

Original Research Article

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Bench Mark Values for Grain Iron Content in Finger Millet (*Eleusine coracana* (L.) Gaertn.)

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ABSTRACT

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Finger millet is an excellent source of mineral elements specifically calcium and iron. The iron content in the ruling variety, GPU-28 is 5.47 mg/100g. Identification of germplasm lines superior to GPU-28 would help in identifying nutritionally superior genotypes and also to serve as genetic resource for recombination breeding. For such screening, use of appropriate procedure and bench mark values are highly useful. Hence, the present study was conducted to confirm the estimation procedure and to arrive at bench mark values for grain iron content in popular varieties. The elemental analysis was carried out in two laboratories. The results of the study indicated a positive correlation between the two laboratories for iron content and confirmed the appropriateness of procedure used for digestion and AAS estimation. Among the varieties, the iron content was significantly superior in GPU-67 (6.52 mg/100g) compared to the GPU-28 and hence, this variety and grain iron content can be considered as a variety with bench mark value for screening large number of germplasm lines.

Introduction

Finger millet is predominantly cultivated in arid and semiarid regions of Africa and Asian countries as one of the staple food crop. In Karnataka, the crop (widely used Cv. GPU-28, MR-1, MR-6, L-5, KMR-340 etc.) is mostly cultivated as *kharif* crop in an area of 6.3 lakh ha with productivity of 1759 kg ha⁻¹ (Anon, 2013). It is a promising source of

micronutrients with high dietary fibre (15–20%), calcium (264–365 mg/100g), magnesium (66–130 mg/100g), iron (3.60–7.31 mg/100g), sodium (0.60–0.95 mg/100g) and potassium (294–1160 mg/100g) with relatively lower quantities of anti-nutritional factors such as tannins and phytate (0.30 and 0.34 mg/100g respectively) (Gopalan *et al.*, 2002; Chethan and Malleshi, 2007; Shashi *et al.*, 2007). Among the micronutrients, iron

and zinc are imperative. The iron deficiency lead to anaemia (WHO, 2015) and; more than 80 % of pregnant women in developing countries do suffer from iron deficiency especially in rural mass (Kruger *et al.*, 2012). Hence, fortification of foods with micronutrients especially iron and the use of diversified foods rich in iron are common practices being followed. The other approach could be bio-fortification of crop which is cost effective in long run, for which identification of genetic resources rich in iron is the basis and the genotypic variation has been evidenced (Kazi and Auti, 2017). However, preliminarily it is pertinent to quantify the element in released varieties which are under cultivation and human consumption. The data pertaining to released varieties is not available and such data would be useful for future bio-fortification studies. Therefore the experiment was planned to quantify the grain iron content in released varieties of finger millet.

Materials and Methods

Seventeen released varieties of finger millet were grown during monsoon, 2017 with protective irrigation at GKVK farm, University of Agricultural Sciences, Bengaluru, Karnataka. The grain was harvested at maturity and used for the estimation of iron content. The grain samples were de-husked and washed thoroughly with acetone followed by double distilled water. Such washed grains were oven dried at 65⁰C for 2 hours. These samples were weighed (0.50 g) using three decimal balance. Such weighed samples were placed in 100 ml capacity conical flask and pre-digested overnight adding 10 ml of concentrated nitric acid. The next day, the pre-digested samples were added with di-acid mixture (HNO₃ and Perchloric acid; 9:4 respectively) and open digested on hot plate in acid fume chamber until the sample is completely digested (white semi-solid) to a two to three millilitre. Then

cooled and volume was made up to 50 ml with double distilled water. These samples were fed to Atomic Absorption Spectrophotometer (AAS) using standard curve made for the element using Merck laboratory chemical. These samples were estimated for iron, using AAS at two laboratories namely, Nutrition Laboratory, Department of Crop Physiology, GKVK and the National Bureau of Soil Science and Land Use Planning for data confirmation. The calculations for the element are as follows.

Fe content (ppm) =

Graph ppm X Vol. of digested sample (ml)

Weight of sample (mg)

Results and Discussion

The grain iron content of finger millet varieties did not differ between the laboratories (Fig. 1). The correlation between two laboratories for grain for iron is positive and significant (Fig. 2). These results suggest that the varieties are stable for their grain iron content and; the procedure adopted for digestion of samples and use of AAS for measuring iron can be adopted for screening of large number of germplasm of finger millet. This is in confirmation with Netravati *et al.*, (2018), where they have digested the sample using hot plate method and measured elements using ICP-OES (Table 1).

