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# SCREENING FOR MICRONUTRIENT (ZN AND FE) CONTENT IN RICE (*ORYZA SATIVA* L.): A PATHWAY FOR BIOFORTIFICATION

**V. Girijaveni*, K. Sammi Reddy, V. Visha Kumari and Jagriti Rohit**

*ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Saidabad P.O., Hyderabad, 500 059, India*

*Corresponding author email: *V.Girija@icar.gov.in*

## ABSTRACT

*One of the major problems disturbing populations specifically in developing countries is malnutrition due to micronutrient insufficiency. Presently, Fe and Zn insufficiency stand in the priority, affecting more than three billion people worldwide. Identifying micronutrient undernourishment as hidden hunger, numbers of interventions were employed to relieve deficiency. Unfortunately, these were not effective due to their narrow reach and problems associated with delivery. Also, these interventions are costly and, hence, out of scope from the people of the weaker sections. Thus, biofortification is considered as a possible alternative and workable solution. The preliminary phase for biofortification is screening of the genotypes for their micronutrient content. It is vital to choose the quantity of micronutrient content that has to meet the diurnal endorsed dose for optimal bodily and mental progress.*

## INTRODUCTION

Currently, universal threat that affecting crop productivity and human nourishment is micronutrient deficiency. The chief reason of micronutrient undernourishment is dependence on deprived quality cereals-based staples and lack of assortment in the food. Agreeing to WHO (2002), among the most important health menace, zinc insufficiency in the diet ranks fifth in developing countries and eleventh worldwide. The diurnal recommended salutary for babies 3-5 mg/day, children 10 mg/day, adult women 12 mg/day, adult men 15 mg/day, and breast-feeding women 16 - 19 mg/day (Dietary Allowances for Americans, 2005). There are a number of interventions to discourse the micronutrient malnutrition difficulty, but utmost people do not have admittance to supplementation approaches and success of other interventions depend on the financial situation and socio- political issues in the countries. The interventions similar as food strengthening and supplementation approaches are costly and not effortlessly reachable for people living in developing nations. Agriculture is the main cradle of nutrients for healthy mortal lifecycle. Hence, it is vital to replenish the soil nutrients and tap the heritable potential to employ the available soil micronutrients efficiently. On a worldwide basis, rice ranks second only to wheat in terms of area reaped, but in terms of its significance as a food crop, rice provides added calories per hactare than other cereal (Kaushal *et al.*, 2010) which are high in calories is deficient in essential micronutrients. Therefore, this article, majorly focuses on selection of the rice genotypes for Zn and Fe content.

## SCREENING METHODOLOGY

Iron (Fe) and zinc (Zn) are assessed in the genotypes by Perl's Prussian blue and DTZ staining approaches. Prom-u-thai *et al.* (2003) employed the Perls' Prussian blue technique with a Prussian blue solution of 2% concentration to classify high grain Fe genotypes in rice. Though these approaches are economical and direct but are qualitative rather than quantitative. According to Choi et al. (2007), precise estimate of micronutrient (Fe and Zn) concentration is generally realized through spectroscopy (AAS/ICPOES) techniques. Apart from these approaches, semi-quantitative screening techniques are best suitable for plant breeding purposes to screen the micronutrient rich genotypes or elite lines. According to Graham *et al.* (2007), semi-quantitative screening approaches could differentiate the genotypes into low and high micronutrients comprising sufficient for plant breeders. The AAS and ICPOES employed to quantify real amounts of micronutrient concentration in the genotypes.

## ADVANTAGES OF SCREENING GENOTYPES FOR MICRONUTRIENT CONTENT

1. It aids in a deeper thoughtful of genetic control mechanisms and the development of molecular markers to enable breeding programs.
2. To choose the fertilizer dosage for agronomic biofortification (e.g. applying Zinc sulphate and ferrous sulphate to cereal crops by basal. Broadcasting or spraying approach), which leads to improvement in the nutrition of populations
3. To know the uptake efficiency of the genotypes to the applied fertilizers and contain the amount of micronutrient in their edible portion.
4. Furthermore, it aids in sensing and exploiting useful interactions and micronutrient bioavailability in humans to fight against micronutrient malnutrition.

## MICRONUTRIENT CONTENT IN GRAINS OF RICE GENOTYPES

The content of micronutrients in rice rest on the grain size, environmental aspects such as soil conditions and climate. When 126 accessions of brown rice were assessed for micronutrient content was ranged from 6.2 ppm to 71.6 ppm for iron and from 26.2 ppm to 67.3 ppm for zinc among different cultivars of know rice species and wild germplasm (Anuradha *et al.*, 2012). Similarly, Banerjee *et al.* (2010) informed that the iron content in rice grain ranged between 4.82-22.69 µg $g^{-1}$ and grain Zn content found between 13.95-41.75 µg $g^{-1}$ in tested rice genotypes and reported that there existed a considerable genotypic variation in the micronutrient content in the seeds in 46 rice accessions.

Brar *et al.*, (2011) evaluated 220 rice genotypes for Fe and Zn, and reported that aromatic rice varieties have high Fe and Zn content. The concentration of Fe and Zn in traditional rice genotypes was considerably higher than that of upgraded cultivars (Brar *et al.*, 2011). Kumar *et al.* (2012) reported Fe and Zn variability in twenty rice genotypes and reported that the Fe and Zn contents stretched between 127.3-659.3 µg $g^{-1}$ and 42.1-63.4 µg $g^{-1}$ in the dehusked grains of twenty rice genotypes. These concentration values can vary based on the sample lots. Zeng *et al.* (2009) evaluated 863 accessions of brown rice in Yunnan and observed mean contents of Cu, Zn and Fe as 13.94 ± 11.39 mg $kg^{-1}$ , 32.49 ± 13.56 mg $kg^{-1}$ , and 32.56 ± 25.37 mg $kg^{-1}$ of Cu, Zn and Fe , respectively. Again, Liang (2007) reported concentration range of Fe (9-45 mg $kg^{-1}$) and Zn (13-39 mg $kg^{-1}$) in 56 rice varieties in China.

Differences in Fe and Zn values in different samples of the same accession can also arise due to the existence or absence of embryo in grains at the time of harvest. Another feature that contributes in difference in the iron and zinc values is the phloem sap piling and dropping rates in the reproductive tissues. Thus, there are no fixed values quite akin to the trait yield and have only a Fe and Zn concentration range.

## CONCLUSION

It is clear from the literature that genetic variability exists among the different genotypes and exploiting those genotypes that have a capacity to maintain enhanced micronutrient content in grain can be a maintainable solution to combat nutrient undernourishment.

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