# THE PARK GRASS PLOTS

# AT ROTHAMSTED

# 1856-1949

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revised by

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Rothamsted Experimental

Station

Harpenden

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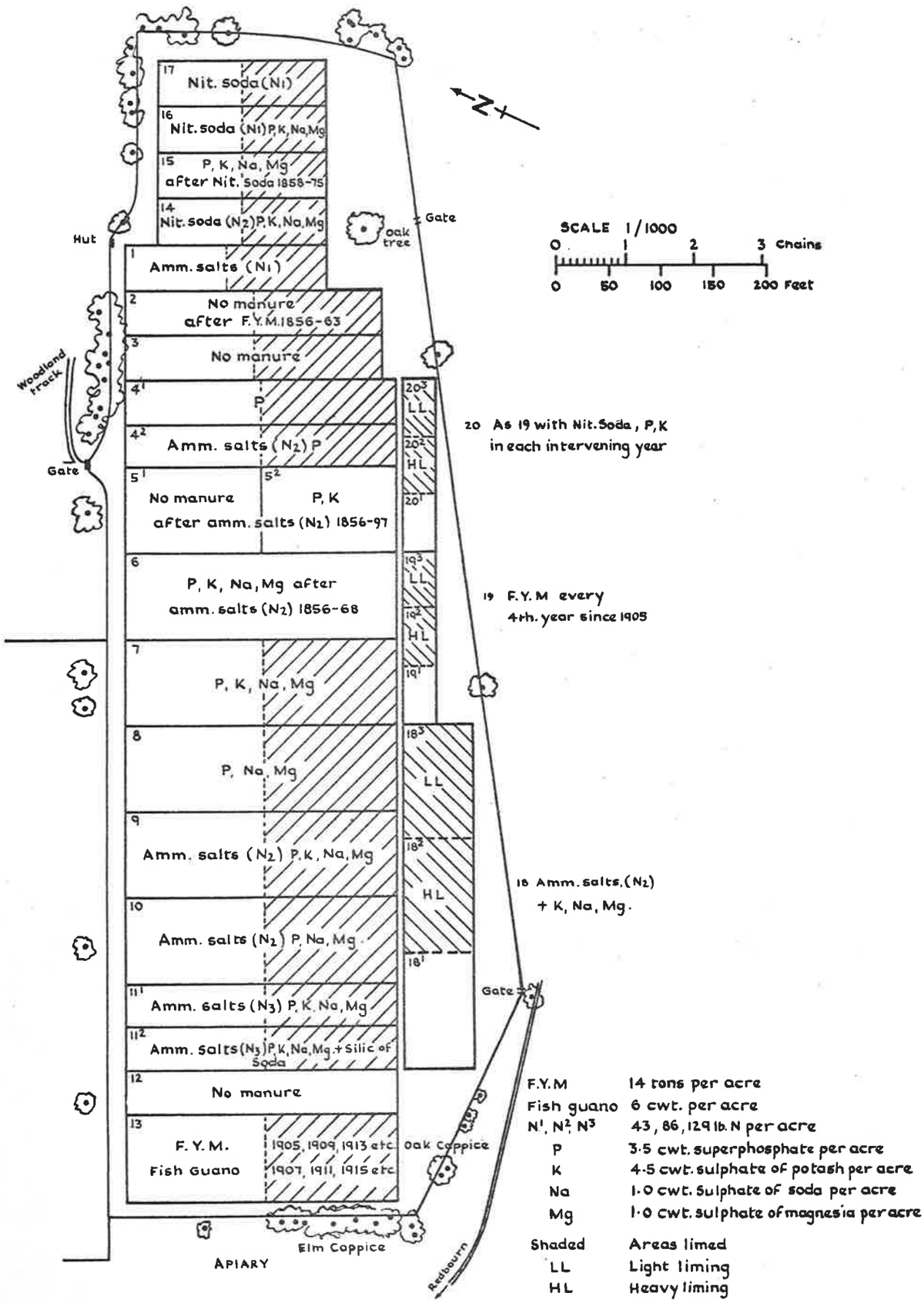
# Park Grass




| | |
|---|---|
| F.Y.M | 14 tons per acre |
| Fish guano | 6 cwt. per acre |
| $N^1$, $N^2$, $N^3$ | 43, 86, 129 lb. N per acre |
| P | 3·5 cwt. superphosphate per acre |
| K | 4·5 cwt. sulphate of potash per acre |
| Na | 1·0 cwt. sulphate of soda per acre |
| Mg | 1·0 cwt. sulphate of magnesia per acre |
| Shaded | Areas limed |
| LL | Light liming |
| HL | Heavy liming |

# FOREWORD

The Park Grass Plots at Rothamsted, laid down in 1856, afford a unique opportunity of studying the effects of long continued manuring with different types of fertiliser on the yield and botanical composition of hay.
The experiment was one of the late Dr. Winifred E. Brenchley's chief interests, and at the time of her death in 1953 she had nearly completed a revision of her monograph Manuring of Grassland for Hay (1924) which dealt with the results up to 1919, so as to include the data for the next thirty years. In the present version, apart from some condensation and a few minor additions, little alteration has been made in the original text. The name, however, has been changed, as a simpler title was thought preferable. The present publication supplies the most recent data available on the botanical composition of the plots, the regular hay analyses having been discontinued since 1949. Observations on the flora are, however, still being carried out and the yields from two cuts of hay recorded as before.

Mention must be made of the help of Miss Heather Pellant, who was largely responsible for the final botanical separations in 1948 and 1949, and who has given valuable assistance in the preparation of the tables.

K. WARINGTON
January 1958

The need for a reprint has afforded the opportunity to introduce some improvements in presentation. At the suggestion of Miss J. M. Thurston, a new table (1b) giving the yield for the limed plots and the pH values of all plots has been added, the Figures have been grouped together at the end of the text, and page-references included in the List of Contents. These, it is hoped, will facilitate the use of the data.

K. WARINGTON
June 1969

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# CHAPTER I

## INTRODUCTION

Manurial experiments on grassland have been carried on continuously at Rothamsted since 1856. About 7 acres of the Park, with a silt-loam soil overlying clay with flints were then divided into twenty plots* varying in area from $\frac{1}{2}$ to 1/8 acre. Two of these received farmyard manure, two were left unmanured, and the others received different combinations and amounts of inorganic fertilizers. In general, the same manurial treatments have been continued on each plot, but any changes that have been made are indicated in the appropriate section. A plan of the field showing the treatments is given on the front page. The area had been under grass for some centuries, and at the beginning of the experiment, therefore, the herbage was a natural one and quickly responded to the fertilizers used. After several years some of the plots began to show signs of lime deficiency, and in November 1883 fresh burnt lime at the rate of 2000 lb. per acre was applied to the west half of each plot. Four years later, in 1887, a similar dressing was given to the east halves except on plot 5, on which the second dressing was postponed till 1896. On plots $11^1$ and $11^2$, which showed much lime deficiency, a dressing of 4000 lb. per acre was put on the east halves in 1887, and also 2000 lb. on the west halves; the same amount of lime was applied to plot 5 in 1896. Thus ultimately every plot received a similar amount of lime over its whole area. In 1903 a fresh system of liming was introduced to demonstrate the effect of long continued lime starvation. 2000 lb. per acre of lime was then applied to the south half of most plots, the application being repeated once every four years, except in 1911 and 1919 when it was omitted. In 1920, 2500 lb. was given to compensate for the omission in 1919 and after this the application of 2000 lb. per acre was resumed once every four years. In the same year, a special scheme of liming was introduced on plots 18, 19 and 20, the details of which are given in the sections dealing with these plots. The hay from the limed and unlimed areas has always been harvested separately.

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* Three of these plots 4, 5 and 11 have since been subdivided.

Until 1872 the aftermath was usually fed off with sheep penned on to each area. On several plots the animals suffered, and as in addition their use introduced factors other than those associated with fertilizers, grazing was discontinued and the second crop was cut, made into hay whenever weather permitted, or else carted green and the equivalent quantity of hay calculated.

The results of the experiments for the first twenty years were exhaustively worked out by Lawes, Gilbert and Masters[1a, b, c] in their classical memoirs, and certain of these plots, still unlimed, were later dealt with by A.D. Hall [2].

Further detailed examinations of the flora were carried out in 1914 and 1919 by W.E. Brenchley and the results published as a monograph [3a]. Here the influence of the different fertilizers was traced from 1862 or earlier up to 1919, and that of additional lime from 1903. During the next thirty years (1920-1949), botanical analyses of the hay were continued on a number of selected plots, and the results are incorporated in the present volume as an extension of the 1924 monograph. The effect of lime has been specially dealt with elsewhere, [Brenchley 3[b,c,d] (1925, 1930, 1935)].

Since the start of the experiment, detailed visual records have been made on the herbage, and from 1920 at least two such field surveys have been carried out each year. These have been used as a source of additional information, but all numerical data are derived from the hay analyses only. For the sake of continuity, the original nomenclature, with the exception of Festuca ovina, (which has been more accurately termed F.rubra) has been retained. The equivalents in the new classification based on "Flora of the British Isles" Clapham, Tutin and Warburg (1952) are given below:-

NOMENCLATURE

| As used in this and earlier publications | Clapham,Tutin and Warburg 1952. |
|---|---|
| Gramineae | |
| Agrostis vulgaris | Agrostis tenuis |
| Aira caespitosa | Deschampsia caespitosa |
| Arrhenatherum avenaceum | Arrhenatherum elatius |
| Avena flavescens | Trisetum flavescens |
| Avena pubescens | Helictotrichon pubescens |

Leguminosae

| | |
|---|---|
| Ononis arvensis | Ononis repens |
| Trifolium minus | Trifolium dubium |

Miscellaneous Species

| | |
|---|---|
| Carex praecox | Carex caryophyllea |
| Conopodium denudatum | Conopodium majus |
| Epilobium angustifolium | Chamaenerion angustifolium |
| Potentilla tormentilla | Potentilla erecta |
| Scabiosa arvensis | Knautia arvensis |
| Spireae ulmaria | Filipendula ulmaria |
| Stachys betonica | Stachys officinale |
| Taraxacum vulgare | Taraxacum officinale |

The numbers attached to the names of the species in Tables 2-6 are for convenience of reference only and carry no significance.

In 1940, a number of large trees were felled on the north side of the field adjacent to the unlimed halves of plots 5-13. This may have some influence on the flora in this area, but so far no definite changes have been observed.


1. (a) Lawes, J. B. & Gilbert, J. H. (1880). Agricultural, botanical and chemical results of experiments on the mixed herbage of permanent grassland, conducted for many years in succession on the same land. Part I. Phil. Trans. R. Soc. 171, 289-416.

   (b) Lawes, J. B., Gilbert, J. H. & Masters, M. T. (1882). ibid. Part II. Phil. Trans. R. Soc. 173, 1181-1413.

   (c) Lawes, J. B. & Gilbert, J. H. (1900) ibid. Part III. Phil. Trans. R. Soc. 192, 139-210.

2. Hall, A. D. (1905). Experiments upon grassland mown for hay every year. The Rothamsted Experiments. Chapter 9, pp. 150-159.

3. (a) Brenchley, W. E. (1924). Manuring of grassland for hay. (The Rothamsted Monographs on Agricultural Science). 144 pp.

   (b) Brenchley, W. E. (1925). The effect of light and heavy dressings of lime on grassland. J. Minist. Agric. Fish. 32, 504-512.

   (c) Brenchley, W. E. (1930). The varying effect of lime on grassland with different schemes of manuring. J. Minist. Agric. Fish. 37, 663-673.

   (d) Brenchley, W. E. (1935). The influence of season and of the application of lime on the botanical composition of grassland herbage. Ann. appl. Biol. 22, 183-207.

   (e) Brenchley, W. E. (1935). Park Grass plots. Rep. Rothamsted exp. Stn for 1934, 138-159.

4. Cashen, R. O. (1947). The influence of rainfall on the yield and botanical composition of permanent grass. J. agric. Sci., Camb. 37, 1-10.

5. Warren, R. G. & Johnston, A. E. (1964). The Park Grass Experiment. Rep. Rothamsted exp. Stn for 1963, 240-262.

## METHODS OF SAMPLING AND ANALYSIS

Handfuls of grass were taken at regular intervals from every swathe of the cutting machine. Each sample was then sub-sampled until a weight of approximately 12-20 lb. was obtained. The bundles of grass were transferred the same day to the laboratory and at once spread out to dry under cover, and the weight of the resulting hay determined. Provided the grass was turned frequently and carefully during drying, little breakage or loss of colour occurred, both important points for facilitating the subsequent botanical separation.

Two alternative types of analyses were carried out (a) complete, in which every species was determined and (b) partial, in which the herbage was divided into three groups, Graminеae, Leguminosae and Miscellaneous. Complete separations were made of the hay from all plots at five-year intervals from 1862-1877, of certain plots in 1903 and again of all plots in 1914 and 1919. After this date they were made as seemed desirable, but all plots were included in one of the final two years 1948 and 1949. Many of the earlier analyses were carried out by A.G. Willis, but from 1914 to 1949 they were under the direction of W.E. Brenchley.

## MANURING, YIELD AND pH VALUES OF THE SOIL

The manurial treatment given to each plot and the average yields over ten-year periods throughout the experiment are given in Table 1. The figures are for the first crops only. A statistical analysis of the influence of rain fall on yield and botanical composition of the plots was made by R.O. Cashen in 1947[4]. pH values of the soil were determined on most plots in 1945 and the results given as item (a) in the descriptive features of each plot. The figures are approximate only as slight variations, particularly on the limed areas, are to be expected.

# CHAPTER II

## FLOWERING PLANTS AND MOSSES

### Flowering Plants

A characteristic feature of grassland herbage is the large number of species that occur. During the ninety three years of the experiment i.e. up to 1949, certain changes have taken place, although fundamentally the orders and genera represented have remained practically the same both in number and in kind. During the first years certain species disappeared completely. All of these were originally present in very small quantity and in most cases occurred on a single plot, Carduus arvensis being the only one found on several plots.

The species which have disappeared are:-

| | |
|---|---|
| Gramineae | None |
| Leguminosae | Lotus major |
| | Trifolium minus |
| | Trifolium procumbens |
| | Vicia cracca |
| Miscellaneous | Alchemilla vulgaris |
| | Carduus arvensis |
| | Daucus carota |
| | Galium aparine |
| | Orchis morio |
| | Ornithogalum umbellatum |
| | Plantago media |
| | Ranunculus auricomus |
| | Ranunculus repens |
| | Sonchus oleraceus |
| | Stellaria holostea |
| | Veronica officinalis |

In 1949, the flora at the first cut of hay (which has been the standard of comparison throughout the experiment) consisted of 65 species, contained in 57 genera and 21 natural orders, little change having taken place since 1919. Their response to the different manures is the subject of chapter V.

A few species occur which do not usually appear in the hay samples, and

data regarding their distribution, based on field observations are given on page 144

## Mosses

During the early years of the experiment only three species of mosses were recognised, viz. Hypnum squarrosum, H.rutabulum and H.heans and they occurred chiefly on the unmanured plots. No species of this genus, however, was found in 1921 or in 1949 when further surveys were made*. In 1921, mosses were almost entirely confined to the unlimed areas. They were plentiful on plots with no manure (2, 3 and 12) and with minerals only (6), small amounts occurring on other mineral plots ($4^1$, $5^2$, 7, 16) and with no manure after ammonium salts ($5^1$). In 1949, mosses were more plentiful and abundant on both limed and unlimed areas. The influence of manuring on their distribution based on the 1949 survey is as follows:-

Mosses are encouraged by plots receiving complete minerals (6, 7, 14, 15, 16), nitrate of soda (17), or organic manure (13).

They are discouraged on plots receiving ammonium salts (1, $4^2$, 9, 10, $11^1$, $11^2$, 18), incomplete minerals ($4^1$, 8) and organic manure with minerals and nitrate of soda (19, 20) . Except for Bryum sp. mosses are scarce on the unmanured plots 2 and 3, whether limed or unlimed, though they are plentiful on plot 12, also unmanured and without lime. The principal species here are Brachythecium rutabulum, Eurynchium praelongum with Fissidens bryoides, Bryum capillare and Dicranella heteromalla in addition. In general, liming has little effect on the moss flora, but the addition of lime increased it, particularly the amount of Eurynchium praelongum, on plot 18 and to a less extent on plot 9. Both these plots receive sulphate of ammonia, and minerals without super or complete, respectively. Of the species present over the whole area Eurynchium praelongum is the most abundant, with Brachythecium rutabulum second in importance. Many plots also contain Bryum sp. though this is never plentiful except on plot 6 where mosses are particularly abundant. Other species of special note on this plot are Fissidens bryoides, Brachythecium sp. Phascum cuspidatum and Aulacomnium androgynum.

*Identifications in 1921 and 1949 were kindly carried out by the Staff at Kew Gardens

Less important species are:- Barbula unguiculata, Funaria hygrometrica, Mnium cuspidatum, M.hornum and Weisia microstoma. The 1949 record differs considerably from that made in 1921, only three species, Barbula unguiculata, Dicranella heteromalla and Aulacomnium androgynum being common to both. Some of the genera listed are similar for both years but four entirely new species were recorded in 1949 viz. Funaria hygrometrica, Mnium cuspidatum M.hornum and Phascum cuspidatum. Both the 1921 and 1949 surveys were made in the spring and examination of the plots later in the year might reveal yet other species. Association of mosses with mole heaps was frequently observed.

## CHAPTER III

## GENERAL EFFECT OF INDIVIDUAL AND COMBINED MANURES

### Unlimed

YIELD. Most manurial treatments give an increase of crop over no manure, though the degree of improvement varies greatly. A decrease, however, usually occurs with ammonium salts either alone or with minerals without super.

Nitrogenous manures alone (Plots 1 and 17). Nitrate of soda generally gives an appreciable increase of yield, but sometimes the crop is little better than that on the unmanured plots. With sulphate of ammonia the yield is usually lower than where no manure is applied. Either type of nitrogenous manure gives rather a poor growth of herbage.

Mineral manures alone (Plots 6, 7, 8, 15). With complete minerals the yield is very considerably increased, being on an average two or three times that of the unmanured plots. In the absence of potash (Plot 8) however, it usually falls to about two-thirds of that with complete minerals. The

growth of the herbage is generally good.

Nitrogenous and mineral manures combined (Plots 9, $11^1$, $11^2$, 14, 16). Very heavy yields are obtained with a combination of complete minerals and either nitrate of soda or ammonium sulphate, as much as three tons per acre being reached in some years. Nitrate of soda increases the yield the more rapidly, as a double dressing (= 86 lb. N per acre) often gives as heavy a crop as a triple dressing (= 129 lb. N per acre) of ammonium salts. Seasonal variation is smaller with nitrate of soda than with ammonium sulphate. With heavy dressings of ammonium sulphate, growth may become coarse and rank and the crop is then liable to lodge.

With ammonium salts and minerals without super (Plot 18), the yield is poor and since 1938 it has usually fallen below that of the unmanured plot.

Organic manures (Plots 13, 19, 20). These increase the yield and encourage the grass to get away earlier in the spring than where inorganic manures are used. The type of herbage, however, is much influenced by the other fertilizers applied.

NUMBER OF SPECIES. The largest number of species is found on the unmanured plots, 43 being recorded in 1940, but fluctuations are considerable and only 20 occurred in 1943. With organic manures the number is about 30 and these species are more regular in appearance than those on the unmanured plots. As the applications of inorganic manure, especially of a nitrogenous character, become successively heavier, the number of species decreases until with large dressings of ammonium sulphate only about 8 to 10 survive, of which only 2 or 3 occur in any quantity. Minerals are much less effective than nitrogen in reducing the number of species.

RELATIVE AMOUNTS OF GRAMINEAE, LEGUMINOSAE AND MISCELLANEOUS SPECIES. (Figures 1,2,3).

Nitrogenous manures alone or combined with minerals (Amm.Salts; Plots 1, $4^2$, 9, 10, $11^1$, $11^2$, 18; Nitrate of Soda; Plots 14, 16, 17). An almost complete elimination of Leguminosae is effected by ammonium salts, whether given alone or with minerals. In the presence of nitrate of soda, reduction is less drastic, but still considerable. Miscellaneous species are also reduced by ammonium salts and where the dressing is heavy the herbage consists almost entirely of grass. With nitrate of soda alone, on the other hand, the quantity of Miscellaneous species may be of the order of 30 per cent (1947 and 1949).

Mineral manures alone (Plots 6, 7, 8, 15). All three groups are well represented here. Leguminous plants are specially encouraged and may constitute one third of the herbage, though in the absence of potash (Plot 8) the proportion is smaller. This beneficial effect is entirely offset by the addition of nitrogen as ammonium salts (Plots 9, 10, $11^1$, $11^2$). With nitrate of soda, however, the counteraction is less noticeable, and Leguminosae, chiefly Lathyrus pratensis, may constitute almost 12 per cent of the herbage (Plot 16).

Organic manures (Plots 13, 19, 20). These seem to encourage Leguminosae if used alone, but in combination with inorganic fertilizers it is the nature of the latter which is the determining factor. Thus, when farmyard manure is used after prolonged treatment with ammonium salts (Plot 13), Leguminosae are almost or entirely absent, whereas in combination with nitrate of soda and minerals this group is fairly well represented (Plots 19 and 20). The most conspicuous leguminous plant throughout is Lathyrus pratensis, which both shows the most response to manurial treatment, and also the greatest fluctuations with season.

INDIVIDUAL SPECIES. The majority of species vary in quantity with the type of manuring, but it is often uncertain whether the variation is caused by the direct influence of the manure on the species concerned, or whether it is due to lessened or increased competition with other plants. Plantago lanceolata, Leontodon hispidus, Conopodium denudatum, Briza media and Lotus corniculatus, for

example, which are conspicuous on starved soils tend to disappear with more complete inorganic manuring.

Agrostis vulgaris has increased considerably, and as much as 44.0 per cent may occur on plots receiving heavy ammonium salts and minerals. Festuca rubra is much encouraged with ammonium salts alone, but the addition of minerals brings to the fore Holcus lanatus and Agrostis vulgaris, and to a lesser extent Anthoxanthum odoratum and Arrhenatherum avenaceum.

Ammonium salts and nitrate of soda favour quite different species, for Holcus lanatus is dominant with the former, whereas with the latter Arrhenatherum avenaceum, Dactylis glomerata and Alopecurus pratensis are the most important grasses, Holcus lanatus being almost entirely suppressed.

Minerals encourage Poa pratensis, Lathyrus pratensis and Trifolium pratense, but it is not possible to detect any special effect on species in the Miscellaneous group.

Generally speaking, with moderate or no manuring many species retain their footing even though they may be much reduced in quantity. With excessive manuring, on the other hand, a large number of species tend to disappear entirely, while one or two others increase to such an extent that the balance in the composition of the herbage is seriously upset.

## Limed

YIELD. Liming has now increased the yield on all plots with ammonium salts and minerals, and also with complete minerals alone. With ammonium salts alone, lime did not at first have any constant effect, but since 1919 it has caused an improvement. On the unmanured plots lime brings about only a slight increase in crop.

With the light dressing of nitrate of soda, lime formerly improved the yield in certain seasons only, but since 1940 the benefit has been consistent. With the heavy dressing or mineral manuring, on the other hand, there has been a steady decrease in crop from the addition of lime.

When associated with farmyard manure and fish guano (Plot 13), lime decreased the yield till 1944, but since then the position has been reversed.

NUMBER OF SPECIES. Liming has no constant effect upon the number of species, but it increases them on plots receiving ammonium salts alone or with the addition of minerals, either complete or without super. In the latter case the crop is much increased and an entirely different type of herbage is produced.

RELATIVE AMOUNTS OF GRAMINEAE, LEGUMINOSAE AND MISCELLANEOUS SPECIES.

Since 1919, liming has caused some changes in the proportion of Gramineae. About half the plots show a decrease viz. those receiving ammonium salts (except the largest quantities) a light dressing of nitrate of soda with minerals, farmyard manure, super alone or no manure at all. The only plot showing an increase is that receiving nitrate of soda only. Elsewhere little change has occurred.

Leguminosae are affected in a variable manner and changes in the trends have occurred since 1919. In general no legumes occur where ammonium salts are given, though some may appear where they are applied alone or at a low rate mixed with minerals. Liming has decreased the legumes on the plot with complete minerals and the lower dressing of nitrate of soda but increased them where the higher rate is supplied. The largest increase, however, occurs on the F.Y.M. and fish guano plot where the proportion of Leguminosae has been as high as 41 per cent on the limed compared with 0.2 per cent on the unlimed section. On the remaining plots liming has had little consistent effect.

Miscellaneous species have increased on the limed sections of the unmanured plot 3, those with ammonium salts either with or without other fertilizers, and with F.Y.M. provided artificials are used in addition. Especially large increases have occurred with ammonium salts with minerals without super. Decreases have occurred with minerals or F.Y.M. alone, and to a slight extent where nitrate of soda is given without the addition of minerals. No effect of lime was observed with super alone, or with either dressing of nitrate of soda given with minerals.

INDIVIDUAL SPECIES. On the whole, the effect of lime is more marked on the plots receiving ammonium salts and mineral manures than on those with minerals only, no manure, or with the nitrogen applied as nitrate of soda.

Alopecurus pratensis shows a marked benefit from lime if the manuring is good and soil conditions tend towards acidity. Dactylis glomerata frequently shows a similar response, but Holcus lanatus and Anthoxanthum odoratum are

reduced by lime. Agrostis vulgaris is usually not affected, but is decreased by lime in the presence of ammonium salts (Plot 1), a response it shares with Festuca rubra. With Poa trivialis the effect varies, an increase sometimes occurring on the limed section of plots with minerals alone or F.Y.M., whereas there is an occasional decrease with heavy nitrate of soda and minerals.

Among the Leguminosae, Lathyrus pratensis shows a variable response. Specially large increases in this species were recorded in 1943 and 1944 on the limed half of the plot receiving F.Y.M. and fish guano. Trifolium pratense and Lotus corniculatus are also usually encouraged by lime.

Of the Miscellaneous species, Plantago lanceolata is always increased by lime on the plot receiving ammonium salts alone, though on other plots its response may vary. Conopodium denudatum is also increased on the limed section of this plot though elsewhere it is usually decreased by lime. Rumex acetosa is variable in response, but where manuring is complete, except for potash, there has been a consistent increase due to lime since 1919.

## Silicate of Soda

Silicate of soda applied with heavy ammonium salts has a somewhat similar effect as lime, though it does not generally cause such a large increase in yield. The benefit from silicate is usually greater in the absence of lime and though the effect varies with season the increase in crop may be considerable. Silicate also seems to inhibit the colonization of Epilobium angustifolium on the unlimed areas, for in 1947 none appeared on the plot receiving sodium silicate ($11^2$), though nearly 12 per cent occurred on the adjacent and similarly manured plot but without silicate ($11^1$). The large amount of bare ground due to the severity of the preceeding winter made the high figure possible, for this species is normally unable to compete with grass cut for hay. Since the herbage recovered, Epilobium has almost disappeared and the two plots again have a very similar flora. Some differential effects of silicate on individual species in 1947 on plots receiving heavy ammonium salts and minerals are shown in the following table:-

| | Plot 11[2] | Plot 11[1] |
|---|---|---|
| | With Silicate per cent | No Silicate per cent |
| | Unlimed | |
| Agrostis vulgaris | 44.1 | 4.5 |
| Arrhenatherum avenaceum | 12.7 | 0.3 |
| Holcus lanatus | 40.8 | 81.1 |
| Epilobium angustifolium | - | 11.9 |
| | Limed | |
| Alopecurus pratensis | 70.0 | 78.9 |
| Arrhenatherum avenaceum | 11.3 | 2.9 |

## CHAPTER IV

## EFFECT OF MANURES AND LIME ON INDIVIDUAL PLOTS

In this chapter, the plots are considered under six main headings viz. those receiving A. No Manure, B. Mineral Manures, C. Nitrate of Soda, with and without Mineral Manures, D. Ammonium Salts with Mixed Mineral Manures, E. Ammonium salts alone or with Incomplete Mineral Manure, F. Organic Manures. The characteristics of each individual plot are summarized and information provided regarding the pH of the soil, yield of hay and general type of herbage present. Details of the botanical composition follow, showing the chief constituents of the flora in 1949, the changes that have occurred since 1877, and where appropriate, the effect of lime. The tables have been arranged as far as possible to correspond with the above groups.

### A. NO MANURE (Table 2).

### UNMANURED since 1856 (Plot 3).

#### Condition of Plot in 1949 (Unlimed)

(a) pH 5.5.

(b) Herbage of a characteristic poverty-stricken type. The plants are nearly all low growing and give a leafy hay.

(c) Growth starts late in spring.

(d) Yield very low (Figure 4).

(e) Thirty to thirty-six species, only a few of which are important. Considerable seasonal fluctuations.

(f) The three main groups* of plants are all well represented, the proportion of Gramineae being low and very variable. The range as shown by partial separations from 1903-1947 was:-

| | Percent. |
|---|---|
| G | 28.6 - 57.0 |
| L | 4.2 - 11.0 |
| M | 35.3 - 67.2 |

Main Constituents of the Herbage on Plot 3.

| | |
|---|---|
| **GRAMINEAE** | |
| Festuca rubra<br>Agrostis vulgaris | Usually the most abundant species |
| Dactylis glomerata<br>Anthoxanthum odoratum<br>Holcus lanatus | Occasionally among the three most abundant species |
| Avena pubescens | |
| Briza media | |
| **LEGUMINOSAE** | |
| Lotus corniculatus | Usually the chief species |
| Lathyrus pratensis | |
| Trifolium pratense | |
| **MISCELLANEOUS** | |
| Plantago lanceolata | Usually the chief species |
| Centaurea nigra<br>Leontodon hispidus<br>Poterium sanguisorba | Vary much with season |
| Achillea millefolium | |
| Carex praecox | |
| Conopodium denudatum | |
| Rumex acetosa | |
| Scabiosa arvensis | |
| Ranunculus spp. | Much decreased since 1919 |

* Abbreviated in text:- G = Gramineae; L = Leguminosae; M = Miscellaneous species.

OTHER SPECIES:- Alopecurus, Arrhenatherum, Avena flavescens, Cynosurus, Lolium, Poa pratensis; Trifolium repens; Ajuga, Cerastium, Galium, Hieracium, Luzula, Pimpinella, Potentilla, Prunella, Stellaria, Taraxacum, Thymus, Tragopogon, Veronica. (See Tables).

## Outline of Principal Changes during the Period 1877-1948.

Yield. Much reduced owing to the continued removal of soil nutrients by the hay without any addition of manure. Seasonal variation large.

Number of Species. Reduced.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1929 | 1939 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 18 | 15 | 17 | 17 | 13 | 13 | 12 | 12 | 11 | 11 |
| L | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| M | 28 | 24 | 28 | 31 | 26 | 23 | 14 | 20 | 17 | 21 |
| Total | 50 | 43 | 49 | 52 | 43 | 40 | 29 | 36 | 32 | 36 |

Seasonal variation is considerable. Species that are reduced to the point of disappearance may reappear occasionally.

Composition of the herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1939 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 70.6 | 65.5 | 68.7 | 71.2 | 52.2 | 56.8 | 47.8 | 47.6 | 37.9 | 53.0 |
| L | 8.1 | 5.4 | 9.0 | 8.5 | 7.8 | 6.1 | 4.5 | 9.3 | 6.7 | 7.2 |
| M | 21.3 | 29.1 | 22.3 | 20.3 | 40.0 | 37.1 | 47.6 | 43.1 | 55.4 | 39.8 |

GRAMINEAE. Proportion reduced

Dactylis glomerata — Increased

Lolium perenne, Poa trivialis — Almost disappeared

LEGUMINOSAE. Little changed

MISCELLANEOUS. Increased, fairly steady since 1903

Poterium sanguisorba
Leontodon hispidus
Plantago lanceolata
} Responsible for greater part of increase

The quantity of the individual Miscellaneous plants varies so much from year to year, that it is difficult to estimate their increase or decrease. Some of the species in the table below seem, however, to show a definite trend.

Changes in the Percentage of Certain Species

| | 1862 | 1877 | 1903 | 1914 | 1919 | 1936 | 1939 | 1947 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| Dactylis glomerata | 1.8 | 0.7 | 1.1 | 3.8 | 8.4 | 3.0 | 3.0 | 12.1 | 4.5 |
| Lolium perenne | 6.4 | 4.6 | - | 0.1 | - | - | - | - | - |
| Poa trivialis | 1.5 | 0.6 | * < | - | - | 0.1 | - | - | - |
| Poterium sanguisorba | - | 0.9 | 13.8 | 1.8 | 5.8 | 9.1 | 14.6 | 5.0 | 5.6 |
| Leontodon hispidus | 0.1 | 1.3 | 6.0 | 17.8 | 6.9 | 13.6 | 18.2 | 12.0 | 17.9 |
| Plantago lanceolata | 7.3 | 3.2 | 2.0 | 3.4 | 19.1 | 5.8 | 11.8 | 3.7 | 6.2 |
| Centaurea nigra | 0.3 | 1.1 | 4.1 | 9.1 | 5.8 | 3.0 | 2.9 | 0.6 | 1.0 |
| Luzula campestris | 1.9 | 1.8 | 0.5 | 0.4 | 0.2 | 0.6 | 0.3 | 0.3 | 0.1 |

* < indicates less than 0.05

## Effect of Lime

Until 1943 the limed half was not sharply differentiated from the unlimed area. The herbage was of similar character and appearance, growth beginning at much the same time in the spring. Since then an increase in leguminous plants has been a noticeable feature on the area receiving lime.

pH. 7.0

Yield. Considerably increased by liming up to 1943 but no regular effect since.

Number of Species. No constant effect.

Composition of the Herbage.

GRAMINEAE. Increased till 1938, after which generally reduced

LEGUMINOSAE. Increased

MISCELLANEOUS. Results variable till 1935, since when a tendency to increase

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1940 | | 1947 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 13.1 | 2.9 | 8.4 | 1.5 | 12.1 | 2.0 | 8.4 | 1.1 |
| Anthoxanthum odoratum | 2.8 | 1.0 | 7.0 | 3.1 | 2.8 | 0.9 | 5.1 | 2.6 |
| Avena flavescens | 0.6 | 1.1 | 0.9 | 2.8 | 0.2 | 2.0 | 0.6 | 1.9 |
| Avena pubescens | 4.0 | 14.2 | 4.2 | 19.3 | 5.7 | 18.2 | 3.4 | 13.6 |
| Briza media | 4.3 | 10.5 | 2.0 | 9.0 | 0.9 | 1.5 | 4.7 | 3.6 |
| Poa pratensis | 0.1 | 1.6 | 0.2 | 2.0 | 0.1 | 2.2 | 0.3 | 1.6 |
| Lathyrus pratensis | 0.5 | 2.7 | 0.9 | 1.2 | 0.7 | 2.3 | 2.7 | 2.5 |
| Lotus corniculatus | 3.5 | 3.6 | 1.6 | 2.5 | 6.3 | 13.7 | 3.3 | 5.0 |
| Ranunculus spp. | 0.2 | 1.0 | 0.4 | 2.6 | 0.1 | 1.9 | 1.1 | 8.6 |
| Conopodium denudatum | 0.5 | 0.1 | 4.7 | 0.6 | 1.5 | - | 5.7 | 0.9 |
| Leontodon hispidus | 17.8 | 3.6 | 6.9 | 1.5 | 12.3 | 7.0 | 12.0 | 8.8 |
| Rumex acetosa | 0.3 | 0.6 | 2.0 | 4.2 | 0.2 | 0.3 | 3.7 | 1.8 |

U = Unlimed L = Limed

UNMANURED since 1856 (Plot 12)

Condition of Plot in 1949 (Unlimed)

(a) pH 5.0

(b) Herbage very similar to Plot 3, with minor differences in composition.

(c) Growth starts late in spring.

(d) Yield low but generally higher than on Plot 3.

(e) Thirty to thirty-two species. Considerable seasonal fluctuations.

Main Constituents of the Herbage on Plot 12

The association closely resembles that of Plot 3.

OTHER SPECIES:- As Plot 3, except for Thymus and the addition of traces of Hypochaeris radicata.

## Outline of Principal Changes during the Period 1877-1949

**Yield.** Reduced, slightly above Plot 3.

**Number of Species.** Reduced as on Plot 3, but varies with season.

**Composition of the herbage.**

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 72.4 | 59.0 | 63.7 | 68.3 | 69.3 | 54.7 | 53.2 | 58.6 |
| L | 6.2 | 10.8 | 10.2 | 7.5 | 7.3 | 5.3 | 8.5 | 13.4 |
| M | 21.4 | 30.2 | 26.1 | 24.2 | 23.4 | 40.0 | 38.3 | 28.1 |

**GRAMINEAE.** Much the same as on Plot 3.

| | |
|---|---|
| Dactylis glomerata, Briza media | Probably increased |
| Festuca pratensis | Much reduced |
| Poa trivialis, Cynosurus cristatus, Lolium perenne | Almost or entirely disappeared |

**LEGUMINOSAE.** Little changed, slightly more than on Plot 3.

**MISCELLANEOUS.** Increased, much the same as on Plot 3.

| | |
|---|---|
| Leontodon hispidus | Responsible for most of increase |
| Plantago lanceolata, Centaurea nigra, Conopodium dendudatum | Prominent throughout |
| Luzula campestris | Much decreased |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1949 |
|---|---|---|---|---|---|---|---|
| Arrhenatherum avenaceum | 0.8 | 0.7 | 1.8 | 0.8 | 1.1 | 4.4 | 0.8 |
| Briza media | 1.4 | 1.7 | 4.2 | 3.7 | 10.3 | 2.2 | 6.0 |
| Cynosurus cristatus | 0.5 | 0.4 | 1.0 | 0.4 | < | - | - |
| Dactylis glomerata | 2.8 | 3.2 | 1.9 | 2.6 | 4.5 | 14.4 | 8.8 |
| Festuca pratensis | 10.1 | 3.9 | 2.3 | 3.3 | - | - | 1.6 |
| Lolium perenne | 4.5 | 3.1 | 1.9 | 2.3 | 0.1 | 0.1 | - |
| Poa trivialis | 2.7 | 1.9 | 0.9 | 0.8 | 0.1 | - | - |
| Conopodium denudatum | 1.6 | 5.4 | 2.2 | 2.8 | 0.5 | 10.6 | 1.3 |
| Leontodon hispidus | 0.1 | 0.1 | 0.1 | 0.1 | 6.5 | 2.6 | 10.0 |
| Plantago lanceolata | 7.7 | 8.3 | 0.4 | 1.4 | 5.2 | 15.1 | 6.8 |
| Luzula campestris | 1.1 | 3.0 | 3.0 | 1.5 | 0.5 | 0.3 | 0.6 |

< indicates less than 0.05

UNMANURED since 1864, after FARMYARD MANURE 1856-1863 (Plot 2)

Condition of Plot in 1949 (Unlimed)

Closely resembles Plot 3, but yield is consistently higher.

pH 5.0

Outline of Principal Changes during the Period 1877-1949

Yield. Reduced, as on Plot 3.

Number of Species. Reduced.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1919 | 1939 | 1949 |
|---|---|---|---|---|---|---|---|
| G | 14 | 17 | 18 | 18 | 13 | 13 | 12 |
| L | 3 | 4 | 4 | 4 | 4 | 3 | 4 |
| M | 13 | 20 | 25 | 28 | 18 | 16 | 16 |
| Total | 30 | 41 | 47 | 50 | 35 | 32 | 32 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 75.1 | 84.5 | 80.0 | 75.4 | 60.5 | 57.9 | 58.0 | 53.6 |
| L | 1.9 | 1.6 | 4.9 | 6.5 | 5.7 | 4.4 | 10.7 | 15.4 |
| M | 23.0 | 13.9 | 15.1 | 18.0 | 33.9 | 37.7 | 31.3 | 31.0 |

GRAMINEAE. Proportion reduced.

| | |
|---|---|
| Briza media, Dactylis glomerata | Increased |
| Lolium perenne, Avena flavescens | Reduced |
| Poa trivialis, Bromus mollis | Disappeared |

LEGUMINOSAE. Increased.

| | |
|---|---|
| Lotus corniculatus | Responsible for most of increase |

MISCELLANEOUS. Increased.

| | |
|---|---|
| Leontodon hispidus, Plantago lanceolata | Large increase in some years |
| Centaurea nigra | Increased |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1949 |
|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 2.6 | 4.9 | 11.0 | 18.0 | 8.2 | 8.5 | 10.0 |
| Avena flavescens | 6.0 | 5.9 | 11.6 | 2.9 | 1.0 | 1.2 | 0.2 |
| Briza media | - | < | 0.2 | 0.7 | 5.6 | 3.4 | 1.8 |
| Bromus mollis | 17.8 | 16.4 | 3.9 | 0.2 | - | - | - |
| Lolium perenne | 1.4 | 3.6 | 3.2 | 4.9 | 0.3 | 0.5 | - |
| Poa trivialis | 28.2 | 15.8 | 3.1 | 2.4 | - | - | - |
| Lathyrus pratensis | 1.0 | 1.2 | 4.0 | 5.3 | 0.7 | 0.8 | 2.1 |
| Lotus corniculatus | - | 0.1 | 0.2 | 0.2 | 3.8 | 2.7 | 9.4 |
| Centaurea nigra | < | 0.1 | 1.3 | 0.9 | 7.3 | 4.9 | 1.3 |
| Leontodon hispidus | - | < | < | < | 16.5 | 2.8 | 12.4 |
| Plantago lanceolata | 1.7 | 3.1 | 1.5 | 3.7 | 5.5 | 20.6 | 5.7 |

< indicates less than 0.05

## Effect of Lime

In general, the herbage resembles that of Plot 3 limed.

pH. 7.0

Yield. Increased till 1910 when for some years it was depressed. The effect now varies with season, but lime is usually beneficial.

Number of Species. No regular effect.

Composition of the Herbage.

| | |
|---|---|
| GRAMINEAE | Hardly affected |
| LEGUMINOSAE | Increased |
| MISCELLANEOUS | Decreased |

### Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1949 | |
|---|---|---|---|---|---|---|
| | U | L | U | L | U | L |
| Agrostis vulgaris | 8.2 | 1.9 | 8.5 | 0.5 | 10.0 | 0.5 |
| Anthoxanthum odoratum | 4.0 | 1.5 | 8.8 | 1.7 | 1.1 | 0.4 |
| Avena flavescens | 1.0 | 1.7 | 1.2 | 3.7 | 0.2 | 1.5 |
| Avena pubescens | 4.9 | 18.1 | 4.7 | 20.3 | 3.5 | 22.5 |
| Briza media | 5.6 | 2.7 | 3.4 | 1.7 | 1.8 | 3.9 |
| Dactylis glomerata | 3.8 | 4.9 | 10.7 | 15.2 | 7.9 | 7.5 |
| Festuca rubra | 25.7 | 24.1 | 5.3 | 4.6 | 15.5 | 7.4 |
| Poa pratensis | 0.5 | 1.4 | 0.5 | 1.8 | 0.1 | 1.0 |
| Lathyrus pratensis | 0.7 | 2.4 | 0.8 | 2.2 | 2.1 | 2.4 |
| Ranunculus spp. | 0.3 | 1.4 | 0.5 | 4.4 | 0.9 | 2.8 |
| Conopodium denudatum | 0.5 | 0.1 | 4.4 | 0.7 | 3.2 | 0.2 |
| Leontodon hispidus | 16.5 | 8.5 | 2.8 | 1.7 | 12.4 | 8.7 |
| Rumex acetosa | 0.5 | 0.4 | 1.5 | 2.8 | 1.4 | 0.6 |

U = Unlimed L = Limed

## UNMANURED after AMMONIUM SALTS 1856-1897 (Plot $5^1$)

### Condition of Plot in 1949 (Unlimed)

(a) pH 4.5.

(b) Herbage rather short and patchy in appearance; clumps of *Dactylis glomerata* with *Festuca rubra* frequently dominant.

(c) Growth starts late in spring.

(d) Yield low, often below that of wholly unmanured Plot 3 (Figure 5).

(e) About thirty species or less.

(f) GRAMINEAE form bulk of herbage.

LEGUMINOSAE barely represented.

MISCELLANEOUS plants in good proportion with a large number of species in very small quantity.

### Main Constituents of the Herbage on Plot $5^1$

GRAMINEAE

| | |
|---|---|
| *Festuca rubra* | Forms about half of the total herbage |
| *Agrostis vulgaris*<br>*Anthoxanthum odoratum*<br>*Dactylis glomerata* | Plentiful; order of prevalence varies with season |
| *Arrhenatherum avenaceum* | Variable |
| *Poa pratensis* | Small amount |

MISCELLANEOUS

| | |
|---|---|
| *Centaurea nigra* | Usually well represented |
| *Conopodium denudatum*<br>*Hieracium pilosella*<br>*Hypochaeris radicata*<br>*Plantago lanceolata*<br>*Rumex acetosa* | May be very plentiful |
| *Scabiosa arvensis* | Fairly plentiful |
| *Galium verum* | Variable |

OTHER SPECIES (Several of rare occurrence only):- Aira, Alopecurus, Avena flavescens, A. pubescens, Bromus, Holcus; Lathyrus, Lotus, Trifolium pratense; Achillea, Cerastium, Heracleum, Leontodon, Luzula, Pimpinella, Ranunculus spp. Stellaria, Veronica (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Generally reduced since 1898 when manuring was discontinued, but occasionally heavy.

Number of Species. Considerable variation since the application of ammonium salts was discontinued.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1939 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| G | 17 | 15 | 15 | 13 | 13 | 11 | 10 | 10 | 9 | 7 | 10 |
| L | 4 | 4 | 3 | 2 | 0 | 3 | 1 | 1 | 5 | 3 | 1 |
| M | 17 | 17 | 13 | 14 | 8 | 17 | 14 | 12 | 17 | 17 | 11 |
| Total | 38 | 36 | 31 | 29 | 21 | 31 | 25 | 23 | 31 | 27 | 22 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1934 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| G | 86.3 | 71.9 | 84.7 | 94.1 | 82.4 | 86.4 | 76.6 | 59.0 | 70.6 | 72.8 | 82.2 |
| L | 0.1 | 0.3 | 0.5 | 0.2 | - | 0.5 | 0.4 | 1.5 | 4.4 | 1.1 | 3.1 |
| M | 13.6 | 27.8 | 14.8 | 5.8 | 17.6 | 13.1 | 23.0 | 39.5 | 25.0 | 26.1 | 14.8 |

GRAMINEAE. Proportion reduced

| | |
|---|---|
| Anthoxanthum odoratum | Increased |
| Dactylis glomerata | Increased since change in manuring |
| Agrostis vulgaris, Holcus lanatus | Decreased |
| Lolium perenne | Disappeared |

LEGUMINOSAE. Little changed

| | |
|---|---|
| Lotus corniculatus | Chief species throughout |

MISCELLANEOUS. Increased

| | |
|---|---|
| Centaurea nigra | Increased since change in manuring |
| Rumex acetosa | Occasionally plentiful |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1949 |
|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 24.3 | 21.0 | 26.6 | 29.5 | 11.7 | 17.7 | 4.5 | 17.8 |
| Anthoxanthum odoratum | 5.8 | 5.5 | 3.0 | 4.1 | 12.3 | 8.5 | 11.7 | 1.1 |
| Dactylis glomerata | 2.4 | 1.4 | 0.7 | 3.3 | 1.3 | 9.5 | 8.9 | 4.1 |
| Holcus lantatus | 10.1 | 5.2 | 1.9 | 3.0 | < | 0.2 | 0.6 | 0.7 |
| Lolium perenne | 3.3 | 1.2 | 1.0 | 0.1 | - | - | - | - |
| Centaurea nigra | < | 2.4 | 2.2 | 0.5 | 0.7 | 7.2 | 3.9 | 2.0 |
| Rumex acetosa | 9.2 | 15.9 | 7.1 | 2.1 | 14.8 | 1.4 | 12.3 | 1.0 |

< indicates below 0.05

## B. MINERAL MANURES (Tables 3 and 4)

### MIXED MINERAL MANURE (Plot 7)

Condition of Plot in 1949 (Unlimed)

(a) pH 5.0.

(b) Herbage very varied and well grown, with thick bottom grass. Colour is good, sometimes rather light.

(c) Growth starts fairly late in spring.

(d) Yield good (Figure 6).

(e) Twenty to thirty-three species.

(f) The three main groups of plants are all well represented, the proportions being very variable, though Leguminosae are always plentiful. The range as shown by the partial separations from 1903-1948 was:-

## Main Constituents of the Herbage on Plot 17

GRAMINEAE

| | |
|---|---|
| Dactylis glomerata | Usually dominant |
| Alopecurus pratensis, Holcus lanatus | Usually second in importance |
| Agrostis vulgaris, Anthoxanthum odoratum, Festuca rubra | Plentiful |
| Avena pubescens | Considerably less plentiful |
| Lolium perenne, Briza media, Avena flavescens | Usually in very small quantity; but occasionally more plentiful |

MISCELLANEOUS

| | |
|---|---|
| Plantago lanceolata | Very abundant |
| Centaurea nigra, Leontodon hispidus | Plentiful |

OTHER SPECIES:- Arrhenatherum, Bromus, Cynosurus, Poa pratensis, P.trivialis; Lathyrus, Lotus; Ajuga, Carex, Cerastium, Fritillaria, Luzula, Ophioglossum, Ranunculus spp. Rumex, Taraxacum, Veronica (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Little variation except for marked falls in 1919 and 1944. Seasonal fluctuations small.

Number of Species. Little variation. LEGUMINOSAE reduced since 1914 and MISCELLANEOUS species since 1903.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1933 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 16 | 16 | 17 | 15 | 15 | 14 | 14 | 15 | 9 |
| L | 4 | 3 | 4 | 4 | 4 | 3 | 2 | 1 | 1 |
| M | 13 | 23 | 22 | 29 | 20 | 14 | 15 | 14 | 10 |
| Total | 33 | 42 | 43 | 48 | 39 | 31 | 31 | 30 | 20 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1931 | 1933 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 81.4 | 75.7 | 73.3 | 75.9 | 56.0 | 68.8 | 58.5 | 80.4 | 71.5 | 70.6 |
| L | 0.4 | 0.7 | 1.4 | 0.9 | 2.6 | 0.6 | 0.4 | 0.4 | 0.1 | 0.1 |
| M | 18.2 | 23.6 | 25.3 | 23.2 | 41.4 | 30.6 | 41.1 | 19.2 | 28.5 | 29.3 |

GRAMINEAE. Proportion little permanently changed

| | |
|---|---|
| Dactylis glomerata | Much increased |
| Alopecurus pratensis | Slightly increased |

LEGUMINOSAE. Little changed

MISCELLANEOUS. Little changed

| | |
|---|---|
| Plantago lanceolata | Variable, usually important |
| Centaurea nigra, Leontodon hispidus | Increased |
| Heracleum sphondylium | Disappeared |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1931 | 1933 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alopecurus pratensis | 23.9 | 21.7 | 16.3 | 12.7 | 9.7 | 14.3 | 12.9 | 18.0 | 14.3 | 14.5 |
| Dactylis glomerata | 1.8 | 0.6 | 0.6 | 0.6 | 0.9 | 5.7 | 8.3 | 25.5 | 17.7 | 25.4 |
| Heracleum sphondylium | - | - | - | - | - | - | 0.3 | - | - | - |
| Centaurea nigra | 4.4 | 4.1 | 10.3 | 2.8 | 11.2 | 8.0 | 8.7 | 5.9 | 5.2 | 5.5 |
| Leontodon hispidus | 0.1 | 0.1 | 0.1 | 0.3 | 3.7 | 4.4 | 3.4 | 1.9 | 1.3 | 4.0 |
| Plantago lanceolata | 3.9 | 4.8 | 2.4 | 8.0 | 10.7 | 13.9 | 24.1 | 8.0 | 16.2 | 14.0 |

Effect of Lime

pH. 7.0.

Yield. Little consistent change.

Number of Species. No effect.

Composition of the Herbage.

GRAMINEAE

Avena pubescens, Festuca rubra and to a less extent Avena flavescens are encouraged by lime, while Anthoxanthum odoratum is discouraged; on other species the effect of lime is variable.

Effect of Lime on the Percentage of Certain Species

| | 1921 | | 1925 | | 1929 | | 1933 | | 1949 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L | U | L |
| Anthoxanthum odoratum | 8.6 | 3.1 | 7.1 | 0.9 | 2.7 | 0.2 | 10.3 | 0.5 | 8.7 | 0.8 |
| Avena flavescens | 0.8 | 2.4 | 0.4 | 1.2 | 0.3 | 1.5 | 0.3 | 2.6 | - | 1.5 |
| Avena pubescens | 4.1 | 6.9 | 2.3 | 15.6 | 2.3 | 18.1 | 1.7 | 10.5 | 1.7 | 20.5 |
| Dactylis glomerata | 5.2 | 10.6 | 28.3 | 15.0 | 18.6 | 7.6 | 17.7 | 10.7 | 25.4 | 21.1 |
| Festuca rubra | 11.5 | 21.4 | 6.2 | 21.7 | 6.4 | 26.8 | 6.8 | 29.3 | 9.4 | 22.3 |
| Holcus lanatus | 15.9 | 12.6 | 9.8 | 6.5 | 8.8 | 2.0 | 13.6 | 5.9 | 8.5 | 20.1 |
| Centaurea nigra | 2.0 | 3.6 | 1.7 | 2.4 | 8.4 | 3.4 | 5.2 | 0.3 | 5.5 | 1.4 |
| Plantago lanceolata | 29.4 | 17.7 | 17.4 | 10.7 | 23.0 | 14.8 | 16.2 | 17.1 | 14.0 | 5.6 |

U = Unlimed L = Limed

NITRATE OF SODA (= 43 lb. N per acre) AND MIXED MINERAL MANURE (Plot 16)

Condition of Plot in 1949 (Unlimed)

(a) pH 5.0.

(b) Herbage tall and inclined to lodge, with thick bottom grass. Fairly dark colour, occasional bare patches early in year.

(c) Growth starts fairly early.

(d) Yield heavy, but below Plot 14 (Figure 9).

(e) About twenty-two species, with occasional traces of others.

(f) Composition of herbage variable, the proportion of the three groups changing much with season.

