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ASSESSMENT OF GENETIC VARIATION AND CHARACTER ASSOCIATION OF IRON, ZINC AND PROTEIN WITH AGRONOMIC TRAITS IN PEARL MILLET [*Pennisetum Glaucum* (L.) R. BR.]

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Abstract– The present investigation consists of 98 genotypes (two CMS lines, 30 testers, 60 hybrids and six checks) studied to assess the magnitude of genetic variability and character association of iron, zinc and protein with other agronomic traits. Pearl millet grain has rich iron content, zinc content and protein and are essential for human nutrition. Estimation of genetic parameters *viz*., variability, heritability, genetic advance will provide the basis for selecting systematic breeding strategy to improve the genotypes with desirable traits. Moderate PCV and GCV values were observed for grain iron and protein content, high PCV and GCV values were observed for zinc content. Influence of environment on these traits is low because of the less difference between the estimates of GCV and PCV. High heritability coupled with high genetic advance as percent of mean was observed for zinc content. Strong correlation was observed between grain iron and zinc content and their weak correlations with other agronomic traits indicated there is a possibility to breed high grain Fe and Zinc contents simultaneously in different plant agronomic backgrounds might be suitable for different agro-climatic regions.

INTRODUCTION

Pearl millet is one of the important drought tolerant dual purpose staple food crop in arid and semi-arid tropics. This crop grown well in harsh environments where other cereal crops couldn't survive. In India it grows in an acreage of 7.54 million hectares with a production of 10.36 million tones and productivity of 1373.86 kg/ha (Ministry of agriculture, 2019-2020). Pearl millet grains are of good nutritive value with 73% carbohydrates, 11% proteins, 8.4% fat and rich source of minerals such as iron (6-7mg/100 g) and zinc (3.4 mg/100 g) (Malik, 2015). Among micro-nutrients, it is loaded with minerals with relative abundance of Iron and Zinc (Satyavathi *et al*., 2017). These two micronutrients iron and zinc are essential for balanced human nutrition. Hence there is need to explore the genotypes with high nutritive value. Knowledge on association between agronomic and nutritional traits is pre-requisite for breeding lines with more nutritional components along with high yield. Correlation coefficient analysis helps in identification of component traits in selection programme. Existence of correlation attributed to the presence of linkage or pleotropic effect of genes or physiological, developmental and environmental effect or in combination of all (Govindaraj *et al*. 2009). The present study was undertaken to determine the magnitude of genetic variability and to identify the traits having desirable correlation with iron, zinc and protein.

MATERIALS AND METHODS

The test material for the present investigation consisted of 98 genotypes *viz*., two male sterile lines (ICMA 97111 and ICMA 04999), 30 testers from four states (Tamilnadu, Maharashtra, Madhya Pradesh and Andhra Paradesh), six national checks (GHB 558, GHB 905, RHB 173, HHB 272, MPMH 21, HHB 67 improved) and 60 F_1 hybrids generated by crossing two male sterile lines with 30 testers in Line × Tester mating design (Kempthorne, 1957) at IIMR during *summer*, 2019. The total 98 genotypes including checks were evaluated in alpha lattice

design (Patterson and Williams, 1976) with three replications during *kharif*, 2019. Recommended agronomic and plant protection measures were taken up to raise the healthy crop. The observations were recorded for 18 quantitative traits and 4 qualitative traits. The traits days to 50 per cent flowering, plant height, leaf length, leaf width, stem width, total number of tillers per plant, total number of productive tillers, panicle length, panicle width, panicle weight, 1000-grain weight, grain number per panicle and grain number per unit structural panicle mass were recorded on five randomly selected competitive plants in each replication. Green fodder yield, dry fodder yield, grain yield, total biomass, harvest index were taken on plot basis.

Iron content and zinc content were estimated as given by Tandon (1999) by Atomic Absorption Spectrophotometry (AAS), (Lindsay and Norvell, 1978) and protein was recorded by estimating nitrogen content (%) following Micro-Kjeldhal method (Tandon, 1999) and multiplying with the conversion factor (6.25) as described by Sadasivam and Manickam (1996). The genotypic and phenotypic coefficients of variation were calculated using the formulae given by Burton (1952), heritability in broad sense was computed as suggested by Hanson *et al.* (1956) and genetic advance was calculated based on formula given by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

