INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

www.ijabpt.com Volume-5, Issue-1, Jan-Mar-2014 Coden : IJABPT Copyrights@ 2014

ISSN : 0976-4550

Received: 03rd Jan-2014 *Revised: 05th Jan-2014* *Accepted: 17th Jan 2014*

Research article

CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS IN MAIZE (*Zea mays* L.)

G. Praveen Kumar[1], Y.Prashanth[2], V. Narsimha Reddy[3], S. Sudheer Kumar[4] and P. Venkateshwara Rao[5]

[1]Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, Hyderabad-30.
[2]Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, Hyderabad-30.
[3]Principal Scientist (Plant Breeding), Maize Research Centre (MRC), A.R.I, R.nagar, Hyderabad-30
[4]Professor, Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, Hyderabad-30.
[5]Professor, Department of plant physiology, College of Agriculture, Rajendranagar, Hyderabad-30.

ABSTRACT: An investigation was carried out on correlation and path analysis for 12 characters on 60 F_1s obtained by crossing 20 inbred lines with three testers using line × tester mating design in maize. Sixty hybrids along with 23 parents and three standard checks were evaluated for twelve characters during *rabi*, 2012-13. The phenotypic character association among the yield components revealed positive association of grain yield per plant with days to maturity, plant height, ear height, ear length, ear girth, number of kernel rows per plant, number of kernels per row, 100-kernel weight and shelling percentage. Grain yield per plant negatively correlated with days to 50 per cent tasseling and days to 50 per cent silking. The path coefficient analysis at phenotypic level revealed that character, 100-kernel weight (0.2863) exhibites the largest direct effect on grain yield per plant followed by number of kernels per row (0.2509) and ear girth (0.2202. Further, days to 50 per cent tasseling, days to 50 per cent silking and days to maturity recorded negative direct effect on grain yield.

Key words: Path Coefficient, Maize, Character

INTRODUCTION

Maize (*Zea mays* L.) is one of the important cereal crops and occupies a prominent position in global agriculture. During the centuries maize plant was known for it's multifariously use. Maize is used like a human food, livestock feed, for producing alcohol and no alcohol drinks, built material, like a fuel, and like medical and ornamental plant (Bekric and Radosavljevic, 2008). Because of very wide utilization of maize, the main goal of all maize breeding programs is to obtain new inbred and hybrids that will outperform the existing hybrids with respect to a number of traits. In working towards this goal, particular attention is paid to grain yield as the most important agronomic characteristic. Grain yield is a complex quantitative trait that depends on a number of factors. Thus, knowledge of interrelationships between grain yield and its contributing components will improve the efficiency of breeding programs through the use of appropriate selection indices (Mohammadi et al., 2003). Path coefficient analysis has been widely used in crop breeding to determine the nature of relationships between grain yield and its contributing components, and to identify those components with significant effect on yield for potential use as selection criteria. Path analysis showed direct and indirect effects of cause variables on effect variables. In this method, the correlation coefficient between two traits is separated into the components which measure the direct and indirect effects. Generally, this method provides more information among variables than do correlation coefficients since this analysis provides the direct effects of specific yield components on yield, and indirect effects via other yield components. Our objective was to determine the relationship between grain yield and related characters. Also, one of the goals this study was founding the direct and indirect effects of morphological traits on grain yield.

MATERIALS AND METHODS

Twenty newly developed inbred lines of maize *viz.*, MRC 1, MRC 2, MRC 3, MRC 4, MRC 5, MRC 6, MRC 7, MRC 8, MRC 9, MRC 10, MRC 11, MRC 12, MRC 13, MRC 14, MRC 15, MRC 16, MRC 17, MRC 18, MRC 19 and MRC 20 were crossed with three testers *viz.*, BML 7, BML 14 and BML 15 during *Kharif*, 2012.

Subsequently, during *Rabi*, 2012-13 the resulting 60 F_1 crosses along with three standard checks (DHM 117, 900M Gold and NK 6240) and parents (lines and testers) were evaluated in randomized block designhn with three replications. Both the crossing and evaluation works were carried out at Maize Research Centre, Agricultural Research Institute, Rajendranagar, Hyderabad. Each entry was sown in two rows of four meters length with a spacing of 75 cm between rows and 20 cm between the plants. The data on twelve quantitative characters namely, plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row, 100 kernel weight, shelling percentage and grain yield per plant were recorded on five randomly selected competitive plants in each replication, whereas days to 50 per cent tasseling, days to 50 per cent silking, days to maturity were recorded on plot basis. Correlation coefficients and path analysis were conducted following the methods of Al-Jibouri *et al*. (1958) and Dewey and Lu (1959), respectively.

