Electronic Journal of Plant Breeding, 6(2): 600-602 (June 2015)
ISSN 0975-928X

Research Note

Genetic variability study in pearl millet (*Pennisetum glaucum* (L.) R. Br. for green fodder yield and related traits

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(Received:26 Dec 2014; Accepted:11 Feb 2015)

Abstract

A field experiment was carried out in pearl millet (*Pennisetum glaucum* (L.) R. Br.) with 30 genotypes including three check varieties, to study genetic variability for green fodder yield and its related characters. The observations were recorded on individual plant basis for five randomly selected plants of each genotype for each replication for plant height, leaf length, leaf width, stem thickness, internode length and spike length. Days to 50% flowering, number of tillers per meter row length, dry matter per cent, dry matter yield, leaf area, green fodder yield and ash content were observed on plot basis. The results revealed that the genotypes were significantly different for all the 13 characters, indicating sufficient variability in the experimental material. The characters dry matter yield, leaf: stem ratio, green fodder yield, leaf area, spike length and number of tillers per meter row length showed high GCV and PCV. High estimates of heritability along with high genetic advance (% of mean) were observed for number of tillers per meter row length, leaf stem ratio, spike length, green fodder yield, dry matter yield and leaf area. Therefore, selection for these characters will be more effective.

Keywords
Pearl millet, Genetic variability, heritability, genetic advance

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is world's sixth and India's fourth important cereal food crop after rice, wheat and maize. Pearl millet is an important food and fodder crop of short duration in India. The efficiency of milch as well as draught animals largely depends upon the supply of quality of ration in which green fodder plays a vital role. In the recent years, shortage of fodder has remained the burning problem which calls for the attention of researchers to initiate efforts that can ensure regular fodder supply for development of dairy farming and improving the cattle wealth. Pearl millet is rated as good source of fodder owing to its prolific regeneration capacity, good growth, heavy tillering, leafiness, thin and succulent stem and capacity to provide nutrients. It is valuable as cattle feed on account of its good utility and high albuminoids and fat content. The straw of this crop is fairly rich in carbohydrates (67%). Some of other important quality aspects of forage are protein (11.6%), lignin, dry matter yield and its digestibility. The development of new high yielding varieties of green fodder requires knowledge of the existing variability and also the extent of association among the yield contributing characters. The variability in plant population is the first need for genetic improvement in any crop. The amount of variability for improving economic characters in the germplasm of any crop sets the limit of progress that can be achieved through selection. The extent of variability is measured by GCV and PCV which provides information about relative amount of variation in different characters. Heritability provides sufficient indication about the cause or complexity of improvement in a character. Development of a plant breeding strategy hinges mainly on the support provided by genetic information on the inheritance and behavior of major quantitative characters associated with the yield or any other economic trait of concern to the plant breeder. Hence the present investigation was undertaken.

The experimental material used in the present investigation consisted of 30 genotypes of pearl millet including three check varieties namely Giant Bajra, RBC-2 and AVKB-19. Genotypes were obtained from AICRP on Forage crops and AICRP on Pearl Millet, Agriculture Research Station (SKRAU), Bikaner, which were differing in growth and morphological characters. The crop was raised during *Kharif* 2012 at Agricultural Research Station (SKRAU), Bikaner. The experiment was laid out in Randomized Block Design with three replications. Each plot consisted of two rows of 4 meter length, spacing between rows was 30 cm. Normal and uniform cultural operations were followed to raise a good crop. The observations were recorded on the basis of five selected plants and average was taken for plant height, leaf length, leaf width, stem thickness, internode length and spike length. The data were recorded on plot basis for days to 50% flowering, number of effective tillers per meter row length, green fodder yield and dry matter yield. The genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated as per formula suggested by Burton (1952) and Johnson *et al.* (1955). Heritability was estimated by the formula as suggested by Johnson *et al.* (1955). The expected genetic advance at 5% selection intensity was calculated by formula as given by Lush (1940) and Johnson *et al.* (1955).

