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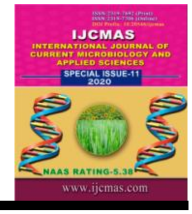

Original Research Article

Character association, Variability and Heritability Studies for Grain Yield and its Yield Attributes in Pearl Millet (*Pennisetum Glaucam* (L.) R. Br)

N. Anuradha*, P. Kranthi Priya, T.S.S.K. Patro, Y. Sandhya Rani and U. Triveni

Acharya NG.Ranga Agricultural University, Agricultural Research Station, Vizianagaram -535 001, A.P., India

**Corresponding author*

ABSTRACT

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is a quick growing *kharif* cereal crop which forms the staple food in arid and semi arid regions of Indian subcontinent and Africa. The experiment material for the present study comprised of 16 pearl millet genotypes including one check variety (ABV 04) which were evaluated at Agricultural Research Station, Vizianagaram, Andhra Pradesh during *kharif*, 2020 to assess character association, genetic variability, heritability and genetic advance for nine yield contributing traits. Analysis of variance revealed significant differences for all the traits included under study indicating ample scope for improvement of yield and various yield attributing characters. High phenotypic coefficent of variation is observed by number of productive tillers per plant (23.92) where as moderate GCV was observed by 1000 seed weight (15.7). High heritability (89.74, 61.18) coupled with high genetic advance as percent of mean (30.80, 23.01) is observed for 1000 test weight and fodder yield respectively indicating preponderance of additive gene action and selection is effective for these traits. Grain yield showed positive association with all the characters while it was negatively correlated with panicle diameter indicating that there is no association between panicle diameter with grain yield.

Keywords

Pearl millet, variability, heritability, genetic advance and correlation

Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] belongs to the family Poaceae (graminae) . It is highly cross-pollinated crop with protogynous flowering and windborne pollination mechanism. Pearl millet is one of the major cereals grown primarily for grain production and it is the fourth most important staple food after rice, wheat, and maize in India. India is the largest producer of this crop in Asia and occupies an area of 6.84 mha with production and productivity of 7.26 mt and 1061 kg/ ha. (Anonymous, 2012-13). Pearl millet is mainly grown in Rajasthan, Western part of Gujarat, Haryana and Western Utter Pradesh. Pearl millet is one of the staple cereal food and fodder crop for 90 million resource poor people, grown especially in arid and semi-arid regions of Asia and Sub-Saharan Africa covering an area of more than 29 where micronutrient deficiencies are particularly concentrated (Shukla *et al*., 2014). It has high protein content with balanced amino acids, carbohydrates and fat. It is also rich in many micronutrients such as calcium, iron and zinc and is free from anti nutritional compounds like tannins (Malhotra and Dhindsa, 1984).

More is the genetic variability in the base material more are the chances for 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

The experiment was conducted with 16 pearl millet genotypes including one check variety (ABV O4). All genotypes were evaluated at Agricultural Research Station, Vizianagaram, Andhra Pradesh during *kharif*, 2020. Genotypes were planted in a randomized complete block design (RCBD) with three replications and a spacing of 50 × 10 cm. per each entry. Every genotype was grown in 6 lines each of 4 m length. Fertilizers, DAP (87 kg/ha), MOP (42 kg/ha) and Urea (22 kg/ha) were applied basally at the time of land preparation and remaining 22 kg/ha Urea was applied three weeks after sowing. Standard management practices were followed to maintain a healthy crop. Observations were recorded on five plants for plant height (cm), number of productive tillers per plant, panicle length (cm), panicle diameter (cm), 1000 test weight (g). Days to 50% flowering, days were recorded by visualizing the entire plot. Fodder yield and grain yield were recorded on per plot basis and then converted into per hectare.

Analysis of variance and summary statistics was calculated as per Panse and Sukathme (1967). Phenotypic and genotypic coefficients of variation (PCV and GCV) were computed as per Burton and Devane (1953). Heritability in broad sense was computed as per Allard (1960). Genotypic and phenotypic correlations were calculated according to Falconer (1981). Heritability and genetic advancement were categorized into low, medium and high as per Johnson *et al*., (1955).

Results and Discussions

Analysis of Variance components (Table 1) revealed significant differences for all the traits included under study indicating presence of adequate amount of variability among different genotype for all those traits.

In the present study Raj 171 (4318 kg/ha) and 86M64 (4198 kg/ha) had significantly showed higher yields when compared with the local check ABV 04 (2697 kg/ha) shown in (Table 2). Dhanashakti was the earliest with 60 days to maturity followed by ICMV 221with 61 days to maturity. These two genotypes can utilized for breeding earliness in pearl millet. The local check variety ABV 04 can be used for breeding non-lodging genotypes since it was observed to be the shortest (149.22cm) among all sixteen genotypes studied. Long panicle length is indicative of getting higher grain yield. ICMV 155(31.22) showed higher panicle length when compared with local check ABV 04(26.33). More panicle diameter was shown by Kaveri super boss (3.81) compared with local check ABV 04 (3.14). More test weight for 1000 grains was shown by ICMV 221 (18.78g) over check variety ABV 04 (7.7g).

