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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet

Asian Network for Scientific Information

308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 6 (2): 136-138, 2003
ISSN 1028-8880

Character Association and Path Coefficient Analysis of Grain Yield and Yield Components Maize (*Zea mays* L.)

Muhammad Bashir Alvi, Muhammad Rafique, Muhammad Shafique Tariq,
Amer Hussain, Tariq Mahmood and Muhammad Sarwar
Ayub Agricultural Research Institute, Faisalabad, Pakistan

Abstract: Interrelationships between grain yield and its components were determined by genotypic correlation and path co-efficient analysis in eighteen maize lines/hybrids. The results indicated that grain yield was positively and significantly associated with all parameters studied. The results also showed that number of kernels row^{-1} has maximum positive direct effect on grain yield. It was followed by 1000-kernel weight, ear length and number of rows ear^{-1}. Ear height had negative direct effect on grain yield. It was concluded that number of kernels row^{-1}, 1000-kernel weight, ear length and number of rows ear^{-1} were the main yield components.

Key words*:* *Zea mays*, correlation, path coefficient, yield components, yield, Pakistan

Introduction

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. Correlation studied between yield and yield components and between yield components themselves is a pre-requisite to plan a meaningful breeding programme. Several workers have attempted to determine linkage between the characters on which the selections for high yields can be made. Annapurna *et al.* (1998) found that seed yield was positively and significantly correlated with plant height, ear girth, number of seed row^{-1} and number of rows ear^{-1}. You *et al.* (1998) reported significant correlations between yield and number of rows ear^{-1}, number of grains row^{-1} and 1000-grain weight and also number of grains row^{-1} and number of rows ear^{-1}. Khatun *et al.* (1999) studied that grain yield plant^{-1} was positively and significantly correlated with 1000-grain weight, number of kernels ear^{-1}, ear weight and ear insertion height. Orlyanskll *et al.* (1999) studied that most important traits influencing grain yield are number of grains row^{-1} and number of grain cob^{-1}. Characters like number of grains row^{-1}, 1000-grain weight, cob diameter and plant height are also be useful in improving grain yield in hybrid. Maximum correlation of grain yield was obtained with number of kernels row^{-1} followed by plant height and cob length (Gautam *et al.*, 1999).

Manivannan (1998) found that ear girth, kernel rows, 1000-grain weight, kernels row $^{-1}$ and ear length had significant correlations with seed yield. Mani *et al.* (1999) studied that grain yield plant^{-1} indicated highly significant positive correlation with all the other attributes. Devi, *et al.* (2001) reported that ear length, number of seed rows ear^{-1}, number of seeds row^{-1} and 100-seed weight positively influenced the yield directly and also indirectly through several components.

Materials and Methods

Eight local hybrids viz; FHY-256, FHY-697, FHY-319, FHY-698, FHY-522, FHY-699, FHY-520 and FHY-700 along with their parents and two commercial hybrids as check were sown in randomized complete block design (RCBD) replicated twice during February, 2002 at Maize Research Station, Ayub Agricultural Research Institute ,Faisalabad. Each genotype was sown in two rows of 5m length in each replication. At maturity 10 random plants from each entry within replication were taken to record data for plant height (cm), ear length (cm), ear diameter (cm), number of kernel rows ear^{-1}, number of kernels row^{-1}, 1000-kernel weight and grain yield plant^{-1} (g).

The data were subjected to standard statistical technique for analysis of variance to establish the level of significance among genotypes according to Steel and Torrie (1980). Genotypic coefficient of variability (GCV), Phenotypic coefficient of variability (PCV), heritability estimates in broad sense (h^2), genetic advance (G.A) as percent of means, genotypic (rg) and phenotypic (rp) correlation coefficient were determined as desired by Singh and Chaudhry (1979) whereas path coefficient analysis was made according to Dewey and LU (1959).

Results and Discussion

The differences between GCV and PCV were very low for all characters studied which showed that the environmental effects in the development of these parameters are minimum (Table 1). The range of mean

Table 1: Range, TMS, GCV, PCV, h^2, and GA as percent of mean

Parameters	Range	TMS	GCV(%)	PCV(%)	h^2	GA (% of mean)
Plant height	80-190	1714.99**	19.61	20.47	91.83	56.54
Ear height(cm)	43-101	710.81**	23.29	24.75	88.56	35.44
Ear length(cm)	10-17	8.02**	13.82	14.47	91.15	3.85
Ear diameter(cm)	3.47-4.83	0.38**	9.07	9.75	86.50	0.72
No. of rows ear^{-1}	12-16	2.80**	7.56	8.38	81.41	2.08
No. of kernels row^{-1}	14-37	122.98**	28.52	29.23	95.17	15.57
1000-kernel weight(g)	16-30	2703.56**	15.19	15.39	97.30	74.19
Grain yield Plant^{-1}(g)	47-149	3301.16	38.55	39.86	93.50	79.55

**=Highly significant, TMS= Treatment mean square, GCV=Genotypic coefficient of variability, PCV=Phenotypic coefficient of variability, h^2=heritability, GA=Genetic advance.