The analysis of variance revealed that genotypes differed significantly for days to 50% flowering, plant height, number of tillers per meter row length, leaf : stem ratio, leaf length, leaf width, stem thickness, internode length, spike length, dry matter yield, dry matter (%), leaf area and green fodder yield indicating that sufficient variability was present in the material for the characters studied. The estimates of GCV, PCV, heritability and GA as per cent of mean for 13 characters was given in Table 1. Comparison of coefficients of variance indicated that phenotypic coefficient of variance was higher than the genotypic coefficient of variance for all the characters, which indicated that the environment plays a role in the expression of characters. The high GCV and PCV were observed for dry matter yield, leaf : stem ratio, green fodder yield, leaf area, spike length and number of tillers per meter row length. It indicates that selection can be applied on the traits to isolate more promising line. Moderate GCV and PCV were observed for plant height, leaf length, dry matter per cent and leaf width This indicates these characters can be improved by the vigorous selection. Low GCV and PCV were observed for internode length and days to 50 % flowering. It indicates that the breeders should go for source of high variability for these traits to make improvement. High and significant variability was reported earlier for leaf: stem ratio by Ghazy *et al.* (2012); for leaf area by Aryana *et al.* (1996); for number of tillers and fodder yield by Vidyadhar *et al.* (2007); for number of tillers, leaf: stem ratio and green fodder yield by Shanmuganathan *et al.* (2006); and for dry matter yield by Nagar *et al.* (2006).

In general the heritability estimates were high for most of characters. High heritability was reported for leaf: stem ratio by Shanmuganathan *et al.* (2006) and Ghazy *et al.* (2012); for green fodder yield by Lakshmana and Guggari (2001), Khatri *et al.* (2002), Bochaliya (2005), Shanmuganathan *et al.* (2006), Vidyadhar *et al.* (2007) and Gangaram (2011); for dry matter yield by Rathore (1993) and Nagar *et al.* (2006) and for leaf area by Bochaliya (2005). Genetic advance as per cent of mean was high for all traits except stem thickness. Stem thickness recorded moderate level of genetic advance as per cent of mean.

To conclude, heritability estimates along with genetic advance were more useful than heritability estimates alone in predicting this response to selection. High heritability along with high genetic advance (% of mean) was observed for number of tillers per meter row length, leaf length, spike length, green fodder yield, dry matter yield and leaf area. In this condition, selection will be more effective. Low heritability and low genetic advance (% of mean) was observed for stem thickness and inter node length, where the response to selection will be poor.

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Table 1. Genetic variation for different characters of pearl millet genotypes

Character	Range	Mean	SE (diff.) ±	GCV	PCV	Heritability (Broad sense) (%)	G.A. as % of mean
Days to 50% flowering	39-61	46.26	2.11	11.32	12.63	80.35	20.90
Plant height (cm)	83.44-215.33	168.88	7.32	19.72	20.42	93.24	39.23
Number of tillers per meter row length	21.67-68	41.66	3.61	27.25	29.25	86.82	52.31
Leaf : Stem ratio	0.14-0.44	0.23	0.02	36.46	38.31	90.60	71.49
Leaf length (cm)	39.1-77.6	61.30	3.22	17.57	18.71	88.14	33.97
Leaf width (cm)	1.93-4.3	3.03	0.29	15.50	19.51	63.10	25.36
Stem thickness (cm)	1.99-3.47	2.63	0.22	12.14	15.79	59.13	19.23
Internode length (cm)	12.3-23.27	18.54	1.28	12.22	14.87	67.61	20.71
Spike length (cm)	10.75-39.1	22.97	1.35	28.91	29.80	94.13	57.78
Dry matter yield (q/ha)	34.43-184.86	99.71	9.93	40.87	42.66	91.81	80.68
Dry matter (%)	16.35-35.66	26.09	2.41	17.04	20.46	69.36	29.23
Leaf area (cm^2)	61.02-206.75	142.35	12.82	29.17	31.19	87.49	56.21
Green fodder yield (q/ha)	132.11-596	382.29	0.36	34.81	36.70	89.96	68.01