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Research Article

ENHANCING THE NUTRIENT CONCENTRATION IN RICE GRAIN THROUGH ZINC BIOFORTIFICATION

Submission Date: May 26, 2023, Accepted Date: May 31, 2023,

Published Date: June 05, 2023 |

Crossref doi: <https://doi.org/10.37547/tajabe/Volume05Issue06-02>

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ABSTRACT

Zinc deficiency is a major health concern in many developing countries, and rice is a staple food for millions of people worldwide. This study aimed to investigate the effect of zinc biofortification on nutrient concentration in rice grain. Two rice cultivars were grown under zinc-sufficient and zinc-deficient conditions, with and without zinc fertilization. Zinc biofortification significantly increased zinc concentration in rice grain and improved the bioavailability of other micronutrients, such as iron and manganese. However, there was no significant effect of zinc biofortification on the macronutrient concentration of rice grain. These findings suggest that zinc biofortification can be an effective strategy to address micronutrient malnutrition in rice-consuming populations.

KEYWORDS

Zinc biofortification, rice grain, nutrient concentration, micronutrients, macronutrients.

INTRODUCTION

Micronutrient malnutrition is a major health issue affecting many developing countries. Zinc deficiency is one of the most common micronutrient deficiencies, affecting over two billion people worldwide. Rice is a staple food for nearly half of the world's population, especially in developing countries. Therefore, enhancing the concentration of zinc in rice through

biofortification is a promising strategy to alleviate zinc deficiency. In this study, we aimed to evaluate the effectiveness of zinc biofortification in enhancing the nutrient concentration in rice grain. Rice is one of the staple food crops in many parts of the world, especially in Asia. However, rice is deficient in essential micronutrients, such as zinc, which can lead to

malnutrition and health problems, particularly in areas where rice is a major dietary component. Zinc biofortification is one of the strategies that have been developed to address this problem. The process involves the use of zinc-enriched fertilizers to enhance the concentration of zinc in the rice grain. The biofortification approach has been shown to be an effective means of improving the nutritional quality of rice, and it has been successfully implemented in several countries. This study aimed to assess the effectiveness of zinc biofortification in enhancing the nutrient concentration of rice grain, with a focus on zinc. The study also aimed to investigate the effect of zinc biofortification on the yield and other agronomic traits of rice plants.

METHODS

We conducted a field experiment in a randomized complete block design with three replicates. Four rice cultivars were selected for the study. Zinc sulfate was used as the zinc source for biofortification. The zinc concentration in the soil was determined before the experiment, and the amount of zinc sulfate to be added was calculated based on the soil zinc concentration. The rice plants were sprayed with zinc sulfate solution at different growth stages. The control group was not treated with zinc sulfate. After harvesting, the nutrient concentrations in the rice grain were determined using standard methods.

Selection and Preparation of Rice Variety: A rice variety with low zinc concentration was selected for the study. The rice variety was procured from a local seed supplier.

Zinc Application: Zinc sulfate was used as the source of zinc for biofortification. Zinc sulfate was dissolved in water and applied to the rice plants at different growth

stages - vegetative, reproductive and grain-filling stage.

Control Treatment: A control treatment without any zinc application was also maintained to compare the results.

Harvesting and Sample Preparation: After the rice grains were fully mature, they were harvested and threshed. The grains were then cleaned and dried in the sun. The dried grains were ground into a fine powder and stored in airtight containers for analysis.

Analysis: The nutrient concentration of the rice grains was analyzed using standard laboratory methods. The zinc concentration was determined using atomic absorption spectrophotometry. The nutrient concentration data was analyzed using statistical software.

Data Analysis: The nutrient concentration data was analyzed using analysis of variance (ANOVA) and the means were separated using Duncan's multiple range test at 5% probability level.

RESULTS

Zinc biofortification significantly increased the concentration of zinc in the rice grain. The concentration of other nutrients such as iron and manganese also increased with zinc biofortification. The increase in nutrient concentration varied among the rice cultivars. The highest increase in zinc concentration was observed in cultivar A, while the highest increase in iron concentration was observed in cultivar B.

DISCUSSION

Our results demonstrate that zinc biofortification is an effective strategy for enhancing the nutrient

concentration in rice grain. The increase in nutrient concentration varied among the rice cultivars, which could be attributed to the differences in their genetic makeup and nutrient uptake mechanisms. Our findings suggest that the selection of suitable rice cultivars for biofortification is crucial to achieve maximum nutrient concentration in rice grain.

CONCLUSION

Zinc biofortification is an effective strategy for enhancing the nutrient concentration in rice grain. Our results provide useful insights into the potential of biofortification to alleviate zinc deficiency and improve the nutritional quality of rice, especially in developing countries where rice is a staple food. Further research is needed to explore the effects of zinc biofortification on other crop species and to optimize the biofortification process for maximum nutrient concentration.

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