



How does UVB seed priming affect agronomic and yield traits of rice genotypes under UVB-stress?

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Introduction

- Rice cultivation is increasingly shifting to higher altitudes (e.g., up to 3000 m a.s.l. in the Nepalese highlands), where rice cultivars have to adopt to higher levels of ultraviolet-B (UVB) radiation stress.
- UVB-priming is known to enhance defense mechanisms against abiotic stresses in certain crops, the genotype-specific effects of UVB-seed priming on rice under UVB stress remain unexplored.
- Research questions:
 - How UVB-seed priming affects physiological and yield traits of rice?
 - How rice genotypes response to seed priming along with exposure to UVB stress?
 - To what extent the seed priming and UVB stress interaction affect the accumulation of nutritionally important grain minerals?

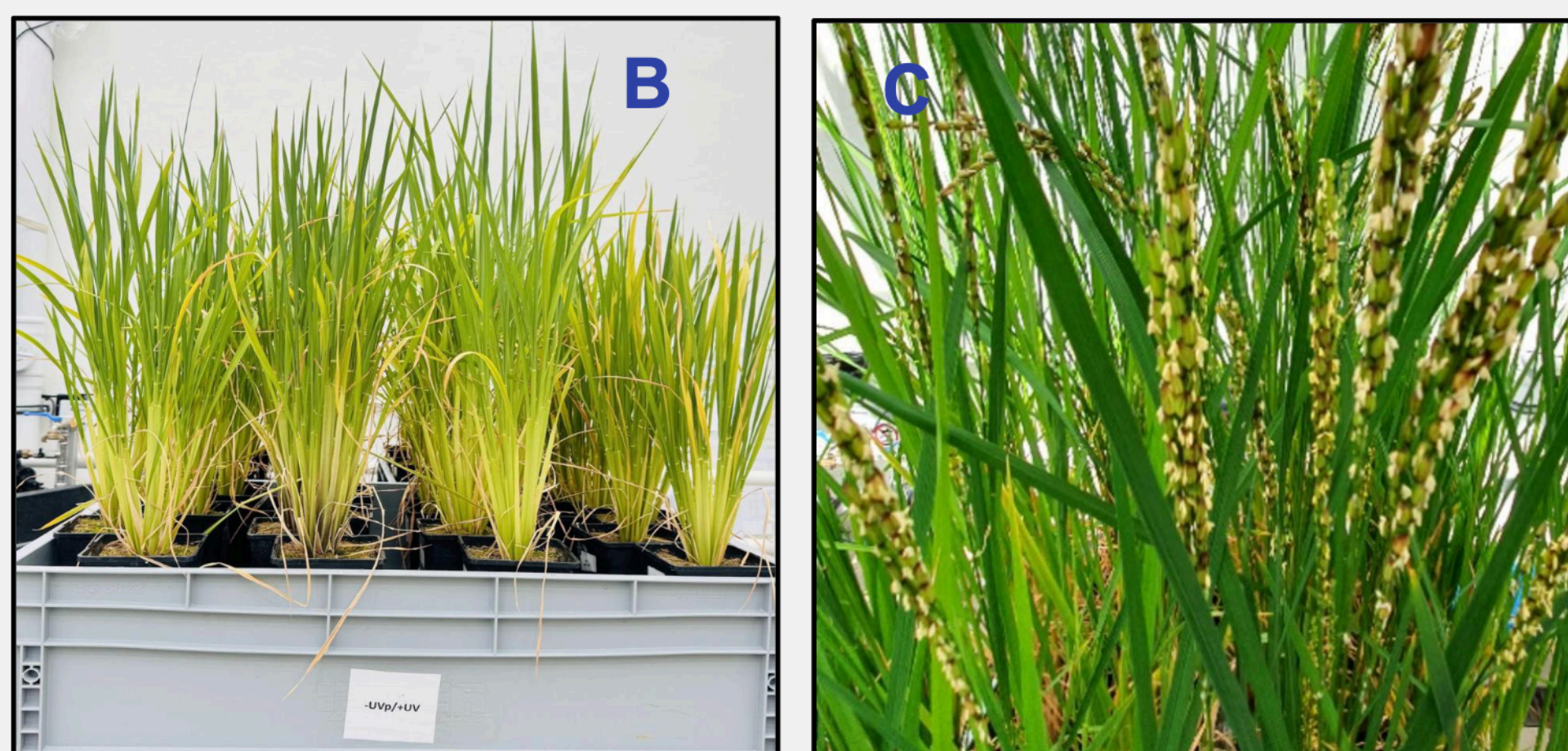


Fig. 1 : Rice plants inside the UV Chamber (A). Four rice genotypes in the Greenhouse (B). Rice genotype CH1 at flowering stage in the Greenhouse (C).

