



Genetic Variability, Heritability and Genetic Advance for Yield and Yield Component Characters among Restorer Lines of Pearl millet [*Pennisetum glaucum* (L.) R. Br.]

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ABSTRACT

An investigation was carried out to study genetic variability, heritability and genetic advance among 182 restorer (R-)lines of pearl millet for twelve characters *viz.*, days to 50% flowering, plant height, ear length, ear diameter, productive tillers per plant, head yield per plant, grain yield per plant, panicle harvest index, fresh stover yield per plant, dry matter yield per plant, 1000 grain weight and grain harvest index. The results revealed that the characters ear length, ear diameter, productive tillers per plant, head yield per plant, grain yield per plant, fresh stover yield per plant, dry matter yield per plant and 1000 grain weight showed high PCV and GCV. High estimates of heritability along with genetic advance (% mean) were observed for plant height, ear length, ear diameter, productive tillers per plant, and 1000 grain weight indicating that the selection for these traits would be more effective.

Key words: *Genetic Advance, Heritability, Pearl millet, Restorer (R-) lines, Variability.*

The genetic variability present in the population is the prerequisite for the success of any crop improvement program. An insight into the magnitude of variability along with heritability and genetic advance helps to measure the amount of progress that could be expected with selection for a particular character. Hence, an attempt was made to study genetic variability, heritability and genetic advance present in the material used in the experiment.

MATERIAL AND METHODS

The material used in the experiment comprised of 182 restorer (R-) lines of Pearl millet and evaluated during *kharif*, 2014 at RP 9A field, ICRISAT, Patancheru, Hyderabad in a Randomized block design with two replications. Observations were recorded on five randomly selected plants for twelve characters *viz.*, days to 50% flowering, plant height, ear length, ear diameter, productive tillers per plant, head yield per plant, grain yield per plant, panicle harvest index, fresh stover yield per plant, dry matter yield per plant, 1000 grain weight and grain harvest index. The planting was done on ridges which were 75 cm apart. Each entry was planted in single row of 2 m length with a

spacing 15 cm between plant to plant, at a uniform depth. Standard agronomic management practices were followed throughout the entire growing period as required. The data were subjected to statistical analysis using GenStat Version 14.0 software and genetic parameters such as phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) as per Burton (1952), heritability in broad sense (h^2_b) and expected genetic advance as percent of mean (GAM) worked out as per Johnson *et al.* (1955) and Hanson (1963).

RESULTS AND DISCUSSION

The analysis of variance for 182 inbred lines of pearl millet for twelve quantitative traits are presented in Table 1 and revealed significant differences among the genotypes for all the characters studied, indicating the presence of variability in the material. The estimates of PCV, GCV, heritability and genetic advance as percent of mean are presented in Table 2. All the characters under study showed wide range of values, revealing ample scope for exploitation of the traits through the process of selection. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters

indicating the influence of environment on expression of these traits. Highest magnitude of PCV and GCV (67.76 and 58.10) were observed for dry matter yield per plant, while lowest PCV (9.59) and GCV (7.34) were recorded by days to 50% flowering and panicle harvest index. This is in agreement with the findings of Kant *et al.* (2012) and Singh *et al.* (2014a) for dry matter yield per plant. The characters *viz.*, ear length, ear diameter, productive tillers per plant, head yield per plant, grain yield per plant, fresh stover yield per plant, dry matter yield per plant and 1000 grain weight recorded high PCV and GCV. These results are in correspondence with the findings of Bika and Shekhawat (2015) for ear length and fresh stover yield per plant Kumar *et al.* (2015) for productive tillers per plant, Chaudhary *et al.* (2012) and Vagadiya *et al.* (2013) for head yield per plant and grain yield per plant, Vinodhana *et al.* (2013) for 1000 grain weight. Moderate PCV and GCV were observed for plant height and grain harvest index. Moderate PCV and low GCV was recorded by panicle harvest index, while low estimates of PCV and GCV were noticed for days to 50% flowering. This indicates that there is considerable amount of variability for majority of the characters studied.

