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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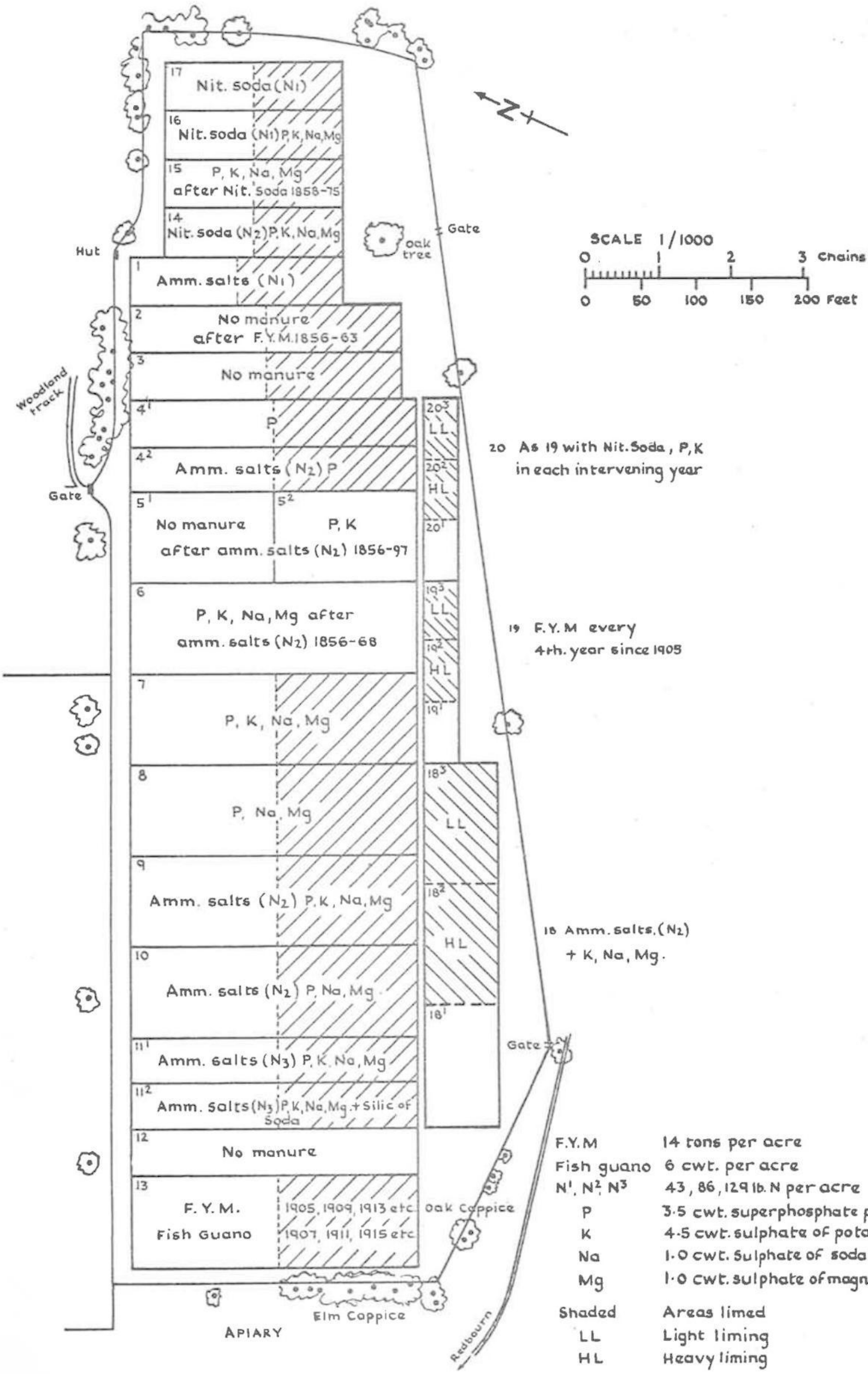
Park Grass



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

F O R E W O R D

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

C O N T E N T S

(Figures and Tables are grouped together, after p.144 of the text)

CHAPTER I

FIGURES

TABLES

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.

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*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 Agrostis vulgaris	Usually the most abundant species
Dactylis glomerata Anthoxanthum odoratum 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 Leontodon hispidus Poterium sanguisorba Achillea millefolium Carex praecox Conopodium denudatum Rumex acetosa Scabiosa arvensis	Vary much with season
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, Anthoxanthum odoratum, Dactylis glomerata	Plentiful; order of prevalence varies with season
Arrhenatherum avenaceum	Variable
Poa pratensis	Small amount

MISCELLANEOUS

Centaurea nigra	Usually well represented
Conopodium denudatum, Hieracium pilosella, Hypochaeris radicata, Plantago lanceolata, 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	Usually in very small quantity;
Avena flavescens	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, MISCELLANEOUS } in small quantity only.

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 Arrhenatherum avenaceum Dactylis glomerata	Increased
Poa trivialis	Much reduced
Poa pratensis	Variable
Festuca rubra	Increased at first, but now practically disappeared
Lolium perenne 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 Anthoxanthum odoratum Arrhenatherum avenaceum 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	Increased till 1929 since when almost disappeared
Arrhenatherum avenaceum	

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

LEGUMINOSAE

Lathyrus pratensis	Usually the chief species
Trifolium pratense, Lotus corniculatus	Occasionally the chief species

MISCELLANEOUS

Conopodium denudatum, Heracleum sphondylium, Achillea millefolium, Centaurea nigra, Plantago lanceolata, 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 Dactylis glomerata	Usually dominant
Alopecurus pratensis	Occasionally dominant
Poa trivialis Avena flavescens	Reduced

LEGUMINOSAE

Lathyrus pratensis	Usually dominant
Trifolium pratense 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 Anthoxanthum odoratum 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, Arrhenatherum avenaceum, Dactylis glomerata, Festuca rubra, Holcus lanatus, Anthoxanthum odoratum	Usually among the most abundant species
Avena flavescens, Avena pubescens	Present in fair quantity
Briza media	Small in amount but characteristic
LEGUMINOSAE	
Trifolium pratense, Lotus corniculatus	Chief species
MISCELLANEOUS	
Plantago lanceolata	Chief species
Ranunculus spp., Conopodium denudatum, Scabiosa arvensis, Achillea millefolium, Centaurea nigra, Leontodon hispidus, 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	Increased
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 Alopecurus pratensis Dactylis glomerata Festuca rubra	The most abundant species, but precedence varies with season
Anthoxanthum odoratum Arrhenatherum avenaceum Avena pubescens Holcus lanatus	Usually present

LEGUMINOSAE

Lathyrus pratensis	Sometimes plentiful
Trifolium pratense	Usually in small quantity

MISCELLANEOUS

Conopodium denudatum Achillea millefolium Plantago lanceolata 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 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 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 Alopecurus pratensis Anthoxanthum odoratum Poa pratensis	Well represented but vary in relative abundance
Arrhenatherum avenaceum Avena pubescens Dactylis glomerata Holcus lanatus	Quantities small and variable

LEGUMINOSAE

Lathyrus pratensis	Chief species
Lotus corniculatus 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 Festuca rubra Dactylis glomerata Holcus lanatus Anthoxanthum odoratum	Chief species; vary in relation abundance

LEGUMINOSAE

Trifolium pratense Lathyrus pratensis Lotus corniculatus 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, 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*.

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* 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, 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/and Festuca rubra 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, Anthoxanthum odoratum, Arrhenatherum avenaceum, 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	Disappeared
Avena pubescens	
Lolium perenne	
Poa trivialis	

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

MISCELLANEOUS

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

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	}	Much reduced
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 Alopecurus pratensis Anthoxanthum odoratum Festuca rubra	Chief species
Arrhenatherum avenaceum Avena flavescens Avena pubescens Dactylis glomerata Holcus lanatus	Usually fairly well represented, but relative abundance varies with season
Poa trivialis	Quantity small
LEGUMINOSAE	
Lathyrus pratensis	Chief species
MISCELLANEOUS	
Achillea millefolium Centaurea nigra Plantago lanceolata Ranunculus spp. Rumex acetosa	Relative abundance varies with season

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., Rumex acetosa	Response varies with season

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)

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* 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 vin 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, 41, 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 enitrely 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.

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* 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

Plot3	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.

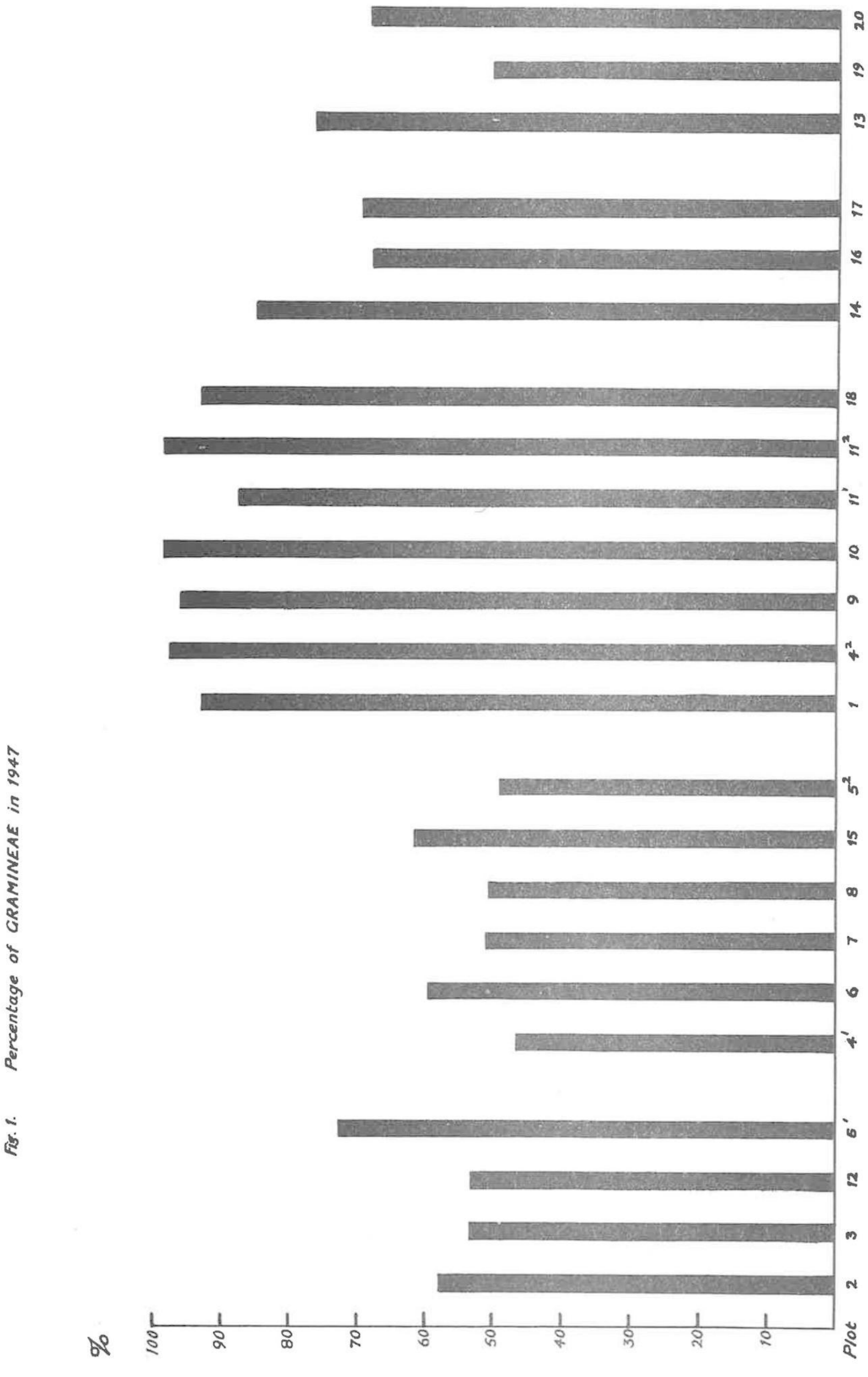

Percentage of GRAMINEAE in 1947
%
100
90
80
70
60
50
40
30
20
10
Plot
2
3
12
6'
1
5²
15
8
7
6
4'
9
4²
10
11'
11²
18
14
16
17
13
19
20

Fig. 1.

