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GENETIC VARIABILITY AND ASSOCIATION ANALYSIS FOR DRY FODDER YIELD AND ITS COMPONENT TRAITS IN PEARL MILLET INBRED

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SUMMARY

Genetic variability in pearl millet was studied for dry fodder yield and its attributing traits using 30 inbred lines at ICAR-AICRP on Pearl Millet, Project Coordinating Unit, Mandor-Jodhpur. A significant variance reporated for all the characters which indicate ample amount of variation. Wide range of phenotypic and genotypic variability reported for green fodder yield per plant, grain yield per plant, number of productive tillers per plant, dry fodder yield per plant and leaf area which indicated direct selection may be effective for these characters. High heritability coupled with moderate genetic advance per cent mean was reported for green fodder yield per plant followed by grain yield per plant, effective number of tillers per plant, dry fodder yield per plant, lead area, stem girth and plant height. Correlation study revealed a positive and significant association of dry fodder yield with green fodder yield per plant, grain yield per plant, days to 50% flowering, days to maturity, plant height and stem girth at both phenotypic and genotypic level, while leaf area at genotypic level. Hence, these traits are more helpful in boosting the dry fodder yield performance of inbred lines.

Key words : Pearl millet, GCV, PCV, heritability, genetic advance, correlation

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is an erect annual grass (growingup to 3 m height) having a profuse root system. It is widely grown as a food crop in subsistence agriculture in Africa and on the Indian subcontinent (Arya *et al.,* 2014). The forage/ stover, at the time of harvest is an important secondary product in subsistence agriculture for animal feed, fuel, or construction. It is widely grown for silage, hay, pasture, green-chop and directly designed standover feed (FAO, 2009). It could tolerant drought, heat, leached acid sandy soils with very low clay and organic matter. So, on the basis of these advantages pearl millet is considered as hardy crops. Its vegetative matter is rich in phosphorous and calcium mineralsand also have high protein content and low hydrocyanic acid (HCN), it is an excellent fodder crop. Pearl millet has great importance as forage as well as stover crop (Choudhary *et al.,* 2015). The development of high fodder yielding varieties depends upon the knowledge of existing variability and also character association between the different attributing traits (Nguyen *et al.,* 2019). Pearl millet is bestowed with a rich stock of genetic variability for various traits like yield components, adaptation and quality. Exploitation of this variability can possible to produce high yield and fodder yielding hybrids and varieties (Bikash *et al.,* 2013). Therefore in present investigation, an attempt was made to appraise genetic variability in pearl millet inbred lines for fodder yield and associating traits.

MATERIALS AND METHODS

Thirty pearl millet inbred lines obtained from ICAR-AICRP-PM, Jodhpur, IARI, New Delhi, RARI, Durgapura,CCS HAU, Hisar, JAU, Jamnagar andICRISAT, Hyderabad were used in this study. These inbreeds were evaluated during *Kharif*, 2020 in randomized block design with three replicationsat Research Farm of ICAR-AICRP on Pearl Millet, Project Coordinating Unit, Mandor-Jodhpur. Weekly weather forecasts during the experimental period were recorded from the Agriculture Research Station (ARS), Mandor-Jodhpur are presented in Fig. 1.The mean temperature varied between maximum 31.8°C -37.8°C and minimum 26.5-31.9°C during the experimental period. The crop received 180 mm of rainfall and 13 rainy days during the growing season. The average weekly relative humidity fluctuated between 22 and 91% during the experimental period. Data was recorded on basis of five plants selected from each inbred line from each replication except days to 50% flowering and days to maturity which was recorded on plot basis. Then, the recorded data was averaged and subjected to statistical analysis. The analysis of variance was estimated by Panse and Sukhatme (1985). Various variability parameters (GCV and PCV) was calculated by Lush (1940) and Burton (1952). The method suggested by Johnson *et al.* (1955)was acquired to formulate the estimates of broad sense heritability and genetic advance per cent mean. The correlation between different characters was estimated by Searle (1961).

RESULTS AND DISCUSSION

In present investigation, the analysis of variance reported that there was significant differences present among inbred lines for all the characters (Table 1), which illustrated that inbred lines exhibited ample amount of variability. So, there is ample scope of improvement in breeding programmes. Substantial variation was reported by Bika and Shekhawat (2015), Singh and Chhabra (2018) and Kumawat *et al.* (2019).

