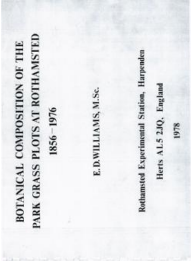
This work is licensed under a Creative Commons Attribution 4.0 International License.

Thank you for using eradoc, a platform to publish electronic copies of the Rothamsted Documents. Your requested document has been scanned from original documents. If you find this document is not readible, or you suspect there are some problems, please let us know and we will correct that.

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


BOTANICAL COMPOSITION OF THE
PARK GRASS PLOTS AT ROTHAMSTED
1856 1976

E.D.WILLIAMS, M.Sc.

Rothamsted Experimental Station, Harpenden
Herts AL5 2JQ, England
1978

Full Table of Content

Introduction

Rothamsted Research

Rothamsted Research (1978) *Introduction ;* Botanical Composition Of The Park Grass Plots At Rothamsted 1856-1976, pp 1L - 1R **- DOI: https://doi.org/10.23637/ERADOC-1-156**

This work is licensed under a Creative Commons Attribution 4.0 International License.

INTRODUCTION

The Park Grass experiment was laid down by Lawes and Gilbert in 1856 to ascertain what were the optimum amounts and combinations of inorganic and organic fertilisers needed to obtain maximum yields of hay. When the experiment started "the Park had already been under grass for certainly more than a century" (Lawes & Gilbert, 1859). There is no record of any seeds having been sown, so the species present at the outset represented indigenous species and strains of plants. Prior to 1851 the land was manured with farm-yard dung, road scrapings and the like, and sometimes with guano or other purchased manure. One crop of hay (3-5 t ha^{-1}) was removed annually, and the second crop was always eaten off by sheep. In 1851 and 1852 sheep were fed with turnips on part of the field but during 1853-55 it received no manure.

The experiment was in effect an extension of the work previously started with arable crops on other fields; the lay-out resembled that on the Broadbalk winter wheat experiment where the fertiliser treatments were applied in strips running throughout the field. Although treatments on some plots were changed during the early years, a few plots were split to increase the number of treatments and some were added a little later than others, most plots have now received unchanged treatment for at least a century. Details of the amounts of fertilisers and individual plot treatments are given in Tables 1(a) and 1(b) respectively and a plan of the experiment (as in 1975) in Fig. 1

The treatments can be considered within four main groups: (1) no nitrogen; (2) nitrogen applied at three amounts as ammonium sulphate; (3) nitrogen applied at two amounts as sodium nitrate. Within the three groups there are comparisons of P and – with and without K Na Mg, applied as their sulphates, for some of the amounts of N. (4) Farmyard manure since 1905, either alone, alternating with fish meal, or with inorganic fertilisers.

Tentative applications of lime were made to different halves of the plots on two occasions, during 1883-84 and during 1887-88, but it was not until 1903 that a regular scheme of liming was introduced (Table 2). In 1920 more plots came into the liming scheme and another scheme was also introduced to test two laboratory methods for measuring the lime requirement of soils. In 1965 a new liming scheme (Warren, Johnston & Cooke, 1965) was introduced. In this scheme each half-plot is further divided into two, giving four sub-plots (*a, b, c* and *d*) for each fertiliser treatment and it is intended that eventually sub-plots of all plots should have soils with pHs of approximately 7.0, 6.0, 5.0 and 4.0 in water. A start was made during 1965-68 on the first phase of this scheme when lime was applied to previously unlimed sub-plots *c* in an attempt to increase their pH to 5 and also increased rates of lime were given to previously limed sub-plots *b* to increase their pH to 6. Only plots given ammonium sulphate were sufficiently acid then to require lime. In 1976 another phase of the same scheme, viz. the raising of the pH of sub-plots *a* to 7, where they are less than this, was begun. The amounts of lime so far given to those *b* and *c* sub-plots which have already come into the new scheme are given in Table 2 and the present pHs of all sub-plots in Table 3. The pHs on previous dates are given by Warren & Johnston (1964), Johnston (1972) and Thurston, Williams & Johnston (1976).

The management of the plots has remained fairly constant throughout; the plots have been cut for hay every year, usually in June, but occasionally in July. Before 1960 the yields of hay were recorded and dry matter yield often estimated on samples of hay. Since 1960 yield has been estimated from the weight of herbage taken in

1L

This work is licensed under a Creative Commons Attribution 4.0 International License.

sample strips by forage harvester and the dry matter content of sub-samples taken immediately after cutting. Thus, dry matter yields since 1960 cannot be directly compared with those before 1960. The remainder of the herbage on each plot is then made into hay. During fifteen of the first twenty years of the experiment the aftermath was grazed by sheep. Since 1887 all of the second cut has been carted, weighed and yield given as hay, or since 1960, as herbage dry matter. In addition to work on the botanical composition of the plots, chemical analyses of soil and herbage have also been made at intervals (e.g. Lawes & Gilbert, 1900; Warren & Johnston, 1964) and recently the soil and surface fauna have been surveyed (Edwards & Lofty, 1975; Edwards, Butler & Lofty, 1976).

The full Latin names of species whose generic names only are given in the text appear in Table 4. These are as in Clapham, Tutin & Warburg (1962). Also in Table 4 are the common names recommended by the Botanical Society of the British Isles (Dony, Perring & Rob, 1974).

HISTORY OF WORK ON BOTANICAL COMPOSITION OF THE PLOTS AND THE NEED FOR FURTHER ANALYSES

The experiment soon showed how yield could be increased by fertilisers. For example, even in 1856 yield was trebled by P and K and the largest amount of N. Differences in yield have persisted and become accentuated since although yields declined on most plots they did so more on some than on others.

The treatments also soon began to change the botanical composition of the swards. In their report of results during 1856-58 Lawes & Gilbert (1859) wrote: "Perhaps the most remarkable and interesting of the effects of the different descriptions of manure upon the complex herbage of which the experimental meadow was composed was the very varying degree in which they respectively developed the different kinds of plants. In fact, the plots had each so distinctive a character in regard to the prevalence of different plants that the experimental ground looked almost as much as if it were devoted to trials with different seeds as with different manures. So striking and characteristic indeed were the effects produced in this respect that in 1857 and 1858 the subject was considered to be of sufficient interest to induce us to request the examination of the plots by Professor Henfrey, to which he kindly assented".

Lawes & Gilbert noted that the 'character of the herbage' was fairly uniform throughout the field at the start of the experiment but that unfortunately little evidence was obtained on the changes that occurred during the first seven years (Lawes, Gilbert & Masters, 1882). There is, however, some information for the early years. During the second year (1857) samples of herbage were taken for botanical analyses from many of the plots but the results were not published. In 1858 samples of herbage were taken from seven plots, sub-sampled and using specimen plants to aid identification a number of boys were set to pick from the weighed sample all they could find to correspond with the types. This left a large 'undetermined residue of detached foliage and undeveloped stems' which was then separated into four or five different lots. The separations were supervised by Dr. E. Pugh of Pennsylvania. The percentage contribution to the air dry (or hay) weight of the different fractions were then calculated (Lawes & Gilbert, 1859). About 20 species of plants were identified in these analyses; the main grasses were *Lolium* and *Holcus*. Further details are given when the botanical composition of individual plots is discussed. In 1862 a complete botanical analysis was made of all plots and this was repeated at five-year intervals until 1877. By this time the

https://doi.org/10.23637/ERADOC-1-156