The values of PCV obtained for yield and its attributing characters ranged from (6.30) for days to maturity to (23.92) for number of productive tillers per plant (Table 3). The values of GCV ranged from (5.27) for panicle length to (15.78) for 1000 test weight. Similar results were reported by Anuradha *et al*., 2017. Phenotypic coefficient of variability is higher than genotypic coefficient of variability for all the characters indicating that the interaction of genotypes with environment.

Table.1 ANOVA of sixteen pearl millet genotypes

Source of Variations	Df	Mean Sum of Squares								
		DFF	DM	PH	NPT	PL	PD	GY	FY	TSW
Treatments	15	40.3	52.3	497.0	0.7	8.8	0.2	729163.3	2298297.2	16.6
Replications	2	0.4	0.4	736.2	0.2	0.4	0.1	430901.3	785173.8	5.9
Error	30	1.1	0.7	245.6	0.3	2.1	0.1	198319.7	401295.2	0.6

Note: DFF: Days to 50% flowering; DM: Days to maturity; PH: Plant height (cm); NPT: No. of productive tillers per plant; PL: Panicle length(cm); PD: Panicle Diameter; GY: Grain yield (kg/ha); FY: Fodder yield (kg/ha); TSW: Thousand Seed weight

Table.2 Performance of sixteen pearl millet genotypes

S.No	Entry	DFF	DM	PH	NPT	PL	PD	GY	FY	TSW
1	HHB 299	38	67	138.80	2.56	27.95	3.47	3030	6366	14.82
2	NBH 5767	38	68	178.14	3.22	26.70	3.08	3622	4934	15.00
3	Pratap (MH 1642)	39	70	167.75	2.67	29.94	3.21	3820	5399	14.08
4	NBH 4903	43	74	181.24	1.78	28.76	2.97	3204	6402	15.87
5	NBH 5061	42	72	190.06	2.33	27.79	3.28	3862	5126	14.35
6	86M86	39	68	169.38	3.22	29.59	3.55	3375	6180	12.78
7	Kaveri Super Boss	43	74	164.87	3.11	29.24	3.81	3733	7465	14.73
8	86M64	40	71	172.74	3.11	28.70	3.45	4198	5934	14.05
9	GHB 558	34	65	163.61	3.44	25.93	3.67	3135	5210	15.12
10	Dhanshakti	32	60	168.12	2.02	27.74	3.45	3123	4745	17.65
11	ICMV 221	32	61	180.63	2.67	25.30	3.66	2883	4354	18.78
12	Pusa Comp. 612	37	66	180.75	2.56	30.97	3.16	4003	5784	14.55
13	ABV 04	40	70	174.01	2.89	27.91	3.45	3102	6595	14.40
14	Raj 171	34	62	178.20	3.22	29.26	3.03	4318	5441	16.32
15	ICMV 155	36	66	180.45	2.11	31.22	3.10	3060	4790	13.33
16	LC	33	63	149.22	2.67	26.33	3.14	2697	4375	7.87
	Mean	37	67	171.12	2.72	28.33	3.34	3448	5569	14.61
	CD (1%)	2.39	1.94	35.19	1.19	3.27	0.63	999.78	1422.17	1.75
	CD (5%)	1.77	1.44	26.13	0.88	2.43	0.47	742.48	1056.17	1.30
	CV (%)	2.84	1.29	9.16	19.41	5.14	8.43	12.92	11.38	5.34

Note: DFF: Days to 50% flowering; DM: Days to maturity; PH: Plant height (cm); NPT: No. of productive tillers per plant; PL: Panicle length(cm); PD: Panicle Diameter; GY: Grain yield (kg/ha); FY: Fodder yield (kg/ha); TSW: Thousand Seed weight

Table.3 Genetic parameters of sixteen pearl millet genotypes

S.No	Parameter	DFF	DM	PH	NPT	PL	PD	GY	FY	TSW
1	**Mean**	37	67	171.12	2.72	28.33	3.34	3448	5569	14.61
2	**Minimum**	32	60	139	1.78	25.30	2.97	2697	4354	7.87
3	**Maximum**	43	74	190	3.44	31.22	3.81	4318	7465	18.78
4	**GCV**	9.66	6.17	5.35	13.98	5.27	5.88	9.66	6.17	5.35
5	**PCV**	10.07	6.30	10.61	23.92	7.36	10.28	10.07	6.30	10.61
6	**ECV**	2.84	1.29	9.16	19.41	5.14	8.43	2.84	1.29	9.16
7	**H^2 (B)**	92.05	95.82	25.43	34.17	51.19	32.67	92.05	95.82	25.43
8	**Genetic Advance**	7.14	8.36	9.51	0.46	2.20	0.23	7.14	8.36	9.51
9	**GAM**	19.09	12.44	5.56	16.84	7.76	6.92	19.09	12.44	5.56

