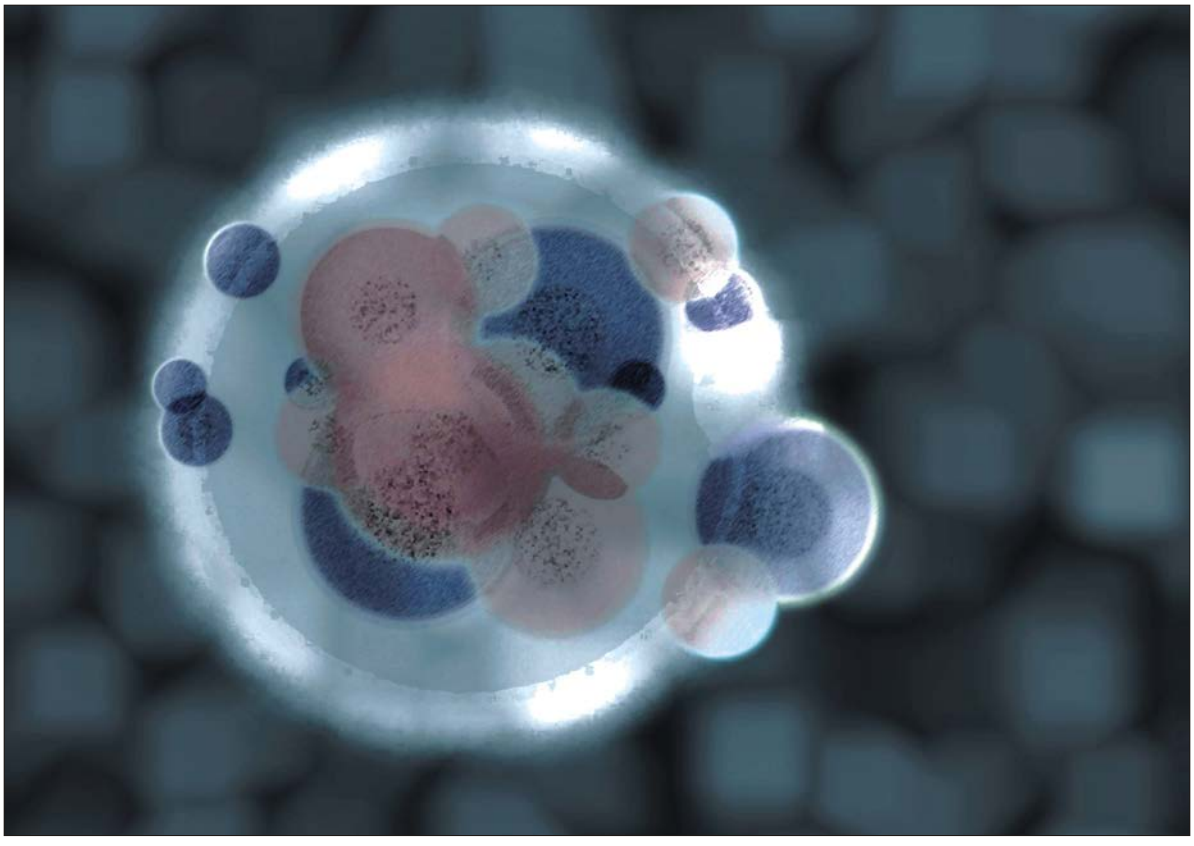

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Evaluation of S_1 Maize (*Zea mays* L.) Families at Seedling Stage under Drought Conditions

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Abstract: Highly significant differences were found among S_1 maize families and treatments for all indicated traits except dry root weight which was non- significant among treatments. Treatments $\times$ S_1 families interaction was found significant for fresh shoot weight, dry shoot weight and fresh shoot length. The values of coefficient of variation for fresh shoot weight was found to higher than fresh root weight, dry root weight and dry shoot weight. Broad-sense heritability estimates were ranging between 54.27-83.99 percent for indicated seedling traits. Positive and linear inter-relationships were found among all indicated traits. It is therefore suggested on the basis of broad-sense heritability, coefficient of variation estimates and positive linear relationships that dry root weight may be more useful selection criteria, while selecting for superior S_1 maize families for water stress conditions.

Key words: Selection criteria seedlings, maize drought

Introduction

Maize (*Zea mays* L.) is being used as food and as an important kharif fodder grown alone and in mixture in the country. Maize is adaptable to widely varying climatic and soil conditions. In view of its increasing importance, improvement on maize has picked considerable attention in Pakistan and other countries of the world (Hunter, 1980; Han, 1982; Prasad and Singh, 1980; Bhole and Patil, 1983; Russell, 1985; Bhatti, 1988; Dai *et al.,* 1990; Kirilov and Naidenov, 1990; Wolf *et al*., 1993; Nazir, 1994; Ayub *et al.,* 1998; Hussain and Aziz, 1998; Ahsan, 1999; Mehdi and Ahsan. 1999a, b Ahsan and Mehdi. 2000; Mehdi and Ahsan 2000). The canal system of Pakistan is ranked among the best systems of the world, but still vast tract of land are solely dependent on rain. Consequently, crop plants of such areas are exposed to extreme environmental factors and experiences frequent water stress during their growing period.

Generally in arable agriculture. drought describes a condition in which available soil moisture is reduced to point when plant growth is severally affected (Osmanzai *et al.,* 1987) The problem of moisture stress can be solved either by providing supplemental irrigation to crop in rainfed areas or by developing such genotypes which can produce higher and stable yield in water limiting areas. The provision of supplemental irrigation is not feasible and realistic for Pakistan due to economic reasons. Therefore development of drought tolerant cultivars is the best way to cope with the drought stress. The present study was therefor. conducted to observe the differences in the S. maize families in response to drought stress.