Table 2: Genotypic and phenotypic correlation coefficient of various grain yield components with yield in maize

Parameters		Ear height (cm)	1000-kernel weight (g)	Number of kernels/ row	Number of rows/ear	Ear diameter (cm)	Ear length (cm)	Grain yield/ plant (g)
Plant height (cm)	rg	0.9224	0.5801	0.7852	0.5816	0.7089	0.7680	0.7990
	rp	0.9000	0.5503	0.7051	0.5136	0.6580	0.6963	0.7518
Ear height (cm)	rg		0.5020	0.5931	0.4847	0.6546	0.6183	0.6103
	rp		0.4739	0.5342	0.4130	0.5809	0.5856	0.5689
1000-kernel	rg			0.3758	0.1617	0.6595	0.5978	0.6904
weight(g)	rp			0.3638	0.1111	0.6055	0.5874	0.6724
Number of	rg				0.7746	0.7001	0.9038	0.9291
Kernel srow^{-1}	rp				0.6881	0.6345	0.8812	0.8786
Number of	rg					0.7908	0.5701	0.7151
Rows ear^{-1}	rp					0.7084	0.4889	0.6163
Ear diameter	rg						0.6273	0.8295
(cm)	rp						0.5858	0.7686
Ear length (cm)	rg							0.9439
	rp							0.8799

Table 3: Direct and indirect effects of agronomic characters on grain yield

Parameters	Plant height (cm)	Ear height (cm)	1000-kernel weight(g)	Number of kernels row^{-1}	Number of rows ear^{-1}	Ear diameter (cm)	Ear length (cm)	Grain yield plant^{-1}(g)
Plant height (cm)	(0.1304)	-0.1993	0.1739	0.3042	0.0766	0.0835	0.2296	0.7990**
Ear height (cm)	0.1203	(-0.2160)	0.1505	0.2298	0.0638	0.0771	0.1848	0.6103**
1000-kernel weight (g)	0.0756	-0.1084	(0.2999)	0.1456	0.0213	0.0777	0.1787	0.6904**
Number of kernels row^{-1}	0.1024	-0.1281	0.1127	(0.3874)	0.1020	0.0825	0.2702	0.9291**
Number of rows ear^{-1}	0.0758	-0.1047	0.0485	0.3001	(0.1317)	0.9320	0.1705	0.7151**
Ear diameter (cm)	0.0925	-0.1414	0.1978	0.2712	0.1041	(0.1179)	0.1875	0.8295**
Ear length (cm)	0.1002	-0.1336	0.1793	0.0751	0.3502	0.0739	(0.2928)	0.9439**

* = Significant, ** = Highly significant

values for all the traits was high and treatment mean squares (TMS) were significant. GCV was the highest in case of grain yield plant^{-1} followed by number of kernels ear^{-1}, ear height, plant height, 1000-kernel weight and ear length. Heritability was also higher than 80 % for all parameters showing heritable variation among genotypes. Heritability for 1000-kernel weight, number of kernel ear^{-1} and grain yield plant^{-1} was comparatively higher than other traits studied (Table 2). Genetic advance (G.A.) as percentage of mean for grain yield per plant, 1000-kernel weight, plant height and ear height was higher showing that these parameters were under the control of additive genes. Annapurna *et al.* (1998), You *et al.* (1998), Mani, *et al.* (1999) and Manivannan (1998) reported more or less similar findings. Ear length had highly significant correlation with seed yield followed by number of kernels row^{-1}, ear diameters and ear height. Khatun *et al.* (1999) and Devis *et al.* (2001) concluded the same results.

Number of kernels row^{-1} directly contributed the maximum towards grain yield plant^{-1} followed by 1000-kernel weight, ear length and number of kernel rows ear^{-1} (Table 3). Moreover, number of kernels row^{-1} contributed indirectly via all other parameters studied except ear height in the development of grain yield plant^{-1}. Similarly, 1000-kernel weight imparted significant effect on seed yield via ear length and number of kernels row^{-1}. Ear length positively contributed in the development of grain yield plant^{-1} via number of kernels row^{-1} and 1000-grain weight. Number of rows ear^{-1} indirectly contributed positive effect on grain yield via ear diameter, number of kernels row^{-1} and ear length, ear diameter indirectly contributed positive effect via number of kernels row^{-1}, 1000-kernel weight and ear length.

Ear height had negative direct effect on grain yield (Table 3). However, it had indirectly positive effect on grain yield via number of kernels row^{-1}, ear length, 1000-kernel weight and plant height. Plant height contributed indirectly to grain yield via all other parameters except ear height. Similar findings were observed by Gautam *et al.* (1999), Manivannan (1998), Orlyanskll *et al.* (1999) and

Devi *et al.* (2001). From the results of this study it is concluded that effective selection for superior genotype is possible considering number of kernels row^{-1}, 1000-kernel weight, ear length and number of rows ear^{-1}.

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