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Microbial-assisted Fe and Zn Biofortification of Tomato Grown in Vermicompost-amended Gypsiferous Soil

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Abstract

Globally, gypsiferous soil covers more than 100 million hectares worldwide, with important occurrences in arid and semi-arid Mediterranean environments. These soils are often characterized by low micronutrient availability, particularly iron (Fe) and zinc (Zn), due to high calcium content, sub-alkaline conditions, and reduced nutrients solubility. Microorganisms represent a sustainable strategy to enhance micronutrient mobilization and plant uptake by producing organic acids and other solubilizing compounds, especially when combined with organic amendments. The present study aimed to evaluate the effect of bacterial and/or fungal inoculation of a gypsiferous soil amended with vermicompost i) on biofortification of tomato plants with Fe and Zn and ii) on tomatoes quality. A greenhouse pot experiment was conducted using tomato plants (Solanum lycopersicum L., cv. Big Rio) grown in 18 × 22 cm pots containing gypsiferous soil amended with 10% vermicompost. Biofortification treatments received Zn as zinc sulfate heptahydrate ($ZnSO_2 . 7H_2O$) and Fe as sulfate heptahydrate (FeSO2 · $7H_2O$), respectively. Zinc and iron were supplied as split applications during plant growth. Zinc was applied twice at 7.3 mg pot^{-1}, 21 days apart, while iron was applied twice at 43.8 mg pot^{-1}, also 21 days apart. Microbial inoculation was performed in two steps: Trichoderma harzianum was applied at transplanting at 50 mL pot^{-1} and 1 × 10^6 conidia mL^{-1}, followed by a second application 20 days later at 25 mL pot^{-1} at the same concentration. Pantoea agglomerans was applied 5 days after transplanting at 50 mL pot^{-1} and 1 × 10^8 CFU mL^{-1}, followed by a second application 20 days later at 25 mL pot^{-1} at the same concentration. The experiment included five replicates per treatment, arranged in a completely randomized design, with pots periodically repositioned to minimize positional effects under greenhouse conditions. Biofortification will be assessed by quantifying the uptake of Fe and Zn in different plant organs. The effects of biofortification and microbial inoculation on fruit quality will be assessed by evaluating secondary metabolites and vitamin C content in tomato fruits. The results will be presented at the congress.

Keywords: microbial inoculation, fruit quality, secondary metabolites