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Improvement of K⁺ and Na⁺ Ion homeostasis and salt tolerance by Co-inoculation of arbuscular mycorrhizal fungi (AMF) and spore associated bacteria (SAB)

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Abstract

Salinity inhibits plant growth and restricts the efficiency of arbuscular mycorrhizal fungi. The selective uptake of nutrients from the soil and their effective transport to host roots make it essential for plant growth and development under salt stress. AMF spore associated bacteria shown to improve mycorrhizal efficiency under stress. Thus, this study aimed to understand the co-inoculation efficiency of AMF and SAB on maize growth and ion homeostasis under salt stress. Two AMF strains and one SAB were inoculated with maize either alone or in combination with one another. The results of our study showed that AMF and SAB co-inoculation significantly improved dry weight and nutrient uptake of maize under salt stress. Co-inoculation significantly reduced proline accumulation in shoots and Na⁺ accumulation in roots. Co-inoculation treatment also exhibited the high K⁺/Na⁺ ratios in roots at 25 mM NaCl. Mycorrhizal colonization showed positive influence for regulation of ZmAKT2, ZmSOS1 and ZmSKOR gene expressions, contributing to K⁺ and Na⁺ ion homeostasis. CLSM view showed that SAB were able move and localize into inter and intra cellular spaces of maize roots. In addition, CLSM view of AMF spores showed that gfp-tagged SAB also associated on the spore outer hyaline layer.

Keywords: Arbuscular mycorrhizal fungi, Spore associated bacteria, Salt stress, Na/K homeostasis

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