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Correlation and path analysis for grain yield and its components in pearl millet *(Pennisetum glaucum* (L.) R.Br.)

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Abstract: Seven male sterile lines were crossed with nine testers and the resultant sixty three hybrids were utilized for correlation and path analysis. Grain yield per plant was found to be positively and significantly correlated with plant height, number of productive tillers, earhead length and earhead girth at genotypic level. This indicated the importance of plant height, number of productive tillers, earhead length and earhead girth in influencing the grain yield in pearl millet. The characters, earhead length, 1000 grain weight and days to 50 per cent flowering exerted maximum direct effect on grain yield per plant indicating its importance in determining grain yield per plant, and also number of productive tillers and earhead girth exerted direct effect on grain yield per plant. Selection based on these characters may be helpful in planning efficient breeding programme.

Key words: Correlation, path analysis, yield contributing characters, pearl millet

Introduction

Pearl millet *(Pennisetum glaucum* (L.) R.Br.) is one of the eight major world cereals and fourth in importance after rice, wheat and sorghum in India. Pearl millet is grown in about 10 million ha in India producing 7 million tones of grains (Government of India, 1996). It is grown in most of the states in India, but is found to have concentrated in nine states, namely Rajasthan, Gujarat, Haryana, Maharashtra, Uttar Pradesh, Tamil Nadu, Karnataka, Andhra Pradesh and Madhya Pradesh, thus showing its resilience to grow in most unfavourable environments such as parts of Rajasthan. Tamil Nadu ranks sixth among Indian states both in area and production of pearl millet (Ramasamy *et al,* 1999). Historically, pearl millet breeding research in TamilNadu dates back to late 1930s. The first variety, CO l was released in 1939. The information about the association of different quantitative characters particularly grain yield and its attributes is very much essential in the field of plant breeding. The knowledge on correlation helps in determining the component characters of complex entity. However, the extent of contribution of a particular character to any dependent variable may not be judged from the genetic variation and correlation studies. Where as path coefficient analysis of yield components brings out the relative importance of their direct and indirect effects and gives a clear understanding of their association with seed yield. It permits a critical look to recognize the special forces acting to produce a given correlation and its relative importance. Selection on the basis of direct and indirect effects is much more useful than selection for yield *per se.*

Table 1. Genotypic correlation coefficients among grain yield components of pearl millet

Characters	Days to 50% flowering	Plant height	No.of productive tillers	Earhead length	Earhead girth	1000 grain weight	Grain yield per plant
Days to 50% flowering	1.000	0.338**	0.058	0.042	-0.153	-0.505**	0.101
Plant height		1.000	0.366**	0.295**	0.174	0.035	0.295**
No.of productive tillers			1.000	0.122	0.115	-0.018	0.245*
Earhead length				1.000	0.412*	-0.042	0.816**
Earhead girth					1.000	0.440**	0.544**
1000 gain weight						1.000	0.202
Grain yield per plant							1.000

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

Table 2. Direct (diagonal) and indirect effects of six yield contributing characters on grain yield of pearl millet

Characters	Days to 50% flowering	Plant height	No.of productive tillers	Earhead length	Earhead girth	1000 grain weight	Correlation with grain yield
Days to 50% flowering	0.290	0.098	0.017	0.012	-0.044	-0.147	0.101
Plant height	-0.044	-0.130	-0.047	-0.038	-0.023	-0.005	0.295**
No.of productive tillers	0.010	0.063	0.172	0.021	0.020	-0.003	0.245*
Earhead length	0.033	0.232	0.096	0.787	0.324	-0.033	0.816**
Earhead girth	-0.018	0.021	0.014	0.049	0.119	0.052	0.544**
1000 gain weight	-0.170	0.012	-0.006	-0.014	0.148	0.337	0.202

** Significant at 1 per cent level; * Significant at 5 per cent level. Residual effect = 0.438

Materials and Methods

The present investigation was performed with seven cytoplasmic genic male sterile lines *viz.*, 81 A, LI11A, 732A, ICMA91444, ICMA91777, ICMA94222 and Tib2A and nine testers *viz.*, PT811/10, PT1793, PT2060, PT4450, PT5442, PT5591, PT5749, ICMV221 and Palladam local and their sixty three hybrids. Sixty three hybrids along with their .sixteen parents were grown in a randomized block design with two replications during *rabi*- 2004. Five random plants were selected excluding border plants from each entry and from each replication and were used for taking observations on days to 50 per cent flowering , plant height(cm), number of productive tillers, earhead

length (cm), earhead girth (cm), 1000 grain weight (g) and grain yield per plant (g) and their mean values were subjected to statistical analysis.