Genetic Variability

Presence of genetic variability is important for achieving effective breeding programme. Studies on PCV, GCV, heritability and genetic advance helps in estimating the inherent and environmental factors. The variability analysis revealed that among the 98 genotypes iron, zinc and protein contents ranges from 4.25-7.91 mg/100g, 1.81-4.87mg/100g and 5.4-14.8% with the means of 5.88, 3.06mg/100g and 9.42% respectively. High PCV (21.35) and GCV (21.12) were observed for zinc content indicated the presence of high variability. Moderate PCV (Fe=13.97, Protein=19.11) and GCV (Fe=13.69, Protein=18.81) were observed for iron content and protein indicating the presence of less variability among the genotypes (Table 1). Difference between the estimates of GCV and PCV for these traits is also less indicating little influence of environment. These results were in accordance with Yadav *et al*., (2020) for zinc content. High heritability (Fe=95.94; Zn=97.90; Protein=96.92) coupled with high genetic advance as percent of mean (Fe=27.62; Zn=43.05; Protein=38.16) indicating the predominance of additive gene action in the inheritance of these traits. Simple selection may be sufficient for improving these traits. These findings are in line with the results of Govindraraj *et al.,* (2011) and Mahendrakar *et al*., (2019).

Correlation of grain Fe and Zn contents with agronomic traits

Correlation coefficients of iron, zinc and protein contents with agronomic traits were estimated (Table 2). Correlation of total number of productive tillers/plant with zinc content (0.208*) and days to 50% flowering with protein (0.227*) shows significantly positive association in low magnitude, indicating that these nutrients can be improved by enhanced number of productive tillers and increased number of days for 50% flowering, respectively. Significantly negative association was observed with panicle length (Fe=-0.219*, Zn=-0.305*, protein=-0.304*), panicle width (Zn=-0.275*, Protein=-0.222*), panicle weight (Zn=-0.216*, protein=-0.251*), test weight (Zn=-0.238*, protein=-

Table 1. Estimates of variability, heritability and genetic advance as per cent of mean for iron, zinc and protein contents in pearl millet

	Iron content (mg/100g)	Zinc content (mg/100g)	Protein (%)
Mean	5.88	3.06	9.42
Range:			
Minimum value	4.25	1.81	5.41
Maximum value	7.91	4.87	4.8
PCV	13.97	21.35	19.11
GCV	13.69	21.12	18.81
Heritability (%)	95.94	27.62	96.9
Genetic advance as percent of mean (%)	97.90	43.05	38.16

Table 2. Correlation coefficients of agronomic traits with Fe, Zn and protein in pearl millet

		Fe	Zn	Protein
1	Days to 50 per cent flowering	-0.175	-0.038	0.227*
2	Plant height (cm)	-0.099	-0.035	-0.015
3	Leaf length (cm)	-0.132	-0.097	0.023
4	Leaf width (cm)	-0.154	-0.115	-0.040
5	Stem width (cm)	-0.165	-0.104	0.085
6	Total number of tillers per plant	0.091	0.110	0.021
7	Total number of productive tillers per plant	0.119	0.208*	0.119
8	Panicle length (cm)	-0.219*	-0.305*	-0.314*
9	Panicle width (cm)	-0.118	-0.275*	-0.222*
10	Panicle weight (t/ha)	-0.146	-0.216*	-0.251*
11	1000 grain weight (g)	-0.102	-0.238*	-0.371*
12	Green fodder yield (t/ha)	-0.042	0.002	0.035
13	Dry fodder yield (t/ha)	-0.051	0.026	0.107
14	Grain yield(t/ha)	-0.213*	-0.319*	0.322*
15	Grain number per panicle	-0.271*	-0.283*	0.027
16	Total biomass (t/ha)	-0.097	-0.039	-0.009
17	Harvest index	-0.017	-0.271*	-0.220*
18	Grain number per unit structural panicle mass	-0.075	-0.074	0.043
19	Iron content (mg/100g)	1.000	0.864**	0.204*
20	Zinc content (mg/100g)	0.864**	1.000	0.425**
21	Protein content (%)	0.043	0.425**	1.00

0.371*), grain yield (Fe=-0.213*, Zn=-0.319* and Protein=-0.322*), grain number per panicle (Fe=-0.271*, Zn=-0.283*) and harvest index (Zn=-0.271*, protein= -0.220*).

Significantly positive correlation was present among the traits i.e., Fe with Zn (0.864*), Fe with protein (0.204*), Zn with protein (0.425**) and grain yield with protein (0.322*). Strong correlation between iron and zinc suggested that there is a possibility of improvement of both the traits simultaneously. Similar results were earlier reported by Sharma, (2018) and Subbulakshmi *et al*. (2018). These results state that there is independence between agronomic and nutrient traits (Fe, Zn and protein).

CONCLUSION

High genotypic and phenotypic coefficient of variation, heritability and genetic advance as percent of mean indicating the presence of variability among the studied genotypes with additive gene action for these traits. Significant correlation between quality traits and week correlations with agronomic traits indicated there is a possibility to breed high grain grain Fe and Zn contents simultaneously in different plant agronomic backgrounds might be suitable for different agro-climatic regions.

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