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Variance Components and Association Between Grain Yield and its Component in Pearl Millet

L.K. Dubey and V.K. Manga
Central Arid Zone Research Institute, Jodhpur 342 003, India

Abstract: Variability, correlation and heritability were studied in 45 genotypes of pearl millet. The genotypic (GCV) and phenotypic (PCV) coefficients of variation were higher for grain yield and ear head weight. The PCV were higher than the GCV for all the characters studied. High genetic advance along with high percentage of broad sense heritability were observed for ear head weight and dry fodder weight. The grain yield was negatively correlated with days to 50% flowering where as it was positively and significantly correlated with number of ear heads per plot and ear head weight.

Key words: *Pennisetum glaucum* (L) R. Br., correlation, variance components, and heritability.

Pearl millet, an out breeding crop, is endowed with enormous variability for agronomically important traits. Genetic variability plays a vital role in pearl millet since it offers scope for natural and artificial selection to tailor genotypes better suited for diverse agro-ecological conditions. More the genetic variability in the base material, more are the chances of improvement. Besides variability, knowledge about association among grain yield and its component traits is also important, for improving yield through correlated response. Hence the present investigation was undertaken to study variability, correlation and heritability.

Materials and Methods

Nine inbred lines of pearl millet CZI 962; CZI 9613-1; CZI 9624; CZI 9621; CZI 9623; CZI 96/1604; CZI 1676-2; CZI 98/6; CZI 98/9 and their 36 F_1s were planted in a randomized block design with three replications at the Central Arid Zone Research Institute, Jodhpur. Each plot consisted of 4 m long row with row spacing of 60 cm and within row plant to plant distance of 15 cm. Data were recorded in each entry on plant height (cm), effective tillers per plant, ear length (cm), ear girth (cm), days to 50% flowering, number of ear heads per plot, ear head weight (g) plot, grain (g) yield per plot, and dry fodder yield (g) per plot. Threshing ratio (grain weight per ear head weight), total biomass and harvest index (HI) were computed using primary data. Mean values were subjected to analysis of variance. Genotypic and phenotypic correlation and genetic variability parameters were estimated following Singh and Chaudhary (1977).

Results and Discussion

Significant F values for all traits (Table 1) indicated presence of genetic variability for all characters justifying the use of material in the present study. Study of mean and range values for various characters

Table 1. Mean, range and F values of various morphological traits in pearl millet

Traits	Mean	Range	SEm	F value
Plant height (cm)	140.13	85.0-170.3	10.4	3.91
Days to 50% flowering	46.0	41-51	1.8	4.1
Effective tillers per plant	1.4	1.1-3.0	0.21	7.18
Ear length (cm)	22.0	13.3-29.3	2.00	3.94
Ear girth (cm)	2.46	1.83-3.13	0.19	3.26
Number of ear heads per plot	56.2	31.3-103.3	6.36	12.28
Ear head weight (g) per plot	812.7	347.6-1360	100.9	14.94
Threshing ratio	0.57	0.31-0.68	0.04	5.48
Harvest index	0.26	0.18-0.37	0.34	4.72
1000-grain weight (g)	5.6	3.93-9.63	0.11	253.3
Grain yield (g) per plot	467.8	165-791	60.17	16.54
Dry fodder yield (g) per plot	1349	613-2667	249.09	4.40
Biomass	1816.2	744-3355	267.79	6.99

revealed that flowering time ranged from 41 days to 51 days, suggesting the possibility of selecting early flowering material, suited to short growing season of arid environment. Grain yield varied from 165 g per plot to 791 g per plot. Dry fodder yield ranged from 613 g per plot to 2667 g per plot. Variability was also observed for HI and threshing ratio, suggesting the possibility of selecting genotypes with better partitioning of assimilates. Sufficiently large range was observed for 1000 grain weight,

Table 2. Genetic variability parameters of pearl millet

Character	PCV	GCV	h^2 (bs)	GA as per cent of mean
Plant height	12.77	8.97	0.493	12.97
Days to 50% flowering	7.18	5.14	0.512	7.52
Effective tiller per plant	32.35	26.54	0.673	45.0
Ear length	15.66	11.03	0.496	16.0
Ear girth	12.24	8.03	0.430	10.97
Number of ear heads per plant	30.27	26.90	0.790	49.2
Ear head weight	36.16	32.81	0.823	61.31
Threshing ratio	14.02	10.85	0.599	17.54
Harvest index	24.58	18.29	0.554	26.92
1000-grain weight	31.03	25.46	0.673	11.25
Grain yield	39.19	35.88	0.838	67.60
Dry fodder yield	33.05	24.09	0.532	36.18
Biomass	31.27	25.53	0.667	26.42