The genotypic correlation between yield and its component traits and among themselves were worked out as per the methods suggested by Johnson *et al.* (1955). The significance of genotypic correlation coefficient was tested by referring to the standard table given by Snedecor (1961). Path coefficient analysis was carried out as suggested by Dewey and Lu (1959). The simple correlation coefficients already estimated at genotypic level were utilized for this purpose. By keeping yield as dependent variable and other six yield attributing characters as independent variables, the various direct and indirect effects were estimated. The direct and indirect effects were classified based on the scale given by Lenka and Misra (1973).

Results and Discussion

The nature and the extent of association that existed between the grain yield and its components and the association between the yield component characters were studied. The results on correlation studies are given in Table 1. The genotypic correlation coefficients of grain yield per plant and other characters were further partitioned into direct and indirect effects and the results are presented in the Table 2.

Correlation analysis provides an information about inter relationship between the characters. In the present study, an attempt was made to find out correlation between yield and yield contributing characters in pearl millet, consisting of sixty-three hybrids and sixteen parents.

Plant height, earhead length and earhead girth showed highly significant and positive association with grain yield per plant. This confirmed that these three characters were mostly responsible for determining the yield. Days to 50 per cent flowering recorded non significant positive correlation with grain yield per plant, highly significant positive correlation with plant height, highly significant negative correlation with 1000 grain weight, and significant positive correlation with number of productive tillers and earhead length. These results are in accordance with the findings Navale *et al.* (1995), Madhusudhana and Govila (2001a), Anarase *et al.* (2001) and Manojkumar *et al.* (2002).

Number of productive tillers and earhead length had highly significant positive correlation with plant height, which revealed- that tall plants could contribute to fodder characters coupled with yield. Plant height had a weak association with earhead girth and 1000 grain weight. Number of productive tillers showed non-significant positive correlation with earhead length and earhead girth and non-significant negative correlation with 1000 grain weight. This was in conformity with the earlier reports of Borole and Patil (1991) and Manojkumar *et al.* (2002). Earhead length had a strong positive correlation with earhead girth and non-significant negative correlation with 1000 grain weight. But earhead girth had highly significant positive correlation with 1000 grain weight. These results are in accordance with the findings of Anarase *et al.* (2001).

The path coefficient analysis provides an effective means of partitioning the correlation coefficients into direct and indirect effects and gives a clear understanding of their association with grain yield. Path analysis in the present study revealed that earhead length exerted the highest positive direct effect on grain yield. 1000 grain weight recorded high and positive direct effect on grain yield followed

by days to 50 per cent flowering, number of productive tillers and earhead girth. Plant height had negative direct effect on grain yield per plant. Indirect effects of other characters were also found to be significant towards the grain yield. Earhead girth had highest positive indirect effect on grain yield through earhead length followed by 1000 grain weight. Plant height exerted positive indirect effect through earhead length towards grain yield. Plant height exerted positive indirect effect through plant height and earhead length respectively. Both plant height and earhead length exerted positive indirect effect through earhead girth. The highest negative indirect effect was observed in days to 50 per cent flowering through 1000 grain weight on grain yield, and 1000 grain weight through days to 50 per cent flowering. This was in conformity with Khairwal *et al.* (1990), Anarase *et al.*, (2001) and Manojkumar *et al.* (2002).

The studies on correlation coefficients and path analysis indicated that the characters *viz*., earhead length, earhead girth and plant height were the yield contributing characters in pearl millet. The effect of residual factors over grain yield indicated that 43.80 per cent of variability was uncounted and there might be a few more componential characters other than those studied in the present investigation, which might have been responsible for influencing the grain yield of pearl millet.

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