Fig.2.

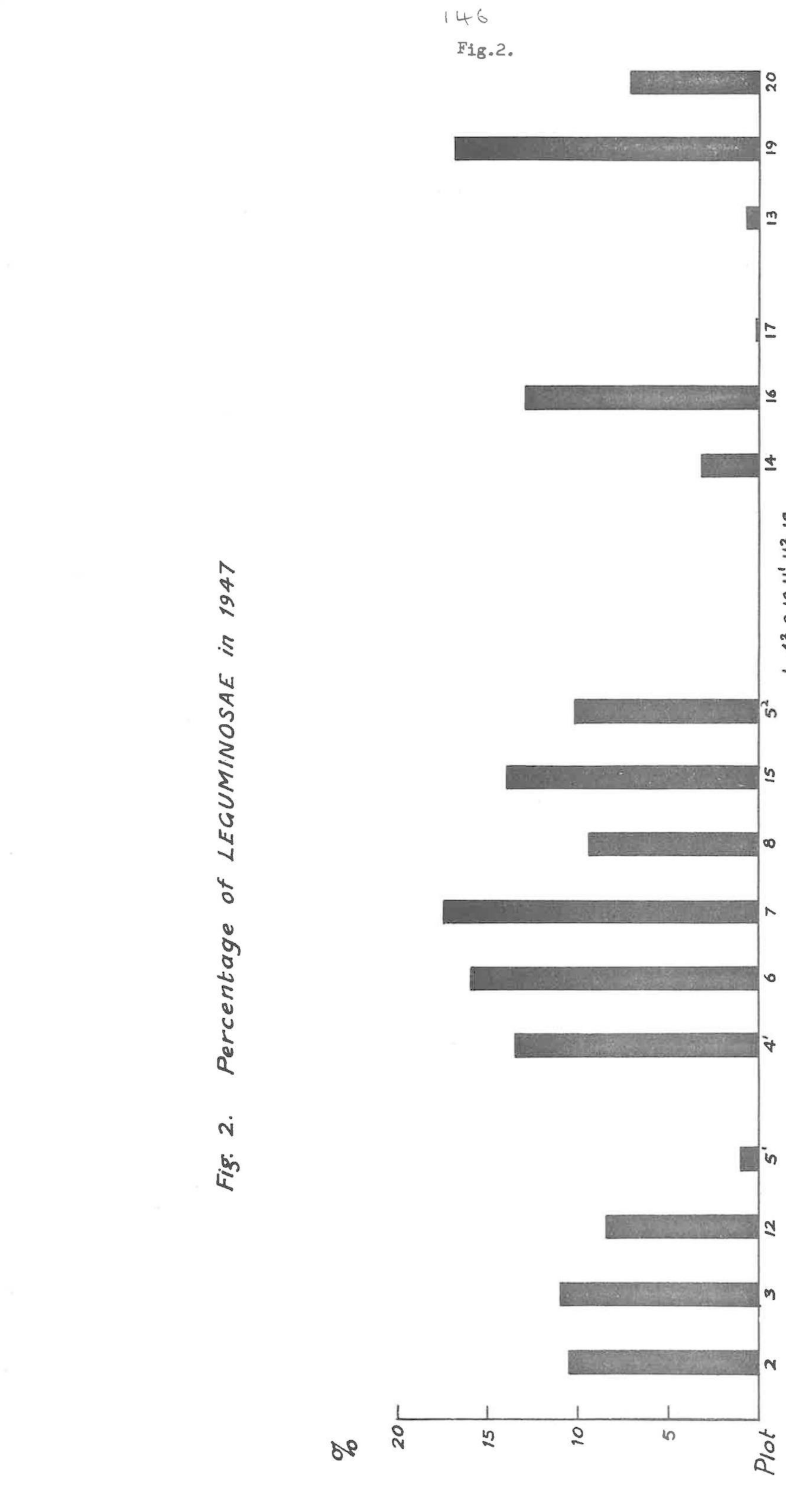


Fig. 2. Percentage of LEGUMINOSAE in 1947

Fig.3.

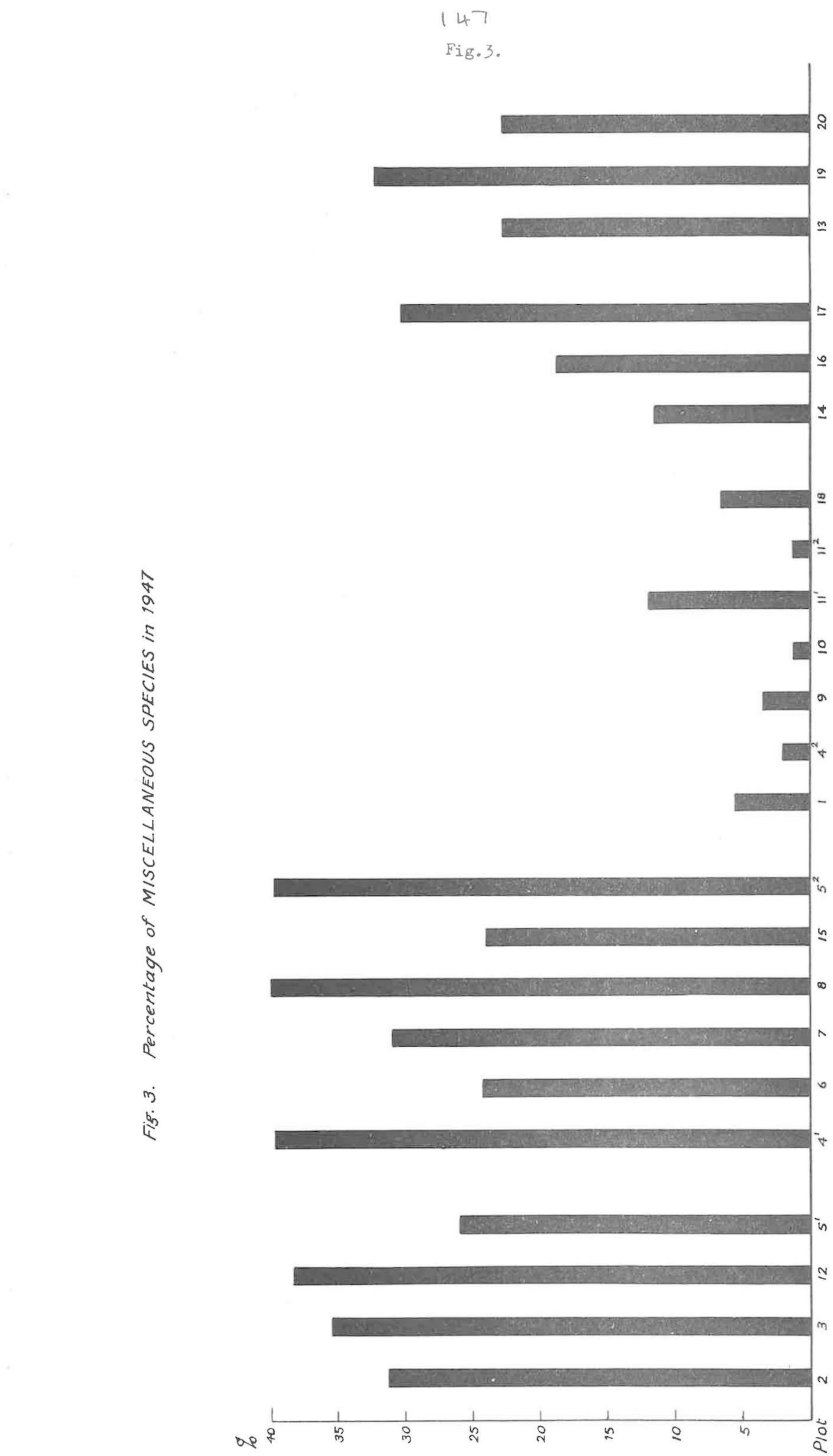


Fig. 3. Percentage of MISCELLANEOUS SPECIES in 1947
%
40
35
30
25
20
15
10
5
Plot
2
3
12
5'
4'
6
7
8
15
5²
1
4²
9
10
11'
11²
18
16
14
19
13
17
20

Fig. 4. YIELD (lb. per acre 1st crop) PLOT 3._____Unlimed- - - - - -Limed

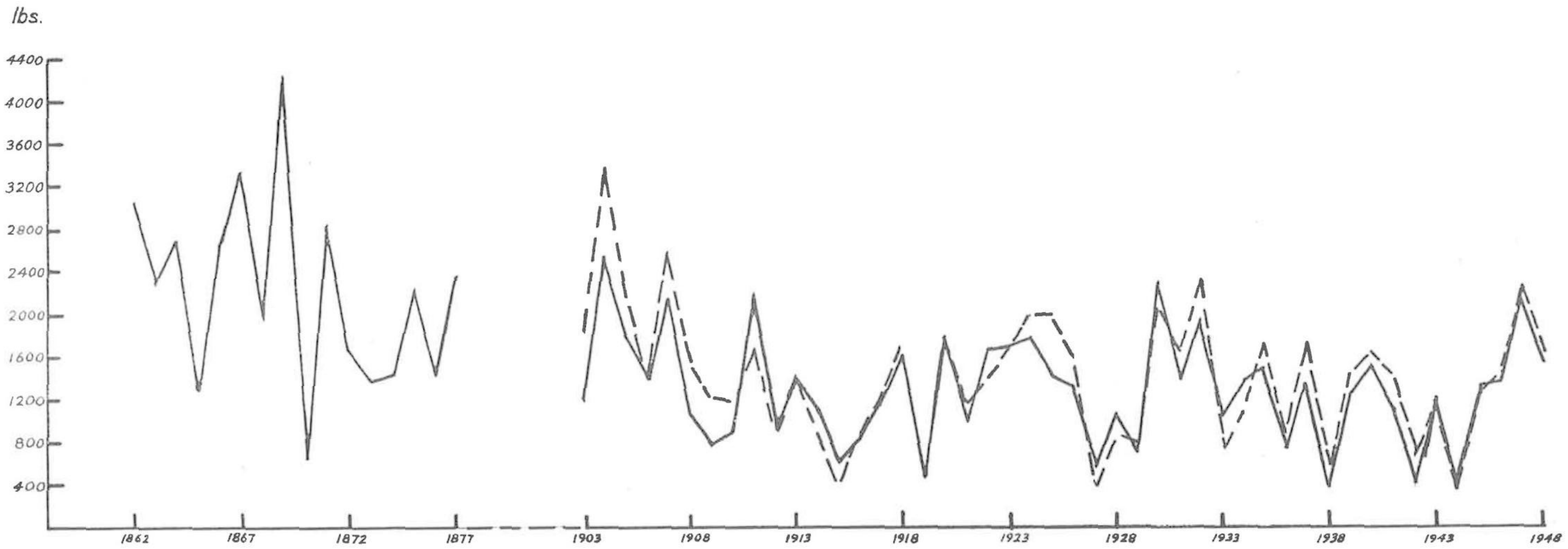


Fig. 4.

