A PRELIMINARY INVESTIGATION INTO THE ROOT SYSTEMS OF PERENNIAL RYEGRASS (LOLIUM PERENNE) AND WHITE CLOVER (TRIFOLIUM REPENS) USING A PRESCRIBED SAMPLING METHOD FOR THE STUDY.

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1939.

C O N T E N T S.

D. RESULTS AND DISCUSSIONS.

I. Effect of Different Rates of Defoliation.

(a) Perennial Ryegrass.

(b) White Clover.

(c) Combinations of Perennial Rye and White Clover.

(d) Discussion.

II. Effect of 1" and 3" Spacing of Plants.

III. Effect of Combination of Perennial Rye and White Clover.

IV. Seasonal Variation.

(a) Root Weight

(b) Tiller number.

V. General Observations on Occurrence of Nodules on White Clover.

E. CRITICISM OF TECHNIQUE.

(a) General.

(b) Border Effect.

F. SUMMARY AND CONCLUSIONS.

LIST OF DIAGRAMS AND ILLUSTRATIONS.

A. INTRODUCTION:

> "The roots of plants are the least known, least understood and least appreciated part of the plant."
>
> Weaver and Bruner.

The fundamental importance of an extensive, well developed and healthy root system cannot be over emphasised. It must hold the plant firmly in the ground, provide a large effective absorptive area through which ample nutrients will become available for growth, and, by penetrating deeply, or by building up reserves, it must protect the plant against the exigencies of a dry season.

The study of the roots then, important as they are, would appear to have been unduly neglected when one considers the amount of research carried out using as a basis some above ground feature of the plant. In this connection W.F. Loehwing (1) may be quoted - "As one surveys the monumental literature dealing with crop production, the small fraction thereof devoted to roots and the absorption processes seems entirely out of proportion to their importance".

This state of affairs may emanate from the failure to admit the possibilities of investigations of the roots or may be due to the difficulty of studying them, but whatever the cause it is very noticeable in the case of many of our pasture plants. These have been the objects of intensive breeding and selection

based on their ability to produce foliage and this work has affected a marked and creditable improvement in the last few years.

An examination of the present accepted methods of root study reveals that they are usually slow, tedious and expensive. Weaver (2) used a method wherein a large hole is excavated adjacent to the plant to be studied and each root is laboriously traced out by picking the soil away. Pavlychenko (3) has used a method which involves the removal of large blocks of soil which have to be hoisted from the ground. These methods, while being suitable for giving a picture of the nature of the root system of a particular species would be quite inadequate to show the effects of various treatments on that species. In the main such studies involve the use of single plants and/or the use of boxes of soil which immediately set up artificial conditions. Spragueue (4) has used a system essentially similar to that described here wherein he digs out a small prism of soil and then trims it to a given size.

However, the method adopted here is very much simplified but is as yet untried and must be critically examined step by step and its value as a means of studying root behaviour under different experimental conditions ascertained. In view of this the investigation of several general points would appear to present wider scope for such preliminary exploration. Results which could be satisfactorily subjected to statistical analysis would naturally come later when a suitable technique has been

evolved and proven and the prerequisites of a statistically accurate experiment known.

Many problems would immediately present themselves for investigation following the evolution of a suitable technique. The effect on root development of placement of fertilizers, of the time of sowing down the pastures, of the various cultivation practices, are all points that could well be studied with a view to ascertaining the adequacy of existing systems of husbandry. Work done by Bertram (5) shows the depressing effect on the root system of allowing the water table to approach the surface of the soil, work by Jacques in N.Z. (6) demonstrates the detrimental results of too frequent grazing, while Bates (7) has amply illustrated the inhibiting effect of an acid soil. Similarly more work may bring to light new, or provide additional confirmation of known effects of mis-management.

The accumulation of a detailed knowledge of the roots themselves and the factors influencing their development might lead to much more important work being done. Some practical application may be found in the matter of soil erosion which is a very serious problem both from the individual farmer's point of view and perhaps more so from the national aspect.

Further, it is not impossible that a strain of grass may be evolved which is suited to dry or sandy areas by virtue of a root system which penetrates deeply or which is capable of storing considerable reserves or which in other ways allows the plant to continue growth or maintain itself under such adverse conditions.

While realising the value of root studies one must not lose sight of the fact that the ultimate test of a strain of grass is the amount of food material produced. Actually a high total production may not be so important as a lesser production with much of it at a period of normally low production or during a period of adverse conditions for growth. The point is, however, that only insofar as they increase the value of the species have root studies any practical application in this direction.