Materials and Methods

The experiment was conducted in the greenhouse of Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad on February 25, 2000. The experimental material comprised of 50 S_1 maize families derived after one cycle of recurrent selection programme of the Fodder Research Project of Pakistan Science Foundation Islamabad. The S_1 families were evaluated for seedling traits under water stress conditions. Twelve seeds of each S_1 maize family were sown in iron trays filled with sun dried river sand keeping row to row and plant to plant distances of 5 and 30.5 cm, respectively. Randomized complete block design was used with three treatments (normal, 60 and 75 percent stress) and two replications. The experiment was harvested after three weeks of planting and data were recorded for fresh shoot length (cm), fresh root length (cm), fresh shoot weight (mg) and fresh root weight (mg). Fresh samples were dried at 60°C for 72 hours in an electric oven and then dry shoot and root weight Img) were recorded. Data were analyzed by using the analysis of variance technique (Steel and Torrie, 1980). Simple linear correlation coefficients were also estimated using the method of Kown and Torrie (1964). Thereafter pooled coefficient of variation and broad-sense heritability were also determined for each indicated trait.

Results and Discussion

Mean squares from the analysis of variance (Table 1) for al indicated seedling traits revealed highly significant differences ($p \leq 0.01$) among S_1 maize families and treatments. Dry root weight was found to be highly significant among S_1 families, but non-significant among treatments. Maiti *et al.* (1994) observed significant differences for root length, shoot length and shoot dry weight among maize genotypes at seedling stage under water stress conditions. Hussain (1989) also reported significant differences among some seedling traits. Weerathworn *et al*. (1992) found that maize seedlings were different significantly for dry root and dry shoot weight under water stress conditions. Treatment $\times$ S_1 families interaction was significant for fresh shoot weight, dry shoot weight and fresh shoot length (Table 1).

The values of coefficient of variation (Table 2) were found smaller for fresh root and shoot length (12.86 and 14.53% respectively). However the values of coefficient of variation (CV%) for fresh shoot weight, fresh root weight, dry shoot weight and dry root weight were 118.21, 33.73, 22.73 and 29.02% respectively). Similarly Mehdi and Ahsan (1999a) reported high values of CV (%) for fresh shoot weight at seedling stage. Mehdi and Ahsan (2000) also reported higher values of coefficient of variation 1%) for fresh shoot weight, fresh root weight, dry shoot weight and dry root weight.

Moderate broad-sense heritability estimates (Table 2) were found for fresh shoot length 155.74 %), fresh root length (54.27%), fresh shoot weight 165.16%) and dry shoot weight 68.98%). but higher broad-sense heritability were found for fresh and dry root weight (76.59 and 83.99% respectively). Hussain (1989) reported significantly higher broad-sense heritabirrty estimates for fresh root length, fresh root weight

Table 1: Mean squares from the analysis of variance for some indicated seedling traits in maize under drought conditions

Sov	df	Fresh shoot length (cm)	Fresh root length (cm)	Fresh shoot weight (mg)	Fresh root weight (mg)	Dry Shoot weight (mg)	Dry root weight (mg)
Replications	1	30.60*	0.02*	1033*	88374f^{NS}	166^{NS}	7636*
S_1 families (F)	49	6.634**	8.47**	32261^{NS}	217607**	1220**	9392**
Treatments (T)	2	1214.38**	121.02**	9158453**	6000398**	52238**	3697^{NS}
T × F	98	2.93*	3.87^{NS}	11239**	50945^{NS}	379**	1504^{NS}
Error	149	2.06	3.46	4820	42380	120	1499

NS = Non-significant, *,** = Significant at 5 and 1 percent probability level respectively

Table 2: Pooled means ± standard deviation, coefficients of variation (CV%) and broad-sense heritability estimates for some indicated seedling traits in maize under drought conditions

Traits	Means + Standard deviation	CV %	$h^2_{(R.S)}$
Fresh shoot length	9.88 ± 1.44	14.53	55.74%
Fresh root length	14.47 ± 1.86	12.86	54.27%
Fresh shoot weight	381.25 ± 69.43	18.21	65.15%
Fresh root weight	607.37 ± 205.86	33.89	76.59%
Dry shoot weight	48.20 ± 10.96	22.73	68.98%
Dry root weight	133.42 ± 38.72	29.02	83.99%

Table 3: Linear correlation coefficients for some indicated seedling traits in maize under drought conditions

Trait	Fresh Shoot length	Fresh root length	Fresh shoot weight	Fresh root weight	Dry root weight
Fresh root length	0.432**				
Fresh shoot weight	0.873**	0.322**			
Fresh root weight	0.642**	0.481**	0.684**		
Dry shoot weight	0.160**	0.28 6**	0.174**	0.605**	
Dry root weight	0.794**	0.369**	0.846**	0.718**	0.437**

** = Significant at 1% probability level

and fresh shoot weight. But Mehdi and Ahsan (2000) found moderate broad-sense heritability estimates for fresh shoot weight, dry root weight and, fresh shoot and root length.

There were positive and highly significant linear correlation coefficients found among all indicated seedling traits (Table 3). Similarly Mehdi and Ahsan (2000) also reported positive and significant linear correlation coefficients among fresh shoot and root length, fresh shoot and root weight and, dry root and shoot weight.

It is suggested from the results on the basis of high broad-sense heritability estimates, coefficients of variation, positive significant interrelationships and non-significant interaction between treatment × S_1 families that dry root weight may be more useful selection criteria, while selecting maize S_1 families for drought tolerance.

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