A celebration of 150 years of the

Park Grass Experiment

150 years

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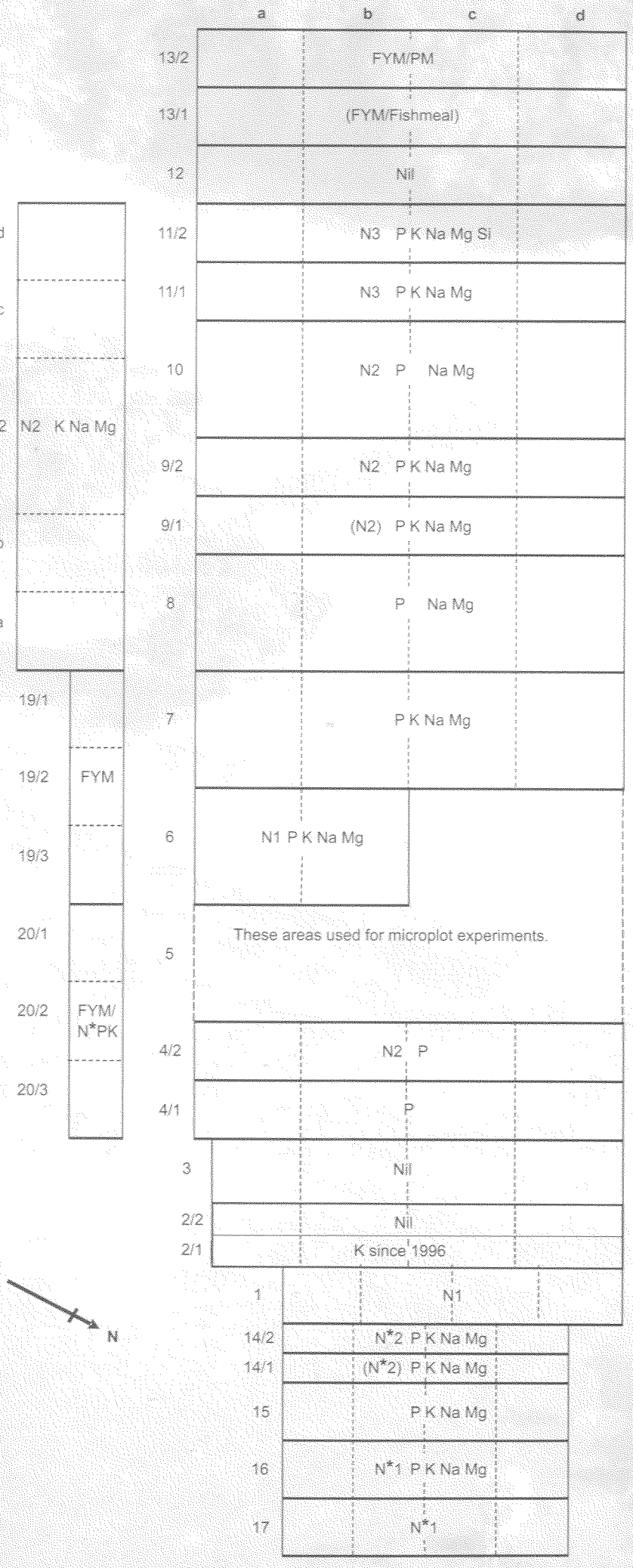
ROTHAMSTED RESEARCH



Plot layout and current treatments

Plot treatments
(per hectare per year unless indicated)

Nitrogen (applied in spring)

N1, N2, N3: ammonium sulphate supplying 48, 96, 144 kg N and 55, 110, 165 kg S

N*1, N*2: sodium nitrate supplying 48, 96 kg N and 78, 157 kg Na

(N2), (N*2): last applied 1989

Minerals (applied in winter)

P: triple superphosphate supplying 35 kg P

K: potassium sulphate supplying 225 kg K and 99 kg S

Na: sodium sulphate supplying 15 kg Na and 10 kg S

Mg: magnesium sulphate (Epsom salts) supplying 10 kg Mg and 13 kg S

Si: water soluble sodium silicate supplying 135 kg Si and 63 kg Na

Plot 20: rates of fertilizer in years when FYM is not applied; 30 kg N*, 15 kg P, 45 kg K

Organics (applied every 4th year)

FYM: 35 t farmyard manure supplying c. 240 kg N, 45 kg P, 350 kg K, 25 kg Na, 25 kg Mg, 40 kg S, 135 kg Ca

PM: Pelleted poultry manure (replaced fishmeal in 2003) supplying c. 65 kg N

On plot 13/2 FYM and PM (previously fishmeal) are applied in a 4-year cycle *ie:*
FYM in 2005, 2001, 1997, 1993 *etc*
PM in 2003, fishmeal in 1999, 1995, 1991 *etc*

(FYM/Fishmeal): FYM and fishmeal last applied in 1993 and 1995 respectively.