Per cent

| | 1914 | 1919 | 1947 |
|---|---|---|---|
| G | 75.6 | 86.0 | 68.2 |
| L | 15.9 | 1.2 | 13.0 |
| M | 8.5 | 12.8 | 18.8 |

## Main Constituents of the Herbage on Plot 16

GRAMINEAE

| | |
|---|---|
| Alopecurus pratensis | Usually the chief species |
| Anthoxanthum odoratum, Dactylis glomerata | Occasionally very plentiful |
| Bromus mollis | Very variable, prominent in some seasons |
| Arrhenatherum avenaceum | |
| Avena pubescens | |
| Festuca rubra | |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Very variable in quantity |

MISCELLANEOUS

| | |
|---|---|
| Taraxacum vulgare | Occasionally plentiful |
| Achillea millefolium | |
| Plantago lanceolata | |

OTHER SPECIES:- Agrostis, Avena flavescens, Holcus, Lolium, Poa pratensis, P.trivialis; Lotus, Trifolium pratense, T.repens; Anthriscus, Conopodium, Leontodon, Ranunculus spp. Rumex, Tragopogon (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Slightly reduced soon after 1877, but has since remained constant, except for seasonal fluctuations.

Number of Species. Reduced particularly in the MISCELLANEOUS group.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 17 | 14 | 17 | 15 | 12 | 11 | 8 | 13 |
| L | 3 | 4 | 4 | 4 | 3 | 1 | 4 | 2 |
| M | 14 | 16 | 15 | 22 | 11 | 9 | 11 | 8 |
| Total | 34 | 34 | 36 | 41 | 26 | 21 | 22 | 23 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 78.0 | 84.4 | 81.6 | 82.9 | 75.6 | 86.0 | 68.2 | 75.3 |
| L | 2.2 | 1.8 | 7.4 | 9.4 | 15.9 | 1.2 | 13.0 | 11.9 |
| M | 19.8 | 13.8 | 11.0 | 7.7 | 8.5 | 12.8 | 18.8 | 12.8 |

GRAMINEAE Proportion little permanently changed

| | |
|---|---|
| Alopecurus pratensis, Arrhenatherum avenaceum | Much increased |
| Anthoxanthum odoratum, Dactylis glomerata | Increased |
| Agrostis vulgaris, Festuca rubra | Decreased |
| Avena flavescens, Holcus lanatus, Lolium perenne, Poa trivailis | Almost disappeared |

LEGUMINOSAE Very variable

| | |
|---|---|
| Lathyrus pratensis | Chief species |

MISCELLANEOUS Some increase

| | |
|---|---|
| Plantago lanceolata, Taraxacum vulgare | Increased |
| Rumex acetosa | Probably decreased |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1949 |
|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 12.5 | 13.6 | 12.4 | 14.6 | 4.8 | 1.3 | 2.3 |
| Alopecurus pratensis | 0.7 | 8.3 | 15.2 | 12.2 | 26.5 | 50.6 | 22.5 |
| Arrhenatherum avenaceum | 0.1 | - | 0.2 | 0.1 | 2.8 | 3.3 | 22.0 |
| Avena flavescens | 18.4 | 14.9 | 18.8 | 6.7 | 3.6 | 1.2 | 0.6 |
| Dactylis glomerata | 1.6 | 2.6 | 3.8 | 4.6 | 9.7 | 20.1 | 9.9 |
| Festuca rubra | 11.1 | 10.4 | 10.3 | 16.7 | 7.6 | 1.8 | 6.2 |
| Holcus lanatus | 10.5 | 11.7 | 5.1 | 12.6 | 1.4 | 1.7 | 1.1 |
| Lolium perenne | 5.6 | 6.2 | 3.1 | 3.6 | - | - | 0.1 |
| Poa trivialis | 6.9 | 9.0 | 6.5 | 4.8 | 0.1 | 0.3 | 0.1 |
| Plantago lanceolata | 1.3 | 0.8 | 0.1 | 0.2 | 2.9 | 2.5 | 6.3 |
| Taraxacum vulgare | 0.2 | < | - | - | 1.4 | 7.3 | 0.9 |
| Rumex acetosa | 5.5 | 5.6 | 1.2 | 2.2 | 0.1 | 1.0 | 0.2 |

< indicates below 0.05

Effect of Lime

pH. 7.0.

Yield. Reduced till 1939, since when it has increased. Tendency to lodge lessened.

Number of Species. No constant effect.

Composition of the herbage.

GRAMINEAE Decreased except Avena pubescens and Festuca rubra.

LEGUMINOSAE Decreased.

MISCELLANEOUS Little consistent change.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1949 | |
|---|---|---|---|---|---|---|
| | U | L | U | L | U | L |
| Agrostis vulgaris | 4.8 | 0.2 | 1.3 | 0.2 | 2.3 | 0.2 |
| Alopecurus pratensis | 26.0 | 25.5 | 50.5 | 35.9 | 22.5 | 10.9 |
| Anthoxanthum odoratum | 2.8 | 0.1 | 2.0 | < | 4.2 | 0.2 |
| Avena pubescens | 5.0 | 13.8 | 2.8 | 17.6 | 5.8 | 15.3 |
| Bromus mollis | 7.8 | 3.0 | < | < | 0.2 | 0.6 |
| Dactylis glomerata | 9.7 | 9.5 | 20.1 | 18.9 | 9.9 | 13.4 |
| Festuca rubra | 7.8 | 30.9 | 1.8 | 11.4 | 6.2 | 14.4 |
| Holcus lanatus | 1.5 | 0.6 | 1.7 | 0.2 | 1.1 | - |
| Poa trivialis | 0.1 | 1.6 | 0.3 | 0.4 | 0.1 | 0.4 |
| Lathyrus pratensis | 14.4 | 1.3 | 1.2 | 0.7 | 11.7 | 8.5 |
| Plantago lanceolata | 2.8 | 0.4 | 2.5 | 1.5 | 6.3 | 5.3 |
| Taraxacum vulgare | 1.4 | 0.3 | 7.2 | 0.1 | 0.9 | 3.3 |

U = Unlimed L = Limed

NITRATE OF SODA (= 86 lb. N per acre) AND MIXED MINERAL MANURE (Plot 14)

Condition of Plot in 1949 (Unlimed)

(a) pH 6.0.

(b) Herbage dark green, very lush, and often lodges badly. Anthriscus sylvestris is conspicuous and Taraxacum vulgare very prevalent in some seasons.

(c) Growth starts very early in spring.

(d) Yield heavy, being higher than that where equal or even greater amounts of nitrogen as sulphate of ammonia are given (Plots 9, $11^1$, $11^2$).

(e) Ten to eighteen species, with occasional traces of several others.

(f) GRAMINEAE usually forms 90 per cent of the herbage.

LEGUMINOSAE } in small quantity only.

MISCELLANEOUS }

## Main Constituents of the Herbage on Plot 14

GRAMINEAE

| | |
|---|---|
| Alopecurus pratensis, Arrhenatherum avenaceum | Chief species |
| Dactylis glomerata | Important |
| Poa pratensis, Poa trivialis | Usually in fair quantity, some times important |
| Bromus mollis | Very variable |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Usually the only species |

MISCELLANEOUS

| | |
|---|---|
| Anthriscus sylvestris, Taraxacum vulgare | Chief species |
| Rumex acetosa, Plantago lanceolata | Quantity small but characteristic |

OTHER SPECIES:- (Some of rare occurrence only). Agrostis, Anthoxanthum, Avena flavescens, A.pubescens, Briza, Bromus, Festuca rubra, Holcus; Trifolium repens; Achillea, Agrimonia, Centaurea, Conopodium, Heracleum, Hypochaeris, Leontodon, Pimpinella, Ranunculus spp. (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. Little changed.

Number of Species. Reduced, chiefly since 1903.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1935 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 15 | 14 | 14 | 15 | 13 | 12 | 11 | 10 | 10 |
| L | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| M | 10 | 13 | 14 | 11 | 9 | 6 | 4 | 4 | 5 |
| Total | 28 | 30 | 30 | 27 | 24 | 19 | 16 | 15 | 16 |

Composition of the herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1935 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 89.5 | 94.3 | 92.9 | 87.8 | 85.5 | 92.2 | 93.0 | 93.0 | 96.1 | 92.4 |
| L | 0.1 | 0.4 | 1.4 | 0.8 | 3.4 | 4.0 | 2.4 | 0.9 | 0.7 | 2.1 |
| M | 10.4 | 5.3 | 5.7 | 11.4 | 11.1 | 3.8 | 4.6 | 6.1 | 3.2 | 5.5 |

GRAMINEAE

| | |
|---|---|
| Alopecurus pratensis<br>Arrhenatherum avenaceum<br>Dactylis glomerata | Increased |
| Poa trivialis | Much reduced |
| Poa pratensis | Variable |
| Festuca rubra | Increased at first, but now practically disappeared |
| Lolium perenne<br>Holcus lanatus | Disappeared |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Very variable |

MISCELLANEOUS

| | |
|---|---|
| Anthriscus sylvestris | Decreased, especially since 1941 |
| Taraxacum vulgare | Increased considerably |
| Plantago lanceolata | Increased |
| Rumex acetosa | Variable |

Several unimportant species have disappeared.

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1935 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alopecurus pratensis | 0.2 | 3.5 | 3.7 | 20.2 | 28.7 | 22.6 | 53.6 | 61.9 | 49.1 | 31.8 |
| Arrhenatherum avenaceum | 3.1 | - | - | 0.3 | 17.3 | 40.9 | 23.4 | 25.8 | 30.9 | 36.2 |
| Avena pubescens | 0.9 | 0.9 | 0.2 | 0.5 | 2.3 | 3.6 | 3.7 | < | 0.1 | 1.4 |
| Bromus mollis | 18.0 | 17.7 | 42.1 | 8.0 | 23.0 | 5.2 | 0.5 | 1.7 | < | 0.3 |
| Dactylis glomerata | 10.0 | 7.3 | 3.3 | 12.5 | 0.7 | 6.2 | 3.2 | 2.0 | 5.7 | 14.2 |
| Festuca rubra | 0.9 | 1.6 | 0.2 | 0.5 | 2.8 | 5.9 | 5.1 | 0.2 | 0.1 | - |
| Holcus lanatus | 6.6 | 6.6 | 3.7 | 12.8 | < | - | - | - | - | - |
| Lolium perenne | 13.8 | 9.4 | 5.6 | 2.6 | < | 0.1 | - | - | - | - |
| Poa pratensis | 1.5 | 1.1 | 2.6 | 4.0 | 9.2 | 2.2 | 0.8 | 0.7 | 0.3 | 4.7 |
| Poa trivialis | 22.5 | 32.9 | 24.8 | 21.6 | 1.0 | 1.3 | 1.0 | 0.6 | 9.8 | 2.4 |
| Lathyrus pratensis | 0.1 | 0.4 | 1.4 | 0.8 | 3.3 | 4.0 | 2.4 | 0.9 | 0.7 | 2.1 |
| Anthriscus sylvestris | - | 1.5 | 3.9 | 4.6 | 9.5 | 1.0 | 2.4 | 4.9 | 1.3 | 0.1 |
| Taraxacum vulgare | 0.2 | 0.2 | 0.2 | 0.6 | 0.7 | 2.0 | 1.2 | 0.2 | 0.7 | 3.2 |
| Rumex acetosa | 6.9 | 1.1 | 0.6 | 4.4 | 0.6 | 0.5 | 1.0 | 0.9 | 1.3 | 0.4 |

< indicates below 0.05

## Effect of Lime

The limed section of Plot 14 is partly shaded by a large tree and both herbage and yield differ in sun and shade areas.

pH. 7.0.

Yield. Slightly reduced by lime, more so in the shade than in the sun.

Number of Species. Hardly affected in recent years. Earlier a tendency to increase in the shade area.

Composition of the herbage. Little regular variation in any of the three groups of plants.

Effect of Lime on the Percentage of Certain Species

| | 1935 | | | 1940 | | | 1948 | | |
|---|---|---|---|---|---|---|---|---|---|
| | U | L. sun | L. sh. | U | L. sun | L. sh. | U | L. sun | L. sh. |
| Alopecurus pratensis | 61.9 | 22.3 | 20.0 | 49.1 | 18.5 | 12.4 | 31.8 | 12.1 | 6.7 |
| Arrhenatherum avenaceum | 25.8 | 38.1 | 11.0 | 30.9 | 52.0 | 12.1 | 36.2 | 45.0 | 34.7 |
| Dactylis glomerata | 2.0 | 4.5 | 2.2 | 5.7 | 6.0 | 1.9 | 14.2 | 13.6 | 5.0 |
| Festuca rubra | 0.2 | 9.5 | 43.2 | 0.1 | 5.3 | 36.6 | - | 13.3 | 27.4 |
| Poa pratensis | 0.7 | 4.6 | 3.2 | 0.3 | 1.0 | 1.6 | 4.7 | 2.9 | 2.9 |
| Lathyrus pratensis | 0.9 | 12.4 | 4.2 | 0.7 | 1.5 | 15.0 | 2.0 | 3.2 | 3.6 |
| Taraxacum vulgare | 0.2 | 0.2 | 0.2 | 0.6 | 0.9 | 0.7 | 3.2 | 1.1 | 1.7 |

U = Unlimed L = Limed

## D. AMMONIUM SALTS WITH MIXED MINERAL MANURES (Table 5)

### AMMONIUM SALTS (= 86 lb. N per acre) AND MIXED MINERAL MANURE (Plot 9)

Condition of Plot in 1949 (Unlimed)

(a) pH 4.0.

(b) Herbage uneven, luxuriant in parts with some bare patches especially in spring. Colour dark green, comparatively little bottom grass, and hay often stemmy. In 1929 all the herbage on the unlimed half was killed by the severe winter and recolonization during the next two years consisted almost entirely of Holcus lanatus. After 1946 this species decreased rapidly to 51 per cent, but it has since largely regained its dominant position.

The scarcity of MISCELLANEOUS plants brings the plot into sharp contrast with the neighbouring Plots 8, 7, 6.

(c) Growth starts early in spring.

(d) Yield usually high, with large seasonal fluctuations (Figure 10).

(e) About three to nine species and frequently only one viz. Holcus lanatus.

(f) GRAMINEAE 99 to 100 per cent; 1947 was unusual with 96.4%.

LEGUMINOSAE absent.

MISCELLANEOUS species usually under 1 per cent except in 1947 when they reached 3.6 per cent.

Main Constituents of the Herbage on Plot 9

GRAMINEAE

| | |
|---|---|
| Holcus lanatus | Since 1930, frequently 100% of herbage |
| Agrostis vulgaris<br>Anthoxanthum odoratum<br>Arrhenatherum avenaceum<br>Festuca rubra | Relative proportions vary greatly with season |

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | The only significant species |

OTHER SPECIES (Of rare occurrence only). Alopecurus, Avena flavescens, A. pubescens, Bromus, Dactylis, Lolium, Poa pratensis, P.trivialis; Achillea, Epilobium, Heracleum (See Tables).

Outline of Principal Changes during the Period 1877-1949

Yield. Tendency for reduction at first but since 1929, when the herbage was killed by a severe winter, yields have somewhat increased and become more uniform.

Number of Species. Greatly reduced.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 13 | 14 | 16 | 13 | 12 | 9 | 8 | 1 | 6 | 5 |
| L | 2 | 2 | 1 | 4 | 1 | - | - | - | - | - |
| M | 13 | 13 | 13 | 10 | 7 | 5 | 3 | - | - | 1 |
| Total | 28 | 29 | 30 | 27 | 20 | 14 | 11 | 1 | 6 | 6 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 88.6 | 77.1 | 92.2 | 94.7 | 95.9 | 94.7 | 85.0 | 100.0 | 100.0 | 99.5 |
| L | 0.1 | 0.2 | < | 0.4 | - | - | - | - | - | - |
| M | 11.3 | 22.8 | 7.8 | 4.9 | 4.1 | 5.3 | 15.0 | - | - | 0.5 |

GRAMINEAE

| | |
|---|---|
| Holcus lanatus | Greatly increased, may comprise entire herbage |
| Agrostis vulgaris | Very variable since 1929 |
| Anthoxanthum odoratum, Arrhenatherum avenaceum | Increased till 1929 since when almost disappeared |

Avena flavescens, A.pubescens, Dactylis glomerata, Lolium perenne, Poa pratensis and P.trivialis have all practically disappeared, but may occur occasionally.

LEGUMINOSAE

Disappeared

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | Very varisble, may have disappeared |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 12.8 | 13.4 | 15.5 | 12.2 | 3.8 | 18.4 | 12.4 | < | 5.3 | 7.8 |
| Anthoxanthum odoratum | 1.2 | 3.6 | 2.3 | 2.9 | 16.2 | 38.9 | 5.4 | - | 0.3 | 0.4 |
| Arrhenatherum avenaceum | - | 2.5 | 11.4 | 13.2 | 43.3 | 8.6 | 46.9 | - | 0.9 | 0.6 |
| Avena flavescens | 9.1 | 3.8 | 5.3 | 0.7 | 0.2 | 0.1 | - | - | - | - |
| Avena pubescens | 10.2 | 1.4 | 0.5 | 0.1 | 0.1 | - | - | - | - | - |
| Dactylis glomerata | 5.6 | 4.6 | 11.9 | 14.1 | 5.1 | 5.0 | 3.3 | - | - | - |
| Holcus lanatus | 12.1 | 9.8 | 7.6 | 10.4 | 3.9 | 4.1 | 12.4 | 100.0 | 93.3 | 90.6 |
| Lolium perenne | 4.2 | 1.0 | 1.1 | 0.2 | - | - | - | - | - | - |
| Poa pratensis | 10.7 | 13.0 | 22.7 | 18.0 | 11.7 | 1.8 | 0.2 | - | - | - |
| Poa trivialis | 8.7 | 2.1 | 0.6 | 0.1 | < | - | - | - | - | - |
| Rumex acetosa | 5.4 | 10.9 | 4.6 | 3.6 | 2.8 | 4.4 | 14.8 | - | - | - |

< indicates below 0.05

## Effect of Lime

pH. 5.0.

Yield. Much increased. Herbage uniform and contrasts sharply with the unlimed half. Tends to lodge.

Number of Species. Increased, especially since 1929.

### Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1930 | | 1940 | | 1948 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 18.2 | 2.7 | 12.4 | 2.3 | - | 3.3 | 5.3 | 2.6 | 7.8 | 4.3 |
| Alopecurus pratensis | 1.7 | 17.7 | 0.7 | 25.9 | - | 57.4 | 0.1 | 55.0 | - | 38.1 |
| Anthoxanthum odoratum | 38.5 | 12.7 | 5.4 | 1.1 | - | 0.8 | 0.3 | 2.4 | 0.4 | 4.2 |
| Arrhenatherum avenaceum | 8.5 | 38.6 | 46.8 | 47.2 | - | 20.9 | 0.9 | 21.9 | 0.6 | 14.7 |
| Dactylis glomerata | 5.0 | 6.9 | 3.3 | 6.8 | - | 2.3 | - | 4.1 | - | 11.6 |
| Holcus lanatus | 4.0 | 2.2 | 12.4 | 0.8 | 100.0 | 0.5 | 93.4 | 2.1 | 90.6 | 2.5 |
| Poa pratensis | 1.8 | 7.5 | 0.2 | 5.6 | - | 7.0 | - | 2.1 | - | 9.4 |
| Rumex acetosa | 4.4 | 0.7 | 14.8 | 3.5 | - | 0.1 | - | 0.3 | - | 1.1 |

U = Unlimed L = Limed

Composition of the Herbage.

GRAMINEAE Approach 100 per cent

- Alopecurus pratensis — Much increased
- Arrhenatherum avenaceum, Poa pratensis — Increased
- Holcus lanatus — Much decreased

LEGUMINOSAE Increased

MISCELLANEOUS Increased in some seasons

- Heracleum sphondylium, Taraxacum vulgare — Increased since 1935

Almost every species is affected by liming but the response may vary with season e.g. Arrhenatherum avenaceum.

## AMMONIUM SALTS (= 86 lb. N per acre) AND MIXED MINERAL MANURE WITHOUT POTASH (Plot 10)

### Condition of Plot in 1949 (Unlimed)

(a) pH 4.0.

(b) Herbage less luxuriant than on Plot 9, and now differs from it in type.

(c) Growth starts early.

(d) Yield medium, much below that of Plot 9.

(e) About six to sixteen species.

(f) GRAMINEAE usually 98-100 per cent.

LEGUMINOSAE absent.

MISCELLANEOUS species below 2 per cent.

### Main Constituents of the Herbage on Plot 10

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris<br>Anthoxanthum odoratum<br>Holcus lanatus | Chief species |
| Alopecurus pratensis | Very small amounts |
| Festuca rubra | Very small amounts till 1948 |
| Arrhenatherum avenaceum | Usually very small amounts, but important in 1945 and 1946 |

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | Very small amount |

OTHER SPECIES (Mostly of very rare occurrence). Avena flavescens, A.pubescens, Dactylis, Poa pratensis, P.trivialis; Achillea, Centaurea, Galium, Heracleum, Hieracium, Leontodon, Luzula, Plantago, Potentilla, Poterium, Scabiosa, Taraxacum, Veronica. (See Tables).

## Outline of Principal Changes during the Period 1877-1948

**Yield.** Reduced but fluctuating, change first evident in 1909.

**Number of Species.** Greatly reduced.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1935 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 16 | 15 | 15 | 15 | 8 | 9 | 8 | 7 | 7 |
| L | 2 | 1 | 2 | 2 | - | - | - | 1 | - |
| M | 13 | 11 | 6 | 11 | 4 | 1 | 2 | - | 1 |
| Total | 31 | 27 | 23 | 28 | 12 | 10 | 10 | 8 | 8 |

**Composition of the Herbage.**

The balance between the GRAMINEAE and MISCELLANEOUS species is unchanged except for seasonal fluctuations but the LEGUMINOSAE have practically disappeared.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1935 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 85.5 | 82.6 | 94.7 | 93.4 | 98.7 | 92.6 | 99.9 | 99.9 | 99.7 |
| L | 0.1 | 0.1 | < | < | - | - | - | < | - |
| M | 14.4 | 17.3 | 5.3 | 6.6 | 1.3 | 7.4 | 0.1 | - | 0.3 |

< indicates below 0.05

GRAMINEAE

| | |
|---|---|
| Anthoxanthum odoratum | Large increase usually maintained |
| Arrhenatherum avenaceum | Very variable |
| Alopecurus pratensis | Increase of 1877 maintained until 1929, since when it has become unimportant |
| Agrostis vulgaris | Reduced at first, but large increase since 1939 |
| Holcus lanatus | Reduced at first, but large increase since 1935 |
| Dactylis glomerata | Reduced |

Avena flavescens, A.pubescens, Bromus mollis, Lolium perenne, Poa pratensis and P.trivialis have practically disappeared.

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | The only constant representative; quantity very variable |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1935 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 9.4 | 8.6 | 14.1 | 16.3 | 3.0 | 4.0 | 10.3 | 33.9 | 51.9 |
| Alopecurus pratensis | 2.1 | 3.0 | 10.4 | 15.5 | 18.6 | 20.8 | 0.2 | 0.1 | 0.3 |
| Arrhenatherum avenaceum | 0.1 | 11.7 | 13.2 | 9.6 | 4.8 | 25.9 | 1.4 | 0.9 | 4.1 |
| Anthoxanthum odoratum | 1.5 | 5.3 | 3.3 | 5.8 | 49.4 | 21.0 | 21.1 | 31.5 | 10.3 |
| Avena flavescens | 10.1 | 2.0 | 0.8 | 0.2 | - | - | - | - | - |
| Avena pubescens | 10.6 | 1.6 | 0.4 | 0.2 | - | - | - | - | - |
| Bromus mollis | 2.5 | 0.7 | 1.7 | 1.6 | - | - | - | - | - |
| Dactylis glomerata | 12.5 | 5.4 | 3.1 | 4.9 | 1.0 | 1.6 | 0.1 | - | 0.3 |
| Holcus lanatus | 9.5 | 8.2 | 4.4 | 4.7 | 1.1 | 11.6 | 64.4 | 31.3 | 21.6 |
| Lolium perenne | 3.0 | 1.8 | 0.6 | 0.2 | - | - | - | - | - |
| Poa pratensis | 4.1 | 14.8 | 19.6 | 6.5 | 0.9 | 0.3 | - | - | - |
| Poa trivialis | 10.2 | 2.8 | 1.2 | 0.5 | - | - | 0.1 | - | - |

## Effect of Lime

The difference in appearance between limed and unlimed areas is clearly marked. Tendency to lodge increased.

pH. 5.0

Yield. Much increased.

Number of Species. Practically no effect.

Composition of the Herbage.

GRAMINEAE Usually slightly decreased, but seasonal differences.

Alopecurus pratensis, Festuca rubra — Much increased

Anthoxanthum odoratum, Holcus lanatus — Much decreased

LEGUMINOSAE Not affected.

MISCELLANEOUS Slightly increased.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1935 | | 1948 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 3.0 | 3.1 | 4.0 | 0.5 | 10.3 | 1.0 | 51.9 | 1.0 |
| Alopecurus pratensis | 18.6 | 46.5 | 20.8 | 76.8 | 0.2 | 55.2 | 0.3 | 28.6 |
| Anthoxanthum odoratum | 49.4 | 15.2 | 21.0 | 1.1 | 21.1 | 1.9 | 10.3 | 1.8 |
| Arrhenatherum avenaceum | 4.8 | 9.2 | 25.9 | 8.1 | 1.4 | 1.7 | 5.1 | 4.1 |
| Festuca rubra | 19.0 | 14.8 | 6.9 | 5.2 | 2.4 | 33.3 | 10.2 | 54.5 |
| Holcus lanatus | 1.1 | 1.5 | 11.6 | 0.1 | 64.4 | - | 21.6 | 0.5 |
| Poa pratensis | 0.9 | 4.3 | 0.3 | 6.0 | - | 6.2 | - | 3.4 |
| Rumex acetosa | 1.0 | 0.2 | 7.4 | 0.4 | 0.1 | 0.5 | 0.3 | 5.0 |

U = Unlimed L = Limed

AMMONIUM SALTS (= 129 lb. N per acre) AND MIXED MINERAL MANURE
( Plot 11[1] )

Condition of Plot in 1949 (Unlimed)

(a) pH 4.0.

(b) Extremely patchy, especially in winter and spring. Herbage consists of large tufts of grass interspersed with extensive bare patches, covered with partially decayed peaty matter. In favourable seasons seedlings of Holcus lanatus quickly spring up on the bare patches. There is practically no bottom grass and the herbage is very coarse and rank, with a tendency to lodge.

(c) Growth starts very early and may be vividly green in January and February, when most other plots are still dormant.

(d) Yield very heavy.

(e) Only four species of any significance, with occasional traces of a few others.

(f) GRAMINEAE form practically all the herbage.

LEGUMINOSAE almost always absent.

MISCELLANEOUS usually below 2 per cent.

## Main Constituents of the Herbage on Plot 11[1]

GRAMINEAE

| | |
|---|---|
| Holcus lanatus | Dominant species |
| Arrhenatherum avenaceum | Used to be plentiful in some seasons, now scarce |

MISCELLANEOUS

| | |
|---|---|
| Epilobium angustifolium | Very variable; occasionally important |

OTHER SPECIES (Some of rare occurrence only). Agrostis, Alopecurus, Anthoxanthum, Avena pubescens, Dactylis, Festuca rubra, Poa pratensis; Lotus, Trifolium pratense; Leontodon, Ranunculus spp. Rumex (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Reduced but crop heavy in 1932 and 1943.

Number of Species. Reduced.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 15 | 13 | 11 | 11 | 7 | 7 | 6 | 2 |
| L | 1 | 1 | 1 | - | - | - | 1 | - |
| M | 12 | 4 | 4 | 4 | - | 1 | 2 | 1 |
| Total | 28 | 18 | 16 | 15 | 7 | 8 | 9 | 3 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 89.4 | 94.1 | 98.8 | 97.5 | 99.8 | 100.0 | 98.9 | 87.8 | 99.7 |
| L | - | - | - | - | - | - | - | 0.2 | - |
| M | 10.6 | 5.9 | 1.2 | 2.5 | 0.2 | - | 1.1 | 12.0* | 0.3 |

* The high proportion of Miscellaneous species in 1947 is due to the big influx of Epilobium angustifolium which occurred that year.

GRAMINEAE.

| | |
|---|---|
| Holcus lanatus | Much increased |
| Agrostis vulgaris | Reduced |
| Alopecurus pratensis | Much reduced |

Dactylis glomerata, Festuca rubra, Poa pratensis and P.trivialis seem to have disappeared.

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 13.2 | 19.3 | 13.6 | 29.2 | 1.4 | 0.5 | 1.7 | 4.5 | - |
| Alopecurus pratensis | 2.8 | 13.1 | 12.4 | 9.9 | 28.5 | 1.2 | 0.8 | 1.1 | 0.1 |
| Dactylis glomerata | 24.2 | 39.3 | 39.3 | 17.1 | 0.2 | 0.2 | 0.2 | - | - |
| Festuca rubra | 1.5 | 0.5 | 0.4 | 4.2 | < | 0.1 | 0.1 | 0.2 | - |
| Holcus lanatus | 9.9 | 2.9 | 10.3 | 20.3 | 45.6 | 90.9 | 64.8 | 81.1 | 99.7 |
| Poa pratensis | 9.4 | 12.9 | 10.4 | 1.5 | 0.2 | - | - | - | - |
| Poa trivialis | 13.3 | 0.1 | 0.1 | 0.3 | - | - | - | - | - |

Effect of Lime

pH. 4.5.

Yield. Much increased.

Number of Species. Increased.

Composition of the Herbage.

The contrast between the limed and unlimed areas is greater here than on almost any other plot. The herbage is uniform and there are no bare patches.

GRAMINEAE Proportion little affected.

| | |
|---|---|
| Alopecurus pratensis | Replaces Holcus lanatus as the dominant species |
| Arrhenatherum avenaceum | Response varies with season |
| Dactylis glomerata<br>Poa pratensis | Increased |

| | Per cent |
|---|---|
| G | 22.8 - 74.8 |
| L | 8.7 - 40.1 |
| M | 10.0 - 48.8 |

## Main Constituents of the Herbage on Plot 7

GRAMINEAE

| | |
|---|---|
| Festuca rubra<br>Dactylis glomerata | Usually the most abundant species |
| Agrostis vulgaris<br>Alopecurus pratensis<br>Anthoxanthum odoratum | Frequently important. |
| Holcus lanatus | Present in fair quantity |
| Avena pubescens<br>Arrhenatherum avenaceum | Occasionally conspicuous, otherwise insignificant |
| Bromus mollis | Usually insignificant, but abundant in 1948 |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Usually the chief species |
| Trifolium pratense<br>Lotus corniculatus | Occasionally the chief species |

MISCELLANEOUS

| | |
|---|---|
| Conopodium denudatum<br>Heracleum sphondylium<br>Achillea millefolium<br>Centaurea nigra<br>Plantago lanceolata<br>Rumex acetosa | Vary much with season |

OTHER SPECIES:- Avena flavescens, Briza, Festuca pratensis, Lolium, Poa pratensis, P.trivialis; Trifolium repens, Vicia; Carex, Cerastium, Galium, Leontodon, Luzula, Pimpinella, Primula, Ranunculus spp. Scabiosa, Spireae, Stellaria, Taraxacum, Tragopogon, Veronica. (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. Fairly constant except for seasonal fluctuations, with a period of high yields from 1902-1907.

Number of Species. Reduced.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1930 | 1938 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 18 | 16 | 17 | 17 | 16 | 14 | 12 | 10 | 12 | 13 |
| L | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 |
| M | 20 | 22 | 20 | 22 | 17 | 14 | 15 | 14 | 11 | 12 |
| Total | 42 | 42 | 41 | 43 | 37 | 33 | 32 | 28 | 27 | 30 |

Composition of the Herbage. Seasonal effect is very considerable, and the balance of the groups varies from year to year.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1877 | 1903 | 1914 | 1919 | 1930 | 1939 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 64.7 | 74.4 | 41.7 | 68.3 | 52.0 | 43.5 | 45.3 | 28.6 | 46.6 |
| L | 24.7 | 13.7 | 33.2 | 17.0 | 8.8 | 35.3 | 39.7 | 25.9 | 19.8 |
| M | 10.6 | 11.9 | 25.1 | 14.7 | 39.2 | 21.2 | 15.0 | 45.5 | 33.6 |

GRAMINEAE

| | |
|---|---|
| Festuca rubra<br>Dactylis glomerata | Usually dominant |
| Alopecurus pratensis | Occasionally dominant |
| Poa trivialis<br>Avena flavescens | Reduced |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Usually dominant |
| Trifolium pratense<br>Lotus corniculatus | Occasionally dominant |

MISCELLANEOUS

Conopodium denudatum
Heracleum sphondylium
Achillea millefolium
Plantago lanceolata
Rumex acetosa

} Occasionally dominant

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1939 | 1947 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alopecurus pratensis | 0.3 | 0.9 | 1.2 | 0.5 | 4.5 | 1.7 | 1.7 | 1.2 | 4.5 | 8.3 |
| Avena flavescens | 4.0 | 4.8 | 3.7 | 3.7 | 6.6 | 1.8 | 0.7 | 0.5 | 0.8 | 1.0 |
| Dactylis glomerata | 2.6 | 4.7 | 1.7 | 3.7 | 5.0 | 10.2 | 21.6 | 21.8 | 20.8 | 15.7 |
| Festuca rubra | 13.7 | 11.4 | 14.9 | 26.6 | 7.7 | 31.6 | 7.2 | 7.7 | 4.1 | 4.6 |
| Poa trivialis | 3.8 | 4.4 | 2.3 | 2.1 | 1.0 | 0.5 | 0.4 | - | 0.2 | 0.3 |
| Lathyrus pratensis | 13.5 | 6.8 | 36.7 | 12.1 | 22.0 | 10.7 | 7.2 | 28.8 | 11.4 | 11.3 |
| Lotus corniculatus | 1.3 | 0.7 | 0.2 | 0.1 | 0.4 | 0.6 | 0.5 | 2.3 | 0.4 | 0.5 |
| Trifolium pratense | 6.8 | 4.8 | 1.1 | 1.6 | 6.4 | 4.7 | 1.0 | 4.6 | 4.3 | 4.6 |
| Conopodium denudatum | 0.9 | 1.2 | 0.2 | 0.3 | 1.7 | 0.8 | 9.5 | 1.3 | 4.4 | 1.4 |
| Heracleum sphondylium | - | 0.2 | < | 0.6 | 1.9 | 0.5 | 4.2 | 1.3 | 1.1 | 1.0 |
| Achillea millefolium | - | - | - | - | 8.9 | 2.5 | 6.3 | 2.8 | 7.6 | 14.0 |
| Centaurea nigra | < | 0.8 | 0.3 | 0.1 | 1.0 | 6.9 | 2.6 | 4.0 | 7.0 | 4.3 |
| Plantago lanceolata | 0.2 | 1.1 | 0.1 | 0.1 | 0.1 | 0.7 | 1.3 | 1.6 | 5.4 | 6.5 |

< indicates below 0.05

Effect of Lime

pH. 7.0

Yield. Generally much increased.

Number of Species. No constant effect.

Composition of the Herbage.

GRAMINEAE Proportion increased.

Dactylis glomerata — Unaffected, remains dominant

Alopecurus pratensis
Arrhenatherum avenaceum

} Increased

| | |
|---|---|
| Agrostis vulgaris<br>Anthoxanthum odoratum<br>Festuca rubra | Reduced |
| LEGUMINOSAE | No constant effect |
| MISCELLANEOUS | Most species reduced |

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1936 | | 1940 | | 1947 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 7.0 | 4.3 | 5.4 | 2.0 | 6.1 | 0.5 | 3.1 | 0.2 | 4.7 | 0.1 |
| Alopecurus pratensis | 1.7 | 9.8 | 1.7 | 15.2 | 0.8 | 8.4 | 6.1 | 22.9 | 4.5 | 15.7 |
| Anthoxanthum odoratum | 4.2 | 0.6 | 3.6 | 0.5 | 3.7 | 0.3 | 2.6 | 0.1 | 6.7 | 0.3 |
| Avena flavescens | 1.9 | 4.0 | 0.7 | 1.0 | 0.9 | 2.8 | 0.6 | 2.6 | 0.8 | 2.1 |
| Avena pubescens | 2.6 | 4.5 | 2.8 | 8.8 | 1.8 | 4.5 | 1.8 | 2.7 | 1.2 | 3.9 |
| Bromus mollis | 2.1 | 15.6 | 0.1 | 0.6 | - | 0.8 | 0.2 | 7.3 | - | 0.2 |
| Festuca rubra | 31.6 | 13.3 | 7.2 | 5.4 | 10.0 | 2.7 | 6.6 | 1.2 | 4.1 | 1.0 |
| Poa trivialis | 0.5 | 1.9 | 0.4 | 1.2 | 0.1 | 9.0 | 0.3 | 9.3 | 0.2 | 2.1 |
| Lathyrus pratensis | 10.7 | 15.9 | 7.2 | 19.6 | 16.0 | 15.6 | 8.8 | 6.4 | 11.4 | 5.2 |
| Trifolium pratense | 4.7 | 2.8 | 1.0 | < | 9.9 | 4.5 | 4.9 | 2.1 | 4.3 | 0.1 |
| Conopodium denudatum | 0.8 | 0.3 | 9.5 | 3.7 | 1.8 | 0.4 | 2.0 | 0.1 | 4.4 | 0.1 |
| Heracleum sphondylium | 0.5 | 0.3 | 4.2 | 1.6 | 3.9 | 5.6 | 4.8 | 4.4 | 1.1 | 4.6 |
| Achillea millefolium | 2.5 | 0.7 | 6.3 | 1.0 | 2.7 | 0.9 | 1.2 | 0.1 | 7.6 | 0.3 |
| Centaurea nigra | 6.9 | 3.5 | 2.6 | 1.1 | 7.7 | 4.4 | 3.1 | 0.1 | 7.0 | 1.5 |
| Plantago lanceolata | 0.7 | 0.2 | 1.3 | 0.5 | 3.2 | 1.1 | 1.3 | 0.6 | 5.4 | 1.8 |

U = Unlimed L = Limed

## MINERAL MANURE WITHOUT POTASH (Plot 8)

### Condition of Plot in 1949 (Unlimed)

(a) pH 5.0.

(b) Herbage shorter and less luxuriant than in the presence of potash (Plot 7); very varied, with much bottom grass; growth patchy, colour usually rather pale.

(c) Growth starts later than Plot 7.

(d) Yield rather low (Figure 7) and much below that of Plot 7.

(e) Twenty-eight to thirty-six species according to season, number has become more steady since 1935.

(f) The three main groups of plants are all well represented, with a large proportion of Leguminosae. The range as shown by partial separations from 1903-1948 was:-

| | Per cent | | |
|---|---|---|---|
| G | 27.4 | - | 69.0 |
| L | 2.7 | - | 25.3 |
| M | 22.7 | - | 64.8 |

Main Constituents of the Herbage on Plot 8

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris<br>Arrhenatherum avenaceum<br>Dactylis glomerata<br>Festuca rubra<br>Holcus lanatus<br>Anthoxanthum odoratum | Usually among the most abundant species |
| Avena flavescens<br>Avena pubescens | Present in fair quantity |
| Briza media | Small in amount but characteristic |

LEGUMINOSAE

| | |
|---|---|
| Trifolium pratense<br>Lotus corniculatus | Chief species |

MISCELLANEOUS

| | |
|---|---|
| Plantago lanceolata | Chief species |
| Ranunculus spp.<br>Conopodium denudatum<br>Scabiosa arvensis<br>Achillea millefolium<br>Centaurea nigra<br>Leontodon hispidus<br>Rumex acetosa | Vary in relative abundance |

OTHER SPECIES:- Alopecurus, Bromus, Cynosurus, Lolium, Poa pratensis, P.trivialis; Lathyrus, Trifolium repens; Agrimonia, Ajuga, Carex, Cerastium, Galium, Heracleum, Luzula, Pimpinella, Primula, Prunella, Spireae, Stellaria, Taraxacum, Tragopogon, Veronica (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. No general reduction but considerable seasonal variation.

Number of Species. Reduced since 1903, but little change after 1914.

### Number of Species

| | 1862 | 1877 | 1903 | 1914 | 1919 | 1935 | 1948 |
|---|---|---|---|---|---|---|---|
| G | 17 | 16 | 15 | 15 | 13 | 11 | 14 |
| L | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| M | 17 | 26 | 23 | 16 | 15 | 17 | 15 |
| Total | 38 | 46 | 42 | 35 | 32 | 32 | 33 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1935 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 71.7 | 63.0 | 71.5 | 81.2 | 43.5 | 63.3 | 46.6 | 55.6 | 52.5 |
| L | 19.3 | 8.9 | 8.0 | 4.0 | 18.6 | 10.7 | 10.6 | 11.3 | 7.3 |
| M | 9.0 | 28.1 | 20.5 | 14.8 | 37.9 | 26.0 | 42.8 | 33.1 | 40.2 |

GRAMINEAE Decreased

- Poa trivialis, Lolium perenne — Much reduced
- Cynosurus cristatus, Festuca pratensis — Almost disappeared

LEGUMINOSAE Much increased

- Trifolium pratense — Usually responsible for most of increase
- Lotus corniculatus — Increased

MISCELLANEOUS Increased, but very variable since 1903

- Plantago lanceolata — Responsible for most of increase
- Centaurea nigra, Rumex acetosa — Very variable
- Leontodon hispidus — Considerably increased since 1919

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1935 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| Cynosurus cristatus | 0.3 | 0.2 | 1.0 | 1.1 | 0.5 | 0.1 | - | - | - |
| Festuca pratensis | 2.2 | 0.4 | 0.3 | 0.5 | 0.1 | - | - | - | 0.4 |
| Lolium perenne | 5.9 | 2.6 | 1.9 | 7.6 | 0.1 | 0.4 | 0.3 | - | 0.1 |
| Poa trivialis | 5.5 | 3.5 | 1.6 | 3.2 | 0.1 | 0.2 | 0.6 | - | 0.2 |
| Lotus corniculatus | 0.2 | 0.8 | 3.5 | 1.2 | 12.2 | 1.8 | 1.3 | 4.4 | 3.3 |
| Trifolium pratense | 7.7 | 1.1 | 0.3 | 0.4 | 1.4 | 5.4 | 5.0 | 6.5 | 2.7 |
| Centaurea nigra | 0.2 | 0.5 | 0.2 | 0.8 | 7.2 | 9.3 | 4.8 | 2.9 | 2.0 |
| Leontodon hispidus | - | - | - | - | 0.9 | 1.0 | 0.7 | 6.1 | 4.5 |
| Plantago lanceolata | 0.7 | 1.5 | 0.3 | 0.3 | 5.9 | 8.8 | 18.5 | 13.0 | 15.1 |
| Rumex acetosa | 1.9 | 7.9 | 2.0 | 5.8 | 1.9 | 0.6 | 6.9 | 0.8 | 2.9 |

## Effect of Lime

pH. 7.0.

Yield. Not much affected for the first few years, but since 1909 it has been reduced.

Number of Species. No constant effect; usually similar to unlimed area.

Composition of the Herbage.

GRAMINEAE — Increased, particularly Avena pubescens and Arrhenatherum avenaceum in certain years.

LEGUMINOSAE — At first decreased, but since 1936 has increased.

MISCELLANEOUS — Decreased.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1935 | | 1947 | | 1948 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 7.8 | 5.3 | 3.9 | 2.0 | 8.8 | 1.7 | 4.2 | 0.9 | 3.0 | 1.3 |
| Arrhenatherum avenaceum | 3.1 | 4.0 | 8.0 | 18.2 | 7.7 | 31.7 | 12.4 | 8.3 | 14.2 | 14.7 |
| Avena pubescens | 5.2 | 9.4 | 3.4 | 12.1 | 5.8 | 15.2 | 1.7 | 16.7 | 1.9 | 11.3 |
| Briza media | 1.5 | 9.4 | 0.4 | 2.0 | 0.4 | 1.4 | 0.2 | 2.4 | 0.1 | 0.9 |
| Holcus lanatus | 8.0 | 6.9 | 11.2 | 5.2 | 6.4 | 5.1 | 6.5 | 4.2 | 7.4 | 2.1 |
| Lotus corniculatus | 1.8 | 2.1 | 1.3 | 1.6 | 4.4 | 3.4 | 1.8 | 2.1 | 3.3 | 5.9 |
| Trifolium pratense | 5.4 | 5.0 | 5.0 | 1.5 | 6.5 | 4.6 | 6.5 | 7.3 | 2.7 | 3.5 |
| Scabiosa arvensis* | 0.8 | 1.5 | 0.8 | 4.5 | 2.1 | 5.8 | 0.7 | 4.7 | 0.9 | 3.6 |
| Achillea millefolium | 2.8 | 1.3 | 4.8 | 2.1 | 3.6 | 0.8 | 4.1 | 1.1 | 6.9 | 4.0 |
| Leontodon hispidus | 1.0 | 0.3 | 0.7 | 0.3 | 6.1 | 4.1 | 4.9 | 3.4 | 4.4 | 5.6 |
| Plantago lanceolata | 8.8 | 5.3 | 18.5 | 7.7 | 13.0 | 7.8 | 10.0 | 9.5 | 15.0 | 13.1 |
| Rumex acetosa | 0.6 | 0.5 | 6.9 | 7.8 | 0.8 | 1.1 | 5.7 | 2.6 | 2.9 | 1.7 |

U = Unlimed L = Limed

* The increase in Scabiosa arvensis with lime is chiefly evident in the aftermath.

MIXED MINERAL MANURE, AFTER AMMONIUM SALTS 1856-1868 (Plot 6)

Condition of Plot in 1949 (Unlimed)

Closely resembles Plot 7, but proportion of Leguminosae is frequently higher.

pH 5.0.

Outline of Principal Changes during the Period 1877-1949

Yield. Constant, except for seasonal fluctuations.

Number of Species. Probably only affected by season.

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1877 | 1903 | 1914 | 1919 | 1936 | 1949 |
|---|---|---|---|---|---|---|---|
| G | 80.5 | 80.0 | 35.6 | 63.1 | 57.2 | 37.5 | 37.7 |
| L | 0.3 | 6.7 | 40.8 | 24.4 | 11.4 | 39.4 | 31.3 |
| M | 19.2 | 13.3 | 23.6 | 12.5 | 31.4 | 23.1 | 31.0 |

GRAMINEAE — Proportion decreased.

- Alopecurus pratensis, Avena pubescens — Increased
- Lolium perenne — Disappeared

LEGUMINOSAE — Much increased.

- Lathyrus pratensis — Responsible for most of increase
- Trifolium pratense — Increased

MISCELLANEOUS — Very variable.

- Centaurea nigra — Increased
- Rumex acetosa — Variable

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1949 |
|---|---|---|---|---|---|---|---|---|
| Alopecurus pratensis | 1.7 | < | < | 0.1 | 0.6 | 1.9 | 3.0 | 6.1 |
| Dactylis glomerata | 2.1 | 1.7 | 1.3 | 4.1 | 3.5 | 27.6 | 21.2 | 11.8 |
| Avena pubescens | 14.5 | 0.9 | 1.8 | 1.7 | 7.5 | 6.5 | 5.1 | 3.1 |
| Lolium perenne | 4.6 | 1.4 | 0.7 | 2.0 | 0.1 | - | - | - |
| Trifolium pratense | < | < | < | 0.1 | 5.9 | 5.2 | 0.4 | 5.3 |
| Lathyrus pratensis | 0.2 | - | 1.5 | 6.6 | 30.9 | 17.5 | 9.9 | 20.7 |
| Centaurea nigra | - | 1.4 | 1.4 | 0.4 | 1.4 | 6.1 | 1.8 | 5.5 |
| Rumex acetosa | 12.1 | 24.3 | 7.5 | 7.7 | 5.2 | 0.3 | 10.9 | 1.5 |

< indicates below 0.05

## MIXED MINERAL MANURE AFTER NITRATE OF SODA 1858-1875 (Plot 15)

### Condition of Plot in 1949 (Unlimed)

(a) PH 5.0.

(b) Herbage varied, compares with that on Plot 7, but seasonal differences not always the same on the two plots. Much bottom grass.

(c) Growth starts later than Plot 7.

(d) Yield medium, average generally below that of Plot 7, but sometimes exceeds it.

(e) Twenty-three to thirty species.

(f) The three groups are well represented, but all are exceptionally variable. The range as shown by the partial separations from 1903-1949 was:-

| | Per cent |
|---|---|
| G | 37.8 - 98.5 |
| L | 0.0 - 49.9 |
| M | 1.5 - 36.5 |

### Main Constituents of the Herbage on Plot 15

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris<br>Alopecurus pratensis<br>Dactylis glomerata<br>Festuca rubra | The most abundant species, but precedence varies with season |
| Anthoxanthum odoratum<br>Arrhenatherum avenaceum<br>Avena pubescens<br>Holcus lanatus | Usually present |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Sometimes plentiful |
| Trifolium pratense | Usually in small quantity |

MISCELLANEOUS

| | |
|---|---|
| Conopodium denudatum<br>Achillea millefolium<br>Plantago lanceolata<br>Rumex acetosa | The most abundant species, but quantity varies with season |

OTHER SPECIES:- Avena flavescens, Bromus, Lolium, Poa pratensis, P.trivialis; Lotus, Trifolium repens; Centaurea, Galium, Cerastium, Luzula, Pimpinella, Ranunculus spp. Stellaria, Tragopogon (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Reduced after the manuring changed from nitrate of soda to minerals in 1876. A period of high yields followed from 1897-1908, but since then depression has again set in.

Number of Species. Reduced.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1931 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 17 | 16 | 16 | 17 | 16 | 14 | 12 | 12 | 10 | 10 |
| L | 4 | 4 | 3 | 4 | 5 | 4 | 2 | 4 | 4 | 4 |
| M | 18 | 19 | 19 | 24 | 15 | 12 | 11 | 12 | 9 | 9 |
| Total | 39 | 39 | 39 | 43 | 36 | 30 | 25 | 28 | 23 | 23 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1931 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 78.3 | 80.0 | 78.8 | 83.5 | 50.1 | 59.4 | 69.3 | 80.2 | 61.9 | 42.2 |
| L | 0.3 | 0.5 | 0.1 | 1.8 | 29.0 | 33.1 | 5.4 | 7.7 | 14.1 | 27.8 |
| M | 21.4 | 19.5 | 21.1 | 14.7 | 20.9 | 7.5 | 25.3 | 12.1 | 24.0 | 30.0 |

GRAMINEAE Proportion reduced in some seasons.

| | |
|---|---|
| Agrostis vulgaris<br>Arrhenatherum avenaceum | Increased in some seasons |
| Alopecurus pratensis | Increased until 1919, then somewhat decreased |
| Dactylis glomerata | Increased |
| Poa trivialis | Decreased |
| Lolium perenne | Much reduced since 1919 |
| Briza media<br>Cynosurus cristatus | Disappeared |

LEGUMINOSAE Increased in some seasons

| | |
|---|---|
| Lathyrus pratensis | Chief species to account for increase |
| Trifolium pratense, Trifolium repens | Some increase |

MISCELLANEOUS Little changed, but decreased in a few seasons

| | |
|---|---|
| Achillea millefolium | Increased, particularly in some seasons |
| Plantago lanceolata, Rumex acetosa, Conopodium denudatum | Little changed, variable |

Ajuga, Anthriscus, Heracleum and Veronica are among other species which were present in small quantity before 1919 but have now disappeared.

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1933 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 7.7 | 6.9 | 7.7 | 12.9 | 3.0 | 12.0 | 11.3 | 16.8 | 2.8 |
| Alopecurus pratensis | 6.9 | 6.0 | 2.5 | 7.2 | 10.2 | 13.8 | 30.1 | 10.6 | 18.6 |
| Arrhenatherum avenaceum | 0.1 | - | - | - | 0.2 | 0.5 | 1.5 | 10.8 | 0.6 |
| Briza media | 0.1 | - | 0.2 | 0.3 | 0.2 | - | - | - | - |
| Cynosurus cristatus | 0.1 | - | - | 0.1 | - | - | - | - | - |
| Dactylis glomerata | 2.1 | 0.2 | 0.1 | 0.4 | 0.5 | 2.4 | 4.9 | 12.3 | 8.4 |
| Lolium perenne | 7.5 | 3.2 | 4.4 | 7.3 | - | - | - | 0.2 | - |
| Poa trivialis | 6.5 | 23.7 | 8.0 | 6.1 | 1.2 | 0.4 | 0.2 | 0.1 | - |
| Lathyrus pratensis | - | - | - | 1.5 | 16.3 | 28.0 | 5.3 | 7.7 | 22.3 |
| Trifolium pratense | 0.2 | - | - | 0.3 | 5.8 | 2.6 | 0.1 | 0.5 | 1.8 |
| Trifolium repens | - | 0.1 | 0.1 | - | 6.7 | 2.4 | - | 0.9 | 2.8 |
| Conopodium denudatum | 0.6 | 0.2 | 0.4 | 0.8 | 1.1 | 0.2 | 3.6 | 1.5 | 1.1 |
| Achillea millefolium | 2.5 | 1.1 | 2.6 | 0.6 | 10. 0 | 4.3 | 5.3 | 1.5 | 10.0 |
| Plantago lanceolata | 6.9 | 4.7 | 0.3 | 0.6 | 0.2 | 0.3 | 3.7 | 4.4 | 9.7 |
| Rumex acetosa | 6.6 | 7.3 | 2.1 | 5.8 | 1.6 | 0.2 | 7.3 | 2.3 | 0.8 |

## Effect of Lime

pH. 6.5.

Yield. Usually reduced till 1935 since when it has often increased.

Number of Species. No effect.

Composition of the Herbage. Liming did not begin until 1919, and no botanical separation was made before 1921. Little consistent effect is evident on any of the three main groups, but differences in the composition of the herbage are considerable. Avena pubescens is usually encouraged, while Agrostis vulgaris and Anthoxanthum odoratum are discouraged by liming. Lathyrus pratensis, Trifolium pratense and T.repens are all increased by lime in some seasons. Achillea millefolium is much reduced in the presence of lime, while Heracleum sphondylium is favoured by it.

Effect of Lime on the Percentage of Certain Species

| | 1931 | | 1933 | | 1949 | |
|---|---|---|---|---|---|---|
| | U | L | U | L | U | L |
| Agrostis vulgaris | 20.5 | 2.2 | 16.8 | 3.6 | 2.8 | 0.5 |
| Alopecurus pratensis | 18.3 | 28.7 | 10.6 | 8.9 | 18.6 | 6.8 |
| Anthoxanthum odoratum | 4.9 | 0.6 | 8.2 | 0.8 | 1.7 | 0.3 |
| Arrhenatherum avenaceum | 5.8 | 5.9 | 10.8 | 8.0 | 0.6 | 13.9 |
| Avena pubescens | 3.2 | 12.6 | 4.2 | 12.6 | 1.1 | 12.6 |
| Lathyrus pratensis | 4.7 | 3.8 | 7.8 | 13.8 | 223 | 13.4 |
| Trifolium pratense | 0.1 | 0.5 | 0.5 | 6.0 | 1.7 | 2.8 |
| Trifolium repens | 2.8 | 1.6 | 0.9 | 6.6 | 2.8 | 16.5 |
| Heracleum sphondylium | - | 1.3 | - | 1.4 | - | 3.2 |
| Achillea millefolium | 7.7 | 3.3 | 1.5 | 0.8 | 10.0 | 1.2 |
| Plantago lanceolata | 1.9 | 5.5 | 4.4 | 10.0 | 9.7 | 9.6 |

U = Unlimed L = Limed

## SUPERPHOSPHATE AND SULPHATE OF POTASH, AFTER AMMONIUM SALTS

## 1856-1897 (Plot $5^2$)

### Condition of Plot in 1949 (Unlimed)

(a) pH 4.5.

