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Positional variation in grain mineral nutrients within a rice panicle and its relation to phytic acid concentration

Key words: Grain position, Minerals, Phytic acid, PA/Zn, Rice (*Oryza sativa* L.)

Highlights

- Grain position in a rice panicle was a source of variation for grain nutrition
- Heavy weight grains located on primary rachis had higher mineral accumulation
- The effect of grain position on Fe content was more substantial than that on Zn
- Heavy weight grain had low phytic acid content and molar ratio of PA/Zn and PA/Fe
- It is feasible to select rice cultivar with low phytic acid and high mineral nutrient

Background

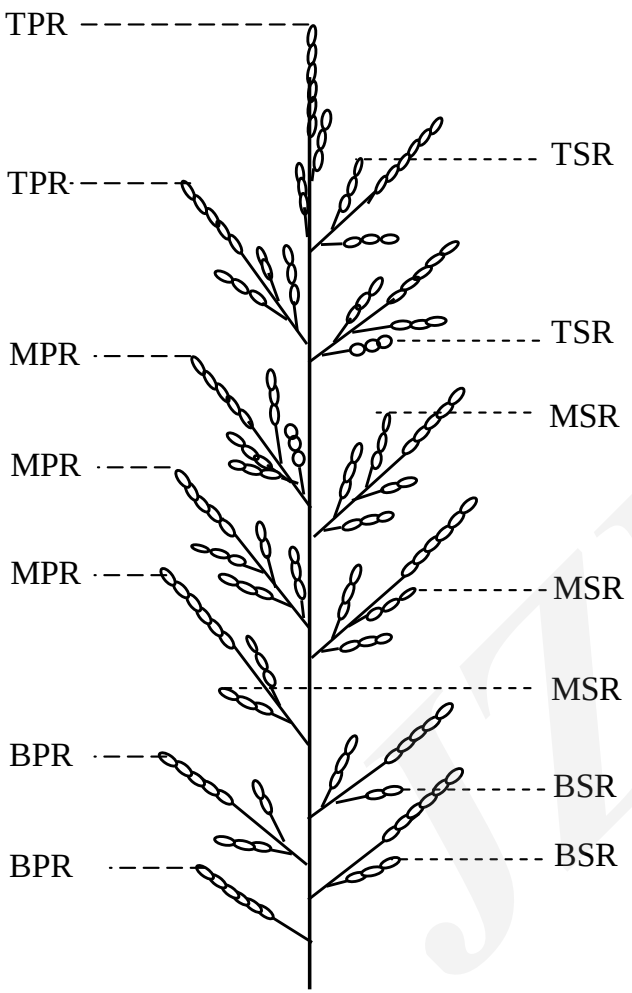
The former studies showed that grain position within a panicle had a considerable impact on grain quality. However, little research has been done on the positional variation of micronutrient and phytic acid (PA) concentration in relation to rice panicle morphology.

Aim

In this study, six japonica rice genotypes, differing in panicle type, grain density and PA content, were used to investigate the effect of grain position on mineral element (K, Mg, Na, Ca, Zn, Fe, Mn, and Cu), as well as PA concentration, and to identify the positional distribution of mineral elements in grains within a panicle as affected by the panicle morphology of rice genotypes

Method

Grains from six positions within a panicle ie, top primary rachides, top secondary rachides, middle primary rachides, middle secondary rachides, bottom primary rachides and bottom secondary rachides, were sampled for analysis



Note:

1) TR, Top rachis; MR, Middle rachis; BR, Bottom rachis; PR, Primary rachis; SR, Second rachis

2) The crossing column between TR and PR means TPR (Top primary rachis), and the corresponding expressions were for TSR (Top secondary rachis), MPR (Middle primary rachis), MSR (Middle secondary rachis), BPR (Bottom primary rachis), and BSR (Bottom secondary rachis), respectively.

Fig. Diagram of six sampling positions in a rice panicle

Conclusion

- **Grain position within a rice panicle was an important source of variation for grain mineral concentrations and their bioavailability, and phytic acid concentration.**
- **Heavy weigh grains located on TPR (Top primary rachis) and MPR (Middle primary rachis) had lower PA concentration, but higher mineral concentrations and Zn, Fe bioavailability relative to the small weight grains located on BSR (Bottom secondary rachis) and MSR (Middle secondary rachis)**
- **The effects of grain positions on Na, Fe and Cu concentrations were more substantial than those on Ca and Zn**
- **These will be of great interest to the scientists working on the relationship between grain nutritional quality and the modification of panicle architecture and morphological pattern for the rice cultivars, particularly for the compact rice cultivars with high grain density and high yield levels.**

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