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Genetic Variability in the Foxtail Millet (*Setariaitalica*) Germplasm As Determined By Nutritional Traits

Brunda[1] S. M, Kamatar[2] M.Y, Naveenkumar[3] K.L Ramaling Hundekar[4] and Umesh kumar[5] .V

[1,4]Ph.D Scholar, College of agriculture vellayani, Kerala Agriculture University-695522.

[2]Department of Genetics and Plant Breeding and University of Agricultural Sciences, Dharwad-5800 05

[3]Ph.D Scholar, Department of Genetics and Plant Breeding, SCI, College of PG-Studies, Central Agricultural University, Umori Road, Umiam-793103

[5]Regional Sericultural Research Station, Bengaluru

*Corresponding Author E-mail: brundasm16@gmail.com

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ABSTRACT

The extent of genetic variability for nutritional traits in the 78 genotypes of foxtail millet were studied.The parameters were analyzed using both NIR and AAS. When all the nutritional parameters were studied it was found that there was no single genotype which was superior for all the parameters so we should select the genotype which is best for maximum number of characters. For protein content Ise 1468, GS 1000, Ise 375, GS 2099 and DHF 30, for crude fibre DHF 27,GS 2109 and DHF 2, for zinc DHF 6, DHF 7, DHF 3 and DHF 17, For iron PratapKagni, DHF 14 , DHF 27, Ise 931 and DHF 26 were recorded the highest nutrients composition compare to checks. The most promising genotypes for nutritional characters are DHF 2, DHF 5 and DHF 1.These three genotypes can be used as donors in further plant breeding programme for the improvement of the most of the characters.

Key words: *Foxtail millet, nutrition, minerals and genotypes.*

INTRODUCTION

Foxtail millet (*Setaria italica* (L.) P. Beauv.] is one of the most economically important millet crops grown for grain, which is used for human consumption, animal, poultry, cage birds feeding and as fodder. The grain of foxtail millet is ovoid in shape, 2 mm long, yellow in colour enclosed by husk varying from pale yellow to orange, red, brown or black colour. Hence it should undergo de husking before processed for food. The grain can be cooked in the same manner as rice and has many food applications (porridge, pudding, breads, cakes, flour, chips, rolls, noodles etc.). It is an important staple food in India and northern China.

Foxtail millet grains are rich in protein, fibre, β carotene, minerals viz., calcium, iron, potassium, magnesium, zinc, antioxidants and vitamins[16]. The grains with husk intact have long shelf life which is a preferable attribute[17]. Millet based dietary fiber, improves glycemic control, decreases hyperinsulinemia and lowers plasma lipid concentrations in patients with type 2 diabetes[5].

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In spite of the health benefits provided by foxtail millet, it has remained as a neglected crop from the mainstream of crop improvement research compared to cereals such as maize *(Zea mays*), rice (*Oryzasativa),* wheat (*Triticumaestivum*), sorghum (*Sorghum bicolor*), and pearl millet (*Pennisetumglaucum*).The reason being millets were neglected in Green Revolution, is that, millet processing, i.e. dehusking is difficult than paddy and no machines are available in millet growing areas and distribution of fine grains through public distribution system made the consumers to shift entirely to fine grains, thus low demand and low production and availability complimentarily reduced the area under millet cultivation, production and consumption. Since, the millets in the world are grown primarily for grain, forage and a potential bio energy source or as an emergency catch crop. Due to their nutracetuticals benefits they can be used widely used in our daily diet. Hence there is an immediate need to increase yield levels and generate the information on the grain quality and nutritional quality components of the millets.

In order to improve the nutritional quality parameters, germplasm characterization is essential that aids in breeding high yielding varieties. In the present situation there is a need to develop high yielding varieties along with good grain quality parameters so that the challenges like productivity, food security and nutritional security can be addressed. So keeping these things in view, a germplasm collection was used to get information on the nutritional traits of these germplasm accessions. The objective is to study the nutrition and grain quality characters.

MATERIALS AND METHODS

The material for experiment comprised of a germplasm collection with 75 genotypes of foxtail millet obtained from All India Coordinated Millet Improvement Project (AICMIP) GKVK, UAS (B) and ARS Hanumanatti, along with 3 national checks HMT100 -1, PS 4 and Sia 326. These genotypes were selected based on diversity of origin and other variability parameters to have a wide genetic base.The nutritional studies was carried out for all the genotypes with three replications.