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 5[1]). _ _ _ _ _ _ _ 1898 – 1947 Minerals (PLOT 5[2]).

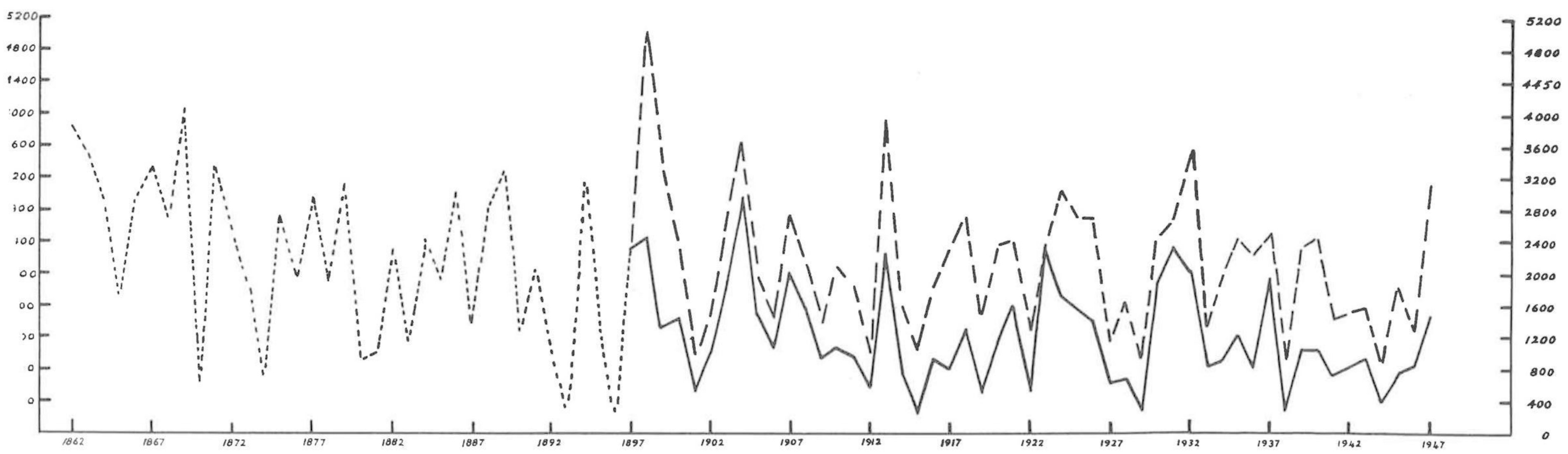


Fig.6.

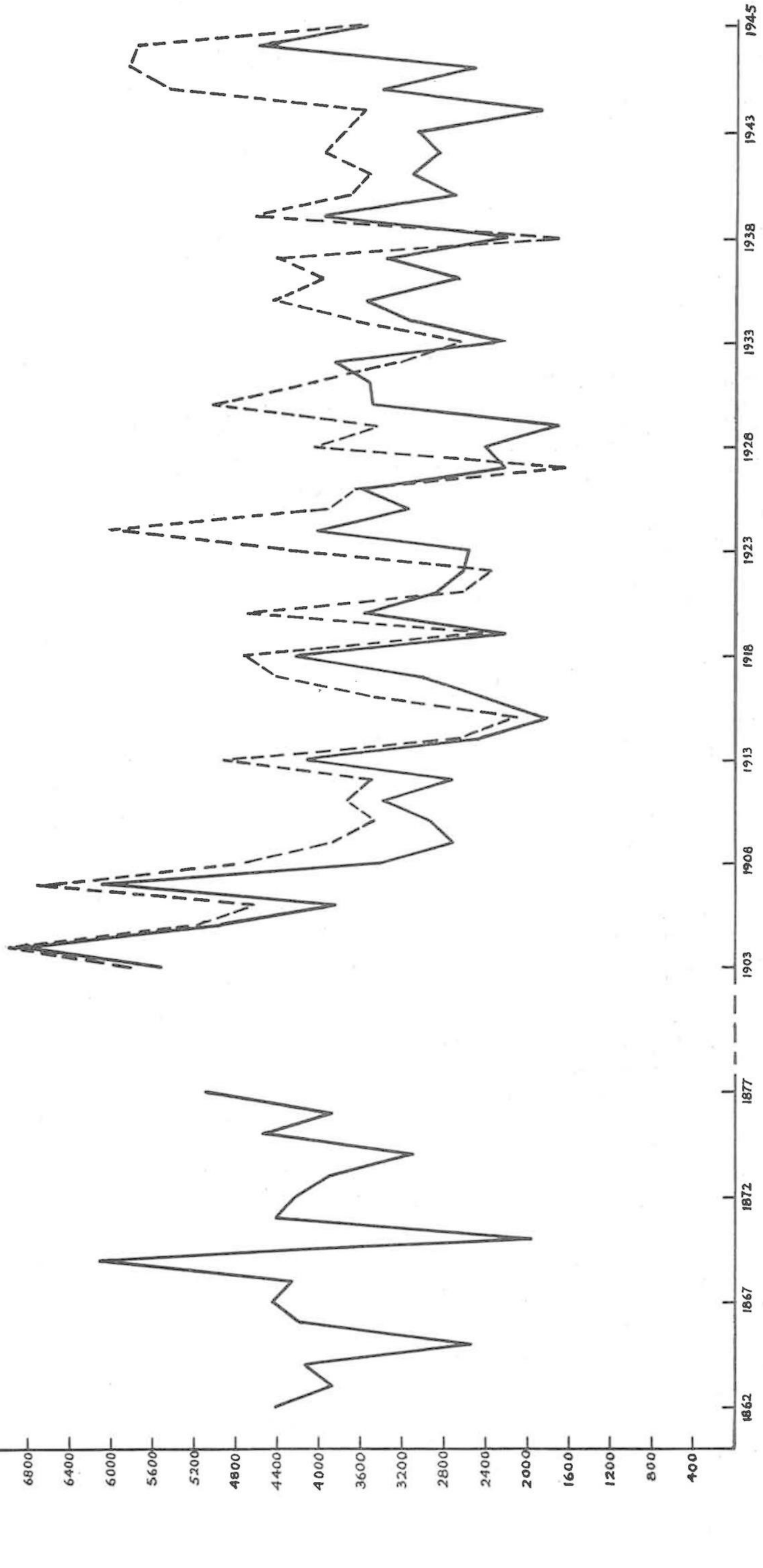


Fig. 6. YIELD (lb. per acre 1st crop) Plot 7. ——— Unlimed - - - - - Limed
lbs
7200
6800
6400
6000
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
1862
1867
1872
1877
1903
1908
1913
1918
1923
1928
1933
1938
1943
1945

Fig.7.

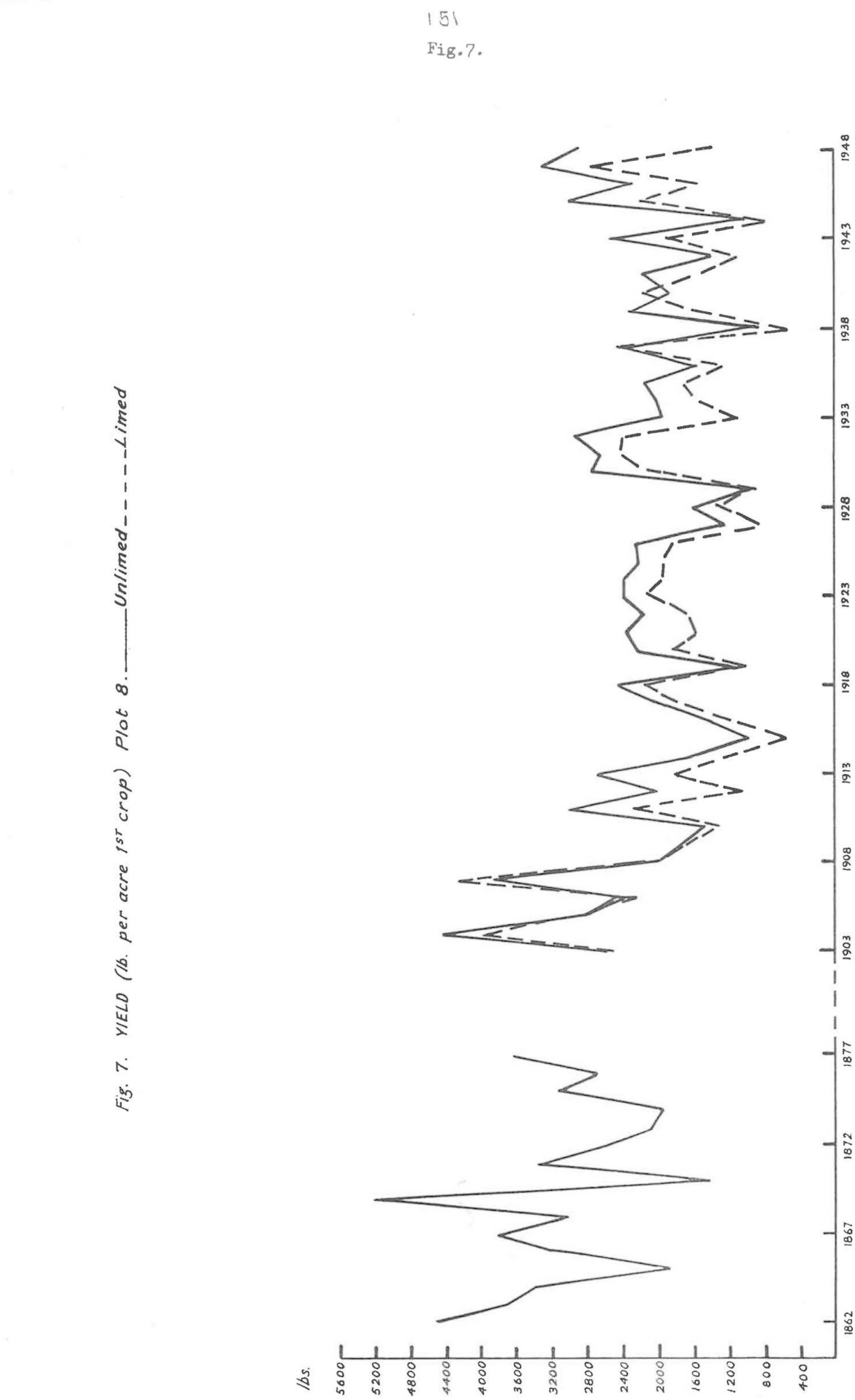


Fig. 7. YIELD (lb. per acre 1st crop) Plot 8. _____Unlimed - - - - -Limed

Fig.8.

