47 |
| None(FYM) | 2/2 | 0.61 | 0.58 | 0.42 | 0.39 | 0.50 |
| None | 3 | 0.64 | 0.77 | 0.39 | 0.44 | 0.56 |
| P | 4/1 | 0.97 | 0.72 | 0.54 | 0.48 | 0.68 |
| N2P | 4/2 | 0.86 | 0.98 | 0.76 | 0.72 | 0.83 |
| N1PKNaMg | 6 | 1.31 | 1.60 | | | 1.45 |
| PKNaMg | 7 | 1.44 | 1.83 | 1.50 | 0.96 | 1.44 |
| PNaMg | 8 | 1.19 | 1.09 | 0.80 | 0.77 | 0.96 |
| PKNaMg(N2) | 9/1 | 1.78 | 1.80 | 1.41 | 0.39 | 1.34 |
| N2PKNaMg | 9/2 | 1.47 | 1.49 | 1.06 | 1.81 | 1.46 |
| N2PNaMg | 10 | 0.94 | 0.92 | 1.00 | 1.20 | 1.01 |
| N3PKNaMg | 11/1 | 1.13 | 1.18 | 0.84 | 2.20 | 1.34 |
| N3PKNaMgSi | 11/2 | 1.42 | 1.33 | 1.02 | 1.89 | 1.42 |
| None | 12 | 1.04 | 0.85 | 0.54 | 0.57 | 0.75 |
| (FYM/F) | 13/1 | 2.42 | 1.91 | 1.57 | 0.76 | 1.67 |
| FYM/PM | 13/2 | 2.81 | 3.07 | 2.21 | 1.74 | 2.46 |
| PKNaMg(N2*) | 14/1 | 1.51 | 1.58 | 1.15 | 1.03 | 1.32 |
| N2*PKNaMg | 14/2 | 1.39 | 1.45 | 1.23 | 1.21 | 1.32 |
| PKNaMg(N2*) | 15 | 1.36 | 1.55 | 1.04 | 0.33 | 1.07 |
| N1*PKNaMg | 16 | 1.66 | 1.86 | 0.86 | 0.65 | 1.26 |
| N1* | 17 | 0.63 | 0.67 | 0.43 | 0.72 | 0.61 |
| N2KNaMg | 18 | 0.68 | 0.80 | 0.94 | 0.45 | 0.72 |
| N2KNaMg | 18/2 | | | | | 1.12 |
| FYM | 19/1 | | | | | 1.74 |
| FYM | 19/2 | | | | | 2.04 |
| FYM | 19/3 | | | | | 1.91 |
| FYM/N*PK | 20/1 | | | | | 1.65 |
| FYM/N*PK | 20/2 | | | | | 1.83 |
| FYM/N*PK | 20/3 | | | | | 1.78 |

2ND CUT MEAN DM% 28.52



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**09/R/PG/5**

## TOTAL OF 2 CUTS DRY MATTER TONNES/HECTARE

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

Grand mean 4.37

| Lime Manure | | a | b | c | d | Mean |
|---|---|---|---|---|---|---|
| N1 | 1 | 3.30 | 2.25 | 1.42 | 0.86 | 1.96 |
| K | 2/1 | 2.37 | 3.62 | 1.14 | 0.86 | 2.00 |
| None(FYM) | 2/2 | 2.92 | 2.65 | 1.31 | 1.34 | 2.05 |
| None | 3 | 2.93 | 3.10 | 1.21 | 1.32 | 2.14 |
| P | 4/1 | 4.00 | 3.92 | 2.19 | 2.12 | 3.06 |
| N2P | 4/2 | 2.70 | 3.09 | 2.82 | 2.15 | 2.69 |
| N1PKNaMg | 6 | 6.35 | 7.07 | | | 6.71 |
| PKNaMg | 7 | 6.71 | 7.56 | 6.64 | 4.15 | 6.26 |
| PNaMg | 8 | 3.72 | 3.59 | 3.06 | 2.89 | 3.31 |
| PKNaMg(N2) | 9/1 | 7.06 | 7.34 | 6.05 | 1.73 | 5.54 |
| N2PKNaMg | 9/2 | 6.84 | 6.99 | 5.26 | 5.07 | 6.04 |
| N2PNaMg | 10 | 3.42 | 3.57 | 4.58 | 2.85 | 3.60 |
| N3PKNaMg | 11/1 | 6.57 | 6.36 | 5.88 | 5.72 | 6.13 |
| N3PKNaMgSi | 11/2 | 6.17 | 6.50 | 5.82 | 5.24 | 5.93 |
| None | 12 | 3.01 | 2.88 | 1.39 | 1.70 | 2.25 |
| (FYM/F) | 13/1 | 5.53 | 5.20 | 3.82 | 2.89 | 4.36 |
| FYM/PM | 13/2 | 6.52 | 7.73 | 6.05 | 4.98 | 6.32 |
| PKNaMg(N2*) | 14/1 | 6.05 | 6.64 | 5.41 | 5.24 | 5.83 |
| N2*PKNaMg | 14/2 | 6.01 | 6.09 | 5.37 | 5.05 | 5.63 |
| PKNaMg(N2*) | 15 | 6.32 | 6.96 | 5.56 | 2.55 | 5.35 |
| N1*PKNaMg | 16 | 6.92 | 7.55 | 4.63 | 4.04 | 5.78 |
| N1* | 17 | 2.66 | 2.68 | 2.14 | 2.65 | 2.53 |
| N2KNaMg | 18 | 2.72 | 3.61 | 3.47 | 2.02 | 2.95 |
| N2KNaMg | 18/2 | | | | | 4.08 |
| FYM | 19/1 | | | | | 5.96 |
| FYM | 19/2 | | | | | 7.50 |
| FYM | 19/3 | | | | | 7.18 |
| FYM/N*PK | 20/1 | | | | | 6.43 |
| FYM/N*PK | 20/2 | | | | | 6.83 |
| FYM/N*PK | 20/3 | | | | | 7.33 |

TOTAL OF 2 CUTS MEAN DM% 28.31



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