The grain iron content ranged from 3.98 to 6.52 mg/ 100g and highest being in variety GPU-67 (6.52 mg/ 100g) and is significantly higher than GPU-28 (5.47 mg/100g). Similarly, Babu *et al.*, (1987) reported grain iron content ranged from 3.3 to 14.8 mg/ 100g. Further, Singh and Srivastava (2006) reported iron content of 16 finger millet varieties ranged from 3.61 to 5.42 mg /100g.

Table.1 Genotypic variation in zinc and iron content in popular finger millet varieties

Variety	Grain Fe (mg/100g)
Location	Pooled
GPU-48	3.98
RAU-8	4.06
KOPN -330	4.15
GPU-66	4.28
KMR-316	4.35
POORNA	4.59
VL-146	4.66
SHARADHA	4.75
VR-708	4.79
VL-347	5.06
INDAF-15	5.13
L-5	5.17
PES-110	5.18
PR-202	5.43
GPU-28	5.47
KEMPURAGI	5.66
GPU-67	6.52
Mean	4.99
CD @ 5 %	0.63
SEm \pm	0.22
C.V. (%)	7.7

Fig.1 Finger millet grain iron content across the laboratories

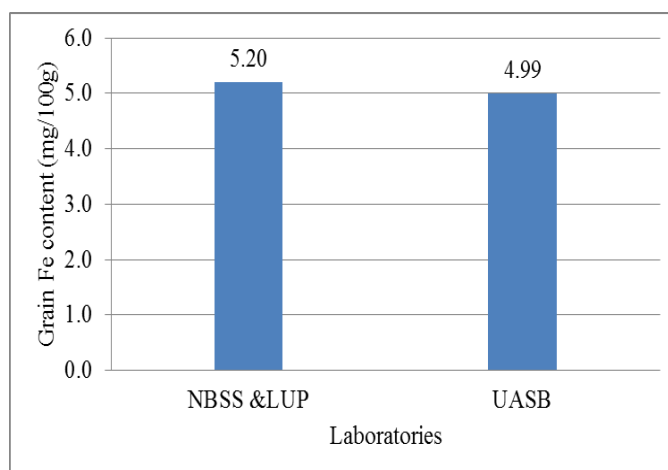
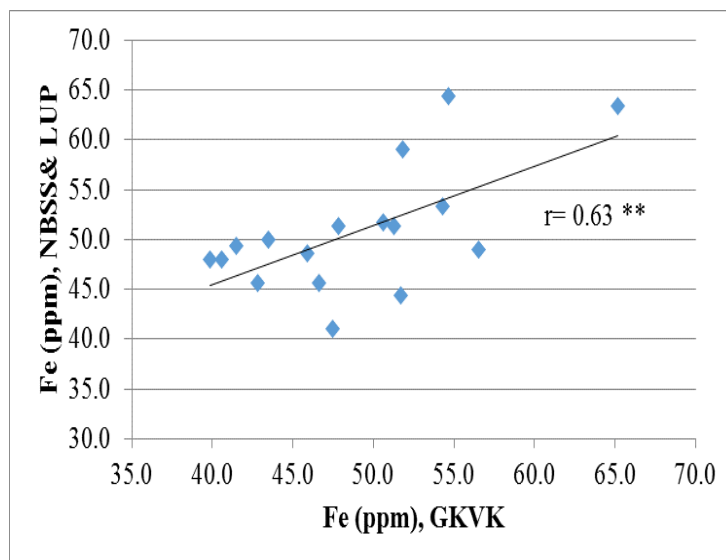


Fig.2 Relationship between grain iron content between two laboratories



In a recent study, Wafula *et al.*, (2018) reported grain iron content ranged from 3.1 to 4.3 mg/100g. Similar result of 3.9 mg/ 100g grain of iron has been reported in another study by Kumar *et al.*, (2016). Louwagie (2016) also reported a range of total iron content from 0.94 to 1.73 mg/100 g. Varietal differences observed in different studies could be due to genetic, soil, environmental factors (Shashi *et al.*, 2007; Singh and Raghuvanshi, 2012). Hence, the grain iron content (6.52 mg/100g) obtained in Cv. GPU-67 following the current methodology, can be used as bench mark value for screening large germplasm to identify genetic resources rich in grain iron content.

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