Materials and methods

Selected Genotypes

- Four rice varieties: IR29 (sensitive, lowland), Marshi & CH1 (UV-adapted, highland), and DBB (unknown, highland).

Seed Priming (UVBp)

- Exposed seeds to a UVB dose of $22 \text{ kJ m}^{-2} \text{ day}^{-1}$ prior to germination. (2 hours).

UVB Treatment

- Transplanted seedlings into 2.5 L soil pots and grown them under UVB stress ($22 \text{ kJ m}^{-2} \text{ day}^{-1}$) for two weeks in a UV growth chamber. (UVB: 2 hours per day).

Treatment combinations

- UVBp/-UVB, -UVBp/+UVB, +UVBp/-UVB, +UVBp/+UVB.

Growth Phase

- After two weeks, all plants were transferred to a greenhouse and grown until harvest.

Physiological Traits

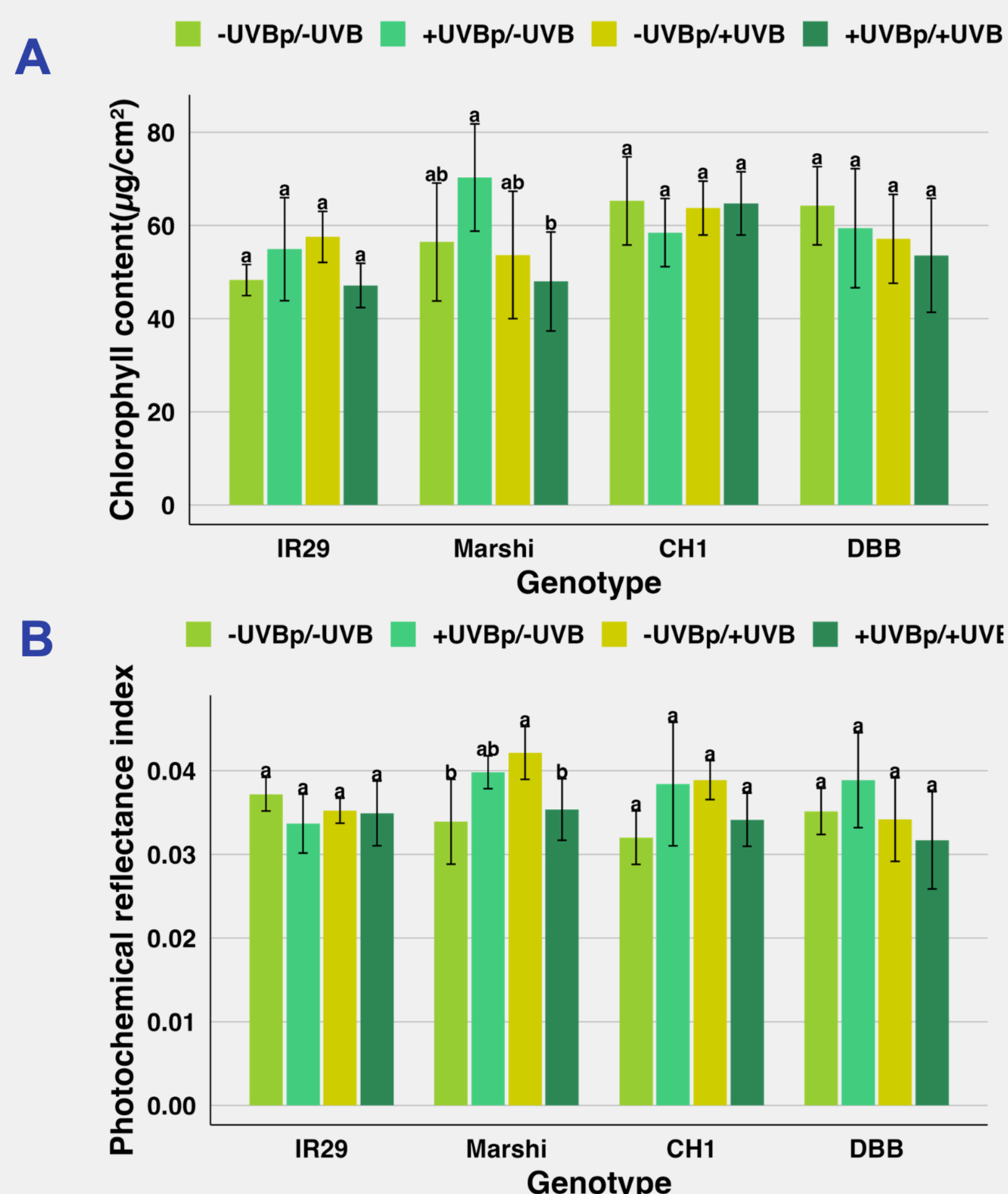


Fig 2. Chlorophyll concentration (mean $\pm$ SD) (A) and photochemical reflectance index (mean $\pm$ SD) (B) per plant for four rice genotypes under combinations of UVB seed priming and UVB stress. $n=5$, Tukey-HSD, $P = 0.05$