(b) Herbage very patchy and uneven in height. *Dactylis glomerata* clumps characteristic. Better growth than on Plot $5^1$.

(c) Growth starts late in spring.

(d) Yield medium; considerably higher than Plot $5^1$ (Figure 5).

(e) Nineteen to twenty-seven species.

(f) Herbage well mixed, but the relative proportions of the three main groups vary widely. The range from 1903-1949 was:-

| | Per cent |
|---|---|
| G | 44.6 - 88.7 |
| L | 2.2 - 35.5 |
| M | 7.7 - 39.9 |

### Main Constituents of the Herbage on Plot $5^2$

GRAMINEAE

| | |
|---|---|
| *Festuca rubra* | Chief species, abundant |
| *Agrostis vulgaris*<br>*Alopecurus pratensis*<br>*Anthoxanthum odoratum*<br>*Poa pratensis* | Well represented but vary in relative abundance |
| *Arrhenatherum avenaceum*<br>*Avena pubescens*<br>*Dactylis glomerata*<br>*Holcus lanatus* | Quantities small and variable |

LEGUMINOSAE

| | |
|---|---|
| *Lathyrus pratensis* | Chief species |
| *Lotus corniculatus*<br>*Trifolium pratense* | Sometimes well represented |

MISCELLANEOUS

| | |
|---|---|
| Achillea millefolium | Very prevalent in some years |
| Scabiosa arvensis, Centaurea nigra, Rumex acetosa | Vary much with season |
| Luzula campestris | Dominant in 1930, but had disappeared by 1947 |

OTHER SPECIES:- Poa trivialis; Trifolium repens, Vicia; Cerastium, Conopodium, Galium, Heracleum, Hieracium, Hypochaeris, Pimpinella, Plantago, Ranunculus spp. Stellaria, Veronica (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Reduced during the first fifteen years following the change in manuring in 1898, but since 1912 has tended to increase, and is always higher than that on Plot 5[1].

Number of Species. Reduced after 1867, and have remained fairly constant since 1919. A temporary drop occurred in 1930.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1930 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 17 | 15 | 15 | 13 | 11 | 11 | 8 | 10 | 9 |
| L | 4 | 4 | 3 | 2 | 4 | 3 | 3 | 4 | 5 |
| M | 17 | 17 | 13 | 14 | 17 | 17 | 8 | 13 | 12 |
| Total | 38 | 36 | 31 | 29 | 32 | 31 | 19 | 27 | 26 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1904 | 1914 | 1919 | 1930 | 1934 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| G | 86.3 | 71.9 | 84.7 | 94.1 | 88.7 | 76.3 | 63.2 | 46.0 | 56.0 | 49.1 | 44.6 |
| L | 0.1 | 0.3 | 0.5 | 0.2 | 3.2 | 8.4 | 4.5 | 26.6 | 35.5 | 11.0 | 26.5 |
| M | 13.6 | 27.8 | 14.8 | 5.7 | 8.1 | 15.3 | 32.3 | 27.4 | 8.5 | 39.9 | 28.9 |

GRAMINEAE Proportion decreased since change in manuring

| | |
|---|---|
| Alopecurus pratensis | Increased |
| Poa pratensis | Some increase |
| Agrostis vulgaris, Festuca rubra | Decreased |
| Lolium perenne | Disappeared |

LEGUMINOSAE Considerably increased

| | |
|---|---|
| Lathyrus pratensis, Lotus corniculatus | Much increased |

MISCELLANEOUS Increased

| | |
|---|---|
| Centaurea nigra | Responsible for most of increase |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1926 | 1949 |
|---|---|---|---|---|---|---|---|---|
| Alopecurus pratensis | 0.7 | 0.5 | 0.8 | 0.2 | 4.0 | 11.2 | 12.6 | 9.1 |
| Poa pratensis | 1.1 | 0.7 | 0.6 | 0.2 | 4.7 | 6.3 | 2.2 | 2.6 |
| Bromus mollis | - | - | - | - | 3.0 | 0.1 | - | - |
| Agrostis vulgaris | 24.3 | 21.0 | 26.6 | 29.5 | 16.7 | 8.4 | 20.7 | 7.1 |
| Festuca rubra | 22.0 | 30.6 | 46.6 | 53.3 | 34.3 | 19.6 | 13.7 | 11.5 |
| Lolium perenne | 3.3 | 1.2 | 1.0 | 0.1 | - | - | - | - |
| Lotus corniculatus | 0.1 | 0.3 | 0.4 | 0.1 | 3.9 | 3.1 | 1.6 | 5.2 |
| Lathyrus pratensis | < | < | < | 0.1 | 2.0 | 1.3 | 6.7 | 16.8 |
| Centaurea nigra | < | 2.4 | 2.2 | 0.5 | 9.0 | 3.4 | 3.2 | 5.4 |
| Rumex acetosa | 9.2 | 15.9 | 7.1 | 2.1 | 2.5 | 18.1 | 3.0 | 5.7 |
| Luzula campestris | 1.1 | 0.6 | 0.2 | 0.1 | 0.7 | 4.3 | 3.3 | 1.8 |

< indicates below 0.05

## SUPERPHOSPHATE OF LIME (Plot 4[1])

### Condition of Plot in 1949 (Unlimed)

(a) pH 5.5.

(b) Herbage resembles that of unmanured plots in spring, but later becomes more luxuriant.

(c) Growth starts late in spring.

(d) Yield medium (Figure 8).

(e) Twenty-nine to forty-four species. Considerable seasonal fluctuation but tending to decrease.

(f) The three main groups of plants are all well represented, the proportion being very variable. The range as shown by the partial separations from 1903-1949 was:-

| | Per cent. |
|---|---|
| G | 32.5 - 67.7 |
| L | 2.6 - 17.6 |
| M | 28.4 - 54.0 |

### Main Constituents of the Herbage on Plot 4[1]

GRAMINEAE

| | |
|---|---|
| Avena pubescens<br>Festuca rubra<br>Dactylis glomerata<br>Holcus lanatus | Chief species; vary in relation abundance |
| Anthoxanthum odoratum | |

LEGUMINOSAE

| | |
|---|---|
| Trifolium pratense<br>Lathyrus pratensis<br>Lotus corniculatus<br>Trifolium repens | Well represented |

MISCELLANEOUS

Plantago lanceolata
Ranunculus spp.
Achillea millefolium
Leontodon hispidus
Rumex acetosa
} Often very plentiful

OTHER SPECIES:- Agrostis, Alopecurus, Arrhenatherum, Festuca pratensis, Lolium, Poa pratensis; Centaurea, Cerastium, Conopodium, Luzula, Pimpinella, Poterium, Stellaria, Taraxacum, Hypochaeris (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Fairly constant, but fell during 1936-45 since when the former level has been nearly regained.

Number of Species. Reduced, but only Miscellaneous species show a marked change.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 16 | 15 | 16 | 16 | 15 | 14 | 14 | 14 | 15 |
| L | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| M | 24 | 25 | 26 | 22 | 22 | 15 | 13 | 14 | 14 |
| Total | 44 | 44 | 47 | 43 | 41 | 34 | 32 | 32 | 34 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 75.0 | 66.9 | 67.0 | 71.8 | 43.0 | 57.7 | 52.8 | 46.8 | 46.7 |
| L | 2.8 | 2.8 | 8.6 | 5.5 | 17.6 | 17.7 | 2.7 | 13.5 | 14.4 |
| M | 22.2 | 30.3 | 24.4 | 22.7 | 39.4 | 34.6 | 44.5 | 39.7 | 38.9 |

GRAMINEAE Proportion reduced

Dactylis glomerata — Increased
Agrostis vulgaris
Lolium perenne
Poa trivialis
} Much decreased

LEGUMINOSAE Variable, but on the whole increased

MISCELLANEOUS Increased

| | |
|---|---|
| Leontodon hispidus<br>Plantago lanceolata | Responsible for most of increase |
| Rumex acetosa | Variable, dominant in 1947 |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1949 |
|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 7.2 | 6.1 | 13.9 | 9.9 | - | 0.9 | 0.7 | 2.0 |
| Alopecurus pratensis | 1.3 | 1.8 | 0.9 | 1.4 | 0.3 | 0.1 | 0.1 | 2.2 |
| Avena pubescens | 9.4 | 5.0 | 4.1 | 4.0 | 9.8 | 9.9 | 13.9 | 5.5 |
| Dactylis glomerata | 2.3 | 1.0 | 0.6 | 1.4 | 1.3 | 4.6 | 11.3 | 7.1 |
| Lolium perenne | 9.3 | 5.2 | 3.1 | 4.4 | - | 0.1 | 0.2 | 0.3 |
| Poa trivialis | 5.2 | 5.7 | 3.8 | 4.7 | 0.6 | 0.6 | 1.4 | 0.5 |
| Ranunculus spp. | 5.9 | 1.4 | 4.3 | 6.1 | 1.5 | 0.4 | 1.6 | 3.8 |
| Centaurea nigra | 0.4 | 0.4 | 1.0 | 0.7 | 4.8 | 8.6 | 7.5 | 1.7 |
| Leontodon hispidus | 0.6 | 0.6 | 0.1 | 0.9 | 14.7 | 12.4 | 2.5 | 11.0 |
| Plantago lanceolata | 5.6 | 9.7 | 3.1 | 3.8 | 2.5 | 6.8 | 17.8 | 8.5 |

Effect of Lime

pH. 7.0

Yield. Consistently decreased.

Number of Species. No effect.

Composition of Herbage.

| | |
|---|---|
| GRAMINEAE | Reduced or little affected. |
| LEGUMINOSAE | Considerably increased. |
| MISCELLANEOUS | Reduced or little affected. |

A noticeable feature is the number of species that are affected by liming whether beneficially or adversely. The action of lime on Leontodon hispidus and Rumex acetosa varies with season.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1949 | |
|---|---|---|---|---|---|---|
| | U | L | U | L | U | L |
| Alopecurus pratensis | - | 1.3 | 0.1 | 1.5 | 2.2 | 2.4 |
| Anthoxanthum odoratum | 4.0 | 1.5 | 3.2 | 1.8 | 3.4 | 1.1 |
| Avena pubescens | 9.9 | 12.7 | 13.9 | 19.8 | 5.5 | 18.1 |
| Briza media | 2.2 | 3.4 | 1.3 | 2.8 | 0.5 | 1.8 |
| Dactylis glomerata | 4.6 | 1.8 | 11.3 | 6.4 | 7.1 | 4.9 |
| Holcus lanatus | 8.6 | 6.4 | 9.9 | 6.8 | 6.7 | 4.5 |
| Lathyrus pratensis | 1.7 | 11.2 | 1.6 | 5.0 | 3.0 | 7.3 |
| Lotus corniculatus | 1.1 | 2.1 | 0.7 | 3.6 | 3.7 | 7.7 |
| Ranunculus spp. | 0.4 | 1.1 | 1.6 | 4.5 | 3.8 | 2.3 |
| Leontodon hispidus | 12.4 | 6.8 | 2.5 | 2.3 | 11.0 | 6.3 |
| Plantago lanceolata | 6.8 | 4.0 | 17.8 | 11.2 | 8.5 | 9.7 |
| Rumex acetosa | 0.7 | 0.6 | 10.2 | 6.2 | 5.8 | 2.1 |

U = Unlimed L = Limed

C. NITRATE OF SODA WITH AND WITHOUT MINERAL MANURES (Table 4).

NITRATE OF SODA (= 43 lb. N per acre) (Plot 17).

Condition of Plot in 1949 (Unlimed)

(a) pH 6.0.

(b) Herbage very mixed, uneven, of a dark blackish green colour; not so tall as on Plot 16.

(c) Growth starts early, but progresses slowly.

(d) Yield medium, rather less variable than on many other plots.

(e) Usually about thirty species with an occasional trace of several others.

(f) GRAMINEAE rather more than twice as plentiful as MISCELLANEOUS species.
LEGUMINOSAE scarce.
A large number of species occur in very small quantity.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1947 | | 1949 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Alopecurus pratensis | 1.2 | 27.2 | 0.8 | 63.9 | 1.1 | 78.9 | 0.1 | 82.0 |
| Anthoxanthum odoratum | 0.1 | 2.1 | - | 0.1 | 0.8 | 0.6 | - | < |
| Arrhenatherum avenaceum | 6.6 | 27.0 | 31.3 | 15.5 | 0.3 | 2.0 | - | 2.3 |
| Dactylis glomerata | 0.2 | 4.9 | 0.2 | 5.7 | - | 2.5 | - | 4.9 |
| Holcus lanatus | 90.9 | 32.0 | 64.8 | 11.6 | 81.1 | 7.6 | 99.6 | 3.5 |
| Poa pratensis | - | 2.7 | - | 2.0 | - | 4.5 | - | 5.2 |

U = Unlimed L = Limed

The percentage of Holcus lanatus on the unlimed area in 1947 would probably have been greater if Epilboium angustifolium had not been so prevalent.

## AMMONIUM SALTS (=129 lb. N per acre) AND MIXED MINERAL MANURE WITH SILICATE OF SODA (Plot $11^2$)

### Condition of Plot in 1949 (Unlimed)

(a) Ph 4.0.

(b) Bare patches rather less extensive than on Plot $11^1$, owing to the ameliorating action of the silicate. The latter seems to have decreased Holcus lanatus but increased Agrostis vulgaris and Arrhenatherum avenaceum.

(c) Growth starts very early as on Plot $11^1$.

(d) Yield the heaviest of the unlimed plots; generally less variable than that of Plot $11^1$.

(e) Eight species, with occasional traces of a few others.

(f) GRAMINEAE form practically all the herbage.

LEGUMINOSAE almost always absent.

MISCELLANEOUS plants usually absent, but occasionally up to 1.5 per cent.

## Main Constituents of the Herbage on Plot 11[2]

GRAMINEAE

Agrostis vulgaris
Arrhenatherum avenaceum
Holcus lanatus

} Relative proportions vary with season

OTHER SPECIES (Mostly of very rare occurrence). Alopecurus, Anthoxanthum, Avena flavescens, A.pubescens, Dactylis, Festuca rubra, Poa pratensis, P.trivialis; Lathyrus, Lotus; Plantago, Ranunculus spp. Rumex (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Reduced, especially since 1904.

Number of Species. Reduced.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 14 | 14 | 13 | 11 | 9 | 9 | 7 | 6 |
| L | - | - | - | - | - | - | - | - |
| M | 7 | 5 | 3 | 5 | - | 1 | 1 | 1 |
| Total | 21 | 19 | 16 | 16 | 9 | 10 | 8 | 7 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| G | 94.2 | 95.7 | 99.3 | 98.5 | 100.0 | 99.6 | 98.8 | 99.4 |
| L | - | - | - | - | - | - | - | - |
| M | 5.8 | 4.3 | 0.7 | 1.5 | - | 0.4 | 1.2 | 0.6 |

GRAMINEAE

Agrostis vulgaris — Much reduced between 1877 and 1914. Temporary increase up to 1947 at expense of Alopecurus pratensis*.

---

* This increase probably dates from 1929 when most of the herbage was killed by frost, and changes in flora occurred during recolonisation. Precise data are, however, lacking.

| | |
|---|---|
| Holcus lanatus | Much increased |
| Arrhenatherum avenaceum, Alopecurus pratensis | Recently much reduced |
| Dactylis glomerata, Poa pratensis | Almost disappeared |
| Festuca rubra | Little affected |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 18.8 | 24.2 | 10.2 | 17.1 | 0.5 | 0.7 | 44.1 | 5.3 |
| Alopecurus pratensis | 1.5 | 6.3 | 22.7 | 20.1 | 17.5 | 29.8 | 0.8 | 0.3 |
| Arrhenatherum avenaceum | 6.4 | 4.8 | 12.7 | 21.1 | 20.7 | 45.7 | 12.7 | 0.8 |
| Dactylis glomerata | 23.3 | 38.3 | 27.2 | 13.4 | 0.3 | 2.8 | - | < |
| Festuca rubra | 0.7 | 2.1 | 0.3 | 2.6 | < | 0.1 | 0.2 | 0.1 |
| Holcus lanatus | 7.4 | 4.8 | 10.6 | 19.5 | 59.4 | 20.4 | 40.8 | 92.8 |
| Poa pratensis | 5.1 | 10.4 | 12.4 | 4.5 | 0.7 | 0.1 | 0.1 | - |

< indicates below 0.05

## Effect of Lime

pH. 4.5.

Yield. Usually increased but the difference due to lime is much less regular or marked than on Plot 11[1] and yield may occasionally be reduced.

Number of Species. No constant effect.

Composition of the Herbage. Balance between GRAMINEAE, LEGUMINOSAE and MISCELLANEOUS species not affected.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1947 | | 1949 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 0.5 | 0.2 | 0.7 | - | 44.1 | 0.2 | 5.3 | - |
| Alopecurus pratensis | 17.6 | 49.7 | 29.8 | 76.0 | 0.8 | 70.2 | 0.3 | 57.6 |
| Arrhenatherum avenaceum | 20.8 | 25.6 | 45.7 | 16.3 | 12.7 | 11.3 | 0.8 | 17.5 |
| Dactylis glomerata | 0.3 | 11.0 | 2.8 | 7.3 | - | 7.8 | < | 10.3 |
| Holcus lanatus | 59.4 | 6.2 | 20.4 | < | 40.8 | 2.4 | 92.8 | 1.6 |
| Poa pratensis | 0.7 | 3.5 | 0.1 | 0.2 | 0.1 | 6.3 | - | 10.7 |

U = Unlimed L = Limed

The increase in Alopecurus pratensis and the decrease in Holcus lanatus are very marked. Arrhenatherum avenaceum shows a seasonal response to lime similar to that on Plot 11[1].

## E. AMMONIUM SALTS ALONE OR WITH INCOMPLETE MINERAL MANURE

(Tables 5 and 6)

### AMMONIUM SALTS (= 43 lb. N per acre) ALONE, ALSO WITH FARMYARD MANURE 1856-1863 (Plot 1)

Condition of Plot in 1949 (Unlimed)

(a) pH 4.5.

(b) The herbage is very patchy and areas of bare soil often occur. Later in the season the grass becomes fairly long and very dark green with a tendency to lodge.

(c) Growth starts late.

(d) Yield usually low, occasionally higher than on unmanured plots but may be lower.

(e) About eleven species, with traces of several others.

(f) GRAMINEAE form bulk of herbage.

LEGUMINOSAE absent.

MISCELLANEOUS species up to about 7 per cent, but frequently less.

Main Constituents of the Herbage on Plot 1

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris | Chief species |
| Festuca rubra | Plentiful |
| Dactylis glomerata | Usually present in small quantities |

MISCELLANEOUS

| | |
|---|---|
| Centaurea nigra<br>Rumex acetosa | Quantity variable, may be very plentiful |
| Potentilla reptans | Quantity small but characteristic |

OTHER SPECIES (Mostly of very rare occurrence). Alopecurus, Anthoxanthum, Arrhenatherum, Avena flavescens, A.pubescens, Holcus, Lolium, Poa pratensis P.trivialis; Lathyrus, Lotus, Trifolium pratense, T.repens; Achillea, Anthriscus, Cerastium, Conopodium, Epilobium, Galium, Heracleum, Leontodon, Luzula, Pimpinella, Plantago, Poterium, Ranunculus spp., Taraxacum, Tragopogon, Veronica (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. Reduced.

Number of Species. Very much reduced.

Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1939 | 1948 |
|---|---|---|---|---|---|---|---|---|
| G | 15 | 15 | 18 | 15 | 9 | 10 | 7 | 6 |
| L | 4 | 4 | 3 | 2 | - | - | - | - |
| M | 9 | 15 | 15 | 17 | 8 | 5 | 4 | 5 |
| Total | 28 | 34 | 36 | 34 | 17 | 15 | 11 | 11 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1939 | 1948 |
|---|---|---|---|---|---|---|---|---|
| G | 89.0 | 86.4 | 82.2 | 84.0 | 78.9 | 86.4 | 95.3 | 94.7 |
| L | 0.2 | 1.0 | 0.3 | 0.5 | - | - | - | - |
| M | 10.8 | 12.6 | 17.5 | 15.5 | 21.1 | 13.6 | 4.7 | 5.3 |

GRAMINEAE Increased.

- Agrostis vulgaris, Festuca rubra — Much increased
- Dactylis glomerata — Variable
- Avena pubescens, Poa pratensis — Practically disappeared
- Avena flavescens, Poa trivialis, Bromus mollis, Lolium perenne — Disappeared

LEGUMINOSAE Traces in some years.

MISCELLANEOUS

| | |
|---|---|
| Centaurea nigra | Little change, but unusually plentiful in 1914 |
| Rumex acetosa | Variable |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1939 | 1948 |
|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 0.6 | 6.5 | 20.8 | 23.5 | 16.0 | 18.5 | 52.5 | 75.4 |
| Avena flavescens | 4.0 | 6.9 | 6.2 | 1.4 | - | 0.1 | - | - |
| Avena pubescens | 0.5 | 1.6 | 2.8 | 2.1 | 0.1 | 0.2 | - | 0.2 |
| Bromus mollis | 21.9 | 10.6 | 4.6 | 0.8 | - | - | - | - |
| Dactylis glomerata | 16.4 | 6.4 | 3.3 | 4.2 | 9.5 | 11.3 | 0.8 | 3.2 |
| Festuca rubra | 0.8 | 6.2 | 6.4 | 10.8 | 28.1 | 14.3 | 40.9 | 15.6 |
| Lolium perenne | 1.4 | 3.2 | 1.7 | 1.7 | - | - | - | - |
| Poa pratensis | 1.5 | 6.6 | 7.4 | 1.4 | 0.6 | 0.4 | 0.2 | - |
| Poa trivialis | 31.9 | 22.3 | 4.4 | 2.7 | - | - | - | - |
| Centaurea nigra | - | 0.2 | 1.2 | 0.3 | 19.2 | 2.1 | 0.4 | 0.8 |
| Rumex acetosa | 6.1 | 5.7 | 9.3 | 10.5 | 0.6 | 9.9 | 2.0 | 2.5 |

Effect of Lime

The herbage is more even and thicker than when unlimed.

pH. 7.0.

Yield. Generally much increased but effect varies with season.

Number of Species. Considerably increased.

Composition of the Herbage.

GRAMINEAE Reduced.

| | |
|---|---|
| Agrostis vulgaris | Decreased |
| Alopecurus pratensis, Avena pubescens, Dactylis glomerata | Increased |
| Festuca rubra | Effect varies with season |

LEGUMINOSAE Slightly increased.

MISCELLANEOUS Considerably increased.

| | |
|---|---|
| Plantago lanceolata | Accounts for most of increase |

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1939 | | 1948 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 16.0 | 12.3 | 18.5 | 8.5 | 52.5 | 3.7 | 75.3 | 1.5 |
| Alopecurus pratensis | 2.0 | 4.5 | 1.3 | 5.9 | 0.2 | 4.0 | 0.1 | 2.5 |
| Anthoxanthum odoratum | 15.0 | 6.9 | 17.5 | 7.9 | 0.7 | 2.4 | 0.2 | 1.4 |
| Avena pubescens | 0.1 | 5.1 | 0.2 | 7.7 | - | 34.8 | 0.2 | 12.1 |
| Dactylis glomerata | 9.5 | 7.0 | 11.3 | 23.4 | 0.8 | 13.1 | 3.2 | 18.3 |
| Festuca rubra | 28.1 | 25.9 | 14.3 | 10.6 | 40.9 | 15.2 | 15.6 | 15.4 |
| Holcus lanatus | 7.1 | 5.5 | 22.4 | 10.0 | - | 3.6 | - | 5.8 |
| Poa pratensis | 0.6 | 3.9 | 0.4 | 1.8 | 0.2 | 2.3 | - | 1.3 |
| Centaurea nigra | 19.2 | 22.2 | 2.1 | 4.1 | < | 4.7 | 0.7 | 2.0 |
| Plantago lanceolata | - | - | - | - | - | 3.5 | - | 19.8 |
| Rumex acetosa | 0.6 | 1.0 | 9.9 | 11.5 | 2.0 | 1.7 | 2.5 | 2.1 |

U = Unlimed L = Limed

< indicates below 0.05

AMMONIUM SALTS (= 86 lb. N per acre) AND SUPERPHOSPHATE OF LIME

(Plot $4^2$)

Condition of Plot in 1949 (Unlimed)

(a) pH. 4.0.

(b) Herbage dark green. Tufts of Anthoxanthum odoratum and Festuca rubra with much Agrostis vulgaris at the base are characteristic. Bare patches of undecomposed peaty matter common.

(c) Growth starts early in spring.

(d) Yield medium to low, but very variable (Figure 11).

(e) Eleven to eighteen species with occasional traces of several others till 1919, but only seven present in 1947.

(f) GRAMINEAE form bulk of herbage.

LEGUMINOSAE absent.

MISCELLANEOUS species in fair quantity in some seasons, very scanty in others.

## Main Constituents of the Herbage on Plot 4[2]

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris, Festuca rubra | Chief species |
| Anthoxanthum odoratum | Varies with season |
| Holcus lanatus | Sometimes fairly plentiful |

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | Very variable |

OTHER SPECIES (Mostly of rare occurrence). Alopecurus, Avena pubescens, Dactylis, Poa pratensis, P.trivialis; Lathyrus; Achillea, Conopodium, Epilobium, Leontodon (See Tables).

## Outline of Principal Changes during the Period 1877-1949

Yield. Considerably reduced, particularly since 1911.

Number of Species. Reduced in all three groups of plants independent of season.

### Number of Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 14 | 14 | 15 | 13 | 9 | 9 | 8 | 5 | 5 |
| L | 3 | 3 | 2 | 2 | 1 | - | - | - | - |
| M | 18 | 13 | 11 | 11 | 5 | 6 | 2 | 2 | 1 |
| Total | 35 | 30 | 28 | 26 | 15 | 15 | 10 | 7 | 6 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| G | 80.3 | 86.1 | 88.7 | 94.6 | 93.6 | 98.7 | 92.0 | 97.9 | 99.8 |
| L | 0.1 | < | < | < | < | - | - | - | - |
| M | 19.6 | 13.8 | 11.3 | 5.3 | 6.4 | 1.3 | 8.0 | 2.1 | 0.2 |

< indicates below 0.05

GRAMINEAE

| | |
|---|---|
| Anthoxanthum odoratum | Increased, very considerably in some seasons |
| Agrostis vulgaris | Reduced between 1877 and 1919, but had increased again by 1947 |
| Holcus lanatus | Apparently increasing |
| Festuca rubra | Decreased in some seasons |
| Lolium perenne, Poa trivialis | Disappeared |

LEGUMINOSAE Disappeared.

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | Now the chief species but quantity small and very variable |

Changes in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1903 | 1914 | 1919 | 1947 | 1949 |
|---|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 19.4 | 14.0 | 20.6 | 24.4 | 2.0 | 12.9 | 4.3 | 68.8 | 36.2 |
| Anthoxanthum odoratum | 2.2 | 5.5 | 1.5 | 2.4 | 23.4 | 7.7 | 34.1 | 14.5 | 10.0 |
| Festuca rubra | 6.8 | 26.1 | 49.3 | 55.2 | 53.6 | 73.0 | 47.9 | 9.6 | 35.3 |
| Holcus lanatus | 16.2 | 10.5 | 2.0 | 6.0 | 1.1 | < | 0.3 | 4.8 | 17.5 |
| Lolium perenne | 6.5 | 1.4 | 0.7 | 0.2 | - | - | - | - | - |
| Poa trivialis | 8.1 | 2.2 | 2.1 | 0.3 | 0.2 | - | - | - | - |
| Rumex acetosa | 13.4 | 8.4 | 6.9 | 3.1 | 0.5 | 0.5 | 8.0 | 1.3 | 0.2 |

< indicates below 0.05

Effect of Lime

Herbage greatly improved. Grass tall, thick and less tussocky, though inclined to be rank. Starts into growth much earlier than unlimed area.

pH. 5.5.

Yield. Much increased.

Number of Species. No constant effect until 1919, but much increased by 1947.

Composition of the Herbage.

The GRAMINEAE may be considerably reduced on the limed area in some seasons by an influx of MISCELLANEOUS species. In 1947, for example, the GRAMINEAE comprised

98 per cent and MISCELLANEOUS species 2 per cent of the herbage on the unlimed area, whereas with lime the GRAMINEAE amounted to only 77 per cent, 21 per cent of the remaining herbage consisting of Rumex acetosa.

Alopecurus pratensis is much increased and Agrostis vulgaris much decreased by lime, but the effect on Anthoxanthum odoratum/Festuca rubra and Rumex acetosa varies with season.

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1947 | | 1949 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 12.9 | 1.0 | 4.2 | 0.3 | 68.8 | 1.8 | 36.2 | 2.2 |
| Alopecurus pratensis | 2.5 | 42.2 | 1.4 | 76.1 | 0.2 | 32.5 | 0.7 | 24.3 |
| Anthoxanthum odoratum | 7.7 | 7.6 | 34.0 | 1.1 | 14.5 | 4.6 | 10.0 | 1.2 |
| Festuca rubra | 73.0 | 35.1 | 47.9 | 7.7 | 9.6 | 29.8 | 35.3 | 57.4 |
| Poa pratensis | 1.2 | 12.6 | 0.4 | 12.8 | - | 5.3 | - | 6.3 |
| Rumex acetosa | 0.5 | 0.5 | 8.0 | 1.6 | 1.3 | 20.6 | 0.2 | 3.9 |

U = Unlimed L = Limed

AMMONIUM SALTS (= 86 lb. N per acre) AND MIXED MINERAL MANURE WITHOUT SUPERPHOSPHATE, AFTER MINERALS AND AMMONIUM SALTS SUPPLYING THE CONSTITUENTS OF 1 TON OF HAY, 1865-1904 (Plot 18)

Condition of Plot in 1949 (Unlimed)

(a) pH not determined in 1945. (4.0 in 1957).

(b) Herbage dark green in summer; growth patchy with much bare ground; brown in winter with dead Agrostis vulgaris and Festuca rubra.

(c) Growth starts fairly early, but young green is masked by dead grass.

(d) Yield usually medium, but frequently low especially in later years.

(e) Seven to nineteen species with occasional traces of others.

(f) GRAMINEAE usually form bulk of herbage.

LEGUMINOSAE absent.

MISCELLANEOUS species, chiefly Rumex acetosa, may be up to 20 per cent in some seasons.

## Main Constituents of the Herbage on Plot 18

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris | Chief species |
| Dactylis glomerata | Formerly the chief species, now unimportant |
| Festuca rubra | Plentiful in some seasons |
| Alopecurus pratensis<br>Anthoxanthum odoratum<br>Arrhenatherum avenaceum<br>Holcus lanatus | All much less plentiful than the above but quantity varies with season |

MISCELLANEOUS

| | |
|---|---|
| Rumex acetosa | Chief species, but quantity variable |
| Centaurea nigra | Frequently absent, but may be important e.g. 1938 |

OTHER SPECIES (Mostly of very rare occurrence). Avena flavescens, Bromus, Poa annua, P.pratensis, P.trivialis; Lotus, Trifolium pratense, T.repens; Achillea, Cerastium, Conopodium, Epilobium, Heracleum, Leontodon, Luzula, Pimpinella, Plantago, Prunella, Ranunculus spp., Stellaria, Taraxacum, Tragopogon (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. Fairly constant till the change in manuring in 1905. Reduced since 1908 though seasonal fluctuations are large.

Number of Species. Considerably reduced. Data regarding the effect of the manurial change are unfortunately lacking.

### Number of Species

| | 1867 | 1872 | 1877 | 1914 | 1919 | 1928 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|---|
| G | 15 | 18 | 14 | 10 | 10 | 10 | 6 | 6 |
| L | 4 | 4 | 4 | 1 | - | - | - | - |
| M | 21 | 22 | 21 | 5 | 5 | 6 | 2 | 3 |
| Total | 40 | 44 | 39 | 16 | 15 | 16 | 8 | 9 |

Composition of the Herbage.

### Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1872 | 1877 | 1914 | 1919 | 1928 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|---|
| G | 55.5 | 80.8 | 84.2 | 93.3 | 68.9 | 96.3 | 93.7 | 88.5 |
| L | 5.0 | 3.6 | 2.0 | 0.1 | - | - | - | - |
| M | 39.5 | 15.6 | 13.8 | 6.7 | 31.1 | 3.7 | 6.3 | 11.5 |

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris | Much increased |
| Dactylis glomerata | Much increased at first, but practically disappeared by 1943 |
| Alopecurus pratensis | Increased at first, then fairly steady but quantity small |
| Holcus lanatus | Much reduced |
| Avena flavescens, Avena pubescens, Lolium perenne, Poa trivialis | Disappeared |

LEGUMINOSAE — Practically disappeared

MISCELLANEOUS

| | |
|---|---|
| Centaurea nigra | Almost disappeared, but prominent in 1938 |
| Rumex acetosa | Very variable, probably increased |
| Ranunculus spp. | Disappeared |

Changes in the Percentage of Certain Species

| | 1867 | 1872 | 1877 | 1914 | 1919 | 1928 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 7.3 | 22.0 | 16.4 | 10.0 | 17.6 | 59.0 | 74.6 | 76.9 |
| Alopecurus pratensis | 1.0 | 0.9 | 0.8 | 3.3 | 5.1 | 5.3 | 1.8 | 0.1 |
| Avena flavescens | 3.4 | 5.8 | 3.1 | 0.1 | - | < | - | - |
| Avena pubescens | 2.9 | 2.6 | 1.9 | 0.1 | 0.1 | - | - | - |
| Dactylis glomerata | 1.8 | 1.2 | 1.3 | 37.1 | 34.0 | 9.3 | - | 1.3 |
| Holcus lanatus | 12.8 | 7.3 | 17.5 | 0.9 | 2.4 | 8.2 | 0.5 | -- |
| Lolium perenne | 5.2 | 3.4 | 6.5 | - | - | - | - | - |
| Poa trivialis | 4.8 | 2.9 | 2.8 | - | - | < | 0.1 | - |
| Ranuculus app. | 5.7 | 3.1 | 2.6 | - | - | - | - | - |
| Centaurea nigra | 0.8 | 0.8 | 0.9 | 4.5 | 1.9 | < | - | - |
| Rumex acetosa | 24.3 | 2.0 | 4.7 | 1.1 | 24.6 | 3.2 | 6.2 | 11.2 |

< indicates below 0.05

Effect of Lime

In 1920 the plot was divided into three sections, one of which remained unlimed, while the other two received light (3,951 lb. per acre) and heavy (6,788 lb. per acre) dressings of ground lime respectively every four years. These quantities were originally based on the lime requirement of the soil as shown by its pH value (light dressing, LL) and the Hutchinson-Maclennan method (heavy

dressing, HL). A complete change in the herbage resulted with both levels of lime, the appearance of large quantities of Taraxacum vulgare being the chief feature.

pH. Not determined in 1945. (LL = 7.5; HL = 8.0 in 1957).

Yield. Much increased, especially by the heavy dressing.

Number of Species. Increased.

Number of Species

| | 1928 | | | 1946 | | | 1948 | | |
|---|---|---|---|---|---|---|---|---|---|
| | U | LL | HL | U | LL | HL | U | LL | HL |
| G | 10 | 11 | 10 | 6 | 13 | 13 | 6 | 14 | 11 |
| L | - | - | 1 | - | 3 | 2 | - | 1 | 2 |
| M | 6 | 5 | 6 | 2 | 11 | 9 | 3 | 11 | 6 |
| Total | 16 | 16 | 17 | 8 | 27 | 24 | 9 | 26 | 19 |

Composition of the Herbage.

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris | Much decreased |
| Arrhenatherum avenaceum | Much increased |
| Dactylis glomerata | Much increased |

LEGUMINOSAE Slightly increased

MISCELLANEOUS Much increased

| | |
|---|---|
| Taraxacum vulgare | Responsible for most of increase |
| Plantago lanceolata | Increased |
| Centaurea nigra | Increased in some seasons |
| Rumex acetosa | Decreased |

Effect of Lime on the Percentage of Certain Species

| | 1921 | | | 1928 | | | 1946 | | | 1948 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | LL | HL | U | LL | HL | U | LL | HL | U | LL | HL |
| Agrostis vulgaris | 50.9 | 41.2 | 42.5 | 59.0 | 17.5 | 4.8 | 74.6 | 2.0 | 1.4 | 76.9 | 3.4 | 1.2 |
| Arrhenatherum avenaceum | 0.8 | 2.0 | 1.7 | 0.4 | 2.9 | 18.1 | - | 10.1 | 10.3 | 0.5 | 24.6 | 25.0 |
| Dactylis glomerata | 12.0 | 21.8 | 12.9 | 9.3 | 21.1 | 37.7 | - | 12.5 | 36.5 | 1.3 | 35.0 | 48.3 |
| Festuca rubra | 11.4 | 6.0 | 7.5 | 6.2 | 2.8 | 3.1 | 12.5 | 9.8 | 5.1 | 8.9 | 6.8 | 2.2 |
| Lathyrus pratensis | - | - | - | - | - | 0.2 | - | 0.1 | 1.4 | - | - | 0.5 |
| Trifolium pratense | - | - | - | - | - | - | - | 0.4 | < | - | 0.1 | 0.1 |
| Centaurea nigra | 1.7 | 2.3 | 1.8 | < | < | 0.2 | - | 10.3 | 0.9 | - | 3.5 | - |
| Heracleum sphondylium | 0.3 | - | 0.5 | 0.1 | - | 3.1 | - | 1.5 | 2.4 | - | 0.6 | 1.6 |
| Plantago lanceolata | - | - | - | - | - | - | 0.1 | 17.3 | 4.5 | - | 3.8 | 1.0 |
| Taraxacum vulgare | - | - | - | - | < | 0.2 | - | 22.6 | 23.4 | 0.2 | 8.9 | 10.8 |
| Rumex acetosa | 6.3 | 11.2 | 14.1 | 3.2 | 2.4 | 1.0 | 6.2 | 0.5 | 0.9 | 11.2 | 0.2 | 0.4 |

U = Unlimed; LL = Light Lime; HL = Heavy Lime

< indicates below 0.25

## F. ORGANIC MANURES (TABLE 6).

FARMYARD MANURE AND FISH GUANO ALTERNATELY (EACH ONCE IN FOUR YEARS) AFTER CUT WHEAT STRAW, MINERALS AND AMMONIUM SALTS 1856-1897, AND MINERALS AND AMMONIUM SALTS 1898-1904 (Plot 13)

Condition of Plot in 1949 (Unlimed)

(a) pH 4.6.

(b) Herbage very strong and tall; inclined to lodge; little bottom grass.

(c) Growth starts early in spring, especially in years that farmyard manure is applied.

(d) Yield heavy, but less so since 1938. More uniform than on plots receiving large dressings of artificial manures.

(e) Twenty to twenty-six species with occasional traces of several others.

(f) GRAMINEAE usually from 75-86 per cent.

(f) contd. LEGUMINOSAE very scarce.

MISCELLANEOUS plants 14-25 per cent.

## Main Constituents of the Herbage on Plot 13

GRAMINEAE

| | |
|---|---|
| Alopecurus pratensis | Chief species |
| Agrostis vulgaris | Relative abundance varies with season |
| Anthoxanthum odoratum | |
| Dactylis glomerata | |
| Festuca rubra | |
| Holcus lanatus | |

MISCELLANEOUS

| | |
|---|---|
| Plantago lanceolata | Chief species |
| Conopodium denudatum | Vary with season |
| Achillea millefolium | |
| Rumex acetosa | |

OTHER SPECIES:- Arrhenatherum, Avena flavescens, A.pubescens, Bromus, Lolium, Poa pratensis, P.trivialis; Lathyrus, Trifolium pratense; Anthriscus, Ajuga, Centaurea, Cerastium, Galium, Heracleum, Hypochaeris, Leontodon, Luzula, Ranunculus spp., Stellaria, Taraxacum, Tragopogon, Veronica (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. Slightly reduced at first, but fell sharply when manuring changed in 1904. Some improvement then occurred till 1938 when further reduction set in.

Number of Species. Little changed but considerable seasonal variation.

Composition of the Herbage. Changes are confined to the GRAMINEAE, and probably date from the alteration in manuring in 1904, but unfortunately no complete botanical analysis was made in 1903.

## Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1944 | 1947 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 90.4 | 86.3 | 95.4 | 92.0 | 96.6 | 79.8 | 85.8 | 76.6 | 73.8 |
| L | 0.3 | 0.1 | 0.3 | - | 0.5 | 0.1 | 0.3 | 0.7 | 0.5 |
| M | 9.3 | 13.6 | 4.3 | 8.0 | 3.0 | 20.1 | 13.9 | 22.7 | 25.7 |

GRAMINEAE Proportion reduced

| | |
|---|---|
| Alopecurus pratensis, Anthoxanthum odoratum | Increased |
| Arrhenatherum avenaceum | Decreased since 1919 |
| Dactylis glomerata, Poa pratensis | Much reduced |
| Lolium perenne | Almost disappeared |

LEGUMINOSAE No change, quantity small

MISCELLANEOUS Increased, large seasonal fluctuations

Change in the Percentage of Certain Species

| | 1862 | 1867 | 1872 | 1877 | 1914 | 1919 | 1944 | 1947 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| Alopecurus pratensis | 3.4 | 4.5 | 5.9 | 6.8 | 18.5 | 22.2 | 56.7 | 27.6 | 31.9 |
| Anthoxanthum odoratum | 0.7 | 1.9 | 0.4 | 0.3 | 4.0 | 5.2 | 4.8 | 14.2 | 6.2 |
| Arrhenatherum avenaceum | 0.4 | 2.5 | 9.2 | 11.1 | 24.4 | 17.3 | 0.9 | 2.1 | 3.4 |
| Dactylis glomerata | 27.9 | 20.3 | 43.1 | 40.8 | 7.6 | 9.2 | 6.7 | 9.8 | 9.1 |
| Lolium perenne | 2.8 | 1.2 | 0.2 | 0.1 | - | - | < | - | - |
| Poa pratensis | 3.9 | 10.3 | 11.4 | 10.1 | 0.8 | 1.7 | 1.3 | 0.9 | 0.9 |

Effect of Lime

pH. 6.5

Yield. Increased in some seasons at first, but from 1910-1943 it was reduced. Since then lime has always improved the yield.

Number of Species. Slight increase in some seasons.

Composition of the Herbage. Balance of the three groups little affected except between 1943-1948 when GRAMINEAE increased and LEGUMINOSAE showed large fluctuations. An increase in LEGUMINOSAE (Lathyrus pratensis and Trifolium pratense) began in 1943 and reached a maximum in 1944 and 1945. In 1946 there was a sudden decrease and a low level has since been maintained.

Percentage of Gramineae, Leguminosae and Miscellaneous Species on the Limed Area of Plot 13, 1944-48.

| | 1944 | 1945 | 1946 | 1947 | 1948 |
|---|---|---|---|---|---|
| G | 26.4 | 36.1 | 62.5 | 66.9 | 67.0 |
| L | 41.1 | 36.9 | 7.6 | 7.5 | 10.6 |
| M | 32.5 | 27.0 | 29.9 | 25.6 | 22.4 |

GRAMINEAE

| | |
|---|---|
| Arrhenatherum avenaceum | Usually much increased |
| Agrostis vulgaris, Anthoxanthum odoratum | Much reduced |
| Alopecurus pratensis | Effect varies with season |

MISCELLANEOUS

| | |
|---|---|
| Taraxacum vulgare | Increased |
| Rumex acetosa | Usually reduced |

Effect of Lime on the Percentage of Certain Species

| | 1914 | | 1919 | | 1947 | | 1948 | |
|---|---|---|---|---|---|---|---|---|
| | U | L | U | L | U | L | U | L |
| Agrostis vulgaris | 11.8 | 2.4 | 11.0 | 3.3 | 10.9 | - | 15.7 | 0.2 |
| Alopecurus pratensis | 18.5 | 18.3 | 22.2 | 35.3 | 27.6 | 13.7 | 31.9 | 10.4 |
| Anthoxanthum odoratum | 4.0 | 1.5 | 5.2 | 2.0 | 14.2 | 0.8 | 6.2 | 0.3 |
| Arrhenatherum avenaceum | 24.4 | 40.4 | 17.3 | 20.6 | 2.1 | 14.2 | 3.4 | 25.9 |
| Festuca rubra | 14.6 | 10.7 | 5.5 | 4.7 | 4.5 | 1.0 | 4.0 | 0.9 |
| Poa pratensis | 0.8 | 1.2 | 1.7 | 3.9 | 0.9 | 2.3 | 0.9 | 1.8 |
| Taraxacum vulgare | - | 0.1 | - | 0.2 | 0.9 | 5.4 | 1.5 | 3.2 |
| Rumex acetosa | 1.8 | 0.6 | 15.1 | 6.3 | 2.9 | 2.5 | 1.9 | 0.8 |

U = Unlimed L = Limed

## FARMYARD MANURE EVERY FOURTH YEAR, AFTER NITRATE OF SODA AND MINERALS 1872-1904 (Plot 19)

### Condition of Plot in 1949 (Unlimed)

(a) pH not determined in 1945. (5.5 in 1957).

(b) Herbage patchy and very dark green in spring; a good thick stand of moderately tall mixed herbage.

(c) Growth starts early, and grows rapidly in the year that manure is applied.

(d) Yield medium.

(e) Twenty-one to twenty-eight species, with occasional traces of several others.

(f) All three groups of plants are well represented, the LEGUMINOSAE showing the greatest variation with season (1.8 - 20.0 per cent).

Main Constituents of the Herbage on Plot 19

GRAMINEAE

| | |
|---|---|
| Agrostis vulgaris | Chief species |
| Alopecurus pratensis | |
| Anthoxanthum odoratum | |
| Festuca rubra | |
| Arrhenatherum avenaceum | Usually fairly well represented, but relative abundance varies with season |
| Avena flavescens | |
| Avena pubescens | |
| Dactylis glomerata | |
| Holcus lanatus | |
| Poa trivialis | Quantity small |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Chief species |

MISCELLANEOUS

| | |
|---|---|
| Achillea millefolium | Relative abundance varies with season |
| Centaurea nigra | |
| Plantago lanceolata | |
| Ranunculus spp. | |
| Rumex acetosa | |

OTHER SPECIES:- Briza, Lolium, Poa pratensis; Lotus, Trifolium pratense, T.repens; Agrimonia, Ajuga, Anthriscus, Centaurea, Cerastium, Heracleum, Hypochaeris, Leontodon, Luzula, Plantago, Prunella, Stellaria, Taraxacum, Tragopogon, Veronica (See Tables).

Outline of Principal Changes during the period 1877-1948

Yield. Constant, with seasonal fluctuations, until manuring changed in 1905 when it fell and has since remained at much the same level.

Number of Species. Reduced since the change in manuring.

Number of Species

| | 1862 | 1877 | 1908 | 1914 | 1919 | 1930 | 1940 | 1948 |
|---|---|---|---|---|---|---|---|---|
| G | 16 | 16 | ? | 13 | 13 | 10 | 12 | 12 |
| L | 4 | 5 | ? | 4 | 2 | 4 | 2 | 4 |
| M | 21 | 18 | ? | 14 | 15 | 12 | 13 | 13 |
| Total | 41 | 39 | 39 | 31 | 30 | 26 | 27 | 29 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1872 | 1877 | 1905 | 1914 | 1917 | 1919 | 1936 | 1948 |
|---|---|---|---|---|---|---|---|---|
| G | 89.4 | 81.0 | 64.0 | 78.8 | 68.7 | 75.2 | 84.1 | 50.3 |
| L | 2.5 | 8.7 | 17.8 | 10.0 | 21.4 | 6.1 | 5.2 | 17.4 |
| M | 8.1 | 10.3 | 18.2 | 11.2 | 9.9 | 18.6 | 10.7 | 32.3 |

GRAMINEAE Proportion little changed or slightly reduced till 1944 when reduction marked

| | |
|---|---|
| Alopecurus pratensis | Increased till 1919, later reduced to former level |
| Arrhenatherum avenaceum | Increased |
| Holcus lanatus | Decreased by 1914 |
| Dactylis glomerata | Decreased since 1919 |
| Lolium perenne, Bromus mollis, Cynosurus cristatus | Disappeared |

LEGUMINOSAE Variable, increased in many seasons

| | |
|---|---|
| Lathyrus pratensis | Chiefly responsible for increase |

MISCELLANEOUS Little change till 1944 when considerably increased

| | |
|---|---|
| Achillea millefolium, Plantago lanceolata | Responsible for most of increase since 1944 |
| Ranunculus spp. | Much increased |
| Rumex acetosa | Variable |

Changes in the Percentage of Certain Species

| | 1872 | 1877 | 1914 | 1919 | 1946 | 1948 |
|---|---|---|---|---|---|---|
| Alopecurus pratensis | 0.2 | 5.4 | 13.4 | 22.3 | 13.1 | 6.2 |
| Arrhenatherum avenaceum | < | - | 3.7 | 7.9 | 9.8 | 5.7 |
| Cynosurus cristatus | 1.2 | 2.5 | - | - | - | - |
| Dactylis glomerata | 0.7 | 2.4 | 12.0 | 15.8 | 3.6 | 3.3 |
| Holcus lanatus | 14.0 | 21.2 | 3.5 | 2.1 | 2.7 | 1.3 |
| Achillea millefolium | 0.7 | 0.7 | 1.7 | 1.4 | 6.3 | 10.2 |
| Plantago lanceolata | 0.2 | 0.3 | 0.2 | 0.2 | 15.8 | 11.8 |
| Ranunculus spp. | 2.0 | 0.2 | 1.0 | 4.8 | 5.9 | 5.7 |
| Rumex acetosa | 0.7 | 2.7 | 2.1 | 8.4 | 1.8 | 1.3 |

## Effect of Lime

The quantities of lime applied on this plot to satisfy the lime requirement as determined by the two methods were:- light dressing (LL) 571 lb., and heavy dressing (HL) 3,151 lb. per acre.

pH. Not determined in 1945 (LL = 6.5; HL = 7.6 in 1957).

Yield. Usually decreased, especially with the heavy dressing.

Number of Species. Practically no effect.

Composition of the Herbage.

| | |
|---|---|
| GRAMINEAE | Usually increased, especially by the heavy dressing. Some species reduced. |
| LEGUMINOSAE | Variable; no constant difference between the unlimed and either level of lime. |
| MISCELLANEOUS | Generally decreased, especially by the heavy dressing. |

Effect of Lime on the Percentage of Different Species

| | 1921 | | | 1928 | | | 1946 | | | 1948 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | LL | HL | U | LL | HL | U | LL | HL | U | LL | HL |
| Agrostis vulgaris | 21.8 | 17.8 | 13.9 | 5.8 | 5.1 | 2.4 | 8.0 | 2.8 | 0.1 | 11.8 | 4.3 | 0.5 |
| Alopecurus pratensis | 13.2 | 20.3 | 16.4 | 33.2 | 42.6 | 21.2 | 13.1 | 18.3 | 19.7 | 6.2 | 25.2 | 16.7 |
| Anthoxanthum odoratum | 10.3 | 8.3 | 2.9 | 11.6 | 7.9 | 0.7 | 9.1 | 2.7 | 0.1 | 7.3 | 1.5 | - |
| Arrhenatherum avenaceum | 8.2 | 0.3 | 13.8 | 7.9 | 3.5 | 15.9 | 9.8 | 6.4 | 13.9 | 5.7 | 5.5 | 14.3 |
| Avena flavescens | 5.0 | 7.7 | 10.5 | 3.5 | 3.2 | 6.1 | 1.4 | 0.5 | 2.4 | 1.7 | 3.0 | 3.1 |
| Avena pubescens | 4.0 | 1.9 | 4.6 | 3.0 | 2.8 | 11.9 | 0.5 | 1.7 | 2.7 | 0.9 | 1.9 | 5.4 |
| Festuca rubra | 12.5 | 9.8 | 15.5 | 8.1 | 3.7 | 13.9 | 4.6 | 2.5 | 3.3 | 9.8 | 5.0 | 4.5 |
| Lathyrus pratensis | 4.8 | 2.1 | 3.4 | 1.6 | 1.5 | 1.0 | 9.5 | 10.5 | 13.2 | 13.5 | 7.4 | 7.5 |
| Ranunculus spp. | 0.4 | 1.3 | 0.7 | 1.8 | 2.5 | 1.4 | 5.9 | 10.4 | 2.3 | 5.7 | 7.9 | 4.0 |
| Plantago lanceolata | 0.4 | 0.2 | 0.1 | 0.6 | - | 0.6 | 15.8 | 14.2 | 16.3 | 11.8 | 10.4 | 9.7 |
| Achillea millefolium | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.4 | 6.3 | 5.4 | 1.9 | 10.2 | 5.2 | 2.3 |

U = Unlimed LL = Light lime HL = Heavy lime

## FARMYARD MANURE EVERY FOURTH YEAR WITH NITRATE OF SODA AND MINERALS IN INTERVENING YEARS, AFTER NITRATE OF POTASH AND SUPERPHOSPHATE 1872-1904 (Plot 20)

### Condition of Plot in 1949 (Unlimed)

(a) pH not determined in 1945. (5.7 in 1957).

(b) Herbage mixed and well grown, but rather irregular.

(c) Growth starts early, especially in the years that farmyard manure is applied.

(d) Yield fairly heavy, higher than on Plots 18 and 19.

(e) Fourteen to twenty-nine species, with occasional traces of several others.

(f) All three groups well represented. The range as shown by the partial separations from 1910-1948 was:-

| | Per cent |
|---|---|
| G | 63.5 - 93.2 |
| L | 1.0 - 25.0 |
| M | 4.2 - 29.8 |

## Main Constituents of the Herbage on Plot 20

GRAMINEAE

| | |
|---|---|
| Alopecurus pratensis | Chief species |
| Arrhenatherum avenaceum, Dactylis glomerata | Well represented, but relative abundance varies with season |
| Agrostis vulgaris, Anthoxanthum odoratum, Avena pubescens, Avena flavescens, Festuca rubra, Holcus lanatus | Usually well represented |
| Bromus mollis, Poa trivialis | Very variable in quantity |

LEGUMINOSAE

| | |
|---|---|
| Lathyrus pratensis | Chief species |

MISCELLANEOUS

| | |
|---|---|
| Achillea millefolium, Rumex acetosa | One or other usually dominant |
| Ranunculus spp., Plantago lanceolata, Tragopogon pratensis, Taraxacum vulgare, Veronica chameodrys | Small quantity, variable |

OTHER SPECIES :- Festuca pratensis, Lolium, Poa pratensis; Lotus, Trifolium pratense, T.repens; Ajuga, Cerastium, Centaurea, Conopodium, Heracleum, Luzula (See Tables).

