

Assessment of Genetic Variability, Heritability and Genetic Advance for Seed Yield and its Components in Pearl Millet [*Pennisetum glaucum* (L.) R. Br.] Hybrids under Arid Conditions of Western Rajasthan

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Abstract The present investigation was carried out to estimate genetic variability, heritability and genetic advance among 50 hybrids in pearl millet. Analysis of variance exhibited significant differences among the hybrids for all the studied ten characters indicating presence of good amount of variability. High GCV and PCV were observed for biological yield per plant (g) and seed yield per plant (g) in comparison to other characters indicating the presence of high amount of genetic variability for these characters. Selection for these characters would be effective because the re-

sponse to selection is directly proportional to the variability present in the experimental material. High heritability along with high GCV were recorded for biological yield per plant and high heritability along with high genetic advance as percent of mean was observed for test weight and biological yield. Plant height, ear head length, test weight, biological and seed yield had moderate to high estimate of GCV, PCV and moderate to high heritability. Moderate heritability and genetic advance as percent of mean was observed for days to 50% flowering, plant height, ear head length and ear head diameter. Joint consideration of GCV, heritability along with high genetic advance as percent mean indicated that biological yield per plant (g) and seed yield per plant was mainly under the control of additive gene action. Therefore, direct selection in segregating generation will be responsive for these characters.

Keywords Genetic variability, PCV, GCV, Heritability, Genetic advance.

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Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a major warm season cereal crop of rainfed region mainly in Western Rajasthan. Pearl millet is grown all over the world. India, West Africa, Pakistan and Southern

Table 1. Analysis of variance for different character in pearl millet. * and **=Significance at 5% and 1% level, respectively.

Sl. No.	Characters	Replications (df=2)	Genotypes (df=52)	Error (df=104)
1	Days to 50% flowering	7.93	78.01**	12.23
2	Days to maturity	35.04	131.71**	59.10
3	Plant height (cm)	203.65	590.82**	66.87
4	No. of effective tillers/plant	0.13	0.39**	0.09
5	Ear head length (cm)	6.41	16.79**	2.82
6	Ear head diameter (cm)	0.04	0.17**	0.04
7	Test weight (g)	0.71	3.77**	0.26
8	Harvest index (%)	92.74	285.45**	51.34
9	Biological yield/plant (g)	46.31	182.76**	17.06
10	Seed yield/plant (g)	2.67	61.75**	5.79

Asia are the major pearl millet growing countries in the world. It was originated in West Africa and from there it was introduced into India. It is grown where nothing can be grown. It is an important coarse grain cereal crop of dry land agriculture. It is most important and probably most potential crop among the millets. It can be grown on light textured soil under low moisture condition. It is extensively cultivated as a dual purpose crop under large areas in Africa, Asia and Australia while grown as forage crop only in subtropics of USA. Globally, it ranks 6th among cereal crop in importance followed by wheat, rice, maize, barley and sorghum, while in India it is fourth most important cereal after rice, wheat and sorghum. India is a major pearl millet producing country with 43% of the world area. Pearl millet is traditionally grown as rainfed crop mostly under low soil fertility and rainfall condition. However, it also responds well to irrigation and improved management conditions. India is the largest producer of pearl millet with an annual production of 9.25 million tonnes from an area of 7.0 mha with productivity being 1,250 kg/ha [1]. Rajasthan occupies first position in area and production of pearl millet in India. In Rajasthan, it is cultivated on 40.76 lac hectare area with the production of 44.56 lac tonnes and productivity 1,093 kg/ha [2] which is low because of low moisture and arid conditions prevailing in the state. Out of 4.76 million hectare area under pearl millet in Rajasthan, the share of arid zone in pearl millet cultivation is 2.0 million hectare. The grains

of pearl millet are very nutritious and form the staple diet of approximately 10% of the population in India. It is rich in protein with slightly superior amino acid profile. It is a good source of protein (5.8–20.9%), fat (4.1–6.4%), carbohydrate (59.8–78.2%) and also has good amount of minerals, particularly phosphorus and iron (2.8%).

Genetic reconstruction of a plant type is require for developing high yield genotypes by incorporating and improving yield component therefore evaluation of genotype for genetic variability is essential for present as well as future crop improvement programs. To sustain food wealth and cattle production, pearl millet varieties need to be improved for grain and fodder yield with better quality. Genetic variability for grain yield and its contributing components is prerequisite for selection. The characters should be highly heritable as progress due to selection depends on heritability, selection intensity and genetic advance of the characters [3]. Heritability and genetic advance estimates for different targeted traits help the breeder to apply appropriate breeding methodology in the crop improvement program. Thus, keeping in view all these points mentioned above, the present investigations was undertaken to study genetic variability, heritability and genetic advance for yield components in pearl millet hybrids under arid conditions of Western Rajasthan.

Materials and Methods

The 50 pearl millet hybrids along with three standard check hybrids were raised during *kharif*, 2014 at Agriculture Research Station, Bikaner. The material was evaluated in randomized block design with three replications. Each plot consisted of two rows each of 4 meter length. The spacing between row to row was 50 cm and between plant to plant was 15 cm. The recommended package of agronomic practice was followed to raise a healthy crop. The observations were recorded on individual plant basis on 10 randomly selected plants from each replication for 8 characters viz., plant height, number of effective tillers per plant, ear head diameter, ear length, 1000-seed weight, biological yield per plant, harvest index (%) and seed yield per plant while two characters namely days to

Table 2. Estimates of mean, range, genotypic and phenotypic coefficient of variation, heritability and genetic advance for different characters of pearl millet.