PCV- Phenotypic coefficient of variability, GCV- Genotypic coefficient of variability, h^2 (bs)- Heritability in broad sense, GA- Genetic advance

Table 3. Correlation between grain yield and its components in pearl millet

	Days to 50% flowering	Effective tillers/ plant	Ear length	Ear girth	No. of ear heads/ plot	Ear head weight	Thresh- ing ratio	Harvest index	1000- grain weight	Grain yield	Dry fodder yield	Biomass
Plant height	0.104	-0.019	0.544	0.295	-0.002	0.201	0.001	0.247	-0.008	0.189	0.026	0.081
Days to 50% floweing	–	-0.085	0.068	-0.156	-0.242	-0.457**	-0.254	-0.406**	-0.104	-0.494**	0.239	-0.347*
Effective tillers/plant		–	-0.138	-0.268	-0.853**	0.389*	-0.241	0.089	0.984**	0.261*	0.243	0.275*
Ear length			–	0.412**	-0.187	0.090	0.003	0.171	-0.141	0.092	-0.041	-0.002
Ear girth				–	-0.291*	-0.039	0.254	0.151	-0.278	0.055	-0.093	-0.055
No. of ear heads/plot					–	0.545**	-0.214	0.148	0.859**	0.408**	0.376*	0.426**
Ear head weight						–	0.400	0.618**	0.399*	0.942**	0.582**	0.760**
Threshing ratio							–	0.442*	-0.241	0.439**	0.161	0.268*
Harvest index									0.102	0.715**	-0.141	0.120
1000-grain weight									–	0.269*	0.246	0.280*
Grain yield										–	0.554**	0.757**
Dry fodder yield											–	0.963**

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

offering chances to select for bold grain type. The genotypic (GCV) and phenotypic (PCV) co-efficients of variation were of high magnitude for grain yield, ear head weight, biomass, number of ear heads per plot and 1000-grain weight, indicating that sufficient variability was available for selection of desirable types (Table 2). Low values for GCV and PCV were observed for days to 50% flowering, ear girth, threshing ratio and ear length. Least difference between GCV and PCV was observed for days to 50% flowering indicating little influence of environment. As evident from difference in GCV and PCV, dry fodder weight was highly influenced by environment. The PCVs were higher than GCVs for all the characters, indicating the role of environmental variance in the total variance.

Heritability estimates in broad sense varied from moderate to high for all the traits. Grain yield, ear head weight and number of ear heads per plot showed high heritability. Navale *et al.* (1991) and Bharmre and Harinarayana (1992) also reported high heritability for grain yield. Comparatively lower magnitude of heritability among the characters studied was observed for ear girth and ear length. Mathur and Mathur (1983) also reported low heritability for these traits. The expected genetic gain expressed as per cent of mean was found to be high for grain yield, ear head weight, number of ear heads per plot and effective tillers per plant, moderate for HI, biomass and dry fodder yield and low for days to 50% flowering, ear girth and 1000-grain weight. Traits showing high genetic gain also had high heritability and genetic variability, hence selection can be exercised to achieve higher manifestation of these traits.

Correlation study revealed that grain yield was positively and significantly associated with effective tillers per plant, number of ear heads per plot, ear head weight, threshing ratio, HI and 1000-grain weight, while it was negatively correlated with days to 50% flowering. Similar trend was also observed by Navale (1989) and Kulkarni (1990). This showed that high yield was associated with earliness under arid environment having short moisture availability period. Threshing ratio, which is considered as an indicator of terminal drought tolerance was found to be positively and significantly associated with HI, grain yield and biomass. This showed that genotypes having higher threshing ratio performed better under terminal moisture stress. Threshing ratio was, however, not associated with dry fodder yield. Since most of the component traits of grain yield had moderate to high heritability, selection for higher manifestation of these component traits can be effectively used to improve grain yield in pearl millet.

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