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Correlation and Path Analysis for Morphological Traits in Maize (*Zea mays* L.) Inbred Lines

B Rama Devi, Lal Ahamed M, D Ratna Babu and T Madhumathi
Department of Genetic and Plant Breeding, Agricultural College, Naira 532 185, Andhra Pradesh

ABSTRACT

Correlation and path coefficient analysis was worked out for 8 morphological characters in 40 genotypes of maize inbred lines. Correlation studies indicated that days to 50% silking and 100 seed weight had positive significant association with seed yield per plant. Further partitioning of correlation coeffecients into direct and indirect effects showed that characters 100 seed weight, cob length and days to 50 % silking had positive direct effect on seed yield per plant. The correlation and path analysis clearly indicated that direct selection based on these attributes may be helpful in evolving high yielding genotypes.

Key words: *Correlation, Maize, Morphological traits, Path analysis.*

Maize (*Zea mays.*L) popularly called "Queen of cereals" is the most important cereal crop and it is estimated that approximately 21% of the total grain produced is consumed as food. The use of maize varies in different countries and in India, about 28% of maize produced is used for food purpose, about 11% as livestock feed, 48% as poultry feed, 12% in wet milling industry (for starch and oil production) and 1% as seed. The use of maize varies in different countries and it is estimated that approximately 21% of the total grain produced is consumed as food. Heterosis is being exploited maximum in maize in the farm of hybrids. A great number of hybrids are released for commercial cultivation for yield and quality traits. But there is a tremendous pressure to develop new hybrids having higher yields along with quality traits. To meet these demands breeders should develop potential hybrids to increase the yield. As yield is a complex quantitative trait, considerably affected by environment making selection of genotypes based on yield ineffective. Genetic correlation measures the magnitude of cause-effect relationship between various plant characters that determines the component characters on which selection can be made for improvement in yield. Further, path coefficient analysis, which splits the correlation coefficients, provides precise information on the direct and indirect effects in order to perceive the most influencing characters to be utilized as selection criteria in maize breeding programme

MATERIAL AND METHODS

The experiment was conducted at Agricultural College Farm, Bapatla. It is located in coastal region of the Krishna Agro Climatic Zone of Andhra Pradesh at 15^0 54' N latitude and 80^0 25' E longitude with an altitude of 5.49 m above the mean sea level (MSL) and about 7 km away from the Bay of Bengal. The experimental material used in the present study comprised of 40 inbred lines obtained from IARI Regional Maize Research Center, Dharwad, Karnataka and University of Agricultural Sciences, Dharwad, Karnataka. These lines were evaluated in randomized complete block design with two replications. Each plot consisted of two rows of three -meter long with row spacing and plant spacing of 60 and 30 cm, respectively. Observations were recorded on five randomly selected plants for characters *viz.,* days to 50% silking, days to 50% tasseling, number of nodes per plant, plant height (cm), cob height (cm), cob length (cm), 100 seed weight (g) and seed yield per plant (g). Data on days to 50% tasseling and days to 50% silking recorded on plot basis. Standard cultural practices were adopted from sowing till harvest.

The data was statistically analyzed to estimate genotypic and phenotypic correlation coeffecients and direct and indirect effects of correlation coefficients following the procedures given by Falconer (1964) and Wright (1921), respectively.

RESULTS AND DISCUSSION

The analysis of variance for the seed yield and yield components indicated the presence of sufficient variability in the material studied. The association between yield and yield components is presented in table-1. At both genotypic and phenotypic levels seed yield per plant showed significant positive association with days to 50% silking and 100 seed weight. Thus, the association indicating their usefulness in selection programmes in selecting a high yielding genotypes. These results are in conformity with earlier works of Singhal *et al.* (2006), Abirami *et al.* (2007), Jawaharlal *et al.* (2011), Sumalini and Manjulatha (2012), Kumar *et al.* (2014) and Ali *et al.* (2015).