Characters	Mean	Range	GCV %	PCV %	Heritability (%)	Genetic advance	GA % of Mean
1 Days to 50% flowering	53.64	42–63.33	8.73	10.90	64.19	7.73	14.41
2 Days to maturity	83.68	72.66–95	5.88	10.91	29.05	5.46	6.53
3 Plant height (cm)	124.66	96.06–184.28	10.64	12.51	72.31	23.15	18.64
4 No. of effective tillers/plant	1.48	1–2.35	18.37	26.99	46.32	0.38	25.76
5 Ear head length (cm)	20.98	17.12–26.26	10.29	13.04	62.29	3.51	16.73
6 Ear head diameter (cm)	1.29	1.81–2.68	9.94	13.44	54.70	0.34	15.14
7 Test weight (g)	8.09	5.08–10.17	13.35	14.80	81.31	2.01	24.80
8 Harvest index (%)	37.75	21.46–63.26	17.71	25.96	46.54	9.40	24.89
9 Biological yield/plant (g)	42.63	24.87–66.28	22.07	24.11	83.84	17.75	41.64
10 Seed yield/plant (g)	15.95	6.32–26.27	27.07	30.98	76.32	7.77	48.71

50% flowering and days to maturity were recorded on whole plot basis. The genetic variability, heritability and genetic advance were carried out as per standard procedure.

Results and Discussion

The means of all characters were subjected to analysis of variance for experimental design. The mean square values for all the characters studied are presented in Table 1. Analysis of variance exhibited significant differences among the hybrids for all the characters indicating presence of good amount of variability among the hybrids for all the characters used in study. Replications were non-significant for all the characters indicating good homogeneity among replications.

Estimates of various genetic parameters

A wide range of differences for GCV were observed for character indicating considerable amount of variability present among the genotypes. Comparison of coefficient of variance indicated that the phenotypic coefficient of variance was higher than the genotypic coefficient of variance for all the characters which indicated effect of environment on the characters expression. Among all the characters, high GCV and PCV were observed for biological yield per plant (g) and seed yield per plant (g) in comparison to other

characters indicating the presence of high amount of genetic variability for these characters. Selection for these characters would be effective because the response to selection is directly proportional to the variability present in the experimental material. Moderate GCV and PCV were observed for plant height, ear head length and test weight.

The significant variability for most of the characters was reported in natural population of pearl millet by earlier worker viz. High and significant variability for days to 50% flowering [4], for grain yield per plant for dry fodder yield per plant, for number of effective tillers per plant for test weight [5], whereas moderate variability for ear length was reported by Sagar and Sagar [6].

The heritability estimates was high for test weight and biological yield/plant. It was moderate for the characters i.e. days to 50% flowering, ear head length (cm), ear head diameter (cm), plant height and seed yield per plant (g). High heritability along with high GCV were recorded for biological yield per plant. This indicates closeness of respective σ^2_p and σ^2_g value thereby low environmental effect on expression of this characters. Thus phenotypic selection may be effective for this character. High heritability along with moderate GCV was observed for test weight. While moderate heritability and GCV was observed for plant height and ear head length. The days to maturity showed low heritability and low GCV. Similar estimates of high heritability for various char-

acters have been reported by different workers viz., high heritability for dry fodder yield per plant, for grain yield per plant, test weight, plant height and effective tillers per plant was reported earlier [7, 8]. Thus, based on the present study, characters like test weight and biological yield have high heritability along GCV indicating that these traits were comparatively less affected by environments, hence desirable for selection in breeding program.

The estimates of genetic advance as percent of mean were high (>20%) for characters no. of effective tillers per plant, test weight, harvest index, biological yield per plant and seed yield per plant. Whereas it was moderate (10–20%) for days to 50% flowering, plant height, number of effective tillers per plant and ear head length (cm) [9, 10]. It was recorded low for characters days to maturity. Moderate to high estimates of genetic advance for majority of these traits was given by Govindaraj et al. [11].

In the present investigation, high heritability along with high genetic advance as percent of mean was observed for test weight and biological yield. Moderate heritability and genetic advance as percent of mean was observed for days to 50% flowering, plant height, ear head length and ear head diameter. Days to maturity showed low heritability and low genetic advance. In case of lower heritability and genetic advance selection will be poor. While in high heritability and genetic advanced selection will be effective. Similar results were also reported earlier worker viz., by for grain yield per plant and for dry fodder yield per plant and for test weight (g) [12].

High heritability along with high genetic advance as percent of mean was observed for test weight and biological yield. Moderate heritability and genetic advance as percent of mean was observed for days to 50% flowering, plant height, ear head length and ear head diameter. While in high heritability and genetic advanced selection will be effective. Further, joint consideration of GCV, heritability along with high genetic advance as percent mean indicated that biological yield per plant (g) and seed yield per plant was mainly under the control of additive gene action. Thus, direct selection in segregating generation will be responsive for these characters. The mean of hy-

brids, range, coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean for different character given in Table 2.

Conclusion

Analysis of variance exhibited significant differences among the hybrids for all the studied ten characters indicating presence of good amount of variability. Among all the characters, high GCV and PCV were observed for biological yield per plant (g) and seed yield per plant (g) in comparison to other characters indicating the presence of high amount of genetic variability for these characters. High heritability along with high GCV were recorded for biological yield per plant. While test weight and biological yield per plant also had high heritability associated with high genetic advance as per cent of mean. Plant height, ear head length and test weight had high estimate of GCV, PCV and moderate to high heritability Therefore, selection for these characters would be effective.

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