## Outline of Principal Changes during the Period 1877-1948

Yield. Constant except for seasonal fluctuations till the manuring changed in 1905. Reduced for some years after, but has tended to improve since 1930.

Number of species. Reduced.

Number of Species

| | 1872 | 1877 | 1908 | 1914 | 1919 | 1928 | 1939 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|---|---|
| G | 15 | 16 | ? | 14 | 14 | 14 | 12 | 13 | 12 |
| L | 5 | 4 | ? | 3 | 1 | 2 | 2 | 2 | 3 |
| M | 22 | 18 | ? | 11 | 14 | 11 | 10 | 10 | 9 |
| Total | 42 | 38 | 39 | 28 | 29 | 27 | 24 | 25 | 24 |

Composition of the Herbage.

Percentage of Gramineae, Leguminosae and Miscellaneous Species

| | 1872 | 1877 | 1905 | 1914 | 1917 | 1919 | 1928 | 1939 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|---|---|---|
| G | 87.1 | 86.1 | 62.8 | 84.2 | 66.1 | 81.8 | 93.0 | 84.3 | 72.1 | 86.3 |
| L | 2.0 | 3.7 | 23.4 | 6.5 | 25.0 | 4.7 | 2.8 | 9.0 | 5.7 | 5.0 |
| M | 10.9 | 10.2 | 13.8 | 9.3 | 8.9 | 13.5 | 4.2 | 6.7 | 22.2 | 8.7 |

GRAMINEAE — Proportion relatively constant; exceptionally low (65 per cent) in 1945.

- Alopecurus pratensis, Arrhenatherum avenaceum — Much increased
- Dactylis glomerata — Increased since 1904
- Avena pubescens — Increased from 1904-1919 but now reduced to former level
- Holcus lanatus — Much reduced

LEGUMINOSAE — Very variable: exceptionally high in 1945 (18 per cent).

MISCELLANEOUS — Very variable: exceptionally high (over 20 per cent) in 1942, 1946 and 1947.

- Ranunculus spp., Rumex acetosa — Variable
- Anthriscus sylvestris — Introduced since 1877 and of some importance till 1919, now almost disappeared

Changes in the Percentage of Certain Species

| | 1872 | 1877 | 1914 | 1919 | 1928 | 1946 | 1948 |
|---|---|---|---|---|---|---|---|
| Agrostis vulgaris | 31.4 | 10.4 | 4.5 | 6.5 | 4.1 | 3.0 | 4.1 |
| Alopecurus pratensis | 1.2 | 6.8 | 11.2 | 30.3 | 46.2 | 33.9 | 39.2 |
| Anthoxanthum odoratum | 7.2 | 3.5 | 0.6 | 1.2 | 1.9 | 1.3 | 1.1 |
| Arrhenatherum avenaceum | < | < | 4.2 | 4.6 | 11.3 | 9.9 | 15.1 |
| Avena pubescens | 1.0 | 2.4 | 6.3 | 10.2 | 6.6 | 2.6 | 0.7 |
| Dactylis glomerata | 0.3 | 1.2 | 10.0 | 12.5 | 7.0 | 10.3 | 14.7 |
| Holcus lanatus | 12.4 | 29.5 | 10.4 | 6.8 | 4.1 | 3.0 | 1.0 |
| Lolium perenne | 2.0 | 3.6 | 0.3 | 0.3 | 0.4 | 0.1 | - |
| Lathyrus pratensis | 0.1 | 2.7 | 6.4 | 4.7 | 2.6 | 5.5 | 4.3 |
| Ranunculus spp. | 3.9 | 4.0 | 0.5 | 2.1 | 0.8 | 5.0 | 1.2 |
| Anthriscus sylvestris | - | - | 2.8 | 2.5 | 0.4 | 0.7 | 0.6 |
| Rumex acetosa | 1.3 | 1.5 | 0.3 | 3.3 | 1.4 | 5.1 | 1.5 |

< indicates below 0.05

Effect of Lime

The quantities of lime applied are:- light dressing (LL) 571 lb. and heavy dressing (HL) 2,775 lb. per acre.

pH. Not determined in 1945. (LL = 6.5; HL = 7.6 in 1957).

Yield. No consistent effect.

Number of Species. Little changed, except for occasional increase with heavy lime.

Composition of the Herbage.

GRAMINEAE Proportion unaffected by the light but reduced by the heavy dressing

| | |
|---|---|
| Anthoxanthum odoratum | Usually increased by light lime |
| Arrhenatherum avenaceum | Response varies with season |
| Avena pubescens | Increased by heavy lime |

LEGUMINOSAE Variable, but usually increased by heavy lime

MISCELLANEOUS Increased, especially by the heavy dressing

| | |
|---|---|
| Plantago lanceolata | Increased |
| Ranunculus spp. | Response varies with season |
| Rumex acetosa | |

Effect of Lime on the Percentage of Certain Species

| | 1921 | | | 1928 | | | 1946 | | | 1948 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | LL | HL | U | LL | HL | U | LL | HL | U | LL | HL |
| Agrostis vulgaris | 13.3 | 10.5 | 5.0 | 4.1 | 4.2 | 1.2 | 3.0 | 1.5 | 0.1 | 4.1 | 2.5 | 0.1 |
| Anthoxanthum odoratum | 1.1 | 6.4 | 1.8 | 1.9 | 6.4 | 0.7 | 1.3 | 3.2 | 0.7 | 1.1 | 1.9 | 0.2 |
| Arrhenatherum avenaceum | 10.0 | 9.5 | 4.1 | 11.3 | 8.7 | 3.8 | 9.9 | 26.9 | 15.5 | 15.1 | 21.7 | 17.4 |
| Avena pubescens | 12.3 | 8.0 | 19.2 | 6.6 | 9.3 | 28.9 | 2.6 | 4.0 | 9.1 | 0.7 | 3.0 | 6.8 |
| Holcus lanatus | 10.0 | 10.3 | 8.0 | 4.1 | 7.9 | 5.0 | 3.0 | 2.9 | 1.4 | 1.0 | 5.7 | 1.6 |
| Poa trivialis | 1.2 | 1.8 | 1.0 | 1.2 | 3.5 | 3.0 | 0.9 | 4.0 | 3.6 | 1.3 | 3.9 | 4.3 |
| Plantago lanceolata | 0.5 | 0.4 | - | < | 0.4 | 0.4 | 3.2 | 6.7 | 6.3 | 0.9 | 6.2 | 4.1 |
| Ranunculus spp. | 0.9 | 0.8 | 1.2 | 0.8 | 1.3 | 1.2 | 5.0 | 1.2 | 1.9 | 1.2 | 1.9 | 1.3 |
| Rumex acetosa | 1.5 | 1.3 | 1.1 | 1.4 | 1.6 | 0.3 | 5.1 | 1.6 | 1.7 | 1.5 | 1.4 | 0.5 |

U = Unlimed LL - Light Lime HL = Heavy Lime

< indicates below 0.05

# CHAPTER V.

## EFFECT OF MANURES AND LIME ON INDIVIDUAL SPECIES

Every species of importance is considered individually in this chapter. Some indication is given of the extent to which it has occurred on the various plots, both unlimed and limed, and the manurial treatments which favour or discourage it are briefly summarised. Where applicable, a list follows of the chief plant associations of which it is a member. Changes in nomenclature (1952) are given in brackets. Details of the manurial treatments on the different plots will be found in Table 1.

### A. GRAMINEAE

#### AGROSTIS VULGARIS (A. tenuis) Fig. 12.

Occurs in samples from every plot, limed and unlimed. It is usually present in fair quantity, except on the plots receiving super only or nitrate of soda and minerals. It is very much discouraged by lime.

#### UNLIMED

QUANTITY

Very large (usually over 40 percent)

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $4^2$ | Super and ammonium salts |
| | 10 | Minerals without potash and ammonium salts (under 10 percent till 1939) |
| | $11^2$ | Minerals with silicate and heavy ammonium salts (under 1 percent till 1915) |
| | 18 | Minerals without super, and ammonium salts |

Large (9-20 percent)

| | | |
|---|---|---|
| Plots | $3,5^1$ | Unmanured |
| | $5^2$ | Minerals after ammonium salts till 1897 |
| | 15 | Minerals |

Medium (1-9 percent)

| | | |
|---|---|---|
| Plots | 6, 7, 8 | Minerals |
| | 11[1] | Minerals and heavy ammonium salts (under 1 percent till 1915) |
| | 13, 19 | F.Y.M. * with and without fish guano |
| | 17 | Nitrate of soda |
| | 20 | F.Y.M., minerals and nitrate of soda |

Very variable (0-12 percent)

| | | |
|---|---|---|
| Plot | 9 | Minerals and ammonium salts |

Usually very low

| | | |
|---|---|---|
| Plots | 4[1] | Super |
| | 14, 16 | Minerals and nitrate of soda |

Agrostis vulgaris encouraged by:-

(a) Starved soils

(b) Minerals and sulphate of ammonia, alone or in combination

(c) Organic manures

Agrostis vulgaris not encouraged by:-

(a) Superphosphate

(b) Nitrate of soda with minerals

LIMED **

QUANTITY

Considerably decreased

| | | |
|---|---|---|
| Plots | 1, 4[2], 10 | Ammonium salts with incomplete minerals |
| | 3 | Unmanured |
| | 7, 15 | Minerals |
| | 11[2] | Minerals with silicate and heavy ammonium salts |
| | 13 | F.Y.M. and fish guano alternately |
| | 17 | Nitrate of soda |

---

* F.Y.M. = Farmyard manure.

** For Plots 18, 19 and 20 throughout, both levels of lime are included unless otherwise stated viz. LL = light lime; HL = heavy lime.

Slightly decreased

| | | |
|---|---|---|
| Plots | 8 | Minerals without potash |
| | $11^1$ | Minerals and heavy ammonium salts |
| | 19, 20 | F.Y.M., with and without minerals and nitrate of soda |

Plots with Agrostis vulgaris among the three chief grasses.

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | - | $1,2,3,4^2,5^1,5^2,6,9$ | $7,8,12,17,18$ | - | 1 | - |
| 1919 | - | $1,3,6,9,15,18$ | $2,4^2,5^2,7,11^1,13$ | - | - | - |
| 1948 or 1949 | $1,4^2,10,11^2,18$ | $2,3,5^1,9,13$ | $5^2,19$ | - | - | 18 LL |

Agrostis vulgaris in Plant Communities

UNLIMED

A marked feature of all associations except the specialized ones occuring with heavy nitrogenous manuring or super alone. The absence of Agrostis from the Dactylis-Holcus-Festuca-Avena pubescens community in the latter case (Plot $4^1$) is noteworthy, as the herbage is not of the coarse rank nature which would kill out Agrostis simply by competition.

LIMED

Agrostis vulgaris is a less conspicuous element of the various associations on the limed areas.

## AIRA CAESPITOSA (Deschampsia caespitosa)

Present on fewer plots in 1919 than in 1877, traces occurring only on Plot $5^1$, 8, 10, 18 and 19. It was recorded on Plots $5^1$ and 18 (heavy lime) in 1946, but has since apparently disappeared.

## ALOPECURUS PRATENSIS Fig. 13.

Usually occurs in samples from every plot, limed and unlimed. It responds readily to a plentiful supply of nutrients provided sufficient lime is applied. It requires abundant nitrogen and thrives on the unlimed areas of plots receiving sodium nitrate but requires lime before it can take advantage of nitrogen supplied as ammonium sulphate.

### UNLIMED

QUANTITY

Large (usually well over 10 percent)

| | | |
|---|---|---|
| Plots | $5^2$ | Minerals after ammonium salts till 1897 |
| | 13 | F.Y.M. and fish guano alternately |
| | 14, 15 | Minerals with and without nitrate of soda (high N) |
| | 17 | Nitrate of soda |
| | 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

Medium (1 to 9 percent)

| | | |
|---|---|---|
| Plots | 3 | Unmanured |
| | 7 | Minerals |
| | 18 | Ammonium salts and minerals without super |

Small (usually under 1 percent)

| | | |
|---|---|---|
| Plots | 1, $4^2$, 9, 10 | Ammonium salts with and without minerals |
| | $5^1$ | Unmanured |
| | 8 | Minerals without potash |
| | $11^1$, $11^2$ | Minerals and heavy ammonium salts |

Alopecurus pratensis encouraged by:-

(a) Nitrate of soda, whether alone or with minerals
(b) Minerals alone or after ammonium salts
(c) Organic manures

Alopecurus pratensis not encouraged by:-

(a) Starved soils
(b) Most incomplete manures
(c) Heavy dressings of ammonium salts

LIMED

QUANTITY

Greatly increased

| | | |
|---|---|---|
| Plots | $4^2$ | Super and ammonium salts |
| | 9, 10, $11^1$, $11^2$ | Minerals with and without potash, and ammonium salts |

Increased

| | | |
|---|---|---|
| Plot | 1 | Ammonium salts |

Decreased

| | | |
|---|---|---|
| Plots | 13 | F.Y.M. and fish guano alternately |
| | 14 | Minerals and nitrate of soda (high N) |
| | 17 | Nitrate of soda |
| | 20 | F.Y.M., minerals and nitrate of soda |

On plots with highly acid soil and a good supply of plant nutrients, liming has caused a very great increase in Alopecurus pratensis e.g. 0.8 to 31.8; 1.1 to 78.9; and 0.2 to 32.5 percent on Plots 9, $11^1$ and $4^2$ respectively in 1947.

On plots with slightly acid soil, liming has usually had little or no effect on the relative quantity, irrespective of the level of nutrient supply.

Plots with Alopecurus pratensis among the three chief grasses

Unlimed

| | First | Second | Third |
|---|---|---|---|
| 1914 | 15,16,17 | 13,14,19,20 | 10,$11^2$,$11^1$ |
| 1919 | 13,14,15,16,17,19,20 | $5^2$, $11^2$ | 10, 18 |
| 1948 or 1949 | $11^1$,$11^2$,13,15,16,20 | $5^2$,6,7,14,17 | 2, 3, 12 |

Limed

| | First | Second | Third |
|---|---|---|---|
| 1914 | $4^2$, 10, $11^2$ | 9,$11^1$,13,16 | - |
| 1919 | $4^2$,10,$11^1$,$11^2$,13,16 | 7, 8 | - |
| 1948 or 1949 | 9,$11^1$,$11^2$,19,20 | 3, $4^2$, 10 | 13, 15 |

## Alopecurus pratensis in Plant Communities

### UNLIMED

(a) Heavy nitrogenous and mineral manures (Plot 14), not too acid. Alopecurus - Arrhenatherum with Dactylis. Comparatively few Leguminous or Miscellaneous plants.

(b) Less but fairly heavy manuring (Plots 15, 16, 17, 19, 20). Alopecurus with Dactylis - Festuca rubra - Arrhenatherum and less generally Agrostis and Anthoxanthum. Lathyrus and Plantago usually well represented.

(c) Organic manures (Plot 13). Alopecurus with Agrostis - Dactylis - Anthoxanthum - Festuca rubra - Holcus - Plantago - Rumex and Achillea. Leguminosae unimportant.

### LIMED

(a) Minerals only (Plot 7). Alopecurus - Arrhenatherum - Dactylis with Bromus in some years.

(b) Superphosphate and ammonium salts (Plot $4^2$). Alopecurus - Festuca rubra - Poa pratensis, but the two latter may take a subordinate place in some seasons.

(c) Heavy nitrogenous and mineral manures:-(Plot 9)Alopecurus - Anthoxanthum - Arrhenatherum - Dactylis; (Plot 10)Alopecurus - Festuca rubra Arrhenatherum - Rumex;(Plot $11^1$)Alopecurus with occasional other grasses; (Plot $11^2$) Alopecurus - Arrhenatherum with occasional Dactylis and Poa pratensis.

(d) Organic manures (Plot 13). Arrhenatherum - Dactylis - Alopecurus with much Lathyrus and Plantago in some years.

N.B. The Alopecurus associations are more varies on the limed than on the unlimed plots, and Agrostis vulgaris is no longer a chief component.

## ANTHOXANTHUM ODORATUM Fig. 14.

Occurs to some extent in samples from every plot. It flourishes best on well manured and acid soil, and is usually reduced by lime.

### UNLIMED

**QUANTITY**

Large and very variable (10 to 52 per cent)

| | | |
|---|---|---|
| Plot | 10 | Minerals without potash and ammonium salts |

Fairly large and very variable (usually over 10 percent)

| | | |
|---|---|---|
| Plots | $4^2$ | Super |
| | $5^1$ | Unmanured after ammonium salts till 1897 |

Small (usually under 8 percent)

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |
| | $5^2$ | Minerals after ammonium salts till 1897 |
| | 7, 8, 9 | Minerals with and without ammonium salts |
| | 13 | F.Y.M. and fish guano alternately |
| | 17 | Nitrate of soda |
| | 18 | Minerals without super and ammonium salts |
| | 19, 20 | F.Y.M. with and without nitrate of soda and minerals |

Very small (usually under 1 percent)

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $11^1$, $11^2$, 14 | Minerals and heavy nitrogenous manuring |

Anthoxanthum odoratum encouraged by:-

Ammonium salts with minerals, except when nitrogen very high.

Anthoxanthum odoratum not encouraged by:-

(a) Ammonium salts alone

(b) Heavy nitrogenous manures and minerals

Other manurial treatments have little effect.

LIMED

QUANTITY

Considerably decreased

| | |
|---|---|
| Plots $4^2$ | Super and ammonium salts |
| 10 | Minerals without potash and ammonium salts |
| 13, 19 | F.Y.M. with and without fish guano alternately |
| 15 | Minerals |
| 17 | Nitrate of soda |

Plots with Anthoxanthum odoratum among the three chief grasses.

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | 9, 10 | - | 1, $4^2$, $5^2$ | - | 10 | 9 |
| 1919 | - | $5^1$, 10 | 2, 12 | - | - | - |
| 1948 or 1949 | - | - | 10, 19 | - | - | 10 |

Anthoxanthum odoratum in Plant Communities

UNLIMED

(a) Unmanured (Plots 2, 3, 12) and nitrate of soda (Plot 17). Associations very mixed, with Anthoxanthum in variable proportion.

(b) Unmanured after ammonium salts (Plot $5^1$); Festuca rubra - Agrostis - Anthoxanthum - Dactylis - Rumex - Centaurea - Conopodium.

(c) Ammonium salts with superphosphate (Plot $4^2$); Agrostis - Festuca rubra - Holcus - Anthoxanthum - Rumex.

(d) Ammonium salts and minerals without potash (Plot 10); Anthoxanthum - Agrostis - Holcus with some Arrhenatherum.

(e) F.Y.M. and fish guano; (Plot 13) Alopecurus - Agrostis - Anthoxanthum with Dactylis - Festuca - Plantago - Rumex and Achillea.

LIMED

(a) Ammonium salts (Plot 1); Avena pubescens - Dactylis with Anthoxanthum - Festuca rubra.

Contd.

(a) Ammonium salts with super (Plot $4^2$); Alopecurus - Festuca rubra with Poa pratensis and Anthoxanthum.

(b) Ammonium salts and minerals with and without potash (Plots 9 and 10); Alopecurus - Anthoxanthum with Arrhenatherum and Dactylis on Plot 9 and Alopecurus - Festuca rubra - Arrhenatherum with Anthoxanthum on Plot 10.

## ARRHENATHERUM AVENACEUM (A. elatius) Fig. 15.

Generally occurs in samples from every plot, limed and unlimed. It thrives best on plots receiving heavy complete manures, whether as organic or artificial fertilizers. Elsewhere comparatively little is present. The effect of lime is very variable and large increases or decreases may occur on the same plot in different seasons.

### UNLIMED

QUANTITY

Large (up to 40 percent)

| | |
|---|---|
| Plots 14 | Minerals and nitrate of soda |
| $11^1$*, $11^2$* | Minerals and ammonium salts with and without silicate of soda |

Medium (usually over 8 percent)

| | |
|---|---|
| Plots 8 | Minerals without potash |
| 16 | Minerals and nitrate of soda |
| 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

Usually small (1 to 9 percent)

| | |
|---|---|
| Plots 12 | Unmanured |
| $4^1$ | Super |
| $5^1$, $5^2$ | Unmanured or minerals after ammonium salts to 1897 |
| 6, 7, 15 | Minerals |
| 10 | Minerals and ammonium salts without potash |
| 13 | F.Y.M. and fish guano alternately |

---

* Till 1919 only. No further complete botanical analyses were made till 1949 when 1.0 percent was present. According to field observations the reduction occurred about 1922.

Very small (under 1 percent)

| | |
|---|---|
| Plots 2, 3 | Unmanured |
| 1 | Ammonium salts |
| 9, $11^1$, $11^2$, 18 | Ammonium salts and minerals with and without super |
| 17 | Nitrate of soda |

Probably absent

| | |
|---|---|
| Plot $4^2$ | Super and ammonium salts |

Arrhenatherum avenaceum encouraged by:-

(a) Nitrogenous dressings with minerals; if N as ammonium salts till 1919 only

(b) Minerals with and without potash

(c) Organic manures

Arrhenatherum avenaceum not encouraged by:-

(a) Nitrogenous manures alone, or since 1919, heavy ammonium salts with minerals

(b) Starved soils

(c) Most incomplete manures

LIMED

QUANTITY

Usually increased

| | |
|---|---|
| Plots 1, 9 | Ammonium salts with and without minerals |
| 7 | Minerals |
| $11^1$, 18 | Ammonium salts and minerals with and without super |
| 13, 19 HL | F.Y.M. with and without fish guano |
| 14, 20 | Minerals and nitrate of soda with and without F.Y.M. |

Effect varies with season

| | |
|---|---|
| Plots 8, 15 | Minerals |
| 10 | Ammonium salts and minerals without potash |
| $11^2$ | Heavy ammonium salts with minerals and silicate of soda |

Little affected

| | |
|---|---|
| Plots 3 | Unmanured |
| $4^2$ | Super and ammonium salts |
| 17 | Nitrate of soda |

Seasonal effect of lime on the percentage of Arrhenatherum avenaceum on heavily manured plots

| Plot | 1914 | 1919 | 1948 or 1949 |
|---|---|---|---|
| 9 | Increase ( 8 - 39) | No effect | Increase (0.6 - 14) |
| 10 | Increase ( 5 - 9) | Decrease (26 - 8) | Little change ( 5 - 4) |
| $11^1$ | Increase ( 7 - 21) | Decrease (31 - 16) | Increase (0.0 - 2) |
| $11^2$ | Increase (21 - 26) | Decrease (46 - 16) | Increase (0.8 - 17) |

Plots with Arrhenatherum avenaceum among the three chief grasses

Unlimed

| | First | Second | Third |
|---|---|---|---|
| 1914 | 13, 14 | $11^1$, $11^2$ | - |
| 1919 | 9, 10, $11^2$ | 8, $11^1$, 13, 14 | 19 |
| 1948 or 1949 | 8, 14 | $4^1$, 16, 20 | 9, $11^2$ ( 1 percent) |

Limed

| | First | Second | Third |
|---|---|---|---|
| 1914 | 9, 13 | $11^1$, $11^2$ | |
| 1919 | 8, 9 | 10, $11^1$, $11^2$. 13 | - |
| 1948 or | 8, 13, 14*, 15, 16, 20 | 10, 18, 19 | 7 |

* Both Sun and Shade

Arrhenatherum avenaceum in Plant Communities

UNLIMED

(a) Minerals without potash (Plot 8); Festuca rubra - Arrhenatherum - Holcus - Trifolium pratense - Plantago.

(b) Heavy nitrogenous manures and minerals.

Ammonium salts with and without silicate of soda (Plots $11^1$ and $11^2$); formerly an important constituent of the association on both plots but now inconspicuous.

Nitrate of soda (Plot 14); Arrhenatherum - Alopecurus - Dactylis.

(c) Organic manures.

F.Y.M. alone (Plot 19); Alopecurus - Arrhenatherum - Anthoxanthum - Agrostis - Lathyrus - Plantago.

F.Y.M. and minerals (Plot 20); Alopecurus - Arrhenatherum - Dactylis - Lathyrus - Rumex.

LIMED

(a) Minerals with and without potash.

With potash (Plot 7); Alopecurus - Arrhenatherum - Dactylis - Lathyrus - Heracleum.

Without potash (Plot 8); Arrhenatherum - Avena pubescens - Lotus - Plantago.

(b) Nitrogenous manures and minerals.

Ammonium salts (Plots 9 and $11^2$) Alopecurus - Arrhenatherum - with or without much Dactylis.

Nitrate of soda (Plot 14); Arrhenatherum - Festuca rubra - with Alopecurus, Lathyrus and Dactylis (Sun), Avena pubescens (Shade).

(c) Nitrogenous manures and minerals without super (Plot 18); Arrhenatherum - Dactylis - Festuca rubra - Taraxacum; with light lime Centaurea and Plantago also.

(d) Organic manures.

F.Y.M. and fish guano (Plot 13); Dactylis - Arrhenatherum - Alopecurus - Lathyrus - Plantago.

F.Y.M. with and without minerals and nitrate of soda (Plots 19 and 20); Arrhenatherum - Alopecurus with Dactylis - Lathyrus - Plantago, and Ranunculus on Plot 19.

AVENA FLAVESCENS (Trisetum flavescens)

UNLIMED

QUANTITY

Small (1.5 - 4 percent)

| | | |
|---|---|---|
| Plots | 17 | Nitrate of soda |
| | 19, 20 | F.Y.M. with and without minerals |

Very small (under 1 percent)

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |
| | 6, 7, 8, 15, 16 | Minerals alone or with nitrate of soda (low N) |

Absent

| | |
|---|---|
| Plots 1, $4^2$, 9, 10, $11^1$ | Ammonium salts with and without minerals |
| $11^2$, 18 | |
| $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| 13 | F.Y.M. and fish guano alternately |
| 14 | Minerals and nitrate of soda (high N) |

LIMED

Slightly increased in some seasons on Plots 1, 3, 7, 8, 14(shade), 17 and 19, otherwise little effect.

Avena flavescens in Plant Communities

A very insignificant member of all the associations in which it occurs, except occasionally on the limed sections of plots receiving F.Y.M.

AVENA PUBESCENS (Helictotrichon pubescens) Fig. 16.

Generally distributed over the whole area, but is very intolerant of ammonium salts and is entirely absent from a few plots, and present in such small quantities on others that it does not appear in the hay samples. It is much less plentiful on the unlimed areas than it was before 1919 and may be considerably increased by lime, even to the extent of becoming one of the three chief grass species. On the limed section of Plot 14 it is particularly abundant in the part shaded by a tree, little occurring in the sun.

UNLIMED

QUANTITY

Medium (usually 1 to 6 percent)

| | |
|---|---|
| Plots 2, 3, 12 | Unmanured |
| $4^1$, | Super |
| $5^2$, | Minerals after ammonium salts till 1897 |
| 6, 7, 8, 15 | Minerals with and without potash |
| 16, 17 | Nitrate of soda with and without minerals |
| 20 | F.Y.M. with minerals and nitrate of soda |

Very small (not usually over 1 percent)

| | | |
|---|---|---|
| Plots | 14 | Minerals and nitrate of soda (high N) |
| | 19 | F.Y.M. after minerals and nitrate of soda |

Almost or entirely absent

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $4^2$ | Super and ammonium salts |
| | 9, 10, $11^1$, $11^2$ | Minerals and ammonium salts |
| | 13 | F.Y.M. and fish guano alternately |
| | 18 | Minerals without super, and ammonium salts |

Avena pubescens encouraged by:-

(a) Minerals, especially superphosphate

(b) Nitrate of soda, alone or with minerals

Avena pubescens not encouraged by:-

(a) Ammonium salts, alone or with minerals

(b) Frequent dressings of organic manures

LIMED

QUANTITY

Greatly increased

| | | |
|---|---|---|
| Plots | 1* | Ammonium salts |
| | 2, 3 | Unmanured |
| | $4^1$ | Super |
| | 15 | Minerals |
| | 16, 17 | Nitrate of soda with and without minerals |

Increased

| | | |
|---|---|---|
| Plots | 7, 8 | Minerals with and without potash |
| | 14, 20 | Minerals and nitrate of soda with and without F.Y.M. |
| | 19 (HL) | F.Y.M. after minerals and nitrate of soda |

Little or unaffected

Plots $4^2$, 9, 10, $11^1$, $11^2$, 13, 18, 19 (LL)

---

* Avena pubescens is negligible on the unlimed part of this plot.

## Avena pubescens in Plant Communities

### UNLIMED

A rather insignificant member of various mixed associations.

### LIMED

(a) Ammonium salts (Plot 1); Avena pubescens - Dactylis - Festuca rubra - sometimes with Plantago.

(b) Unmanured (Plots 2, 3); Avena pubescens - Lotus with Festuca rubra - Dactylis - Trifolium pratense - Plantago - Leontodon and on Plot 3 also Alopecurus - Briza - Poterium.

(c) Superphosphate (Plot $4^1$); Avena pubescens - Trifolium pratense - Lotus - Lathyrus with Leontodon - Plantago - and sometimes Ranunculus spp.

(d) Minerals and nitrate of soda (Plot 16); Arrhenatherum - Alopecurus - Avena pubescens - Dactylis - Lotus - Lathyrus - Trifolium pratense: sometimes with Bromus - Anthriscus - Ranunculus spp.

(e) Minerals alone (Plot 15); Arrhenatherum - Avena pubescens - Trifolium pratense - T.repens - Lathyrus with Plantago.

(f) Nitrate of soda (Plot 17); Avena pubescens - Dactylis - Festuca rubra - Plantago - Ranunculus and sometimes Leontodon autumnalis.

### Plots with Avena pubescens among the three chief grasses

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | - | $4^1$ | - | $4^1$ | 2,3,$4^1$,8 | 16 |
| 1919 | $4^1$ | - | - | 2,3 | 8 | 7,16 |
| 1948 or 1949 | - | - | - | 2,3,$4^1$ | 8,15,16 | 1,17,14 (shade) |

## BRIZA MEDIA

Present on a few plots only. It is generally an indicator of poverty or exhaustion of soil, and disappears when conditions are improved. It is usually increased by lime.

### UNLIMED

**QUANTITY**

Small ( 1.0 - 6 percent)

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |
| | $4^1$ | Super |
| | 8 | Minerals without potash |
| | 17 | Nitrate of soda |

Absent

Plots 1, $4^2$, $5^1$, $5^2$, 6, 7, 9, 10, $11^1$, $11^2$, 13, 14, 15, 16, 18, 19, 20.

Briza media encouraged by:-

(a) Starved or exhausted soils
(b) Nitrate of soda alone

Briza media not encouraged by:-

(a) Fair or good manuring of every kind
(b) Ammonium salts alone
(c) Complete minerals alone

### LIMED

**QUANTITY**

Increased

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured |
| | $4^1$ | Super |
| | 8 | Minerals without potash |

Briza media in Plant Communities

A constituent of the very varied association characteristic of the poorer soils, but is only conspicuous at flowering time. It does not appear to be specially associated with any particular species or group of species, except Plantago and Leontodon.

## BROMUS MOLLIS

Occurs on a few plots only. Quantity extremely variable with season, but has on the whole become less plentiful.

### UNLIMED

**QUANTITY**

**Small** (usually under 1 percent)

| | |
|---|---|
| Plots 6, 7, 15 | Minerals with potash |
| 14, 16 | Nitrate of soda with minerals |
| 20 | F.Y.M. with minerals and nitrate of soda (plentiful in 1943 and 1944). |

**Traces only**

| | |
|---|---|
| Plots $4^1$ | Super |
| 8 | Minerals without potash |
| 13, 19 | F.Y.M. with and without fish guano |
| 17 | Nitrate of soda |

**Absent**

Plots 1, 2, 3, $4^2$, $5^1$, $5^2$, 9, 10, $11^1$, $11^2$, 12, 18. Traces on Plot 12 in 1940.

*Bromus mollis* encouraged by:-

(a) Nitrate of soda and minerals with and without F.Y.M.

*Bromus mollis* not encouraged by:-

(a) Starved soils

(b) Ammonium salts with and without minerals

### LIMED

**QUANTITY**

**Increased**

| | |
|---|---|
| Plots 7, 14, 16 | Minerals with and without nitrate of soda |
| 19 | F.Y.M. after minerals and nitrate of soda |

### *Bromus mollis* in Plant Communities

*Bromus* shows a specially close connection with certain Leguminosae and Miscellaneous species, notably *Lathyrus*.

(a) Minerals, limed or unlimed (Plots 7, 15); Bromus - Lathyrus - Trifolium pratense - T.repens - Centaurea - Achillea - Plantago.

(b) Minerals and nitrate of soda, limed or unlimed (Plots 14, 16); Bromus - Lathyrus - Anthriscus - Ranunculus spp., Plantago - Taraxacum - Rumex.

## CYNOSURUS CRISTATUS

Traces occur on a few plots. Both distribution and quantity remained comparatively unchanged till 1919, since when a gradual decrease has taken place.

## DACTYLIS GLOMERATA

Occurs in samples on practically every plot, limed and unlimed. It is plentiful with most types of manuring except those inducing very acid or starved conditions. It is not greatly affected by liming except where soil acidity is high.

### UNLIMED

**QUANTITY**

Fairly large (8-25 percent)

| | |
|---|---|
| Plots 6, 7, 8, 15 | Minerals with and without potash |
| 13 | F.Y.M. and fish guano alternately |
| 14, 16 | Minerals and nitrate of soda |
| 17 | Nitrate of soda |
| 20 | F.Y.M., minerals and nitrate of soda |

Small, but variable (usually under 5 percent)

| | |
|---|---|
| Plots 1 | Ammonium salts |
| 2, 3, 12 | Unmanured |
| $4^1$ | Super |
| $5^2$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| 19 | F.Y.M. after minerals and nitrate of soda |

Very small (usually under 1 percent)

| | | |
|---|---|---|
| Plots | $4^2$ | Ammonium salts and super |
| | 9, 10 | Ammonium salts and minerals with and without potash |
| | $11^1$, $11^2$ | Heavy ammonium salts and minerals with and without silicate |
| | 18* | Ammonium salts and minerals without super |

Dactylis glomerata encouraged by:-

(a) Minerals with and without potash

(b) Nitrate of soda with and without minerals

(c) F.Y.M. with and without minerals and nitrate of soda

Dactylis glomerata discouraged by:-

(a) Starved soils

(b) Ammonium salts with or without minerals (complete or partial)

LIMED

QUANTITY

Considerably increased

| | | |
|---|---|---|
| Plots | 1, 9 | Ammonium salts with and without minerals |
| | 13 | F.Y.M. and fish guano alternately |
| | 18 | Ammonium salts and minerals without super |
| | $11^1$, $11^2$ | Heavy ammonium salts and minerals with and without silicate |

Little changed

| | | |
|---|---|---|
| Plots | 3 | Unmanured |
| | 7, 8 | Minerals with and without potash |

Slightly decreased

| | | |
|---|---|---|
| Plots | 14 | Minerals and nitrate of soda (high N, shaded area) |
| | 15 | Minerals |
| | 17 | Nitrate of soda |

Plots with Dactylis glomerata among the three chief grasses

| | Unlimed | | |
|---|---|---|---|
| | First | Second | Third |
| 1914 | 6 | 7, 16, 18 | $5^1$, 14, 19 |
| 1919 | 2,6,7,12,18 | 3,16,19,20 | $5^1$, 17 |
| 1948 or 1949 | 6, 7, 17 | 8, 12, 15 | 1, 4[1], $5^1$, 13, 14, 16, 18, 20 |

* Large amounts of Dactylis glomerata occurred on this plot till 1919 but in 1948 only traces were left.

| | LIMED | | |
|---|---|---|---|
| | First | Second | Third |
| 1914 | - | - | 7 |
| 1914 | 7 - | 2, 16 - | - |
| 1948 or 1949 | 1, 7, 18 | 2, 4[1], 13, 14 sun, 17, 19 LL | 9, 11[1], 19 HL, 20 |

## Dactylis glomerata in Plant Communities

### UNLIMED

(a) Festuca rubra - Agrostis - Dactylis is a common community associated with other species according to the manuring:-

No manure or nitrate of soda alone (Plots 2, 3, 12, 17); with Alopecurus - Anthoxanthum - Avena pubescens - Briza - Leontodon hispidus - Plantago or Rumex.

Minerals only (Plots 6, 7, 15) and Organic manure (Plot 19) with Lathyrus and Alopecurus, Achillea and Plantago.

Organic manure with and without minerals and nitrate of soda (Plots 13, 20) with Alopecurus and often Plantago and Rumex.

(b) Minerals and nitrate of soda (Plots 14, 16); Alopecurus - Arrhenatherum - Dactylis with Taraxacum, and Lathyrus on Plot 16.

(c) Minerals without potash (Plot 8); Arrhenatherum - Festuca rubra - Dactylis - Trofilium pratense - Achillea - Plantago.

### LIMED

(a) Unmanured (Plot 3); Avena pubescens - Festuca rubra - Alopecurus - Dactylis - Lotus.

(b) Ammonium salts alone (Plot 1); Avena pubescens - Festuca rubra - Dactylis with Plantago.

(c) Minerals (Plot 7); Alopecurus - Arrhenatherum - Avena pubescens - Dactylis - Lathyrus - Trifolium repens - Heracleum.

## FESTUCA RUBRA * Fig. 17.

Occurs in samples from every plot, limed and unlimed. It is generally plentiful except where the manuring is very heavy and it is much affected by season. The response to lime varies considerably.

### UNLIMED

**QUANTITY**

**Large** (often over 40 percent)

| | |
|---|---|
| Plot $5^1$ | Unmanured after ammonium salts till 1897 |

**Very variable with season** (mostly up to 20 percent)

| | |
|---|---|
| Plots 1 | Ammonium salts |
| 2, 3, 12 | Unmanured |
| $4^1$, $4^2$ | Super with and without ammonium salts |
| $5^2$ | Minerals after ammonium salts till 1897 |
| 7, 8 | Minerals with and without potash |

**Small** (up to 11 percent)

| | |
|---|---|
| Plots 6, 15 | Minerals |
| 10 | Ammonium salts and minerals without potash |
| 13 | F.Y.M. and fish guano alternately |
| 16, 17 | Nitrate of soda with and without minerals |
| 18 | Ammonium salts and minerals without super |
| 19, 20 | F.Y.M. with or without minerals and nitrate of soda |

**Very small** (under 1 percent)

| | |
|---|---|
| Plots 9 | Ammonium salts and minerals |
| $11^1$, $11^2$ | Heavy ammonium salts and minerals with and without silicate |
| 14 | Heavy nitrate of soda and minerals |

*Festuca rubra* encouraged by:-

(a) Starved soils

(b) Minerals and light dressings of ammonium salts singly or in combination

(c) Organic manures

---

* The *Festuca ovina* of the early records of J.B. Lawes and J.H. Gilbert and later of W.E. Brenchley, now identified by Mr. C.E. Hubbard of the Herbarium, Kew as *F.rubra*.

Festuca rubra not encouraged by:-

(a) Minerals and heavy dressings of nitrate of soda or ammonium salts

LIMED

QUANTITY

Considerably increased

| | | |
|---|---|---|
| Plots | $4^2$ | Super and ammonium salts |
| | 9, 10 | Ammonium salts and minerals with or without potash |
| | 14, 16 (particularly shade) | Minerals and nitrate of soda |
| | 17 | Nitrate of soda |
| | 18 (HL) | Ammonium salts and minerals without super |

Decreased

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 3 | Unmanured |
| | 7, 8, 15 | Minerals with and without potash |
| | 13 | F.Y.M. and fish guano alternately |

Little affected

| | | |
|---|---|---|
| Plots | $11^1$, $11^2$ | Ammonium salts and minerals with and without silicate |
| | 18 (LL) | Ammonium salts and minerals without super |
| | 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

Plots with Festuca rubra as the chief grass

| | Unlimed | Limed | Plots with no limed area |
|---|---|---|---|
| 1914 | 1,2,3,$4^1$,$4^2$,7,8,18,19,20 | 1,2,3,$4^1$,8,16 | $5^1$,$5^2$,12 |
| 1919 | $4^2$ | - | $5^1$,$5^2$ |
| 1949 | 2,3,$4^1$ | $4^2$,10,17 | $5^1$,$5^2$,12 |

Festuca rubra in Plant Communities

UNLIMED

A prominent feature of many plant associations. Festuca - Agrostis - Anthoxanthum is characteristic of Plots $4^2$ (Ammonium salts and super) and $5^1$ (Unmanured after Ammonium salts).

Its occurrence appears to bear little relation to the general balance of the three main groups of herbage, as it may be dominant where Gramineae, Leguminosae and Miscellaneous plants are well represented, and also where one or both of the latter groups are nearly or entirely suppressed.

LIMED

Association very varied as on the unlimed and dominance is affected by season. Ammonium salts and super (Plot $4^2$) Festuca - Alopecurus - Poa pratensis.

FESTUCA PRATENSIS

Rarely seen on any plot and has decreased considerably both in distribution and quantity. At one time it was more plentiful on the limed sections, especially of Plots 7, 8 and also Plot 19 (HL).

HOLCUS LANATUS Fig. 18.

Occurs in samples from every plot, limed and unlimed. It is usually kept in check by its associates, but it tends to dominate the situation when conditions are less favourable to the other species. High nutrition, associated with soil acidity, gives it great encouragement.

UNLIMED

QUANTITY

Very large (up to 100 percent)

| | |
|---|---|
| Plots 9, $11^1$ | Ammonium salts and minerals |

Variable (mostly 20-74 percent)

| | |
|---|---|
| Plots 10 | Ammonium salts and minerals without potash |
| $11^2$ | Ammonium salts and minerals with silicate |

Small (mostly under 10 percent)

| | |
|---|---|
| Plots 2, 3, 12 | Unmanured |
| $4^1$, $4^2$ | Super with and without ammonium salts |
| $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| 6, 16 | Minerals with and without nitrate of soda (low N) |
| 7, 8, 15 | Minerals with and without potash |
| 13 | F.Y.M. and fish guano alternately |
| 17 | Nitrate of soda |
| 18 | Minerals without super and ammonium salts |
| 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

Almost or entirely absent

| | |
|---|---|
| Plots 1 | Ammonium salts |
| 14 | Minerals and nitrate of soda (high N) |

Holcus lanatus encouraged by:-

(a) Heavy dressings of ammonium salts and minerals

(b) Nitrate of soda alone

(c) Omission of potash

Holcus lanatus not encouraged by:-

(a) Starved soils

(b) Mineral manures, alone or in combination with nitrogenous fertilizer other than heavy dressings of ammonium salts

Suppressed by:-

(a) Ammonium salts alone

(b) Heavy nitrate of soda and aminerals

## LIMED

QUANTITY

Increased

| | |
|---|---|
| Plot 1 | Ammonium salts |

Decreased

| | |
|---|---|
| Plots 7, 8 | Minerals with and without potash |
| 19 (HL) | F.Y.M. after minerals and nitrate of soda |

Considerably decreased

| | |
|---|---|
| Plots 9, 10 | Minerals and ammonium salts |
| $11^1$, $11^2$ | Minerals and heavy ammonium salts with and without silicate |
| 17 | Nitrate of soda |

Little or variably affected

Plots 2, 3, $4^1$, $4^2$, 13, 14, 15, 16, 18, 19LL, 20.

Plots with Holcus lanatus among the three chief grasses

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | $11^1$,$11^2$ | 8 | $4^1$,13,20 | $11^1$ | - | 2, $4^1$, 13 |
| 1919 | 1,2,3,8,$11^1$ | 9,17 | $4^1$, $11^2$, | - | $4^1$ | 1, 2, 3, $11^1$ |
| 1948 or 1949 | 9, $11^1$, $11^2$ | 10 | $4^2$, 8 | - | - | $4^1$, $11^1$ |

On plots with highly acid soils and a good supply of plant nutrients, liming has caused a very great decrease in Holcus lanatus viz. 90.6-2.5 percent (Plot 9, 1948) and 81.7-7.6 and 40.8-2.4 percent (Plots $11^1$ and $11^2$ respectively, 1947). The effect of lime on plots of medium or low acidity is much smaller.

Holcus lanatus in Plant Communities

UNLIMED

(a) Ammonium salts and minerals (Plots 9, 10); Holcus - Anthoxanthum - Agrostis with the latter two usually almost absent on Plot 9.

(b) Heavy ammonium salts and minerals (Plots $11^1$, $11^2$); Holcus - Agrostis with Arrhenatherum also on Pplot $11^2$

The other associations in which Holcus occurs are both very varied in composition, and also influenced by season.

LIMED

Most of the associations are varied and variable, even on Plots $11^1$ and $11^2$ where Holcus, usually plentiful, may be greatly reduced in some seasons.

## LOLIUM PERENNE

Very small amounts often occur on Plots 8, 17 and 20 although formerly this species was found on most plots in fair quantity.

## POA PRATENSIS Fig. 19.

Present on most plots and is tenacious of its position in spite of the very small amounts that usually occur. It is not much affected by manuring, but is considerably increased by lime.

### UNLIMED

QUANTITY

Small (up to 6 percent)

| | | |
|---|---|---|
| Plots | $5^2$ | Minerals after ammonium salts till 1897 |
| | 7, 14, 15 | Minerals with and without heavy nitrate of soda |

Very small (usually under 1 per cent)

All other plots, but usually absent on Plots 9 and 10.

### LIMED

QUANTITY

Much increased

| | | |
|---|---|---|
| Plots | $4^2$ | Super and ammonium salts |
| | 9, 10 | Ammonium salts and minerals with and without potash |
| | $11^1$, $11^2$ | Heavy ammonium salts and minerals with and without silicate |

Increased

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2, 3 | Unmanured |
| | 13 | F.Y.M. and fish guano alternately |

Little affected

Plots $4^1$, 7, 8, 14, 15, 16, 17, 18, 19, 20.

## Poa pratensis in Plant Communities

### UNLIMED

An insignificant member of all associations except occasionally on Plot 14 where it may be quite prominent.

### LIMED

Insignificant except on the following plots:-

(a) Super and ammonium salts (Plot $4^2$); Alopecurus - Festuca rubra - Poa pratensis - Anthoxanthum.

(b) Minerals and ammonium salts (Plots 9, 10); Alopecurus - Arrhenatherum - Poa pratensis with Anthoxanthum and Dactylis (Plot 9) or Festuca rubra (Plot 10).

(c) Minerals and heavy ammonium salts (Plots $11^1$, $11^2$); Alopecurus - Poa pratensis - with Arrhenatherum, Dactylis and Holcus.

## POA TRIVIALIS

### UNLIMED

Present in very small amounts.

QUANTITY

Small (usually under 1 percent)

| | |
|---|---|
| Plots 14, 16 | Minerals and nitrate of soda (9.8 percent on Plot 14 in 1940) |

Very small (under 0.9 percent)

| | |
|---|---|
| Plots $4^1$ | Super |
| 6, 7, 8, 15 | Minerals with and without potash |
| 13 | F.Y.M. and fish guano alternately |
| 17 | Nitrate of soda |
| 19, 20 | F.Y.M. with and without nitrate of soda and minerals |

Almost or entirely absent

Plots 1, 2, 3, $4^2$, $5^1$, $5^2$, 9, 10, $11^1$, $11^2$, 18.

### LIMED

QUANTITY

Increased (sometimes considerably)

| | |
|---|---|
| Plot 7 | Minerals |

Increased

| | |
|---|---|
| Plot 1 | Ammonium salts |
| 2, 3 | Unmanured |
| 8, 15 | Minerals without and with potash |
| 13, 19, 20 | F.Y.M. with and without minerals and nitrate of soda |
| 14(sun), 16 | Nitrate of soda and minerals |
| 17 | Nitrate of soda |

Little or unaffected

Plots $4^1$, $4^2$, 9, 10, $11^1$, $11^2$, 18.

Even where liming causes a considerable increase, the amount may remain very small.

## Poa trivialis in Plant Communities

Formerly an insignificant member of all associations in which it occurred, but now of some importance on the limed sections.

## B. LEGUMINOSAE

### LATHYRUS PRATENSIS

Abundant on certain plots, particularly those receiving mineral manures. On most other plots very little is present. The effect of lime varies with the manuring.

### UNLIMED

QUANTITY

Sometimes large (up to 34 percent)

| | |
|---|---|
| Plots 6, 7, 15 | Minerals |
| $5^2$ | Minerals after ammonium salts till 1897 |
| 16 | Minerals and nitrate of soda (low N) |

Medium (up to 13 percent)

| | |
|---|---|
| Plots 14 | Minerals and nitrate of soda (high N) |
| 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

Very small

| | |
|---|---|
| Plots 2, 3, 12 | Unmanured |
| $4^1$ | Super |
| 8 | Minerals without potash |
| 13 | F.Y.M. and fish guano alternately |

Almost or entirely absent

Plots 1, $4^2$, $5^1$, 9, 10, $11^1$, $11^2$, 17, 18.

Lathyrus pratensis encouraged by:-

(a) Minerals, alone or with nitrate of soda
(b) Occasional dressings of organic manures

Lathyrus pratensis not encouraged by:-

(a) Starved soils
(b) Ammonium salts alone or with minerals
(c) Nitrate of soda alone

LIMED

QUANTITY

Considerably increased

| | | |
|---|---|---|
| Plots | 1, 9 | Ammonium salts with and without minerals |
| | 13 | F.Y.M. and fish guano alternately |
| | 14 | Minerals and nitrate of soda (high N) |

Slightly increased

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured |
| | $4^1$ | Super |

Decreased

| | | |
|---|---|---|
| Plots | 7 | Minerals |
| | 16 | Minerals and nitrate of soda (low N) |

Little affected

Plots $4^2$, 8, 10, $11^1$, $11^2$, 15, 17, 18, 19, 20.

Plots with Lathyrus pratensis among the three chief species of the whole herbage.

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | 15 | 6, 7, 16 | - | 7 | - | $4^1$ |
| 1919 | - | - | 6, 7 | 7 | - | - |
| 1948 or | $5^2$, 6, 15, 19 | - | 16, 7 | 7 | 15 | - |

Lathyrus pratensis in Plant Communities

UNLIMED

(a) Complete minerals or occasional dressings of organic manure. (Plots $5^2$, 6, 7, 15, 19, 20); Festuca rubra - Lathyrus - Dactylis - Agrostis, often with Anthoxanthum - Arrhenatherum - Holcus - Alopecurus.

(b) Minerals and nitrate of soda (Plots 14, 16); Lathyrus - Alopecurus Arrhenatherum - Dactylis with Taraxacum - Plantago and occasionally Anthriscus.

LIMED

(a) Minerals with and without ammonium salts (Plots 7, 9); Dactylis - Alopecurus - Arrhenatherum - Lathyrus, with Trifolium repens on Plot 7 and Anthoxanthum on Plot 9.

(b) F.Y.M. and fish guano (Plot 13); Alopecurus- Arrhenatherum - Dactylis - Lathyrus - Plantago.

(c) Minerals and heavy nitrate of soda (Plot 14); Arrhenatherum - Alopecurus - Dactylis - Lathyrus.

(d) Minerals alone (Plot 15); Arrhenatherum - Avena pubescens - Festuca rubra - Lathyrus with Trifolium repens - Plantago.

## LOTUS CORNICULATUS

Low growing and usually late flowering, so is probably more abundant than appears from the hay analyses. It was particularly noticeable in August 1921 after the prolonged drought, and in June 1929, 1930, 1934, 1939 and 1945.

UNLIMED

QUANTITY

| | | |
|---|---|---|
| Large | (up to 9 percent) | |
| Plots | 2, 3, 12 | Unmanured |
| Medium | (up to 5 percent) | |
| Plots | $4^1$ | Super |
| | $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| | 6, 7, 8 | Minerals with and without potash |
| | 19. | F.Y.M. after minerals and nitrate of soda |

Almost or entirely absent

Plots 1, $4^2$, 9, 10, $11^1$, $11^2$, 13, 14, 15, 16, 17, 18, 20.

Lotus corniculatus encouraged by:-

(a) Starved soils
(b) Minerals

Lotus corniculatus usually suppressed by:-

(a) Nitrogenous manures with minerals
(b) Frequent organic manuring

LIMED

QUANTITY

Considerably increased

| | | |
|---|---|---|
| Plots | 3 | Unmanured |
| | $4^1$ | Super |
| | 8 | Minerals without potash |
| | 17 | Nitrate of soda |

Increased

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 19 (HL) | F.Y.M. after minerals and nitrate of soda |

Decreased

| | | |
|---|---|---|
| Plot | 7 | Minerals |

Lotus corniculatus in Plant Communities

Not usually a significant species, except in the very mixed associations on the plots receiving no manure or incomplete minerals.

ONONIS ARVENSIS (O. repens).

Occurs in small quantity on Plot $4^1$ Unlimed (Super).

TRIFOLIUM PRATENSE

Owing to its low growth, it does not always appear in representative quantity in the hay samples, especially when the season is unfavourable.

UNLIMED

QUANTITY

Often large (up to 18 percent)

| | | |
|---|---|---|
| Plots | 6, 7, 8 | Minerals with and without potash |

Medium

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |

Small

| | | |
|---|---|---|
| Plots | $4^1$ | Super |
| | $5^2$ | Minerals after ammonium salts till 1897 |
| | 15, 16 | Minerals with and without nitrate of soda |

Trace or absent

Plots 1, $4^2$, $5^1$, 9, 10, $11^2$, 13, 14, 17, 18, 19, 20.

Trifolium pratense encouraged by:-

(a) Minerals
(b) Starved soils

Trifolium pratense almost or entirely suppressed by:-

(a) Ammonium salts
(b) Heavy organic manures
(c) Heavy dressings of sodium nitrate

LIMED

Effect variable; quantity usually increased, but little changed on Plot 8 (Minerals without Potash) where it is already plentiful.

Trifolium pratense in Plant Communities

Not a significant member of any association, except on plots receiving minerals only without lime.

UNLIMED

(a) Complete minerals (Plots 6 and 7); Dactylis - Lathyrus - Trifolium pratense - Plantago - Rumex with Anthoxanthum and Achillea; Lotus and Conopodium in addition on Plot 6.

(b) Minerals without potash (Plot 8); Dactylis - Arrhenatherum - Festuca rubra - Holcus - Trifolium pratense - Plantago - Rumex.

## TRIFOLIUM REPENS

Owing to its low growth and late development it does not appear in representative quantity in the hay samples.