Conclusion and outlook

- The effect of UV-B seed priming on physiology and yield related traits varied among genotypes.
- Chlorophyll was relatively increased in IR29 and Marshi with priming, whereas photosynthetic activity (PRI) was relatively increased in Marshi and CH1.
- UVB-priming tends to improve grain yield in IR29, Marshi and CH1, whereas the proportion of filled grains improved under combined treatments (UVBp+UVB) in CH1 and DBB.
- UVB-treatments (UVBp or UVB) did not affect iron content in grains for all genotypes, whereas zinc was higher in CH1 only under UVB treatment.
- UVBp doses and duration should be considered for future research.

Yield Traits

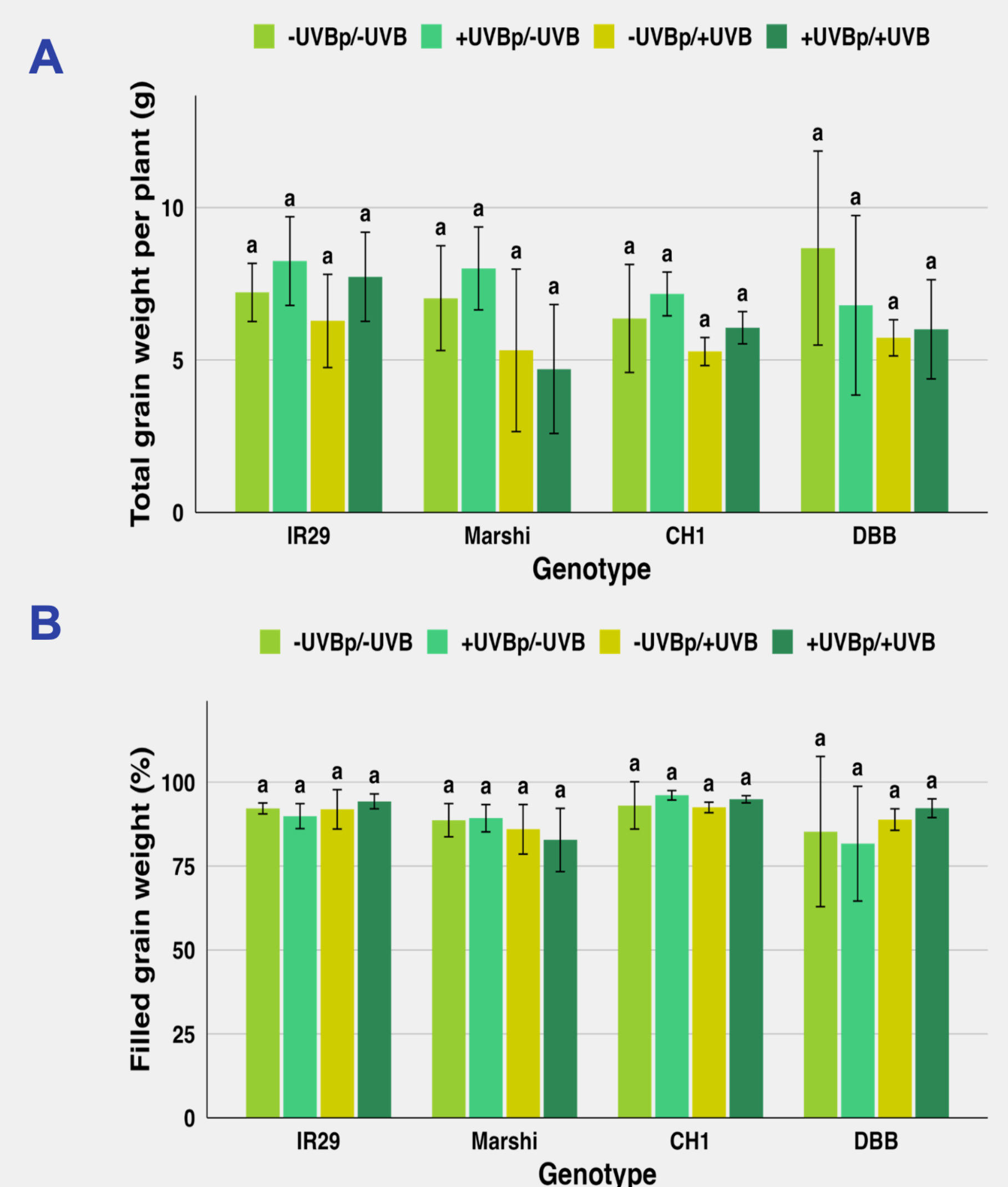


Fig 3. Total grain yield (mean $\pm$ SD) (A) and filled grain weight % (mean $\pm$ SD) (B) per plant for four rice genotypes under combinations of UVB seed priming and UVB stress. $n=5$, Tukey-HSD, $P = 0.05$

Grain Mineral Content

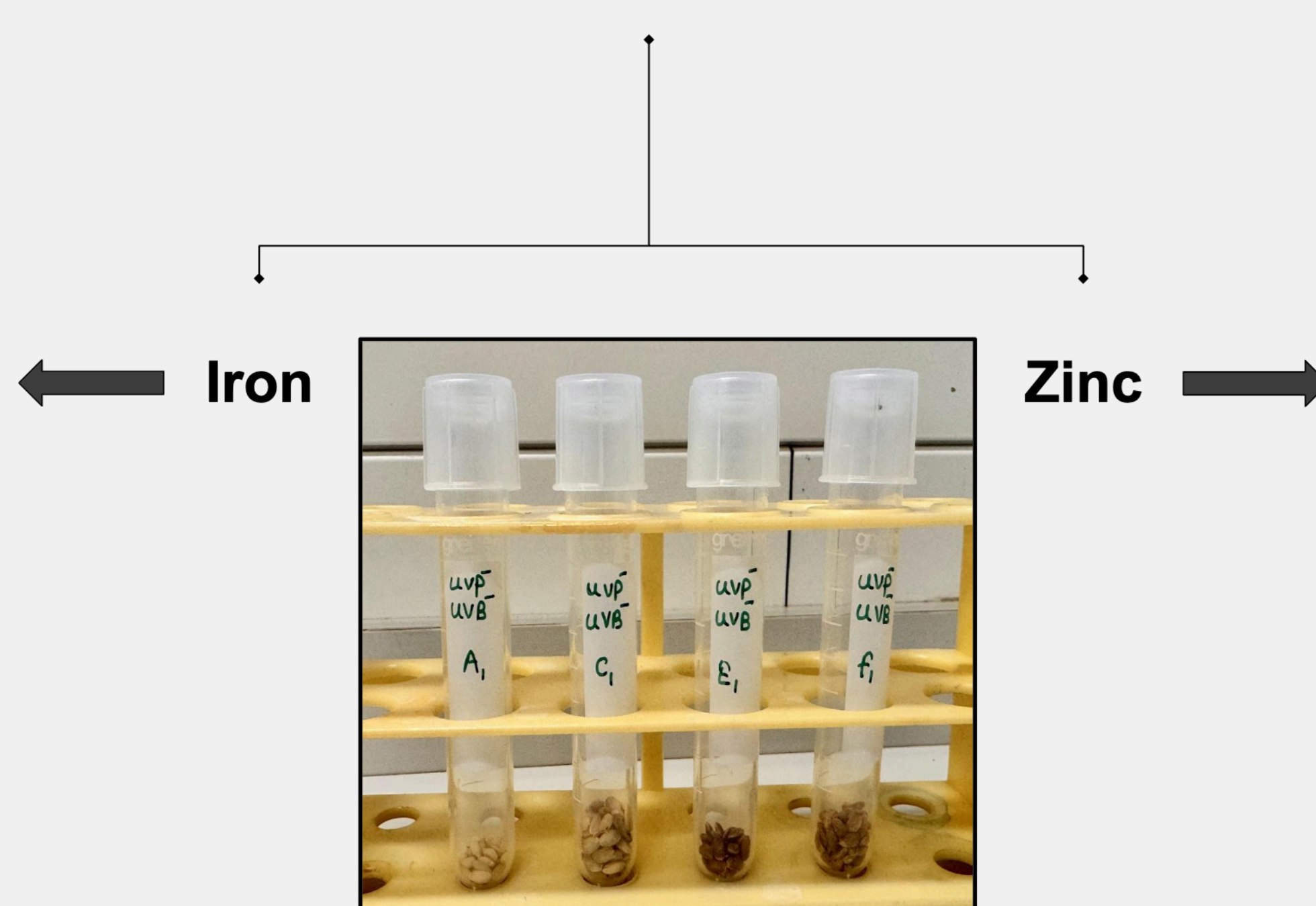


Fig 4. Rice grain iron content for four rice genotypes under combinations of UVB seed priming and UVB stress. $n=5$, Tukey-HSD, $P = 0.05$

