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Character Association and Path Coefficient Analysis for Grain Yield and its Component Traits in Pearl Millet [*Pennisetum Glaucum* (L.) R.Br.] Hybrids

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Abstract

The present study was carried out on twenty six genotypes of pearl millet [*Pennisetum glaucum* (L.) R.Br.] with view to find out the correlation and path co efficient values among the grain yield components. Grain yield/plant had significant positive association with harvest index (0.800, 0.884) whereas it exhibited significant negative association with days to 50 per cent flowering (-0.381,-0.474) and days to maturity (-0.365,-0.459) at phenotypic and genotypic levels. Path analysis revealed that harvest index (1.0608, 1.0857) and dry fodder yield per plant (0.6208, 0.4415) had highest positive direct effect on grain yield per plant at phenotypic and genotypic level. This indicating that grain yield was mainly a product of direct effects of harvest index and dry fodder yield per plant so selection based on these characters would improve grain yield/plant.

Key words: Pearl millet, Correlation coefficient, Path analysis, Grain yield,

Introduction

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is world's sixth and India's fourth important cereal food crop after rice, wheat and maize. Pearl millet is an important food and fodder crop of short duration in India. Pearl millet is well adapted in areas characterized by drought, low soil fertility, and high temperature. In India, pearl millet occupied an area of 7.95 mha with production of 8.79 mt and productivity 1106 kg/ha, respectively (Anonymous, 2013-2014). Pearl millet is mainly grown in Rajasthan, Uttar Pradesh, Gujarat, Maharashtra, Haryana, Karnataka, Tamil Nadu, Madhya Pradesh, and Andhra Pradesh states of the country. Rajasthan occupies first position in area and production of pearl millet in India. In Rajasthan, it is cultivated on 44.37 lac hectares area with the production of 39.55 lac tonnes and productivity of 892 kg/ha (Anonymous, 2013-2014). The pearl millet grains are very nutritious and form the staple diet of approximately 10 per cent of the population in India.

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It has high protein with slightly superior amino acid profile. It is a good source of protein (11.5%), fat (4.1-6.4%), carbohydrate (59.8-78.2%) and also has good amount of minerals particularly phosphorus and iron (2.8%). The grain yield is a complex character and direct selection for yield is not so much easy. Therefore, selection based on yield components and its contributing characters could be more efficient and reliable, knowledge of inter-relationships between yield and its components and among the component characters is indispensable as plant breeding tools (Izge *et al.,* 2006). In this study, an attempt was made to study the interrelationship among characters and the direct and indirect effects of important yield components on grain yield by adopting correlation and path coefficient analysis, with a view to identify the potential hybrids..This study will determine the criteria for selection that could be effectively used with high yield potential.

Materials and methods

Twenty-six pearl millet hybrids were evaluated in randomized block design with three replications at Agricultural Research Station, Bechwal, Bikaner ($27^0$11' N, 71^0 54 °E and 228.5m m ASL) during kharif 2014 under hyper arid conditions. Each plot consisted of six rows each of 5.0 meter length. The spacing between row to row was 50 cm and between plant to plant was 15 cm. Normal and uniform cultural operations were followed during the crop season to raise a good crop. The experiment was sown on 21 July, 2014 with pre sowing irrigation with the basal application of 20 kg N + 20 kg P/ha. While 20 kg N/ha was applied as top dressed 30 DAS. The observations were recorded on individual plant basis on 10 randomly selected plants from each replication for characters *viz.,* plant height, number of effective tillers per plant, ear length, ear head diameter, harvest index (%), dry fodder yield per plant and grain yield per plant while characters namely days to 50 per cent flowering and days to maturity and 1000-seed weight were recorded on whole plot basis Coefficients of correlation between two characters were determined as suggested by AL-Jibouri *et al.* (1958). Path coefficient analysis was carried out as suggested by Wright (1921) and illustrated by Dewey *et al.*(1959).

Results and Discussion

Complex characteristics such as yield must be related to many individually distinguishable characteristics. It is obvious that grain yield is a complex character that depends up on many independent yield contributing characters, which are regarded as yield components. All changes in the components need not however, be expressed by changes in yield. This is due to varying degree of positive and negative associations between yield and its components and among components themselves. Therefore, selection should be based on these component characters after assessing their association with grain yield per plant.

