CORRELATION AND PATH COEFFICIENT ANALYSIS IN MAIZE *(ZEA MAYS* L.)

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Five elite inbred lines of maize were crossed in all possible combinations in order to find the correlation and path coefficient of grain yield with plant height, number of ears per plant, number of kernel rows per ear, number of kernels per row, 100-grain weight, ear length and ear girth. Number of ears per plant and ear girth showed highly significant phenotypic and genotypic correlations with grain yield. Path coefficient analysis showed that ear length had maximum direct positive effect on grain yield whereas the effects of plant height and number of ears per plant appeared to be relatively small.

INTRODUCTION

Correlation and path coefficient analysis of plant data provides a thorough understanding about genetic association of various plant traits with grain yield and their relative contribution to increase plant productivity. Number of rows per ear appeared to be the most important component of grain weight per ear, which was indirectly influenced by 1000-grain weight and number of grains per row (Dornescu, 1973). Singh and Nigham (1977) analysed data for 42 strains of maize and found that grain yield was positively and significantly correlated with five components of yield. Godawat (1982) reported data on grain yield per plant and seven other characters from 22 late, 20 medium and 18 early genotypes in maturity which indicated that increase in yield was due to selection for 100-grain weight in early group, while the plant height and 100-grain weight in late group. Under the local conditions, Najeebullah (1987) found that number of ears per plant had maximum direct positive effect on grain yield, whereas number of kernels per row and ear diameter showed negative effects on grain yield. In another study ear length and number of kernel rows per ear had maximum direct effect on grain yield (Ahmed, 1989). The primary objective of this study was to determine the degree to which various characters of maize are associated with economic productivity and also to work out the precise contribution of each component.

MATERIALS AND METHODS

The experimental material comprised five elite inbred lines of maize, i.e. OH 28, K 55, A 556, 82 P_2 and WM 13R. The parental lines were sown in the experimental area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during spring 1988 and were crossed in all possible combinations. During the ensuing season the seeds of the twenty hybrids along with the five parents were planted following a randomised complete block design with three replications. The seeds of each family were dibbled in two rows of 4.5 m length, keeping row to row and plant to plant distances of 60 and 30 cm, respectively. The two rows of each entry contained thirty plants.

At maturity, data on ten random plants were recorded for plant height, number of ears per plant, number of kernel rows per ear, number of kernels per row, 100-grain weight, ear length, ear girth and grain yield per plant. Phenotypic (r_p) and genotypic (r_g) correlation coefficients were computed by applying formulae given by Kwon and Torrie (1964). The path coefficient analysis was done as suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The results (Table 1) showed that genetic correlation between plant height and grain yield per plant was positive (0.38) and highly significant. At the same time path analysis showed that plant height had direct effect on grain yield per plant, i.e. 2.15 (Table 2). The indirect effect via number of ears per plant was also positive (0.36) followed by ear length (0.33). These results suggest that while using plant height as a criterion for selection, number of ears per plant and ear length should also be given due consideration. The results get support from the findings of Kang *et al.* (1983).

The data revealed that number of ears per plant was significantly correlated with grain yield both phenotypically and genotypically, and the respective coefficients were 0.89 and 0.95 (Table 1). Although the direct effect of number of ears per plant was positive (1.57), yet the indirect effect via ear length was 0.91, while via plant height it was 0.49 (Table 2). Positive direct effect of number of ears per plant suggested that the character should be given due consideration as a criterion for indirect selection for grain yield. The results are in line with those of Singh and Nigham (1977) and Najeebullah (1987).

Table 1. Phenotypic and genotypic correlation coefficients between grain yield per plant and its components

Character	Phenotypic correlation coefficient	Genotypic correlation coefficient
Plant height vs grain yield per plant	0.325	0.381*
Ears per plant vs grain yield per plant	0.895**	0.946*
Kernel rows per ear vs grain yield per plant	0.376	0.416*
Kernels per row vs grain yield per plant	0.136	0.071*
100-grain weight vs grain yield per plant	0.499*	0.477*
Ear length vs grain yield per plant	0.407*	0.134*
Ear girth vs grain yield per plant	0.529**	0.640*

* Significant
** Highly significant

Although analysis of the data revealed that number of kernel rows per ear was positively and significantly correlated with grain yield at the genotypic level (Table 1), the direct effect of the character on grain yield remained negative, i.e. -2.14 (Table 2). However, the indirect effect of kernel rows via 100-grain weight, number of ears per plant and plant height was positive. From these results it is clear that while using number of kernel rows per ear as a criterion for selection, grain weight should also be given due importance. Similar results have been reported by Dornescu (1973).

via ear length (3.08), plant height (0.80) and number of ears per plant (0.53) were positive (Table 2). Particular attention should be given to ear length while making selection based upon 100-grain weight. The results are in line with Ahmad (1989).