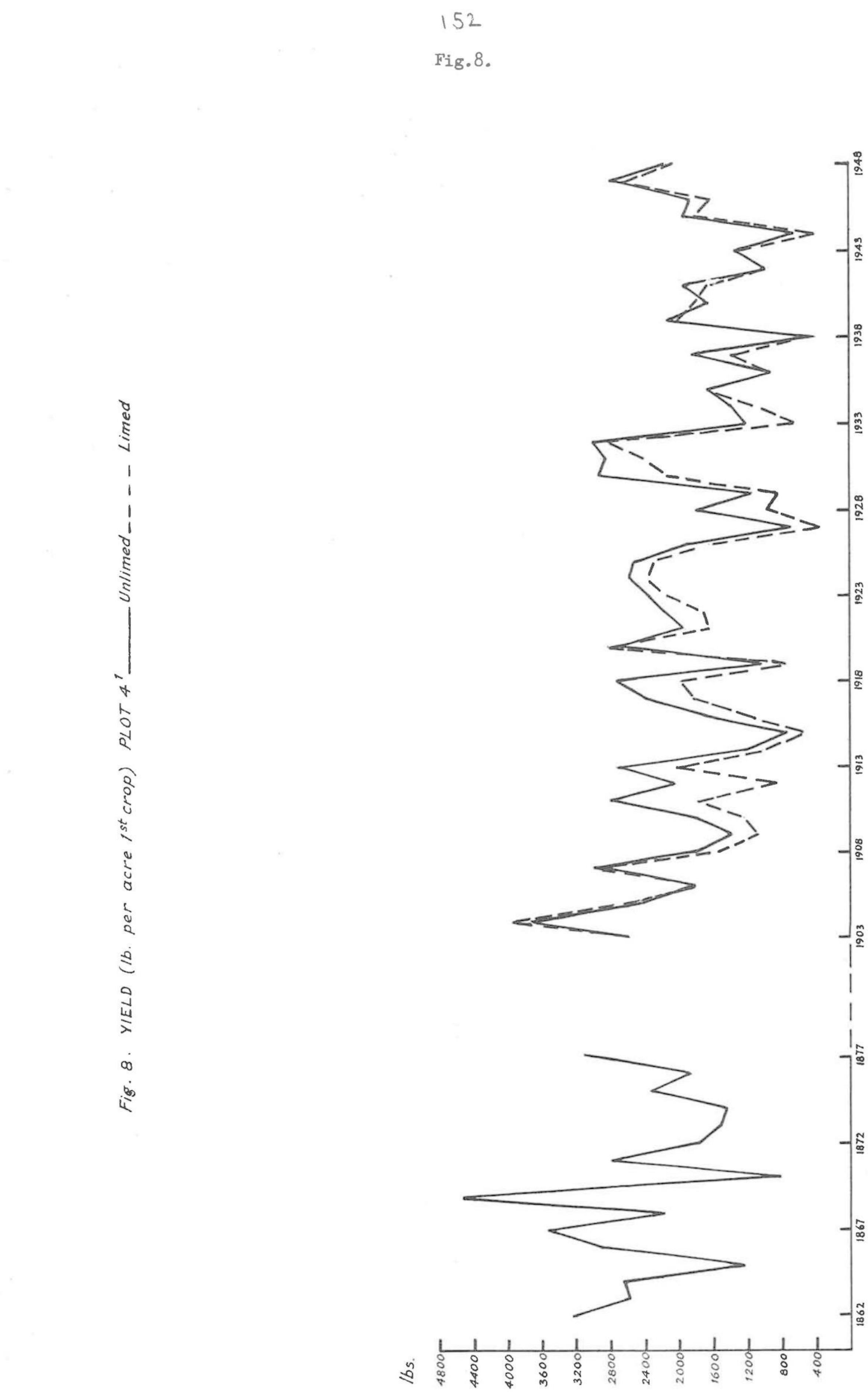


Fig. 8. YIELD (lb. per acre 1st crop) PLOT 4¹ ——— Unlimed - - - - - Limed
lbs.
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
1862
1867
1872
1877
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948

Fig.9.

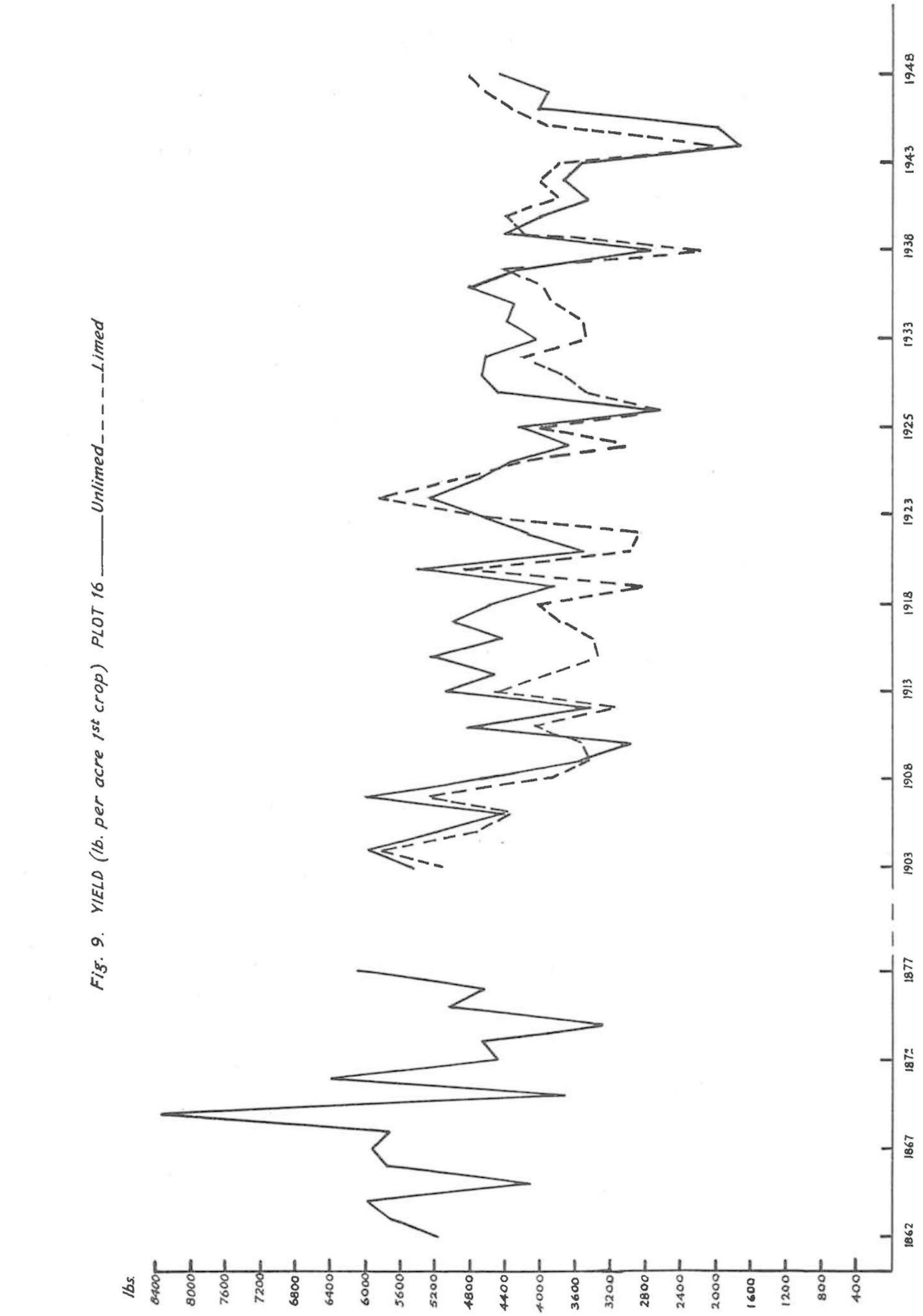


Fig. 9. YIELD (lb. per acre 1st crop) PLOT 16 ——Unlimed- - - - -Limed

Fig. 10.

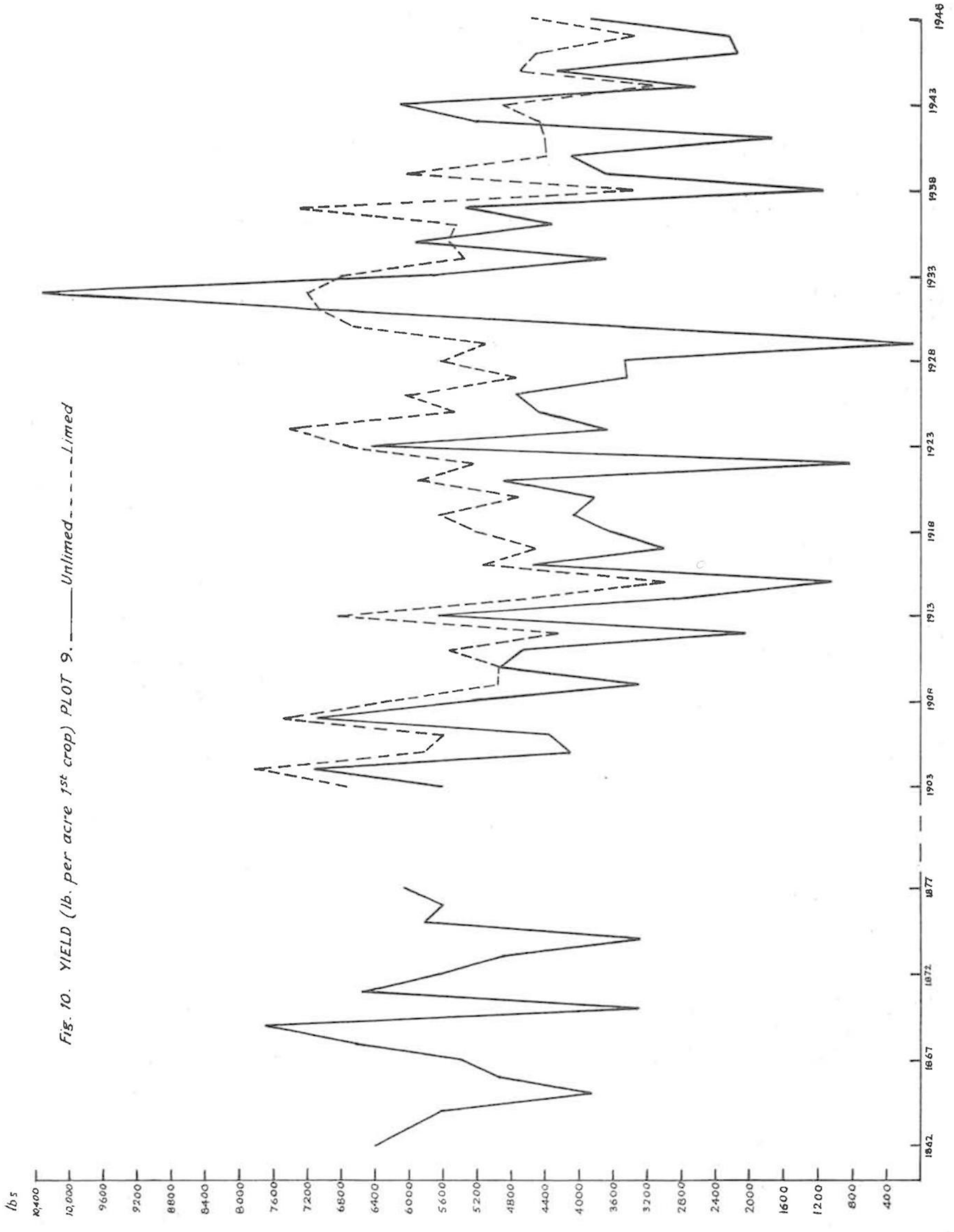


Fig. 10. YIELD (lb. per acre 1st crop) PLOT 9. ——Unlimed- - - - -Limed
lbs
10,400
10,000
9600
9200
8800
8400
8000
7600
7200
6800
6400
6000
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
1842
1867
1872
1877
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948

Fig. 11.

