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Heritability, Character Association and Path Analysis for Grain Yield and Yield Contributing Characters in Maize

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ABSTRACT

An experiment with parents, F1's and Check BH 1576 was conducted in diallel fashion excluding reciprocals during *kharif*, 2007 to study the correlation and path analysis for yield and yield contributing characters in maize. The diallel experiment was conducted to estimate combining ability effects. Along with combining ability effects, heritability, correlation and path analysis were estimated. Results showed that plant height has the highest correlation (r = 0.66) followed by number of kernels per row (r= 0.65) with kernel yield. Results obtained from path analysis revealed that number of kernels per row exhibited the largest direct effect on kernel yield and more important for selecting maize cultivars with high yield among different traits. 100 kernel weight and number of kernels per row had direct effect on kernel yield. Thus, these two traits may be given importance in selecting genotypes for high kernel yield in maize breeding programmes.

Key words : Association, Heritability, Path Analysis, Yield Attributes.

Maize crop plays an important role in the world economy and is valuable ingredient in manufactured items that affect a large proportion of the world Population (Alvi *et al*., 2003). Maize is the third most important cereal food crops of the world after rice and wheat. In India, maize ranks fourth next to rice, wheat and sorghum. Superior position of maize is due to its diversified use as food, feed, fodder and raw material in industries. To meet the ever increasing demand, it is essential to breed new high yielding inbreds and hybrids that will outperform the existing hybrids with respect to a number of traits. As direct selection for grain yield is not effective because of low heritability, it is necessary to know the relation between grain yield and yield contributing traits which had high heritability, so that indirect selection for grain yield can be accomplished. The objective of the present study was to determine relationship between grain yield and yield attributing traits and also to estimate the heritability parameters.

MATERIAL AND METHODS

Eight elite inbred lines of maize *viz.,* BML-15, BML-13, BML-10, CM-132, CM-133, CM-210, CM-209 and CM-119 were selected and crossed in diallel fashion excluding reciprocals during *kharif*, 2007. The resulting 28 crosses along with parents and a standard check BH 1576 were evaluated in randomized block design, replicated thrice, during *rabi*, 2007-08 at Agricultural College Farm, Rajendranagar, Hyderabad. Each entry was represented by a single row of 5 m length. The spacing of 75 x 25 cm was followed between and within the rows. The data were recorded on yield and yield contributing traits *viz.,* days to 50 per cent tasseling, days to 50 per cent silking, days to 50% maturity, plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row, 100 kernel weight and kernel yield. Analysis of variance was carried out according to the standard statistical technique to establish the level of significance among the genotypes. Correlation coefficients were determined as described by Singh and Chaudary (1979).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all traits studied, indicating the existence of sufficient variation in the material studied. The heritability (Table 1) was considerably high (>85%) for grain yield per plant, 100 grain weight, number of kernels per row, ear girth, plant height, 50 per cent tasseling and 50 per cent silking, which are considered to be useful for effective selection. Several scientists or researchers have also reported high heritability estimates for plant height, number of kernels per row (Umakanth and Sunil, 2000; Choudhary and Chaudary, 2002), ear girth (Dawood and Mohammed, 1989), 100 grain

Table 1. Heritability of yield and yield contributing characters in maize.

S.No	Character	Heritability (%)
1	Days to 50 % tasseling	88.19
2	Days to 50 % silking	86.71
3	Days to maturity	77.99
4	Plant height	89.04
5	Ear height	76.89
6	Ear length	79.11
7	Ear girth	89.08
8	Number of kernel rows per ear	74.57
9	Number of kernels per row	85.72
10	100 kernel weight (g)	98.18
11	Grain yield per plant	95.38

Table 2. Phenotypic (P) and Genotypic (G) correlation coefficient analysis of yield and yield contributing characters in maize.