Table 2. Direct and indirect effects of different characters on grain yield per plant

Character	Direct effect	Indirect effect via	
Plant height	2.15	Ears per plant	0.36
		Ear length	0.33
Ears per plant	1.57	Ear length	0.91
		Plant height	0.49
Kernel rows per ear	-2.14	100-grain weight	0.69
		Ears per plant	0.51
		Plant height	0.50
Kernels per row	-3.85	Ear length	3.42
		100-grain weight	0.53
Ear length	5.77	Ears per plant	0.25
		Plant height	0.12
Ear girth	-1.90	Ear length	5.89
		Plant height	0.46

The number of kernels per row had positive and significant genetic association with grain yield per plant. However, direct effect of kernels per row on grain yield was negative (Table 2). Indirect effects of number of kernels per row via ear length and 100-grain weight were positive. Indirect effect via ear length was greater and must be considered during selection based on number of kernels per row. Similar findings have been reported by Singh and Nigham (1977) and Najeebullah (1987).

The grain weight was positively and significantly correlated with grain yield per plant, both phenotypically and genotypically with respective correlation coefficients of 0.49 and 0.47 (Table 1). Godawat (1982) also reported similar results. Although direct effect of 100-grain weight on final yield was negative (-0.301), indirect effect

Ear length was positively and significantly correlated with grain yield per plant (Table 1) both at the phenotypic and genotypic levels. The direct effect of ear length on grain yield per plant was positive (5.77) and high. Indirect effects via number of ears per plant and plant height were positive with respective values of 0.25 and 0.12, suggesting that by increasing ear length, the yield per plant may be increased. Similar findings have been reported by Najeebullah (1987) and Ahmad (1989).

Ear girth was positively and highly significantly correlated with grain per plant both phenotypically and genotypically (Table 1). The direct effect of ear girth on grain yield per plant appeared to be negative, i.e.

-1.90 (Table 2). Indirect effect via ear length and plant height was observed to be positive. It is, therefore, evident that indirect effects through ear length and plant height were important and must be considered at the time of selection based on ear girth. Negative direct effect of ear girth have been reported by Najeebullah (1987).

From the foregoing discussion, it is concluded that number of ears per plant, grain weight, number of grains per row and ear length should be given due consideration as a criterion for indirect selection for grain yield. Their positive, direct and indirect effects were found to be contributing significantly towards grain yield.

REFERENCES

Ahmad, A. 1989. Correlation and path coefficient analysis in maize *(Zea mays* L.). M.Sc. Thesis, Dept. Plant Breeding & genetics, Univ. Agric., Faisalabad.

Dewey, R.D. and K.H. Lu. 1959. Correlation and path coefficient analysis of components of crested wheatgrass seed production. Agron. J. 51: 515-518.

Dornescu, A. 1973. Analysis of yield components in maize by means of correlations and path coefficients. Institutul Agronomic "Ion Ionsescu de Brad", 1. Iasi, Romania, 51-57 [Pl. Br. Abstr. 46: 1358; 1976].

Godawat, S.L. 1982. Intra-group correlations in three maturity groups of maize *(Zea mays* L.). Madras Agric. J. 69: 814-816. [Pl. Br. Abstr. 54: 4430; 1984].

Kang, M.S., M.S. Zuber and G.F. Krause. 1983. Path coefficient analysis of grain yield and harvest grain moisture in maize. Tropical Agric. 60: 253-256. [Pl. Br. Abstr. 54: 871; 1984].

Kwon, S.H. and J.H. Torrie. 1964. Heritability and inter-relationship among traits of two soybean populations. Crop Sci. 4: 196-198.

Najeebullah, M. 1987. Correlation and path coefficient analysis in maize (Zea mays L.). M.Sc. Thesis, Dept. Plant Breeding & Genetics, Univ. Agric., Faisalabad.

Singh, S.P. and H.K. Nigham. 1977. Path coefficient analysis for yield components in maize *(Zea mays* L.). Allahabad Farmer 48: 163-165. [Pl. Br. Abstr. 49: 6945; 1979].