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Correlation and Path Analysis Studies in Maize (*Zea mays* L.)

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ABSTRACT

The present investigation was carried out to study the correlation and path analysis for seven quantitative characters in thirty-six crosses along with twelve parents. Single plant yield exhibited highly significant positive correlation with ear girth, ear length, test-weight and plant height which were in turn significantly correlated among themselves revealing that due emphasis may be laid for these characters to increase yield during selection process. Path coefficient analysis revealed that ear length, ear girth, test-weight and plant height had direct effect on yield.

Key words : Correlation, Maize, Path analysis and Yield

Maize is an important staple food crop and provides bulk of raw materials for the livestock and many agro-allied industries of the world. Yield being a complex character, plant breeders are interested in developing cultivars with improved yield and other desirable agronomic and phenological characters. Grain yield is a function of genotype x environment interaction (Annicchiarico, 2002). A more acceptable crop genotype is the one which exhibits wide adaptability to varying environments. In a given environment, the grain yield of a particular maize genotype (variety or hybrid) depends on its potential grain yield components (Grafius, 1960). Hence, a clear picture of contribution of each component in final expression of complex character is essential. In order to achieve the goal of increased production by increasing the yield potential of the crop, knowledge on direction and magnitude of association between yield and yield related traits is essential for a plant breeder (Kumar *et al.,* 2011). Correlation studies between yield and yield components and between yield components themselves is a prerequisite to plan a meaningful breeding program (Ahmad and Saleem, 2003).

Correlation coefficient measures the mutual association only between a pair of variables, when more than two variables are involved, the correlations *per se* may not provide a clear picture of the importance of each component in determining grain yield. Path coefficient analysis provides more information among variables than correlation coefficients since this analysis indicates the direct effects of specific yield components on yield and indirect effects *via* other yield components (Moral *et al*., 2003). Correlation in combination with path analysis would give a better insight into the cause and effect relationship between different pairs of characters.

The present investigation was carried out using 48 entries, which included thirty-six crosses and twelve parents, to understand the association of grain yield and its contributing characters so as to determine the *inter se* association between the traits. The path coefficient analysis which measures the direct influence of one variable upon another by permitting the separation of the simple correlation coefficient into components of direct and indirect effects was also carried out.

MATERIAL AND METHODS

Thirty-six crosses, generated by crossing six lines with six testers, along with their parents were grown in randomized block design replicated thrice with a spacing of 75 X 20 cm at National Seed Project, Acharya N G Ranga Agricultural University, Rajendranagar. Each entry was grown in two rows of 4.8 m length. Biometrical observations *viz.,* plant height, ear length, ear girth, test-weight and yield per plant were recorded on ten competitive individual plants in each replication

and the mean values were computed. Days to 50% flowering and days to maturity were recorded on plot basis. The genotypic and phenotypic correlations between the characters under study were computed using the line X tester data as per the method of Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The data revealed that the difference between the genotypic and phenotypic correlation coefficients was very narrow and hence, only the results of genotypic correlations are presented in Table 1. Grain yield per plant exhibited significant and positive relationship with ear girth, ear length, test-weight and plant height. These four characters had in turn significant correlation among themselves. Therefore, due emphasis has to be laid for these characters during selection for yield improvement. Similar kind of trait association was reported for grain yield with plant height (Sharma *et al*., 1982), ear length (Tyagi and Pokhriyal, 1988), ear girth (Qadir and Saleem, 1991) and test-weight (Khayatnezhad *et al.,* 2010).

Saidaiah *et al.* (2008) observed that plant height, ear length, ear girth and test weight exhibited positive and significant correlation coefficients with yield in 40 F_1s and their 14 parents. Kumar *et al.* (2011) reported similar results in 28 single cross hybrids obtained through diallel crossing using eight parental lines.

The character days to 50% flowering had highly significant positive correlation with days to maturity (0.939) and plant height (0.449). Days to maturity had significant positive correlation with days to 50% flowering (0.939), plant height (0.423) and test-weight (0.290). Plant height was positively correlated with all the characters except ear length. The correlation coefficients for days to 50% flowering, days to maturity, ear girth, test-weight and yield were 0.449, 0.423, 0.299, 0.419 and 0.388, respectively. Ear length exhibited highly significant positive correlation with ear girth (0.821), test-weight (0.598) and yield per plant (0.899). Ear girth registered highly significant positive correlation with ear length (0.821), test-weight (0.681), yield per plant (0.903) and low significant value for plant height (0.299). Test-weight had highly positive significant correlation with ear length (0.598), ear girth (0.681) and yield per plant (0.766), plant height (0.419) and low significant correlation with days to maturity (0.290).

