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Coefficient of Variation, Inter-relationship and Heritability Estimates for Some Seedling Traits in Maize in C_1 Recurrent Selection Cycle

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Abstract: The experiment was carried out to evaluate two hundred S_1 maize families for fresh shook weight and other seedling traits to select superior families for further inter-crossing in C_1 recurrent selection procedure. The values of coefficient of variation (%) for fresh shoot weight, fresh root weight, dry shoot weight and dry root weight were found to be higher (38.8, 25.6, 56.8 and 84.1% respectively). Broad-sense heritability estimates for fresh shoot weight, dry root weight, fresh shoot length and fresh root length were found to be moderate (53.91, 50.26, 62.50 and 48.74%, respectively). Positive and significant linear correlation coefficients were found among all indicated seedling traits.

Key words: Maize, seedings, heritability, correlation, fodder

Introduction

Maize fodder crop is adaptable to widely varying climatic and soil conditions. Its planting from February to September helps cope with the fodder scarcity problems faced in May-June and October-November (Chaudhry, 1994). Maize *(Zea mays* L.) fodder is nutritious and is relished by all kinds of livestock. It is also a cash crop for growers. Significant variation exists for nutritional quality traits of the stover and whole-plant forage in maize (Wolf *et al*., 1993). Peak yield of green herbage occurs at the beginning of milky ripeness (Kirilov and Naidenov, 1990).

The production of maize fodder per acre is very low in Pakistan as compared to many other countries of the world. An adequate and regular supply of nutritious fodder is needed in Pakistan for livestock production in order to meet the requirements of milk, meat, butter and other products for human population. The objective of the experiment was to evaluate the two hundred S_1 families for fresh shoot weight and other seedling traits to select superior families for further inter-crossing to develop maize population for fodder purposes. There are five necessary steps, which to develop maize population for fodder purposes. There are five necessary steps, which are need to develop a high green fodder yielding maize population (Mehdi and Ahsan, 1999a,b): (I) selection of tall plants with broader leaves, (2) selfing of selected tall plants with broader leaves to make S_1 families, (3) testing these S_1 families for high green fodder yield and selecting high green fodder yielding S_1 families, (4) inter-crossing of these selected S_1 families to develop a population to proceed C_1 recurrent selection cycle, (5) repeating of all these four steps in C_1 recurrent selection cycle to develop high green fodder yielding population.

Materials and Methods

The experiments was conducted in a green house in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. Two hundred S_o families were tested in this experiments. The families were raised on February, 6, 1999 in two blocks and each block was assigned with 100 S_o families. The experiment were conducted in a modified randomized complete block design with two replications. Ten seeds per family were sown in iron trays filled with river sand by keeping row-to-row and plant-to-plant distances of 5.0 and 3.5 cm, respectively. Water was applied to the seedlings regularly and was not a limiting factor for growth. Temperature was not controlled in the green house and no supplementary lighting was used. The experiment was harvested on February, 19, 1999. Data were recorded for fresh shoot length (cm), fresh root length (cm), fresh shoot weight (mg) and fresh root weight (mg). Fresh samples were left for drying in the oven. When they were completely dried, data were recorded for dry shoot weight (mg) and dry root weight (mg). Data were analyzed for the analysis of variance technique (Steel and Torrie, 1980). The coefficient of variation for all parameters was calculated as $S/\bar{x}$, where S = standard deviation and $\bar{x}$ = mean of a parameter among S_1 families. The genetic component ($\sigma^2 g$) of variance was calculated as outlined by Robinson *et al*. (1951). The phenotypic variance ($\sigma^2 p$) was calculated by dividing S_1 families mean squares with number of replications. The broads-sense heritability was calculated for each trait as: $h^2_{(BS)} = \sigma^2 g/\sigma^2 p$. Thereafter simple correlation coefficients were also estimated (Kwon and Torrie, 1964).

Results and Discussion

The values of coefficients of variation per cent (Table 1) were found lower for shoot and root length per plant (20.2 and 15.5% respectively). However the values of CV (%) for fresh shoot weight, fresh root weight, dry shoot weight and dry root weight were found to be higher (388, 25.8, 56.6 and 84.1% respectively). Similarly, Mehdi and Ahsan (1999a) reported high values of CV (%) for fresh shoot weight at seedling stage. They also reported high values of CV (%) for green fodder yield at 50 percent flowering stage in maize families (Mehdi and Ahsan, 1999b). Ayub *et al*. (1998) found significant differences among

Table 1: Pooled mean ± standard deviation, CV% and broad-sense heritability ($h^2_{(BS)}$) estimates for fresh shoot weight and other seedling traits among two hundred S_1 families as seedling stage

Trait	Mean	CV%	$h^2_{(BS)}$
Fresh shoot weight (mg)	314.53 ± 122.18	38.8	53.91
Fresh root weight (mg)	569.60 ± 146.90	25.8	20.89
Dry shoot weight (mg)	21.75 ± 12.31	56.6	19.52
Dry root weight (mg)	37.85 ± 31.37	84.1	50.26
Fresh shoot length (cm)	11.52 ± 2.33	20.2	62.50
Fresh root length (cm)	9.56 ± 1.48	15.5	48.74

Table 2: Correlation coefficients for fresh shoot weight and other seedling traits among two hundred S_1 maize families at seedling stage

Trait	Fresh shoot weight	Fresh root weight	Dry shoot weight	Dry root weight	Fresh shoot length
Fresh root weight	0.700**				
Dry shoot weight	0.567**	0.492**			
Dry root weight	0.512**	0.580**	0.445**		
Fresh shoot length	0.711**	0.479**	0.406**	0.320**	
Fresh root length	0.431**	0.475**	0.216**	0.286**	0.607"*

** = $p<0.01$.

maize cultivars for green fodder yield. Moderate broad-sense heritability estimates (Table 1) were found for fresh weight (53.91%), dry root weight (50.25%), fresh shoot length (62.5%) and fresh root length (48.74%) and suggested that this proportion of genetic component of variance may be useful, while selecting superior S_1 families for the further inter-crossing to develop maize population for fodder purposes. There were low broad-sense heritability estimates found for fresh root weight and dry shoot weight. However, it is generally suggested from the study of coefficients of variation and broads-sense heritabity estimates of S_1 maize families in C_1 recurrent selection cycle that fresh shoot weight might be useful selection criteria, while selecting superior families for inter-crossing. Similarly, Mehdi and Ahsan (1999a) suggested that fresh shoot weight may be more useful selection, while selecting superior families at seedling stage in maize.

There were positive and significant linear correlation coefficients found among all indicated traits (Table 2). Mehdi and Ahsan (1999a) reported highly significant correlation coefficients among fresh shoot weight, number of leaves per plant and plant height. There were highly significant correlations between green fodder yield and some other plant traits in maize (Mehdi and Ahsan, 1999b). Rehman *et al*. (1992) also reported strong relationship between dry matter yield and plant height in maize. These results also indicate that there was more variability among S_1 lines for fresh shoot, fresh root weight, dry shoot weight and dry root weight. Therefore, fresh shoot and fresh root weight variability may be more useful in developing the population for fodder purposes.

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