

Short Communication

**ASSESSMENT OF MOST POPULAR THREE MONTHS AGE RICE VARIETIES  
FOR ZINC (Zn) ACCUMULATION IN BROWN RICE**

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**INTRODUCTION**

Zinc (Zn) malnutrition affects over three billion people worldwide, mostly in developing countries (Sperotto, *et al.*, 2010). To overcome the above problem, food fortification has been recommended as one of the approaches (Mehansho, 2006). Since rice is a staple food, bio fortification of rice with Zn is the easiest way to improve the Zn nutrition requirement of human beings. In addition to agronomical management, selecting genotypes with high efficiency of Zn accumulation even under low Zn condition and partition into grain have been identified as a reliable way to find out the most suitable variety for bio fortification (Prom-u-thai *et al.*, 2006). Rice samples of brown rice and milled rice were evaluated for Zn during 2006 – 2008 by Martinez *et al.* (2010) and found that brown rice contained 20 – 25 mg/kg Zn while milled rice had 16 – 17 mg/kg Zn. According to Martinez *et al.* (2010), micronutrient dense cultivars can be selected from existing germplasm or can be generated through genetic modification. Plant breeders need to identify donor parents carrying the target traits for high Zn. Around 75 % of the total Zn was reported to be present in the endosperm of brown rice (Jiang *et al.*, 2008). As such, Zhang *et al.* (2005) showed that single grain selection of narrow grains of rice tends to increase content of Zn. The objectives of the present study were to screen 3 months age most popular recommended rice varieties for Zn content in their brown rice and to determine the relationship between Zn content with grain weight.

**MATERIALS AND METHODS**

A field study was conducted during 2014 *Yala* season at the Rice Research and Development Institute (RRDI), Bathalagoda, located in the low country intermediate zone, IL1, agro-ecological region (latitudes 7° and 8°, longitude 80° and 81° and at an elevation of 65 m above mean sea level). Soil of the site belongs to Kurunegala series which characterized as Red Yellow Podzolic soil great soil group (Wickramasinghe,

2005). To maintain the uniformity of the Zn in all plots, field maintained without applying any sort of organic or inorganic fertilizer for four decades was selected. Most commonly grown and popular seven, three month age recommended rice varieties (Bg 300, At 303, Bg 304, Bg 305, At 306, At 307, Bg 310) were selected. Plots, size 6 m × 3 m, were arranged in accordance with Randomized Complete Block Design (RCBD) and treatments were replicated three times. Seventeen days old seedlings were transplanted in the field as one seedling per hill at the spacing of 15 cm × 15 cm. During the whole cultivation period pest or disease damages could not be observed at harmful level. During the cropping period no any kind of fertilizers or manure were added. Hand weeding was done to control weeds. Before crop establishment, two composite soil samples were obtained from the field using a soil auger. Samples were air dried, crushed and sieved through 2 mm sieve.

Extractable Zn content in the soil was determined using DPTA (Diethylene Triaminepenta Acetic Acid) method by atomic absorption spectrophotometer (AAS). At the time of harvesting, 5 plants were collected randomly from each plot and seeds were separated from panicles by hand. Collected seed samples were air dried and kept in oven for 3 days under 70 °C for oven drying. Oven dried seed samples were de-husked to separate grain and husk. Grains were ground to obtain powdered samples. Before using the ground samples for analysis they were oven dried overnight at 70 °C. Care was taken to wash and clean all equipment with tap water and then with distilled water before using them. Samples were digested using double acid (one volume of perchloric acid (approximately 60 % m/m HClO<sub>4</sub>) to four volume of nitric acid (approximately 70 % m/m HNO<sub>3</sub>) were mixed and digested samples were analyzed for available Zn concentrations using AAS. Treatment mean differences were evaluated by Duncan Multiple Range Test (DMRT) mean separation test at  $\alpha=0.05$ .