Correlation studies revealed that days 50% silking showed positive significant association with cob length (0.371 and 0.398) and seed yield per plant (0.357 and 0.259) at both genotypic and phenotypic levels indicating simultaneous improvement of these traits will be effective. It also showed positive non significant association with days to 50% tasseling (0.019 and 0.015), number of nodes per plant (0.155 and 0.203), plant height (0.166 and 0.182), cob height (0.226 and 0.190) and 100 seed weight (0.041 and 0.084) at both genotypic and phenotypic levels. Similar results were also obtained by Singhal *et al.* (2006), Jawaharlal *et al.* (2011), Sumalini and Manjulatha (2012) and Reddy *et al.* (2013).

Days to 50% tasseling showed positive nonsignificant association with number of nodes per plant (0.237 and 0.141), plant height (0.238 and 0.162), cob height (0.010 and 0.008) and seed yield per plant (0.003 and 0.003) at genotypic and phenotypic levels, respectively, indicating weak association of these characters with days to 50% tasseling. It also showed the negative nonsignificant association with cob length (-0.114 and -0.042) and 100 seed weight (-0.107 and -0.049) at both genotypic and phenotypic levels. Similar results were also reported by by Singhal *et al.* (2006), Reddy *et al.* (2013) and Azam *et al.* (2014) in their studies in maize.

Number of nodes per plant showed positive significant association with plant height (0.526 and 0.419), cob height (0.566 and 0.464) and cob length (0.457 and 0.297) at genotypic and phenotypic levels, respectively, indicating that close association of these characters with number of nodes per plant and this association can be exploited in breeding programmesto develop lines resistant to stem borers. It also showed positive nonsignificant association with the 100 seed weight (0.083 and 0.086) and seed yield per plant (0.2621 and 0.1554) at both genotypic and phenotypic levels.

Plant height showed positive significant association with cob height (0.405 and 0.360) and cob length (0.404 and 0.354) at both genotypic and phenotypic levels, respectively, indicating simultaneous selection for these traits is possible. Plant height also showed positive nonsignificant association with 100 seed weight (0.178 and 0.147) and seed yield per plant (0.057 and 0.101). Similar results were also obtained by Jawaharlal *et al.* (2011), Sumalini and Manjulatha (2012), Langade *et al.* (2013), Reddy *et al.* (2013), Kumar *et al.* (2014), Ali *et al.* (2015) and Rahman *et al.* (2015).

Cob height showed positive significant association with no. of nodes per plant (0.566 and 0.464), plant height (0.405 and 0.360) and cob length (0.560 and 0.464) at genotypic and phenotypic levels, respectively, indicating the close association and increasing one character will lead to the increase in another character and *vice versa*. Similar results reported by Sumalini and Manjulatha (2012) and Reddy *et al.* (2013).

At genotypic level and phenotypic levels, cob length showed negative nonsignificant association with 100 seed weight (-0.146 and -0.062) and posiyive non significant association with the seed yield per plant (0.255 and 0.155). Similar results were also reported by Jawaharlal *et al.* (2011) and Langade *et al.* (2013) in their experiments in maize.

The path analysis indicated that days to 50 % tasseling, days to 50% silking, number of nodes per plant, cob length and 100 seed weight showed direct positive effects on seed yield per plant (Table 2). This was supported by Kumar and Kumar (2000), Kumar and Singh (2004), Reddy *et al.* (2013), Alake *et al.*(2008), Rafiq *et al.* (2010), Sumalini and Manjulatha (2012), Wali *et al*. (2012), Langade *et al*. (2013), Kumar *et al.* (2014), Ali *et al*. (2015) and Rahman *et al.* (2015). Among all the characters under study direct contribution of 100 seed weight and cob length on the yield is more, indicating that due weightage should be given to these traits in on selection *i.e,* process with more on 100 seed weight and higher cob length and there should be economic balance among these traits to get high seed yield per plant.

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlation of seed yield with other yield traits of maize (*Zea mays* L.).

