

Variability, Correlation and Path Coefficients in Inbreds of Pearl Millet (*Pennisetum typhoides*)

P. MUKHERJI¹, R. K. AGRAWAL², and R. M. SINGH³

In fifty one inbreds of pearl millet, variability, heritability, genetic advance, correlation and path-co-efficient were studied. Grain yield/plant, plant height and ear length showed high GCV and genetic advance as percentage of mean. Heritability (broad sense) ranged from 16.12% (effective tillers/plant) to 91.44% (ear girth). The correlation of grain yield with plant height, ear length, ear girth and test weight was significant and positive. Effective tillers/plant showed a negative non-significant total correlation with yield, while the direct effect was highly positive. Other important positive direct effects were noticed for plant height and 1000 grain weight. Plant height contributed indirectly to the total correlation of most of the characters with yield.

The present investigation was initiated to study variability, heritability, and genetic advance, for eight characters in pearl millet to study their direct and indirect relationships with grain yield in fifty one inbred of pearl millet.

MATERIAL AND METHODS

Fifty one genetically diverse and elite inbreds of pearl millet were raised in a randomized block design with three replications during *kharif* 1977 at the Agricultural Research Farm, B. H. U., Varanasi. Each plot had three rows of 15 plants spaced at 50 cm between the rows and 15 cm within the rows. Recommended agronomical practices were followed to raise a good crop. Observations were recorded on ten randomly chosen plants from the central row, for days to 50 per cent flowering, total tillers/plant, effective tillers/plant, height, ear length, ear girth, grain

yield/plant and test weight (1000-grain weight).

Plot means were used to compute the analysis of variance, covariance and correlation coefficients following Panse and Sukhatme (1967). The broad sense heritability was estimated according to Allard (1960). The path-coefficient analysis was conducted as described by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The fifty one inbreds in the present study exhibited statistically significant difference among themselves for all the eight characters.

The degree of success in selection programme depends primarily upon the magnitude of heritable variation. In the present study it was evident that the characters which exhibited high herita-

1 Dy. Director, Tassar Silk, Board, Ranchi, 2 Jr. Scientist 3 Head.

Department of Genetics and Plant Breeding, Banaras Hindu University, Varanasi-5

bility did not necessarily have high genetic coefficient of variation and genetic advance as percentage of mean (Table I). Ear girth and ear length had the highest heritability (91.4 per cent and 88.9 per cent), while they showed comparatively the smaller values of GCV (12.9 and 17.8). Low heritability and GCV estimates observed for total and effective tillers/plant were in accordance with the findings of Gupta and Athwal (1966) and Gupta and Nanda (1971a). Fairly high estimates were obtained for heritability and GCV for plant height and yield/plant. High heritability estimates for grain yield and plant height were also recorded by Gupta and Nanda (1971a). However, Gupta and Dhillon (1974) reported low to moderate heritability for grain yield, plant height and test weight.

Grain yield/plant had significant positive genotypic associations with plant height ($r = 0.362$), ear length ($r = 0.504$), ear girth ($r = 0.588$) and test weight ($r = 0.336$), while total and effective tillers/plant were not significantly correlated with yield (Table II). Gupta and Nanda (1971b) and Gupta and Dhillon (1974) also could not establish any significant correlation between yield and tiller number. This antagonism might be due to the negative correlation of tiller number with ear length and ear girth. Singh (1976) observed that negative correlation of effective tillers/plant with ear length, ear girth and test weight resulted in negative association

between effective tillers/plant and yield. The association between grain yield and days to flowering ($r = 0.308$) was nonsignificant. Phul *et al.* (1974) and Gupta and Nanda (1971b) also reported similar results.

With a few exceptions component characters, days to flowering, plant height, ear length, ear girth and test weight were significantly and positively inter-related among themselves. If selection is practiced for any of these components, simultaneous gain for all other characters would be achieved. Significant association of plant height with test weight and no correlation of plant height with 50 per cent earing were reported by Phul *et al.* (1974). The estimates of genotypic correlations were slightly higher in magnitude than the phenotypic associations for most of the character pairs, suggesting differential influence of environment on the expression of the characters.

The grain yield, an ultimate product of the direct and indirect effects of component characters, was positively and directly influenced by effective tillers/plant (1.085), plant height (1.503) and test weight (0.544). Total tillers/plant and ear girth had negative direct effects on grain yield (-2.046 and -42.6). The direct effects of remaining characters, i. e. days to flowering and ear length, were positive but low (Table III). Phul *et al.* (1974) also reported negative direct effects of days to flowering and positive direct effects

of tiller number, plant height and ear length.

Ear girth was significantly and positively correlated with yield, however, its direct effect was negative and moderately high; indirect effects via total tillers/plant, plant height and test weight were responsible for the observed association. Similarly, the non-significant negative correlation between yield and total tillers/plant resulted from high negative indirect effects through effective tillers/plant.

The correlations of effective tillers/plant and plant height with yield were lower in magnitude than their high positive direct effects. The negative indirect effects via total tillers/plant lowered the correlation coefficient. The direct effects and the correlation coefficients of test weight and days to flowering with yield were of similar magnitude. The indirect effects do not seem to influence the actual correlation to any appreciable degree. On the other hand, the indirect effects of ear length via plant height, test weight, total tillers/plant and days to flowering inflated the magnitude of association than the actual effect on grain yield. Phul et al. (1974) reported that plant height and ear length influenced grain yield mainly through tillers.