Note: DFF: Days to 50% flowering; DM: Days to maturity; PH: Plant height (cm); NPT: No. of productive tillers per plant; PL: Panicle length(cm); PD: Panicle Diameter; GY: Grain yield (kg/ha); FY: Fodder yield (kg/ha); TSW: Thousand Seed weight

Table.4 Correlation coefficients between grain yield and its component characters in pearl millet

	DFF	DM	PH	NPT	PL	PD	GY	FY	TSW
DFF	1.000	0.981**	0.2	-0.054	0.383	-0.014	0.367	0.752**	-0.106
DM		1.000	0.17	-0.021	0.321	0.008	0.318	.705**	-0.162
PH			1.000	-0.177	0.226	-0.3	0.417	-0.15	0.398
NPT				1.000	-0.22	0.402	0.323	0.177	-0.117
PL					1.000	-0.328	0.477	0.394	-0.127
PD						1.000	-0.193	0.301	0.234
GY							1.000	0.277	0.155
FY								1.000	0.03
TSW									1.000

Note: DFF: Days to 50% flowering; DM: Days to maturity; PH: Plant height (cm); NPT: No. of productive tillers per plant; PL: Panicle length(cm); PD: Panicle Diameter; GY: Grain yield (kg/ha); FY: Fodder yield (kg/ha); TSW: Thousand Seed weight

Moderate phenotypic coefficient of variation is observed for fodder yield (18.26), grain yield (17.77), 1000 test weight (16.66), panicle diameter (10.28), plant height (10.61) and days to 50 % flowering (10.07). Similar results were reported by Anuradha *et al.*, (2017). Low PCV was observed for characters days to maturity (6.30) and panicle length (7.36). Moderate GCV was observed for characters 1000 seed weight (15.78), fodder yield (14.2), number of productive tillers per plant (13.98) and grain yield (12.20). Genetic coefficient of variance does not provide the clear indication of proportion of heritable components of variation therefore estimation of heritability become necessary. Highly heritable traits are governed by genotypic variances rather than with environmental variance. Hence, there is more chance for success in selection of genotypes based on heritability. However, heritability informs whether the variation is genetic or non genetic while Genetic Advance as Percent Mean (GAM) enlightens the aspect of gene action.

High heritability was recorded by days to maturity (95.82) followed by days to 50 % flowering (92.05). High heritability (89.74, 61.18) coupled with high genetic advance as percent of mean (30.80, 23.01) is observed for 1000 test weight and fodder yield respectively indicating preponderance of additive gene action and selection is effective for these traits.

In the present study, low heritability (25.43) coupled with low GAM(5.56) were observed for plant height indicating that environment is the main role in governing this character and selection for this character may not be effective. Similar results have been reported by Lakshmana *et al.*, (2003), Nagar *et al.*, (2006) and Anuradha *et al*., (2018).

Correlation of various traits helps in selection of superior genotypes based on phenotypic selection of easily heritable characters. Grain yield which is quantitatively inherited is difficult to improve through simple selection as observed from heritability and GAM values. Hence, selection for higher grain yield is to be done through other highly heritable and simply selectable traits. The correlation coefficients in which days to 50 % flowering showed highly significant positive association with days to maturity and fodder yield and non significant positive association with plant height, panicle length and grain yield (Table 4). Days to maturity showed highly significant positive association with fodder yield and non significant positive association with plant height, panicle length, panicle diameter and grain yield and negative association with all other traits. Similar results were reported by Anuradha *et al*., 2018. Plant height showed negative association with number of production tillers per plant, panicle diameter and fodder yield and showed positive association with other traits. Similar results were reported by Anarase *et al*., 2001. Panicle length showed positive association with grain yield and fodder yield and negative association with panicle diameter and 1000 test weight. Panicle diameter showed positive association with fodder yield and thousand test weight and negative association with grain yield.

In the present study, grain yield showed positive association with all the characters while it was negatively correlated with panicle diameter indicating that there is no association between panicle diameter with grain yield. The higher grain yield can be achieved indirectly by improving the all other traits. Among all other traits the contribution of panicle length to grain yield is more. Hence to increase grain yield one can rely upon panicle length to some extent.

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