

Soil application of effective microorganisms and nitrogen alleviates salt stress in hot pepper (*Capsicum annuum* L.) plants.

Abdelsattar Abdelkhalik, Taia A. Abd El-Mageed, Ibrahim A. A. Mohamed, Wael M. Semida, Omar A. A. I. Al-Elwany, Ibrahim M. Ibrahim, [Khaulood A. Hemida](#), Mohamed T. El-Saadony, Synan F. AbuQamar, Khaled A. El-Tarabily and Mohammad A.H. Gyushi

The applications of effective microorganisms (EMs) and/or nitrogen (N) have a stimulating role on plants against abiotic stress conditions. The aim of the present study was to determine the impact of the co-application of EMs and N on growth, physio-biochemical attributes, anatomical structures, nutrients acquisition, capsaicin, protein, and osmoprotectant contents, as well as the antioxidative defense system of hot pepper (*Capsicum annuum* L.) plants. In the field trials, EMs were not applied (EMs⁻) or applied (EMs⁺) along with three N rates of 120, 150, and 180 kg unit N ha⁻¹ (designated as N₁₂₀, N₁₅₀, and N₁₈₀, respectively) to pepper plants grown in saline soils (9.6 dS m⁻¹). The application of EMs and/or high N levels attenuated the salt-induced damages to pepper growth and yield. The application of EMs⁺ with either N₁₅₀ or N₁₈₀ increased the number, average weight and yield of fruits by 14.4 or 17.0%, 20.8 or 20.8% and 28.4 or 27.5%, respectively, compared to pepper plants treated with the recommended dose (EMs⁻ × N₁₅₀). When EMs⁺ was individually applied or combined with either N₁₅₀ or N₁₈₀, we observed increased accumulation of capsaicin by 16.7 or 20.8%, protein by 12.5 or 16.7%, proline by 19.0 or 14.3%, and total soluble sugars by 3.7 or 7.4%, respectively, in comparison with those treated with the integrative EMs⁻ × N₁₅₀. In addition, the non-enzymatic contents (ascorbate, and glutathione) and enzymatic activities (catalase, superoxide dismutase, and glutathione reductase) of the antioxidant defense systems significantly increased in pepper plants treated with EMs⁺ alone or combined with N₁₅₀ or N₁₈₀ under salt stress conditions. Higher accumulation of nutrients (N, P, K⁺, and Ca²⁺) along with reduced Na⁺ acquisition was also evidenced in response to EMs⁺ or/and high N levels. Most anatomical features of stems and leaves recovered in pepper plants grown in saline soils and supplied with EMs⁺ and N. The application of EMs and N is undoubtedly opening new sustainable approaches toward enhancing *abiotic stress* tolerance in crops (e.g. hot pepper).