The present study on path analysis suggests that the improvement in yield through selection can be achieved by concentrating on higher number of effective tillers/plant and greater test

weight. In the material under study however, positive selection for plant height might also improve the yield potential.

REFERENCES

- ALLARD, R. W. 1960. *Principles of Plant Breeding*. John Wiley and Sons, Inc. New York—London.
- BURTON, G. W. 1952. Quantitative inheritance in grasses. *Proc. 6th Int. Grassld. Cong.* 1: 227—83.
- DEWEY, D. R. and K. H. LU. 1959. A correlation and path-coefficient analysis of components of crested wheat grass seed production. *Agron. J.* 51: 515—18.
- GUPTA V. P. and D. S. ATHWAL, 1966. Genetic variability, correlation and selection indices for grain characters in pearl millet. *J. Res. Punjab. agric. Univ. Ludhiana* 3: 111—17.
- GUPTA, V. P. and B. S. DHILLON, 1974. Variation in chemical composition and components of yield in bajra grain. *Indian J. Genet.* 34: 22—26.
- GUPTA, V. P. and G. S. NANDA, 1971a. Role of grain, plant and head characters in improving grain yield of pearl millet. *Indian J. Genet.* 31: 128—31.
- GUPTA, V. P. and G. S. NANDA, 1971b. Component analysis of green fodder yield in bajra. *Indian J. Genet.* 31: 143—44.
- PANSE, V. G. and P. V. SUKHTAME, 1967. *Statistical Methods for Agricultural Workers*. I. C. A. R., New Delhi.
- PHUL, P. S., S. K. GUPTA and K. S. GILL, 1974. Association analysis of some morphological and physiological traits in pearl millet. *Indian J. Genet.* 34: 346—351.
- SINGH, F. 1976. Genetics of downey mildew resistance, yield and yield contributing traits in pearl millet (*Pennisetum typhoides* S & H). Ph. D. Thesis, Dept. of Gen. & P. I. Bred., B. H. U., Varanasi.

TABLE I Estimates of coefficient of variation, heritability and genetic advance for eight characters in pearl millet

Character	Mean ± S.E.	Range	Coefficient of variance		Heritability %	Genetic advance	Genetic advance as % of mean
			Phenotypic	Genotypic			
Days to 50% flowering	57.80 ± 1.70	9.00—73.80	8.33	7.45	79.93	7.93	13.72
Total tillers/ plant	3.33 ± 0.04	1.80—5.33	33.71	14.77	19.20	0.45	13.27
Effective tillers/plant	2.28 ± 0.64	1.20—3.53	37.41	15.12	16.12	0.28	12.28
Plant height	150.87 ± 11.51	7.00—212.93	22.74	20.18	82.36	56.92	37.72
Ear length	24.01 ± 1.23	4.53—37.20	18.93	17.86	86.99	8.33	34.69
Ear girth	1.88 ± 0.06	1.49—2.41	13.61	12.95	91.44	0.46	24.47
Yield/plant	19.16 ± 2.77	7.86—36.18	35.60	30.89	75.30	10.58	55.22
Test weight	8.28 ± 0.41	5.71—10.40	13.38	11.94	79.63	1.82	21.97

TABLE II. Estimates of genotypic and phenotypic (In parenthesis) correlations between eight character pairs in pearl millet

Character	Total tillers/plant	Effective tillers/plant	Plant height	Ear length	Ear girth	Yield/plant	Test weight
Days to 50% flowering	-0.134 (-0.123)	-0.339* (-0.175)	0.074 (0.049)	0.411* (0.343)*	0.215 (0.189)	0.308 (0.252)	0.115 (0.091)
Total tillers/plant		0.716 (0.773)**	0.597** (0.155)	-0.061 (0.031)	-0.399* (-0.110)	-0.113 (-0.088)	0.248 (0.104)
Effective tillers/plant			0.101 (-0.059)	-0.318 (-0.060)	-0.542** (-0.181)	-0.022 (-0.050)	0.192 (0.035)
Plant height				0.277 (0.224)	0.325* (0.290)	0.362* (0.322)	0.102 (0.067)
Ear length					0.414* (0.374)*	0.504** (0.413)*	0.465** (0.394)*
Ear girth						0.588** (0.473)**	0.350* (0.305)
Yield/plant							0.335* (0.251)

* Significant at $P = 0.05$ ** Significant at $P = 0.01$

TABLE III - Path-co-efficient analysis showing direct and indirect effects of seven components on grain yield of pearl millet.

Character	Days to 50% flowering	Total tillers/plant	Effective tillers/plant	Plant height	Ear length	Ear girth	Test weight	Genotypic correlation with yield
Days to 50% flowering	0.270	0.276	-0.318	0.112	-0.041	-0.052	0.962	0.308
Total tillers/plant	-0.036	-2.046	0.776	0.896	-0.007	0.170	0.135	-0.112
Effective tillers/plant	-0.092	-1.465	1.085	0.152	-0.038	0.231	0.105	-0.022
Plant height	0.020	-1.021	0.109	1.503	0.033	-0.138	0.056	0.352*
Ear length	0.111	0.125	-0.345	0.417	0.119	-0.176	0.253	0.504**
Ear girth	-0.058	0.817	-0.588	0.488	0.050	-0.426	0.190	0.588**
Test weight	0.039	-0.509	0.209	0.153	0.556	-0.149	0.544	0.335*

Residual effect = 0.419