RESULTS AND DISCUSSION

In general, genotypic correlations were of higher magnitude than the corresponding phenotypic values which indicates that though there is strong inherent association between characters studied, its expression is lessened due to influence of environment and considering the importance of phenotypic correlation it was discussed in the results. Days to 50 percent tasseling registered significant positive phenotypic correlations with days to 50 per cent silking (0.9532) and days to maturity (0.3065) and significant negative phenotypic correlation with plant height (-0.4791), ear height (-0.4354), ear length (-0.5804), ear girth (-0.4438), number of kernel rows per ear (-0.213), number of kernels per row (-0.5561), 100-kernel weight (-0.4776), shelling percentage (-0.3865), grain yield per plant (-0.6012). Days to 50 percent silking recorded significant positive phenotypic correlation with days to maturity (0.2992) and significant negative phenotypic correlation with plant height (-0.5178), ear height (-0.4704), ear length (-0.6182), ear girth (-0.4726), number of kernel rows per ear (-0.1809), number of kernels per row (-0.5865), 100- kernel weight (-0.5099), shelling percentage (-0.4392) and grain yield per plant (-0.6365). Days to maturity showed significant positive phenotypic correlations with ear length (0.13460), ear girth (0.2852), 100-kernel weight (0.2544) and grain per plant (0.1443). Plant height exhibited significant positive phenotypic correlations with ear height (0.9207), ear length (0.8493), ear girth (0.6782), number of kernels per row (0.8214), 100-kernel weight (0.7019), shelling percentage (0.3426) and grain yield per plant (0.8488). Ear girth exhibited significant positive phenotypic correlations with number of kernel rows per ear (0.2880), number of kernels per row (0.5956), 100-kernel weight (0.7450), shelling percentage (0.2692) and grain yield per plant (0.8016).

Table . Phenotypic (P) and Genotypic (G) correlation coefficient analysis of yield and yield component characters in maize

Character		Days to 50 % silking	Days to maturity	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	Number of kernel rows per ear	Number of kernels per row	100-kernel weight (g)	Shelling percentage	Grain yield per plant (g)
Days to 50 % tasseling	P	0.9532 **	0.3065 **	-0.4791 **	-0.4354 **	-0.5804 **	-0.4438 **	-0.2136 **	-0.5561 **	-0.4776 **	-0.3865 **	-0.6012**
	G	1.0126 **	0.3323**	-0.5164**	-0.4840**	-0.6341**	-0.5006**	-0.2467**	-0.6121**	-0.5093**	-0.5129**	-0.6392**
Days to 50 % silking	P		0.2992 **	-0.5178 **	-0.4704 **	-0.6182 **	-0.4726 **	-0.1809 **	-0.5865 **	-0.5099 **	-0.4392 **	-0.6365**
	G		0.3220**	-0.5506**	-0.5160**	-0.6713**	-0.5187**	-0.2153**	-0.6442**	-0.5571**	-0.5291**	-0.6765**
Days to maturity	P			0.1036	0.0313	0.1346 *	0.2852 **	0.0203	0.1030	0.2544 **	0.0358	0.1443*
	G			0.1048	0.0189	0.1447 *	0.3253**	0.0268	0.1013	0.2849**	0.0451	0.1456*
Plant height (cm)	P				0.9207 **	0.8493 **	0.6782 **	0.0025	0.8214 **	0.7019 **	0.3426 **	0.8488**
	G				0.9676**	0.9014**	0.7393**	0.0062	0.8583**	0.7470**	0.4048**	0.8664**
Ear height (cm)	P					0.7862 **	0.5753 **	-0.0508	0.7858 **	0.5826 **	0.3080 **	0.7666**
	G					0.8678**	0.6641**	-0.0555	0.8503**	0.6610**	0.3830**	0.8174**
Ear length (cm)	P						0.6982 **	-0.0077	0.8888 **	0.7400 **	0.4059 **	0.8878**
	G						0.7598**	-0.0132	0.9430**	0.8018**	0.5134**	0.9301**
Ear girth (cm)	P							0.2880 **	0.5956 **	0.7450 **	0.2692 **	0.8016**
	G							0.3471**	0.6623**	0.8168**	0.3312**	0.8705**
Number of kernel rows per ear	P								-0.0192	-0.0113	0.0045	0.0829
	G								-0.0280	-0.0078	0.0000	0.0973
Number of kernels per row	P									0.6247 **	0.4592 **	0.8454**
	G									0.6888**	0.5402**	0.8755**
100-kernel weight (g)	P										0.4680 **	0.8432**
	G										0.5715**	0.8924**
Shelling percentage	P											0.4915**
	G											0.5739**

P represents Phenotypic correlation coefficient; **G** represents Genotypic correlation coefficient
* Significant at 5 per cent level; ** Significant at 1 per cent level