Fig. 5 : Dehusked rice grains of four selected genotypes were prepared for grain mineral content analysis

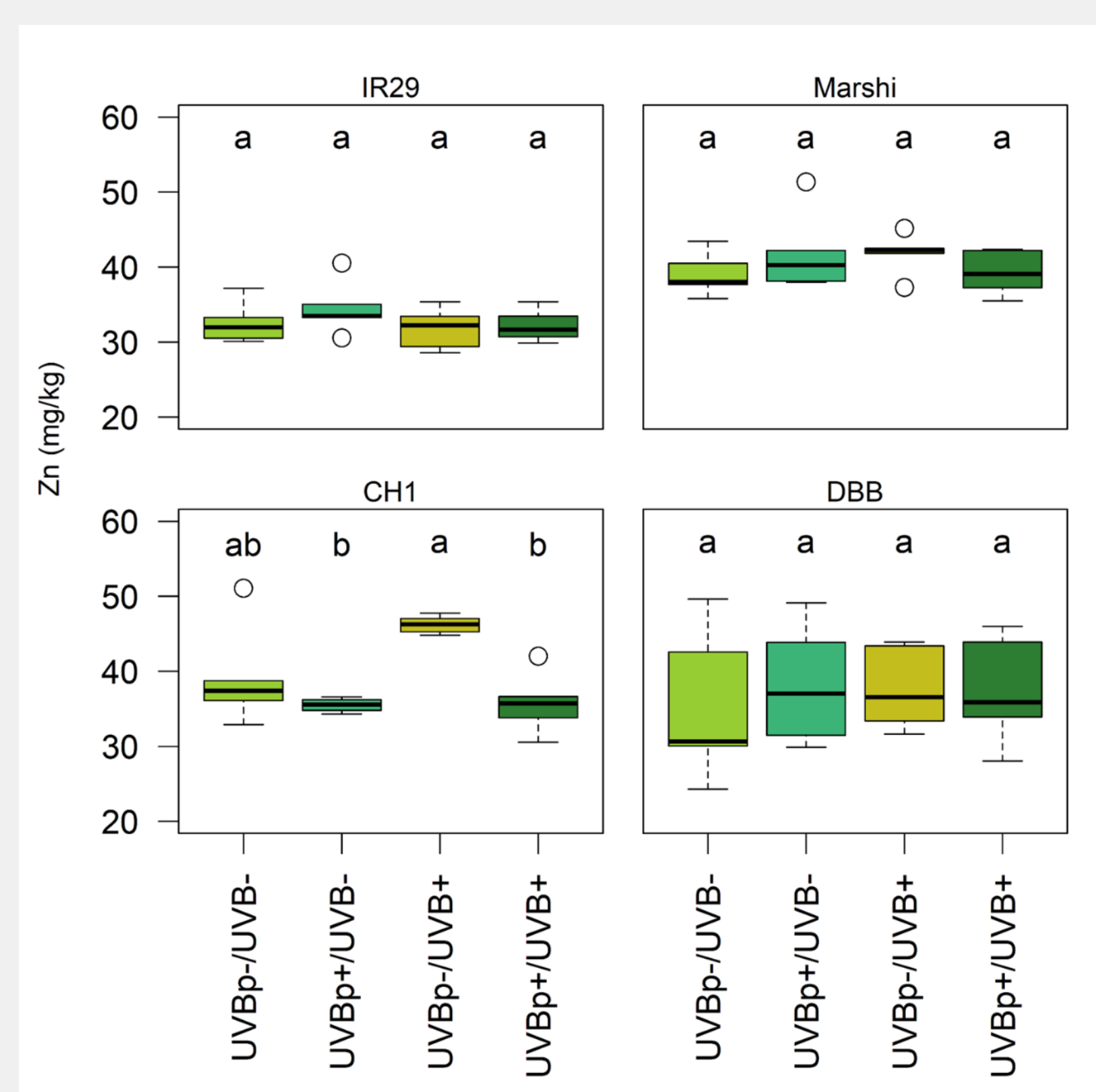


Fig 6. Rice grain zinc content for four rice genotypes under combinations of UVB seed priming and UVB stress. $n=5$, Tukey-HSD, $P = 0.05$