Nutritional composition

The proximate parameters of seventy five genotypes were analyzed in Near infrared reflectance spectroscopy (NIRS). The foxtail millet grain samples were pre calibrated using NIRS for the parameters moisture, protein, fat, carbohydrate, crude fiber, total minerals and total energy with the thirty foxtail millet dehusked landraces Further the genotypes selected for the study were analyzed by NIRS using the software ISI scan and WinISI for the above mentioned proximate parameters. NIR is a fast and nondestructive technique that provides multi constituent analysis of virtually any matrix. The principle of detection and measurement of chemical composition of biological materials was based on vibrational responses of chemical bonds to NIR radiations**.**

Minerals estimation

The trace elements (iron, zinc, copper and manganese) were estimated by wet digestion using triacid mixture. A known aliquot of test sample was suitably diluted and micronutrients in the test sample (Cu, Mn, Zn and Fe) were determined using Atomic Absorption Spectrophotometer (model :AAS GBS Avanta).

RESULTS AND DISCUSSION

An attempt was made to identify to superior genotypes for each of traits over the superior check and it is presented in Table 1 and 2.The genotypes *viz*., K 2, Krishnadevaraya and H 1 had the highest moisture content compared to the best check PS 4 similar result are reported by Kulkarni *et al*[11]., Kulkarni and Naik[9,10], Itagi[4], Veena *et al*[23]., Singh *et al*[20]., Balasubramanian and Vishwanathan[1] and Nambi*et al*[14]. For protein content 12 genotypes recorded higher values than the best check Sia 326 protein content, Among them Ise 1468, GS 1000, Ise 375, GS 2099 and DHF 30 was the top 5 genotypes, Upadhaya *et al*[22]., Jun

Young Kim *et al*[6]., Kamara *et al*[7]., and Kulkarni and Naik[9,10] reported similar results.Forty nine genotypes recorded the higher crude fiber content of which DHF 27, GS 2109 and DHF 2 was higher when compared to check Sia 326. Similar results are reported by Veena *et al*[23]., Mohamed *et al*[12]., and Khouloudbchar *et al*[8]. The genotypes *viz.*, DHF 26, DHF 15, DHF 25, DHF 24 and DHF 18 other genotypes recorded higher carbohydrates than the best check Sia -326, Similar results are reported by Mustafa *et al*[13]., Nambi*et al*[14]., and Roopa[19].

Among the 75 genotypes 17 had higher total mineral content than the best check HMT 100-1. viz., Krishnadevaraya, Ise 1312, DHF 13, DHF 11, DHF 15 and Ise 931 were recorded highest mineral content. Similar results are obtained by Gopalan*et al*[3]., Ravindran[18] and Khouloudbachar*et al*[8]. Fourteen genotypes recorded the higher total energy, among them GS 1000, K 2 and GS 2129 were the top three genotypes when compared to the best check HMT 100-1.The genotypes Pratapkagni, DHF 14, DHF 27, Ise 931 and DHF 27 had recorded the highest iron content than the national check PS-4.Similar results are reported by Barbeau *et al*[2]., Phillip and Maloo[15], Veena *et al*[23]., and velu *et al*[24]. The genotypes *viz.*, DHF 6, DHF 7, DHF 3 and DHF 17 recorded highest zinc than the best check PS 4. Similar results are obtained by Sridevi *et al*[21]., and Upadhaya *et al*[22]. The genotypes viz., Chithra, GS 2040, DHF 21, DHF 17, Ise 758 and GS 2105 had higher copper content than the best check PS 4 as reported by Sridevi *et al*[21]., and Upadhyaya *et al*[22].

National checks PS 4,Sia 326 and HMT 100-1 recorded the highest manganese content. None of the genotypes tested had higher manganese content than the best checks. Among the genotypes DHF 17, DHF 19, DHF 20, DHF 18 and DHF 16 had higher manganese content among themselves.

Table 1: Performance of top ten superior Genotypes over checks with respect to mean value and their four important nutrient characters in foxtail millet

Genotypes	Protein (%)	Crude fiber (%)	Fe (mg/100 g)	Zn (mg/100 g)
DHF 2	12.00	2.24	2.54	1.12
DHF 13	12.61	1.96	1.06	1.04
DHF 5	13.12	2.14	1.23	1.19
DHF 18	12.27	2.03	2.31	0.97
DHF 1	13.00	2.23	1.55	0.99
DHF 4	11.92	2.15	1.43	1.00
DHF 20	12.89	2.01	2.21	1.07
DHF19	12.35	2.02	1.28	1.07
DHF16	12.55	2.18	2.06	0.85
DHF 25	9.97	2.19	2.13	0.91
Mean	12.27	2.12	1.78	1.02
Checks				
HMT100-1	13.29	1.95	3.08	1.05
PS 4	13.38	1.97	4.34	1.23
Sia 326	13.53	2.04	1.80	1.13

Table 2: Performance of top ten superior Genotypes over checks for nutritional parameters in foxtail millet