Number of kernels per row exhibited significant positive phenotypic correlations with 100-kernel weight (0.6247), shelling percentage (0.4592) and grain yield per plant (0.8454). The trait 100-kernel weight exhibited significant positive phenotypic correlations with shelling percentage (0.4680) and grain yield per plant (0.8432). This character exhibited significant positive phenotypic correlations with grain yield per plant (0.4915). Path coefficient analysis allows separation of the direct effect and their indirect effects through other attributes by partitioning the correlations (Wright, 1921). Hence, the path coefficient analysis was undertaken to know the direct and indirect effects in maize. In this study, the phenotypic character association among the yield components revealed positive association of grain yield per plant with days to maturity, plant height, ear height, ear length, ear girth, number of kernel rows per plant, number of kernels per row, 100-kernel weight and shelling percentage. Grain yield per plant negatively correlated with days to 50 per cent tasseling and days to 50 per cent silking, which is similar to the findings of Jawaharlal *et al.* (2011), Raghu *et al*. (2011) and Zerei *et al*. (2012).

Table : Phenotypic (P) and Genotypic (G) path coefficient analysis of yield and yield component characters in maize

Character		Days to 50 % tasseling	Days to 50 % silking	Days to maturity	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	Number of kernel rows per ear	Number of kernels per row	100-kernel weight (g)	Shelling percentae	Grain yield per plant (g)
Days to 50 % tasseling	P	**-0.0295**	-0.0112	-0.0115	-0.0496	-0.0162	-0.0791	-0.0977	-0.0048	-0.1395	-0.1368	-0.0253	-0.6012**
	G	**-0.0398**	0.0974	-0.0432	-0.002	0.0064	-0.1392	-0.1885	0.0019	-0.1512	-0.1331	-0.0479	-0.6392**
Days to 50 % silking	P	-0.0281	**-0.0118**	-0.0113	-0.0536	-0.0175	-0.0842	-0.1041	-0.0040	-0.1472	-0.1460	-0.0287	-0.6365**
	G	-0.0403	**0.0961**	-0.0419	-0.0022	0.0068	-0.1474	-0.1953	0.0017	-0.1592	-0.1456	-0.0494	-0.6765**
Days to maturity	P	-0.009	-0.0035	**-0.0377**	0.0107	0.0012	0.0183	0.0628	0.0005	0.0258	0.0729	0.0023	0.1443*
	G	-0.0132	0.031	**-0.1301**	0.0004	-0.0003	0.0318	0.1225	-0.0002	0.025	0.0745	0.0042	0.1456*
Plant height (cm)	P	0.0141	0.0061	-0.0039	**0.1036**	0.0343	0.1157	0.1493	0.0001	0.2061	0.201	0.0224	0.8488**
	G	0.0205	-0.0529	-0.0136	**0.004**	-0.0128	0.1979	0.2783	0.0000	0.2121	0.1952	0.0378	0.8664**
Ear height (cm)	P	0.0129	0.0055	-0.0012	0.0953	**0.0373**	0.1071	0.1267	-0.0011	0.1972	0.1668	0.0201	0.7666**
	G	0.0192	-0.0496	-0.0025	0.0038	**-0.0133**	0.1905	0.25	0.0004	0.2101	0.1728	0.0358	0.8174**
Ear length (cm)	P	0.0171	0.0073	-0.0051	0.0879	0.0293	**0.1362**	0.1537	-0.0002	0.223	0.2119	0.0265	0.8878**
	G	0.0252	-0.0645	-0.0188	0.0036	-0.0115	**0.2195**	0.286	0.0001	0.233	0.2096	0.048	0.9301**
Ear girth (cm)	P	0.0131	0.0056	-0.0107	0.0702	0.0215	0.0951	**0.2202**	0.0064	0.1494	0.2133	0.0176	0.8016**
	G	0.0199	-0.0499	-0.0423	0.0029	-0.0088	0.1668	**0.3765**	-0.0027	0.1637	0.2135	0.0309	0.8705**
Number of kernel rows per ear	P	0.0063	0.0021	-0.0008	0.0003	-0.0019	-0.0011	0.0634	**0.0223**	-0.0048	-0.0032	0.0003	0.0829
	G	0.0098	-0.0207	-0.0035	0.0000	0.0007	-0.0029	0.1307	**-0.0079**	-0.0069	-0.002	0.0000	0.0973
Number of kernels per row	P	0.0164	0.0069	-0.0039	0.0851	0.0293	0.1211	0.1311	-0.0004	**0.2509**	0.1789	0.03	0.8454**
	G	0.0243	-0.0619	-0.0132	0.0034	-0.0113	0.207	0.2494	0.0002	**0.2471**	0.18	0.0505	0.8755**
100-kernel weight (g)	P	0.0141	0.006	-0.0096	0.0727	0.0217	0.1008	0.164	-0.0003	0.1567	**0.2863**	0.0306	0.8432**
	G	0.0202	-0.0536	-0.0371	0.003	-0.0088	0.176	0.3075	0.0001	0.1702	**0.2614**	0.0534	0.8924**
Shelling percentage	P	0.0114	0.0052	-0.0013	0.0355	0.0115	0.0553	0.0593	0.0001	0.1152	0.134	**0.0654**	0.4915**
	G	0.0204	-0.0509	-0.0059	0.0016	-0.0051	0.1127	0.1247	0.0000	0.1335	0.1494	**0.0935**	0.5739**

