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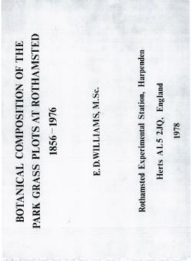
Botanical Composition of the Park Grass Plots at Rothamsted 1856-1976


BOTANICAL COMPOSITION OF THE
PARK GRASS PLOTS AT ROTHAMSTED
1856 1976

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Full Table of Content

Method of Sampling and Plots and Sub-plots Sampled During 1973-76

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give a measure of change during quarter of a century on the parts of the ammonium sulphate plots which had received unchanged treatment.

(4) To obtain a measure of seasonal variation the unlimed and limed half-plots of three of the plots sampled in 1975 were again sampled in 1976 together with two sub-plots sampled in 1974 and one sampled in 1973. It must be stressed, however, that the weather conditions preceding the 1975 and 1976 hay harvests differed greatly. The 1975 harvest followed an extremely wet period from autumn 1974 until May 1975 but the 1976 harvest was preceded by very dry weather from the summer of 1975 onwards. It is also likely that the sub-plots sampled in 1973 and 1974 would still be in a state of change induced by the new liming scheme when sampled in 1976.

Comparisons of the effects of the treatments on the botanical composition of the plots at particular dates have, as noted earlier, been made frequently in the past. These elucidated certain general principles but conclusions from many of the detailed comparisons of the percentage composition of the species may inevitably apply only to the specific conditions (e.g. nutrient status, pH) prevailing at a particular time and need not necessarily apply throughout the course of the experiment. Moreover, for many minor components it is not always possible to separate treatment effects, seasonal effects and sampling error. Too much emphasis cannot therefore be placed on comparisons of minor components in particular years nor indeed on the exact magnitude of difference of more abundant species. Comparisons over a number of years should give a better measure of differences due to treatment when effects due to season and sampling error are minimised. Since the major ecological 'truths' have been well established it is now equally important and interesting to ascertain the successional changes that are occurring on the plots. Less attention has been given to this, partly because of the difficulty of assembling the vast amount of accumulated data which extends over 120 years. During the present investigations, however, it became clear that a realistic interpretation of the present-day flora should take account of past changes and to this end all previous data have been put together. (See Tables 7 - 45.) Greater detail is of course available in the original publications; for reasons given earlier it is, however, doubtful whether these tell us much more about the herbage, except on the total number of species on a plot.

METHOD OF SAMPLING AND PLOTS AND SUB-PLOTS SAMPLED DURING 1973-76

Since 1960 tedding the herbage immediately after cutting has left it too fragmented to use for botanical analysis so the method of sampling used in the past could not be adopted. In 1973 and 1974 samples were cut by hand every 2-3 paces from the standing crop about 0.3m to each side of the forage harvester strips (which are cut before the rest of the crop to estimate yield), and also to each side of the centre strip cut for access for studies of the soil and surface fauna by the Entomology department in those years. Four strips are forage harvested on the larger and two on the smaller plots and this enabled sampling to be done along ten transects on the larger and along six on the smaller plots. No centre access strips were cut during 1975 and 1976 so that sampling was done along either eight or four transects. However, the fewer transects in those years, compared with 1973 and 1974, were partly offset by twice the area being sampled as half-plots were sampled in 1975 and 1976 but quarter-plots in 1973 and 1974. Samples were air-dried in a shaded glasshouse and then packed in polythene sheets in the laboratory and analysed during the winter. Approximately 600 g of hay was

3L

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analysed from each sub- or half-plot.

The plots sampled in the four years were as follows:-

(1) 1973 – sub-plots *c* and *d* of plots 1 (N_1), 4^2 (N_2P), 9 ($N_2PKNaMg$), 10 (N_2PNaMg), 11^1 ($N_3PKNaMg$), 11^2 ($N_3PKNaMgSi$) and 18 (N_2KNaMg), i.e plots receiving N as ammonium sulphate.

(2) 1974 – sub-plots *a* and *b* of plots 4^2, 9, 10, 11^1 and 11^2 and also sub-plots 13*c* and 13*d* (FYM and fish meal).

(3) 1975 – unlimed (U) and limed (L) half-plots of plots 3 (unmanured), 7 (PKNaMg), 8 (PNaMG), 14 ($N_2^*PKNaMg$), 16 ($N_1^*PKNaMg$) and 17 (N_1^*).

(4) 1976 – unlimed (U) and limed (L) half-plots of 3, 7, 14 and sub-plots *a, b* and *c* of plot 9.

The dates of sampling in 1973, 1974, 1975 and 1976 were respectively 12, 20, 9 and 9 June.

As in 1948 and 1949 about 1-2% of the samples consisted of small detached fragments which were not sorted into species. Although it would have been technically possible to do so it would have taken too much time. To maintain continuity with past records the contribution of each species was expressed as a percentage of the total hay (air dry) weight of the sample. However, yields since 1960 have been based on dry weight before hay-making and it is possible that the contribution to dry weight may differ slightly from that to hay weight. Since yields of many plots differ greatly the % figures have nevertheless been used to calculate the weights of the different species per unit area to provide a measure of quantitative as well as qualitative difference between plots (see Tables 39, 41, 43 and 45).

The two main aims of this paper – to present recent data on the botanical composition of some of the main plots and at the same time to trace the major changes that have occurred on them with time and to report on the effects of the new liming scheme – are considered separately.

RESULTS

1. CHANGES WITH TIME

A. PLOTS NOT RECEIVING NITROGEN

1. **Unmanured plots** [3, 12 (since 1856) and 2 (since 1863)]

Although most treatments are neither randomised nor replicated two plots, 3 and 12, at different ends of the field have received no fertiliser from the start. However, Lawes, Gilbert & Masters (1882) considered plot 3 to be the true 'control' plot since they deduced that soil had in the past been brought in to plot 12 to level this part of the field. The soil of plot 12 has differed in chemical composition from plot 3 and yielded more hay for most of the duration of the experiment (Warren & Johnston, 1964). Plot 2 has received no manure since 1863 and so can now also be considered an unmanured plot.

The botanical composition of Plot 3 in 1858 (Lawes & Gilbert, 1859), is a reasonable indication of the flora of the whole field at the start of the experiment. About twenty species of higher plants were identified on the plot in 1858 but during 1862 about fifty species were found "a result no doubt due to the much greater amount of attention and labour bestowed upon the more recent separations" (Lawes & Gilbert, 1863). During 1877-1903 a decline in the number of species then occurred and between 1910 and 1948 the number of species identified averaged about 37. Thirty species were found in 1975 and 35 in the 1976 samples, but since the range of variation for

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