## RESULTS AND DISCUSSION

Extractable Zn content in the soil at the time of planting was  $0.39 \pm 0.01$  mg/kg. This value was far below the critical level of 1 mg/kg reported by Bandara *et al.* (2005). Therefore, cultivating rice at this Zn level will help to select the best varieties which have the capacity to absorb and accumulate Zn in rice grain under low available Zn condition. Zn concentration in grain of all 7 rice varieties ranged from 24.6 mg/kg to 31.8 mg/kg. According to Chandel *et al.* (2010) there is a significant variation among rice varieties for their Zn content in grains. Proving the above finding, the highest Zn content of 31.8 was reported from long slender rice variety At 306 and followed by At 307 (Figure 1). These

results show the significant genetic diversity or variation in the 3 months age rice germplasm on accumulation of Zn in brown rice.

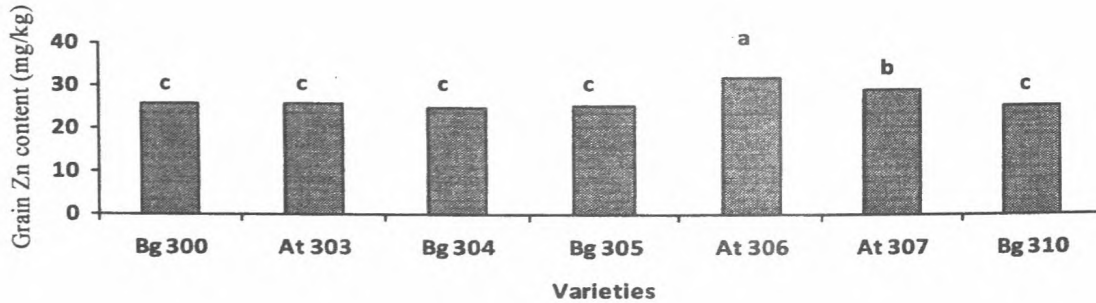


Figure 1. Zn content in brown rice of seven rice varieties.

According to Welch and Graham (2004), Zn content in rice varieties vary from absorption, translocation and transport within the plant. Results appeared in the Figure 2 revealed that though the relationship between seed weight and Zn content in brown rice has a positive trend but the relationship was not significant ( $R^2 = 0.23$ ).

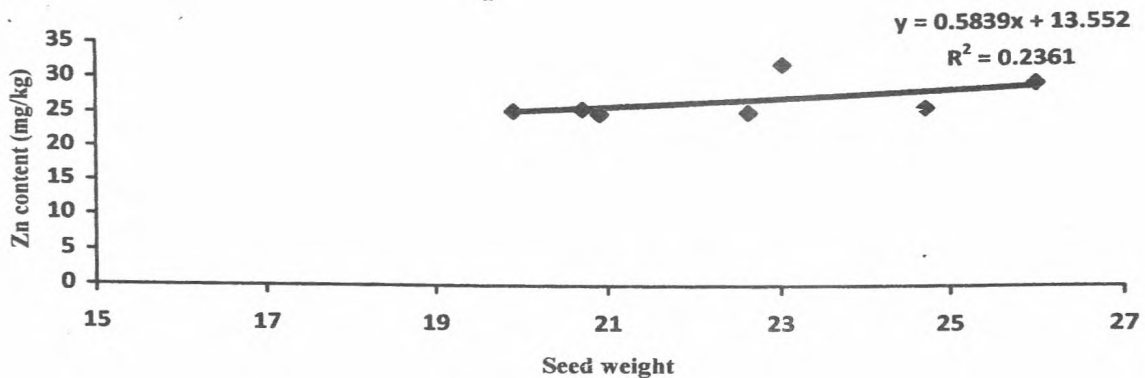


Figure 2. Relationship between seed weight and Zn content in brown rice.

### CONCLUSION

The level of Zn varied from 24.6 to 31.4 mg/kg and the highest value was recorded from At 306 while Bg 310 had the lowest. Since there is a varietal difference affecting Zn accumulation in grain, whole rice germplasm should be tested for Zn accumulation in brown rice to find out most suitable variety for bio-fortification and relationship of Zn with seed shape should also be examined to determine the donor parents for future breeding programmes.

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