Path coefficient analysis was used to obtain further information on the inter-relationship among traits and their effects on grain yield and is presented in Table 2. Days to 50% flowering had negative direct effect (-0.0295 / -0.0315) on yield. However, the correlation of this character with yield was positive (0.1382 / 0.1381) because of its indirect positive influence through days to maturity, plant height, ear length, ear girth and test-weight. Days to maturity had a low positive direct influence on yield (0.0142 / 0.0162). Its influence on yield was indirectly through plant height, ear length, ear girth and test-weight. Plant height had a direct effect on yield (0.0947 / 0.0946) influencing the yield indirectly to a moderate extent through days to maturity, plant height, ear length and ear girth. Ear length registered considerable direct effect on yield (0.4598 / 0.4602). The indirect effects of ear length on yield were through ear girth, test-weight, days to maturity and plant height. Ear girth registered direct positive effect (0.3534 / 0.3542) for yield. Indirect influence of this character on yield was observed through ear length, test-weight, plant height and days to maturity. Test-weight recorded a positive direct effect on yield (0.2137 / 0.2437). The indirect effect of this character on yield was recorded through ear length, ear girth, plant height and days to maturity.

Path coefficient analysis revealed that yield was under the positive direct influence of ear length, ear girth, test-weight, plant height, days to maturity and negative direct effects through days to 50% flowering. Ear length showed a maximum direct effect followed by ear girth and test weight towards yield. When individual characters were taken into consideration, the maximum indirect effects towards yield were through these characters. The above results are in agreement with that of Sharma and Kumar (1987), Singh *et al*. (1987) and Dwivedi and Godawat (1994). Since ear length, ear girth and test-weight have manifested high direct effects and positive association with yield, selection for these characters would be more effective to bring simultaneous improvement of yield and its components in the present breeding material.

Table 1. Genotypic correlation coefficients of yield and yield attributing characters in maize

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Ear length (cm)	Ear girth (cm)	Test-weight (g)	Yield per plant (g)
Days to 50% flowering	1.000	0.939*	0.449**	0.018	0.132	0.262	0.138
Days to maturity		1.000	0.423**	0.085	0.193	0.290*	0.196
Plant height (cm)			1.000	0.227	0.299*	0.419**	0.388**
Ear length (cm)				1.000	0.821**	0.598**	0.899**
Ear girth (cm)					1.000	0.681**	0.903**
Test-weight (g)						1.000	0.766**
Yield per plant (g)							1.000

* Significant at 5% level ** Significant at 1% level

Table 2. Phenotypic (P) and Genotypic (G) path coefficients for the characters studied in parents and hybrids of maize.

Characters		Days to 50% flowering	Days to maturity	Plant height (cm)	Ear length (cm)	Ear girth (cm)	Test-weight (g)	Yield per plant (g)
Days to 50%	P	**-0.0295**	-0.0280	-0.0133	-0.0006	-0.0039	-0.0078	0.1382
flowering	G	**-0.0315**	-0.0300	-0.0142	-0.0006	-0.0042	-0.0083	0.1382
Days to maturity	P	0.0314	**0.0142**	0.0060	0.0012	0.0028	0.0041	0.1977
	G	0.0154	**0.0162**	0.0069	0.0014	0.0032	0.0047	0.1983
Plant height (cm)	P	0.0427	0.0400	**0.0947**	0.0216	0.0285	0.0398	0.3884
	G	0.0426	0.0404	**0.0946**	0.0216	0.3798	0.2761	0.3885
Ear length (cm)	P	0.0086	0.0395	0.1049	**0.4598**	0.3798	0.2761	0.9023
	G	0.0087	0.0396	0.1052	**0.4602**	0.3814	0.2769	0.9040
Ear girth (cm)	P	0.0466	0.0693	0.1062	0.2920	**0.3534**	0.2423	0.9071
	G	0.0467	0.0699	0.1066	0.2936	**0.3542**	0.2437	0.9092
Test-weight (g)	P	0.0564	0.0624	0.0899	0.1283	0.1465	**0.2137**	0.7683
	G	0.0562	0.0622	0.0894	0.1278	0.1461	**0.2124**	0.7692

Bold values are the direct effects

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