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Correlation and Path Coefficient Analysis of Grain Yield and Yield Component Traits in Maize (*Zea mays* L.)

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ABSTRACT

An experiment was conducted to study the correlation and path analysis for eleven characters of maize on 45 F_1S, their 18 parents (15 lines and 3 testers) along with two standard checks raised during *kharif,* 2011. Grain yield was found to be significantly and positively correlated with plant height, ear height, ear girth, number of kernel rows per ear, number of kernels per row, 100-kernel weight at genotypic level while days to 50% tasseling and 50% silking and days to maturity recorded negative and significant association with yield. Path analysis at genotypic level revealed that number of kernels per row had exhibited the maximum positive direct effect followed by ear girth, 100-kernel weight, number of kernel rows per ear, plant height, ear length and ear height.

Key words : Correlation, Grain yield, Path analysis, Maize.

Maize (*Zea mays* L.) is the third most important cereal food crop after wheat and rice. It is produced primarily for animal feed and industrial uses and it is partitioned as follow, about 35% for human nutrition requirement and 65% for animal feed (Kusakiz, 2010). At present, maize has been recognized as an industrial crop because of its diversified products like starch, syrup, glucose, gluten and oil. About 49% of total maize produced is being utilized in the poultry feed industry.

Grain yield is a complex inherited trait, which is highly influenced by environment, therefore direct selection alone is not revealing but indirect selection for other characters which are closely associated with yield will be more effective to increase the efficiency of selection. Correlation and path analysis can assist to determine certain characters to be used in the improvement of the complex characters such as yield. Genotypic correlations reveal the existence of real associations and partitioning the genotypic correlation coefficient of yield components with grain yield into direct and indirect effects will help to estimate the actual contribution of an attribute and its influence through other characters.

The objective of the experiment was to evaluate the genotypic and phenotypic correlations and to estimate the direct and indirect effects of yield component traits on grain yield, which can be kept as the selection criteria.

MATERIAL AND METHODS

Forty five crosses generated by crossing 15 inbred lines with 3 testers during *Rabi,* 2010-11 at Maize Research Centre, Rajendranagar, Hyderabad. The 45 F_1 hybrids thus generated from above Line x Tester crossing program were evaluated in randomized block design with three replications along with parental lines (15 lines and 3 testers) and 2 checks (DHM 115 and DHM 117) at Research farm, College of Agriculture, ANGRAU, Rajendranagar, Hyderabad. Each entry was raised in two rows with a row length of 4m and the spacing maintained was 75 cm between rows and 20 cm between plants. The recommended package of practices was followed to raise a good crop. Observations on grain yield and its 10 important component traits were recorded from five competitive plants which were selected randomly to record observations on days to 50 percent tasseling, days to 50 per cent silking, days to maturity, plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row, 100-kernel weight and grain yield per plant. The mean values were used for statistical analysis. The phenotypic and genotypic correlation coefficients were worked out as per the method suggested by Johnson *et al.* (1955). Path analysis was carried out using the simple correlation coefficient to know the direct and indirect effects of the yield and components of yield as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

Table 4.7. 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)	Grain yield (g per plant)
Days to 50%	P	0.9691**	0.3661**	-0.2135**	-0.1584*	-0.3914**	-0.2287**	-0.1513*	-0.4889**	-0.4260**	-0.5420**
tasseling	G	0.9944**	0.3664**	-0.2296**	-0.1706*	-0.4223**	-0.2669**	-0.1938**	-0.5340**	-0.4396**	-0.5737**
Days to 50%	P		0.3876**	-0.1986**	-0.1315	-0.3836**	-0.2173**	-0.1385	-0.5032**	-0.4154**	-0.5285**
silking	G		0.3935**	-0.2095**	-0.1366	-0.4143**	-0.2485**	-0.1657*	-0.5497**	-0.4396**	-0.5613**
Days tomaturity	P			-0.1027	0.0173	-0.0891	-0.0388	0.0709	-0.3035**	-0.0873	-0.1760**
	G			-0.0823	0.0447	-0.0981	-0.0576	0.0781	-0.3453**	-0.0993	-0.1939**
Plant height(cm)	P				0.7872**	0.6540**	0.6738**	0.4274**	0.5548**	0.4717**	0.6173**
	G				0.8098**	0.7498**	0.7730**	0.4993**	0.6263**	0.5369**	0.6919**
Ear height(cm)	P					0.5264**	0.6208**	0.3996**	0.4904**	0.3615**	0.5656**
	G					0.6068**	0.7223**	0.4729**	0.5505**	0.4085**	0.6288**
Ear length (cm)	P						0.6902**	0.4767**	0.7828**	0.5860**	0.8047**
	G						0.7336**	0.5234**	0.8136**	0.6120**	0.8376**
Ear girth (cm)	P							0.6601**	0.6652**	0.6761**	0.8048**
	G							0.7123**	0.7077**	0.7160**	0.8535**
Number of kernel	P								0.4799**	0.2216**	0.5576**
rows per ear	G								0.5021**	0.2324**	0.5902**
Number of	P									0.5497**	0.8908**
kernels per row	G									0.5600**	0.9006**
100 kernelweight	P										0.7477**
(g)	G										0.7541**