Correlation Coefficient Analysis

From the perusal of the estimates of phenotypic and genotypic coefficients of variation (Table 1), in general, it was observed that estimates of genotypic correlation coefficients were in most cases higher than their corresponding phenotypic correlation coefficients. More significant genotypic association between the different pairs of characters than the phenotypic correlation means that there is strong association between those characters genetically, but the phenotypic value is lessened by the significant interaction of environment. The correlations of grain yield per plant (g) were positive and significant at phenotypic and genotypic levels with harvest index (0.800, 0.884) also it showed positive and significant correlation with plant height (0.316), number of effective tillers per plant(0.509) and dry fodder yield per plant (0.326) at genotypic levels. Grain yield per plant (g) has negative and significant correlation with days to 50 per cent flowering (-0.381, -0.474) and days to maturity (-0.365, -0.459) at phenotypic and genotypic levels. This trait was non-significantly positively correlated with ear head length (0.028, 0.067) and test weight (0.118, 0.021) at both levels, while it showed non-significant negative correlation with ear head diameter(-0.093, -0.206) . These significantly correlated characters with grain yield per plant (g) need due consideration during any selection programmes. Latha and Shanmunga (1998), Pareek (2002) Thangasamy and Gomathinayagam (2003), Chaudhary et al. (2003) Borkhataria et al. (2005) and Izge et al. (2006) had been reported similar findings of positive and significant correlation for grain yield per plant (g) with yield components.

Table 1: Correlation coefficients analysis in pearl millet hybrids.

		Days to Days to flowering	Days to Maturity	Plant height tillers per plant	No. of effective length	Ear head diameter	Ear head	Test weight (%)	Harvest Index per plant	Biological yield per plant	Seed yield
(1) Days to 50%	P	1.000	0.972**	-0.217	-0.306	-0.257	0.243	-0.355*	-0.557**	0.288	-0.381*
flowering	G	1.000	1.008	-0.254	-0.644**	-0.418**	0.358*	-0.420**	-0.766**	0.522**	-0.474**
(2) Days to maturity		P	1.000	-0.154	-0.271	-0.212	0.212	-0.360*	-0.532**	0.279	-0.365*
		G	1.000	-0.224	-0.700**	-0.367*	0.409*	-0.402**	-0.781**	0.593**	-0.459**
(3) Plant height			P	1.000	0.120	0.243	-0.152	0.159	0.225	0.047	0.237
			G	1.000	0.265	0.346*	-0.265	0.215	0.368*	0.068	0.316*
4) No. of effective				P	1.000	0.213	-0.278	0.117	0.257	-0.063	0.215
tillers/plant				G	1.000	-0.118	-1.013**	0.378*	0.738**	-0.449**	0.509**
(5) Ear head length					P	1.000	-0.068	-0.058	0.082	-0.040	0.028
					G	1.000	-0.342*	-0.046	0.097	-0.046	0.067
(6) Ear head						P	1.000	0.160	-0.181	0.188	-0.093
diameter						G	1.000	0.257	-0.379*	0.280	-0.206
(7) Test weight							P	1.000	0.186	-0.105	0.118
							G	1.000	0.215	-0.267	0.021
(8) Harvest index								P	1.000	-0.392*	0.800**
(%)								G	1.000	-0.154	0.884**
(9 Dry fodder									P	1.000	0.204
yield /plant									G	1.000	0.326*
(10) Grain yield										P	1.000
/ Plant										G	1.000

* Significant at 5% probability level

** Significant at 1% probability level

Path Coefficient Analysis

To obtain clear understanding of association of the genotypic and phenotypic correlation coefficient was partitioned into direct and indirect effects through path coefficient analysis in Table 2. Path coefficient provides an effective way of finding direct and indirect sources of correlation. At phenotypic level, highest direct positive effect on seed yield was observed for harvest index (1.0608) followed by dry fodder yield per plant (0.6208), days to 50 per cent flowering (0.0239) and test weight (0.004).While highest direct negative effect was recorded for days to maturity (-0.0014), Number of effective tillers per plant (-0.0127), ear length (-0.0206), plant height (-0.0256), and ear diameter (-0.0329) similarly at At genotypic level, highest direct positive effect on seed yield was observed for harvest index (1.0857) followed by dry fodder yield (0.4415), days to 50 per cent

flowering (0.1027), test weight (0.0162) and ear head length (0.0076).While highest direct negative effect was recorded for days to maturity (-0.0305) followed by ear head diameter (-0.0759), plant height (-0.0923) and Number of effective tillers per plant (-0.1065).

Conclusion

Correlation studies showed positive and significant correlation of grain yield/plant with harvest index, plant height, number of effective tillers per plant and dry fodder yield per plant at genotypic levels Therefore, selection for the improvement of the grain yield/plant based upon these characters will be effective. Path coefficient analysis further revealed that harvest index and dry fodder yield/plant had positive direct effect on grain yield.

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