### UNLIMED

QUANTITY

Relatively large (up to 3.9 percent)

| | | |
|---|---|---|
| Plots | 7, 8, 15 | Minerals with and without potash |
| | 19 | F.Y.M. after minerals and nitrate of soda |

Absent

Plots $4^2$, $5^1$, 9, 10, $11^1$, $11^2$, 13, 14, 18.

Traces on all other plots.

### LIMED

QUANTITY

Increased

| | | |
|---|---|---|
| Plots | 7, 15 | Minerals |
| | 20 (LL) | F.Y.M. with minerals and nitrate of soda |

Little affected

All other plots.

## VICIA SEPIUM

Occurs in small quantity on the unlimed sections of Plots 6 and 7 and occasionally on the limed area of Plot 7.

## C. MISCELLANEOUS SPECIES

### ACHILLEA MILLEFOLIUM

#### UNLIMED

**QUANTITY**

Fairly large (up to 14 percent)

| | | |
|---|---|---|
| Plots | 6, 7, 8, 15 | Minerals with and without potash |
| | 19 | F.Y.M. after minerals and nitrate of soda |

Small (up to 4 percent)

All other plots except:- $4^2$, 9, 10, $11^1$, $11^2$ where absent.

Achillea millefolium encouraged by:-

(a) Minerals
(b) F.Y.M.

Achillea millefolium discouraged by:-

(a) Ammonium salts

#### LIMED

Achillea is decreased by liming, except on Plots 1 and 17 where there is a slight increase, and Plots $11^1$, 19 and 20 where no change occurs.

### AGRIMONIA EUPATORIA

Has become more plentiful since 1919, particularly on the limed half of Plot 8 (minerals without potash). Owing to its late development little appears in the hay samples and the following data are based on field observations in September for the ten years 1940-1949.

#### UNLIMED

Recorded in flower

Almost every year

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |

In 3 seasons

| | | |
|---|---|---|
| Plots | $4^1$ | Super |
| | 8 | Minerals without potash |

In 1 or 2 seasons

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $4^2$ | Super and ammonium salts |
| | $5^1$ | Unmanured after ammonium salts till 1897 |
| | 18 | Ammonium salts and minerals without super |
| | 19 | F.Y.M. after minerals and nitrate of soda |

LIMED

Recorded in flower

Almost every year

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2, 3 | Unmanured |
| | $4^1$ | Super |
| | 8 | Minerals without potash (usually rated plentiful) |
| | 18 | Ammonium salts and minerals without super |
| | 19 | F.Y.M. after minerals and nitrate of soda |

In 3 or 4 seasons

| | | |
|---|---|---|
| Plots | 7 | Minerals |
| | 16 | Minerals and nitrate of soda |

In 1 or 2 seasons

| | | |
|---|---|---|
| Plots | 13 | F.Y.M. and fish guano alternately |
| | 17 | Nitrate of soda |
| | 15 | Minerals |

AJUGA REPTANS

Little appears in the hay samples, but it is a regular feature on the plots receiving no manure (2, 3, $5^1$, 12), nitrate of soda (17) and F.Y.M. with and without minerals (13, 19, 20) and to a less extent super ($4^1$) and minerals without potash (8). The addition of lime has no marked influence on its distribution or quantity, except on Plot 1 (ammonium salts alone) where a small amount of Ajuga is introduced.

## ANTHRISCUS SYLVESTRIS

### UNLIMED

**QUANTITY**

**Small** (up to 5 percent)

| | | |
|---|---|---|
| Plots | 14, 16 | Nitrate of soda and minerals |

**Trace**

| | | |
|---|---|---|
| Plot | 20 | F.Y.M., minerals and nitrate of soda |

**Absent**

All other plots

### LIMED

**QUANTITY**

**Increased**

| | | |
|---|---|---|
| Plots | 16 | Nitrate of soda and minerals |
| | 13 | F.Y.M. and fish guano alternately |

**Introduced**

| | | |
|---|---|---|
| Plots | 7, 9 | Minerals with and without ammonium salts |

**Absent**

All other plots

## CAREX PRAECOX (C.caryophyllea)

### UNLIMED

**QUANTITY**

**Appreciable** (up to 1.7 percent)

| | | |
|---|---|---|
| Plots | 3 | Unmanured |
| | 17 | Nitrate of soda |

**Trace**

| | | |
|---|---|---|
| Plot | 8 | Minerals without potash |

**Absent**

All other plots

### LIMED

Up to 0.3 percent on Plot 3 and a trace on Plot 8 otherwise absent.

## CENTAUREA NIGRA

Centaurea nigra is encouraged by one-sided manuring whether nitrogenous or mineral but suppressed when both are applied together. Its response to lime varies.

### UNLIMED

**QUANTITY**

Medium (up to 8 percent)

| | | |
|---|---|---|
| Plots | 3, 5[1] | Unmanured |
| | 4[1] | Super |
| | 6, 7, 8 | Minerals with and without potash |
| | 17 | Nitrate of soda |

Small (under 1 percent)

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 13, 19 | F.Y.M. |
| | 15 | Minerals |

Absent

All other plots, except for traces on Plot 10.

Centaurea nigra encouraged by:-

(a) Starved soils
(b) Nitrogenous manures or mineral manures alone

Centaurea nigra almost or entirely suppressed by:-

(a) Nitrogenous and mineral manures applied together
(b) Organic manures

### LIMED

**QUANTITY**

Increased

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 13, 19, 20 | F.Y.M. with and without nitrate of soda and minerals |
| | 18 | Ammonium salts and minerals without super |

Decreased

| | | |
|---|---|---|
| Plots | 7, 15 | Minerals |
| | 17 | Nitrate of soda |

Little or unaffected

Plots 3, 4[1], 8, 14.

## Centaurea nigra in Plant Communities

Occurs in the very mixed association of plots receiving no manure or incomplete fertilizers. It is seldom found on well manured soils.

## CERASTIUM VULGATUM

### UNLIMED

Present in small quantity on most plots, except those receiving ammonium salts or nitrate of soda, with or without minerals.

### LIMED

Quantity usually slightly increased.

## CONOPODIUM DENUDATUM (C.majus)

Very variable with season and has ranged from 1-10 percent. As it flowers and dies down early it is probably more abundant than is indicated by the hay analyses.

### UNLIMED

QUANTITY

| | | |
|---|---|---|
| Medium | (usually over 5 percent) | |
| Plots | 2, 3, 12 | Unmanured |
| | 6, 7 | Minerals |
| Small | (usually under 2 percent) | |
| Plots | 1, $4^1$ | Ammonium salts with and without super |
| | $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| | 8, 15 | Minerals with and without potash |
| | 13 | F.Y.M. and fish guano alternately |
| | 16 | Minerals and nitrate of soda (low N) |
| | 17 | Nitrate of soda |
| | 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

Almost or entirely absent

| | | |
|---|---|---|
| Plots | $4^2$, 9, 10, $11^1$, $11^2$, 18 | Ammonium salts and minerals with and without super |
| | 14 | Minerals and nitrate of soda (high N) |

Conopodium denudatum encouraged by:-

(a) Starved soils
(b) Minerals

Conopodium denudatum discouraged by:-

(a) Ammonium salts
(b) Heavy nitrate of soda and minerals

LIMED

QUANTITY

Decreased

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured |
| | 7, 8 | Minerals with and without potash |
| | 13 | F.Y.M. and fish guano alternately |

Little affected

All other plots

Conopodium denudatum in Plant Communities

Occasionally conspicuous in the varied associations on the unmanured and mineral plots.

EPILOBIUM ANGUSTIFOLIUM (Chamaenerion angustifolium)

Appears occasionally on the unlimed sections only*. In 1947 it was unusually plentiful on the following plots, all of which receive ammonium salts.

| | | |
|---|---|---|
| Plot 1 | Ammonium salts alone | Trace |
| $4^2$ | " " " and super | 0.8 percent |
| 9 | " " and minerals | 1.7 " " |
| $11^1$ | " " (heavy) and minerals | 11.9 " " |

GALIUM VERUM

Occurs in some seasons in very small quantities on most plots, except those receiving ammonium salts and minerals.

---

* The source of invasion is adjacent to the unlimed sections which increases the chance of colonization on these areas. The inhibiting effect of lime on establishment, however, appears to be real and compares with that of sodium silicate

(See p.12 ).

## HERACLEUM SPHONDYLIUM

Has greatly increased on certain plots since 1924.

### UNLIMED

QUANTITY

**Fairly plentiful**

| | |
|---|---|
| Plots 6, 7 | Minerals (up to 4 percent on Plot 7) |

**Small, often absent**

| | |
|---|---|
| Plots 9, | Minerals and ammonium salts; (0.4 percent) |
| 13, 19 | F.Y.M. (1.3 percent; Plot 13) |
| 14 | Minerals and heavy nitrate of soda; (up to 1.0 percent) |

**Traces**

Plots $5^2$, 8, 10, 16, 17, 20.

**Absent**

All other plots.

### LIMED

QUANTITY

**Greatly increased**

| | |
|---|---|
| Plots 7, 9 | Minerals with and without ammonium salts |

**Increased**

| | |
|---|---|
| Plot 19 | F.Y.M. after minerals and nitrate of soda |

**Introduced**

| | |
|---|---|
| Plot $11^2$ | Ammonium salts, minerals and silicate of soda |
| 15, 16 | Minerals with and without nitrate of soda |
| 18 | Ammonium salts and minerals without super |

## HIERACIUM PILOSELLA

Has become more plentiful and may be important on Plot $5^1$ (unmanured after ammonium salts till 1897). It occurs to some extent also on the following plots including any limed areas:-

| | |
|---|---|
| Plots 2, 3, 12 | Unmanured |
| $4^1$ | Super |
| $5^2$ | Minerals after ammonium salts till 1897 |
| 8 | Minerals without potash |

## HYPOCHAERIS RADICATA

Has increased in distribution, and now occurs to some extent on all plots except:-

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $4^1$ | Super |
| | 10, $11^1$, $11^2$ | Ammonium salts and minerals with and without silicate |
| | 16 | Minerals and nitrate of soda |
| | 18 | Ammonium salts and minerals without super |
| | 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

## LEONTODON AUTUMNALIS

Late flowering, so no figures from hay analyses are available. The following data are from observations made in September, 1946-1949.

### UNLIMED

QUANTITY

Abundant

| | | |
|---|---|---|
| Plots | $4^1$ | Super |
| | 8, 15 | Minerals with and without potash |
| | 17 | Nitrate of soda |

Plentiful

| | | |
|---|---|---|
| Plots | 3 | Unmanured |
| | 16 | Minerals and nitrate of soda (low N) |

Small

| | | |
|---|---|---|
| Plots | 2, 12 | Unmanured |
| | $5^2$ | Minerals afer ammonium salts till 1897 |
| | 6, 7 | Minerals |
| | 13 | F.Y.M. and fish guano alternately |
| | 14 | Minerals and nitrate of soda (high N) |
| | 20 | F.Y.M. minerals and nitrate of soda |

Absent

All other plots.

### LIMED

In general the quantity is reduced by lime.

QUANTITY

Plentiful

| | | |
|---|---|---|
| Plot | 17 | Nitrate of soda |

Small

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2 | Unmanured |
| | 7, 8, 15 | Minerals with and without potash |
| | 10 | Ammonium salts and minerals without potash |
| | 13, 19 | F.Y.M. with and without fish guano |
| | 18 | Ammonium salts and minerals without super |

## LEONTODON HISPIDUS Fig. 20.

Abundant on a few plots, but traces may occur on most others.

### UNLIMED

QUANTITY

Fairly large (up to 18 percent)

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |
| | $4^1$ | Super |
| | 8 | Minerals without potash |
| | 17 | Nitrate of soda |

Small (0.1-1.9 percent)

| | | |
|---|---|---|
| Plots | $5^1$ | Unmanured after ammonium salts till 1897 |
| | 6, 7 | Minerals |
| | 13 | F.Y.M. and fish guano alternately |
| | 19 | F.Y.M. after minerals and nitrate of soda |

Occasional traces

Plots 1, $5^2$, 9, 10, $11^1$, 14, 18, 20.

Absent

All other plots.

Leontodon hispidus encouraged by:-

(a) Starved soils

(b) Super

Leontodon hispidus discouraged by:-

(a) Most forms of good or medium manuring

LIMED

QUANTITY

Slightly increased or little changed

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $4^1$ | Super |
| | 13 | F.Y.M. and fish guano alternately |

Decreased

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured |
| | 17 | Nitrate of soda |

Plots with Leontodin hispidus among the three chief species of the whole herbage.

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | - | 2, 3, $4^1$ | - | - | - | 2 |
| 1948 or 1949 | 2, $4^1$, 3 | 12 | - | - | 3 | - |

Leontodon hispidus in plant communities

UNLIMED

A characteristic of the association on the plots with no manure, super and minerals without potash (2, 3, 12, $4^1$, 8). Festuca rubra - Agrostis - Dactylis - Holcus - Anthoxanthum - Briza, Trifolium pratense - Leontodon - Plantago - Rumex - (Little or no Agrostis on Plot $4^1$ and little Briza on Plot 8).

LIMED

Characteristic of the same plots as the unlimed areas, but in somewhat different association. viz. Dactylis - Avena pubescens - Holcus - Briza - Trifolium pratense - Leontodon - Plantago - Centaurea. (Often much Poterium on Plot 3 and Scabiosa on Plot 8).

## LINUM CATHARTICUM

Rarely if ever appears in the hay samples. On the unlimed areas it occurs only on Plots 2 and 3 (unmanured), but it is a regular feature on the limed halves of both these plots and also of Plot $4^1$ (super) and to a less extent of Plot 1 (ammonium salts).

## LUZULA CAMPESTRIS

Has increased since 1914.

### UNLIMED

**QUANTITY**

**Variable** (mostly below 1 percent)

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2, 3, 12 | Unmanured |
| | $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| | 6, 7, 8, 15 | Minerals with and without potash |
| | 17 | Nitrate of soda |

**Traces**

Plots $4^1$, 9, $11^1$, $11^2$, 13, 18, 19.

**Absent**

Plots $4^2$, 10, 14, 16, 20.

### LIMED

Little general change in quantity, but decreased on Plots 7, 8 and 15.

## PIMPINELLA SAXIFRAGA

Owing to its late development, very little appears in the hay samples and it is more plentiful, especially on the plots receiving no manure or minerals, than the analytical figures indicate. Probably increased by lime.

## PLANTAGO LANCEOLATA Fig. 21.

Plantago lanceolata is chiefly associated with poor exhausted soils and may be very plentiful in some seasons. The effect of lime varies with the manuring.

## UNLIMED

### QUANTITY

**Large** (may reach 33 percent)

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |
| | $4^1$ | Super |
| | 8 | Minerals without potash |
| | 13 | F.Y.M. and fish guano alternately |
| | 17 | Nitrate of soda |
| | 19 | F.Y.M. after minerals and nitrate of soda |

**Variable** (up to 6.5 percent)

| | | |
|---|---|---|
| Plots | 6, 7, 15 | Minerals |
| | 20 | F.Y.M., minerals and nitrate of soda |

**Absent or occasional traces**

Plots 1, $4^2$, $5^1$, $5^2$, 9, 10, $11^1$, $11^2$, 14, 16, 18.

*Plantago lanceolata* encouraged by:-

(a) Starved or exhausted soils
(b) Nitrate of soda alone
(c) F.Y.M., with and without fish guano

*Plantago lanceolata* almost or entirely suppressed by:-

(a) Ammonium salts with minerals
(b) Nitrate of soda with minerals
(c) Unmanured or minerals after ammonium salts

## LIMED

### QUANTITY

**Increased**

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 13 | F.Y.M. and fish guano alternately |
| | 15 | Minerals |
| | 18 | Minerals without super and ammonium salts |
| | 20 | F.Y.M., minerals and nitrate of soda |

**Decreased**

| | | |
|---|---|---|
| Plots | 7, 8 | Minerals with and without potash |
| | 14, 16 | Nitrate of soda and minerals |

**Effect variable**

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured |
| | $4^1$ | Super |

Unaffected

| | | |
|---|---|---|
| Plots | 17 | Nitrate of soda |
| | 19 | F.Y.M. after minerals and nitrate of soda |

## Plantago lanceolata in plant communities

Generally characteristic of the various associations on the poorer soils, although it is also conspicuous on the plot receiving F.Y.M. and fish guano. It may show a connection with Briza and Leotodon hispidus.

### Plots with Plantago lanceolata among the three chief species of the whole herbage.

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1914 | - | - | 8, 17 | - | - | - |
| 1919 | 2, 3, 4[1], 8, 17 | - | - | - | 2, 3, 4[1] | 8 |
| 1948 or 1949 | 8, 13 | - | 4[1] | 1 | 3, 4[1], 8 | 13 |

## POTENTILLA REPTANS

Occurs occasionally. A characteristic feature of Plot 1 (ammonium salts alone).

### UNLIMED

QUANTITY

Small

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts (1.9 percent in 1948) |
| | 3 | Unmanured (0.3 percent in 1948) |

Trace

| | | |
|---|---|---|
| Plot | 13 | F.Y.M. and fish guano alternately |

### LIMED

Almost absent. [0.1 percent on Plot 1 (ammonium salts) and a trace on Plot 3 (unmanured) in 1948].

## POTERIUM SANGUISORBA

Poterium sanguisorba is usually regarded as a calcareous plant and the quantity occurring on the unlimed plots is unexpected.

### UNLIMED

QUANTITY

Large clumps

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured (18 percent, 1938) |
| | $4^1$ | Super |

Traces

Plots $5^1$, 8, 10, 14.

### LIMED

QUANTITY

Large clumps

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured (13 percent, 1947) |
| | $4^1$ | Super |

Traces

Plots 8, 10.

## PRIMULA VERIS

Seldom represented in the hay samples.

### UNLIMED

QUANTITY

Present

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured (especially Plot 12) |

Occasional

| | | |
|---|---|---|
| Plot | $4^1$ | Super |

### LIMED

Seldom recorded. Originally present on Plots 7, 8, 13, 15 and 19 but has now disappeared.

## RANUNCULUS ACRIS ET BULBOSUS

Occur on all plots, occasionally in fair amount, R.acris being the more important of the two species.

### QUANTITY

**Variable** (1.0 - 9.8 percent)

| | | |
|---|---|---|
| Plots | 6, 7, 8 | Minerals with and without potash |
| | 19, 20 | F.Y.M. with and without minerals and nitrate of soda |

**Small** (under 1 percent)

| | | |
|---|---|---|
| Plots | 2, 3, 12 | Unmanured |
| | $4^1$ | Super |
| | $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| | 13 | F.Y.M. and fish guano alternately |
| | 15 | Minerals |
| | 16, 17 | Nitrate of soda with and without minerals |

**Almost or entirely suppressed**

Plots 1, $4^2$, 9, 10, $11^1$, $11^2$, 14, 18.

Ranunculus spp. encouraged by:-

(a) Minerals
(b) Starved soils
(c) F.Y.M.

Ranunculus spp. suppressed by:-

(a) Ammonium salts

### LIMED

### QUANTITY

**Increased**

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2, 3 | Unmanured |
| | $4^1$, 7 | Minerals |
| | 13, 19LL | F.Y.M. with and without fish guano |
| | 17 | Nitrate of soda |

**Decreased**

| | | |
|---|---|---|
| Plot | 8 | Minerals without potash |

## RUMEX ACETOSA Fig. 22.

Rumex acetosa occurs on all plots. It is usually fairly plentiful where manuring is incomplete, but less so in the presence of heavy dressings of ammonium salts or nitrate of soda. Lime usually increases it when applied with ammonium salts and super or minerals, but decreases it if given with minerals alone or with F.Y.M. Its prevalence varies greatly with season and the following grouping is approximate only.

### UNLIMED

QUANTITY

Fairly large

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2, 3, 12 | Unmanured |
| | $4^1$ | Super |
| | $5^2$ | Minerals after ammonium salts till 1897 |
| | 6, 7, 8 | Minerals with and without potash |
| | 13, 20 | F.Y.M. with fish guano or with minerals and nitrate of soda |
| | 18 | Minerals without super and ammonium salts |

Small

| | | |
|---|---|---|
| Plots | $4^2$ | Super and ammonium salts |
| | $5^1$ | Unmanured after ammonium salts till 1897 |
| | 9, 10, $11^2$ | Minerals and ammonium salts |
| | 14, 16, 17 | Nitrate of soda with and without minerals |
| | 15 | Minerals |
| | 19 | F.Y.M. after minerals and nitrate of soda |

Trace or absent

| | | |
|---|---|---|
| Plot | $11^1$ | Minerals and heavy ammonium salts |

Rumex acetosa encouraged by:-

(a) Minerals
(b) Ammonium salts
(c) Organic manures
(d) Starved soils

Rumex acetosa not encouraged by:-

(a) Sodium nitrate
(b) Heavy nitrogenous manures

LIMED

QUANTITY

Increased

| | | |
|---|---|---|
| Plots | $4^2$ | Super and ammonium salts |
| | 10 | Minerals without potash and ammonium salts |

Decreased

| | | |
|---|---|---|
| Plots | 7 | Minerals |
| | 13 | F.Y.M. and fish guano alternately |
| | 18 | Minerals without super and ammonium salts |
| | 20 | F.Y.M., minerals and nitrate of soda |

Plots with Rumex acetosa among the three chief species of the whole herbage.

| | Unlimed | | | Limed | | |
|---|---|---|---|---|---|---|
| | First | Second | Third | First | Second | Third |
| 1919 | - | $5^1$,$5^2$,6,7,9,18 | $4^2$,13,15,19 | - | 1 | 8 |
| 1948 or 1949 | - | - | - | - | - | 10 |

Rumex acetosa in Plant Communities

Occurs in a great variety of associations, of which Festuca rubra is always a prominent member when Rumex is plentiful.

SCABIOSA ARVENSIS (Knautia arvensis)

As it flowers late, little is usually found in the hay samples and data are chiefly obtained from observations on the aftermath.

UNLIMED

QUANTITY

Usually present

| | | |
|---|---|---|
| Plots | 2, 3, $5^1$, 12 | Unmanured |
| | $5^2$, 6, 7, 8 | Minerals |

Occasional

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 13 | F.Y.M. and fish guano alternately |
| | 20 | F.Y.M., minerals and nitrate of soda |

Usually absent

All other plots.

LIMED

Scabiosa is a marked feature of the aftermath on Plot 8 (minerals without potash), and also sometimes on Plots 2, 3, 12 (unmanured). It has greatly increased and may on occasions reach a figure as high as 8 or 10 percent, e.g. Plots 3 and 8 respectively in 1936.

## SPIREA ULMARIA (Filipendula ulmaria)

May occur locally in fair quantity, but more usually absent.

UNLIMED

QUANTITY

Sometimes appreciable

| | | |
|---|---|---|
| Plots | 7, 8 | Minerals with and without potash (3 percent 1938; 2 percent 1940 Plot 7) |

LIMED

QUANTITY

Much increased

| | | |
|---|---|---|
| Plot | 8 | Minerals without potash |

Trace

| | | |
|---|---|---|
| Plot | 1 | Ammonium salts |
| | 3 | Unmanured |

Suppressed

| | | |
|---|---|---|
| Plot | 7 | Minerals |

## STELLARIA GRAMINEA

UNLIMED

Less plentiful than previously, but a small quantity is found on a few plots viz.

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | 2, 3, 12 | Unmanured |
| | 7, 8, 15 | Minerals with and without potash |
| | 13 | F.Y.M. and fish guano alternately |

LIMED

Quantity usually slightly decreased, except occasionally with ammonium salts (Plot 1) or minerals (Plot 7).

## TARAXACUM VULGARE (T. officinale).

Flowers and dies down early and is much more abundant where it occurs than the hay analyses indicate. Has increased considerably since 1919, particularly on the limed areas.

UNLIMED

QUANTITY

Small

| | | |
|---|---|---|
| Plots | 14, 16 | Minerals and nitrate of soda (up to 3 percent Plot 14) |
| | 13, 19, 20 | F.Y.M. with and without other fertilizers |

Very small

Plots 3, 6, 7, 8, 15, 17, 18.

Absent

All other plots.

LIMED

QUANTITY

Very much increased

| | | |
|---|---|---|
| Plot | 18 | Minerals without super and ammonium salts |

Considerably increased

| | | |
|---|---|---|
| Plots | 7, 9 | Minerals with and without ammonium salts |
| | 13 | F.Y.M. and fish guano alternately |

Slightly increased

| | | |
|---|---|---|
| Plots | 1 | Ammonium salts |
| | $4^1$ | Super |
| | 2, 3 | Unmanured |
| | $11^1$, $11^2$ | Minerals and heavy ammonium salts |
| | 14, 16 | Minerals and nitrate of soda |
| | 19, 20 | F.Y.M. with and without minerals and sodium nitrate |

Unaffected

Plots $4^2$, 8, 10, 15, 17.

## TRAGOPOGON PRATENSIS

Has increased since 1915, especially on the limed areas.

### UNLIMED

QUANTITY

Fairly plentiful (up to 3 percent)

| | | |
|---|---|---|
| Plot | 20 | F.Y.M., minerals and nitrate of soda |

Small (under 1 percent)

| | | |
|---|---|---|
| Plots | 3 | Unmanured |
| | 6, 7, 15 | Minerals |

Traces or Absent

All other plots.

### LIMED

QUANTITY

Considerably increased

| | | |
|---|---|---|
| Plots | 2 | Unmanured |
| | 7, 9 | Minerals with and without ammonium salts |
| | 13, 19 | F.Y.M. with and without fish guano |
| | 14, 16 | Minerals and nitrate of soda |
| | 18 | Minerals without super and ammonium salts |

## URTICA DIOICA

Rarely present, but has occurred in fair amount as follows:-

### UNLIMED

| | | |
|---|---|---|
| Plots | 7 | Minerals (0.9 percent 1947; 1.7 percent 1948) |
| | 8 | Minerals without potash (0.2 percent 1947). |

### LIMED

| | | |
|---|---|---|
| Plot | 7 | Minerals (trace in 1948). |

## VERONICA CHAMAEDRYS

Occurs in small quantities and is encouraged by lime.

UNLIMED

QUANTITY

Very small

| | | |
|---|---|---|
| Plots | 3, 12 | Unmanured |
| | $4^1$ | Super |
| | $5^1$, $5^2$ | Unmanured or minerals after ammonium salts till 1897 |
| | 6, 7, 8 | Minerals with and without potash |
| | 13, 19 | F.Y.M. with and without fish guano |
| | 17 | Nitrate of soda |
| | 20 | F.Y.M., minerals and nitrate of soda |

LIMED

QUANTITY

Increased

| | | |
|---|---|---|
| Plots | 2, 3 | Unmanured |
| | 7, 8, 15 | Minerals with and without potash |
| | 19(LL) | F.Y.M. after minerals and nitrate of soda. |

Species present 1940-49 in very small amounts which rarely, or never, appear in the Hay Samples.

| SPECIES | PLOTS | |
|---|---|---|
| | Unlimed | Limed |
| Agropyron repens | 20 | - |
| Bellis perennis | $4^1$,17 | 2 |
| Cardamine pratensis | 19 | - |
| Chrysanthemum leucanthemum | $3,4^1$ | 2,8 |
| Crepis spp. | - | 19 |
| Festuca loliacea | - | 9,19 |
| Fritillaria meleagris | 17 (considerable) | - |
| Galium mollugo | - | 13 |
| Geum urbanum | - | 7,19 |
| Hypericum perforatum | 12 | - |
| Lapsana communis | - | 18 |
| Ophioglossum vulgatum | 17 | 2 |
| Potentilla sterilis | 12,17 | - |
| Potentilla tormentilla (P.erecta) | $5^1$ | - |
| Prunella vulgaris | - | 13 |
| Rosa spp. | $12,5^1,5^2$ | 17 |
| Rubus spp. | $1,4^2$,18 | - |
| Senecio jacobea | 2,3 | $1,2,4^1,4^2,8$ |
| Stachys betonica (S.officinale) | 12 | - |
| Stellaria media | 20 | 18,20 |
| Thymus serpyllum | 12 | 3 |
| Veronica serpyllifolia | 12 | - |
| Viola canina | $5^1$ | - |

Fig. 1.

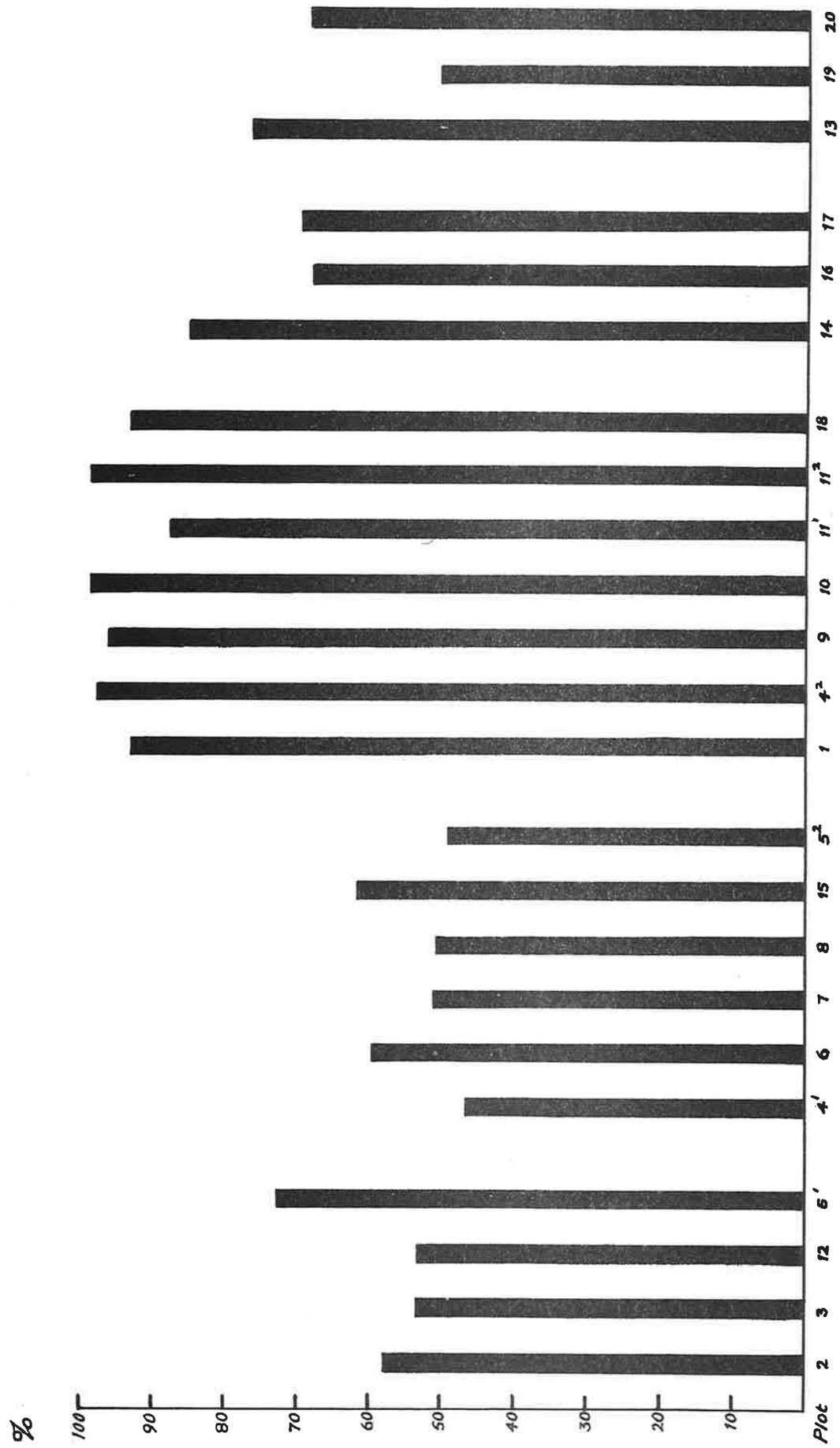



Fig. 1. Percentage of GRAMINEAE in 1947

Fig.2.

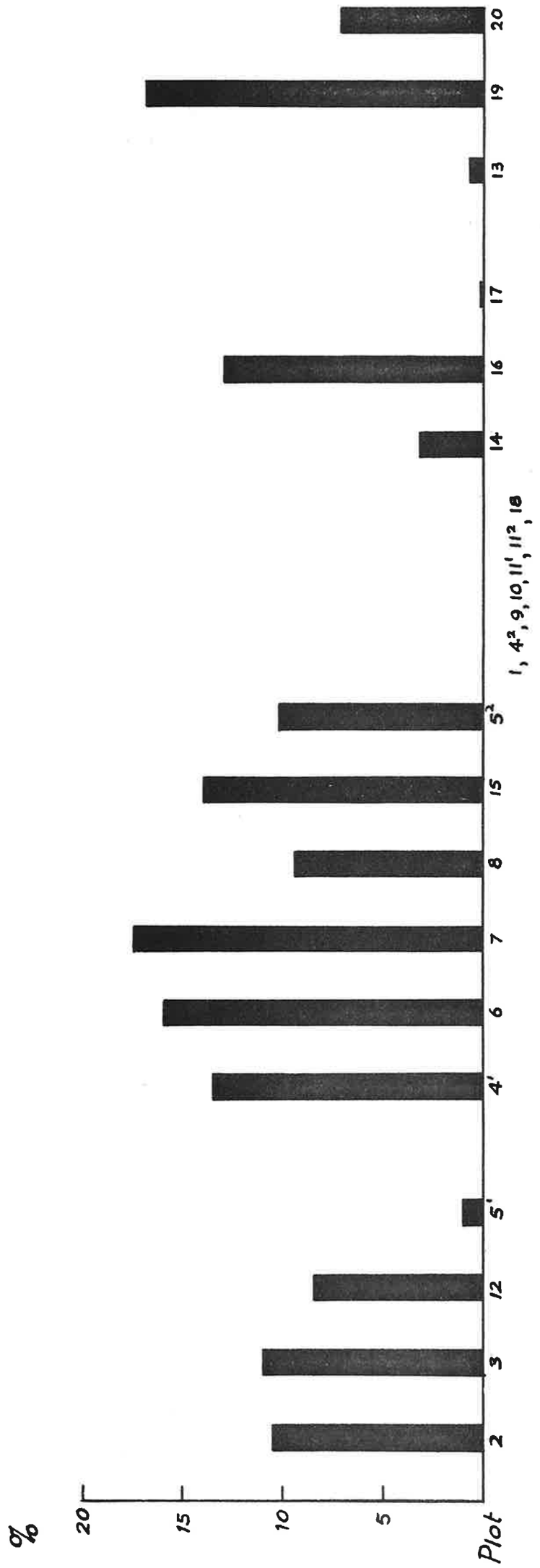



Fig. 2. Percentage of LEGUMINOSAE in 1947

Fig.3.

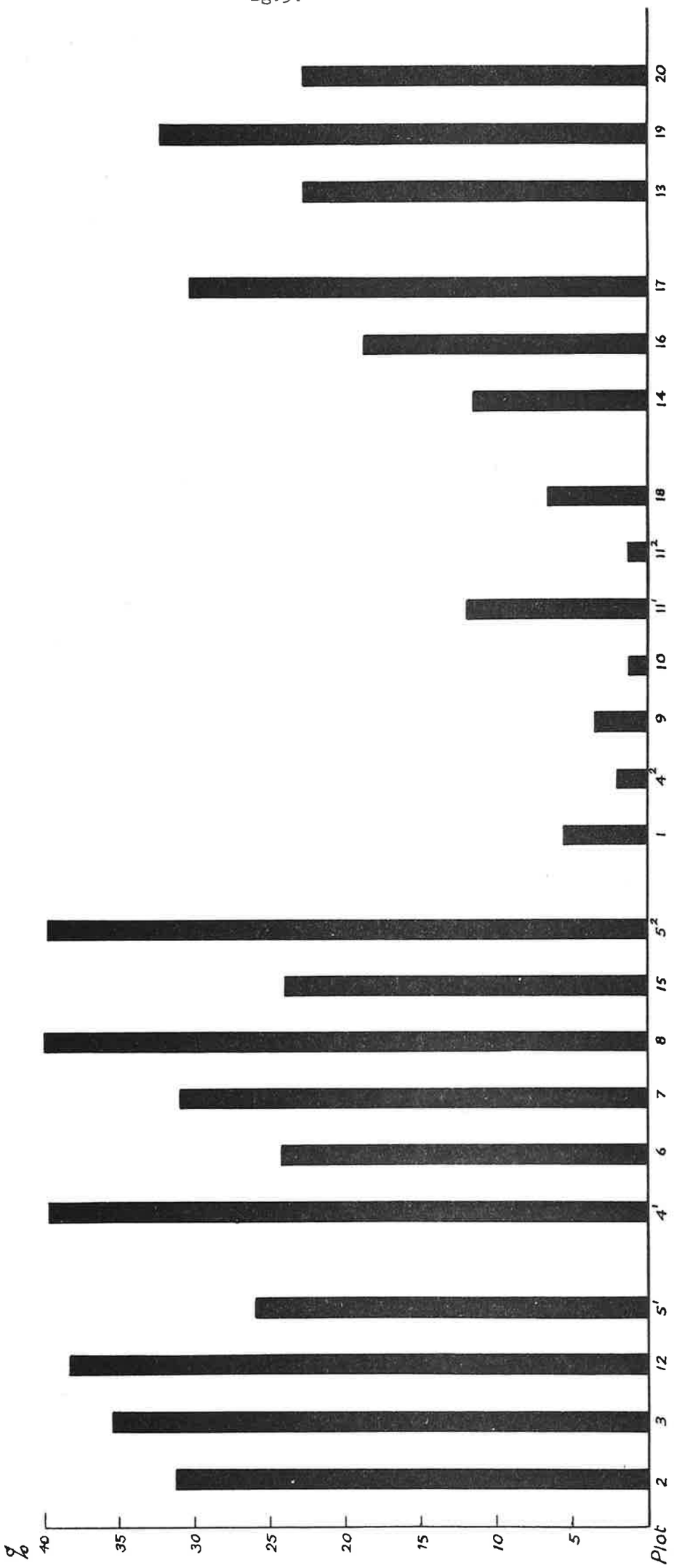



Fig. 3. Percentage of MISCELLANEOUS SPECIES in 1947

Fig.4.

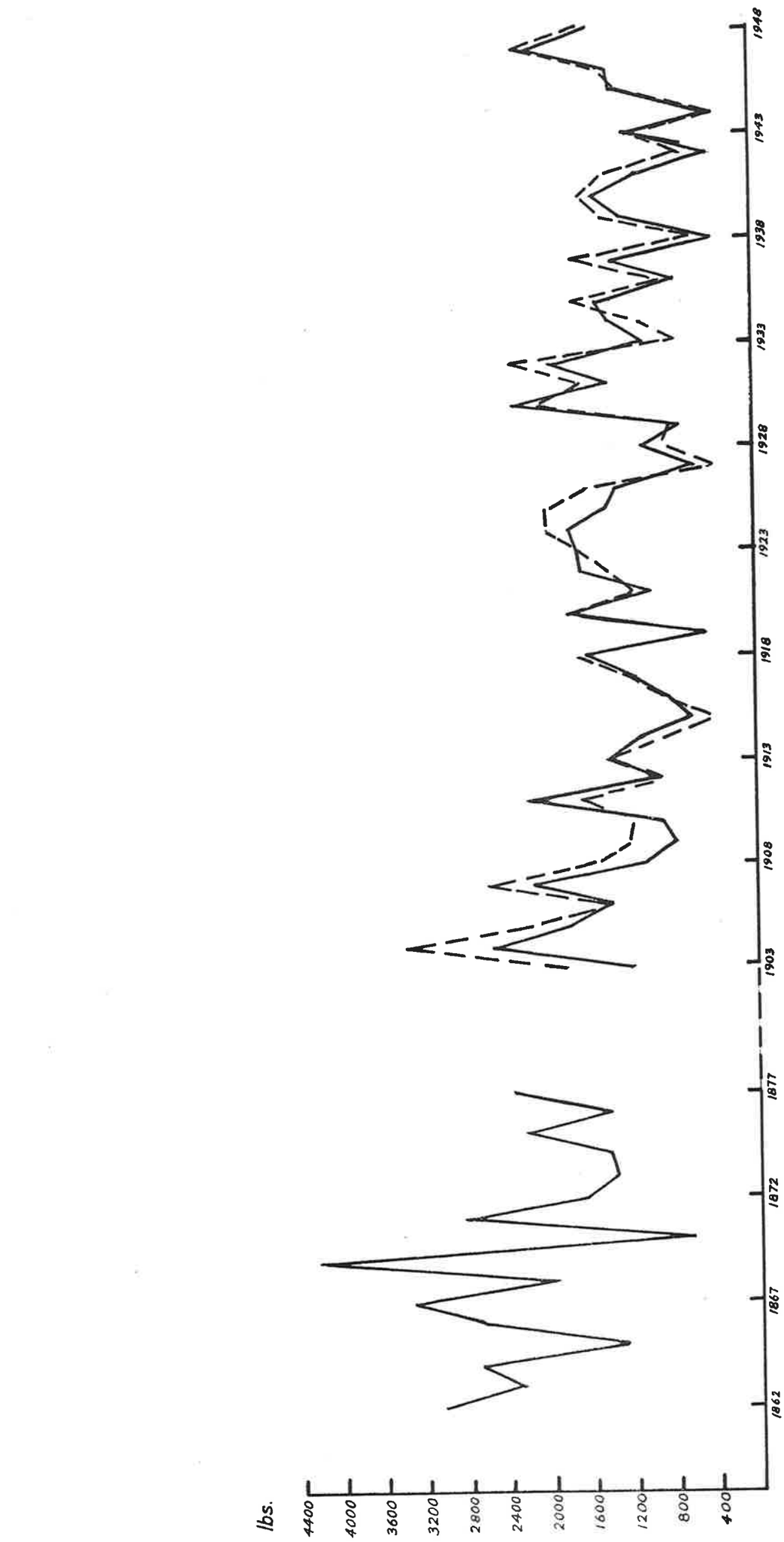
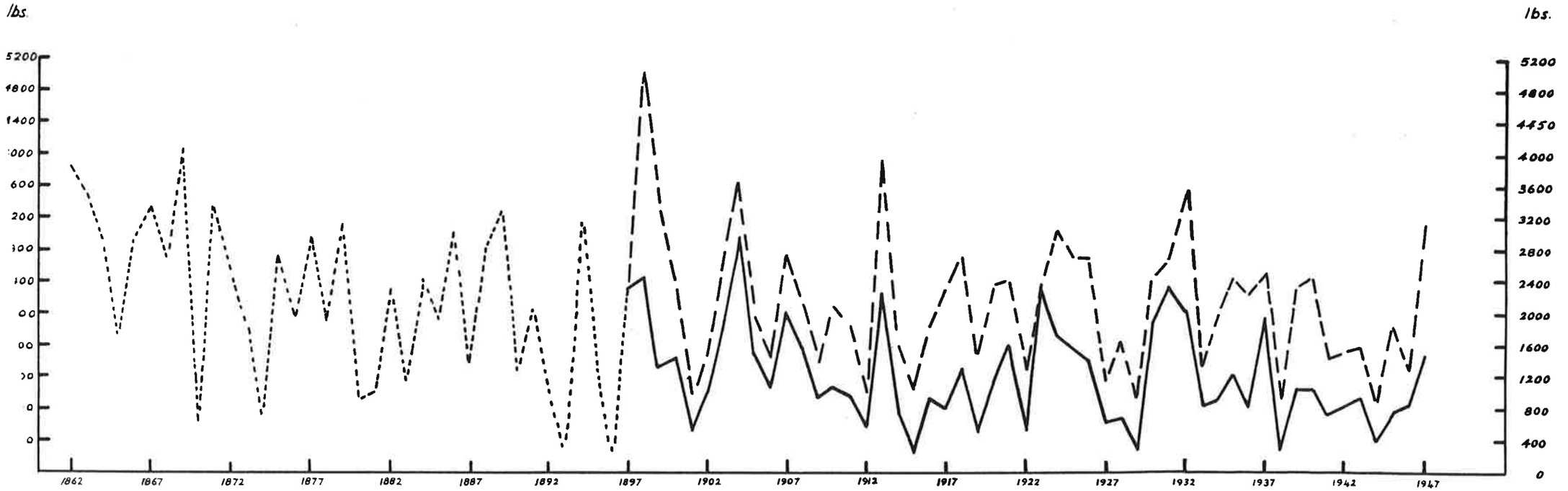



Fig. 4. YIELD (lb. per acre 1st crop) PLOT 3._____Unlimed- - - - - Limed

Fig. 5. YIELD (lb. per acre 1st crop) PLOT 5. showing effect of change in manuring in 1897

..... 1862 – 1897 Ammonium salts _____ 1898 – 1947

Unmanured (PLOT 5¹). _ _ _ _ _ _ _ 1898 – 1947 Minerals (PLOT 5²).




149
Fig. 5.

Fig.6.

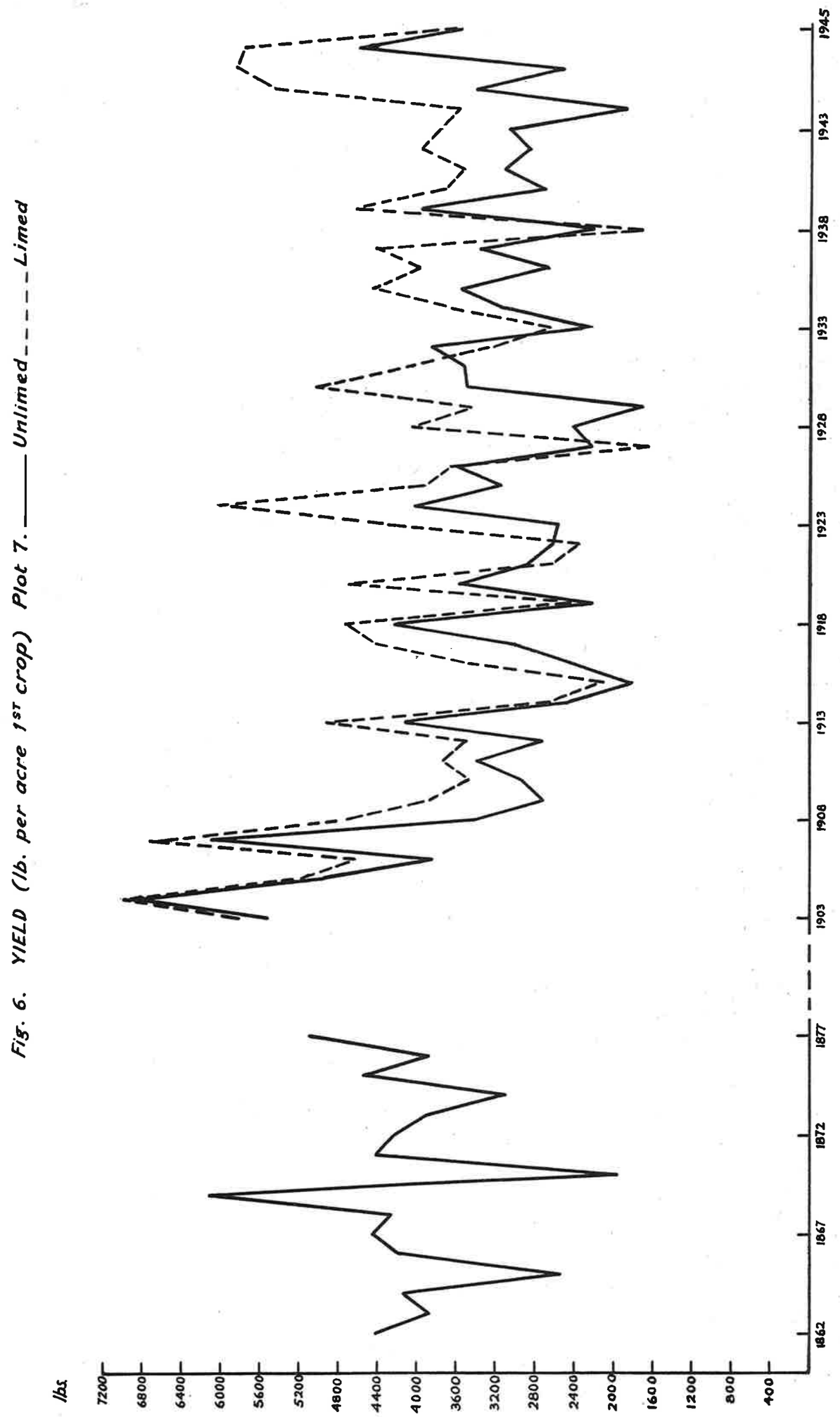



Fig. 6. YIELD (lb. per acre 1st crop) Plot 7. _____ Unlimed - - - - - Limed

Fig.7.

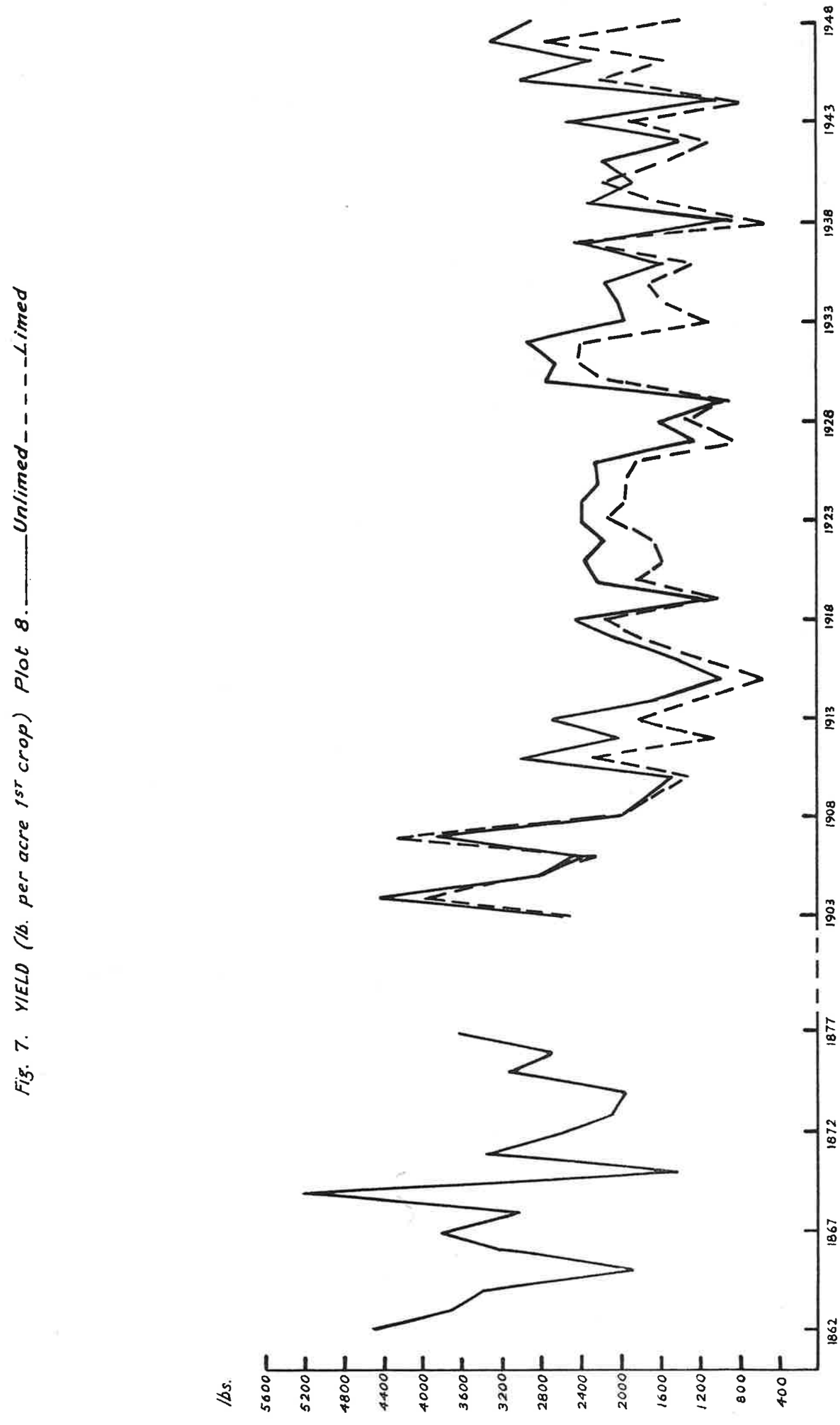



Fig. 7. YIELD (lb. per acre 1st crop) Plot 8._____Unlimed- - - - -Limed

Fig.8.

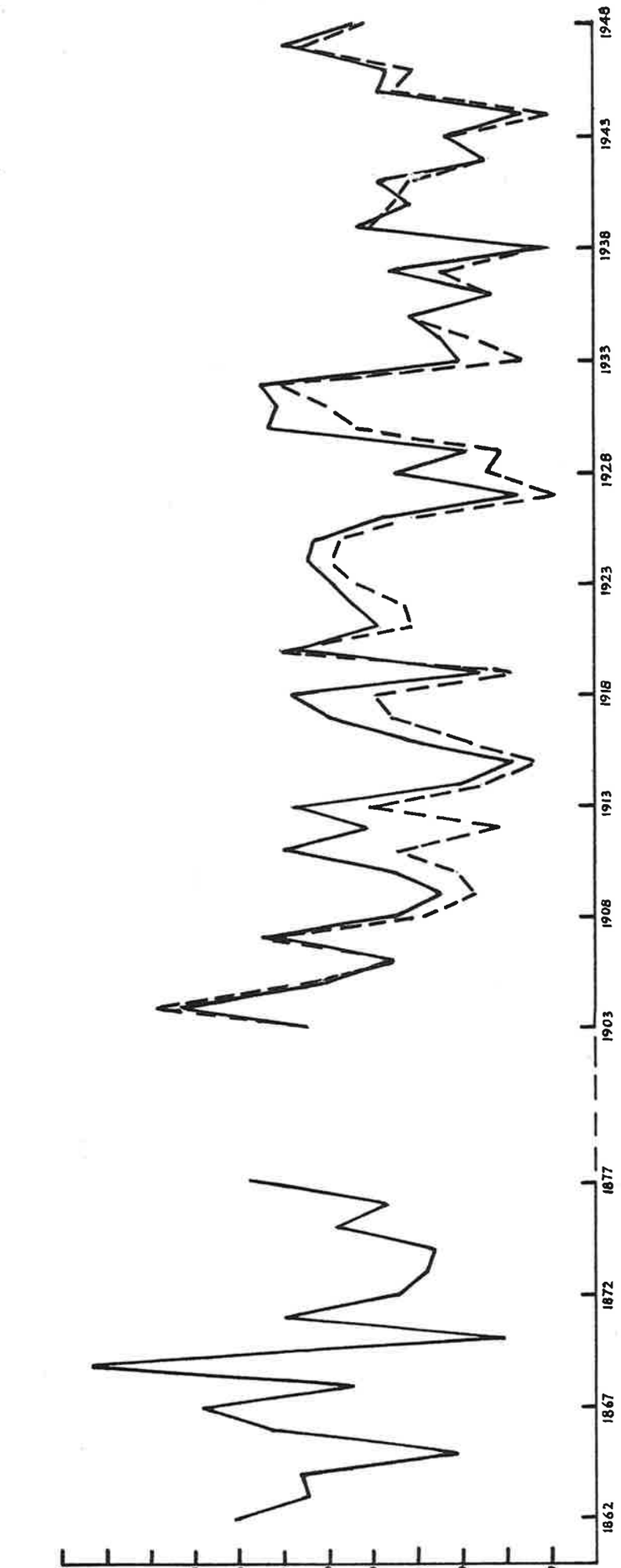



Fig. 8. YIELD (lb. per acre 1st crop) PLOT 4' _____ Unlimed - - - - Limed

Fig.9.