The mean, range, GCV, PCV, heritability and genetic advance as per cent of mean of different inbreds for various traits are presented in Table 2. Large variation among pearl millet inbred lines were found for the characters like, days to 50% flowering (47-66 days), days to maturity (72-87 days), leaf area (60.46-199.8 cm^2), plant height (102.33-200.33 cm), stem girth (0.66-1.26 cm), number of effective tillers per plant (1.0-3.7), green fodder yield per plant (61.86-246 g), grain yield per plant (8.52-43.7 g) and dry fodder yield per plant (-81.33 g) in present investigation, offer an ample scope of selection for desirable parental inbred line for hybrid development. Therefore, on the basis of mean performance of different genotypes for studied characters, the genotypes PPMI 1267 and J 2290 were found promising.

The variability parameters (GCV and PCV) for nine characters studied during present investigation (Table 2). It indicated that phenotypic coefficient of variation exceeded genotypic coefficient of variation which concluded that the variation was not only due to genotypes but environment also play an important role. High coefficient of variance in term of PCV and GCV exhibited green fodder yield per plant (43.61%, 42.39%), grain yield per plant (44.11%, 41.60%), number of productive tillers per plant (38.86%, 36%), dry fodder yield per plant (33.40%, 30.59%) and leaf area (27.58%, 25.87%) which indicated direct selection may be effective for these characters. The finding was in agreement with Bika and Shekhawat (2015) for dry matter yield, leaf area, green fodder yield per plant and number of tiller per plant and Kumawat *et al.* (2019) for effective number of tillers and grain yield per plant. Moderate estimates of PCV and GCV were observed for stem girth (17.75%, 16.20%) and plant height (14.93%, 13.14%) which are in accordance with Choudhary *et al.* (2012) and Kumawat *et al.* (2019) for plant height and Singh and Chhabra (2018) for stem girth. Low PCV and GCV were noticed for days to 50% flowering (10.17%, 8.93%) and days to maturity (6.59%, 5.06%). Similar results were reported by Dapke *et al.* (2014) and Sumathi and Revathi (2016). The effectiveness of selection not only depends upon the variability but also the extent of variability transmitted from one generation to another generation. The highest heritability coupled with genetic advance per cent mean was registered for green fodder yield per plant (94.51%, 84.90%) followed by grain yield per plant (89.00%, 80.83%),

TABLE 1

Analysis of variance (ANOVA) of pearl millet genotype for dry fodder yield and its attributes

Source	DF	Days to 50% flowering	Days to maturity	Leaf area	Plant height	Stem girth	Number of productive tillers	Green fodder yield/ plant	Dry fodder yield/ plant	Grain yield/ plant
Replication	2	13.43	20.84	3.34	287.66	0.013	0.08	275.55	15.43	18.30
Treatment	29	74.83*	57.79*	2655.92*	1317.61*	0.07*	1.63*	11170.30*	856.11*	219.41*
Error	58	6.74	10.83	115.91	116.12	0.004	0.08	216.68	51.39	8.71

*represent significant at 5% level.

effective number of tillers per plant (85.90%, 68.92%), dry fodder yield per plant (83.90%, 57.74%), lead area (88.00%, 49.98%), stem girth (83.30%, 30.47%) and plant height (77.50%, 23.84%). Such confirmatory results were also given by Singh *et al.* (2015) for stem thickness, effective number of tillers, dry fodder weight per plant and grain yield per plant, Bika and Shekhawat (2015) for green fodder yield per plant, effective number of tillers, dry fodder weight per plant and grain yield per plant. High heritability coupled with moderate genetic advance per cent mean was reported for days to 50% flowering (77.10%, 16.16%), while moderate heritability along with low genetic advance observed for days to maturity (59.10%, 8.02%). Earlier

TABLE 2

Mean, range, variability, heritability (broad sense), genetic advance and genetic advance as per cent of mean of pearl millet genotypes for dry fodder yield and it's attributes.

Characters	Mean	Range		Coefficient of variance		Heritability % (broad sense)	Genetic advance as percent of mean (at 5% level)
		Min.	Max.	Genotypic	Phenotypic		
Days to 50% flowering	53	47	66	8.93	10.17	77.1	16.16
Days to maturity	78	72	87	5.06	6.59	59.1	8.02
Leaf area (cm2)	112.48	60.46	199.8	25.87	27.58	88.0	49.98
Plant height (cm)	152.28	102.33	200.33	13.14	14.93	77.5	23.84
Stem girth (cm)	0.91	0.66	1.26	16.20	17.75	83.3	30.47
Number of productive tillers/plant	1.99	1.0	3.7	36	38.86	85.9	68.72
Green fodder yield/plant (g)	141.99	61.86	246	42.39	43.61	94.51	84.9
Grain yield per plant (g)	20.14	8.52	43.70	41.60	44.11	89.0	80.83
Dry fodder yield (g)	53.53	24	81.33	30.59	33.40	83.9	57.74

