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INTER-RELATIONSHIPS AMONG YIELD AND QUALITY PARAMETERS IN PEARL MILLET HYBRIDS UNDER RAINFED CONDITIONS*

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SUMMARY

Correlation studies revealed that the characters viz., ear girth and effective tillers per plant exhibited significant positive phenotypic correlations with grain yield per plant, while protein had positive but non-significant. Path coefficient analysis based on genotypic correlation showed high positive and direct effects on grain yield per plant by ear girth and days to 50 per cent flowering. The high association of ear girth and effective tillers per plant with grain yield per plant; their large direct effects suggested maximum emphasis in selection for improvement of grain yield in pearl millet.

Key words : Pearl millet [*Pennisetum glaucum* (L.) R. Br.], correlation coefficient, path analysis

Pearl millet, a diploid species (2n=14) believed to be originated in West Africa (Stoskopf, 1985), is of great importance in the semi-arid tropics, where it is a stable food for millions of people. The crop is grown commonly under the most difficult farming conditions, including those in drought stricken areas, where soil fertility is low and food supplies are dependent on rainfall. Besides grain as food, its straw is commonly used as feed for animals. Since selection based on yield components and secondary 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). This study will determine the criteria for selection that could be effectively used with high yield potential.

MATERIALS AND METHODS

Thirty pearl millet promising hybrids including two checks (HHB-67 Improved and HHB-226) were grown in a randomized block design (RBD) with three replications in six-row plot of 4 m length with a spacing of 50 x 20 cm under rainfed conditions in Dryland Research Area of Chaudhary Charan Singh Haryana Agricultural University, Hisar. Seeds were sown by hand plough under conserved moisture conditions on 22 July, 2011 and normal cultural practices were followed as per rainfed conditions viz., 40 kg N and 20 kg P_2O_5/ha. The four central rows out of six were used for recording observations. Five competitive and randomly selected plants of each hybrid were used for data collection and observations were recorded for the yield and its component characters studied i. e. days to 50 per cent flowering, plant height, number of nodes, inter-node length, number of productive tillers/plant, ear length, ear girth, 1000-grain weight, days to maturity, protein content, fat content and grain yield/plant. Phenotypic and genotypic linear correlation coefficients were calculated using the formula suggested by Al-Jibouri *et al.* (1958). The correlation coefficients were partitioned into direct and indirect effects using the path coefficient analysis according to Dewey and Lu (1959).

RESULTS AND DISCUSSION

Genotypic and Phenotypic Correlation Coefficients

Genotypic and phenotypic correlation coefficients between all possible combinations of yield

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components and quality traits are presented in Table 1. In general, genotypic correlation coefficients were higher than their respective phenotypic correlation coefficients for most of the combinations among characters under study. Based on phenotypic correlations, the results revealed that only ear girth and effective tillers per plant had positive and significant correlations with seed yield per plant, while protein content also had positive but non-significant correlation, confirming the results of previous workers *viz*., Chaudhary *et al*. (1998), Kumar *et al.* (2002), Pareek (2002) and Vetriventhan and Nirmala Kumari (2007).

Inter-relationship among morphological and yield components exhibited that days to 50 per cent flowering had positive and significant phenotypic correlation coefficient with plant height (0.490), nodes per tiller (0.363) and days to maturity (0.941), whereas plant height showed positive and significant correlation with ear length (0.578), nodes per tiller (0.474), days to maturity (0.474) and test weight (0.416) under rainfed situations., where no pre-sowing and post-sowing irrigation was applied.

Protein and fat contents were neither correlated significantly with seed yield nor with any other morphological and yield components, revealing independency of quality characters with the increase or decrease of other parameters including seed yield. This result is in close agreement with those obtained by earlier workers (Deosthale *et al.*, 1971, Kumar *et al.,* 1983).

Path Coefficient Analysis

The direct and indirect effects different morphological and yield components on seed yield per plant based on partitioning of genotypic correlation coefficients are given in Table 2.

Direct Effects

The direct effects of different traits on seed yield as revealed by the diagonal values suggested that the highest positive and direct effects on grain yield per plant were recorded by ear girth (0.49), days to 50 per cent flowering (0.49), protein content (0.37), nodes per tiller (0.37) and effective tillers per plant (0.32) in that order. On the other hand, days to maturity, plant height, 1000-seed weight, inter-node length and fat content had high but negative direct effects in that order on grain yield per plant. Positive direct effect of ear girth on grain yield per plant is in close agreement with studies of Ramamoorthi *et al.* (1996) and Berlin and Springer (1998).

