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Heritability and Interrelationships for Some Plant Traits in Maize Single Crosses

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Abstract
A local maize hybrid programme was developed in which fifteen single crosses were made among six maize inbred lines viz., 20 P_2 -2, N-84, A-556, OH 54-3B, WM 13-RA and K-55. Broad sense heritabilily estimates were higher (greater than 75%) for all the traits studied. Correlation of plant height, number of kernels per row and 100-grain weight were positive and highly significant with grain yield per plant. As these traits possessed high heritability values, it is, therefore, suggested that improvement in grain yield can be made by using these traits as selection criteria.

Key words: Heritability, Correlations, Grain yield

Introduction
Maize is the third leading cereal in Pakistan after wheat and rice being grown on an area of 0.871 million ha (Anonymous, 1997). It has tremendous yield potential (1445 kg ha^{-1}) and could contribute significantly to the country's grain production. The real impetus to quantitative genetics in maize breeding was provided after its economic importance was realized. Although, grain yield is the primary trait of interest which a maize breeder despretely wants to improve. There are, however, some other secondary traits such as maturity, lodging resistance, disease resistance etc. that modern breeder must consider for eventual usefulness of genotypes evaluated for yield. Genetic correlations are of interest to determine degree of association between traits and how they may enhance selection. This depends upon the estimates of heritability for each traits and genetic correlation between them. The influence of some maize plant traits on grain yield has been observed and discussed by Martin and Russell (1984), Mahajan *et al*. (1990), Zafar (1990), Betran and Hallauer (1996) and Hussain (1997). The objective of this study was to identify some plant traits which could be used as selection criteria for improving grain yield in maize single crosses.

Materials and Methods
The study was carried out in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The experimental material comprised of six elite maize inbred lines viz, 20 P_2-2, N-84, A-556, OH54-3B, WM 12-RA and K-55. These inbred lines were sown in the crossing block and fifteen single crosses were attempted among them. The seed of these crosses alongwith their six parents were sown in a triplicated randomized complete block design. The distance between plants and row was kept at 23 and 75 cm, respectively. At maturity of the crop, the data were recorded on ten guarded plants selected from each genotype for plant height, number of ears per plant, ear length, ear diameter, number of kernel rows per ear, number of kernels per row, 100-grain weight and grain yield per plant. The data collected for these traits were subjected to analysis of variance technique given by Steel and Torrie (1980). Broad sense heritability for each recorded trait was calculated as ratio of the genotypic variance to phenotypic variance ($^2\sigma g/^2\sigma p$) according to Burton and Devane (1953). Phenotypic (rp) and genotypic (rg) correlation coefficients were computed by using the formula of Kwon and Torrie (1964.)

Results and Discussion
Hertability estimates of various maize plant traits are shown in Table 1 and the extent of correlation among them is presented in Table 2. Heritability estimates were higher (greater than 75%) for all the traits studied.

Plant height showed a very strong and positive correlation towards kernels per row and grain yield per plant. Since the heritability estimates of the traits under discussion are reasonably high, there is a possibility for the simultaneous improvement of these traits. A positive genotypic correlation between plant height and grain yield in also observed by Mahajan *et al*. (1990) and Betran and Hallauer (1996). Number of ears per plant showed significant correlation at phenotypic level with ear length and number of kernel rows per ear. Because the heritabilities of number of ears per plant and ear length were high, there is a possibility that ear length can also be improved by improving number of ears per plant also. There existed a highly significant and positive correlation between ear length and number of kernel rows per ear which suggests that an improvement in ear length could in turn increase number of kernel rows per ear. A nonsignificant correlation of ear diameter was born with rest of the traits. Similar type of findings were also observed by Martin and Russell (1984). Similarly, the correlation of kernel rows per ear with kernels per row, 100-grain weight and grain yield per plant was also non-significant.

However, number of kernels per row and grain yield per plant showed very strong association with each other both at phenotypic and genotypic level. As the heritability estimates of these two traits involved in association are high, there is a strong possibility for the simultaneous improvement of the traits. A strong and positive association between the two traits was also reported by Zafar (1990) and Hussain (1997).

Table 1: Heritability estimates of various maize plant traints.

Trait	Heritability (%)	Trait	Heritability (%)
Plant height (cm)	98.11	Number of kernel rows per ear	93.14
Number of ears per plant	94.00	Number of kernels is per rows	96.95
Ear length (cm)	93.33	100-grain weight (g)	87.00
Ear diameter (cm)	76.92	Grain yield per plant (g)	88.81

Table 2: Phenotypic (rp) and genotypic (rg) correlations of various maize plant traits

		1	2	3	4	5	6	7	8
1	rp	1.00	-0.24	-0.16	0.33	-0.19	0.62**	0.003	0.87**
	rg	1.00	-0.26	-0.16	0.05	-0.21	0.65**	0.02	0.99**
2	rp			0.33	0.09	0.41**	0.23	-0.04	-0.25
	rg			0.38	0.23	0.44	0.22	-0.07	-0.29
3	rp				0.19	-0.60**	0.07	0.14	-0.18
	rg				0.25	-0.88**	0.09	0.09	-0.16
4	rp					0.21	0.09	-0.26	0.07
	rg					0.36	0.11	-0.38	0.08
5	rp						0.05	0.08	-0.16
	rg						0.04	0.04	-0.17
6	rp							0.07	0.67**
	rg							0.11	0.83*
7	rp								0.75**
	rg								0.87**

1 = Plant height (cm); 2 = No. of ears/plant; 3 = Ear length (cm); 4 = Ear diameter (cm); 5 = No. of kernel rows per ear; 6 = No. of kernels per row; 7 = 100-grain weight (g); 8 - Grain yield per plant (g)
*,** = Significant at 0.05, 0.01 probability levels, respectively

Similarly, 100-grain weight and grain yield per plant were also significantly and positively correlated with each other. Keeping in view the heritability estimates of the two traits, it is suggested that there is a possibility for improving grain yield per plant by improving grain weight.

From the present study it is concluded that plant height, ear length, number of kernels per row and 100-grain weight could be used as effective selection criteria for improving grain yield in maize single crosses.

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