Parents		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 kernels per row	100 Grain Weight	Grain Yield/ plant
Days to 50%	P	1	**0.966****	0.865**	0.069	0.063	0.005	-0.103	-0.249	-0.084	0.046	-0.075
tasseling	G	1	**0.992****	0.942**	0.082	0.096	0.009	-0.123	-0.259	-0.076	0.057	-0.068
Days to 50%	P		1	**0.955****	0.039	0.035	-0.027	-0.111	-0.222	-0.080	0.042	-0.053
silking	G		1	**0.974****	0.054	0.053	-0.018	-0.136	-0.238	-0.076	0.054	-0.043
Days to maturity	P			1	**0.014**	0.039	-0.056	-0.098	-0.144	-0.078	0.039	-0.011
	G			1	**0.041**	0.043	-0.039	-0.139	-0.181	-0.074	0.059	0.014
Plant height	P				1	**0.784****	0.601**	0.497**	-0.09	0.498**	0.399*	0.598**
(cm)	G				1	**0.930****	0.725**	0.532**	-0.108	0.554**	0.422**	0.661**
Ear height (cm)	P					1	**0.521****	0.423**	-0.089	0.342*	0.308	0.444**
	G					1	**0.718****	0.526**	-0.13	0.417*	0.359*	0.502**
Ear length (cm)	P						1	**0.754****	0.05	0.577**	0.347**	0.551**
	G						1	**0.865****	0.079	0.676**	0.391**	0.632**
Ear girth (cm)	P							1	**0.077**	0.459**	0.219	0.477**
	G							1	**0.087**	0.518**	0.230	0.543**
Number of kernel	P								1	**0.104**	-0.133	0.341**
rows per ear	G								1	**0.124**	-0.160	0.416**
Number kernels	P									1	**0.292**	0.601**
per row	G									1	**0.298**	0.649**
100 Grain weight	P										1	**0.604****
	G										1	**0.618****

"**P**" represents Phenotypic correlation coefficient; "**G**" represents Phenotypic correlation coefficient

* Significant at 5 per cent level; ** Significant at 1 per cent level.

Table 3. Phenotypic (P) and Genotypic (G) path coefficient analysis of yield and yield contributing characters in maize.

Parents		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 kernels per row	100 Grain Weight	Grain Yield/plant
Days to 50%	P	**-0.2212**	0.2117	0.1860	0.1461	0.1433	-0.1542	-0.1849	0.1625	0.1698	-0.1910	-0.7433
tasseling	G	**0.6040**	0.5917	0.5195	0.4312	-0.4169	0.4459	0.5125	-0.4602	0.4680	-0.5307	-0.7561
Days to 50%	P	-0.1949	**0.2036**	-0.1710	0.1262	0.1278	-0.1433	-0.1624	0.1495	0.1476	-0.1711	0.7004
silking	G	0.5435	**0.5548**	-0.4804	0.3744	-0.3647	0.4085	0.4531	-0.4214	0.4074	-0.4784	-0.7109
Days to maturity	P	-0.0591	0.0590	**-0.0703**	0.0424	0.0409	0.0424	0.0564	-0.0482	-0.0536	-0.0589	0.6879
	G	0.0248	0.0249	**-0.0288**	0.0190	-0.0179	-0.0184	-0.0238	-0.0207	-0.0223	-0.0247	0.7023
Plant height	P	-0.0994	-0.0933	-0.0909	**0.1506**	0.1279	0.0802	0.0988	0.0937	-0.1104	0.1018	0.7929
(cm)	G	0.1526	0.1442	-0.1407	**0.2137**	0.2024	0.1294	0.1494	0.1498	-0.1679	0.1556	0.8573
Ear height (cm)	P	-0.1459	0.1414	-0.1309	0.1913	**0.2253**	-0.0998	0.1151	0.1265	-0.1742	0.1439	0.7834
	G	0.1463	0.1393	-0.1316	0.2008	**-0.2119**	-0.1004	0.1443	0.1266	-0.1720	0.1433	0.8220
Ear length (cm)	P	0.0323	-0.0326	-0.0280	0.0247	0.0205	**-0.0464**	0.0302	-0.0321	-0.0226	0.0298	0.5218
	G	-0.0669	-0.0667	-0.0579	0.0548	-0.0429	**-0.0906**	-0.0626	0.0665	-0.0461	0.0618	0.5496
Ear girth (cm)	P	0.0981	-0.0936	-0.0942	0.0771	0.0756	-0.0764	**0.1174**	-0.0910	-0.0892	0.1013	0.7418
	G	-0.1328	-0.1278	-0.1292	0.1094	-0.1066	-0.1082	**-0.1565**	0.1255	-0.1198	0.1375	0.7531
Number of kernel	P	0.0222	-0.0222	-0.0207	0.0188	0.0170	-0.0209	0.0234	**-0.0302**	-0.0203	0.0235	0.7266
rows per ear	G	-0.0125	-0.0125	-0.0118	-0.0116	-0.0098	-0.0121	-0.0132	**0.0165**	-0.0113	0.0133	0.7547
Number kernels	P	0.2613	-0.2467	-0.2593	0.2495	0.2633	-0.1661	0.2585	-0.2280	**0.3404**	0.2609	0.8351
per row	G	-0.3855	-0.3654	-0.3856	0.3909	-0.4038	-0.2532	-0.3810	0.3424	**0.4976**	0.3857	0.841
100 Grain weight	P	0.1908	0.1856	0.1851	0.1493	0.1412	0.142	0.1907	-0.172	-0.1693	**0.2209**	0.8062
	G	-0.176	0.1727	0.172	0.1459	0.1354	0.1367	0.176	0.1614	0.1552	**0.2003**	0 .819