Character	Days to 50% tasseling	Days to 50% silking	No. of nodes/ plant	Plant height (cm)	Cob height (cm)	Cob length (cm)	100 seed weight(g)	Seed yield/ plant (g)
Days to 50% silking	**1.000**	0.015	0.203	0.182	0.190	0.398**	0.084	0.259*
Days to 50% tasseling	0.019	**1.000**	0.141	0.162	0.008	-0.042	-0.049	0.003
No. of Nodes/ plant	0.155	0.237	**1.000**	0.419**	0.464**	0.297**	0.086	0.155
Plant height (cm)	0.166	0.238	0.526**	**1.000**	0.360**	0.354**	0.147	0.101
Cob height (cm)	0.226	0.010	0.566**	0.405*	**1.000**	0.464**	-0.055	0.088
Cob length (cm)	0.371*	-0.114	0.457**	0.404*	0.560**	**1.000**	-0.062	0.155
100 seed weight (g)	0.041	-0.107	0.083	0.178	-0.058	-0.146	**1.000**	0.269*
Seed yield/ plant (g)	**0.357***	**0.003**	**0.262**	**0.057**	**0.154**	**0.255**	**0.471****	**1.000**

*=significant at 5% level **=significant at 1% level

The direct contribution of plant height is negative (-0.3386) but it showed positive indirect effect *via.* cob length (0.1323) and 100 seed weight (0.1014) at genotypic level. Similar results were also reported by Kumar and Singh (2004), Abirami *et al.* (2007), Langade *et al.* (2013), Reddy *et al.* (2013), Azam *et al.* (2014), Kumar *et al.* (2014) and Ali *et al.* (2015). Direct effect of cob height was also negative (-0.0191) on seed yield per plant but it showed positive indirect effect *via* cob length (0.1835) at genotypic level. Similar results were also reported by Sumalini and Manjulatha (2012), Reddy *et al.* (2013), Azam *et al.* (2014) and Kumar *et al.* (2014).

In plant breeding, it is very difficult to have complete knowledge of all component traits of yield. The residual effect permits precise explanation about the pattern of interaction of other possible components of yield. In other words, residual effect measures the role of possible independent variables which were not included in the study on the dependent variable. In the present study, the residual effect observed was high both at genotypic and phenotypic levels, (0.7322 and 0.9262) because the independent variables studied may not depict the total variation of the seed yield per plant. May be some more morphological and physiological characters have to be considered to denote the total variation of dependent variable *i.e* seed yield per plant.

Days to 50% silking and 100 seed weight showed the positive significant correlation and positive direct effect with the seed yield per plant, indicating true relationship and direct selection through these traits will be effective.

LITERATURE CITED

Abirami S, Vannirajan C, Arumugachamy S and Uma D 2007 Correlation and path analysis for morphological and biochemical traits in maize genotypes. *Plant Archives,* 7 (1): 109-113.

Alake C O, Ojo D K, Oduwaye and Adekoya M K 2008 Genetic variability and correlation studies in yield and yield related characters of tropical maize (*Zea mays* L.). *ASSET An International Journal*, 8 (1):14-27.

Ali Q, Ahsan M, Qasrani S A, Malook I R S U, Sher A, Shakoor A and Mubarik M K 2015 Genetic variability and correlation analysis for various morpho-physiological traits in maize (*Zea mays* L.) for green fodder yield. *American-Eurasian Journal of Agricultural and Environmental Sciences,* 15 (7):1298-1303.

Azam G M D, Umakantha Sarker, Maniruzzam and Bhagya Rani B 2014 Genetic variability of yield and its contributing characters in maize inbreds under drought stress

Falconer D S 1964 *An Introduction to Quantitative Genetics.* Oliver and Boyd, Edinburgh, London. 312-324.

Jawaharlal J, Reddy G L and Kumar R S 2011 Genetic variability and character association studies in maize. *Agricultural Science Digest,* 31 (3): 173-177.

Kumar A and Singh N N 2004 Identification of yield contributors through path analysis in maize. *Annals of Agricultural Research,* 25 (3): 448-450.

Table 2. Direct and indirect effects (genotypic & phenotyptic) of yield components on seed yield in 1 40 genotypes of maize (*Zea mays* L.).

