

Original Research Article

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Characterization of Genotypes for Nutritional traits in Foxtail Millet [*Setaria italica* (L.) Beauv.]

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ABSTRACT

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In the present study, 25 genotypes were chosen from the list of 149 genotypes of foxtail millet based on their diversity, superiority for various traits, and were assessed for varietal differences for grain protein (%) and micronutrients (Zn, Fe, Ca) contents. The range of values for grain nutrients content among the selected genotypes are recorded for protein (6.2-10.89%), zinc content (2.29-11.4 mg/100g), iron content (0.33 to 16.26 mg/100g) and calcium content (1.99 to 22.69 mg/100g). Among the 25 selected genotypes, the two agronomically superior lines viz., GS 78 and GS 71 were found to be nutritionally superior in terms of grain nutrients content (protein and micronutrients). The genotype GS 78 was found superior for grain protein (%), zinc, iron and calcium content, and GS 71 for grain protein (%), zinc and calcium content hence could be utilized in value addition. The genotypes recorded with high protein, iron, zinc and Calcium content may be further utilized in breeding for these nutritional traits.

Introduction

Small millets have long cultivation history (3000-5000 years), were major food crops at one time, are highly resilient crops and assured harvests, can be used as catch crops, suitable for less fertile/native fertility soils, are infected with a fewer pests and diseases, grains highly nutritious and even superior to rice and wheat in certain constituents, are physiologically very efficient, wide adaptation and are reliable for harvest (Upadhyaya *et al.*, 2008). It is of interest to note that lower incidence of cardiovascular diseases, duodenal ulcer and hyperglycemia (diabetes) are reported among regular millet consumers. However, nationally, gradual decrease in area (55.35 lakh hectares in 1950-

55 to 9.05 lakh hectares in 2008-09) and production (20.7 lakh tones in 1950-55 to 4.5 lakh tones in 2008-09) has been occurred over the years

Foxtail millet [*Setaria italica* (L.) Beauv.] was commonly grown and was part of balanced diet in earlier days has been replaced with other crops. In the current changing life style and food habits of people, consumption of nutrigrain cereals in the daily diet is poor due to lack of cultivation of nutrigrain cereals and availability of high yielding but less nutritious cereals in the last few decades. To meet out the nutrition demand of growing population, area under millets must be

rejuvenated through millet policy. Attention has to be given to development of reliable production technologies specially the development of high yielding varieties. Foxtail millet grains are rich in protein, minerals (calcium, iron, potassium, magnesium, and zinc) and vitamins (Rai, 2002). It is not only widely used as an energy source for pregnant and lactating women, but also for sick people and children, and especially for diabetics. It reduces blood sugar concentration in women diabetics (Sema and Sarita, 2002). The grains have long shelf-life, a preferable attribute (Ravi *et al.*, 2010). It has been suggested to use foxtail millet protein as a food component to fight type 2 diabetes and cardiovascular diseases (Choi *et al.*, 2005). In spite of the foxtail millet being beneficial to health, it remained a neglected crop from the mainstream of crop improvement research compared to cereals such as maize (*Zea mays*), rice (*Oryza sativa*), wheat (*Triticum aestivum*), sorghum (*Sorghum bicolor*), and pearl millet (*Pennisetum glaucum*) (Upadhyaya *et al.*, 2011). Number of diverse germplasm accessions with agronomically (earliness and high grain yield) and nutritionally (high seed protein, calcium, iron and zinc) superior traits were identified by Upadhyaya *et al.*, (2011) in a minicore collection for use in foxtail millet breeding. In the present study an effort has been made to characterize the genotypes for Nutritional traits in Foxtail millet [*Setaria italica* (L.) Beauv.] for their superiority for both nutritional and agronomical traits.