Phenotypic residual effect = 0.323; Genotypic residual effect = 0.297;
"**P**" represents Phenotypic path coefficient; "**G**" represents Phenotypic path coefficient;
Bold values are direct effects

weight (Choudhary and Chaudary, 2002) and grain yield per plant (Choudhary and Chaudary, 2002, Alamnieatanaw *et al*., 2006 and Farzana Jabeen *et al.,* 2007).

Results showed that plant height showed highest positive and significant correlation (r = 0.66) (Table 2) with kernel yield, followed by number of kernels per row (r= 0.65), ear length (r= 0.63), 100 kernel weight (r= 0.62), ear girth (r= 0.54), ear height (r= 0.50) and number of kernel rows per ear (r= 0.42). Agrama (1996) reported that the number of rows per ear has the most direct effect on kernel yield. Similar results were reported earlier in maize for the association of kernel yield with plant height (Sadek *et al*., 2006), number of kernels per row (Kumar and Satyanarayana, 2001), ear length (Kumar and Satyanarayana, 2001 and Mohan *et al*., 2002), 100-kernel weight (Kumar and Satyanarayana, 2001 and Sadek *et al*., 2006), ear girth (Gautam *et al*., 1999 and Mohan *et al*., 2002), ear height (Kumar and Satyanarayana, 2001 and Mohan *et al*., 2002). Ear and plant height were significantly correlated with kernel yield, which indicated that taller plants with high ear placement were better yielding as compared to shorter ones with low ear placement (Gautam *et al*., 1999).

The results of path coefficient analysis are mentioned in Table 3. Number of kernels per row exhibited the largest direct effect on grain yield followed by 100 grain weight and number of kernels per row. Similarly, Panchanadhan *et al.* (1978) reported 100 grain weight exerted maximum direct effect on grain yield. Sharma and Kumar (1987) also reported that grain yield of maize was directly influenced by number of kernels per row and 100 grain weight. Hence, direct selection for these traits would be effective. Hundred grain weight and number of kernels per row recorded positive direct effect on grain yield. These findings are in accordance with earlier reports of Mahajan *et al.* (1995), Devi *et al.* (2001) and Mohan *et al.* (2002). Geetha and Jayaraman (2000) also reported that number of kernels per row had direct effect on grain yield. However, the path coefficient analysis studies of Sharma and Kumar (1987) and Devi *et al.* (2001) revealed the positive direct effect of plant height on grain yield. Further, days to 50 per cent tasseling and ear girth recorded negative direct effect on grain yield in the present investigation and this is in agreement with the reports of Kumar and Kumar (1997) and Mohan *et al.* (2002). The results thus emphasized the need for selection based on plant type with greater number of kernels per row, number of kernel rows per ear and 100 grain weight, since these were found to be the important contributors for grain yield.