Lime

Sub-plots a, b and c: differential amounts of chalk applied, *if needed,* every three years to maintain soil pH 7, 6 and 5, respectively

Sub-plot d receives no chalk

Plots 1-13 started in 1856, plots 14-17 in 1858, plot 18 in 1865 and plots 19 and 20 in 1872.

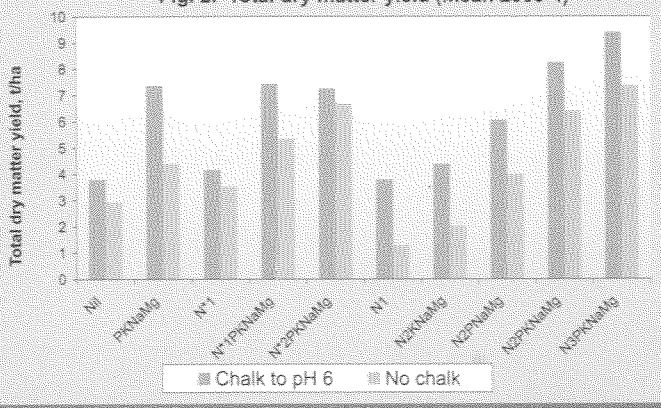
Sub-plots range in size from 75 - 634 m^2

Front cover: Aerial view of Park Grass taken 23rd May 2005

Yields

Yields of total dry matter (not hay) are shown in Fig. 2. Largest yields are on limed sub-plots given PKNaMg and 144 kg N ha^{-1}. Yields with 96 kg N ha^{-1} as either ammonium or nitrate (and PKNaMg) are similar; where P or K has been withheld yields are reduced. Similarly, yields on plots given N only are no better than the Nil plots because lack of P and K limits yield. Interestingly, on soils receiving PKNaMg but no N fertiliser yields are as good as those on plots receiving PKNaMg plus 96 kg N ha^{-1} because of the large proportion of legumes in the sward (see main table). However, where no lime is applied soil pH is about 4.9 and legumes are less common; consequently yields are less. On all treatments, yields on unlimed sub-plots are less than those on soils maintained at pH 6, or above. However, even on the acid soils (pH 3.6 - 3.7) dominated by one or two species, yields are c.7 t ha^{-1}.

Fig. 2. Total dry matter yield (mean 2000-4)



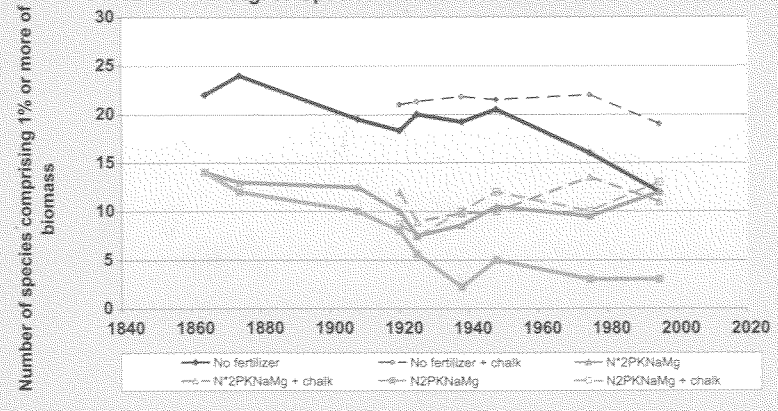
Archiving Samples

Soil samples (most 0-23cm, some deeper) have been taken periodically from the experiment, infrequently at first, more regularly in the last 40 years as we have sought to control soil pH more closely. The soils, together with unground samples of herbage from each plot every year, have been archived Such action was incredibly far-sighted and has allowed us to retrospectively analyse samples for many factors which could not have been anticipated 150 years ago. Such analyses have included ^{14}C, ^{34}S, cadmium and other heavy metals, dioxins, PAH's and DNA. Recent analysis of archived herbage for plutonium and uranium provided the first evidence that fallout from atmospheric bomb tests carried out in the Nevada Desert in 1952/3 reached northwest Europe. (Warneke *et al*, 2002, *EPSL* **203,** 1047-1057)

Botanical composition

The table overleaf shows soil pH and those species comprising 10% or more of the above ground biomass together with the total number of species identified on each sub-plot (mean 1991-2000 data). There are many interactions, some clear, some not, between fertilizer and manure treatments and pH. Figure 3 shows the impact of selected treatments on the number of species comprising 1% or more of the biomass. Numbers of species have decreased, even on the Nil plots, through acid deposition. Applying N as sodium nitrate or ammonium sulphate reduces diversity further, and in the ammonium form also rapidly acidifies the soil, reducing the number of species to one or two, *Holcus lanatus* (Yorkshire Fog) and *Anthoxanthum odoratum* (Sweet Vernal Grass). Lime aids recovery from acidity. Withholding N also causes more species to return (not shown).

Fig. 3. Species number over time



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