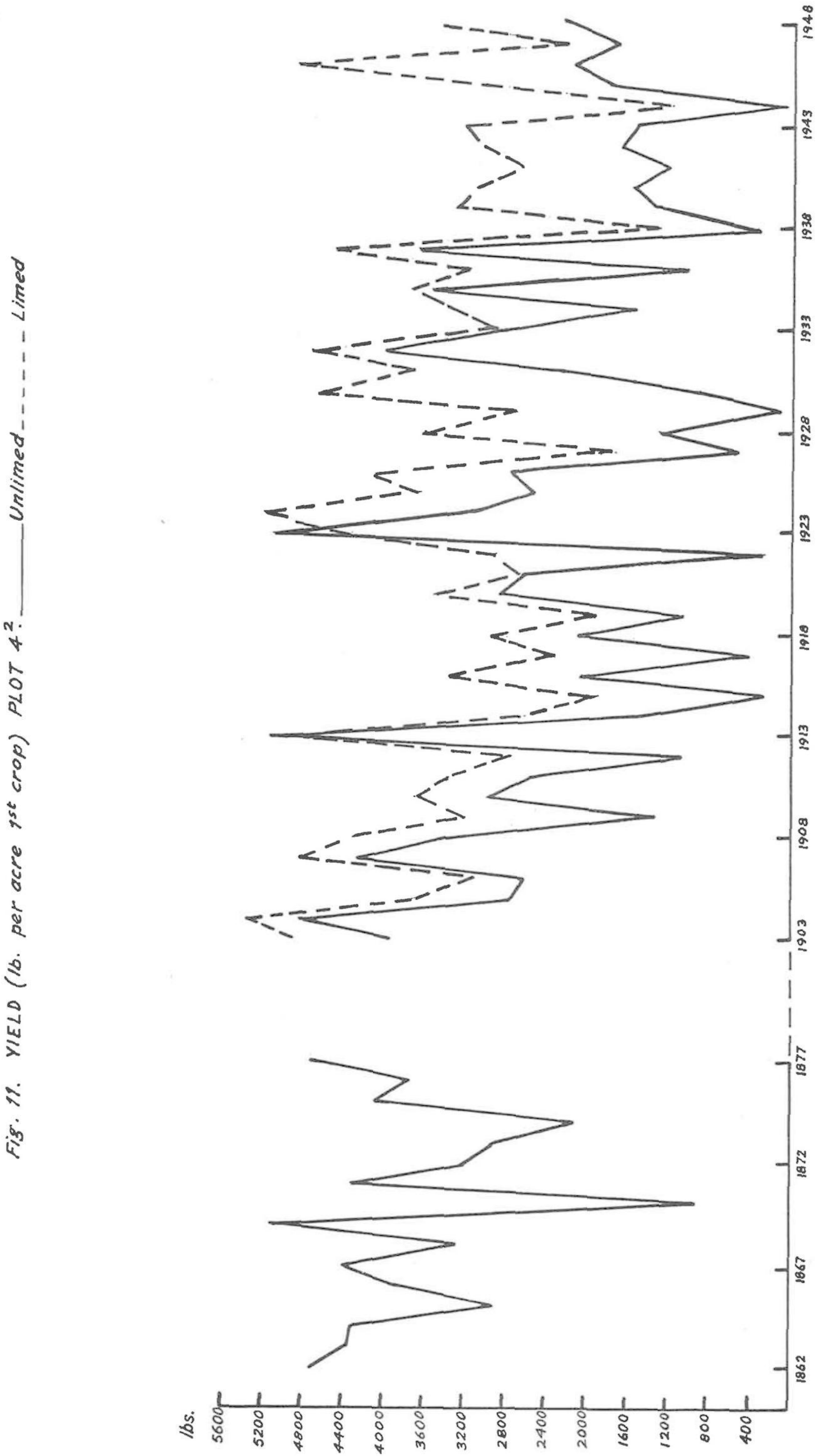


Fig. 11. YIELDS (lb. per acre 1st crop) PLOT 4.2 ——Unlimed - - - - - - Limed
lbs.
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
1862
1867
1872
1877
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948

Fig.12.

Fig. 12. Percentage of Agrostis vulgaris in 1947

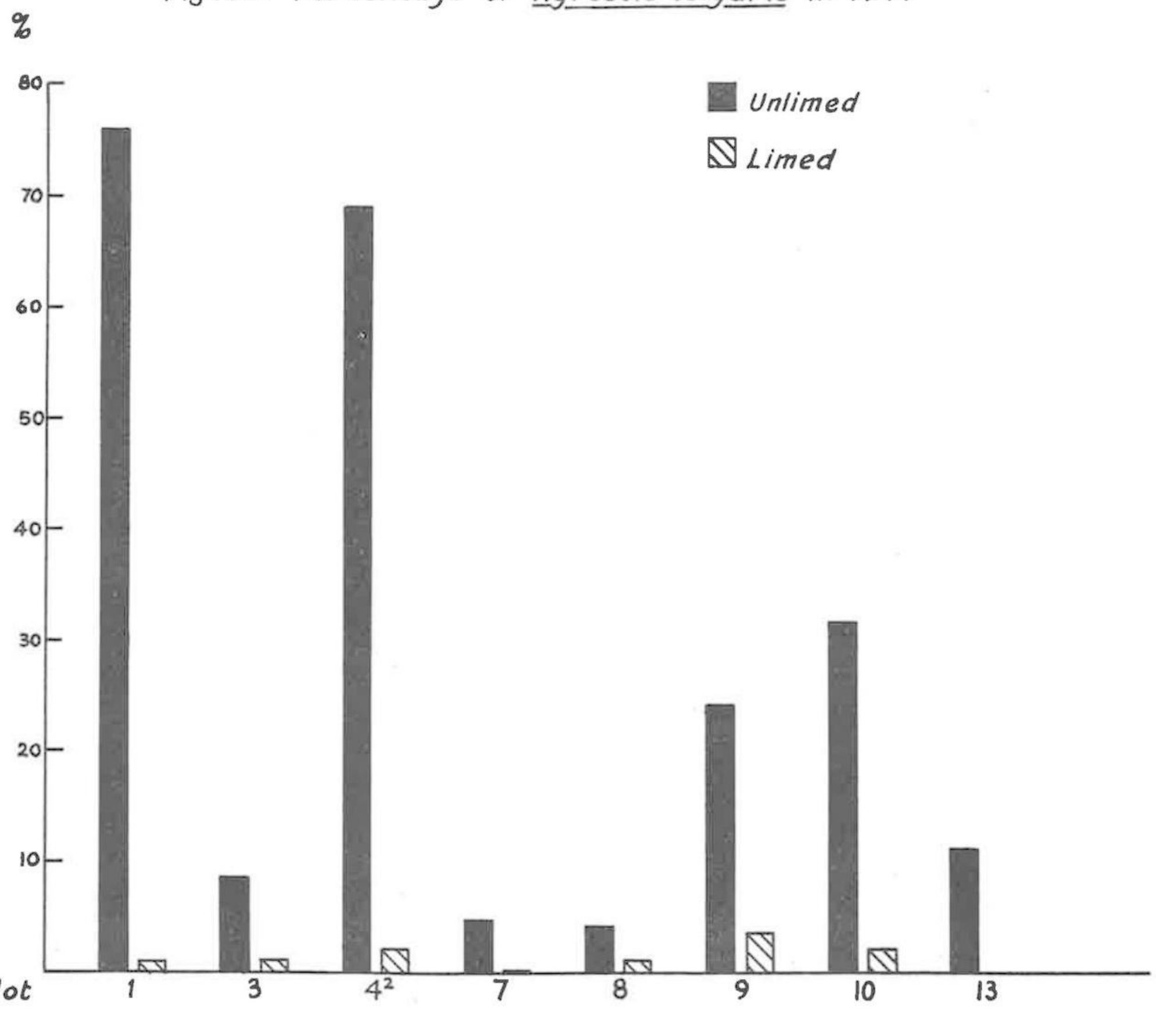


Fig. 13.

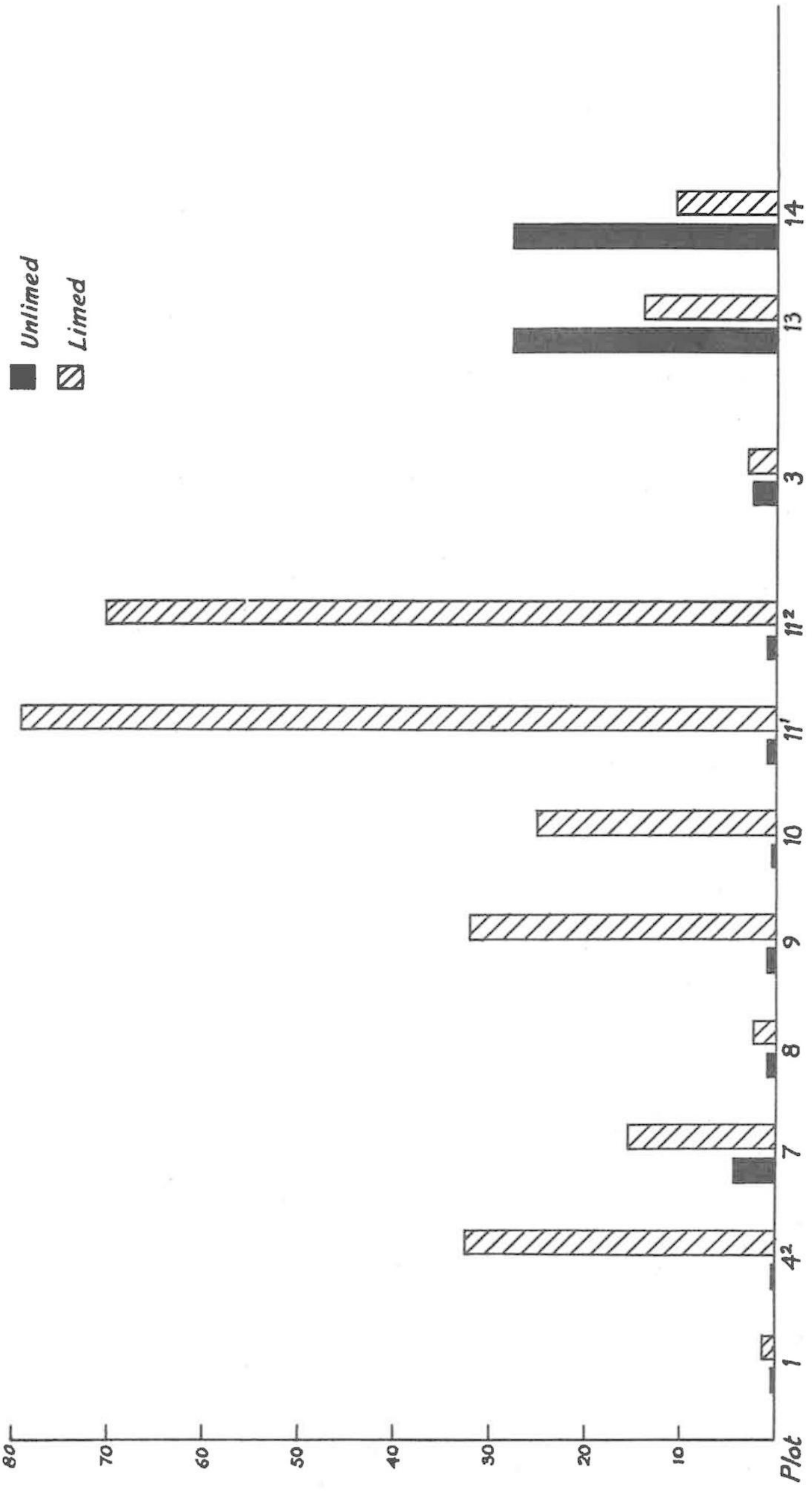


Fig. 13. Percentage of Alopecurus pratensis in 1947

Fig. 14.

