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Improvement in zinc biofortification of wheat to combat zinc malnutrition and food security issues in semi-arid regions of Pakistan

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Abstract

Zinc biofortification of wheat (*Triticum aestivum* L.) is a promising approach for addressing malnutrition and improving food security. Zinc is an essential micronutrient for human health, and its deficiency is a significant public health concern, particularly in developing countries. Wheat is a staple food for over 1 billion people worldwide, and biofortifying it with zinc could significantly improve the nutritional status of vulnerable populations. Research has shown that zinc biofortification of wheat can significantly increase the zinc concentration in the grain, leading to improved nutritional status in humans who consume wheat. Zinc biofortification can also increase crop yields, particularly in zinc-deficient soils, which can contribute to improving food security. The most logical strategy to improve Zn biofortification and agricultural productivity is to combine plant breeding with agronomic biofortification. However, its efficiency in semi-arid sub-tropical regions is not much explored. Thus, the primary purpose of this study was to assess the response of wheat genotypes to foliar application of zinc sulphate in terms of yield, grain, straw zinc content, and Zn bioavailability. Thirteen distinct wheat genotypes factorially combined with three zinc sulphate treatments (0, 0.4 %, and 0.6 %) were evaluated over the course of a two-year field experiment. Zinc sulphate and genotypes significantly ($p < 0.05$) influenced grain and biological yield, grain and straw Zn levels, and grain Zn bioavailability, and their interaction was also significant. Different genotypes exhibited a modest to strong correlation between grain zinc concentration and grain yield and grain zinc bioavailability, as determined by regression analysis. In crux, foliar Zn application boosted grain Zn biofortification and yield of wheat genotypes. Based on yield enhancement and grain zinc biofortification, the genotypes Akbar-19, Ujala, and Zincol can be recommended for increasing grain zinc content and bioavailability in semi-arid regions of Pakistan.

Keywords: Association among traits, zinc bioavailability, zinc contents