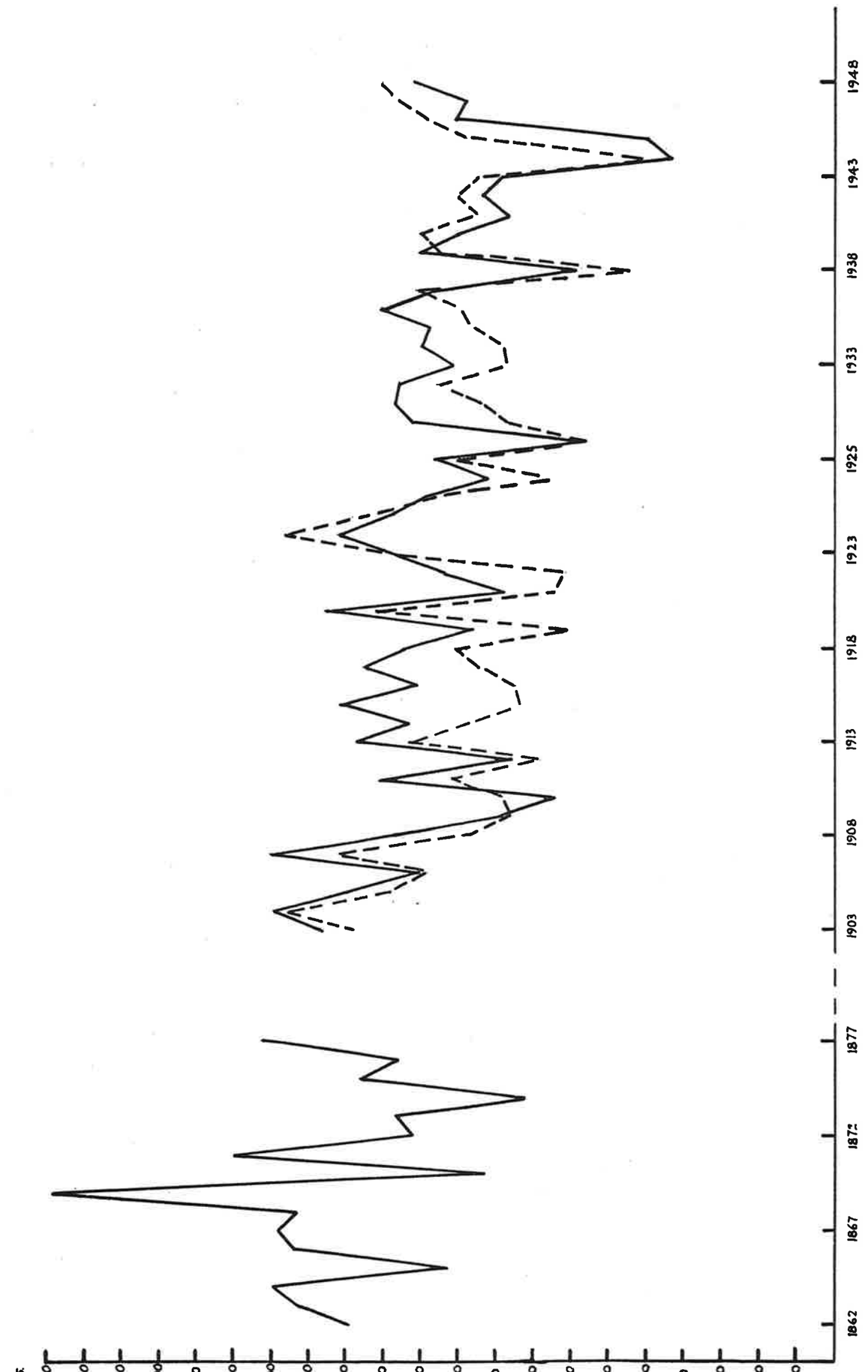



Fig. 9. YIELD (lb. per acre 1st crop) PLOT 16 _____Unlimed_ _ _ _ _Limed

Fig. 10.

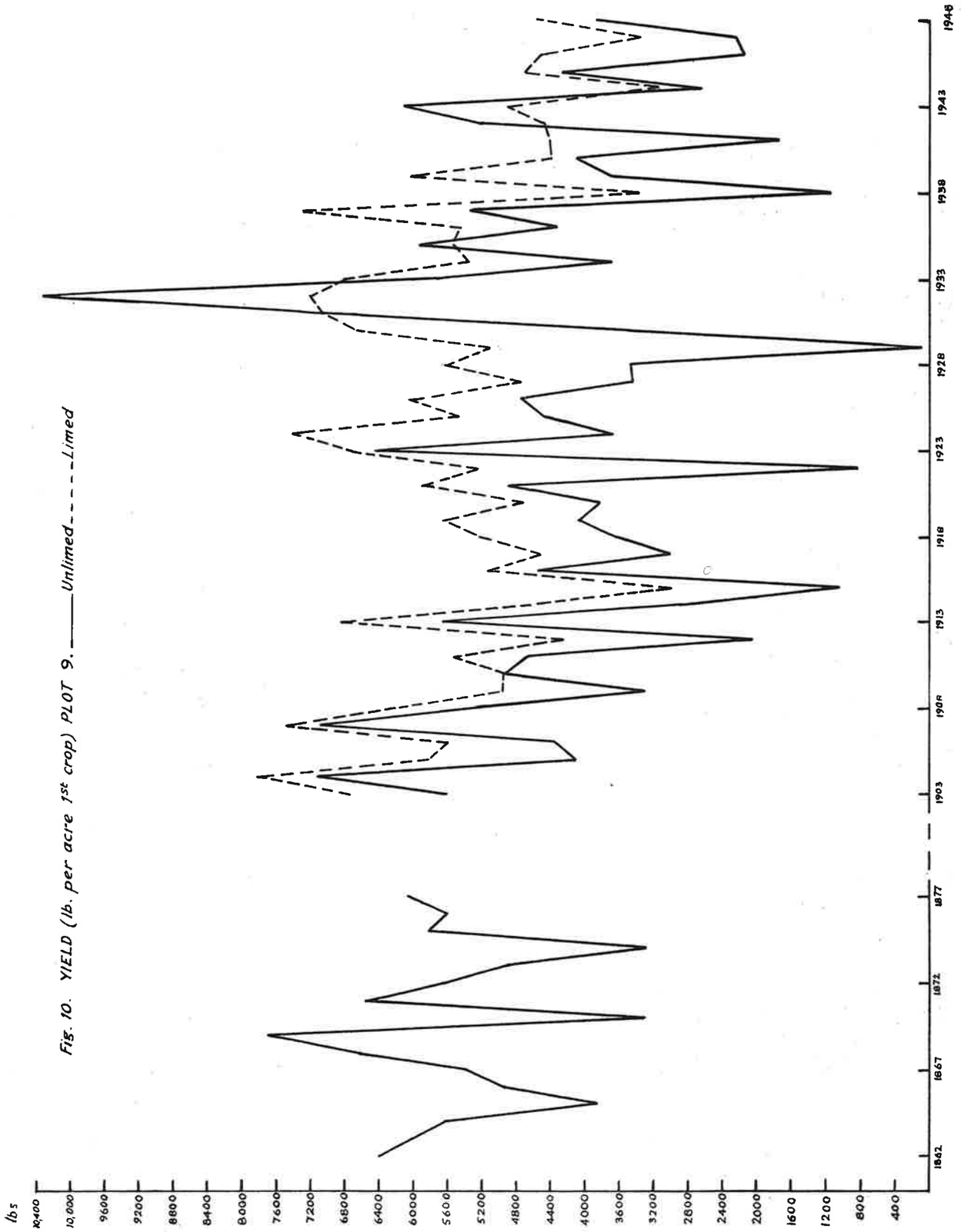



Fig. 10. YIELD (lb. per acre 1st crop) PLOT 9. ——Unlimed - - - - Limed

Fig.11.

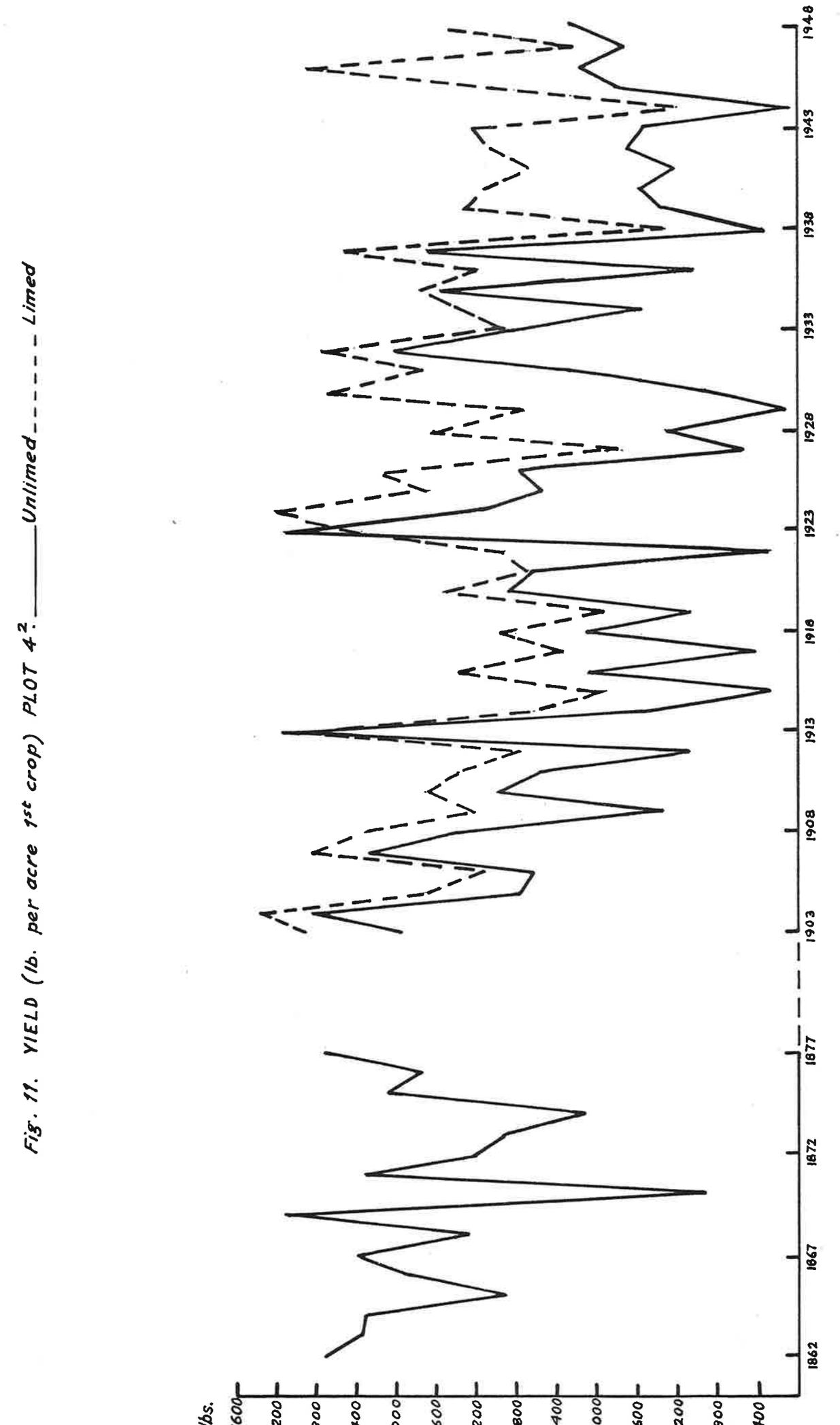



Fig. 11. YIELD (lb. per acre 1st crop) PLOT 4². _____Unlimed - - - - - Limed

Fig. 12.

*Fig. 12. Percentage of Agrostis vulgaris in 1947*

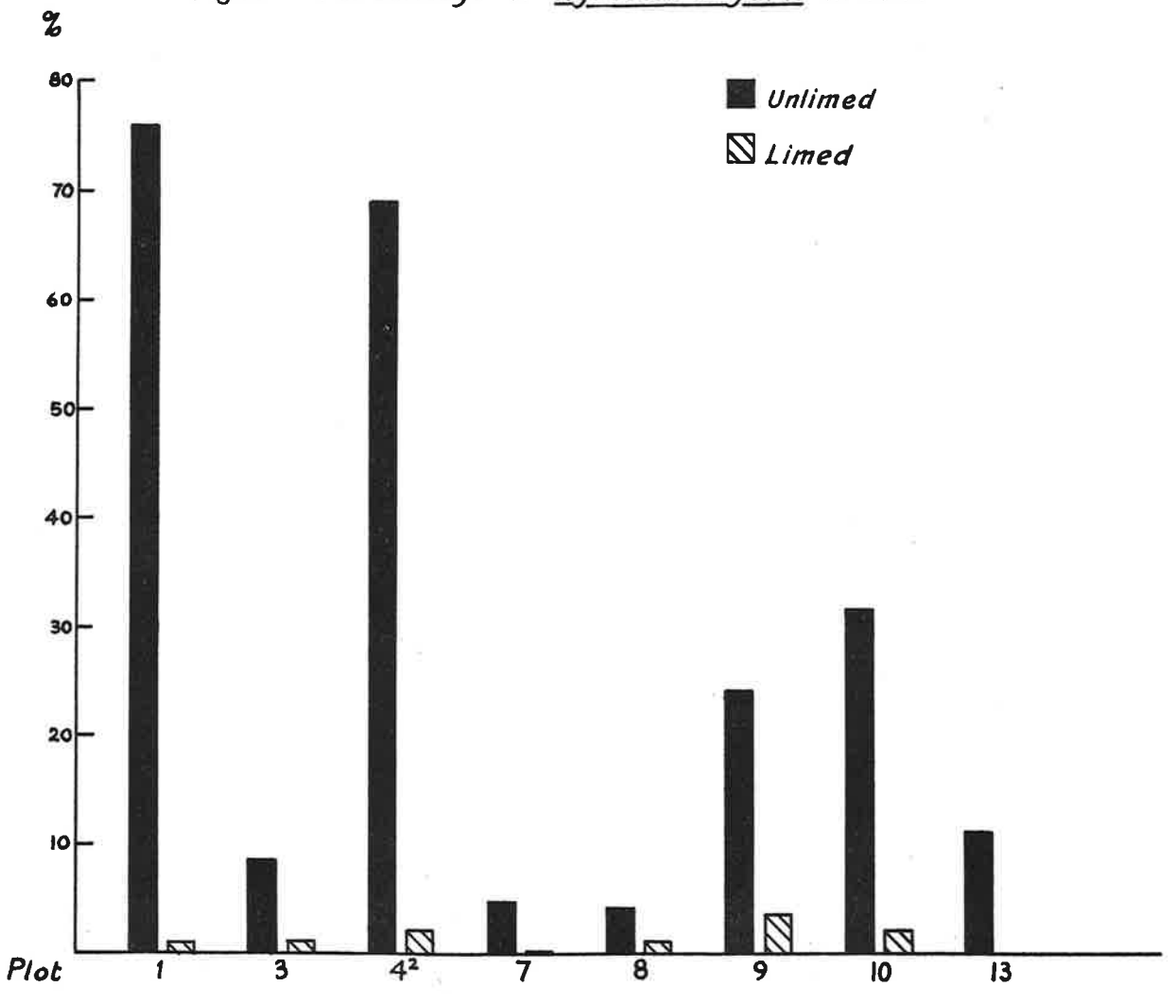


Fig. 13.

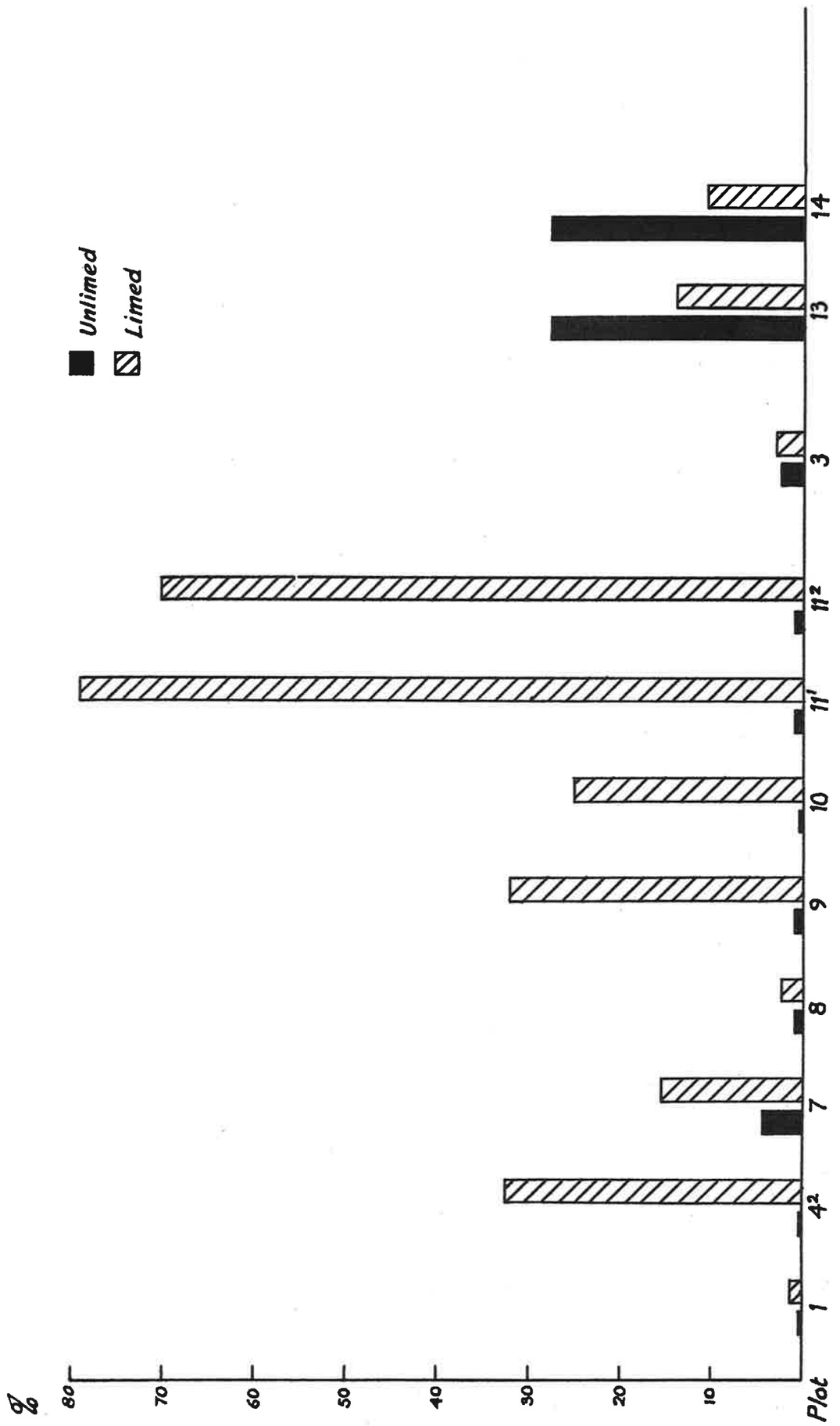



*Fig. 13. Percentage of Alopecurus pratensis in 1947*

Fig. 14.

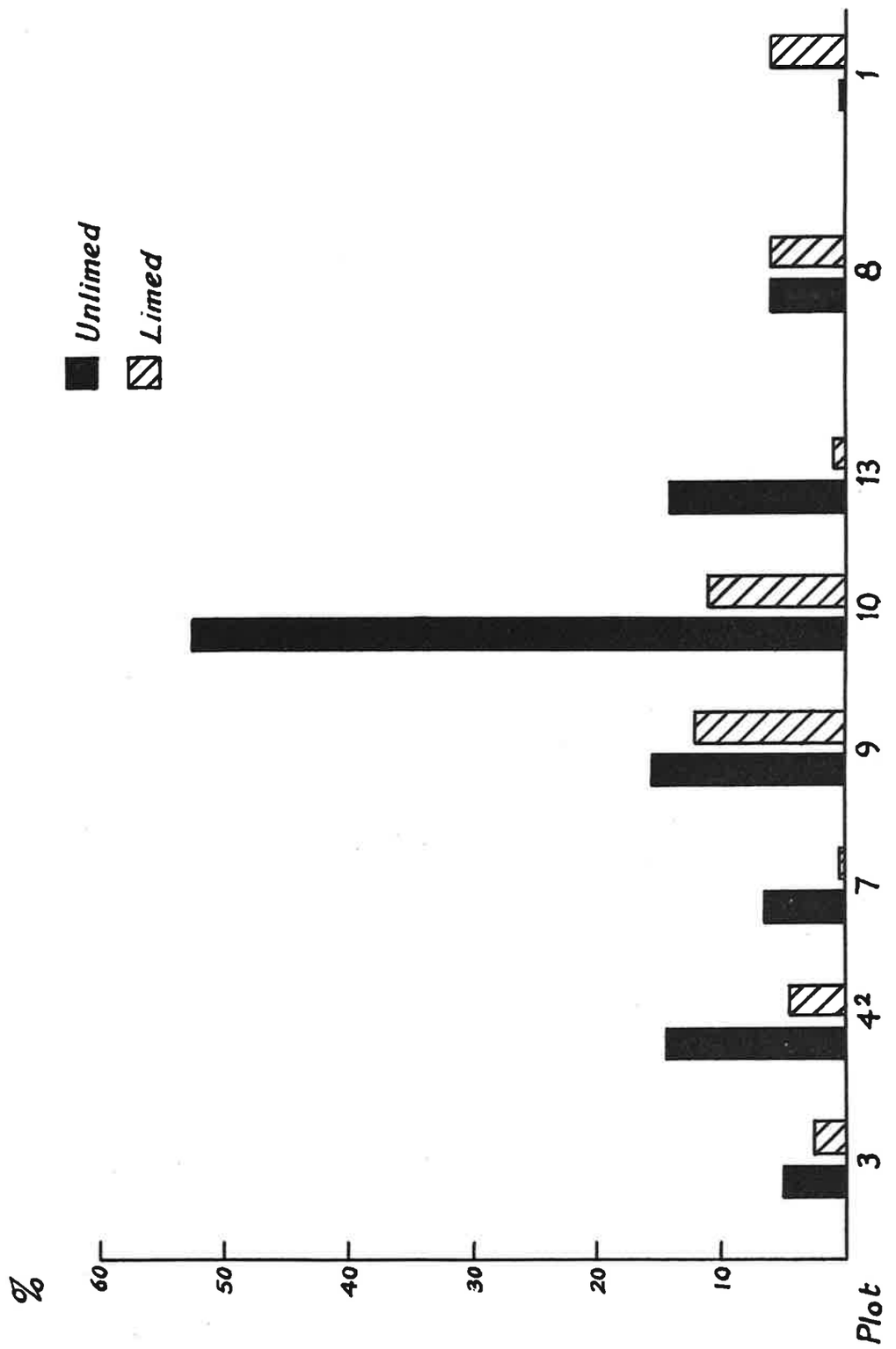



*Fig. 14. Percentage of Anthoxanthum odoratum in 1947*

Fig. 15.

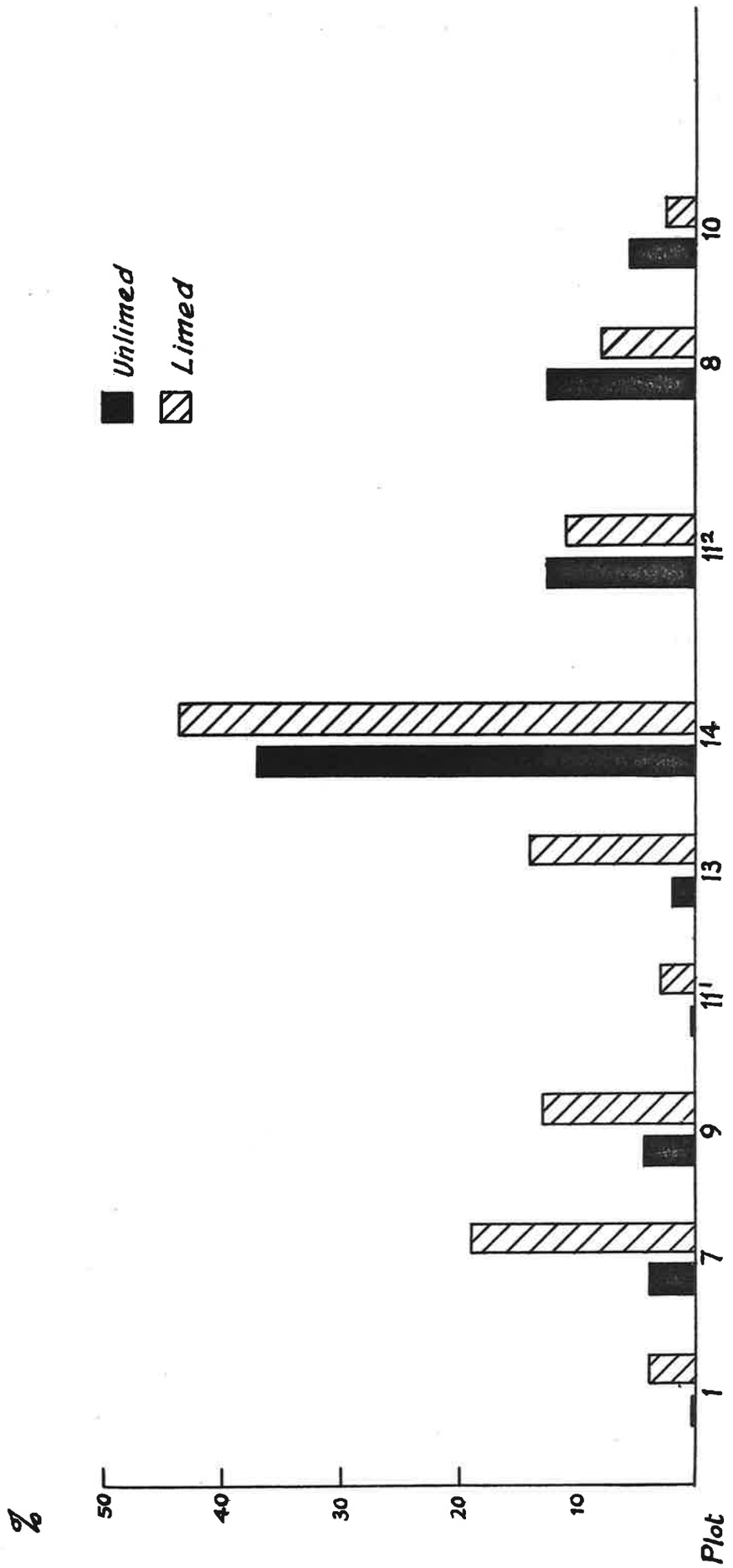



*Fig. 15. Percentage of Arrhenatherum avenaceum in 1947*

Fig. 16.

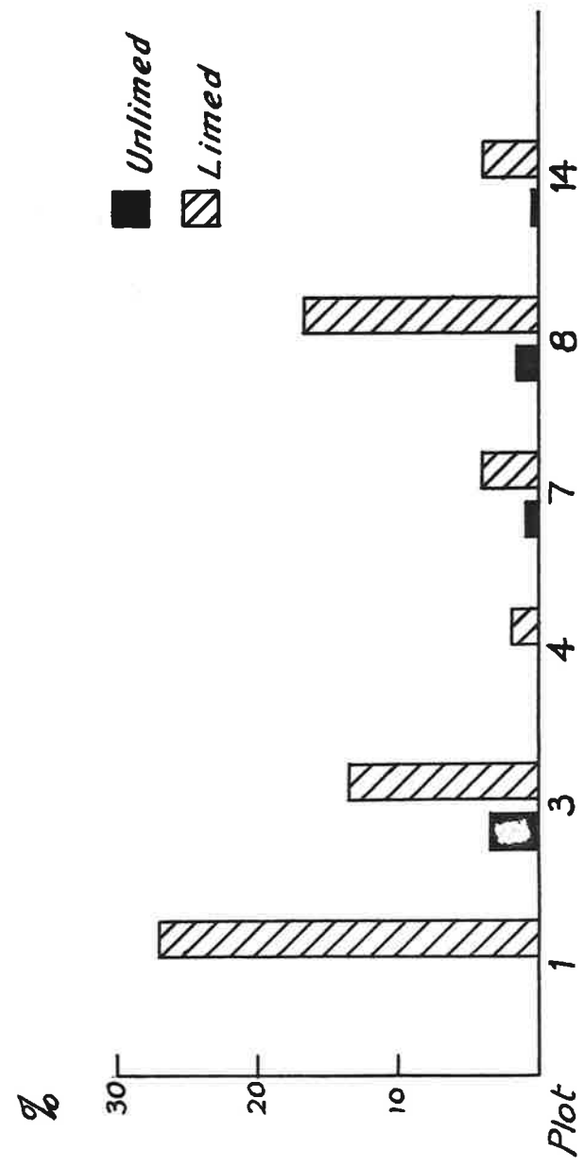



*Fig. 16. Percentage of Avena pubescens in 1947*

Fig. 17.

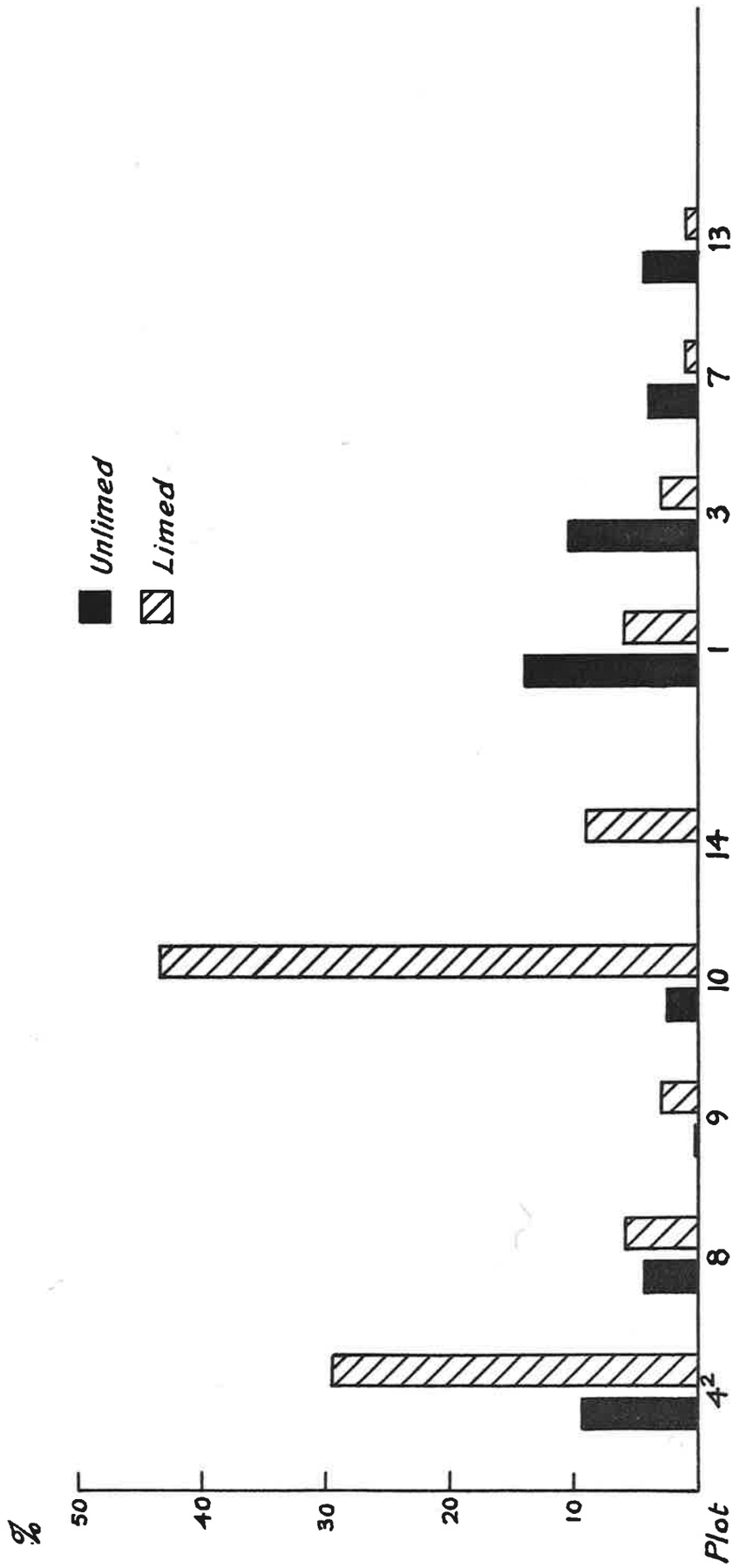



*Fig. 17. Percentage of Festuca rubra in 1947*

Fig. 18.

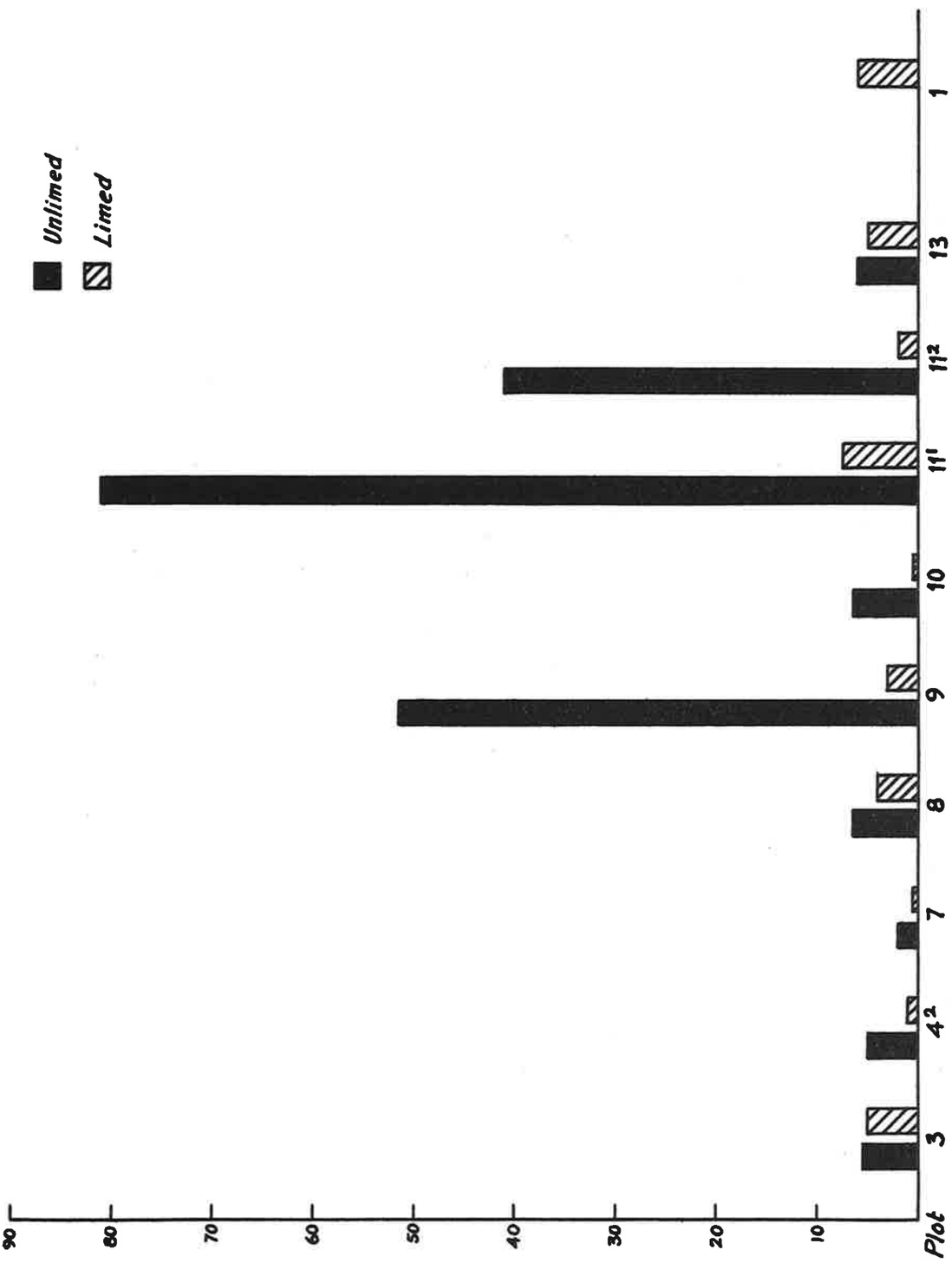



Fig. 18. Percentage of Holcus lanatus in 1947

Fig. 19.

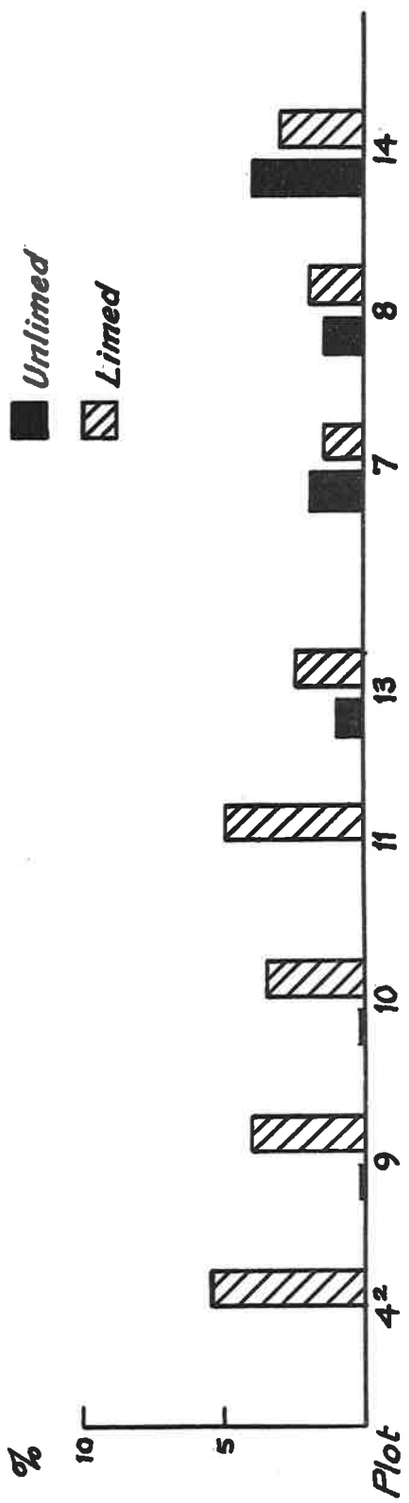



*Fig. 19. Percentage of Poa pratensis in 1947*

Fig.20.

*Fig. 20. Percentage of Leontodon hispidus in 1947*

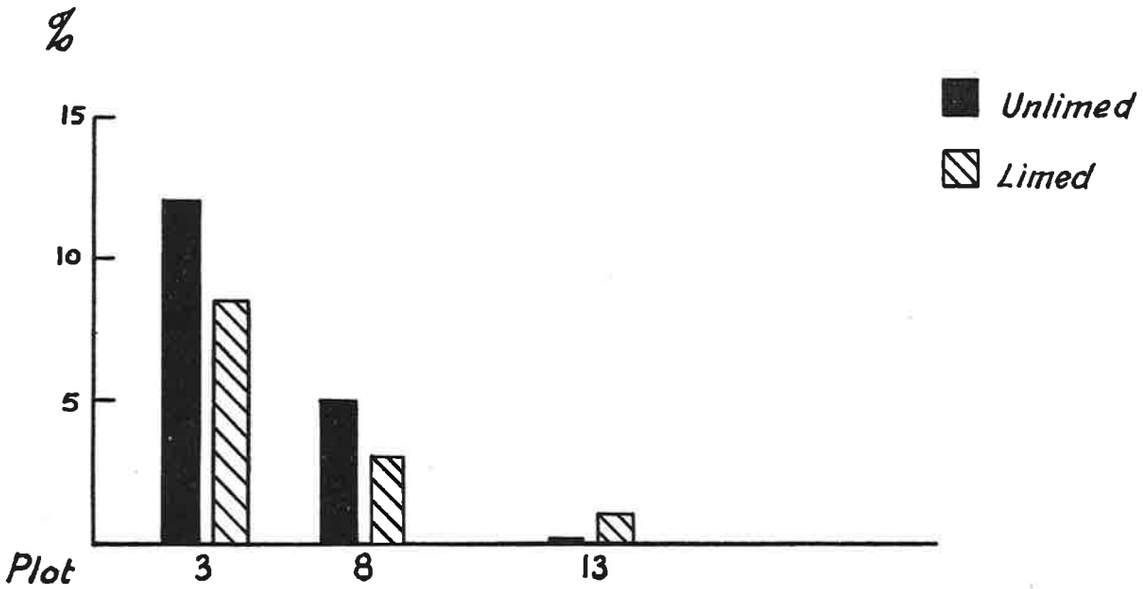


Fig.21.

*Fig. 21. Percentage of Plantago lanceolata in 1947*

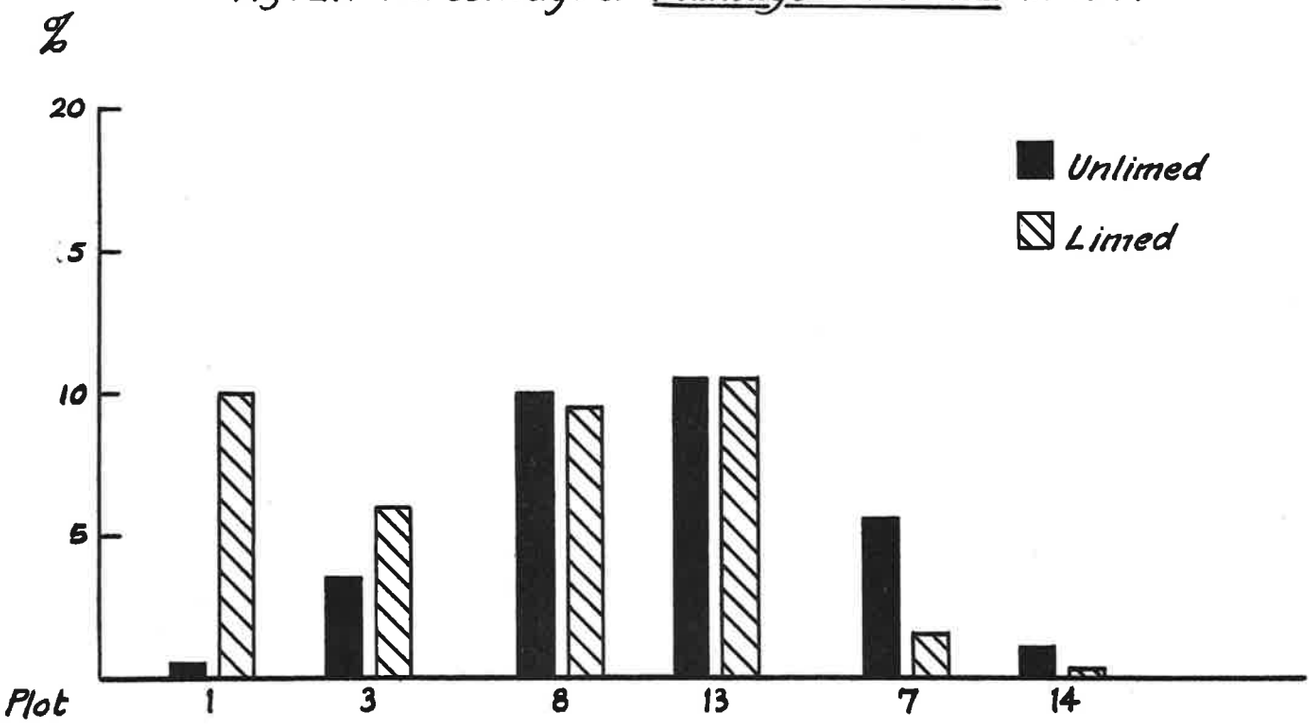


Fig.22.

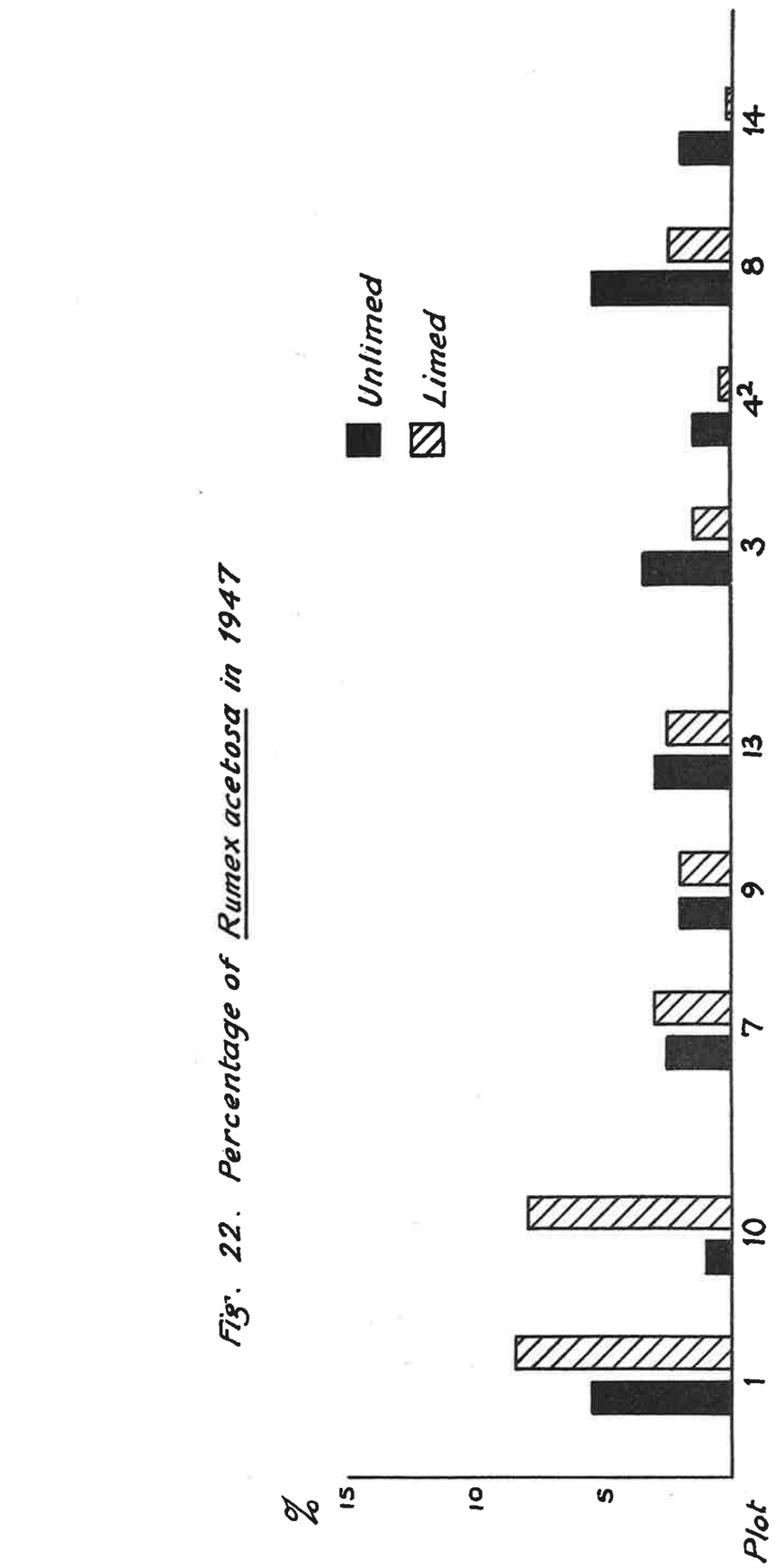



*Fig. 22. Percentage of Rumex acetosa in 1947*

TABLE 1a

| Plot | Description of Manure | Quantity of Manure per Acre. Nitrogenous Manures: Ammonium sulphate (Lb.) | Nitrate of soda (Lb.) | Mineral Manures: Superphosphate 37 per cent (Cwt.) | Sulphate of Potash (Lb.) | Sulphate of soda (Lb.) | Sulphate of Magnesia (Lb.) | Silicate of Soda (Lb.) | Organic Manures: Farmyard Manure (Ton.) | Fish Guano (Cwt.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ammonium salts = 43 lbs.N (with farmyard manure, 1856-63) | 220 | - | - | - | - | - | - | - | - |
| 2 | Unmanured (after farmyard manure, 1856-63) | - | - | - | - | - | - | - | - | - |
| $3_1$ | Unmanured | - | - | - | - | - | - | - | - | - |
| $4_2$ | Superphosphate of lime | - | - | 3.5 | - | - | - | - | - | - |
| $4_1$ | Superphosphate and ammonium salts = 86 lbs. N | 440 | - | 3.5 | - | - | - | - | - | - |
| $5^1$ | (N.half) Unmanured (after ammonium salts, 1856-97 = Plot 5) | - | - | - | - | - | - | - | - | - |
| $5^2$ | (S.half) Superphosphate, sulphate of potash (after ammonium salts, 1856-97 = Plot 5) | - | - | 3.5 | 500 | - | - | - | - | - |
| 6 | As plot 7 (after ammonium salts, 1856-68) | - | - | 3.5 | 500 | 100 | 100 | - | - | - |
| 7 | Complete mineral manure | - | - | 3.5 | 500 | 100 | 100 | - | - | - |
| 8 | Mineral manure without potash | - | - | 3.5 | - | 100 | 100 | - | - | - |
| 9 | Complete mineral manure and ammonium salts = 86 lbs. N. | 440 | - | 3.5 | 500 | 100 | 100 | - | - | - |
| 10 | Mineral manure (without potash) and ammonium salts = 86 lbs. N. | 440 | - | 3.5 | - | 100 | 100 | - | - | - |
| $11^1$ | Complete mineral manure and extra ammonium salts = 129 lbs. N. | 660 | - | 3.5 | 500 | 100 | 100 | - | - | - |
| $11^2$ | As plot 11 and silicate of soda | 660 | - | 3.5 | 500 | 100 | 100 | 400 | - | - |
| 12 | Unmanured | - | - | - | - | - | - | - | - | - |
| 13 | Farmyard manure and fish guano, each once in four years since 1905 (after cut wheat straw, minerals, and ammonium salts) | - | - | - | - | - | - | - | 14 | 6 |
| 14 | Complete mineral manure and nitrate of soda 86 lbs. N. | - | 550 | 3.5 | 500 | 100 | 100 | - | - | - |
| 15 | Complete mineral manure (after nitrate of soda, 1858-75) | - | - | 3.5 | 500 | 100 | 100 | - | - | - |
| 16 | Complete mineral manure and nitrate of soda = 43 lbs. N. | - | 275 | 3.5 | 500 | 100 | 100 | - | - | - |
| 17 | Nitrate of soda = 43 lbs. N. | - | 275 | - | - | - | - | - | - | - |
| 18 | Mineral manure without superphosphate, and ammonium salts = 86 lbs. N (after minerals and nitrogen equal to constituents of 1 ton of hay, 1865-1904) | 440 | - | - | 500 | 100 | 100 | - | - | - |
| 19 | Farmyard manure every fourth year (after superphosphate, sulphate of potash, and nitrate of soda, 1872-1904) | - | - | - | - | - | - | - | 14 | - |
| 20 | Farmyard manure every fourth year; sulphate of potash, superphosphate, and nitrate of soda = 26 lbs. N in other years (after superphosphate and nitrate of potash, 1872-1904) | - | 168 | 1.8 | 100 | - | - | - | 14 | - |

Average Produce of Hay per Acre over the Nine Successive 10 year Periods, 1856-1945, and over the 4-year Period, 1946-49. First Crops only.

| Plot | Averages Over. 1856-65. (Cwts.) | 1866-75. (Cwts.) | 1876-85. (Cwts.) | 1886-95. (Cwts.) | 1896-1905. (Cwts.) | 1906-15. (Cwts.) | 1916-25. (Cwts.) | 1926-35. (Cwts.) | 1936-45. (Cwts.) | 1946-1949. (Cwts.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 48.4 | 37.8 | 30.1 | 23.8 | 19.3 | 18.9 | 15.9 | 13.5 | 7.1 | 9.5 |
| 2 | 41.7 | 32.1 | 22.0 | 20.5 | 15.1 | 14.2 | 14.3 | 13.3 | 9.2 | 14.0 |
| $3_1$ | 22.6[1] | 20.0 | 17.5 | 16.8 | 13.2 | 10.9 | 11.9 | 11.7 | 8.6 | 13.0 |
| $4_1$ | 24.4 | 21.3 | 19.1 | 16.5 | 15.7 | 16.8 | 19.7 | 16.4 | 12.2 | 17.8 |
| $4^2$ | 39.6 | 30.5 | 30.4 | 29.0 | 26.8 | 22.5 | 19.7 | 17.8 | 12.8 | 16.2 |
| $5_1$ | 30.5 | 22.1 | 17.6 | 17.5 | -[6] | - | - | - | - | - |
| $5^1$ | - | - | - | - | 14.4[6] | 10.2 | 10.1 | 11.0 | 7.9 | 9.3 |
| $5^2$ | - | - | - | - | 24.2[6] | 17.2 | 20.1 | 18.7 | 15.8 | 16.3 |
| 6 | 31.4 | 30.2 | 30.5 | 29.0 | 34.9 | 29.5 | 28.4 | 24.9 | 23.0 | 29.6 |
| 7 | 33.9 | 36.8 | 32.3 | 27.1 | 36.1 | 30.0 | 27.4 | 26.6 | 26.2 | 29.2 |
| 8 | 33.6 | 26.6 | 21.8 | 16.5 | 21.3 | 19.3 | 18.5 | 18.2 | 16.9 | 22.9 |
| 9 | 53.6 | 48.4 | 50.5 | 39.3 | 44.1 | 36.8 | 35.2 | 42.2 | 34.6 | 29.1 |
| 10 | 52.8 | 39.6 | 38.6 | 35.5 | 34.6 | 25.6 | 26.1 | 24.1 | 19.3 | 19.7 |
| $11^1$ | 61.7[2] | 53.6 | 48.5 | 47.6 | 37.8 | 45.9 | 41.5 | 45.8 | 30.3 | 30.5 |
| $11^2$ | 66.4[2] | 61.7 | 60.6 | 62.0 | 57.1 | 56.8 | 50.9 | 53.4 | 42.4 | 34.4 |
| 12 | 25.1 | 22.9 | 18.0 | 17.1 | 17.6 | 14.0 | 14.8 | 13.6 | 11.2 | 13.8 |
| 13 | 55.1 | 57.6 | 54.2 | 49.1 | 47.0[7] | 32.1[8] | 41.2 | 42.2 | 32.1 | 28.6 |
| 14 | 53.1[3] | 60.5 | 53.8 | 45.6 | 50.0 | 47.7 | 54.9 | 53.5 | 48.0 | 51.0 |
| 15 | 36.1 | 34.9 | 24.9 | 29.1 | 38.7 | 30.1 | 27.8 | 25.6 | 17.4 | 23.8 |
| 16 | 48.1[3] | 47.6 | 41.5 | 37.4 | 40.4 | 39.9 | 40.6 | 36.9 | 30.9 | 35.8 |
| 17 | 34.3 | 33.5 | 30.1 | 27.0 | 28.9 | 25.7 | 25.2 | 21.3 | 17.3 | 23.4 |
| 18 | - | 33.1[4] | 32.2 | 31.1 | 29.1[7] | 29.3[8] | 23.4 | 20.2 | 10.3 | 9.9 |
| 19 | - | 38.6[5] | 37.2 | 43.6 | 39.2[7] | 26.4[8] | 26.4 | 26.2 | 26.1 | 29.5 |
| 20 | - | 36.5[5] | 38.7 | 40.3 | 41.2[7] | 33.1[8] | 30.6 | 37.6 | 33.5 | 39.1 |

[1] 7 years only, 1859-65
[2] 4 " " 1862-65
[3] 8 " " 1858-65
[4] 11 " " 1865-75
[5] 4 years only, 1872-75
[6] 8 " " 1898-1905
[7] 9 " " 1896-1904
[8] 11 " " 1905-15

TABLE 1a

Manures - all plots
Yield of hay on all unlimed plots

TABLE 1 b.

| Plot | Regular liming [1] (Burnt lime) Begun in Year | Regular liming [1] (Burnt lime) Amount per acre every 4th year | pH Plots 1-17 in 1945 Plots 18-20 in 1957 Unlimed | pH Plots 1-17 in 1945 Plots 18-20 in 1957 Limed | Average produce of hay per acre over two successive 10 - year periods 1926 - 45 and over the 4 - year period 1946 - 9. First crop only, cwt at 85% dry matter, LIMED 1926 - 35 | LIMED 1936 - 45 | LIMED 1946 - 49 |
|---|---|---|---|---|---|---|---|
| 1 | 1903 | 2000 lb | 4.5 | 7.0 | 17.2 | 13.6 | 16.9 |
| 2 | 1903 | " | 5.0 | 7.0 | 12.8 | 9.0 | 13.4 |
| 3 | 1903 | " | 5.5 | 7.0 | 10.6 | 8.7 | 12.7 |
| 4-1 | 1903 | " | 5.5 | 7.0 | 11.8 | 10.0 | 15.3 |
| 4-2 | 1903 | " | 4.0 | 5.5 | 30.7 | 24.2 | 24.2 |
| 5-1 | - | - | 4.5 | - | - | - | - |
| 5-2 | - | - | 4.5 | - | - | - | - |
| 6 | - | - | 5.0 | - | - | - | - |
| 7 | 1903 | 2000 lb | 5.0 | 7.0 | 31.0 | 30.4 | 33.0 |
| 8 | 1903 | " | 5.0 | 7.0 | 13.4 | 12.2 | 13.6 |
| 9 | 1903 | " | 4.0 | 5.0 | 50.6 | 38.0 | 32.7 |
| 10 | 1903 | " | 4.0 | 5.0 | 36.6 | 30.6 | 24.9 |
| 11-1 | 1903 | " | 4.0 | 4.5 | 51.9 | 45.4 | 45.1 |
| 11-2 | 1903 | " | 4.0 | 4.5 | 53.4 | 47.3 | 45.8 |
| 12 | - | - | 5.0 | - | - | - | - |
| 13 | 1903 | 2000 lb | 4.6 | 6.5 | 36.0 | 26.4 | 29.2 |
| 14 | 1920 | " | 6.0 | 7.0 | 46.9 | 38.5 | 39.6 |
| 15 | 1920 | " | 5.0 | 6.5 | 23.8 | 21.7 | 23.4 |
| 16 | 1903 | " | 5.0 | 7.0 | 30.4 | 29.5 | 31.1 |
| 17 | 1920 | " | 6.0 | 7.0 | 22.7 | 17.7 | 19.7 |
| 18 | 1920 | 61 cwt | 4.0 | 8.0 | 38.0 | 21.9 | 22.6 |
| " | 1920 | 35 cwt | | 7.5 | 30.2 | 20.0 | 20.1 |
| 19 | 1920 | 28 cwt | 5.5 | 7.6 | 21.5 | 22.0 | 24.6 |
| " | 1920 | 5 cwt | | 6.5 | 24.1 | 23.3 | 26.2 |
| 20 | 1920 | 25 cwt | 5.7 | 7.6 | 33.3 | 27.6 | 35.3 |
| " | 1920 | 5 cwt | | 6.5 | 35.1 | 29.7 | 32.4 |

TABLE 1b. Liming, soil pH and yield of hay on limed plots

[1] 1911 omitted. 1919 dressing not given until 1920 and amount increased by $\frac{1}{4}$ to allow for the extra year.