Genotypes	Protein (%)	Genotype	Crude fiber (%)	Genotype	Fe (mg\100g)	Genotype	Zn (mg\100g)	Genotypes	Total mineral (%)	Genotype	Cu (mg\100g)
Ise 1468	14.37	DHF 26	2.31	Pratapkagni	4.08	DHF 6	2.53	Krishnadevaraya	1.57	Chithra	3.37
GS 1000	14.07	GS 2109	2.28	DHF 14	4.04	DHF 7	1.45	Ise 1312	1.47	GS 2040	3.35
Ise – 375	14.04	DHF 2	2.24	DHF 27	3.51	DHF 3	1.33	DHF13	1.46	DHF 21	3.11
GS 2099	13.96	DHF 1	2.23	Meera	3.37	DHF 17	1.26	DHF 11	1.44	DHF-17	3.03
DHF 30	13.96	DHF 29	2.23	Ise 931	3.14	GS 2040	1.22	DHF 15	1.44	Ise 758	2.95
Meera	13.88	GS 2164	2.21	DHF 26	2.86	GS 2105	1.22	Ise 931	1.43	GS 2105	2.93
Ise 140	13.76	DHF 28	2.20	RFM 10	2.76	DHF 13	1.21	DHF-8	1.43	DHF 30	2.75
GS 271	13.71	GS 2099	2.19	DHF 2	2.54	H 2	1.21	DHF 24	1.41	GS 511	2.67
GS 2105	13.70	DHF 25	2.19	CO 4	2.50	K 2	1.20	DHF 12	1.41	Meera	2.54
GS 592	13.66	DHF 30	2.18	DHF 7	2.47	DHF 21	1.20	GS 1483	1.41	Ise 931	2.44
Mean	13.92		2.21		3.13		1.38		1.44		2.91
Checks											
HMT 100-1	13.29		1.95		3.08		1.05		1.33		2.07
PS-4	13.38		1.97		4.34		1.23		1.24		2.82
Sia-326	13.53		2.04		1.80		1.13		1.25		2.30

CONCLUSION

Based on the studies conducted it can be concluded that for improving nutritional quality characters genotypes namely Ise 1468, GS 1000, Ise 375 for protein; DHF 26 for fiber ; DHF 6 for zinc content; Krishnadevaraya for total minerals; Chithra, GS 2040 for copper can be valuable material for developing nutritionally superior genotypes as per the needs of consumer for a particular nutrient. In general genotypes the DHF 1,DHF 2 and DHF 5 can be utilized to develop high yielding as well as nutritionally good genotypes of foxtail millet as these three genotypes had higher grain yield levels with high nutritional contents.

For protein content Ise 1468, GS 1000, Ise 375, GS 2099 and DHF 30, for crude fibre DHF 27,GS 2109 and DHF 2, for zinc DHF 6, DHF 7, DHF 3 and DHF 17, For iron PratapKagni, DHF 14 , DHF 27, Ise 931 and DHF 26 were recorded the highest nutrients composition compare to checks. The most promising genotypes for nutritional characters are DHF 2, DHF 5 and DHF 1.These three genotypes can be used as donors in further plant breeding programme for the improvement of the most of the characters.