Phenotypic residual effect = 0.2807 **Genotypic residual effect = 0.1778**

P represents Phenotypic correlation coefficient; **G** represents Genotypic correlation coefficient. **Bold** values are direct effects
* Significant at 5 per cent level; ** Significant at 1 per cent level

The character, 100-kernel weight (0.2863) exhibited the largest direct effect on grain yield per plant followed by number of kernels per row (0.2509), ear girth (0.2202), ear length (0.1362), plant height (0.1036), shelling percentage (0.0654), ear height (0.0373), number of kernel rows per ear (0.0223), days to 50 per cent silking (-0.0118), days to 50 per cent tasseling (-0.0295) and days to maturity (-0.0377). 100-kernels weight had direct positive phenotypic effect on grain yield per plant (0.2863). It had negative indirect effect through days to maturity (-0.0096) and number of kernel rows per ear (-0.0003). Indirect positive influence of 100-kernels weight on grain yield was observed through days to 50 per cent tasseling (0.0141), days to 50 per cent silking (0.006), plant height(0.0727), ear height (0.0217), ear length (0.1008), ear girth (0.164), number of kernels per row (0.1567) and shelling percentage (0.0306). Similar results of direct positive effect of 100-kernels weight on grain yield was reported by Muhammad Rafiq *et al*. (2010), Ram Reddy *et al.* (2012) and Zarei *et al*. (2012) who found positive direct effect of 100-kernels weight on grain yield.

The high direct effect of 100-kernel weight and number of kernels per row appeared to be the main factor for their strong association with grain yield per plant. Hence direct selection for these traits would be effective. Further, days to 50 per cent tasseling, days to 50 per cent silking and days to maturity recorded negative direct effect on grain yield in the present investigation and this is in agreement with the reports of Venugopal *et al*.(2003) and Kumar *et al*.(2006).
The residual effect was 0.2807 for phenotypic and 0.1778 for genotypic path coefficient analysis. As residual effect is low, it indicates that all the characters studied contributed for grain yield.

CONCLUSION

To conclude, the investigation clearly indicating that the main yield contributing characters in maize are 100-kernel weight, number of kernels per row, ear girth, ear length, shelling percentage, ear height and number of kernel rows. The results thus emphasized the need for selection, based on plant type with greater 100-kernel weight, number of kernels per row, ear girth, ear length and shelling percentage, since these were found to be important contributors for grain yield.

REFERENCES

Mohammadi SA, Prasanna BM, Singh NN. (2003). Sequential path model for determining interrelationships among grain yield and related characters in Maize. Crop Sci. 43:1690-1697.

Al-Jibouri, H.A., Miller, P.A and Robinson, H.F. (1958). Genotypic and environment variances in an upland cotton crops of interspecific origin. Agronomy Journal. 50: 633-634.

Dewey, D.R and Lu, K.H. (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal. 51: 515-518.

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, S., Shahi, J.P., Singh, J and Singh, S.P. (2006). Correlation and path analysis in early generation inbreds of maize (*Zea mays* L.). Crop Improvement. 33 (2): 156-160.

Muhammad Rafiq, ch., Muhammad Rafique, Amer Hussain and Muhammad Altaf. (2010). Studies on heritability, correlation and path analysis in maize (*Zea mays* L.). Journal of Agricultural Research. 48 (1): 35-38.

Ram Reddy, V., Seshagiri Rao, A and Sudarshan, M.R. (2012). Heritability and character association among grain yield and its components in maize (*Zea mays* L.). Journal of Research. ANGRAU. 40 (2): 45-49.

Raghu, B., Suresh, J., Sudheer Kumar, S and Saidaiah, P. (2011). Character association and path analysis in maize (*Zea mays* L.). Madras Agricultural Journal. 98 (1-3): 7-9.

Venugopal, M., Ansari, N.A and Rajani Kanth, T. (2003). Correlation and path analysis in maize. Crop Research Hissar. 25 (3): 525-529.

Wright, S. (1921). Correlation and Causation. Journal of Agricultural Research. 20: 557-585.

Zarie, B., Kahrizi, D., Aboughadareh, A.P. and Sadeghi, F. (2012). Correlation and path analysis for determining interrelationships among grain yield and related characters in corn hybrids (*Zea mays* L.). International Journal of Agriculture and Crop Sciences. 4 (20): 1519-1522.