NUMBER OF SPECIES, AND PERCENTAGE OF EACH SPECIES AND GROUP OF SPECIES.

NO MANURE.

| Manuring | Since 1856. | | | | | | | | | | | | | | After F.Y.M., 1856-1863. | | | | | | After Ammonium Salts, 1856-1857. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot number | 3 | | | | | | | | | | 12 | | | 2 | | | | | | 5[1] | | | | | |
| Unlimed or Limed | UNLIMED | | | | | | LIMED | | | | | UNLIMED | | | UNLIMED | | | LIMED | | | UNLIMED | | | | |
| Season | 1903 | 1914 | 1919 | 1926 | 1936 | 1948 | 1914 | 1919 | 1926 | 1936 | 1948 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 | 1903 | 1914 | 1919 | 1926 | 1949 |
| GRAMINEAE | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 13 | 13 | 12 | 12 | 12 | 11 | 12 | 12 | 14 | 13 | 12 | 14 | 12 | 12 | 13 | 13 | 12 | 13 | 14 | 13 | 13 | 11 | 10 | 10 | 10 |
| 1. Agrostis vulgaris | 0.2 | 13.1 | 8.4 | 18.3 | 14.2 | 15.6 | 2.9 | 1.5 | 2.2 | 3.5 | 0.8 | 8.5 | 4.8 | 3.5 | 8.2 | 6.5 | 10.0 | 1.9 | 0.5 | 0.5 | 11.7 | 17.7 | 4.5 | 23.6 | 17.8 |
| 2. Aira caespitosa | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | 0.3 | 0.5 | 0.7 |
| 3. Alopecurus pratensis | 0.6 | 0.3 | 0.3 | 1.9 | 1.2 | 7.9 | 1.1 | 0.6 | 2.7 | 2.5 | 6.2 | 1.4 | 1.7 | 7.6 | 1.7 | 1.5 | 9.6 | 1.9 | 1.5 | 4.1 | 0.3 | 0.1 | 0.7 | 0.6 | 0.3 |
| 4. Anthoxanthum odoratum | 1.3 | 2.8 | 7.0 | 3.1 | 3.3 | 0.7 | 1.1 | 3.1 | 0.4 | 0.2 | 0.7 | 2.9 | 7.7 | 3.4 | 4.0 | 8.8 | 1.1 | 1.5 | 1.7 | 0.4 | 12.3 | 8.5 | 11.7 | 12.3 | 1.1 |
| 5. Arrhenatherum avenaceum | 0.1 | 0.1 | 0.3 | 0.1 | 0.1 | 0.1 | 0.2 | 0.5 | 0.4 | 0.2 | 0.1 | 1.1 | 4.4 | 0.8 | 0.2 | 1.4 | 0.4 | - | 0.3 | 0.2 | 0.2 | 0.4 | 1.7 | 4.9 | 0.5 |
| 6. Avena flavescens | 0.9 | 0.6 | 0.9 | 0.7 | 0.6 | 0.2 | 1.1 | 2.8 | 3.4 | 4.9 | 1.2 | 0.6 | 0.5 | 0.2 | 1.0 | 1.2 | 0.2 | 1.7 | 3.7 | 1.5 | < | - | - | - | - |
| 7. Avena pubescens | 4.8 | 4.0 | 4.2 | 4.3 | 4.7 | 2.7 | 14.2 | 19.3 | 18.6 | 11.9 | 13.4 | 2.3 | 3.6 | 4.1 | 4.9 | 4.7 | 3.5 | 18.1 | 20.3 | 22.5 | < | 0.5 | 0.2 | 0.3 | 0.5 |
| 8. Brisa media | 20.1 | 4.3 | 2.0 | 1.3 | 3.1 | 0.2 | 10.5 | 9.0 | 10.9 | 5.4 | 1.0 | 10.3 | 2.2 | 6.0 | 5.6 | 3.4 | 1.8 | 2.7 | 1.7 | 3.9 | - | - | - | - | - |
| 9. Bromus mollis | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | 0.2 | - | - | - |
| 10. Cynosurus cristatus | 0.3 | 0.1 | 0.2 | 0.3 | - | - | - | - | 0.1 | 0.1 | - | < | - | - | 0.3 | 0.6 | - | 0.1 | 0.1 | - | < | - | - | - | - |
| 11. Dactylis glomerata | 1.1 | 3.8 | 8.4 | 5.2 | 3.0 | 4.5 | 3.1 | 7.4 | 8.1 | 2.9 | 3.3 | 4.5 | 14.4 | 8.8 | 3.8 | 10.7 | 7.9 | 4.9 | 15.1 | 7.5 | 1.3 | 9.5 | 8.9 | 8.2 | 4.1 |
| 12. Festuca rubra | 17.5 | 24.7 | 6.7 | 7.5 | 13.0 | 16.6 | 23.5 | 5.1 | 5.8 | 7.2 | 4.1 | 33.5 | 10.2 | 19.4 | 25.7 | 5.3 | 15.5 | 24.1 | 4.6 | 7.4 | 55.7 | 47.3 | 46.7 | 27.9 | 55.8 |
| 13. Festuca pratensis | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.6 | - | - | 0.1 | - | - | - | - | - | - | - | - |
| 14. Holcus lanatus | 5.1 | 2.9 | 9.2 | 6.6 | 1.6 | 4.3 | 4.4 | 7.7 | 6.2 | 2.9 | 2.5 | 2.7 | 4.9 | 2.8 | 4.3 | 10.7 | 3.3 | 5.0 | 9.3 | 2.0 | < | 0.2 | 0.6 | 1.2 | 0.7 |
| 15. Lolium perenne | - | 0.1 | - | - | - | - | - | - | 0.2 | - | - | 0.1 | 0.1 | - | 0.3 | 0.5 | - | 0.1 | 0.2 | 0.1 | - | - | - | - | - |
| 16. Poa pratensis | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 1.6 | 2.0 | 2.4 | 3.9 | 2.1 | 0.3 | 0.4 | 0.2 | 0.5 | 0.5 | 0.1 | 1.4 | 1.8 | 1.0 | 0.9 | 1.1 | 1.4 | 1.2 | 0.7 |
| 17. Poa trivialis | < | - | - | - | 0.1 | - | 0.1 | 0.1 | 0.4 | 1.5 | 0.3 | 0.1 | - | - | - | - | - | 0.1 | 0.3 | 0.3 | - | 0.2 | - | - | - |
| Stalks | - | - | - | - | - | - | 0.7 | - | - | - | - | 0.9 | - | - | 0.1 | - | - | 0.1 | - | - | - | 0.6 | - | - | - |
| Total | 52.3 | 56.9 | 47.7 | 49.4 | 45.0 | 53.0 | 64.5 | 59.1 | 61.8 | 47.1 | 35.7 | 69.2 | 54.9 | 58.4 | 60.6 | 57.8 | 53.5 | 63.6 | 61.1 | 51.4 | 82.4 | 86.3 | 76.7 | 80.7 | 82.2 |
| LEGUMINOSAE | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of Species | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 0 | 3 | 1 | 3 | 1 |
| 1. Lathyrus pratensis | 2.5 | 0.5 | 0.9 | 1.5 | 0.7 | 0.9 | 2.7 | 1.2 | 2.1 | 0.9 | 2.0 | 1.0 | 2.0 | 1.1 | 0.7 | 0.8 | 2.2 | 2.4 | 2.1 | 2.4 | - | 0.2 | - | 0.1 | - |
| 2. Lotus corniculatus | 3.6 | 3.5 | 1.6 | 3.0 | 6.7 | 3.8 | 3.5 | 2.5 | 4.0 | 10.3 | 7.0 | 4.2 | 1.7 | 7.4 | 3.8 | 2.7 | 9.4 | 2.1 | 2.5 | 9.9 | - | 0.2 | 0.4 | 0.5 | 3.1 |
| 4. Trifolium pratense | 1.4 | 2.1 | 2.1 | 1.4 | 2.0 | 2.5 | 2.3 | 1.8 | 1.5 | 4.7 | 6.4 | 2.1 | 1.6 | 4.6 | 1.0 | 0.8 | 3.6 | 2.8 | 0.9 | 4.8 | - | 0.1 | - | 0.1 | - |
| 5. Trifolium repens | 0.1 | 0.1 | - | 0.2 | 0.2 | 0.3 | - | - | 0.1 | 0.3 | 0.7 | < | - | 0.2 | 0.1 | - | 0.4 | 0.1 | 0.1 | 0.7 | - | - | - | - | - |
| Total | 7.6 | 6.2 | 4.6 | 6.1 | 9.6 | 7.3 | 8.5 | 5.5 | 7.7 | 16.2 | 16.1 | 7.3 | 5.3 | 13.3 | 5.6 | 4.3 | 15.6 | 7.4 | 5.6 | 17.8 | 0 | 0.5 | 0.4 | 0.7 | 3.1 |
| MISCELLANEOUS | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 26 | 22 | 13 | 22 | 20 | 21 | 18 | 15 | 22 | 16 | 16 | 22 | 15 | 20 | 17 | 15 | 16 | 19 | 14 | 18 | 9 | 17 | 14 | 17 | 11 |
| 1 & 2. Ranunculus acris et bulbosus | 1.9 | 0.2 | 0.4 | 0.1 | 0.1 | 0.1 | 1.0 | 2.6 | 1.7 | 1.2 | 3.0 | 0.1 | 0.5 | 0.7 | 0.3 | 0.5 | 0.9 | 1.4 | 4.4 | 2.8 | - | 0.1 | 0.3 | 0.2 | - |
| 3. Viola canina | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - |
| 4. Cerastium vulgatum | 1.1 | 0.2 | 0.6 | 0.1 | 0.3 | 0.2 | 0.6 | 0.8 | 0.5 | 0.3 | 0.2 | 0.4 | 0.8 | 0.1 | 0.5 | 0.8 | 0.2 | 0.6 | 1.0 | 0.3 | 0.2 | 0.2 | 0.4 | 0.1 | - |
| 5. Stellaria graminea | 0.9 | 0.1 | - | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | - | - | 0.1 | 0.3 | 0.2 | 0.1 | - | 0.1 | < | 0.1 | - | - | 0.1 | 0.1 | 0.2 | 0.2 |
| 6. Linum catharticum | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | 0.1 | 0.5 | 0.6 | - | - | - | - | - |
| 7. Agrimonia eupatoria | - | - | - | - | - | - | - | - | 0.1 | 0.2 | - | - | - | - | 0.1 | - | - | 0.1 | - | - | - | - | - | - | - |
| 8. Alchemilla vulgaris | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | 0.3 | 0.1 | - | 0.1 | - | 0.3 | 0.1 | - | 0.1 | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - |
| 11. Poterium sanguisorba | 13.8 | 1.8 | 5.8 | 5.8 | 9.1 | 5.6 | 2.6 | 3.1 | 3.6 | 8.8 | 11.7 | - | - | - | - | - | 0.6 | - | - | 0.1 | - | - | - | - | - |
| 12. Spiraea ulmaria | - | - | - | - | - | - | - | - | - | - | 0.4 | - | - | 0.2 | - | - | - | - | - | 0.3 | - | - | - | - | - |
| 14. Conopodium denudatum | 0.9 | 0.5 | 4.7 | 5.5 | 2.5 | 1.6 | 0.1 | 0.6 | 0.6 | 0.3 | 0.1 | 0.5 | 10.6 | 1.3 | 0.5 | 4.4 | 3.2 | 0.1 | 0.7 | 0.2 | 0.1 | 0.1 | 1.3 | 1.8 | 2.0 |
| 15. Heracleum sphondylium | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.3 | - | - | - |
| 16. Pimpinella saxifraga | 0.4 | 0.6 | - | 0.7 | 1.0 | 0.1 | 0.7 | 0.1 | 0.8 | 0.8 | 0.2 | 0.4 | 0.1 | 0.1 | 0.6 | 0.1 | 0.1 | 0.7 | 0.2 | 0.3 | - | 0.2 | 0.1 | 0.1 | - |
| 17. Galium verum | < | 0.1 | - | 0.1 | 0.6 | 1.1 | - | - | - | - | - | 0.1 | - | 0.9 | 0.2 | 0.4 | 1.6 | - | - | - | 1.4 | 1.0 | 2.0 | 0.3 | 0.5 |
| 18. Scabiosa arvensis | 0.8 | 0.1 | - | 0.6 | 4.5 | 0.9 | 0.9 | 1.6 | 2.7 | 10.4 | 2.1 | 0.5 | 1.0 | 1.6 | 0.2 | 0.1 | 0.5 | 0.1 | 0.5 | 1.7 | 0.3 | 1.1 | 0.6 | 1.4 | 1.7 |
| 19. Achillea millefolium | 2.7 | 0.8 | 1.6 | 1.5 | 2.2 | 1.3 | 1.0 | 1.9 | 1.2 | 0.8 | 1.0 | 1.4 | 2.0 | 1.8 | 0.9 | 1.2 | 1.9 | 0.7 | 1.2 | 1.2 | < | 0.4 | 0.7 | 1.0 | 1.7 |
| 20. Centaurea nigra | 4.1 | 9.1 | 5.8 | 2.8 | 2.9 | 1.0 | 10.7 | 6.2 | 3.8 | 3.2 | 2.0 | 5.5 | 3.0 | 1.8 | 7.3 | 4.9 | 1.3 | 7.7 | 4.5 | 2.5 | 0.7 | 7.2 | 3.9 | 6.3 | 2.0 |
| 22. Hieracium pilosella | 0.2 | 0.1 | - | 0.1 | - | - | 0.1 | - | 0.1 | - | - | < | - | - | - | - | - | 0.1 | - | - | - | 0.2 | - | < | - |
| 23. Hypochaeris radicata | < | - | - | - | - | 0.1 | - | - | - | - | - | 0.1 | - | 0.1 | - | - | - | - | - | 0.1 | - | 0.2 | - | - | 0.4 |
| 24. Leontodon hispidus | 6.0 | 17.8 | 6.9 | 5.5 | 13.6 | 17.9 | 3.6 | 1.5 | 1.7 | 4.2 | 12.5 | 6.5 | 2.6 | 10.0 | 16.5 | 2.8 | 12.4 | 8.5 | 1.7 | 8.7 | - | - | 0.1 | 0.1 | 1.7 |
| 26. Taraxacum vulgare | < | 0.1 | - | 0.2 | 0.1 | 0.1 | - | - | 0.1 | 0.1 | 0.2 | - | - | 0.2 | 0.1 | - | 0.4 | - | - | 0.5 | - | - | - | - | - |
| 27. Tragopogon pratensis | < | 0.1 | - | 0.1 | 0.3 | 0.1 | - | - | 0.1 | - | - | < | 0.2 | 0.1 | - | 0.1 | - | < | - | 0.2 | - | - | - | 0.1 | - |
| 28. Primula veris | 0.1 | - | - | 0.1 | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 29. Plantago lanceolata | 2.0 | 3.4 | 19.1 | 17.4 | 5.8 | 6.2 | 3.6 | 12.1 | 9.0 | 4.9 | 13.0 | 5.2 | 15.1 | 6.8 | 5.5 | 20.6 | 5.7 | 7.9 | 15.4 | 10.2 | - | 0.2 | 0.4 | 1.7 | 2.4 |
| 30. Veronica chamaedrys | 0.6 | 0.1 | 0.1 | 0.2 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.6 | 0.2 | 0.1 | - | 0.1 | 0.1 | 0.1 | - | 0.1 | 0.3 | 0.1 | - | 0.1 | 0.1 | 0.1 | - |
| 31. Ajuga reptans | 0.1 | 0.1 | 0.1 | - | - | - | - | - | 0.1 | - | - | < | 0.1 | - | - | 0.1 | - | - | - | - | - | - | - | - | - |
| 32. Prunella vulgaris | 0.1 | 0.1 | - | - | 0.1 | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 33. Thymus serpyllum | < | - | - | - | 0.3 | 0.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 2.2 | 0.4 | 2.0 | 2.4 | 0.3 | 2.4 | 0.6 | 4.2 | 3.7 | 0.6 | 1.3 | 0.2 | 3.0 | 1.0 | 0.5 | 1.5 | 1.4 | 0.4 | 2.8 | 0.6 | 14.8 | 1.4 | 12.3 | 4.7 | 1.0 |
| 35. Luzula campestris | 0.5 | 0.4 | 0.1 | 0.1 | 0.6 | 0.1 | 0.4 | 0.2 | 0.2 | 0.4 | 0.2 | 0.5 | 0.3 | 0.6 | 0.5 | 0.1 | 0.4 | 0.4 | 0.1 | 0.5 | 0.1 | 0.2 | 0.8 | 0.6 | 1.2 |
| 36. Carex praecox | 1.2 | 1.3 | 0.5 | 1.0 | 0.5 | - | 0.8 | 0.4 | 0.4 | 0.1 | - | 1.9 | 0.3 | 0.4 | 0.1 | - | 0.1 | 0.1 | - | - | - | - | - | - | - |
| Mosses | 0.1 | - | - | 0.1 | - | 0.1 | 0.1 | - | 0.1 | - | - | - | - | - | - | - | - | < | - | - | < | - | - | 0.1 | - |
| Total | 40.0 | 37.5 | 47.7 | 44.6 | 45.2 | 39.8 | 27.1 | 35.5 | 30.8 | 36.9 | 48.2 | 23.5 | 39.9 | 28.1 | 34.0 | 37.7 | 30.8 | 29.0 | 33.4 | 30.9 | 17.6 | 13.1 | 23.1 | 18.8 | 14.8 |

TABLE 2

Botanical analyses
Plots 3, 12, (2, 5[1])
Unmanured

<= less than 0.05

TABLE 3.

NUMBER OF SPECIES AND PERCENTAGE OF EACH SPECIES AND GROUP OF SPECIES

| | MIXED MINERAL MANURE = Potassium, Sodium and Magnesium sulphates and Superphosphate of lime | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manuring | COMPLETE 1856 and since | | | | | | | | | | WITHOUT POTASH after COMPLETE 6 years 1856-1861 | | | | | | | | COMPLETE after Ammonium salts 13 years, 1856-1868 | | | | COMPLETE after Nitrate of Soda 18 years, 1858-1875 | | | | | | | | | |
| Plot number | 7 | | | | | | | | | | 8 | | | | | | | | 6 | | | | 15 | | | | | | | | | |
| Unlimed or Limed | UNLIMED | | | | | | LIMED | | | | | UNLIMED | | | | | LIMED | | | UNLIMED | | | | UNLIMED | | | | | | LIMED | | |
| Season | 1903 | 1914 | 1919 | 1925 | 1935 | 1948 | 1914 | 1919 | 1925 | 1935 | 1948 | 1903 | 1914 | 1919 | 1935 | 1948 | 1914 | 1919 | 1935 | 1948 | 1903 | 1914 | 1919 | 1949 | 1903 | 1914 | 1919 | 1923 | 1933 | 1949 | 1923 | 1933 | 1949 |
| **GRAMINEAE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 16 | 14 | 12 | 12 | 11 | 13 | 13 | 12 | 13 | 12 | 14 | 15 | 16 | 13 | 11 | 14 | 15 | 13 | 15 | 14 | 15 | 12 | 12 | 11 | 16 | 14 | 12 | 12 | 13 | 10 | 13 | 12 | 12 |
| 1. Agrostis vulgaris | 3.3 | 7.0 | 5.4 | 11.1 | 8.3 | 3.8 | 4.3 | 2.0 | 1.8 | 0.7 | 0.4 | 0.7 | 7.8 | 3.9 | 8.8 | 3.0 | 5.3 | 2.0 | 1.7 | 1.3 | 2.5 | 7.4 | 7.6 | 2.5 | 3.0 | 12.1 | 11.4 | 13.1 | 16.8 | 2.8 | 13.8 | 3.6 | 0.5 |
| 2. Aira caespitosa | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - |
| 3. Alopecurus pratensis | 4.5 | 1.7 | 1.7 | 1.1 | 3.6 | 8.3 | 9.8 | 15.2 | 8.9 | 11.3 | 13.2 | 0.5 | 0.4 | 1.2 | 0.9 | 5.6 | 1.0 | 1.5 | 2.7 | 2.7 | 0.6 | 1.9 | 3.0 | 6.1 | 10.2 | 13.9 | 30.1 | 8.5 | 10.6 | 18.6 | 15.5 | 8.9 | 6.8 |
| 4. Anthoxanthum odoratum | 1.4 | 4.2 | 3.6 | 2.3 | 1.9 | 3.6 | 0.6 | 0.5 | 0.1 | 0.8 | 0.3 | 1.5 | 3.9 | 4.6 | 3.0 | 2.4 | 3.2 | 1.5 | 0.4 | 1.4 | 1.9 | 5.0 | 4.3 | 2.2 | 1.7 | 3.1 | 3.5 | 3.8 | 8.2 | 1.7 | 0.2 | 0.8 | 0.3 |
| 5. Arrhenatherum avenaceum | 1.2 | 1.2 | 3.1 | 5.3 | 0.2 | 2.4 | 2.0 | 2.6 | 27.3 | 6.3 | 11.7 | 4.2 | 3.1 | 8.0 | 7.5 | 14.2 | 4.0 | 18.2 | 13.7 | 14.7 | 1.9 | 1.1 | 3.2 | 2.2 | 0.2 | 0.5 | 1.5 | 1.1 | 10.8 | 0.6 | 2.6 | 8.0 | 13.9 |
| 6. Avena flavescens | 6.6 | 1.9 | 0.7 | 0.5 | 0.4 | 1.0 | 4.0 | 1.0 | 0.5 | 3.4 | 2.5 | 3.9 | 2.1 | 1.2 | 1.6 | 0.5 | 3.2 | 1.6 | 5.3 | 2.1 | 1.5 | 0.8 | 0.2 | 0.1 | 5.5 | 1.7 | 0.9 | 0.7 | 0.8 | 0.2 | 0.9 | 1.9 | 0.2 |
| 7. A. pubescens | 4.3 | 2.6 | 2.9 | 1.5 | 2.5 | 1.1 | 4.5 | 8.8 | 8.1 | 8.7 | 5.2 | 8.0 | 5.2 | 3.4 | 5.8 | 1.9 | 9.4 | 12.1 | 15.2 | 11.3 | 7.5 | 6.5 | 5.1 | 3.1 | 4.2 | 2.0 | 2.0 | 2.0 | 4.2 | 1.1 | 3.3 | 12.5 | 12.6 |
| 8. Brima media | 0.1 | - | - | 0.1 | - | - | - | - | - | - | - | 5.9 | 1.5 | 0.4 | 0.4 | 0.1 | 9.4 | 2.0 | 1.4 | 0.9 | 0.2 | - | - | - | 0.2 | - | - | - | - | - | - | - | - |
| 9. Bromus mollis | 0.6 | 2.1 | 0.1 | - | - | 0.2 | 15.6 | 0.6 | < | 2.9 | 2.1 | - | 0.2 | - | - | - | 0.1 | - | 0.1 | < | 0.2 | 0.7 | 0.1 | 0.2 | 3.4 | 2.9 | 0.1 | 0.7 | 0.6 | - | 2.3 | 0.2 | 1.1 |
| 10. Cynosurus cristatus | 0.1 | - | - | - | - | - | - | - | - | - | - | 0.5 | 0.1 | - | - | - | 0.1 | - | 0.1 | - | - | 7.4 | - | - | - | - | - | - | - | - | - | - | - |
| 11. Dactylis glomerata | 5.0 | 10.2 | 21.6 | 34.1 | 6.1 | 15.7 | 12.5 | 18.6 | 22.8 | 11.2 | 13.2 | 1.1 | 4.0 | 3.8 | 2.6 | 12.6 | 2.9 | 5.1 | 5.3 | 5.6 | 3.5 | 27.6 | 21.2 | 11.8 | 0.5 | 2.4 | 5.0 | 3.3 | 12.3 | 8.4 | 1.6 | 6.6 | 4.5 |
| 12. Festuca rubra | 7.7 | 31.6 | 7.1 | 9.3 | 20.1 | 4.6 | 13.3 | 5.4 | 3.2 | 4.9 | 1.0 | 9.5 | 25.0 | 6.9 | 17.6 | 5.2 | 21.4 | 6.0 | 8.6 | 2.1 | 8.8 | 3.4 | 6.7 | 5.3 | 15.0 | 13.8 | 7.4 | 20.9 | 9.2 | 7.0 | 23.7 | 13.4 | 3.7 |
| 13. F. pratensis | 0.5 | 0.2 | - | - | - | 0.3 | - | - | - | - | 3.3 | 0.1 | - | - | - | 0.4 | - | - | - | 6.9 | 0.1 | 1.1 | - | - | < | - | - | - | - | - | - | - | - |
| 14. Holcus lanatus | 3.1 | 3.4 | 4.3 | 6.5 | 3.0 | 2.8 | 2.5 | 1.6 | 0.7 | 0.2 | 1.2 | 6.3 | 8.0 | 11.2 | 6.4 | 7.4 | 6.9 | 5.2 | 5.1 | 2.1 | 2.9 | 0.1 | 4.4 | 2.7 | 2.3 | 5.6 | - | 2.1 | 4.0 | 1.4 | 1.7 | 1.6 | 1.6 |
| 15. Lolium perenne | 0.1 | 0.2 | - | - | - | - | - | - | < | - | 0.2 | 0.1 | 0.4 | 0.3 | - | 0.1 | 0.1 | 0.1 | 0.1 | - | < | - | - | - | < | 0.2 | 6.0 | - | 0.1 | - | 0.9 | - | - |
| 16. Poa pratensis | 2.3 | 1.4 | 1.2 | 1.0 | 1.3 | 2.6 | 1.3 | 1.6 | 1.1 | 4.5 | 1.2 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.4 | 2.0 | 1.5 | 1.5 | 3.7 | - | 1.3 | 1.7 | 2.5 | 0.4 | 1.4 | 1.4 | 1.1 | 0.5 | 1.8 | 0.3 | 1.2 |
| 17. P. trivialis | 1.0 | 0.5 | 0.4 | < | 0.1 | 0.3 | 1.9 | 1.2 | 0.7 | 3.7 | 1.1 | 0.1 | 0.2 | 0.6 | - | 0.1 | 0.8 | 0.7 | 1.6 | 0.8 | 0.2 | - | 0.1 | - | 1.2 | 0.4 | 0.2 | 0.2 | 0.1 | - | 0.9 | 0.3 | 0.4 |
| Stalks | - | 0.1 | - | - | - | - | 0.6 | - | - | - | - | - | 0.3 | - | - | - | 0.5 | - | - | - | - | - | - | - | - | 0.4 | - | - | - | - | - | - | - |
| Total | 41.8 | 68.3 | 52.1 | 72.8 | 47.5 | 46.7 | 72.9 | 59.1 | 75.2 | 58.6 | 56.6 | 43.4 | 63.3 | 46.6 | 55.7 | 52.6 | 69.6 | 58.0 | 62.8 | 53.4 | 35.6 | 63.1 | 57.2 | 37.7 | 49.9 | 59.5 | 69.5 | 57.8 | 78.8 | 42.2 | 69.5 | 58.1 | 46.8 |
| **LEGUMINOSAE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 5 | 4 | 5 | 5 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 3 |
| 1. Lathyrus pratensis | 22.0 | 10.7 | 7.1 | 6.1 | 31.0 | 11.3 | 15.9 | 19.5 | 1.1 | 23.6 | 15.6 | 3.7 | 3.4 | 4.2 | 0.3 | 0.6 | 2.4 | 5.0 | 0.7 | 1.5 | 30.9 | 17.5 | 9.9 | 20.7 | 16.3 | 28.0 | 5.3 | 15.1 | 7.7 | 22.3 | 11.2 | 13.8 | 13.4 |
| 2. Lotus corniculatus | 0.4 | 0.6 | 0.5 | < | 2.8 | 0.5 | 0.1 | < | < | - | < | 12.2 | 1.8 | 1.3 | 4.4 | 3.3 | 2.1 | 1.6 | 3.4 | 5.9 | 2.3 | 1.6 | 1.1 | 2.6 | < | 0.1 | - | - | - | 0.9 | - | - | - |
| 4. Trifolium pratense | 6.4 | 4.7 | 1.0 | 0.2 | 3.1 | 4.6 | 2.7 | < | < | 1.8 | 3.4 | 1.4 | 5.4 | 5.0 | 6.5 | 2.7 | 5.0 | 1.5 | 4.6 | 3.5 | 5.9 | 5.2 | 0.4 | 5.3 | 5.8 | 2.6 | 0.1 | 0.1 | 0.5 | 1.7 | 2.6 | 6.0 | 2.8 |
| 5. T. repens | 4.3 | 0.9 | 0.1 | - | 0.7 | 3.4 | 1.0 | - | - | 6.1 | 6.3 | 1.3 | 0.1 | < | 0.1 | 0.7 | 0.1 | - | - | 0.1 | 1.7 | 0.1 | 0.1 | 2.2 | 6.7 | 2.4 | - | 0.3 | 0.9 | 2.8 | 4.6 | 6.6 | 16.5 |
| 6. T. minus? | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.5 | 0.2 | - | - | - | - | - | - | - | - |
| 7. Vicia sepium? | - | 0.1 | 0.1 | < | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - |
| Total | 33.1 | 17.0 | 8.8 | 6.5 | 37.6 | 19.9 | 19.7 | 19.5 | 1.1 | 31.5 | 25.3 | 18.6 | 10.7 | 10.5 | 11.3 | 7.3 | 9.6 | 8.1 | 8.7 | 11.1 | 40.8 | 24.4 | 11.5 | 31.3 | 29.0 | 33.1 | 5.4 | 15.4 | 9.1 | 27.7 | 18.4 | 26.4 | 32.7 |
| **MISCELLANEOUS** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 16 | 13 | 14 | 13 | 12 | 12 | 13 | 14 | 11 | 13 | 13 | 23 | 15 | 14 | 17 | 15 | 13 | 15 | 14 | 16 | 20 | 15 | 12 | 13 | 14 | 11 | 10 | 14 | 13 | 9 | 11 | 13 | 12 |
| 1 & 2. Ranunculus acris et bulbosus | 2.8 | 0.9 | 1.9 | 0.8 | 0.3 | 0.7 | 0.7 | 4.0 | 2.1 | 0.3 | 1.9 | 10.9 | 0.5 | 2.1 | 0.8 | 5.7 | 0.7 | 4.6 | 0.5 | 2.1 | 3.7 | 1.1 | 4.1 | 0.8 | 6.2 | 0.8 | 2.7 | 1.3 | 0.4 | 0.4 | 1.4 | 0.5 | 1.8 |
| 3. Viola canina | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | < | - | - | - | - | - | - | - | - | - | - | - |
| 4. Cerastium vulgatum | 0.3 | 0.2 | 0.1 | - | 0.1 | - | < | 0.1 | - | - | < | 1.1 | 0.7 | 0.5 | 0.3 | 0.1 | 0.7 | 1.1 | 0.8 | 0.4 | 0.1 | 0.1 | - | - | < | 0.1 | - | 0.1 | 0.1 | - | - | 0.1 | 0.1 |
| 5. Stellaria graminea | 0.1 | - | 0.1 | < | 0.2 | - | - | - | - | 0.7 | - | 0.4 | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | - | < | - | 0.1 | - | - | - | - | 0.1 | 0.1 | - | - | - | - |
| 7. Agrimonia eupatoria | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | < | 0.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - |
| 11. Poterium sanguisorba | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - |
| 12. Spiraea ulmaria | 0.9 | 0.7 | 1.9 | 1.2 | 0.1 | - | - | - | - | - | - | 0.1 | - | - | 0.1 | - | - | - | - | 0.6 | - | < | - | - | - | - | - | - | - | - | - | - | - |
| 13. Anthriscus sylvestris | - | - | - | - | - | - | - | - | 1.1 | - | 0.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | < | 0.1 | - | 0.1 | - | - | - | - | - |
| 14. Conopodium denudatum | 1.7 | 0.8 | 9.5 | 2.6 | 0.2 | 1.4 | 0.3 | 3.7 | 0.5 | 0.1 | 0.1 | 0.8 | 0.1 | 2.9 | 0.1 | 0.8 | - | 0.5 | - | 0.2 | 1.3 | - | 6.7 | 4.1 | 1.1 | 0.2 | 3.6 | 2.5 | 1.5 | 1.1 | 2.0 | 0.7 | 0.5 |
| 15. Heracleum sphondylium | 1.9 | 0.5 | 4.2 | 4.2 | 2.3 | 1.0 | 0.3 | 1.6 | 12.0 | 2.9 | 4.5 | - | - | - | 0.1 | - | - | - | - | - | 0.3 | 0.1 | 0.3 | 0.6 | - | - | 0.3 | - | - | - | - | 1.4 | 3.1 |
| 16. Pimpinella saxifraga | 0.5 | - | - | - | - | - | - | < | - | 0.1 | - | 1.0 | 0.1 | 0.2 | 0.6 | 0.1 | 0.3 | 0.1 | 0.8 | 0.2 | 1.3 | 0.3 | 0.1 | - | 0.2 | - | - | - | 0.1 | - | - | - | - |
| 17. Galium verum | - | 0.2 | 0.2 | - | - | 0.2 | - | - | - | - | - | 0.3 | 0.3 | 0.1 | 1.4 | 0.4 | 0.3 | - | - | 0.2 | 0.3 | - | - | 0.1 | - | - | - | 0.1 | 0.1 | - | - | - | - |
| 18. Scabiosa arvensis | 0.1 | 0.5 | 0.1 | 0.3 | - | - | 0.8 | 0.6 | - | 0.1 | 0.3 | 2.2 | 0.8 | 0.8 | 2.1 | 0.9 | 1.5 | 4.5 | 5.7 | 3.6 | 0.8 | 0.8 | 1.4 | 1.1 | < | - | - | - | - | - | - | - | - |
| 19. Achillea millefolium | 8.9 | 2.5 | 6.3 | 1.8 | 1.8 | 14.0 | 0.7 | 1.0 | 0.6 | 0.5 | 1.0 | 3.5 | 2.8 | 4.8 | 3.6 | 6.9 | 1.3 | 2.1 | 0.8 | 4.0 | 7.6 | 3.1 | 5.0 | 8.9 | 10.0 | 4.3 | 5.3 | 1.7 | 1.5 | 10.0 | 1.2 | 0.9 | 1.2 |
| 20. Centaurea nigra | 1.0 | 6.9 | 2.5 | 2.2 | 5.0 | 4.3 | 3.5 | 1.1 | 0.8 | 1.3 | 0.5 | 7.2 | 9.3 | 4.8 | 2.9 | 2.0 | 9.3 | 4.5 | 5.1 | 2.5 | 1.3 | 6.1 | 1.8 | 5.5 | 0.8 | 1.0 | 0.6 | 0.3 | 0.4 | 7.6 | 0.8 | 0.8 | 1.4 |
| 21. Chrysanthemum leucanthemum | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - |
| 22. Hieracium pilosella | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 23. Hypochaeris radicata | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24. Leontodon hispidus | - | - | - | - | - | - | - | - | - | 0.3 | - | 0.9 | 1.0 | 0.7 | 6.1 | 4.5 | 0.3 | 0.3 | 4.1 | 5.6 | - | - | - | 0.2 | - | - | - | - | - | 0.3 | - | 0.1 | - |
| 26. Taraxacum vulgare | - | - | - | - | 0.1 | 0.4 | < | 0.1 | 1.4 | 1.0 | 1.9 | 0.1 | - | - | 0.1 | 0.1 | - | - | 0.3 | 0.1 | 0.1 | < | - | 0.2 | 0.1 | 0.2 | 1.3 | 0.8 | 0.4 | 0.1 | 1.6 | 0.4 | 1.9 |
| 27. Tragopogon pratensis | 1.1 | 0.2 | 0.1 | < | - | 1.1 | 0.5 | 1.5 | 0.1 | - | 2.6 | 0.5 | - | - | - | - | 0.2 | 0.1 | - | 0.9 | 0.3 | 0.1 | 0.1 | 0.3 | - | 0.1 | 0.3 | 0.5 | 0.1 | - | 0.1 | - | 0.3 |
| 29. Plantago lanceolata | 0.1 | 0.7 | 1.3 | 3.3 | 3.4 | 6.5 | 0.2 | 0.5 | 0.2 | 1.3 | 4.6 | 5.9 | 8.7 | 18.5 | 13.0 | 19.1 | 5.3 | 7.7 | 7.8 | 13.1 | 0.1 | - | 0.1 | 7.4 | 0.2 | 0.3 | 3.8 | 13.5 | 4.4 | 9.7 | 4.6 | 9.7 | 9.6 |
| 30. Veronica chamaedrys | 1.5 | - | - | < | - | - | < | 0.1 | < | 0.5 | 0.1 | 0.7 | 0.1 | 0.1 | 0.4 | 0.3 | - | 0.1 | 0.5 | 0.2 | 0.5 | 0.1 | - | - | 0.2 | - | - | 0.1 | - | - | 0.1 | 0.1 | 0.1 |
| 31. Ajuga reptans | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | 0.1 | - | - |
| 32. Prunella vulgaris | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 3.7 | 0.2 | 10.6 | 4.0 | 0.6 | 2.2 | 0.4 | 7.1 | 4.8 | 0.6 | 0.4 | 1.9 | 0.5 | 6.9 | 0.7 | 2.9 | 0.5 | 7.8 | 1.1 | 1.7 | 5.2 | 0.3 | 10.9 | 1.5 | 1.6 | 0.2 | 7.4 | 2.0 | 2.3 | 0.8 | 0.5 | 0.3 | 0.6 |
| 34(a). Urtica dioica | - | - | - | - | - | 1.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 35. Lusula campestris | 0.2 | 0.2 | 0.3 | 0.2 | 0.9 | 0.2 | < | 0.1 | - | - | - | 0.4 | 0.4 | 0.5 | 0.6 | 0.5 | 0.3 | 0.2 | 0.2 | 0.1 | 0.3 | 0.2 | 0.7 | 0.2 | 0.6 | 0.3 | 0.2 | 3.6 | 1.0 | 0.1 | 0.3 | 0.3 | 0.1 |
| 36. Carex praecox | 0.4 | - | - | - | - | - | - | - | - | - | - | 0.2 | 0.1 | - | - | - | < | - | - | - | < | - | - | - | 0.1 | - | - | - | - | - | - | - | - |
| 37. Ophioglossum vulgatum | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mosses | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 25.2 | 14.5 | 39.1 | 20.6 | 15.0 | 33.7 | 7.4 | 21.5 | 23.6 | 9.7 | 18.2 | 38.1 | 25.6 | 42.8 | 33.1 | 40.2 | 21.0 | 33.7 | 28.5 | 33.5 | 23.4 | 12.3 | 31.3 | 30.9 | 21.1 | 7.6 | 25.9 | 26.7 | 12.4 | 30.1 | 12.5 | 15.4 | 20.7 |

**TABLE 3**

Botanical analyses
Plots 6, 7, 8, 15
Minerals only (no N)

<= less than 0.05

TABLE 4.

NUMBER OF SPECIES AND PERCENTAGE OF EACH SPECIES AND GROUP OF SPECIES.

| | MIXED MINERAL MANURE | | | | SUPERPHOSPHATE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manuring | After Ammonium Salts 42 years, 1856-1897. | | | | Alone, 1856 and since. | | | | | | |
| Plot Number | $5^2$ | | | | $4^1$ | | | | | | |
| Unlimed or Limed | UNLIMED | | | | UNLIMED | | | | LIMED | | |
| Season | 1914 | 1919 | 1926 | 1949 | 1903 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 |
| **GRAMINEAE** | | | | | | | | | | | |
| Number of species | 11 | 11 | 10 | 9 | 15 | 14 | 14 | 15 | 12 | 13 | 13 |
| 1. Agrostis vulgaris | 16.7 | 8.4 | 20.7 | 7.1 | < | 1.0 | 0.7 | 2.0 | 1.6 | 0.5 | 0.4 |
| 3. Alopecurus pratensis | 4.0 | 11.1 | 12.6 | 9.1 | 0.3 | 0.1 | 0.1 | 2.2 | 1.3 | 1.5 | 2.4 |
| 4. Anthoxanthum odoratum | 6.2 | 5.1 | 4.9 | 0.1 | 2.4 | 4.1 | 3.2 | 3.4 | 1.5 | 1.9 | 1.1 |
| 5. Arrhenatherum avenaceum | 0.4 | 2.3 | 7.7 | 1.8 | < | 0.5 | 0.9 | 7.3 | 0.1 | 0.1 | 0.1 |
| 6. Avena flavescens | - | - | - | - | 2.8 | 2.3 | 3.1 | 0.9 | 1.9 | 4.4 | 2.7 |
| 7. Avena pubescens | 1.2 | 1.7 | 2.0 | 5.5 | 9.8 | 10.3 | 14.1 | 5.5 | 13.0 | 20.0 | 18.1 |
| 8. Briza media | - | - | - | - | 11.2 | 2.3 | 1.3 | 0.5 | 3.5 | 2.9 | 1.8 |
| 9. Bromus mollis | 3.0 | 0.1 | - | - | - | - | - | 0.1 | - | - | - |
| 10. Cynosurus cristatus | - | - | - | - | < | 0.1 | 0.1 | - | - | 0.2 | - |
| 11. Dactylis glomerata | 3.8 | 7.4 | 15.1 | 4.7 | 1.3 | 4.7 | 11.4 | 7.1 | 1.8 | 6.5 | 4.9 |
| 12. Festuca rubra | 34.3 | 19.6 | 13.7 | 11.5 | 8.8 | 21.9 | 5.2 | 9.1 | 22.8 | 5.5 | 3.6 |
| 13. Festuca pratensis | - | - | - | - | < | - | - | 0.3 | - | - | 1.1 |
| 14. Holcus lanatus | 0.8 | 1.1 | 3.7 | 4.1 | 4.7 | 8.9 | 10.1 | 6.7 | 6.6 | 6.9 | 4.5 |
| 15. Lolium perenne | - | - | - | - | < | 0.1 | 0.2 | 0.3 | - | - | - |
| 16. Poa pratensis | 4.7 | 6.3 | 2.2 | 2.6 | 0.8 | 1.0 | 0.9 | 0.9 | 0.8 | 2.1 | 1.7 |
| 17. Poa trivialis | 0.1 | 0.1 | < | - | 0.6 | 0.6 | 1.5 | 0.5 | 0.5 | 1.4 | 1.8 |
| Stalks | 1.2 | - | - | - | - | - | - | - | 0.1 | - | - |
| Total | 76.4 | 63.2 | 82.6 | 44.5 | 42.7 | 57.9 | 52.8 | 46.8 | 55.5 | 53.9 | 44.2 |
| **LEGUMINOSAE** | | | | | | | | | | | |
| Number of species | 4 | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 4 | 3 | 4 |
| 1. Lathyrus pratensis | 2.0 | 1.3 | 6.7 | 16.8 | 4.8 | 1.7 | 1.6 | 3.0 | 11.5 | 5.1 | 7.3 |
| 2. Lotus corniculatus | 3.9 | 3.1 | 1.6 | 5.1 | 7.3 | 1.1 | 0.8 | 3.8 | 2.2 | 3.7 | 7.7 |
| 3. Ononis arvensis | - | - | - | - | - | 0.5 | 0.2 | 2.4 | - | - | - |
| 4. Trifolium pratense | 2.5 | - | 0.4 | 1.1 | 2.7 | 3.1 | 0.1 | 2.3 | 5.0 | 0.9 | 4.9 |
| 5. Trifolium repens | 0.1 | - | 0.2 | 1.3 | 2.8 | 1.3 | 0.1 | 2.9 | 0.2 | - | 2.5 |
| 6. Vicia sepium | - | 0.2 | 1.5 | 2.1 | - | - | - | - | - | - | - |
| Total | 8.5 | 4.6 | 10.4 | 26.4 | 17.6 | 7.7 | 2.8 | 14.4 | 18.9 | 9.7 | 22.4 |
| **MISCELLANEOUS** | | | | | | | | | | | |
| Number of species | 16 | 16 | 15 | 12 | 22 | 14 | 12 | 14 | 16 | 15 | 13 |
| 1 & 2. Ranunculus acris et bulbosus | 0.1 | 0.6 | 0.4 | 0.3 | 1.5 | 0.4 | 1.6 | 3.8 | 1.1 | 4.6 | 2.3 |
| 4. Cerastium vulgatum | 0.5 | 0.2 | < | - | 0.7 | 0.6 | 0.6 | 0.4 | 1.0 | 0.2 | - |
| 5. Stellaria graminea | 0.3 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | < | - | 0.1 | 0.1 | - |
| 7. Agrimonia eupatoria | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | - | - | - | - | < | - | - | - | - | - | - |
| 11. Poterium sanguisorba | - | - | - | - | 8.5 | 1.1 | 0.8 | 0.9 | 0.1 | 0.1 | 2.1 |
| 13. Anthriscus sylvestris | - | - | - | - | - | - | - | - | - | - | - |
| 14. Conopodium denudatum | - | 0.1 | 0.1 | 0.1 | 0.2 | - | 0.4 | 1.1 | - | 0.2 | - |
| 15. Heracleum sphondylium | 0.1 | 0.3 | 0.6 | 0.6 | - | 0.4 | - | - | - | - | - |
| 15. Pimpinella saxifraga | 0.2 | 0.4 | 0.2 | 0.3 | 0.5 | - | - | 0.1 | 0.5 | 0.2 | 0.3 |
| 17. Galium verum | 0.3 | 0.2 | 0.1 | - | - | - | - | - | - | - | - |
| 18. Scabiosa arvensis | 0.1 | 0.2 | 1.2 | 0.9 | 0.3 | 0.3 | - | 0.2 | 0.8 | 1.5 | 2.2 |
| 19. Achillea millefolium | 0.8 | 2.8 | 4.5 | 12.8 | 1.8 | 1.6 | 2.3 | 3.8 | 1.1 | 2.3 | 3.4 |
| 20. Centaurea nigra | 9.0 | 3.4 | 3.2 | 5.4 | 4.8 | 8.9 | 7.6 | 1.7 | 8.2 | 5.9 | 3.5 |
| 22. Hieracium pilosella | 0.1 | - | - | - | 0.4 | - | - | - | 0.1 | - | - |
| 23. Hypochaeris radicata | 0.2 | 0.1 | - | - | - | - | - | - | - | - | - |
| 24. Leontodon hispidus | 0.1 | - | - | 0.1 | 14.7 | 12.9 | - | 11.0 | 7.0 | 2.3 | 6.3 |
| 25. Senecio jacobaea | - | - | - | - | - | - | 2.5 | - | - | - | - |
| 26. Taraxacum vulgare | - | - | - | - | 0.1 | - | - | 0.6 | - | - | 0.1 |
| 27. Tragopogon pratensis | - | 0.5 | 0.1 | - | 0.1 | - | - | - | 0.1 | 0.1 | 0.7 |
| 29. Plantago lanceolata | 0.1 | 0.6 | 0.4 | 0.9 | 2.5 | 7.0 | 18.0 | 8.5 | 4.1 | 11.4 | 9.7 |
| 30. Veronica chamaedrys | 0.2 | 0.1 | < | - | 0.4 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.3 |
| 31. Ajuga reptans | - | - | - | - | < | - | - | - | - | - | - |
| 32. Prunella vulgaris | - | - | - | - | 0.1 | - | - | - | - | - | - |
| 34. Rumex acetosa | 2.5 | 18.1 | 5.0 | 5.7 | 1.5 | 0.7 | 10.3 | 3.8 | 0.6 | 6.3 | 2.1 |
| 35. Luzula campestris | 0.7 | 4.3 | 3.3 | 1.8 | 0.6 | 0.5 | 0.3 | 0.9 | 0.6 | 0.3 | 0.4 |
| 36. Carex praecox | - | - | - | - | 0.5 | 0.1 | - | - | 0.1 | - | - |
| Mosses | - | - | - | - | < | - | - | - | - | - | - |
| Total | 19.3 | 32.2 | 17.2 | 29.0 | 39.3 | 34.7 | 44.6 | 38.9 | 25.6 | 35.7 | 33.4 |

