

DETERMINATION OF GENETIC VARIABILITY PARAMETERS AND PATH COEFFICIENTS FOR MAJOR METRIC TRAITS IN PEARL MILLET (*Pennisetum typhoides* L.)

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ABSTRACT

Phenotypic and genotypic coefficients of variation, heritability, genetic advance and path coefficient for 13 traits were estimated in 27 advance lines of Pearl millet (*Pennisetum typhoides* L.). High estimates of phenotypic and genotypic coefficients, heritability and genetic advance determined the scope for improvising harvest index, grain yield per plant, 1000 grain weight, number of effective tillers per plant, length and girth of panicle, through simple selection. However, there was little variability and scope for selection for days to maturity and 50% flowering in the material. Path analysis further indicated the importance of plant height, harvest index, 1000 grain weight, length of panicle, girth of panicle, leaf length and width, as these characters showed highest direct effect on grain yield.

Key words: Genetic variability, path coefficient, metric traits and *Pennisetum typhoides* L.

INTRODUCTION

Pearl millet is undoubtedly an important crop and has vast potential for genetic improvement amongst all the millets. It is cultivated for grain as well as for fodder purposes in the arid regions. It provides staple food for poor in a short period in the relatively dry tracts of the country. The increase in the grain yield per unit area is the primary objective of a plant breeder. The objective can not be achieved unless high yielding, stable, disease and pest resistance variety is developed for specific zone. For developing hybrids / varieties the selection of improved and advanced inbred lines is a pre requisite. With this objective the present study has been under taken to assess the magnitude of variation and relative importance of different characters in a collection of 27 advance inbred lines. Path coefficient analysis was performed to quantify direct and indirect contributions of yield components and developmental traits on grain yield.

MATERIAL AND METHODS

Twenty seven advance pearl millet populations were grown in Randomized Complete Block Design (RCBD) with three replications at College of Agriculture, J.N.K.V.V., Gwalior (M.P.), situated at an altitude of 211.52m above mean sea level. Each plot comprised of 6 rows, the plot size

was 5 x 3m and keeping 50 cm distances between rows. The plots were spaced at 15 cm distance within the rows. Five competitive plants were randomly selected from the middle rows of each experimental plot to record observations on quantitative characters on plant basis; whereas days to 50% flowering and maturity were recorded on plot basis.

Analysis of variance was performed following the standard statistical procedures. The phenotypic and genotypic coefficients of variability (PCV, GCV) were computed according to the method suggested by Burton¹, heritability (broad sense) and genetic advance (GA) as per Johnson *et. al.* Path coefficient analysis was done using genotypic correlation coefficients as suggested by Dewey and Lu³.

RESULTS AND DISCUSSION

Analysis of variance indicated highly significant differences among the genotypes for all the traits which indicated high amount of variability and provides better scope for selection / hybridization (Table-1). Estimates of coefficients of variation, heritability and genetic advance were presented in Table-2. The phenotypic coefficient values (PCV) were higher than the genotypic coefficient of variation values for all the characters. The consistent behavior of both PCV and GCV at phenotypic and

Table - 1: Estimates of mean squares, range, character mean and S.E. difference

Parameters	Plant Height (cm)	Days to 50% Flowering	Maturity Days	Total tillers per plant	Effective tillers per plant	Leaf length (cm)	Leaf width (cm)	Peduncle length (cm)	Panicle length (cm)	Panicle girth (cm)	1000 grain wt. (g)	Harvest index %	Grain yield per plant
Mean square	1257.3**	11.45**	7.8**	0.91**	0.76**	59.49**	0.66**	35.22**	56.9**	5.98**	16.65**	150.9**	288.09**
Range	(200.47-247)	(36.67-46)	(75.67-80.67)	(1.8-4)	(1.07-3.4)	(64.48-81.84)	(2.82-4.54)	(29.62-42.36)	(18.32-35.82)	(6-11.14)	(5.8-14.54)	(11.11-36.09)	(24.4-60.2)
Character mean	235.97	42.69	77.67	3.08	2.175	70.228	3.7	36.459	25.302	8.278	9.964	21.687	40.067
SE (m) ±	16.159	0.957	0.926	0.247	0.229	1.05	0.133	1.137	0.61	0.138	0.007	1.627	1.021

** Significant at 1% level of significance

Table - 2: Estimates of coefficients of variation, heritability and genetic advance for 13 characters

Parameters	Plant Height (cm)	Days to 50% Flowering	Maturity Days	Total tillers per plant	Effective tillers per plant	Leaf length (cm)	Leaf width (cm)	Peduncle length (cm)	Panicle length (cm)	Panicle girth (cm)	1000 grain wt. (g)	Harvest index (%)	Grain yield per plant
PCV (%)	7.2	4.29	1.9	16.98	21.93	6.25	12.47	9.14	17.13	17.02	23.64	32.54	24.33
GCV (%)	11.05	5.1	2.39	19.61	25.44	6.52	13.23	9.9	17.38	17.14	23.66	33.05	24.83
Heritability (%)	42.4	71	62.8	74.9	74.3	92	88.8	85.1	97.1	98.6	99.8	97	96
GA (% of mean)	9.657	7.48	3.102	30.13	39.07	12.34	24.32	17.36	34.78	34.79	48.67	65.98	49.09

