Indian Journal of Agricultural Sciences 86 (3): 291–6, March 2016/Article

Research Articles

Grain iron and zinc densities in released and commercial cultivars of pearl millet *(Pennisetum glaucum)*

K N RAI[1], O P YADAV[2], M GOVINDARAJ[3], W H PFEIFFER[4], H P YADAV[5], B S RAJPUROHIT[6], H T PATIL[7], A KANATTI[8], A RATHORE[9], A S RAO[10] and H SHIVADE[11]

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana 502 324, and *All India Coordinated Pearl Millet Improvement Programme (AICPMIP), Mandor, Jodhpur, Rajasthan 342 304*

Received: 4 July 2015; Accepted: 20 October 2015

ABSTRACT

Crop biofortification is a cost-effective and sustainable agricultural strategy to reduce micronutrient malnutrition arising from iron (Fe) and zinc (Zn) deficiencies. A large number of hybrids and open-pollinated varieties (OPVs) of pearl millet *[Pennisetum glaucum* (L.) R. Br.] have been released and/or commercialized in India. Eighteen OPVs and 15 high-Fe candidate hybrids were evaluated in multi-location trials for Fe and Zn density to identify those with high density of these micronutrients. The Fe density in OPVs varied from 42 mg/kg to 67 mg/kg, and Zn density from 37 mg/kg to 52 mg/kg with ICTP 8203 having the highest Fe density (67 mg/kg) followed by ICMV 221 (61 mg/kg) and AIMP 92901 (56 mg/kg). While ICTP 8203 had also the highest level of Zn density (52 mg/kg), ICMV 221 and AIMP 92901 had 45-46 mg/kg Zn density. The Fe density in hybrids varied from 46 mg/kg to 56 mg/kg and Zn density from 37 mg/kg to 44 mg/kg. Four hybrids, viz. Ajeet 38, Proagro XL 51, PAC 903 and 86M86 had the highest Fe density of 55-56 mg/kg and 39-41 mg/kg Zn density. The six commercial cultivars (2 OPVs and 4 hybrids) identified in this study with high Fe and Zn densities can be undertaken for expanded cultivation in their recommended ecologies to specifically address the Fe and Zn deficiencies in India. This study also enabled to re-define base line for Fe density at 42 mg/kg for hybrids, the most dominant cultivar type grown in India.

Key words: Base line, Cultivar, Iron, Pearl millet, Stability, Variability, Zinc

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a major warm-season cereal, grown primarily for grain production on more about 28 million ha in the arid and semi-arid tropical environments of Asia and Africa with India being the largest producer, both in terms of area (>9 m ha) and production (10 million tonnes) (Yadav *et al.* 2012). It is a significant source of Fe and Zn in the major pearl millet growing states of India. For instance, it has been shown to account for 19-63% of the total Fe and 16-56% of total Zn intake from all food sources in pearl millet growing areas of Maharashtra, Gujarat and Rajasthan (Parthasarathy Rao *et al.* 2006). It is also the cheapest source of these micronutrients as compared to other cereals and vegetables. Cultivated pearl millet has higher levels of both micronutrients, especially Fe content, than other major cereals such as rice, wheat, maize and sorghum (Dwivedi *et al.* 2012). The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), in alliance with the HarvestPlus Biofortification Challenge Program of the CGIAR and in partnerships with public and private sector breeding programs in India, has undertaken a major initiative to examine the prospects of breeding pearl millet cultivars with higher Fe and Zn levels. Large variability for these micronutrients has been observed in pearl millet germplasm and breeding materials (Rai *et al.* 2012, 2015). Considering the larger variability for Fe density, greater seriousness of Fe deficiency than Zn deficiency in certain populations, and highly significant and positive association between these two micronutrients, major emphasis is on Fe density, with Zn density being improved as an associated trait (Rai *et al.* 2013).

ICRISAT has developed and disseminated a large number and diverse range of improved breeding lines and hybrid parents to pearl millet breeding programs in India, which have been used along with the locally bred materials to develop open-pollinated varieties (OPVs) by various research programs in the public sector, and hybrids in both public and private sector (Gowda *et al.* 2004, Mula *et al.* 2007). Considering the large variability for Fe and Zn densities in ICRISAT-bred lines (Rai *et al.* 2012, 2014a) and their extensive utilization in cultivar development, large variability for these micronutrients can be expected among

[1]Former Principal Scientist and Director (e mail: kedarrai64@gmail.com), [2]Director (e mail: opyadav21@yahoo.com), IIMR, New Delhi; [3]Scientist, [4]Director (CIAT-HarvestPlus), [5]Project Coordinator, AICPMIP, [6,7]Professor, [8]Visiting Scientist, [9]Senior Scientist, [10,11]Scientific Officer