| | NITRATE OF SODA. | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manuring | Alone = 43 lb. N. | | | | | | | | | With Mixed Mineral Manure. = 43 lb. N. | | | | | |
| Plot Number | 17 | | | | | | | | | 16 | | | | | |
| Unlimed or Limed | UNLIMED | | | | | | LIMED | | | UNLIMED | | | LIMED | | |
| Season | 1903 | 1914 | 1919 | 1923 | 1933 | 1949 | 1923 | 1933 | 1949 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 |
| **GRAMINEAE** | | | | | | | | | | | | | | | |
| Number of species | 15 | 14 | 14 | 14 | 15 | 9 | 14 | 14 | 15 | 12 | 11 | 12 | 12 | 12 | 11 |
| 1. Agrostis vulgaris | 1.8 | 12.5 | 6.1 | 9.2 | 5.1 | 1.2 | 4.0 | 0.5 | 0.6 | 4.9 | 1.3 | 2.3 | 0.1 | 0.2 | 0.2 |
| 3. Alopecurus pratensis | 9.7 | 14.5 | 12.9 | 13.3 | 14.5 | 14.5 | 10.3 | 9.3 | 7.3 | 26.5 | 50.6 | 22.5 | 25.8 | 36.1 | 10.9 |
| 4. Anthoxanthum odoratum | 11.1 | 4.9 | 7.3 | 7.5 | 10.3 | 8.7 | 2.9 | 0.5 | 0.8 | 2.9 | 2.0 | 4.2 | 0.1 | < | 0.2 |
| 5. Arrhenatherum avenaceum | - | 0.3 | 0.3 | 0.1 | 0.1 | - | 0.4 | 1.9 | 1.7 | 2.8 | 3.3 | 22.0 | 1.3 | 3.1 | 19.4 |
| 6. Avena flavescens | 1.8 | 1.2 | 1.3 | 1.5 | 0.3 | - | 1.3 | 2.6 | 1.5 | 3.6 | 1.2 | 0.6 | 3.0 | 1.1 | 0.6 |
| 7. Avena pubescens | 8.7 | 3.9 | 4.9 | 5.5 | 1.7 | 1.7 | 10.4 | 10.5 | 20.5 | 5.1 | 2.8 | 5.8 | 14.0 | 17.7 | 15.3 |
| 8. Briza media | 2.2 | 1.1 | 0.5 | 0.2 | 0.3 | 0.6 | 0.4 | 1.0 | 0.7 | - | - | - | - | - | - |
| 9. Bromus mollis | 0.2 | 0.1 | - | 0.1 | 0.1 | - | 0.4 | 0.1 | 0.7 | 8.0 | - | 0.2 | 3.0 | < | 0.6 |
| 10. Cynosurus cristatus | 0.2 | - | 0.1 | - | 0.1 | - | - | 0.2 | - | - | - | - | - | - | - |
| 11. Dactylis glomerata | 0.9 | 5.8 | 8.3 | 7.3 | 17.7 | 25.4 | 4.3 | 10.7 | 21.1 | 9.7 | 20.1 | 9.9 | 9.5 | 18.9 | 13.4 |
| 12. Festuca rubra | 12.8 | 14.4 | 4.3 | 17.6 | 6.8 | 9.4 | 35.3 | 29.3 | 22.3 | 7.7 | 1.8 | 6.2 | 30.9 | 11.4 | 14.4 |
| 13. Festuca pratensis | 0.1 | - | - | - | - | - | - | - | 0.8 | - | - | - | - | - | - |
| 14. Holcus lanatus | 4.8 | 7.5 | 10.9 | 2.7 | 13.7 | 8.5 | 2.7 | 5.9 | 2.1 | 1.5 | 1.7 | 1.1 | 0.6 | 0.2 | - |
| 15. Lolium perenne | 0.5 | 1.4 | 0.7 | 0.7 | 0.5 | 0.6 | 0.4 | 1.7 | 2.4 | - | - | - | - | - | - |
| 16. Poa pratensis | 0.2 | 0.1 | 0.3 | 0.6 | 0.1 | - | 0.1 | - | 0.1 | 0.7 | 1.2 | 0.4 | 0.3 | 0.5 | 0.5 |
| 17. Poa trivialis | 1.0 | 0.1 | 0.5 | 1.4 | 0.6 | - | 1.1 | 1.9 | 0.6 | 0.1 | 0.3 | 0.1 | 1.8 | 0.4 | 0.4 |
| Stalks | - | 1.2 | - | - | - | - | - | - | - | 2.3 | - | - | 0.6 | - | - |
| Total | 56.0 | 69.0 | 58.4 | 65.7 | 71.7 | 70.6 | 74.0 | 76.1 | 83.2 | 75.8 | 86.3 | 75.3 | 90.8 | 89.6 | 75.9 |
| **LEGUMINOSAE** | | | | | | | | | | | | | | | |
| Number of species | 4 | 3 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | 2 | 3 |
| 1. Lathyrus pratensis | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | - | - | 14.7 | 1.2 | 11.7 | 1.3 | 0.7 | 8.5 |
| 2. Lotus corniculatus | 2.3 | 0.4 | 0.3 | - | - | - | 1.1 | 1.8 | 2.8 | - | - | - | - | < | - |
| 3. Ononis arvensis | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4. Trifolium pratense | < | 0.1 | - | - | - | - | 0.1 | - | - | 0.8 | - | - | 0.3 | - | 0.7 |
| 5. Trifolium repens | 0.2 | - | - | - | - | - | - | - | - | 0.4 | - | 0.2 | 0.7 | - | 0.4 |
| 6. Vicia sepium | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 2.6 | 0.6 | 0.4 | 0.1 | 0.1 | 0.1 | 1.3 | 1.8 | 2.8 | 13.9 | 1.2 | 11.9 | 2.3 | 0.7 | 9.6 |
| **MISCELLANEOUS** | | | | | | | | | | | | | | | |
| Number of species | 20 | 13 | 14 | 15 | 14 | 10 | 17 | 12 | 13 | 10 | 9 | 7 | 9 | 10 | 9 |
| 1 & 2. Ranunculus acris et bulbosus | 3.9 | 0.6 | 0.8 | 0.3 | 0.2 | 0.4 | 0.5 | 0.5 | 2.1 | 0.3 | 0.3 | 0.2 | 0.6 | 0.8 | 0.4 |
| 4. Cerastium vulgatum | - | 0.3 | 0.3 | 0.4 | 0.2 | 0.1 | 0.9 | 0.5 | 0.1 | - | - | - | - | - | - |
| 5. Stellaria graminea | 0.2 | - | 0.1 | - | - | - | 0.1 | - | - | - | - | - | - | - | - |
| 7. Agrimonia eupatoria | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11. Poterium sanguisorba | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13. Anthriscus sylvestris | - | - | - | - | - | - | - | - | - | 0.1 | 0.9 | - | 0.9 | 3.4 | 1.5 |
| 14. Conopodium denudatum | 0.6 | 0.6 | 1.2 | 0.3 | 0.2 | 0.4 | 0.8 | 0.1 | 0.1 | 0.1 | 0.5 | 0.7 | - | 1.2 | 0.4 |
| 15. Heracleum sphondylium | < | - | 0.3 | - | - | - | 0.3 | - | 0.2 | - | - | - | - | 0.3 | 0.9 |
| 15. Pimpinella saxifraga | < | - | - | 0.1 | - | - | 0.1 | - | - | - | - | - | - | - | - |
| 17. Galium verum | - | - | - | - | - | - | 0.1 | - | 0.4 | - | - | - | - | - | - |
| 18. Scabiosa arvensis | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 19. Achillea millefolium | 2.8 | 1.2 | 0.9 | 0.3 | 0.8 | 1.2 | 1.1 | 0.8 | 1.0 | 2.9 | 0.2 | 3.9 | 3.1 | 1.0 | 1.1 |
| 20. Centaurea nigra | 11.2 | 0.1 | 8.7 | 1.2 | 3.2 | 5.5 | 1.4 | 0.3 | 1.4 | 0.6 | 0.1 | - | 0.9 | 0.4 | - |
| 22. Hieracium pilosella | 2.6 | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - |
| 23. Hypochaeris radicata | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24. Leontodon hispidus | 5.7 | 4.4 | 3.4 | 1.9 | 1.3 | 4.0 | 1.5 | 1.3 | 1.7 | - | - | - | - | - | - |
| 25. Senecio jacobaea | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 26. Taraxacum vulgare | 1.5 | 0.1 | 0.2 | 0.4 | 0.3 | 1.4 | 0.3 | 0.4 | 0.6 | 1.4 | 7.3 | 0.9 | 0.3 | 0.1 | 3.3 |
| 27. Tragopogon pratensis | 0.1 | - | - | - | - | - | - | - | 0.5 | 0.1 | - | 0.7 | 0.2 | 0.1 | 1.4 |
| 29. Plantago lanceolata | 10.7 | 14.0 | 24.1 | 27.1 | 16.2 | 14.0 | 15.9 | 17.1 | 5.6 | 2.9 | 2.3 | 6.5 | 0.4 | 1.9 | 5.3 |
| 30. Veronica chamaedrys | 0.2 | 0.1 | - | 0.3 | 0.2 | - | 0.1 | 0.1 | - | - | - | - | - | - | - |
| 31. Ajuga reptans | 0.5 | - | 0.2 | - | 0.2 | - | - | 0.1 | - | - | - | - | - | - | - |
| 32. Prunella vulgaris | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 1.8 | 0.4 | 0.9 | 0.3 | 1.7 | 0.5 | 0.5 | 0.7 | 0.2 | 0.1 | 1.0 | 0.2 | 0.4 | 0.7 | 0.2 |
| 35. Luzula campestris | 0.8 | 0.3 | 0.1 | 0.8 | 0.2 | - | 0.5 | 0.2 | 0.1 | 0.1 | - | - | < | - | - |
| 36. Carex praecox | 0.6 | 0.1 | 0.2 | 0.8 | 1.4 | 1.8 | 0.9 | - | - | - | - | - | - | - | - |
| Mosses | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 41.3 | 30.3 | 41.4 | 34.4 | 28.4 | 29.3 | 25.1 | 22.1 | 14.0 | 8.6 | 12.8 | 12.9 | 6.8 | 9.5 | 14.5 |

| | NITRATE OF SODA. With Mixed Mineral Manure. = 86 lb. N. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot Number | 14 | | | | | | | | | | | | | |
| Unlimed or Limed | UNLIMED | | | | | | | LIMED | | | | | | |
| | | | | | | | | Limed | Sun | Shade | Sun | Shade | Sun | Shade |
| Season | 1903 | 1914 | 1919 | 1923 | 1935 | 1941 | 1948 | 1923 | 1935 | 1935 | 1941 | 1941 | 1948 | 1948 |
| **GRAMINEAE** | | | | | | | | | | | | | | |
| Number of species | 13 | 12 | 11 | 9 | 10 | 9 | 10 | 12 | 10 | 12 | 9 | 12 | 10 | 11 |
| 1. Agrostis vulgaris | 0.1 | 1.5 | 0.5 | 0.1 | < | < | 0.5 | 0.6 | - | 0.5 | - | 0.1 | 0.1 | 0.4 |
| 3. Alopecurus pratensis | 28.7 | 22.6 | 53.7 | 42.3 | 61.9 | 59.2 | 31.8 | 23.9 | 22.3 | 20.0 | 23.1 | 18.5 | 12.1 | 6.7 |
| 4. Anthoxanthum odoratum | 0.1 | 0.2 | 0.4 | - | - | - | 0.5 | 0.1 | - | 0.1 | - | 0.5 | - | 0.2 |
| 5. Arrhenatherum avenaceum | 17.3 | 40.9 | 23.4 | 33.2 | 25.8 | 28.9 | 36.2 | 34.8 | 38.1 | 11.0 | 44.5 | 18.7 | 45.0 | 34.7 |
| 6. Avena flavescens | 0.3 | 1.9 | 0.7 | - | 0.1 | - | 0.2 | 0.9 | 0.2 | 1.5 | 0.2 | 0.4 | 0.5 | 1.1 |
| 7. Avena pubescens | 2.3 | 3.6 | 3.7 | 0.8 | < | < | 1.4 | 5.0 | 0.8 | 11.1 | 0.8 | 14.4 | 5.3 | 11.6 |
| 8. Briza media | - | - | 0.5 | 3.7 | 1.7 | < | 0.3 | 15.3 | 0.4 | 0.7 | 0.2 | 0.5 | < | - |
| 9. Bromus mollis | 23.0 | 5.2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Cynosurus cristatus | - | - | 3.2 | 5.0 | 2.0 | 7.2 | 14.2 | 0.6 | 4.5 | 2.2 | 7.2 | 1.1 | 13.6 | 5.0 |
| 11. Dactylis glomerata | 0.7 | 6.2 | 5.1 | 0.2 | 0.2 | < | - | 9.2 | 9.5 | 43.2 | 11.4 | 34.5 | 13.3 | 27.4 |
| 12. Festuca rubra | 2.7 | 5.9 | - | - | - | - | - | - | - | - | - | - | - | - |
| 13. Festuca pratensis | - | - | - | - | - | - | - | - | < | 0.2 | - | - | - | 2.3 |
| 14. Holcus lanatus | < | - | - | - | - | - | - | 0.2 | - | - | - | 0.1 | - | - |
| 15. Lolium perenne | < | 0.1 | 0.8 | 0.8 | 0.7 | 0.7 | 4.7 | 2.6 | 4.5 | 3.2 | 1.3 | 3.1 | 2.9 | 2.9 |
| 16. Poa pratensis | 9.2 | 2.2 | 1.0 | 7.6 | 0.6 | 1.6 | 2.4 | 2.8 | 2.4 | 0.8 | 3.9 | 1.5 | 1.0 | 1.1 |
| 17. Poa trivialis | 0.9 | 1.3 | - | - | - | - | - | - | - | - | - | - | - | - |
| Stalks | - | 0.7 | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 85.3 | 92.3 | 93.0 | 93.7 | 93.0 | 97.6 | 92.2 | 96.0 | 82.7 | 94.5 | 92.6 | 93.4 | 93.8 | 93.4 |
| **LEGUMINOSAE** | | | | | | | | | | | | | | |
| Number of species | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 3 |
| 1. Lathyrus pratensis | 3.3 | 4.0 | 2.4 | 0.1 | 0.9 | 0.3 | 2.1 | 0.9 | 12.4 | 4.2 | 4.0 | 4.9 | 3.2 | 3.6 |
| 2. Lotus corniculatus | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3. Ononis arvensis | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | 0.5 |
| 4. Trifolium pratense | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | 0.5 |
| 5. Trifolium repens | < | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6. Vicia sepium | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 3.3 | 4.0 | 2.4 | 0.1 | 0.9 | 0.3 | 2.1 | 0.9 | 12.4 | 4.3 | 4.0 | 5.0 | 3.2 | 4.4 |
| **MISCELLANEOUS** | | | | | | | | | | | | | | |
| Number of species | 9 | 5 | 4 | 4 | 4 | [illegible] | 5 | 4 | 3 | 4 | 5 | 3 | 6 | 3 |
| 1 & 2. Ranunculus acris et bulbosus | 0.2 | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - |
| 4. Cerastium vulgatum | < | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5. Stellaria graminea | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 7. Agrimonia eupatoria | - | - | - | - | - | - | - | - | - | - | 0.3 | - | - | - |
| 10. Potentilla reptans | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11. Poterium sanguisorba | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13. Anthriscus sylvestris | 9.5 | 1.0 | 2.4 | 1.8 | 4.9 | 0.8 | 0.2 | 0.1 | 3.9 | 0.7 | 0.1 | 0.6 | 0.7 | 0.5 |
| 14. Conopodium denudatum | < | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - |
| 15. Heracleum sphondylium | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - |
| 15. Pimpinella saxifraga | - | - | - | - | < | - | - | - | - | - | - | - | - | - |
| 17. Galium verum | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - |
| 18. Scabiosa arvensis | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 19. Achillea millefolium | 0.1 | 0.1 | - | - | - | - | - | - | - | 0.2 | - | - | - | 0.1 |
| 20. Centaurea nigra | < | - | < | - | - | - | - | - | - | - | - | - | - | - |
| 22. Hieracium pilosella | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 23. Hypochaeris radicata | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24. Leontodon hispidus | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 25. Senecio jacobaea | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 26. Taraxacum vulgare | 0.7 | 2.0 | 1.2 | 2.6 | 0.3 | 0.7 | 3.2 | 2.2 | 0.2 | 0.2 | 2.0 | 0.7 | 1.1 | 1.7 |
| 27. Tragopogon pratensis | - | - | - | - | - | - | - | - | - | - | - | - | 0.5 | - |
| 29. Plantago lanceolata | - | - | - | 0.1 | - | - | 1.6 | - | - | - | 0.1 | - | 0.1 | - |
| 30. Veronica chamaedrys | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 31. Ajuga reptans | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 32. Prunella vulgaris | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 0.6 | 0.5 | 1.0 | 1.8 | 0.9 | 0.5 | 0.4 | 0.8 | 0.8 | 0.2 | 0.8 | 0.8 | 0.5 | - |
| 35. Luzula campestris | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 36. Carex praecox | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mosses | < | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 11.1 | 5.7 | 4.6 | 6.3 | 6.1 | 2.0 | 5.3 | 3.2 | 4.9 | 1.3 | 3.3 | 1.5 | 3.0 | 2.3 |

TABLE 4

Botanical analyses

Plots $5^2$ & $4^1$
Minerals

Plots 14, 16, 17
Nitrate of soda + minerals

< = less than 0.05

TABLE 5.

NUMBER OF SPECIES, AND PERCENTAGE OF EACH SPECIES AND GROUP OF SPECIES.

| | AMMONIUM SALTS (400 lb. per acre = 86 lb. N). ⟶ | | | | | | | | | | | | | | | | | | | | AMMONIUM SALTS (600 lb. per acre = 129 lb. N). | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | With Mixed Mineral Manure | | | | | | | | | | | | | | | | | | | | With Mixed Mineral Manure | | | | | | | | | | | |
| Manuring | With Potash | | | | | | | | | | Without Potash | | | | | | | | | | As Plot 9 | | | | | | | With Silicate of Soda since 1861 | | | | | |
| Plot number | 9 | | | | | | | | | | 10 | | | | | | | | | | $11^1$ | | | | | | | $11^2$ | | | | | |
| Unlimed or Limed | UNLIMED | | | | | | LIMED | | | | | UNLIMED | | | | | LIMED | | | | UNLIMED | | | | LIMED | | | UNLIMED | | | | LIMED | | |
| Season | 1903 | 1914 | 1919 | 1935 | 1940 | 1948 | 1914 | 1919 | 1935 | 1940 | 1948 | 1914 | 1919 | 1935 | 1940 | 1948 | 1914 | 1919 | 1935 | 1940 | 1948 | 1903 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 |
| GRAMINEAE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 12 | 10 | 9 | 3 | 6 | 5 | 11 | 10 | 10 | 11 | 12 | 9 | 10 | 8 | 7 | 7 | 9 | 8 | 7 | 8 | 7 | 8 | 8 | 7 | 2 | 9 | 9 | 6 | 9 | 9 | 6 | 8 | 7 | 5 |
| 1. Agrostis vulgaris | 3.8 | 18.3 | 12.5 | < | 5.3 | 7.7 | 2.7 | 2.3 | 1.2 | 2.6 | 4.3 | 3.0 | 4.0 | 10.3 | 33.9 | 51.9 | 3.1 | 0.5 | 1.0 | 2.1 | 1.0 | 1.4 | 0.5 | 1.7 | - | 2.1 | 0.9 | - | 0.5 | 0.7 | 5.3 | 0.2 | < | - |
| 2. Aira caespitosa | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3. Alopecurus pratensis | 4.1 | 1.7 | 0.7 | - | 0.1 | - | 17.9 | 26.0 | 62.1 | 55.0 | 38.1 | 18.7 | 20.8 | 0.2 | 0.1 | 0.3 | 47.1 | 76.9 | 55.2 | 50.3 | 28.6 | 28.5 | 1.1 | 0.8 | 0.1 | 27.3 | 64.0 | 82.0 | 17.6 | 29.8 | 0.3 | 49.7 | 76.0 | 57.5 |
| 4. Anthoxanthum odoratum | 16.2 | 38.3 | 5.4 | 0.1 | 0.3 | 0.4 | 12.8 | 1.1 | 2.9 | 2.4 | 4.1 | 49.7 | 21.1 | 21.1 | 31.5 | 10.3 | 15.4 | 1.1 | 1.9 | 2.9 | 1.8 | 1.0 | 0.1 | < | - | 2.1 | 0.1 | - | < | 0.1 | - | - | - | - |
| 5. Arrhenatherum avenaceum | 43.3 | 8.6 | 46.9 | - | 0.9 | 0.6 | 39.0 | 47.3 | 15.1 | 21.9 | 14.7 | 4.8 | 26.0 | 1.4 | 0.9 | 5.1 | 9.3 | 8.1 | 1.7 | 7.7 | 4.1 | 23.0 | 6.6 | 31.3 | - | 27.1 | 15.5 | 2.3 | 20.8 | 45.7 | 0.8 | 25.6 | 16.3 | 17.5 |
| 6. Avena flavescens | 0.2 | 0.1 | - | - | - | - | 0.2 | < | - | 0.2 | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - |
| 7. Avena pubescens | 0.1 | - | - | - | - | - | - | - | 0.1 | - | 0.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 8. Briza media | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 9. Bromus mollis | < | - | - | - | - | - | 0.3 | - | 1.3 | 1.0 | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Cynosurus cristatus | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11. Dactylis glomerata | 5.1 | 5.1 | 3.3 | - | - | - | 6.9 | 6.8 | 3.6 | 4.1 | 11.6 | 1.0 | 1.6 | 0.1 | < | 0.3 | 0.7 | 1.8 | < | 0.1 | - | 0.1 | 0.2 | 0.2 | - | 4.9 | 5.7 | 4.9 | 0.3 | 2.8 | < | 11.0 | 7.3 | 10.3 |
| 12. Festuca rubra | 7.5 | 15.4 | 3.6 | - | 0.1 | 0.1 | 9.3 | 5.9 | 1.7 | 4.7 | 4.3 | 19.2 | 6.9 | 2.4 | 2.1 | 10.3 | 15.0 | 5.2 | 33.3 | 26.3 | 54.5 | < | 0.1 | 0.1 | - | 0.2 | < | 0.4 | < | 0.1 | 0.1 | < | < | - |
| 14. Holcus lanatus | 3.9 | 4.1 | 12.4 | 99.9 | 93.3 | 90.6 | 2.2 | 0.8 | 4.4 | 2.1 | 2.5 | 1.1 | 11.6 | 64.4 | 31.3 | 21.5 | 1.5 | 0.1 | - | 0.2 | 0.5 | 45.6 | 90.9 | 64.8 | 99.7 | 32.0 | 11.6 | 3.5 | 59.5 | 20.4 | 92.8 | 6.1 | < | 1.6 |
| 15. Lolium perenne | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 16. Poa pratensis | 11.7 | 1.8 | 0.2 | - | - | - | 7.6 | 3.5 | 4.1 | 2.1 | 9.4 | 0.9 | 0.3 | - | - | - | 4.4 | 6.0 | 6.2 | 6.2 | 3.4 | 0.2 | - | - | - | 2.7 | 1.9 | 5.2 | 0.7 | 0.1 | - | 3.5 | 0.2 | 10.7 |
| 17. Poa trivialis | < | - | - | - | - | - | - | - | - | 0.1 | < | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Stalks | - | 0.7 | 0.1 | - | - | - | 0.1 | 0.1 | - | - | - | 0.3 | 0.2 | - | - | - | 3.2 | - | - | - | - | - | 0.5 | - | - | 1.1 | < | - | 0.5 | - | - | 2.8 | - | - |
| Total | 95.9 | 94.7 | 85.1 | 100.0 | 100.0 | 99.4 | 99.0 | 95.8 | 96.5 | 96.2 | 89.7 | 98.7 | 92.5 | 100.0 | 99.8 | 99.7 | 99.7 | 99.7 | 99.3 | 95.8 | 93.9 | 99.8 | 100.0 | 98.9 | 99.8 | 99.5 | 99.7 | 98.3 | 99.9 | 99.7 | 99.3 | 98.9 | 99.8 | 97.6 |
| LEGUMINOSAE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1. Lathyrus pratensis | < | - | - | - | - | - | - | 0.1 | 0.1 | 0.7 | 3.5 | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4. Trifolium pratense | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.1 | 0.7 | 3.5 | 0 | 0 | 0 | < | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MISCELLANEOUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 7 | 5 | 3 | 0 | 0 | 1 | 3 | 4 | 3 | 4 | 7 | 4 | 1 | 2 | 0 | 1 | 2 | 1 | 2 | 1 | 4 | 2 | 0 | 1 | 1 | 2 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 3 |
| 4. Cerastium vulgatum | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - |
| 5. Stellaria graminea | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | - | 0.1 | 0.1 | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | 0.3 | - | - | - | - | - | - | - | - | - |
| 12a. Epilobium angustifolium | - | - | - | - | - | 0.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13. Anthriscus sylvestris | - | - | - | - | - | - | - | - | - | 0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 14. Conopodium denudatum | 0.3 | 0.1 | 0.1 | - | - | - | - | 0.1 | - | - | 0.1 | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 15. Heracleum sphondylium | 0.6 | 0.6 | - | - | - | - | < | 0.3 | 2.8 | 2.0 | 1.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.3 | 0.1 | - | - | - | - | 0.6 | - | 0.1 |
| 17. Galium verum | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 19. Achillea millefolium | 0.4 | 0.1 | - | - | - | - | 0.3 | - | - | - | 0.5 | - | - | - | - | - | - | - | - | - | 0.7 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 20. Centaurea nigra | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 26. Taraxacum vulgare | - | - | - | - | - | - | - | - | 0.6 | 0.5 | 3.3 | - | - | 0.1 | - | - | - | - | 0.2 | - | 0.4 | - | - | - | - | - | - | 0.5 | - | - | - | - | - | 1.3 |
| 27. Tragopogon pratensis | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 29. Plantago lanceolata | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 32. Prunella vulgaris | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 2.8 | 4.4 | 14.9 | - | - | - | 0.7 | 3.5 | 0.2 | 0.3 | 1.1 | 1.1 | 7.4 | 0.1 | - | 0.3 | 0.2 | 0.4 | 0.5 | 4.3 | 5.0 | 0.1 | - | 1.1 | - | 0.1 | 0.1 | 1.3 | - | 0.4 | 0.7 | 0.4 | - | 1.1 |
| Total | 4.2 | 5.3 | 15.1 | 0 | 0 | 0.5 | 1.0 | 4.0 | 3.6 | 3.0 | 6.7 | 1.3 | 7.4 | 0.2 | 0 | 0.3 | 0.3 | 0.4 | 0.7 | 4.3 | 6.2 | 0.1 | 0 | 1.1 | 0.3 | 0.4 | 0.2 | 1.6 | 0 | 0.4 | 0.7 | 1.0 | 0 | 2.5 |

TABLE 5

Botanical analyses
Plots 9, 10, $11^1$, $11^2$
Ammonium salts with
& without minerals

<= less than 0.05

TABLE 6a

NUMBER OF SPECIES AND PERCENTAGE OF EACH SPECIES AND GROUP OF SPECIES

| | AMMONIUM SALTS | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manuring | Alone = 43 lb N; also F Y M 8 years 1856-63 | | | | | | | | = 86 lb N with Superphosphate | | | | | | | =86 lb N with Mixed Minerals without Super; after Minerals + Nitrogen, 40 years, 1865-1904. | | | | | | | | | | | |
| Plot number | 1 | | | | | | | | $4^2$ | | | | | | | 18 | | | | | | | | | | |
| Unlimed or Limed | UNLIMED | | | | LIMED | | | | UNLIMED | | | | LIMED | | | UNLIMED | | | | | LIGHT LIME | | | HEAVY LIME | | |
| Season | 1914 | 1919 | 1939 | 1948 | 1914 | 1919 | 1939 | 1948 | 1903 | 1914 | 1919 | 1949 | 1914 | 1919 | 1949 | 1914 | 1919 | 1923 | 1928 | 1948 | 1923 | 1928 | 1948 | 1923 | 1928 | 1948 |
| GRAMINEAE | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 10 | 10 | 7 | 6 | 12 | 10 | 11 | 11 | 9 | 10 | 8 | 5 | 8 | 7 | 9 | 11 | 10 | 8 | 10 | 6 | 9 | 11 | 14 | 8 | 10 | 11 |
| 1. Agrostis vulgaris | 16.0 | 18.5 | 52.5 | 75.3 | 12.3 | 8.5 | 3.7 | 1.5 | 2.0 | 12.9 | 4.3 | 36.2 | 1.0 | 0.3 | 2.2 | 10.0 | 17.6 | 47.9 | 59.0 | 76.9 | 28.3 | 17.5 | 3.4 | 27.2 | 4.8 | 1.2 |
| 2. Aira caespitosa | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - |
| 3. Alopecurus pratensis | 2.0 | 1.3 | 0.1 | 0.1 | 4.5 | 5.9 | 4.0 | 2.5 | 4.6 | 2.5 | 1.4 | 0.7 | 42.4 | 76.1 | 24.3 | 3.3 | 5.1 | 5.1 | 5.3 | 0.1 | 10.3 | 45.6 | 2.8 | 8.3 | 22.7 | 3.8 |
| 4. Anthoxanthum odoratum | 15.0 | 17.5 | 0.7 | 0.2 | 6.9 | 7.9 | 2.4 | 1.4 | 23.4 | 7.7 | 34.1 | 10.0 | 7.6 | 1.1 | 1.2 | 3.6 | 3.5 | 19.8 | 6.9 | 0.8 | 2.2 | 0.5 | 0.8 | 2.6 | - | - |
| 5. Arrhenatherum avenaceum | 0.1 | 0.4 | 0.1 | - | 0.3 | 1.4 | 2.2 | 3.0 | 1.0 | 0.3 | 3.1 | - | < | - | 2.5 | 0.1 | 1.6 | 0.1 | 0.4 | 0.5 | 2.0 | 2.9 | 24.6 | 2.7 | 18.1 | 25.0 |
| 6. Avena flavescens | - | 0.1 | - | - | 0.7 | 0.6 | 2.2 | 1.7 | - | - | - | - | - | - | - | 0.1 | - | - | < | - | - | < | - | - | < | - |
| 7. Avena pubescens | 0.1 | 0.2 | - | 0.2 | 5.1 | 7.7 | 34.8 | 12.1 | - | < | - | - | - | - | 0.3 | 0.1 | 0.1 | - | - | - | 0.1 | < | 3.1 | - | < | 0.8 |
| 9. Bromus mollis | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.3 | - | - | 0.1 |
| 10. Cynosurus cristatus | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11. Dactylis glomerata | 9.5 | 11.3 | 0.7 | 3.2 | 7.0 | 23.4 | 13.1 | 18.3 | 0.1 | 1.0 | 0.6 | - | - | 0.1 | 0.3 | 37.1 | 34.0 | 3.2 | 9.3 | 1.3 | 8.0 | 21.1 | 35.0 | 9.7 | 37.7 | 48.3 |
| 12. Festuca rubra | 28.1 | 14.3 | 40.9 | 15.6 | 25.9 | 10.6 | 15.2 | 15.4 | 53.5 | 73.0 | 47.9 | 35.3 | 35.1 | 7.7 | 57.4 | 37.8 | 4.2 | 18.3 | 6.2 | 8.9 | 26.4 | 2.8 | 6.8 | 31.1 | 3.1 | 2.2 |
| 13. Festuca pratensis | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - |
| 14. Holcus lanatus | 7.1 | 22.4 | - | - | 5.5 | 10.0 | 3.5 | 5.8 | 1.1 | < | 0.3 | 17.5 | 0.2 | < | 0.1 | 0.9 | 2.4 | 0.2 | 8.2 | - | 1.3 | 0.8 | 0.2 | 1.5 | 1.6 | - |
| 15. Lolium perenne | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | 0.1 |
| 16. Poa pratensis | 0.6 | 0.4 | 0.2 | - | 3.9 | 1.8 | 2.3 | 1.3 | 7.7 | 1.2 | 0.3 | - | 12.6 | 12.8 | 6.3 | 0.3 | 0.4 | 2.2 | 0.9 | - | 6.9 | 5.4 | 0.8 | 4.4 | 6.3 | 1.1 |
| 17. Poa trivialis | - | - | - | - | - | - | 0.2 | 0.3 | 0.2 | - | - | - | - | - | - | - | - | - | < | - | - | 0.2 | 0.2 | - | 0.1 | 0.2 |
| 18. Phleum pratense | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.6 | - | - | 0.1 |
| Stalks | 0.4 | - | - | - | 0.4 | - | - | - | - | 0.1 | - | - | 0.2 | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - |
| Total | 78.9 | 86.4 | 95.2 | 94.6 | 72.6 | 77.8 | 83.6 | 63.3 | 93.6 | 98.7 | 92.0 | 99.7 | 99.1 | 98.1 | 94.6 | 93.4 | 69.0 | 96.8 | 96.2 | 88.5 | 85.5 | 96.8 | 80.8 | 87.5 | 94.4 | 82.9 |
| LEGUMINOSAE | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| 1. Lathyrus pratensis | - | - | - | - | 0.5 | 0.4 | 1.5 | 2.0 | - | - | - | - | - | - | - | 0.1 | - | 0.1 | - | - | - | - | - | - | 0.2 | 0.5 |
| 2. Lotus corniculatus | - | - | - | - | 0.2 | 0.3 | 0.5 | 2.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4. Trifolium pratense | - | - | - | - | - | - | 0.1 | 0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | 0.1 |
| 5. Trifolium repens | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | - | - | - | - | 0.7 | 0.7 | 2.1 | 4.6 | - | - | - | - | - | - | - | 0.1 | - | 0.1 | - | - | - | - | 0.1 | - | 0.2 | 0.6 |
| MISCELLANEOUS | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 7 | 5 | 4 | 5 | 9 | 9 | 12 | 14 | 5 | 6 | 2 | 1 | 2 | 3 | 6 | 5 | 5 | 4 | 6 | 3 | 6 | 5 | 11 | 5 | 6 | 6 |
| 1. 2. Ranunculus acris et bulbosus | 0.1 | - | - | - | 1.3 | 2.1 | 1.1 | 0.7 | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - |
| 4. Cerastium vulgatum | - | - | - | - | 0.8 | 0.9 | 0.2 | 0.6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - |
| 5. Stellaria graminea | - | - | - | - | 0.1 | 0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | 0.1 | - | - |
| 5a. Stellaria holostea | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | - | - | - | 1.9 | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 12. Spiraea ulmaria | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - |
| 13. Anthriscus sylvestris | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 14. Conopodium denudatum | 0.2 | 1.2 | - | 0.1 | 0.2 | 1.1 | 0.1 | 0.1 | - | - | - | - | - | - | - | 0.8 | 4.3 | 0.3 | 0.3 | - | 0.8 | 0.7 | 0.3 | 0.5 | 0.4 | 0.1 |
| 15. Heracleum sphondylium | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | 0.2 | 0.1 | - | - | - | 0.6 | - | 3.1 | 1.6 |
| 16. Pimpinella saxifraga | - | - | - | - | 0.1 | 0.1 | 0.5 | 0.4 | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - |
| 17. Galium verum | 0.2 | - | 2.1 | - | - | - | - | - | 4.4 | 0.4 | - | - | 0.3 | 0.2 | 0.4 | - | - | - | - | - | - | - | - | - | - | - |
| 18. Scabiosa arvensis | - | - | - | - | - | - | 0.9 | 2.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 19. Achillea millefolium | 0.5 | 0.2 | - | - | 0.9 | 1.7 | 1.1 | 1.7 | < | 0.1 | - | - | - | - | 0.8 | 0.2 | 0.2 | - | < | - | 0.1 | 0.1 | 0.2 | - | 0.3 | - |
| 20. Centaurea nigra | 19.2 | 2.1 | 0.4 | 0.7 | 22.2 | 4.1 | 4.7 | 2.0 | 1.4 | 0.1 | 0.1 | - | - | - | - | 4.5 | 1.9 | - | < | - | 0.2 | < | 3.5 | 0.3 | 0.2 | - |
| 23. Hypochaeris radicata | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24. Leontodon hispidus | - | - | - | - | - | - | 0.1 | 1.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - |
| 25. Senecio jacobea | - | - | - | - | - | - | - | 0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 26. Taraxacum vulgare | - | - | - | - | - | - | 0.5 | 1.0 | - | - | - | - | - | - | - | - | - | - | - | 0.2 | - | < | 8.9 | - | 0.2 | 10.8 |
| 27. Tragopogon pratensis | - | - | - | - | - | - | - | - | - | < | - | - | - | - | - | - | - | - | - | - | - | - | 1.2 | - | - | 2.6 |
| 29. Plantago lanceolata | - | - | - | - | - | - | 3.5 | 19.8 | - | - | - | - | - | 0.1 | 0.1 | - | - | - | - | - | - | - | 3.8 | - | - | 1.0 |
| 30. Veronica chamaedrys | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 31. Ajuga reptans | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 32. Prunella vulgaris | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 0.6 | 9.9 | 2.0 | 2.5 | 1.0 | 11.5 | 1.7 | 2.1 | 0.5 | 0.5 | 8.0 | 0.2 | 0.5 | 1.5 | 3.9 | 1.1 | 24.6 | 2.5 | 3.2 | 11.2 | 13.1 | 2.4 | 0.2 | 11.7 | 1.0 | 0.4 |
| 34a. Urtica dioica | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - |
| 35. Luzula campestris | 0.3 | 0.2 | 0.2 | 0.1 | 0.5 | 0.1 | 0.1 | 0.1 | < | - | - | - | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | - | 0.1 | - | - | 0.1 | - | - |
| 36. Carex praecox | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 21.1 | 13.6 | 4.7 | 5.3 | 27.1 | 21.8 | 14.5 | 32.1 | 6.3 | 1.2 | 8.1 | 0.2 | 0.8 | 1.8 | 5.4 | 6.7 | 31.1 | 3.1 | 3.7 | 11.5 | 14.4 | 3.2 | 19.0 | 12.7 | 5.2 | 16.5 |

TABLE 6a
Botanical analyses
Plots 1, $4^2$, 18
Ammonium salts
with or without
minerals.

< = less than 0.05

TABLE 6b.

NUMBER OF SPECIES AND PERCENTAGE OF EACH SPECIES AND GROUP OF SPECIES.

| | FARMYARD MANURE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manuring | Every fourth year with Fish Guano alternately, after cut wheat straw, minerals and ammonium salts, 1845-1904 | | | | | | | | Every fourth year, after Super, Sulphate of Potash and Nitrate of Soda, 33 years 1872 - 1904 | | | | | | | | | | Every fourth year, with Super, Sulphate of Potash and Nitrate of Soda in other years, after Super and Nitrate of soda, 33 years, 1872-1904 | | | | | | | | | | |
| Plot number | 13 | | | | | | | | 19 | | | | | | | | | | 20 | | | | | | | | | | | |
| Unlimed or Limed | UNLIMED | | | | LIMED | | | | UNLIMED | | | | | LIGHT LIME | | | HEAVY LIME | | | UNLIMED | | | | | LIGHT LIME | | | HEAVY LIME | | |
| Season | 1914 | 1919 | 1944 | 1948 | 1914 | 1919 | 1944 | 1948 | 1914 | 1919 | 1923 | 1928 | 1949 | 1923 | 1928 | 1948 | 1923 | 1928 | 1948 | 1914 | 1919 | 1923 | 1928 | 1948 | 1923 | 1928 | 1948 | 1923 | 1928 | 1948 |
| GRAMINAE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 10 | 11 | 12 | 9 | 10 | 11 | 9 | 12 | 14 | 13 | 12 | 12 | 12 | 14 | 13 | 13 | 14 | 13 | 12 | 14 | 14 | 13 | 14 | 12 | 12 | 14 | 13 | 13 | 13 | 13 |
| 1. Agrostis vulgaris | 11.8 | 11.0 | 8.4 | 15.7 | 2.3 | 3.3 | - | 0.1 | 7.6 | 7.5 | 14.3 | 5.8 | 11.8 | 14.7 | 5.1 | 4.3 | 10.3 | 2.4 | 0.5 | 4.5 | 6.6 | 10.5 | 4.1 | 4.1 | 12.7 | 4.2 | 2.5 | 5.3 | 1.2 | 0.1 |
| 2. Aira caespitosa | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3. Alopecurus pratensis | 16.5 | 22.2 | 56.7 | 31.9 | 18.3 | 35.3 | 5.8 | 10.4 | 13.4 | 22.3 | 16.1 | 33.2 | 6.2 | 16.1 | 42.6 | 25.1 | 14.6 | 21.1 | 16.7 | 11.1 | 30.3 | 29.4 | 46.2 | 39.2 | 16.9 | 30.6 | 21.9 | 25.2 | 24.1 | 17.6 |
| 4. Anthoxanthum odoratum | 4.0 | 5.2 | 4.8 | 6.2 | 1.5 | 2.0 | 0.5 | 0.3 | 1.0 | 4.3 | 11.6 | 11.6 | 7.3 | 9.4 | 7.9 | 1.5 | 1.3 | 0.7 | - | 0.6 | 1.1 | 0.3 | 1.9 | 1.1 | 5.7 | 6.4 | 1.9 | 1.2 | 0.7 | 0.2 |
| 5. Arrhenatherum avenaceum | 24.4 | 17.3 | 0.9 | 3.4 | 40.3 | 20.5 | 5.9 | 25.9 | 3.7 | 7.9 | 8.6 | 7.9 | 5.7 | 1.9 | 3.5 | 5.5 | 7.1 | 15.9 | 14.3 | 4.2 | 4.6 | 5.6 | 11.3 | 15.1 | 12.4 | 8.7 | 21.7 | 2.0 | 3.8 | 17.4 |
| 6. Avena flavescens | 0.1 | 0.1 | 0.1 | - | - | < | - | 0.1 | 8.9 | 3.2 | 2.0 | 3.5 | 1.7 | 6.6 | 3.2 | 3.0 | 8.7 | 6.1 | 3.1 | 6.1 | 2.9 | 6.1 | 3.4 | 4.0 | 2.7 | 4.1 | 1.9 | 5.3 | 2.6 | 3.3 |
| 7. Avena pubescens | - | 0.1 | - | - | - | 0.1 | - | 0.3 | 1.7 | 3.3 | 1.9 | 3.0 | 0.9 | 2.7 | 2.8 | 1.9 | 4.3 | 11.9 | 5.4 | 6.3 | 10.2 | 7.7 | 6.6 | 0.7 | 5.3 | 9.3 | 3.0 | 11.7 | 28.9 | 6.8 |
| 9. Bromus mollis | - | - | 0.1 | - | 0.1 | - | 0.1 | 0.1 | 2.1 | 0.2 | 1.0 | - | - | 0.9 | 0.1 | 0.2 | 1.7 | 0.3 | 0.3 | 4.9 | 0.2 | 2.5 | < | 0.2 | 2.4 | 0.3 | 0.1 | 2.9 | 0.2 | 0.2 |
| 10. Cynosurus cristatus | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | < | - | - | - | - |
| 11. Dactylis glomerata | 7.6 | 9.2 | 6.7 | 9.1 | 6.4 | 10.3 | 8.6 | 21.5 | 12.0 | 15.8 | 5.3 | 9.6 | 3.3 | 6.4 | 11.0 | 10.9 | 3.7 | 9.1 | 13.6 | 9.9 | 12.5 | 6.0 | 7.0 | 14.7 | 4.1 | 7.1 | 14.4 | 2.7 | 5.6 | 14.2 |
| 12. Festuca rubra | 14.6 | 5.5 | 3.6 | 4.0 | 10.7 | 4.7 | 1.1 | 0.9 | 21.0 | 6.1 | 13.3 | 8.1 | 9.8 | 14.8 | 3.7 | 5.0 | 16.6 | 13.9 | 4.5 | 22.2 | 4.4 | 13.9 | 5.3 | 3.7 | 14.9 | 6.5 | 2.8 | 21.1 | 9.0 | 4.8 |
| 13. Festuca pratensis | - | - | - | - | - | - | - | - | - | - | - | - | 1.1 | - | - | 0.4 | - | - | 5.7 | - | - | - | - | - | - | - | - | - | - | - |
| 14. Holcus lanatus | 14.6 | 7.2 | 2.7 | 2.5 | 14.4 | 6.4 | 1.7 | 4.4 | 3.5 | 2.1 | 3.4 | 4.9 | 1.3 | 2.1 | 2.6 | 1.7 | 0.2 | 0.9 | - | 10.4 | 6.8 | 1.9 | 4.1 | 1.0 | 2.4 | 7.9 | 5.7 | 1.9 | 5.0 | 1.6 |
| 15. Lolium perenne | - | - | < | - | - | - | - | - | 0.3 | 0.4 | - | < | - | 0.1 | 0.4 | - | 0.3 | < | 0.3 | 0.3 | 0.3 | 0.8 | 0.4 | - | - | 0.3 | 0.1 | 0.2 | 0.1 | 0.8 |
| 16. Poa pratensis | 0.8 | 1.7 | 1.3 | 0.9 | 1.1 | 3.9 | 1.4 | 1.8 | 0.8 | 0.5 | 0.6 | 0.3 | 0.7 | 2.0 | 1.1 | 0.9 | 2.2 | 1.4 | 1.9 | 0.5 | 0.6 | 2.5 | 1.4 | 1.3 | 1.1 | 0.7 | 0.4 | 2.0 | 2.9 | 3.0 |
| 17. Poa trivialis | 0.1 | 0.4 | 0.4 | 0.1 | - | 0.2 | 1.2 | 1.2 | 2.4 | 1.4 | 0.5 | 2.0 | 0.5 | 1.4 | 4.6 | 1.8 | 1.3 | 6.0 | 0.7 | 2.2 | 1.1 | 1.1 | 1.2 | 1.3 | 1.9 | 3.5 | 3.9 | 1.2 | 3.0 | 4.3 |
| 18. Phleum pratense | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Stalks | - | - | - | - | 0.3 | - | - | - | 0.3 | - | - | - | - | - | - | - | - | - | - | 1.1 | 0.1 | - | - | - | - | - | - | - | - | - |
| Total | 96.5 | 79.9 | 85.7 | 73.8 | 95.4 | 86.7 | 26.3 | 67.0 | 78.7 | 75.0 | 78.6 | 89.9 | 50.3 | 79.2 | 88.6 | 62.2 | 72.4 | 89.7 | 67.0 | 84.3 | 81.7 | 88.3 | 92.9 | 86.4 | 82.5 | 89.6 | 80.3 | 82.7 | 87.1 | 74.3 |
| LEGUMINOSAE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 1 | 1 | 1 | 2 | 1 | 1 | 4 | 3 | 4 | 2 | 2 | 2 | 4 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 3 | 1 | 2 | 3 |
| 1. Lathyrus pratensis | 0.5 | 0.1 | 0.3 | 0.5 | 0.9 | 0.8 | 30.9 | 7.9 | 9.2 | 6.0 | 7.3 | 1.6 | 13.5 | 9.3 | 1.5 | 7.4 | 15.5 | 1.0 | 7.5 | 6.4 | 4.7 | 1.9 | 2.6 | 4.3 | 9.9 | 1.8 | 2.1 | 5.3 | 5.1 | 8.8 |
| 2. Lotus corniculatus | - | - | - | - | - | - | 0.2 | - | 0.6 | 0.1 | - | - | 1.1 | - | - | - | 0.5 | 0.9 | 1.7 | 0.1 | - | - | - | 0.1 | - | - | - | - | - | - |
| 4. Trifolium pratense | - | - | - | < | - | - | 7.3 | 2.4 | 0.1 | - | - | - | 0.2 | - | - | 0.1 | - | - | 0.5 | - | - | 0.3 | - | - | - | - | 0.1 | - | - | 0.2 |
| 5. Trifolium repens | - | - | - | - | - | - | 2.6 | 0.3 | 0.1 | - | 0.1 | 0.3 | 2.7 | 0.8 | 0.5 | 1.0 | 0.9 | 2.5 | 0.7 | 0.1 | - | 2.4 | 0.2 | 0.6 | 0.8 | 1.4 | 2.8 | - | 0.2 | 0.9 |
| Total | 0.5 | 0.1 | 0.3 | 0.5 | 0.9 | 0.8 | 41.0 | 10.6 | 10.0 | 6.1 | 7.4 | 1.9 | 17.5 | 10.1 | 2.0 | 8.5 | 16.9 | 4.4 | 10.4 | 6.6 | 4.7 | 4.6 | 2.8 | 5.0 | 10.7 | 3.2 | 5.0 | 5.3 | 5.3 | 9.9 |
| MISCELLANEOUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of species | 6 | 8 | 13 | 12 | 10 | 11 | 12 | 13 | 13 | 14 | 13 | 13 | 13 | 10 | 13 | 12 | 11 | 14 | 8 | 11 | 14 | 11 | 11 | 9 | 9 | 14 | 10 | 13 | 14 | 11 |
| 1. 2. Ranunculus acris et bulbosus | - | - | - | 0.1 | - | - | 0.9 | 2.2 | 1.0 | 4.8 | 4.6 | 1.8 | 5.7 | 5.5 | 2.5 | 7.9 | 4.9 | 1.4 | 4.0 | 0.5 | 2.1 | 1.9 | 0.8 | 1.2 | 2.6 | 1.3 | 1.9 | 2.1 | 1.2 | 1.3 |
| 4. Cerastium vulgatum | 0.1 | 0.2 | 0.3 | 0.1 | 0.2 | 0.7 | 0.5 | 0.1 | 0.4 | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.1 | 0.2 | 0.3 | - | 0.1 | 0.3 | - | < | - | 0.1 | 0.3 | 0.3 | 0.1 | 0.2 | - |
| 5. Stellaria graminea | 0.1 | 0.1 | 0.2 | 0.1 | - | 0.3 | - | - | 0.1 | < | 0.1 | < | 0.2 | - | - | - | - | - | - | - | 0.1 | - | - | - | - | < | - | - | - | - |
| 5a. Stellaria holostea | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. Potentilla reptans | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 12. Spiraea ulmaria | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13. Anthriscus sylvestris | - | 0.3 | 0.2 | - | 0.7 | 2.0 | 2.0 | 0.7 | 3.1 | 0.5 | 1.6 | 0.2 | - | - | < | - | 0.5 | 0.4 | - | 2.8 | 2.5 | 2.7 | 0.4 | 0.6 | 0.7 | 0.3 | - | 3.3 | 0.3 | 0.3 |
| 14. Conopodium denudatum | 0.3 | 3.2 | 0.9 | 0.8 | 0.9 | 2.0 | - | 0.1 | 0.3 | 1.7 | 0.8 | 0.8 | 0.3 | 1.2 | 0.6 | 0.4 | 1.3 | 0.5 | - | 0.1 | 1.5 | 0.8 | - | - | 1.3 | 0.7 | - | 1.5 | 0.5 | - |
| 15. Heracleum sphondylium | 0.3 | 0.7 | 0.2 | - | 0.6 | - | - | - | - | - | - | - | 1.1 | - | < | 0.4 | 0.2 | 0.5 | 1.1 | - | - | - | 0.7 | 0.1 | - | - | 0.1 | - | 0.2 | 0.2 |
| 16. Pimpinella saxifraga | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 17. Galium verum | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | 0.5 | - | - | - | - | - | - | 0.2 | 0.1 | 0.4 |
| 18. Scabiosa arvensis | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 19. Achillea millefolium | 0.5 | 0.4 | 0.7 | 4.0 | < | 0.2 | 0.2 | 0.3 | 1.7 | 1.4 | 0.1 | 0.2 | 10.2 | 0.1 | 0.1 | 5.2 | 0.1 | 0.4 | 2.3 | 2.2 | 1.2 | 0.7 | 0.3 | 0.4 | 0.3 | 1.0 | 1.5 | 0.2 | 0.5 | 2.7 |
| 20. Centaurea nigra | - | - | 0.3 | 0.1 | 0.3 | 0.3 | 4.0 | 0.7 | 1.9 | 0.4 | 0.5 | 0.3 | - | - | - | 1.0 | - | 0.1 | 1.4 | 2.6 | 1.4 | 0.5 | 0.3 | - | - | < | 0.7 | 1.0 | 0.2 | 0.2 |
| 23. Hypochaeris radicata | - | - | 0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24. Leontodon hispidus | - | - | - | 1.7 | - | - | 0.9 | 1.3 | - | - | - | - | 0.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 25. Senecio jacobea | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 26. Taraxacum vulgare | - | - | 0.3 | 1.5 | 0.1 | 0.2 | 6.2 | 3.2 | 0.1 | 0.1 | 0.4 | < | 0.6 | 0.3 | 0.1 | 0.6 | 0.5 | 0.4 | 1.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.7 | 0.8 | 1.0 | 1.1 | 1.2 | 2.7 | 2.3 |
| 27. Tragopogon pratensis | - | - | - | 0.3 | - | < | 0.5 | 1.3 | - | 0.3 | 0.1 | - | - | - | - | 0.4 | - | < | 2.9 | - | 0.2 | 0.1 | - | 3.3 | 0.2 | 0.1 | 1.1 | 1.3 | 0.3 | 3.8 |
| 28. Plantago lanceolata | - | - | 6.2 | 14.7 | < | 0.1 | 16.3 | 11.5 | 0.2 | 0.2 | 0.8 | 0.5 | 11.8 | 0.4 | - | 10.4 | 1.9 | 0.5 | 9.7 | 0.1 | - | 0.1 | < | 0.9 | - | 0.4 | 6.2 | 0.4 | 0.5 | 4.1 |
| 30. Veronica chamaedrys | - | - | 0.5 | 0.2 | < | 0.1 | 0.7 | < | 0.2 | 0.2 | 0.2 | 0.4 | 0.2 | 0.3 | 0.3 | 0.7 | - | 0.1 | - | 0.3 | 0.1 | 0.1 | 0.3 | 0.1 | - | 0.4 | 0.3 | 0.1 | 0.4 | 0.1 |
| 31. Ajuga reptans | - | - | - | - | - | - | 0.1 | < | - | 0.2 | - | 0.3 | 0.2 | 0.2 | 0.2 | - | 0.4 | 0.5 | - | - | 0.3 | - | - | - | - | 0.1 | - | - | - | - |
| 32. Prunella vulgaris | - | - | - | - | - | - | - | - | 0.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 34. Rumex acetosa | 1.8 | 15.1 | 3.9 | 1.9 | 0.6 | 6.3 | 0.4 | 0.8 | 2.1 | 8.4 | 4.3 | 3.5 | 1.3 | 2.1 | 5.1 | 2.3 | 0.3 | 0.7 | 0.3 | 0.3 | 3.3 | 3.1 | 1.4 | 1.5 | 0.8 | 1.6 | 1.4 | 0.3 | 0.3 | 0.5 |
| 34a. Urtica dioica | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 35. Luzula campestris | - | 0.1 | < | - | - | - | - | - | 0.1 | 0.1 | 0.4 | 0.2 | 0.2 | 0.4 | < | 0.1 | 0.3 | 0.1 | - | - | < | 0.1 | < | - | 0.1 | 0.1 | - | 0.2 | < | - |
| 36. Carex praecox | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | 3.1 | 20.1 | 13.9 | 25.5 | 3.4 | 12.2 | 32.7 | 22.2 | 11.5 | 18.6 | 14.0 | 8.4 | 32.4 | 10.7 | 9.4 | 29.5 | 10.6 | 5.9 | 22.8 | 9.2 | 13.6 | 9.3 | 4.3 | 8.8 | 6.9 | 7.3 | 14.9 | 11.9 | 7.4 | 15.9 |

TABLE 6b.
Botanical analyses.
Plots 13, 19, 20
Farmyard manure.

< = less than 0.05.