Broad sense heritability estimates ranged from 34.82% (head yield per plant) to 92.87% (ear diameter). High estimates of heritability were observed for days to 50% flowering, plant height, ear length, ear diameter, productive tillers per plant, dry matter yield per plant and 1000 grain weight. These results are in consonance with the findings of Kant *et al.* (2012) and Singh *et al.* (2014a) for days to 50% flowering, plant height, ear length, ear diameter, dry matter yield per plant and 1000 grain weight, Kumar *et al.* (2015) for productive tillers per plant. Moderate estimates of heritability were recorded by head yield per plant, grain yield per plant, panicle harvest index, fresh stover yield per plant and grain harvest index. Similar results were given by Lakshmana *et al.* (2003) and Yahava (2015) for grain yield per plant. Heritability values coupled with genetic advance would be more reliable than heritability estimates alone for selection of characters. The genetic advance expressed as percent of mean values ranged from 9.06 (panicle harvest index) to 82.71 (productive tillers per plant). Except panicle harvest index, dry matter yield per

plant and grain harvest index, remaining characters showed high estimates of genetic advance. The estimates of heritability and genetic advance as percent of mean were high for days to 50% flowering, plant height, ear length, ear diameter, productive tillers per plant, fresh stover yield per plant and 1000 grain weight suggesting that these traits were amenable for further improvement by following simple selection methods. These findings were in agreement with Bika and Shekhawat (2015) for days to 50% flowering, Vinodhana *et al.* (2013), Singh *et al.* (2014a) and Bika and Shekhawat (2015) for plant height, ear length and ear diameter, Singh *et al.* (2014b) and Kumar *et al.* (2015) for productive tillers per plant and 1000 grain weight.

The traits *viz.*, head yield per plant, grain yield per plant and fresh stover yield per plant recorded moderate heritability coupled with high genetic advance indicating the role of both additive and non-additive gene actions in the inheritance of these characters and improvement can be brought about using breeding methods like diallel selective mating or biparental mating followed by selection in advanced generation. These findings were in accordance with that Yahaya *et al.* (2015) for grain yield per plant. The character grain harvest index recorded moderate heritability accompanied with moderate genetic advance, while moderate heritability coupled with low genetic advance were observed for panicle harvest index revealing that these traits are governed by non-additive gene action and can be improved by selection and intermating among selected ones in early generation followed by selection. In contrast to these findings, Singh *et al.* (2014a) and Kumar *et al.* (2015) reported high heritability coupled with high genetic advance for harvest index.

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Table 1. Analysis of variance for yield and yield component characters in Pearl millet (*Pennisetum glaucum* (L.) R. Br.).

Source of variation	d.f.	TB	PH	EL	ED	Till	HYP	GYP	PHI	TGWT	FSYP	DMYP	GHI
Replications	1	13.44	163.73	5.72	7.49	0.36	37.40	71.50	107.00	4970.00	1183.00	0.001	149.24
Treatments	181	39.41**	943.41**	70.72**	64.20**	3.51**	429.40**	237.10**	91.20**	6604.00**	1249.00**	10.65**	60.56**
Error	181	3.415	63.92	2.956	2.373	0.4729	207.6	106.1	43.03	4400	1030	0.4482	26.09

d.f. – degrees of freedom; ** Significant at 1% level

Table 2. Estimates of variability, heritability and genetic advance as percent of mean for yield and yield component characters in pearl millet [*Pennisetum glaucum* (L.) R. Br.].

S. No.	Character	Mean	Range		Coefficient of variation		Heritability in broad sense [$h^2_{(b)}$]	Genetic Advance (GA)	Genetic Advance as percent of mean (GAM)
			Minimum	Maximum	GCV (%)	PCV (%)			
1	TB	48.26	38.50	61.50	8.79	9.59	84.05	8.01	16.60
2	PH	141.79	91.67	204.17	14.79	15.83	87.31	40.44	28.47
3	EL	20.07	10.83	44.50	29.00	30.24	91.98	11.60	57.30
4	ED	27.65	15.19	40.73	20.11	20.87	92.87	11.03	39.92
5	Till	2.68	1.08	9.19	45.98	52.66	76.25	2.22	82.71
6	HYP	48.18	22.86	134.08	21.86	37.04	34.82	12.80	26.57
7	GYP	32.36	13.93	93.21	25.01	40.48	38.17	10.30	31.83
8	PHI	66.82	33.25	77.62	7.34	12.26	35.89	6.05	9.06
10	FSYP	118.27	23.77	578.50	46.25	62.72	50.32	30.60	25.88
11	DMYP	49.82	13.82	312.60	58.10	67.76	64.22	6.68	13.41
9	TGWT	9.41	4.75	15.38	24.00	25.03	91.92	4.46	47.40
12	GHI	33.50	14.35	49.43	12.39	19.65	39.78	5.39	16.10

TB – Days to 50% flowering; PH- Plant height (cm); EL- Ear length (cm); ED- Ear diameter (cm); Till- productive tillers per plant; HYP- Head yield per plant (g/plant); GYP- Grain yield per plant (g/plant); PHI- Panicle harvest index; FSYP- Fresh stover yield per plant (g/plant); DMYP- Dry matter yield per plant (g/plant); TGWT- 1000 grain weight (g) and GHI- Grain harvest index.

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