Could pigmented rice be an alternative variety for increased nutritional security and mitigation of salinity stress?

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Introduction

Black rice (Superfood)

- Beautiful and deliciously chewy texture.
- High in antioxidants and phytonutrients.

Growing environment might influence rice grain quality

Abiotic Stress →  →

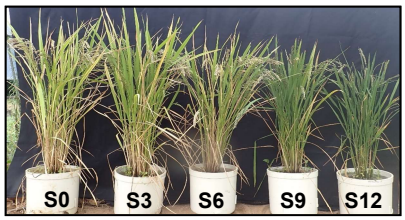
- Increase nutritional quality
- Tradeoff between grain yield and quality.

Hypothesis:

- High antioxidants in black rice may enable it to cope with salinity stress effectively.
- Black rice produced under salt stress increases grain nutritional quality.

Materials and methods

Pot experiment



Salt stress (dS m^{-1})

Two-year field experiments

Results: Pot experiment

Grain yield (g pot^{-1})

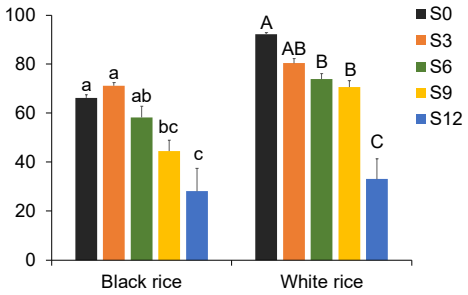


Fig. 1 Salt stress on rice grain yield.

Total phenolic (mg GAE g^{-1})

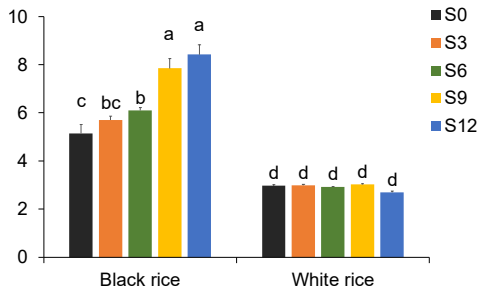


Fig. 2 Salt stress on grain antioxidant.

Gallic acid equivalents (GAE)

- Under moderate stress, black and white rice yield declines were 12% and 20%; high stress was 58% and 64% (Fig. 1).
- The decrease in grain yield was smaller for black rice than for white rice (Fig. 1).

- Salt stress increases phenolic content in black rice but no difference in white rice. (Fig. 2)
- Crude protein concentration was higher under salt stress in both rice varieties (Fig. 3)

Crude protein (%)

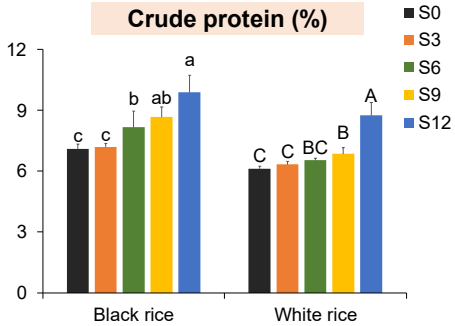


Fig. 3 Salt stress increased grain crude protein %.

Grain visual quality

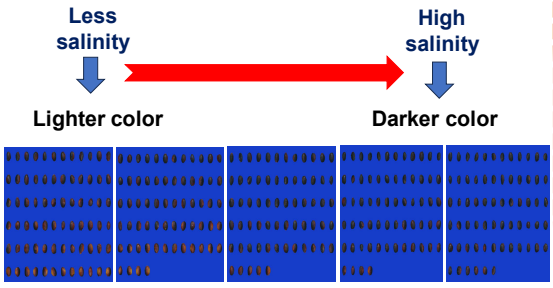


Fig. 4 Black rice grains become darker under salt stress

Field experiment

Grain yield (g m^{-2})

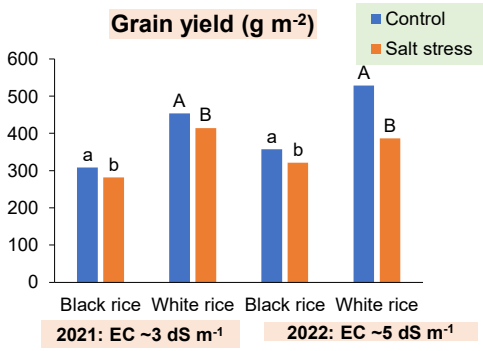


Fig. 5 Salt stress affected grain yield.

- Low grain yield under salt stress for both rice varieties; however less yield reduction in black rice than in white rice (Fig. 5).
- Under high salt stress, black rice phenolic content was increased in year 2 (Fig. 6).

Total phenolic (GAE g^{-1})

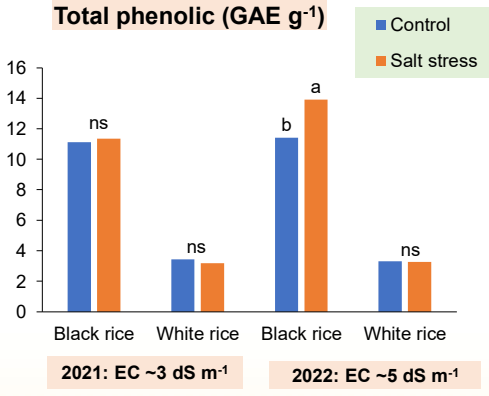


Fig. 6 Salt stress on grain antioxidant.

Conclusions

- Under salt stress, yield decline was smaller in black rice with higher nutritional quality and improved grain color stability.
- Black rice could be an alternative variety to efficiently utilize salt-stressed areas to produce nutrient-rich rice for human consumption.

Acknowledgements

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