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Rice Pre-Heading Growth Promotion Increases Lodging Resistance While Maintaining High Grain Yield

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ABSTRACT

In rice, there are connections between grain yield, biomass production and translocation, and plant lodging resistance. This study compared traits of biomass production and translocation, grain yield, and lodging resistance traits between rice crops grown in two years, with contrasting weather conditions, in order to identify a workable method to achieve both high grain yield and improved plant lodging resistance in rice. According to the findings, crop N uptake, crop growth rate, and biomass output is greater in 2019 than in 2020 during the pre-heading period lower during the post-heading period. Pre-heading biomass was moved to panicles at a rate that was 68% higher in 2019 than in 2020. In comparison to 2020, stem and leaf sheath biomass increased and after heading as well as straw biomass at maturity.

Keywords: Rice, Crop, Fertilizer, Plant

INTRODUCTION

In China, rice is the primary food consumed by more than 65% of the population. Due to a more than 50% increase in rice yield since 1980 and the combined efforts of the government, scientists, and farmers, China now has enough rice to meet domestic demand. Rice production in China still faces a number of difficulties, chief among them how to meet the rising demand for the grain brought on by population expansion and economic development in the face of stagnant or even declining arable land area. In order to secure national food security, it is still essential to produce rice in China with a high grain yield.

By creating biomass and dividing it into grains, rice grain yield is created. It is commonly believed that future gains in rice yield will mostly depend on increased biomass production, even if rice yield can also be raised by increasing biomass production and/or by improving the ratio of biomass partitioned into grains. However, a rise in plant height always goes hand in hand with an increase in biomass output, which might make plants less resistant to lodging. It's also feasible that raising plant height won't make it less resistant to lodge because stiffness of the straw and plant height both affect how resistant a plant is to lodging. According to one study, the best way to increase rice plant lodging resistance is to increase the dry weight per unit length and the breaking resistance of the lower internodes. However, this tactic might lower the proportion of biomass partitioned into grains, which would lower rice grain yield.

The need for a deeper knowledge of the connections between grain yield, plant lodging resistance, and traits of biomass production and translocation in rice is highlighted by all of the aforementioned unknowns. This knowledge will help rice plants become more resistant to lodging while also increasing grain output. A common strategy to accomplish this is to first create rice populations with various biomass production and translocation traits, and then examine the connections between these traits and grain yield and plant lodging resistance. Growing rice crops in varied conditions is one way to complete the first phase. Therefore, in this work, we examined grain yield, lodging resistance features, and biomass production and translocation attributes comparing rice crops grown in two years with differing meteorological settings. The findings of this study should enable the identification of a workable strategy for controlling rice biomass production and translocation in order to attain high grain yield and better plant lodging resistance.

Snippets of Sections

Experimental information: In 2019 and 2020, field tests were carried out at the Crop and Environment Research Center's research farm at Hunan Agricultural University in China. For the pre- and post-heading periods between 2019 and 2020, the difference in the daily mean temperature was only 0.41 and 0.13 °C, respectively. In contrast, the average daily solar radiation during the pre-heading period was 12% lower in 2019 than in 2020.

RESULTS AND DISCUSSION

For grain yield, the major influence of year was not significant, but it was for all evaluated characteristics for lodging resistance. Plant height and fresh weight were *6*% and *16*% greater in 2019 than in 2020, respectively, while plant lodging load was 173% higher

in 2019 than in 2020 on average across two types. Plant lodging index was 55% lower in 2019 than in 2020. Grain yield was not significantly impacted by variety, however all tested lodging was significantly impacted by variety. The pre-heading phase's increased daily sun radiation encouraged crop growth when compared to the same period in 2020 in 2019. The difference in crop N uptake during the pre-heading period, which was higher in 2019 than in 2020, could also account for the variation in pre-heading crop growth. These results match those that Xie, saw under controlled circumstances. But the encouraged pre-heading crop growth did not result in an increase in total biomass.

CONCLUSION

This study found a workable method to increase plant lodging resistance while also increasing grain yield. In particular, regulating biomass production and translocation through encouraging pre-heading growth in rice can improve lodging resistance while maintaining high grain yield.