EVALUATION OF VARIABILITY IN A FOG GRASS (*HOLCUS* spp.) GENE POOL

by

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ABSTRACT

The utimate aim of a breeder's working collection is to utilize the genetic variation for breeding new cultivars. Before this variation can be utilised, it is necessary to obtain the description of attribute from the collection. These can either be obtained from the records of genetic resources (base collection or active collection) or obtained directly from the working collection itself. This will resulted in a huge amount of data. To be of any value, this information need to be classified systematically, and the classification need high degree of objectivity, especially for species of no a priori knowledge.

A Working collection of 160 Yorkshire Fog seed populations, from all over New Zealand, were planted out in Massey University. This formed the gene pool. During Summer 1975, 11 agronomic and morphologic characters were scored in a semi-quantitative scale. This yield approximately 42,000 data records. These were then systematically reduced to 550 by a series of multivariate analysis techniques. The procedures of Multivariate Analysis of Variance, Multiple Discriminant Analysis and Cluster Analysis were reviewed and their computer programmes were developed.

The clustering behaviours of seven agglomerative polythetic strategies were studied and compared, using the full set of characters. Most of the results concurred with studies carried out by other workers The Minimum Increment Sum of Squares strategy was found to be most suitable for this analysis. A probabilistic decision method was devised to decide objectively, the truncating point for clustering.

For all set of data, the studies did not reveal any ecotypes and hence did not agree with the ecoclinal trends hypotheses (of Yorkshire Fog in New Zealand) of Jacquee.The approaches of both studies (of Yorkshire Fog in New Zealand) of Jacques. The approaches of both studies (that of Jacques and the present one) were reviewed critically and a more appropriate approach was suggested for future ecological study.

Preliminary results revealed that there were a few promising groups showing agronomic desirable characters. They were promising breeding materials for future lines selection.

Of all the characters studied, flowering date and clump erectness were found to be the most discriminating characters amongst groups, and the most dominant characters in clustering. These implied that selection should be beneficial, if they had moderate high predictive heretability.

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INTRODUCTION

Hill country pasture is important in New Zealand, as it is a highland country, with 28 million acres (64 percent) of the farming land being steep hill country (Scott 1956).

Hill country pasture production can only be maintained if suitable species are grown. In particular, attention must be given to the species' soil fertility requirements. It is common for high producing pasture species to lose their producing ability where soil fertility falls below their requirements, or where practices to suit their best growth are not followed. In the hill country, soil fertility is often poor (White 1973), and species suit to this are preferred.

Yorkshire Fog grass (Holcus lanatus L.), is noted for a virtual absence of edaphic specialization, wide climatic tolerance, low soil fertility requirement, and good adaptation to extensive agricultural (pastoral) system. This grass has established well in New Zealand in humid hill country, unploughable steep hills, acidic peat soils and even swampy lands (Basnyat 1957). It is the major constituent of some 8 million acres of North Island marginal pasture land, of which 5 million acres are in the wetter hill country of the west. It's contribution toward farm productivity has been judged as significant (Munro 1961, Basnyat 1957).

In 1953, Jacques started to investigate Yorkshire Fog as a useful pasture species. The investigation commenced with collecting a wide range of local seed populations from most major areas of New Zealand. After a series of progeny tests and selections, a synthetic cultivar "Massey Basyn" was bred in 1960 (Jacques 1962). A synthetic cultivar is made up of genotypes which have previously been tested for their ability to produce superior progeny when crossed in all combinations (i.e. they have good combining abilities) (Allard 1960).

In a sward productivity trial, Munro (1961) found that "Massey Basyn" compared favourably with perennial ryegrass and performed much better than a commercial Fog line. Riveros(1963) found

that dry matter yields were always significantly higher in Yorkshire Fog swards, than in ryegrass swards. In a trial from 1961 to 1964, Watkin and Robinson(1974) Found that "Massey Basyn" had a similar dry matter yield to the ryegrasses (Ariki, Manawa and Ruanui); and the seasonal production of "Massey Basny" well distributed, with relatively good production in winter and summer.

To enable further detailed investigation, and to improve further the agronomic value of Yorkshire Fog grass, Dr. R. G. Clements organized another collection of Fog accessions in 1972. A total of 201 seed populations were collected. These included 108 from the North Island, 89 from the South Island, 3 from Australia and 1 from Spain. This collection was sampled from most parts of New Zealand, even the Westland region (Which Jacques had missed out), and the Northland region (which Munro(1961) and Jacques(1962, 1974) considered as having the most potential for highly productive genes).

Out of the 201 seed populations collected, 160 were planted out as a working collection at Massey University. According to Vavilov, "collection and classification" is the first phase of scientific plant breeding (Frankel 1947); and the aim of the presant study was to examine the phenotypic variability in, and to reveal the relationship amongst, major characters within this collection. In this study, populations have been grouped into phenotypically-similar clusters. The clusters so obtained could be used as sources for breeding material. Several multivariate analysis techniques have been used to achieve this. Firstly, multivariate analysis of variance has been used to investigate whether there were any differences amongst populations. Secondly, multiple discriminate analysis has been used to estimate the relationships between the phenotypic characters, and to ordinate the original scores into uncorrelated discriminant scores. Finally, cluster analysis has been used to group together populations with similar phenotypic patterns of dispersion.