Materials and Methods

A total of 25 genotypes from the list of 149 germplasm accessions were used for estimation of grain nutrients content viz., protein content and grain micronutrients (calcium, iron and zinc) content. Total protein was estimated in selected genotypes using Micro Kjeldhal Distillation Method

(A.O.A.C, 1070). About 3-5 gram of dry seed was randomly drawn from each of the genotype were powdered. One gram of powder was accurately weighed using electronic balance and subjected to digestion. Total nitrogen in the seed obtained after titration was multiplied with the factor 6.25 to arrive at protein content and expressed in percentage. Grain micronutrients (calcium, iron and zinc) were estimated using Atomic Absorption Spectrophotometer (AAS) using mineral solution which was made using diacid mixture.

Results and Discussion

In the present study, 25 lines were chosen from the list of 149 genotypes of foxtail millet based on their diversity, superiority for various traits, and were assessed for varietal differences for grain protein (%) and micronutrients (Zn, Fe, Ca) contents. The nutritional data is presented in Table 1 and the results are discussed below. The analysis of variance for the selected lines showed significant difference exists for grain, Zinc, Calcium, Iron and Protein content showed in Table 2.

Grain protein content (%)

Among 25 genotypes screened, the range of variation observed for grain protein content was from 6.2 to 10.89%. GS 95 (10.89%) showed highest protein content followed by GS 64, GS 12, GS 78, GS 71. A total 9 genotypes were performed better than all the three check varieties (PS 4, HMT-100-1, SiA 326). Seetharam *et al.*, (1983) noted that the variability available for protein content in foxtail millet ranged from 7.16 to 15.73 per cent and identified the sources with high protein for both direct exploitation and use in breeding. Kumar and Parmeswaran (1998) studied the characterization of storage protein from selected varieties of foxtail millet.

Table.1 Performance of selected genotypes of foxtail millet for grain nutrients contents

Sl No	Genotype	Protein (%)		Mean	Zn (mg/100g)		Mean	Fe (mg/100g)		Mean	Ca (mg/100g)		Mean
		R I	R II		R I	R II		R I	R II		R I	R II	
1	GS 12	12.64	6.64	9.64	5.33	3.33	4.33	11.46	5.46	8.46	19.76	13.76	16.76
2	GS 64	12.13	8.13	10.13	4.29	0.29	2.29	14.36	8.36	11.36	7.89	3.89	5.89
3	GS 71	10.32	8.32	9.32	10.22	8.22	9.22	12.83	2.83	7.83	12.93	6.93	9.93
4	GS 78	14.49	4.49	9.49	14.3	8.3	11.3	18.48	10.48	14.48	24.69	20.69	22.69
5	GS 95	13.89	7.89	10.89	4.56	2.56	3.56	10.39	0.39	5.39	18.23	8.23	13.23
6	GS 106	9.76	7.76	8.76	7.96	1.96	4.96	14.42	8.42	11.42	22.49	16.49	19.49
7	GS 121	10.67	6.67	8.67	12.4	10.4	11.4	19.26	13.26	16.26	20.43	8.43	14.43
8	GS 213	11.92	3.92	7.92	10.89	0.89	5.89	5.83	1.83	3.83	4.33	2.33	3.33
9	GS 29	11.27	5.27	8.27	4.86	2.86	3.86	1.36	0.96	1.16	8.33	4.33	6.33
10	GS 221	10.94	6.94	8.94	7.26	1.26	4.26	7.94	1.94	4.94	9.69	3.69	6.69
11	GS 276	7.2	5.2	6.20	6.86	0.86	3.86	9.29	7.29	8.29	6.93	2.93	4.93
12	GS 293	13.5	3.5	8.50	4.76	0.76	2.76	14.23	6.23	10.23	7.66	3.66	5.66
13	GS 310	11.94	5.94	8.94	6.46	0.46	3.46	15.13	13.13	14.13	7.93	5.93	6.93
14	GS 510	9.35	7.35	8.35	4.23	2.23	3.23	0.44	0.22	0.33	2.99	0.99	1.99
15	GS 511	9.28	5.28	7.28	4.99	0.99	2.99	8.11	2.11	5.11	6.49	4.49	5.49
16	SiA 3085	12.32	4.32	8.32	5.33	3.33	4.33	7.2	1.2	4.2	6.76	4.76	5.76
17	Co 7	11.59	5.59	8.59	6.36	0.36	3.36	3.47	1.47	2.47	6.83	4.83	5.83
18	SiA 2644	10.38	6.38	8.38	5.13	3.13	4.13	16.09	6.09	11.09	9.86	3.86	6.86
19	TNAU 186	8.89	6.89	7.89	6.53	0.53	3.53	6.06	2.06	4.06	10.46	6.46	8.46
20	SR 11	14.05	4.05	9.05	3.39	1.39	2.39	7.63	1.63	4.63	9.13	7.13	8.13
21	SiA 2593	11.53	5.53	8.53	4.63	0.63	2.63	4.91	0.91	2.91	8.56	4.56	6.56
22	FMGPM-9	8.45	6.45	7.45	3.46	1.46	2.46	8.69	0.69	4.69	10.69	4.69	7.69
23	PS 4	10.03	6.03	8.03	4.36	0.36	2.36	4.53	0.53	2.53	10.23	4.23	7.23
24	HMT-100-1	11.16	3.16	7.16	8.33	0.33	4.33	3.7	1.7	2.7	8.99	4.99	6.99
25	SiA 326	13.73	3.73	8.73	5.16	1.16	3.16	4.93	0.93	2.93	11.16	5.16	8.16