Character		Days to 50% tasseling	Days to 50% silking	No. of nodes/ plant	Plant height (cm)	Cob height (cm)	Cob length (cm)	100 seed weight (g)	Correlation with seed yield /plant (g)
Days to 50% silking	G	**0.2417**	0.0026	0.0287	-0.0564	-0.0043	0.1217	0.0236	0.3576*
	P	**0.1952**	0.0002	0.0168	-0.0070	0.0006	0.0325	0.0217	0.2598*
Days to 50% tasseling	G	0.0047	**0.1346**	0.0438	-0.0809	-0.0002	-0.0374	-0.0608	0.0038
	P	0.0030	**0.0110**	0.0116	-0.0063	0.0000	-0.0034	-0.0128	0.0031
No. of nodes/ plant	G	0.0376	0.0320	**0.1845**	-0.1782	-0.0108	0.1497	0.0473	0.2621
	P	0.0397	0.0015	**0.0825**	-0.0161	0.0014	0.0242	0.0222	0.1554
Plant height (cm)	G	0.0403	0.0321	0.0971	**-0.3386**	-0.0078	0.1323	0.1014	0.0570
	P	0.0356	0.0018	0.0346	**-0.0385**	0.0011	0.0289	0.0379	0.0570
Cob height (cm)	G	0.0547	0.0014	0.1045	-0.1373	**-0.0191**	0.1835	-0.0334	0.1542
	P	0.0372	0.0001	0.0383	-0.0139	**0.0031**	0.0378	-0.0143	0.0882
Cob length (cm)	G	0.0899	-0.0154	0.0844	-0.1369	-0.0107	**0.3272**	-0.0829	0.2556
	P	0.0778	-0.0005	0.0246	-0.0136	0.0014	**0.0814**	-0.0160	0.1552
100 seed weight (g)	G	0.0101	-0.0144	0.0154	-0.0605	0.0011	-0.0478	**0.5672**	0.4710**
	P	0.0164	-0.0005	0.0071	-0.0057	-0.0002	-0.0050	**0.2578**	0.2699*

*=significant at 5% level **= significant at 1% level,
Bold and diagonal values indicate direct effects, Residual effect =0.9262

Kumar M V N and Kumar S S 2000 Studies on character association and path coefficients for grain yield and oil content in maize (*Zea mays* L.). *Annals of Agricultural Research,* 21 (1): 73-78.

Kumar P G, Prashanth Y, Reddy N V, Kumar S S and Rao V P 2014 Character association and path coefficient analysis in maize (*Zea mays* L.). *International Journal of Applied Biology and Pharmaceutical Technology*, 5 (1): 257-260.

Langade D M, Shahi J P, Srivastava K, Singh A and Sharma A 2013 Appraisal of genetic variability and seasonal interaction for yield and quality traits in maize (*Zea mays* L.). *Plant Gene and Trait*. 4 (18): 95-103.

Rafiq C M, Rafique M, Hussain A and Altaf M 2010 Heritability, correlation and path analysis in maize (*Zea mays* L.). *Journal of Agricultural Research*, 48 (1): 35-38.

Rahman M, Talukder M, Mamun M, Hanif M and Uddin M 2015 Studies on Genetic variability, correlation and path analysis of yield attributes in maize genotypes (*Zea mays* L.). *Journal of Chemical, Biological and Physical Sciences,* 5 (4): 3964-3971.

Reddy V R, Jabeen F, Sudarshan M R and Rao A S 2013 Studies on genetic variability, heritability, correlation and path analysis in maize (*Zea mays* L.) over locations. *International Journal of Applied Biology and Pharmaceutical Technology,* 4 (1): 195-199.

Singhal N, Verma S S, Baskheti D C and Kumar A 2006 Heritability, genetic advance, correlation and path-coefficient estimation in high quality protein maize (*Zea mays* L.). *Asian Journal of Biosciences*, 1 (2): 54-56.

Sumalini K and Manjulatha 2012 Heritability, correlation and coefficient analysis in maize. *Maize Journal,* 1 (2): 97-101.

Wali M C, Kachapur R M, Kulkarni V R and Hallikeri S S 2012 Association studies on yield related traits in maize (*Zea mays* L.). *Maize Journal*, 1(2): 131-133.

Wright S 1921 Correlation and causation. *Journal of Agricultural Research,* 20: 557-585.

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