Indirect Effects

The indirect effects of different traits on grain yield via other characters are represented by off-diagonal values. Perusal of results revealed that besides high direct effects, indirect effects of days to 50 per cent flowering

TABLE 1

Phenotypic (above diagonal) and genotypic correlation coefficients (below diagonal) between various characters in pearl millet under rainfed conditions

Characters	DF	PH	EL	EG	ET/P	N/T	INL	TW	DM	P	F	GY/P
DF		0.490**	0.059	0.262	0.124	0.363*	-0.331	0.132	0.941**	-0.140	0.173	0.000
PH	0.571		0.578**	0.310	-0.173	0.474**	0.051	0.416*	0.474**	0.103	-0.011	-0.157
EL	0.138	0.646		0.319	-0.226	0.150	-0.032	0.204	0.09	0.197	-0.066	-0.081
EG	0.369	0.392	0.320		0.224	0.315	-0.053	0.191	0.203	0.064	0.039	0.363*
ET/P	0.197	-0.179	-0.302	0.285		-0.009	-0.037	-0.316	0.063	-0.009	0.102	0.447*
N/T	0.514	0.678	0.239	0.431	-0.079		-0.030	0.076	0.300	-0.120	0.201	0.053
INL	-0.362	0.006	-0.115	-0.11	-0.058	-0.043		0.232	-0.325	0.224	-0.359	-0.096
TW	0.225	0.580	0.240	0.329	-0.359	0.239	0.309		0.131	0.196	-0.317	-0.130
DM	0.986	0.551	0.214	0.347	0.115	0.455	-0.338	0.185		-0.153	0.163	-0.075
P	-0.150	0.115	0.223	0.076	-0.009	-0.166	0.237	0.234	-0.165		-0.145	0.244
F	0.187	-0.001	-0.066	0.033	0.080	0.279	-0.388	-0.388	0.176	-0.153		-0.017
GY/P	-0.041	-0.168	-0.113	0.508	0.579	0.073	-0.075	-0.181	-0.104	0.288	-0.015	

*, **Significant at P=0.05 and P=0.01 levels, respectively.

DF–Days to 50 per cent flowering, PH–Plant height, EL–Ear length, EG–Ear girth, ET/P–Effective tillers/plant, N/T–Nodes/tiller, INL–Inter-node length, TW–Test weight, DM–Days to maturity, P–Protein content, F–Fat content and GY/P–Grain yield/plant.

TABLE 2
Direct (diagonal) and indirect effects (off-diagonal) on various characters on grain yield in pearl millet under rainfed conditions

Characters	DF	PH	EL	EG	ET/P	N/T	INL	TW	DM	P	F	Genotypic correlation with GY/P
DF	**0.4868**	-0.2341	0.0013	0.1809	0.0625	0.1884	0.0480	-0.0443	-0.6358	-0.0559	-0.0387	-0.0407
PH	0.2779	**-0.4100**	0.0063	0.1924	-0.0567	0.2489	-0.0007	-0.1142	-0.3551	0.0427	0.0002	-0.1683
EL	0.0670	-0.2650	**0.0097**	0.1571	-0.0958	0.0875	0.0153	-0.0472	-0.1381	0.0829	0.0137	-0.1129
EG	0.1795	-0.1608	0.0031	**0.4906**	0.0904	0.1581	0.0146	-0.0648	-0.2238	0.0285	-0.0069	0.5085**
ET/P	0.0959	0.0732	-0.0029	0.1397	**0.3175**	-0.0290	0.0077	0.0708	-0.0741	-0.0035	-0.0167	0.5786**
N/T	0.2500	-0.2781	0.0023	0.2114	-0.0251	**0.3669**	0.0057	-0.0471	-0.2935	-0.0618	-0.0579	0.0728
INL	-0.1761	-0.0023	-0.0011	-0.0541	-0.0184	-0.0157	**-0.1327**	-0.0608	0.2180	0.0883	0.0804	-0.0745
TW	0.1094	-0.2379	0.0023	0.1613	-0.1141	0.0878	-0.0410	**-0.1969**	-0.1190	0.0870	0.0804	-0.1806
DM	0.4799	-0.2257	0.0021	0.1703	0.0365	0.1670	0.0449	-0.0363	**-0.6449**	-0.0613	-0.0365	-0.1041
P	-0.0731	-0.0471	0.0022	0.0375	-0.0030	-0.0609	-0.0315	-0.0460	0.1061	**0.3723**	0.0318	0.2884
F	0.0909	0.0004	-0.0006	0.0163	0.0255	0.1024	0.0515	0.0764	-0.1135	-0.0571	**-0.2072**	-0.0150

Character details are given in Table 1.

via ear girth (0.18) and nodes per tiller (0.19) were high and positive, but high and negative via days to maturity and plant height though genotypic correlation with grain yield was non-significant. Similarly, ear girth had positive indirect effects via days to 50 per cent flowering and nodes per tiller, whereas effective tillers per plant had high positive indirect effects via ear girth, days to 50 per cent flowering, plant height and test weight. Protein content though non-significantly associated but had high direct effect and indirect effect via days to maturity on grain yield.

Path analysis in general further revealed that ear girth contributed positively directly as well as indirectly through most of the characters on grain yield, whereas effective tillers per plant contributed mainly directly under rainfed conditions. High association due to direct effect of effective tillers per plant on grain yield was also in close agreement with Das and Balakrishanan (1994) results. Therefore, besides ear girth and effective tillers per plant, days to 50 per cent flowering and nodes per tiller should be taken into consideration while genetic amelioration for grain yield in pearl millet under rainfed conditions.

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