TABLE 3

Phenotypic and genotypic correlation coefficient of pearl millet genotypes for dry fodder yield and its attributes

Characters		Days to 50% flowering	Days to maturity	Leaf area	Plant height	Stem girth	No. productive tillers/plant	Green fodder yield/ plant	Grain yield/ plant	Dry fodder yield/ plant
Days to 50% flowering	P	1.000	0.845**	0.356**	0.198	0.703**	-0.439**	0.561**	-0.025	0.369**
	G	1.000	0.979**	0.459**	0.308**	0.892**	-0.545**	0.672**	-0.012	0.442**
Days to maturity	P		1.000	0.314**	0.110	0.610**	-0.433**	0.496**	-0.028	0.379**
	G		1.000	0.457**	0.216*	0.898**	-0.646**	0.636**	-0.046	0.429**
Leaf area	P			1.000	0.244*	0.539**	-0.383**	0.352**	0.181	0.184
	G			1.000	0.274**	0.631**	-0.456**	0.367**	0.200	0.217*
Plant height	P				1.000	0.200	0.080	0.565**	0.428**	0.290**
	G				1.000	0.298**	0.095	0.625**	0.499**	0.381**
Stem girth	P					1.000	-0.529**	0.591**	0.050	0.271**
	G					1.000	-0.646**	0.647**	0.033	0.335**
No. of productive tillers/plant	P						1.000	-0.038	0.550**	0.195
	G						1.000	-0.087	0.524**	0.126
Green fodder yield/plant	P							1.000	0.505**	0.852**
	G							1.000	0.510**	0.893**
Grain yield/plant	P								1.000	0.545**
	G								1.000	0.552**
Dry fodder yield/plant	P									1.000
	G									1.000

*, ** Represent significant at 5% and 1% levels respectively.

reports are in agreement with Anuradha *et al.* (2018) for days to 50% flowering and Dadarwal *et al.* (2020) for days to maturity. High estimates of coefficient of variation along with high heritability coupled with high genetic advance per cent mean for characters like green fodder yield per plant, grain yield per plant, dry fodder yield per plant, number of effective tillers per plant and leaf area are indicative of additive gene action for these characters which are persuadable in population improvement programmes through simple selection procedures.

Correlation studies provide a good measure of linear relationship between traits andhelp to identify the most important characters that will be considered for effective choice of increasing yield and quality. In the present study, correlation coefficient at phenotypic and genotypic levels between the dry fodder yield and its component characters and also between thecomponent charactersthemselves has been applied to all possible combination. In general, the genotypic correlation coefficient was significantly higher than phenotypic correlation coefficient indicating the inherent association among various studied traits.The correlation coefficient was found positive and significant for most of the characters (Table 3). Dry fodder yield per plant exhibited a highly significant and positive correlation with green fodder yield per plant (0.852, 0.893), grain yield per plant (0.545, 0.552), days to 50% flowering (0.369, 0.442), days to maturity (0.379, 0.429), plant height (0.290, 0.381) and stem girth (0.271, 0.335) at both phenotypic and genotypic level, while leaf area (0.217) positively correlated at genotypic level. These results are in accordance with earlier findings of Singh *et al.*, 2014 for plant height, stem thickness and fresh fodder yield/ plant andNehra *et al.*, 2017 for days to 50% flowering, plant height, green fodder yield per plant, grain yield per plant and Aswini *et al.*, 2022 for days to 50% flowering and plant height.

CONCLUSION

In this study, there is significant amount of variability present. In GCV, PCV, broad sense heritability and genetic gain per cent over mean for traits found that the selection for green fodder yield/plant, grain yield/plant, leaf area and number of effective tillers per plant would be more effective traits in boostingthe performance of pearl millet inbreds. But correlation study revealed that there was no significant association of number of tillers per plant and leaf area (phenotypic level) in improvement of the dry fodder yield per plant. For the enhanced dry fodder yield in Pearl millet inbreds under research will be significant if plants having higher plant height, thicker stems, higher green fodder and take longer time for maturation are the prime criteria for selection.

REFERENCES

Anuradha, N., C. T. Satyavathi, C. Bharadwaj, M. Sankar, S. P. Singh and T. L. Pathy, 2018 : Pearl millet genetic variability for grain yield and micronutrients in the arid zone of India. *Journal of Pharmacognosy and Phytochemistry*,**7**(1): 875-878.

Arya, R. K., M. K. Singh, A. K. Yadav, A Kumar and S Kumar, 2014 : Advances in pearl millet to mitigate adverse environment conditions emerged due to global warming. *Forage Res*., **40**(2) : 57-70.

