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**A STUDY OF THE RELATIONSHIPS BETWEEN LEAF AREA INDEX,
CHLOROPHYLL CONTENT PER UNIT OF GROUND AREA
AND RATE OF DRY MATTER INCREASE IN A
PERENNIAL RYEGRASS SWARD**

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L. A. HUNT

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INTRODUCTION

Many factors are operative in determining the overall productivity of any system of farming. In most cases these can be placed into distinct groups, and where animal production from pasture is concerned three such groups can be distinguished:-

- (a) Factors affecting the amount of dry matter which is produced by the pasture.
- (b) Factors affecting the proportion of this which is harvested.
- (c) Factors affecting the efficiency with which harvested dry matter is converted into animal products.

While all of these factors affect the ultimate level of production only those concerned with pasture dry matter production are considered in this thesis.

Many studies have been carried out in an attempt to improve the understanding of those factors which affect the amount of dry matter produced by the pasture. Some of these have been concerned with the roles of intensity and frequency of defoliation, and in general, they demonstrate an inverse relationship between the yield of pasture dry matter and both the severity and frequency of defoliation. In the light of such information many farmers have attempted to increase the overall output from their grassland by adopting grazing systems in which, ideally, grazing and spelling alternate at intervals appropriate to the climatic

and edaphic environments and to the specific pasture type.

In recent years several systems of grazing management have been tested on a farm scale (McMeekan, 1960). These studies show that the amount of animal material produced from management systems based on the results of pasture studies is little, if any, greater than that from systems previously employed. In order to explain such results, and to facilitate the development of better grazing methods, a more precise understanding of pasture growth has become necessary.

Many recent attempts to obtain a more detailed understanding of pasture growth have involved an intensive study of relationships between the rate of dry matter increase and various characteristics of the photosynthetic system. Leaf area has been widely used as a measure of the size of the photosynthetic system despite the fact that many photosynthetically active cells occur in the stalks, sheaths and petioles. Chlorophyll is essential for photosynthesis and Brougham (1960) found that there was a better correlation between maximum rate of dry matter increase and the chlorophyll content per unit of ground area above the level at which 95% of the noon light was intercepted than between maximum rate of dry matter increase and leaf area index^(*) above a similar measurement level. As a logical extension of such work this thesis involves a study of the relationships

(*) The term leaf area index is used to refer to the ratio of leaf area to ground area occupied (Watson, 1947).

between rate of dry matter increase, leaf area index and chlorophyll content per unit of ground area during the growth of a pasture.

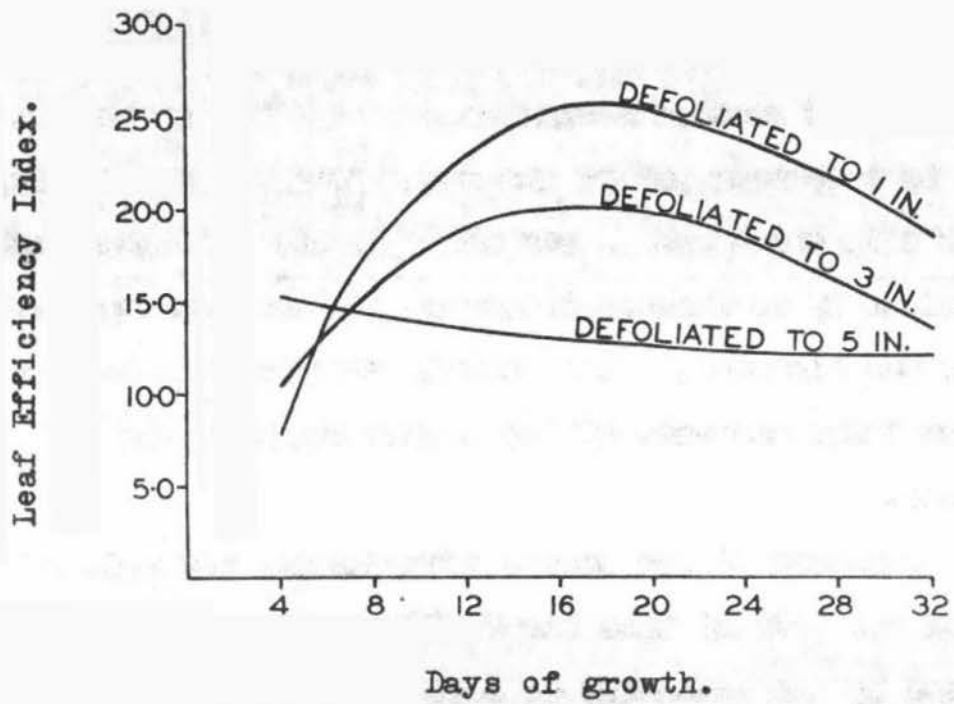


Fig. 1. Leaf Efficiency Index at various stages of growth.

(Brougham, 1956).