Biometrical approach to selection for fodder yield attributes in arid zone grass, Buffel (Cenchrus ciliaris Linn.)

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INTRODUCTION

Cenchrus ciliaris, commonly called as anjan grass in India and Buffel or foxtail elsewhere, is a hardy and vigorously growing dryland pasture species capable of producing good quality forage in arid and semi-arid areas of the country.

In this obligate apomictic species exhibiting enormous polymorphism, although breeding programme is feasible with sexual lines (Taliaferro and Bashaw, 1966), the improvement programme is mostly confined to selection of promising types for which suitable selection criteria need to be identified. The knowledge of the magnitude of genotypic and environmental components of variation and the interrelationships between different traits greatly helps in building up efficient selection criteria. Further, unlike the annuals in which effective selection based on single harvest is possible, the situation is often more complex in perennial forage grasses in which usually several harvests are made during the growing season. The progress by selection in such materials would primarily depend on the presence or absence of genotype × environment interactions which need to be studied.

The studies on the genetic variation in this species (Patil et al., 1964; Chakravarty et al., 1970; Yadav et al., 1974) had been rather limited and were based on single harvest. The information on various genetic parameters, intercorrelations and genotype × harvest interactions based on several harvests with respect to fodder yield attributes is lacking and the present paper is an attempt in this direction.

MATERIAL AND METHODS

Twenty eight diverse genetic stocks of Cenchrus ciliaris were grown in a randomised block design with three replicates at the Central Research Farm, Jhansi (25°N, lat., 78°E, long., 257 m alt.) on a light red soil. Each varietal plot of two rows consisted of 20 plants spaced 60 cm × 30 cm apart. The plots were established in July 1972 by transplanting 45-day old seedlings raised in nursery beds. The data on plant height, tiller number, culm thickness, dry matter and green fodder yield were recorded on five randomly selected plants in each plot separately at seven different harvests during 1972-75. The mean values of five plants were used in the statistical analysis. The genotypic and phenotypic coefficients of variation, heritability (broad sense) and genetic advance (K = 2.06)
were calculated according to Burton and De Vane (1953). The correlation co-efficients were estimated according to Hayes et al. (1955).

RESULTS AND DISCUSSION

The data on range, mean, standard error and the estimates of genotypic and phenotypic co-efficients of variation for individual harvests revealed wide variations for most of the characters studied. There were significant differences between the genotypes at most of the harvests for all the characters except dry matter percentage. The phenotypic and genotypic coefficients of variation were more or less consistently high for tiller number, moderate for culm thickness and low for dry matter percentage whereas these were moderately high for plant height and high for fodder yield but not consistently. The data clearly indicated that there was high genetic variability for fodder yield and tiller number, moderate for plant height and culm thickness and low for dry matter percentage in this population.

The pooled analysis of variance showed that there were significant differences between the genotypes and between the harvests for all the five characters studied. Significant genotype × harvest interactions revealed differential response of genotypes for all the traits at different harvests. Evidently, adequate evaluation of genotypes may not be possible on the basis of only one harvest and therefore, the selection is to be based on the consideration of several harvests. In earlier studies also, the presence of genotype × harvest interactions for nitrogen content in Buffel grass revealed selection to be more difficult (Bray and Pritchard, 1976). In perennial rye grass, interactions were observed between years, cuttings and genotypes for both digestibility and nitrogen content (Rogers and Thompson, 1970).

The heritability estimates were calculated for different characters at different harvests. Heritability estimates from single harvest can only consider variation estimated at that harvest and are inadequate to derive any conclusion when several harvests are considered. In the present study, the plant height showed high heritability more or less consistently over the harvests. Tiller number, culm thickness and fodder yield showed moderately high heritability which was not much consistent over the harvests. The dry percentage had low heritability at all the harvests.

Heritability estimate along with genetic advance is usually more helpful in predicting the value of selection for particular traits. The estimates of genetic advance varied considerably for different traits at different harvests. Comparative-ly high genetic advance was obtained for plant height, tiller number and fodder yield and moderate for culm thickness. The dry matter exhibited low genetic advance. The plant height and tiller number showed comparatively higher estimates of heritability, genetic advance and the coefficients of variation at several harvests suggesting that these two characters were fairly consistent and therefore, selection for these traits would be effective. Additive gene effects are probably more important for such characters wherein high heritability is accompanied with high genetic gain (Panse...
1957). The fodder yield had moderate heritability along with high genetic advance but did not show consistency over the harvests and is, thus, less dependable. The dry matter exhibited low heritability along with low genetic advance and low genotypic co-efficient of variation at all the four harvests. This revealed that progress by selection for this character may not be profitable in this population.

The genotypic correlation co-efficients, in general, were higher than phenotypic and environmental correlations for most of the character combinations. Tiller number showed high positive correlation with fodder yield at phenotypic levels and negative correlation at the genotypic level. High environmental influence would limit response to selection for this character. Culm thickness and dry matter percentage did not exhibit significant positive phenotypic correlation with fodder yield. Positive correlation of plant height with fodder yield at phenotypic levels at all the harvests suggested that selection for this character would be effective for improving fodder yield.

The results of this study indicated that progress by selection could be achieved for plant height and tiller number. The presence of significant genotype × harvest interactions suggested that the breeder should formulate the selection criteria on the basis of several harvests for the genetic improvement in anjan grass.

REFERENCES