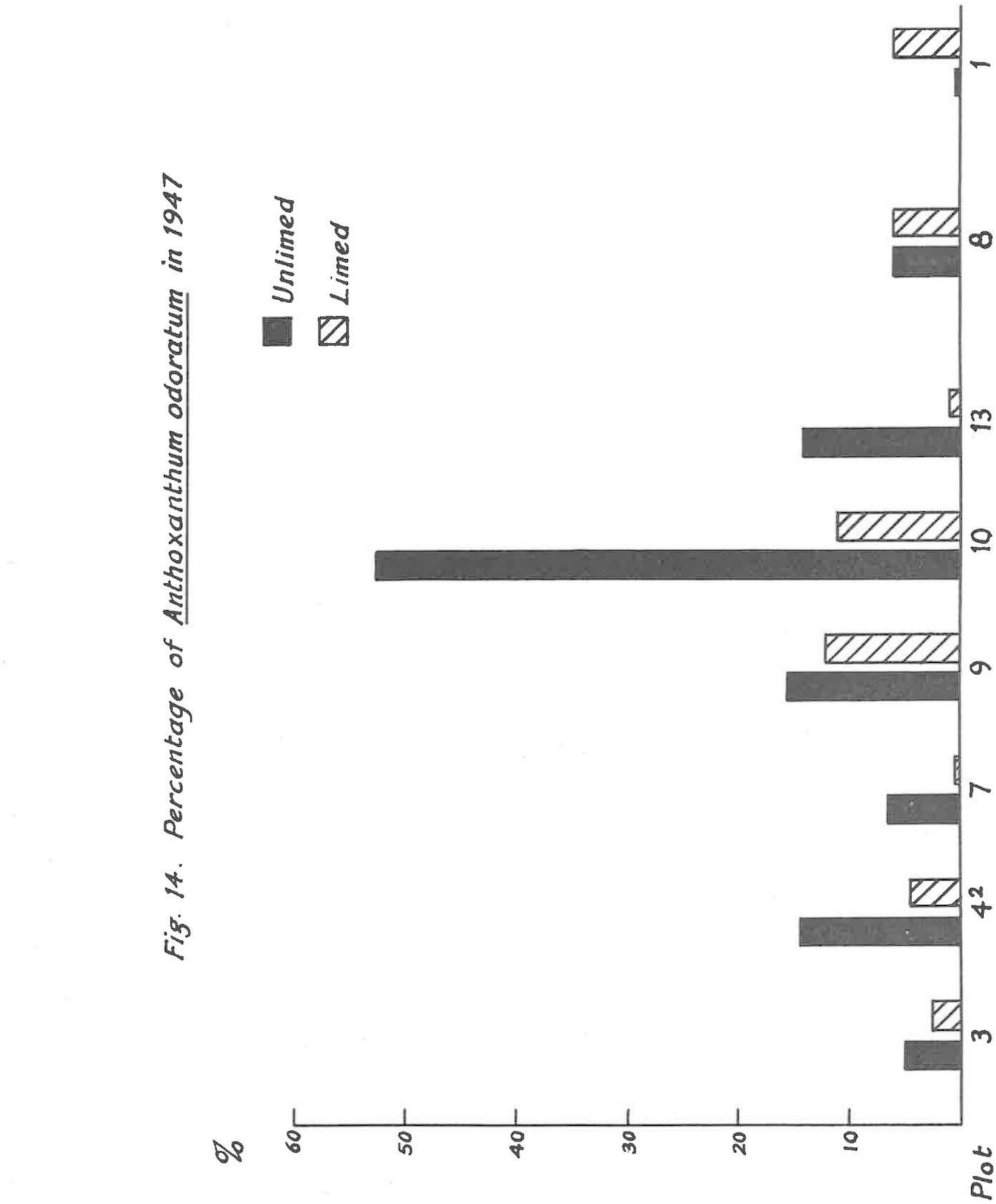


Fig. 14. Percentage of Anthoxanthum odoratum in 1947

Fig. 15.

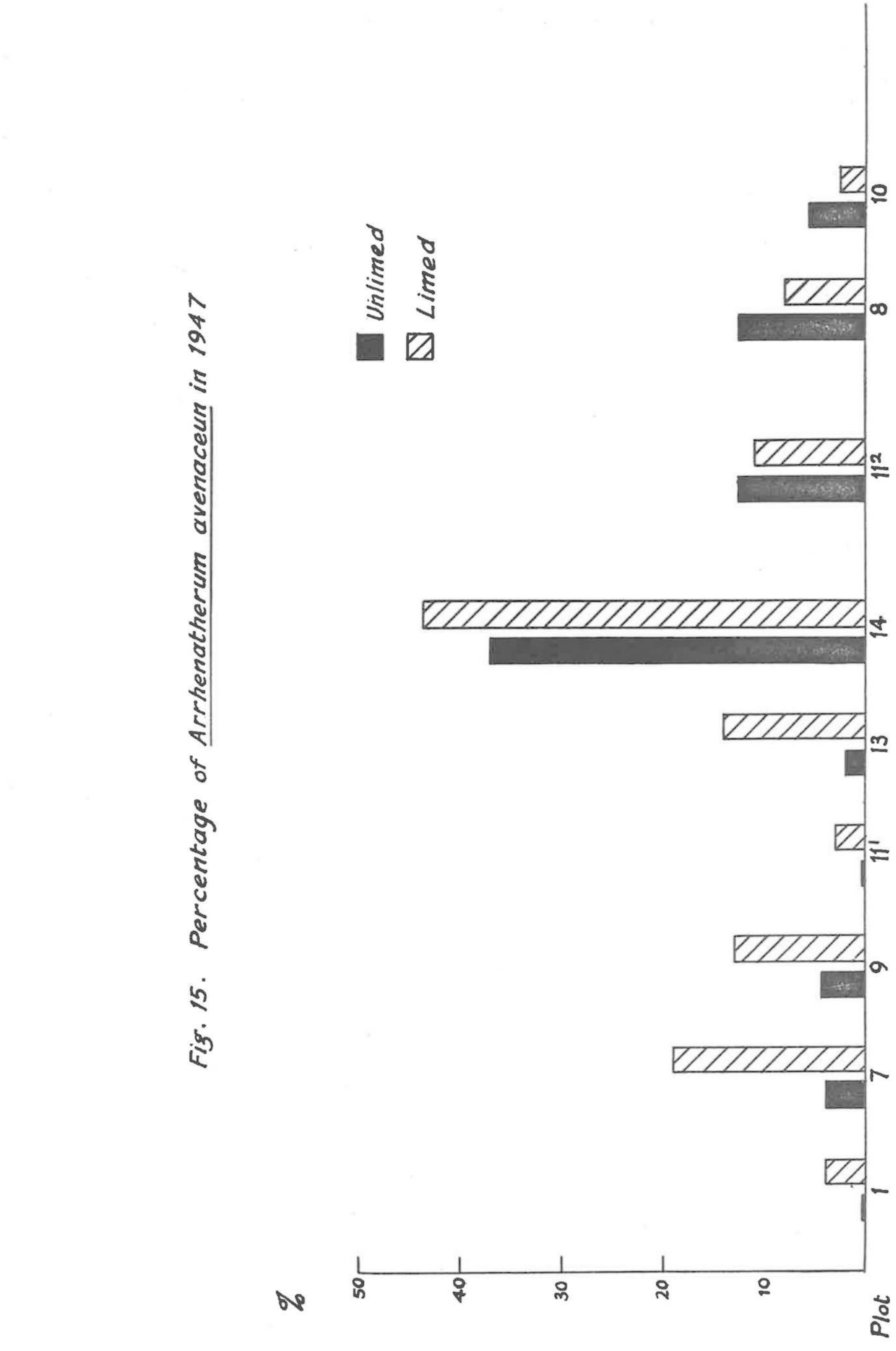


Fig. 15. Percentage of <u>Arrhenatherum avenaceum</u> in 1947

Fig. 16.

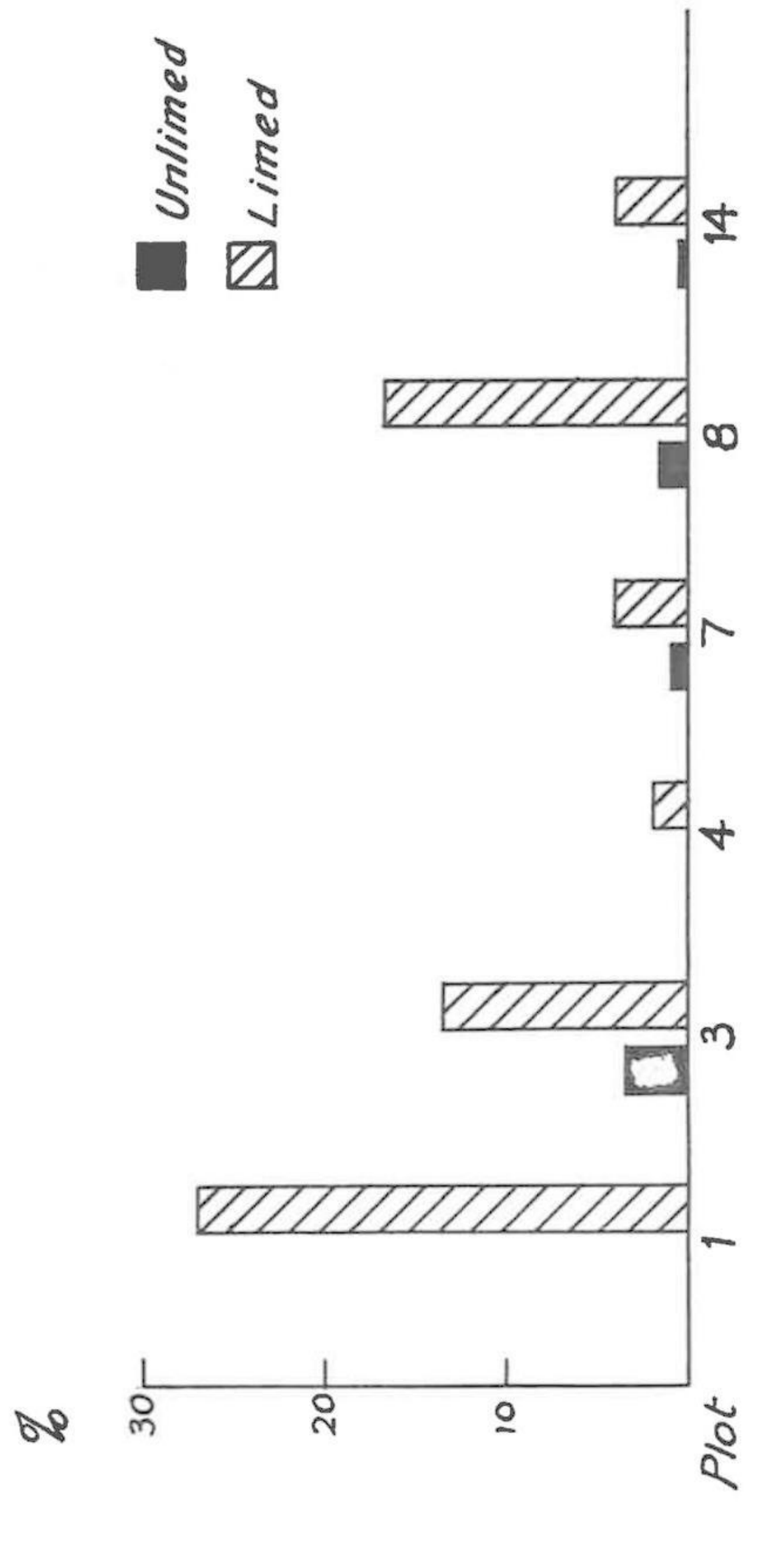


Fig. 16. Percentage of *Avena pubescens* in 1947

Fig. 17.