The results of path analysis showed that number of kernels per row, 100 grain weight, ear girth and number of kernel rows per ear had more importance in selecting different traits of corn in yield.

LITERATURE CITED

Agrama H A S 1996 Sequential path analysis of grain yield and its components in maize. Plant Breeding 115: 343-346.

Alamnietanaw, Murthunjayac W, Salimath P M and Jagadeesha R C 2006 Combining ability and heterosis for grain yield and ear characters in maize. *Karnataka Journal of Agricultural Sciences,* 19(1): 13-16.

Alvi M B M, Rafique M, Tariq S, Hussain A, Mahmood T and Sarwar M 2003 Character association and path coefficient analysis of grain yield and yield components maize (*Zea mays* L.). *Pakistan Journal of Biological Sciences,* 6 (2): 136-138.

Choudhary A K and Chaudary L E 2002 Genetic studies in some crosses of maize (*Zea mays* L.). *Journal of Research*, Birsa Agricultural University, 14: 87-90.

Devi I S, Shaik Mohammed and Mohammed S 2001 Character association and path coefficient analysis of grain yield and yield components in double crosses of maize. Crop Research 21: 355-359.

Farzana Jabeen, Hussain Sahib, K and Satyanarayana E 2007 Combining ability analysis in quality protein maize (*Zea mays* L.). *Crop Research*, 34 (1, 2 & 3): 171-175.

Gautam A S, Mittal R K and Bhandari J C 1999 Correlations and path coefficient analysis in maize (*Zea mays* L.). *Annals of Agricultural Biology Research,* 4:169–71

Geetha K and Jayaraman N 2000 Path analysis in maize (*Zea mays* L.). *Agricultural Science Digest,* 20: 60-1.

Griffing B 1956 Concept of general and specific combining ability in relation to diallel crossing system. *Australian Journal of Biological Sciences,* 9: 463-493.

Kumar A and Kumar D 1997 Correlation studies in maize (*Zea mays* L.). *Annals of Biology,* 13: 271-273.

Kumar P P and Satyanarayana E 2001 Variability and correlation studies of full season inbred lines of maize (*Zea mays* L.). *Journal of Research,* ANGRAU 29: 71-75.

Mahajan V, Gupta A S and Khehra A S 1995 Path analysis in maize over diverse environments. *International Journal of Tropical Agriculture,* 3: 97-101.

Mohan Y C, Singh D K and Rao N V 2002 Path coefficient analysis for oil and grain yield in maize (*Zea mays* L.) genotypes. National Journal of Plant Improvement 4: 75-76.

Panchanadhan R M, Subramanian S and Kolandia Swamy S 1978 Path coefficient study in maize grain yield with yield attributes. *The Madras Agricultural Journal,* 65: 78-80.

Sadek S E, Ahmed M A and El Ghaney H M 2006 Correlation and path coefficient analysis in five parent inbred lines and their six white maize (*Zea mays* L.). *Journal of Applied Sciences Research,* 2(3): 159-167.

Sharma R K and Kumar S 1987 Association analysis for grain yield and some quantitative traits in pop corn. *Crop Improvement,* 14: 201-204.

Singh R K and Chaudary B D 1979 Biometrical methods in quantitative genetic analysis. Kalyani publishers, Ludhiana, New Delhi, India. pp.303.

Umakanth A V and Sunil N 2000 Character association and heritability studies in Harsha maize composite. Bioved. 11: 43-45.

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