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

Table 4.7. Phenotypic (P) and Genotypic (G) correlation 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)	Grain yield (g per plant)
Days to 50%	P	-0.2572	0.1315	0.0131	0.0106	-0.0131	-0.0218	-0.0311	-0.0164	-0.2428	-0.1147	-0.5420 **
tasseling	G	-1.2958	1.1652	0.0190	0.0130	0.0032	-0.0208	-0.0827	0.0006	-0.3056	-0.0699	-0.5737 **
Days to 50%	P	-0.2492	-0.1357	0.0139	0.0098	-0.0109	-0.0214	-0.0296	-0.0150	-0.2499	-0.1119	-0.5285 **
silking	G	-1.2886	-0.1717	0.0204	0.0119	0.0026	-0.0204	-0.0770	0.0005	-0.3145	-0.0679	-0.5613 **
Days tomaturity	P	-0.0941	0.0526	-0.0358	0.0051	0.0014	-0.0050	-0.0053	0.0077	-0.1507	-0.0235	-0.1760 **
	G	-0.4747	0.4611	-0.0517	0.0047	-0.0008	-0.0048	-0.0178	-0.0002	-0.1976	-0.0153	-0.1939 **
Plant height(cm)	P	0.0549	-0.0270	-0.0037	0.0494	0.0653	0.0365	0.0917	0.0464	0.2756	0.1270	0.6173 **
	G	0.2975	-0.2455	-0.0043	0.0567	-0.0152	0.0369	0.2394	0.0015	0.3584	0.0829	0.6919 **
Ear height(cm)	P	0.0407	-0.0178	0.0006	-0.0389	0.0829	0.0294	0.0845	0.0434	0.2436	0.0973	0.5656 **
	G	0.2210	-0.1601	0.0023	-0.0459	0.0188	0.0298	0.2237	0.0015	0.3150	0.0631	0.6288 **
Ear length (cm)	P	0.1007	-0.0521	-0.0032	-0.0323	0.0436	0.0558	0.0940	0.0517	0.3888	0.1578	0.8047 **
	G	0.5472	-0.4855	-0.0051	-0.0425	-0.0114	0.0492	0.2272	0.0016	0.4656	0.0946	0.8376 **
Ear girth (cm)	P	0.0588	-0.0295	-0.0014	-0.0333	0.0515	0.0385	0.1361	0.0716	0.3304	0.1821	0.8048 **
	G	0.3458	-0.2912	-0.0030	-0.0438	-0.0136	0.0361	0.3097	0.0022	0.4049	0.1106	0.8535 **
Number of kernel	P	0.0389	-0.0188	0.0025	-0.0211	0.0331	0.0266	0.0899	0.1085	0.2383	0.0597	0.5576 **
rows per ear	G	0.2511	-0.1942	0.0040	-0.0283	-0.0089	0.0257	0.2206	0.1031	0.2873	0.0359	0.5902 **
Number of	P	0.1257	-0.0683	-0.0109	-0.0274	0.0407	0.0437	0.0905	0.0521	0.4967	0.1480	0.8908 **
kernels per row	G	0.6920	-0.6441	-0.0179	-0.0355	-0.0103	0.0400	0.2192	0.0016	0.5722	0.0865	0.9006 **
100 kernelweight	P	0.1095	-0.0564	-0.0031	-0.0233	0.0300	0.0327	0.0920	0.0240	0.2730	0.2693	0.7477 **
(g)	G	0.5863	-0.5150	-0.0051	-0.0304	-0.0077	0.0301	0.2218	0.0007	0.3205	0.1545	0.7541 **

Phenotypic residual effect = 0.2521 Genotypic residual effect = 0.1995

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.

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences for 11 quantitative traits. The genotypic correlations in general were higher than the phenotypic correlation, revealing strong inherent relationship among the characters studied which was presented in Table 1. Grain yield showed highly significant positive correlation with plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row and 100 kernel weight. Similar results were reported earlier in maize for association of grain yield with plant height (Swarnalatha Devi and Shaik Mohammad, 2001; Sadek *et al.*2006), ear height (Venu gopat *et al.,* 2003), ear length (Ali Akeel wannows *et al.,* 2010), ear girth (Alok kumar *et al.,* 1999; Pradeep kumar and Satyanarayana, 2001), number of kernel rows per ear (Kumar *et al.,* 2006), number of kernels per row (Geetha and Jayaraman, 2000; Pavan *et al.* 2011), 100-kernel weight (Umakanth and Khan, 2001; Raghu *et al.,* 2011). A significant negative association was observed between grain yield and its component traits such as days to 50 percent tasseling, days to 50 per cent silking and days to maturity (Netaji *et al.,* 2000; Venu gopal *et al.,* 2003) which is useful to identify early and late maturing hybrids.

Path coefficient analysis allows separating direct effect and their indirect effects through other attributes by partitioning correlation, presented in Table 2. Path coefficient analysis revealed that the characters number of kernels per row, ear girth, 100-kernel weight, number of kernel rows per ear, plant height, ear length and ear height had positive direct effects towards grain yield. Direct negative effects on grain yield were attributed by days to 50 per cent tasseling, days to 50 per cent silking and days to maturity. Similar results was found by Kumar *et al*. (2006), Pavan *et al.* (2011) and Raghu *et al.* (2011).

Number of kernels per row had exhibited the maximum positive direct effect followed by ear girth, 100-kernel weight, number of kernel rows per ear, plant height, ear length and ear height. These findings are similar to kumar *et al.* (2001) for Number of kernels per row, Raghu *et al.* (2011) for ear girth 100-kernel weight and number of kernel rows per ear. Number of kernels per row with highest direct effect on grain yield also contributed positive indirect effects through ear girth, 100-kernel weight, number of kernel rows per ear and ear length, which further resulted in highest correlation with grain yield. The residual effects permit precise explanation about the pattern of interaction of other possible components of yield. The phenotypic and genotypic residual effects recorded 0.2521 and 0.1995 respectively, indicates that all characters studied contribute for grain yield.

It may be concluded that plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row and 100-kernel weight had significant positive association with grain yield. Number of kernels per row, ear girth, 100-kernel weight, number of kernel rows per ear had a direct positive effect on grain yield appeared to be the main factor for their strong association with grain yield. Thus direct selection for these traits could be effective for improving maize for high grain yield.

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