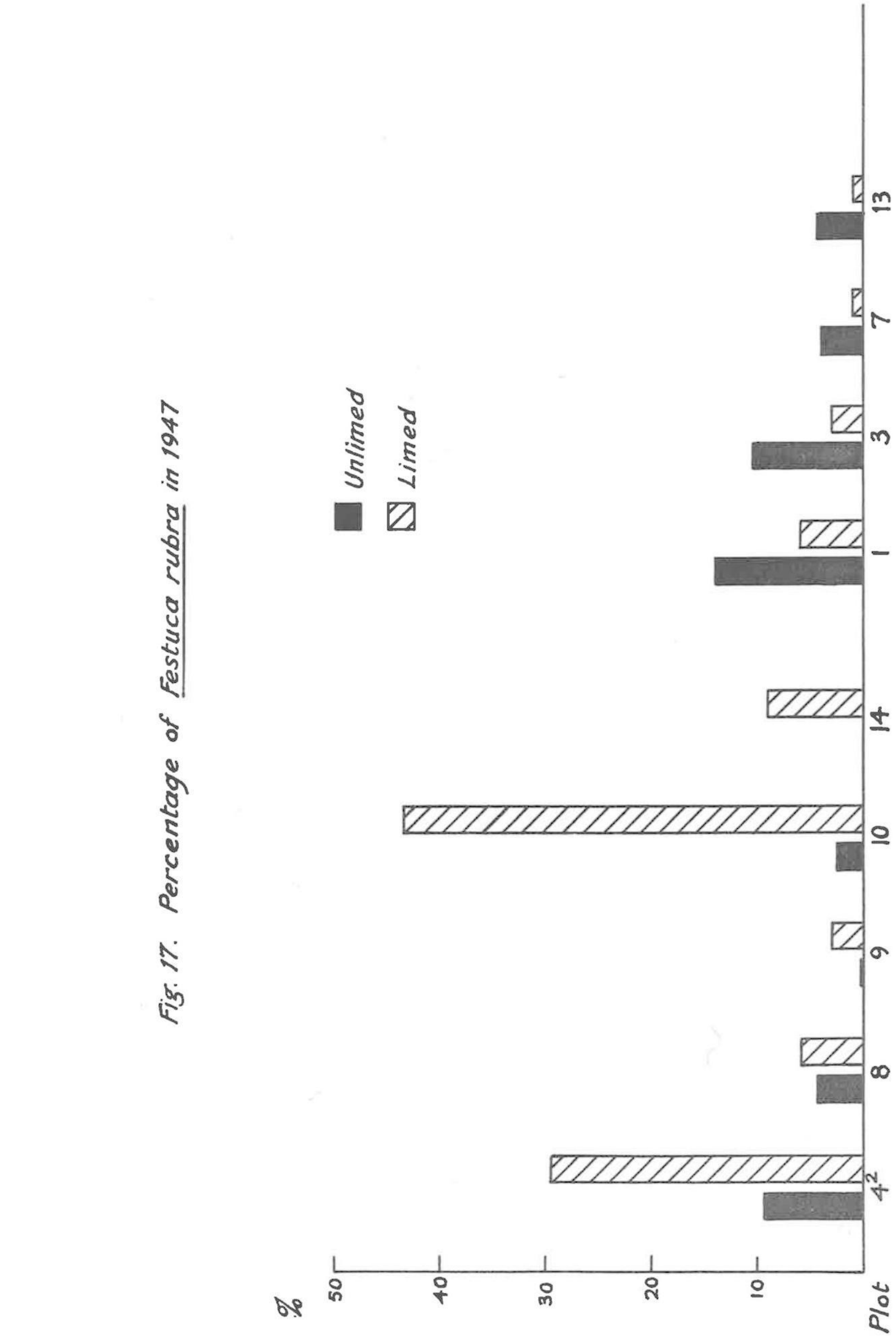


Fig. 17. Percentage of *Festuca rubra* in 1947

Fig. 18.

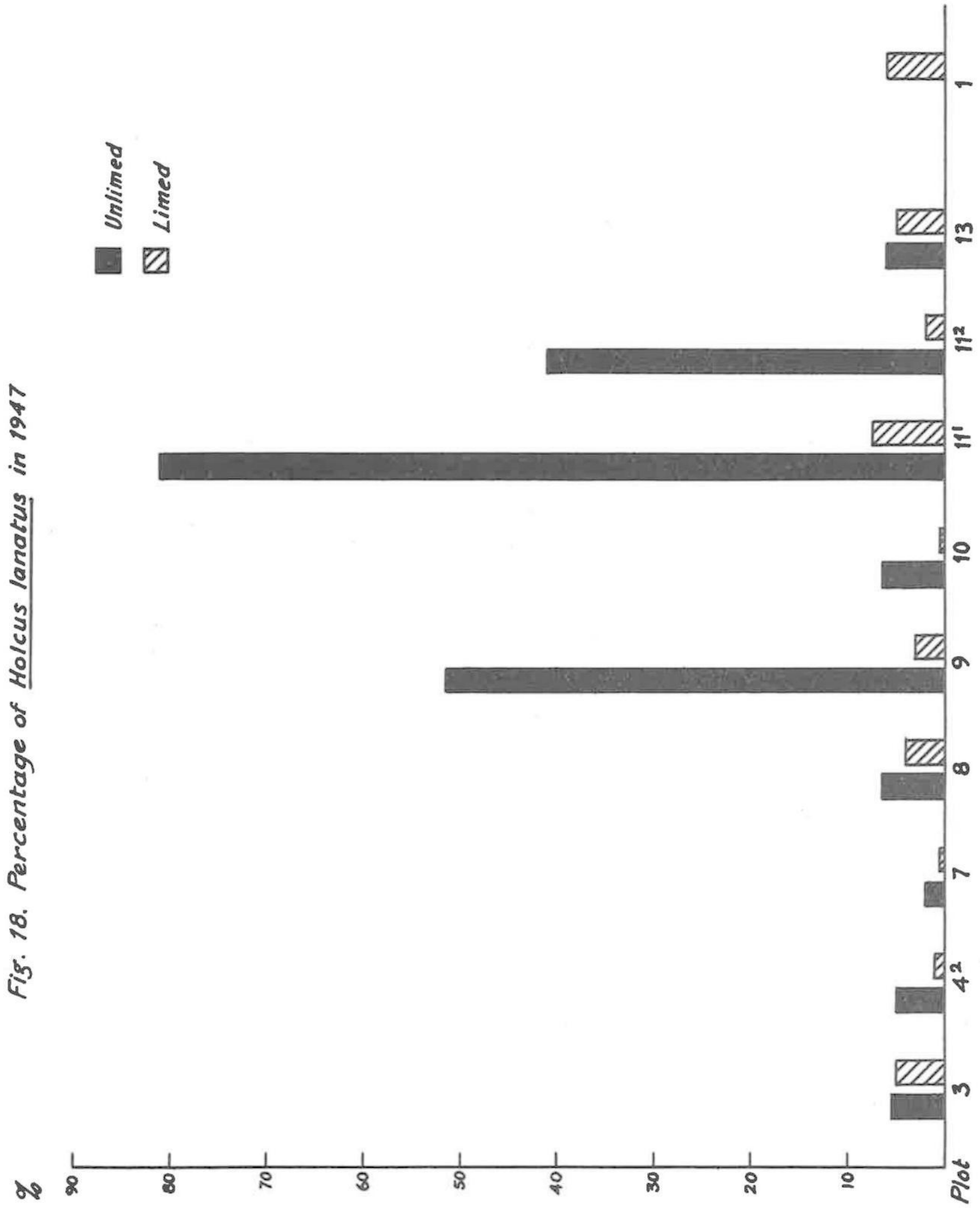
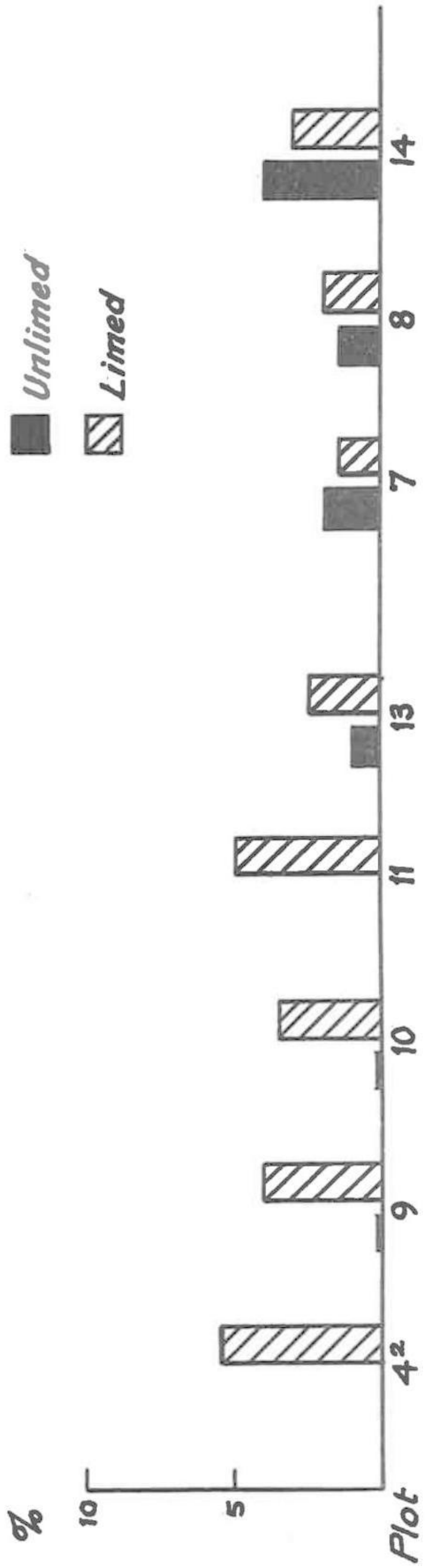


Fig. 18. Percentage of Holcus lanatus in 1947

Fig. 19.



Figs. 19. Percentage of *Poa pratensis* in 1947

Fig.20.