Table.2 ANOVA for grain nutrients content in 25 selected genotypes of foxtail millet

Sl. No	Character	Replication Mss	Treatment Mss	S.Em±	CV (%)	CD5%	CD1%
1	Protein (%)	369.92	1.91*	1.4	0.92	4.08	5.53
2	Zn (mg/100g)	216.32	12.80**	1.11	1.43	3.25	4.41
3	Fe (mg/100g)	341.23	39.81**	1.42	1.21	4.14	5.61
4	Ca (mg/100g)	269.12	49.31**	1.24	0.81	3.64	4.94

Protein content of grain of foxtail millet was 91.7, 105.2 and 112.0 g/kg in Cv. CO 6, TNAU 172 and TNAU 173, respectively. Ravindran (2003) reported the average protein content of foxtail millet was 15.9%.

Grain zinc content (mg/100g)

For grain Zn content, the range of values observed was 2.29-11.4 mg/100g. GS 121 showed highest Zn (11.4 mg/100g) content followed by GS 78, GS 71, GS 213 and GS 106, which were better than all the three check varieties (PS 4, HMT-100-1, SiA 326).

Grain iron content (mg/100g)

For grain iron content, the range of values observed was 0.33 to 16.26 mg/100g. Among 25 genotypes, GS 121 (16.26 mg/100g) showed highest Fe content followed by GS 78, GS 310, GS 106 and GS 64. A total of 18 genotypes were found superior to all the three check varieties (PS 4, HMT-100-1, SiA 326). Phillip and Maloo (1996) evaluated 40 diverse varieties of foxtail millet for their iron content. The varieties were classified into high, moderate, and low iron content categories.

Grain calcium content (mg/100g)

For grain calcium content, the range of values observed among the varieties was 1.99 to 22.69 mg/100g. GS 78 showed highest Ca (22.69 mg/100g) content followed by GS 106, GS 12, GS 121, GS 95, GS 71 and TNAU 186, which were better than all the three check varieties (PS 4, HMT-100-1, SiA 326). A significant variation in calcium content of five minor millets was recorded with values ranging from 12.36 to 29.17 mg/100 g and little millet was reported to contain 12.36 mg calcium (Kulkarni *et al.*, 1992). Veena *et al.*, (2005) reported that the calcium and iron content of barnyard millet varieties ranged

from 17.1 to 32.7 and 1.2 to 1.5 mg/100g seed, respectively.

Among the genotypes, the two agronomically superior lines viz., GS 78 and GS 71 were found to be nutritionally superior in terms grain nutrients content (protein and micronutrients) hence these lines could be utilized in value addition. The genotype GS 78 was found superior for grain protein (%), zinc, iron and calcium content, and GS 71 grain protein (%), zinc and calcium content. The genotypes recorded with high protein, iron, zinc and Ca content may be further utilized in breeding for these nutritional traits.

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