Aswini, M. S., Ganesan, K. N., Ezhilarasi, T. and Sivakumar, SD 2022 : Genetic studies on association and inter-relationship of green fodder yield and fodder quality traits in hybrids of fodder pearl millet [*Pennisetum gluacum* (L.) R. Br.]. *Int. J. Multidisciplinary Res. and Growth Evaluation,* **3**(1) : 1-6.

Bikash, A., I. S. Yadav and R. K. Arya, 2013 : Studies on variability, correlation and path analysis in pearlmillet. *Forage Res.,* **39**(3):134-139.

Bika, N. K. and Shekhawat, S. S. 2015 : Genetic variability study in pearl millet [*Pennisetum gluacum* (L.) R. Br.] for green fodder yield and related traits. *Electronic J. Pl. Breed.*, **6**(2): 600-602.

Burton G. W., 1952 : Quantitative inheritance in grasses. Proceeding on 6th International Grassland Journal **1** : 277-283.

Choudhary, R., B. L. Jat, R. Anwala, S. R. Dhikwal and K. C. Sharma, 2012 : Studies on estimates of genetic variability and character association of yield components and protein content in pearl millet. *Forage Res.,* **38**(2): 80-85.

Choudhary Sunita, Prem Singh, B. K. Hooda and R. K. Arya, 2015 : Multivariate analysis of pearl millet data to delineate genetic variation. *Forage Res.,* **40**(4): 201-208.

Dapke, J. S., D. S. Shah, G. N. Pawar, V. M. Dhembre and M. Kumar, 2014 : Genetic variability and character association over environment in pearl millet (*Pennisetum glaucum* (L.) R. Br.) under dry land conditions of Gujarat. *The Bioscan,* **9**(2): 863-867.

Dadarwal, S. L., S. S. Rajput, and G. L. Yadav, 2020 : Studies on genetic variability parameters in maintainer lines of pearl millet (*Pennisetum glaucum* (L.) R. Br.). *J. Phar. and Phytochemistry*, **9**(6) : 795-797.

FAO, 2009 : Grassland Index. A searchable catalogue of grass and forage legumes. FAO, Rome, Italy.

Johnson, H. W., H. F. Robinson and R. E. Comstock, 1955 : Estimate of genetic and environmental variability in soybeans. *Agronomy J.* **47** : 314-318.

Kumawat, K. R. N. K. Sharma and N. Sharma, 2019 : Genetic variability and character association analysis in pearl millet single cross hybrids under dry conditions of Rajasthan. *Elect. J. Plant Breed.*, **10**(3): 1067-1070.

Lush, J. L. 1940 : Intra-sire correlations or regressions of offspring on dam as a method of estimating heritability of characteristics. *J. Animal Sci.* **1** : 293-301.

Nehra, M., M. Kumar, J. Kaushik, D. Vart, R. K. Sharma, and M. S. Punia, 2017 : Genetic divergence, character association and path coefficient analysis for yield attributing traits in pearl millet [*Pennisetumglaucum*(L.) R. Br.] inbreds. *Chemical Science Review and Letters,* **6**(21): 538-543.

Nguyen Ngoc Vu, Arya, R. K. and Panchta, R.,2019 : Studies on genetic parameters, correlation and path coefficient analysis in cowpea. *Range Management. & Agroforestry*, **40** : 49-58.

Panse, V. G. and Sukhatme, P. V. 1967 : Statistical methods for agricultural workers. ICAR Publication, New Delhi : 145-146.

Searle, S. R. 1961 : Phenotypic, genetic and environmental correlations. *International Biometric Society* **17**(3) : 474-480.

Singh, J. and A. K. Chhabra, 2018 : Genetic variability and character association in advance inbred lines ofpearl millet under optimal and drought condition. *Journal of Crop Breeding and Genetics*, **4**(2): 45-51.

Singh, S., Y. P. Yadav, H. P. Yadav, D. Vart and N.Yadav 2014 : Studies on genetic variability and traits association for grain yield and its components in pearl millet [*Pennisetumglaucum*(L.) R. Br.]. *Forage Res.*, **40**(2) : 91-94.

Singh, S., Y. P. Yadav, H. P. Yadav, D. Vart and N. Yadav, 2015 : Genetic variability, character association and path analysis among yield contributing traits in pearl millet (*Pennisetum glaucum* (L.) R. Br.). *Bioinfolet* **12**(3): 640-644.

Sumathi, P., R. Lalithkannan and S. Revathi, 2016 : Genetic analysis and diversity studies in pearl millet (*Pennisetum gluacum* (L.) R. Br.). *Electronic J. Pl. Breed.*, **7**(4): 1014-1019.