Fig. 20. Percentage of Leontodon hispidus in 1947

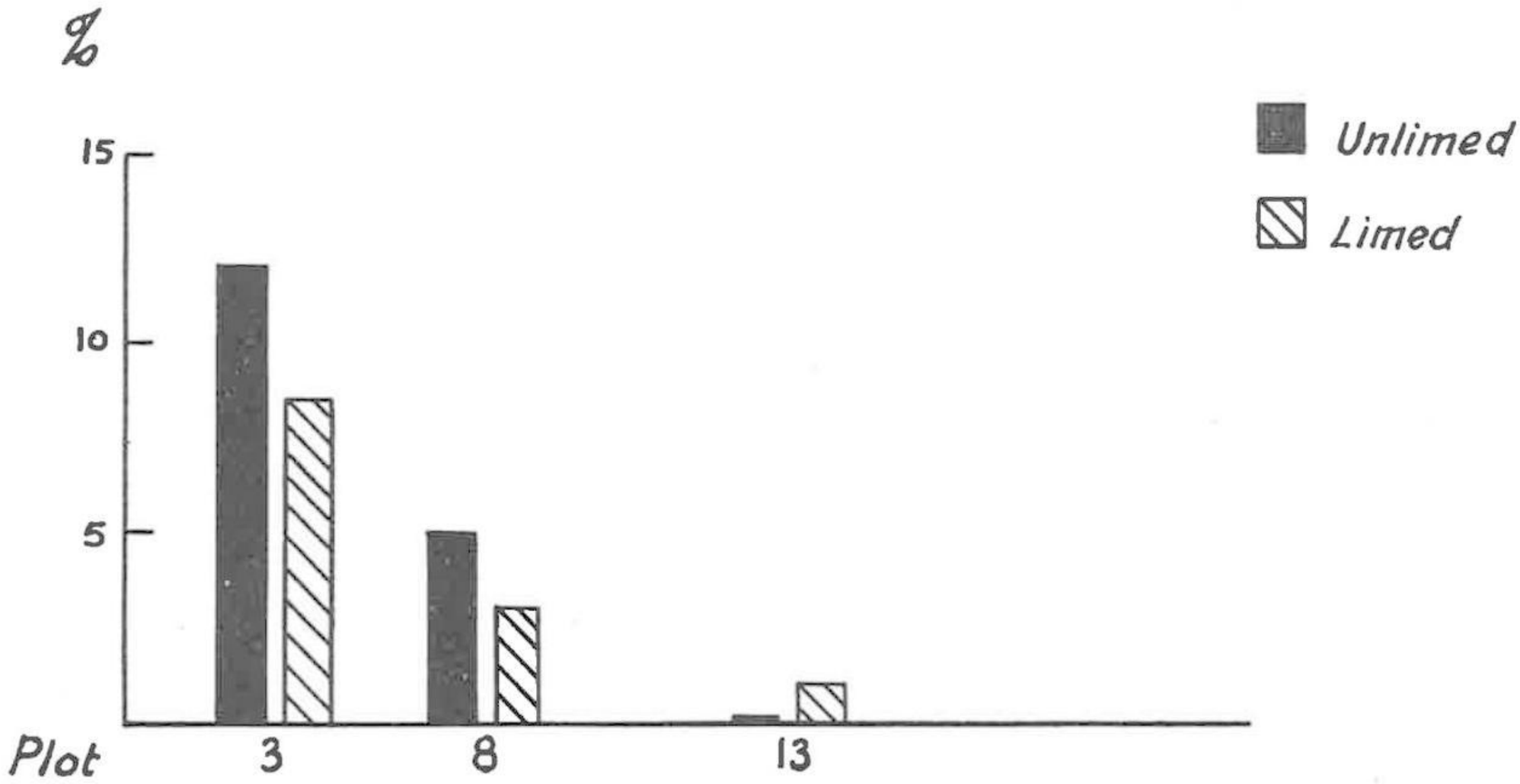


Fig.21.

Fig. 21. Percentage of Plantago lanceolata in 1947

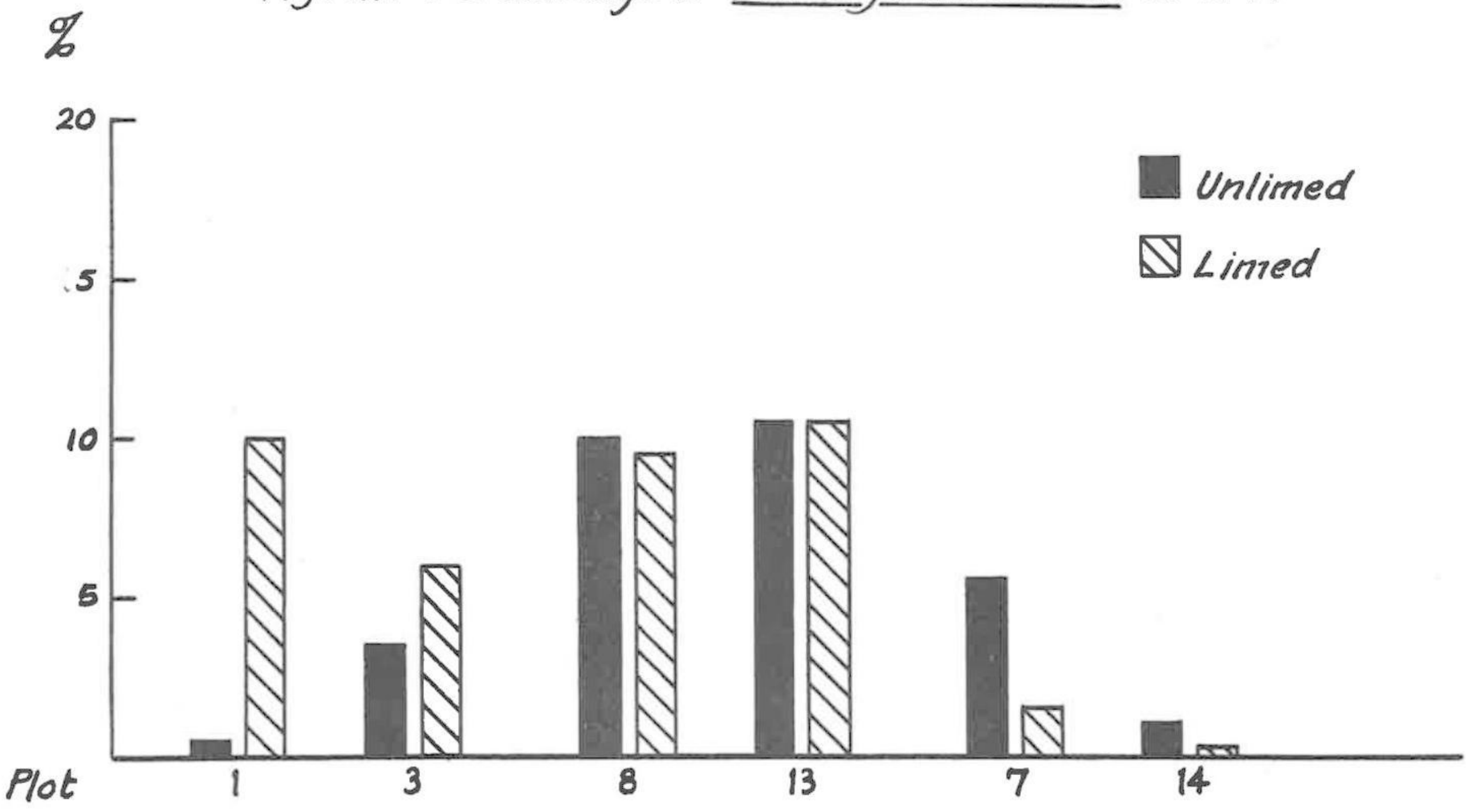


Fig.22.

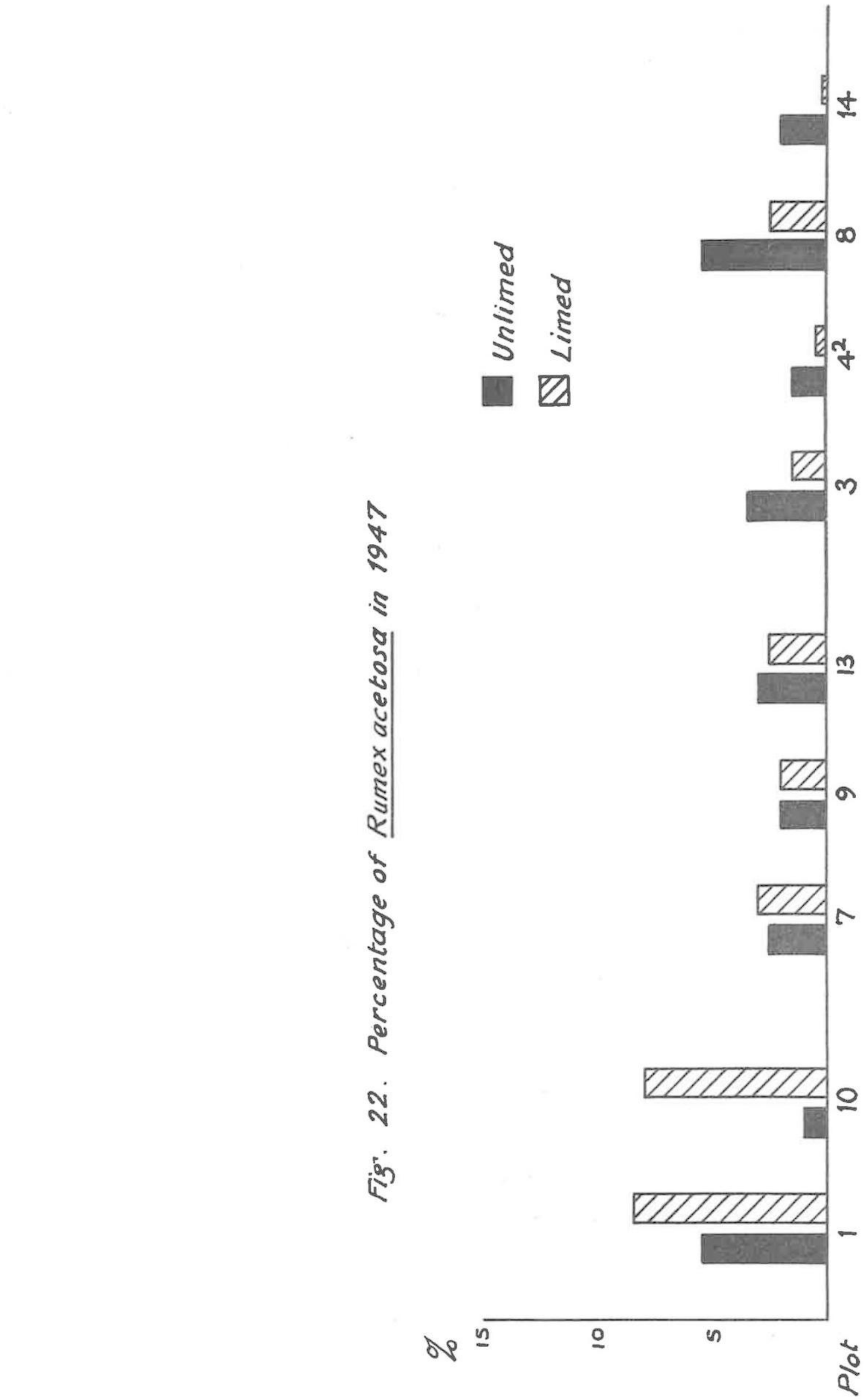


Fig. 22. Percentage of Rumex acetosa in 1947

TABLE 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	9	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	5.8	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	15.3	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	15.9	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	0.5	0.2	0.4	0.5	0.5	2.1	0.5	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	0.5	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	0.5	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	5.2	5.5	1.4	0.5	1.4	0.6	0.1	-	0.9	0.4	-
22. Hieracium pilosella	2.6	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
23. Hypochaeris radicata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24. Leontodon hispidus	3.7	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	0.5	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	2.5	6.3	0.4	1.9	5.3
30. Veronica chamaedrys	0.2	0.1	-	0.5	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	0.5	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	9.3	14.5

	NITRATE OF SODA (continued)													
Manuring	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	-	0.3	-	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	1.2	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	34.9	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	-	0.3
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	0.2	0.5	-
35. Luzula campestris	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36. Carex praecox	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mosses	<	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	11.1	3.7	4.6	6.3	6.1	2.0	5.5	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.