Table - 3: Direct and indirect effects of different plant characters on grain yield in pearl millet

Characters	Plant Height (cm)	Days to 50% Flowering	Maturity Days	Total tillers per plant	Effective tillers per plant	Leaf length (cm)	Leaf width (cm)	Peduncle length (cm)	Panicle length (cm)	Panicle girth (cm)	1000 grain wt. (g)	Harvest index (%)	Correlation coefficient with grain yield/ plant
	Geno.	Pheno.											
1. Plant height	0.626	-0.03	-0.163	-0.005	-0.052	0.08	0.038	0.002	-0.067	-0.035	-0.015	-0.069	0.311** 0.221*
2. Days to 50% flower	0.519	-0.036	-0.184	-0.073	0.131	0.081	0.046	0.001	-0.075	-0.171	-0.035	-0.087	0.118 0.113
3. Maturity	0.492	-0.032	-0.207	-0.021	0.0274	0.064	0.026	0.001	-0.052	-0.083	-0.024	-0.035	0.154 0.14
4. Total tillers per plant	0.012	-0.01	-0.017	-0.25	0.279	0.007	0.003	0.000	0.004	-0.012	-0.005	-0.014	-0.003 0.008
5. Effective tillers per plant	-0.09	-0.013	-0.014	-0.198	0.352	0.003	0.011	0.000	-0.003	-0.129	-0.027	-0.043	0.154 0.119
6. Leaf length	0.312	-0.018	-0.082	-0.012	0.006	0.160	0.062	0.003	-0.082	0.141	-0.011	0.003	0.48** 0.455**
7. Leaf width	0.188	-0.013	-0.043	-0.006	0.032	0.078	0.126	0.001	-0.063	0.264	0.008	-0.056	0.516** 0.47**
8. Peduncle length	0.17	-0.008	-0.04	0.006	0.008	0.066	0.011	-0.006	-0.058	-0.149	-0.026	-0.111	-0.126 -0.119
9. Length of panicle	0.392	-0.025	-0.101	0.01	0.011	0.124	0.075	0.03	0.106	-0.062	-0.027	-0.024	0.270* 0.266*
10. Girth of panicle	-0.035	0.01	0.028	0.005	-0.073	0.036	0.053	-0.001	0.011	0.622	0.044	-0.009	0.69** 0.666**
11. 1000 grain weight	-0.133	0.017	0.067	0.017	-0.131	-0.025	0.013	-0.002	0.039	0.377	0.072	0.184	0.496** 0.485**
12. Harvest index (%)	-0.085	0.006	0.014	0.007	-0.03	0.001	-0.014	-0.001	0.005	-0.011	0.026	0.507	0.425** 0.424**

genotypic levels observed for harvest index, 1000 grain weight suggested that these traits were least influenced by the non-genetic factors. Highest PCV and GCV were recorded for harvest index (33.05 and 32.54), followed by number of effective tillers per plant (25.44 and 21.95), grain yield per plant (24.83 and 24.33), 1000 grain weight (23.66 and 23.64), length of panicle (17.38 and 17.13), girth of panicle (17.14 and 17.02) and total tillers per plant (19.61 and 16.98). The high coefficient of variation for these traits is indicative of high magnitude of variability present in the experimental material. The rest traits exhibited moderate to low PCV and GCV values. Robinson *et al.*, (1949) estimated heritability in cultivated plants and divided in three categories as low (5-10%), medium (10-30%), and high (more than 30%) heritability estimates. In the present study, high heritability was observed for all the traits. High heritability estimates coupled with high genetic advance were observed for harvest index, grain yield per plant, 1000 grain weight, number of effective tillers per plant, length of panicle, girth of panicle and total tillers per plant. High heritability of these traits may be due to additive effects of gene action; which indicates for the possibility of direct selection of these traits.

Correlation studies and path coefficient analysis revealed that grain per plant has

significantly positive correlation with girth of panicle, plant height, 1000 grain weight, leaf width, leaf length, harvest index and length of panicle and negative association with length of peduncle. The association of grain yield per plant with remaining traits was non-significant (Table-3). In pearl millet, Mukherji *et al.*, (1981), Chaubey and Richharia (1993), Savery and Prasad (1994), and Kumar *et al.*, (2002) reported that grain yield was positively associated with plant height, panicle length, panicle girth and 1000 grain weight⁴⁻⁷. The high positive direct effects of plant height, girth of panicle, harvest index and effective tillers per plant was observed on grain yield by path coefficient analysis (Table -3). Total tillers per plant have moderate and negative direct effect on grain yield, while days to maturity, peduncle length and days to 50 % has low negative direct effect on grain yield. High direct effects of number of effective tillers per plant, plant height was reported by Mukherji *et al.* (1982).

Considering the results obtained from path coefficient analysis, it is suggested that due emphasis should be given during selection on the traits like girth of panicle, plant height, number of effective tillers per plant and harvest index for effective improvement of grain yield in the pearl millet genotypes for the defined agro ecological situation.

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