REFERENCES

1. Balasubramanian, S. and Viswanathan, S., Influence of Moisture Content on Physical Properties of Minor Millets. *J. Food Sci. Technol..*, **47(3):** 279- 284 (2010).
2. Barbeau, W.E. and Hilu, K.W., Protein, calcium, iron and amino acid content of selected wild and domesticated cultivars of finger millet. *Plant Foods for Human Nutrition (Formerly QualitasPlantarum)*, **43(2):** 97-104 (1995).
3. Gopalan, C., Ramasastri, B.V. and Balasubramanian, S.C., *Nutritive value of Indian Foods.*National Institute of Nutrition, (ICMR), Hyderabad, 47 (2002).
4. Itagi, S.K., Development and evaluation of millet based composite food for diabetics II, *Ph. D. Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (2003).
5. Jali, M.V., Kamatar, M.Y., Sujata, M.J., Hiremath, M.B. and Rama, K.N., Efficacy of value added foxtail millet therapeutic food in the management of diabetes and dyslipidamea in type 2 diabetic patients. *Rec. Res. Sci. Technol.,* **4(7):** 3-4 (2012).
6. Jun Young Kim, Ki Chang Jang, Bo Ram Park, Sang Ik Han, Kyung Jin Choi, Sang Yeol Kim, Seong Hwan Oh, JiEun Ra, Tae Joung Ha, Jin Hwan Lee, Jaeyoung Hwang, Hang Won Kang and Woo Duck Seo, Physicochemical and anti oxidative properties of selected barnyard millet (*Echinochlo autilis*) species in Korea. *Food Sci.Biotechnol.*, **20(2):** 461-469 (2011).
7. Kamara, M.T., Huiming, Z., Kexue, Z., Amadou, I. and Tarawalie, F., Comparative Study of Chemical Composition and Physicochemical Properties of Two Varieties of Defatted Foxtail Millet Flour Grown in China. *American J. Food Technol.,* **4:** 255-267 (2009).
8. Khouloudbachar, Elhemmansour, Abdennaceur Ben Khaled, Mabrouka Abidl, Mansohaddad, Fiber Content and Mineral Composition of the Finger Millet of the Oasis of Gabes .*Tunisia J. Agric. Sci.,* **5(2):** 213- 216 (2013).
9. Kulkarni, L.R. and Naik, R.K., Chemical composition and protein quality of Italian millet.*Karn. J. Agric. Sci.,* **12:** 164-167 (1999).
10. Kulkarni, L.R. and Naik, R.K., Nutritive value, protein quality and organoleptic quality of kodo millet (*Paspalumscorbiculatum*).*Karnataka J. Agric. Sci.,* **13(1):** 125-129 (2000).
11. Kulkarni, L.R., Naik, R.K. and Katarki, P.A., Chemical composition of minor millets.*Karn. J. Agric. Sci.,* **5(3):** 255-258 (1992).
12. Mohamed Lamine Bangoura, Zhou Hui Ming, John Nsor Atindana, Zhu Khe Xue, Michel Bano Tolno and Peng We, Extraction and fractionation of insoluble fibers from foxtail millet (*Setariaitalica*(L.) P. Beauv). *American J. Food Technol.,* **6(12):** 1034-1044 (2011).

13. Mustafa, A.G. and Magdi, O., Chemical composition and Nutritional Potential of pearl millet Grown in Jazan Region of Soudi Arabia. *J. Soudi. Soc. Agric. Sci*., **7(1):** 11-21 (2008).
14. Nambi, V.A., Eganathan, P. and Maria Philip, Proximate and mineral composition analysis of little millet collected from some millet growing areas in Tamil Nadu. *Indian J Plant Genet* Resour., **25(2):** 189-191 (2012).
15. Phillip, J. and Maloo, S.R., An evaluation of *Setariaitalica* for seed iron content. **82:** ISMN 37 (1996).
16. Rai, M., Nutritive cereals. In: Survey of Indian Agriculture, The Hindu, Chennai, Tamil Nadu, India, pp. 59–62 (2002).
17. Ravi, S.B., Hrideek, T.K., Kumar, A.T.K., Prabhakaran, T.R., Mal, B., Padulosi, S., Mobilizing neglected and underutilized crops to strengthen food security and alleviate poverty in India. *Indian J. Plant Genet.Reso.*, **23:** 117–121 (2010).
18. Ravindran, G., Studies on millets: Proximate composition, mineral composition, phytate and oxalate contents. *Food Chem.,* **39(1):** 99-107 (2003).
19. Roopa, U., Kasturiba, B., Ramanaik, Usha Malagi, Shanthakumar, G., Hemalatha and Kiran Mirajkar, Physico chemical and functional properties of little millet genotypes.*Karnataka J. Agric. Sci.,* **26(4):** 539-542 (2013).
20. Singh, K.P., Mishra, H.N., Supradip Saha, B., Moisture dependent properties of barnyard millet grain and kernel. *J. Food Engg.*, **96:** 598–606 (2010).
21. Sridevi, Nirmala B. Yenagi, Basavaraj, Hanchinal R.R. and Basarkar P.W., Evaluation of Antioxidant Contents and Activity of Regional whole Grains, Cooked and Enriched Foods of North Karnataka. *J. Dairying Foods &Home Sci.,* **30(1):** 241-248 (2011).
22. Upadhyaya, H.D., Ravishankar, C.R., Narasimhudu, Y., Sharma., N.D.R.K., Singh, S.K., Varshney, S.K., Reddy, V.G., Singh, S., Parzies, H.K., Dwivedi, S.L., Nadaf, H. L., Sahrawat, K.L. and Gowda, C.L.L., Identification of trait specific germplasm and developing a mini core collection for efficient use of foxtail millet genetic resources in crop improvement. *Field Crops Res.*, **124:** 459–467 (2011).
23. Veena, B. Chimmad, B.V., Naik, R.K. and Shantakumar, G., Physico chemical and nutritional studies in barnyard millet.*Karnataka J. Agril. Sci*., **18(1):** 101-105 (2005).
24. Velu, G., Rai, K.N., Sahrawat, K.L. and Sumalini, K., Variability for grain iron and zinc contents in pearl millet hybrids. *J. SAT Agri. Res.*, **16(2):** 6-12 (2008).