

MITIGATION OF SALT STRESS IN SOYBEAN BY THE APPLICATION OF *Bacillus* SPECIES

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Executive Summary

Considering the growth-promoting potential and other regulatory roles of bacteria, we investigated the possible mechanism of the role of *Bacillus subtilis* in conferring salt tolerance in soybean. Soybean (*Glycine max* cv. BARI Soybean-5) seeds were inoculated with *B. subtilis*, either through presoaking with seeds or direct application with pot soil. After 20 days of sowing, both seed- and soil-inoculated plants were exposed to 50, 100, and 150 mM NaCl for 30 days. A clear sign of oxidative stress was evident through a remarkable increase in lipid peroxidation, hydrogen peroxide, methylglyoxal, and electrolyte leakage in the salt-treated plants. Moreover, the efficiency of the ascorbate (AsA)-glutathione (GSH) pathways was declined. Consequently, plant growth, biomass accumulation, water relations, and synthesis of the photosynthetic pigments were decreased. Salt stress also caused increased Na^+/K^+ ratio and decreased Ca^{2+} . On the contrary, *B. subtilis* inoculated plants showed increased levels of AsA and GSH, their redox balance, and the activities of AsA-GSH pathway enzymes, superoxide dismutase, catalase, glutathione peroxidase, glutathione *S*-transferase, and peroxidase. *B. subtilis* inoculated plants also enhanced the activities of glyoxalase enzymes, which mitigated methylglyoxal toxicity in coordination with ROS homeostasis. Besides this, the accumulation of K^+ and Ca^{2+} was increased to maintain the ion homeostasis in the *B. subtilis* inoculated plants under salinity. Furthermore, plant water status was uplifted in the salt-treated soybean plants with *B. subtilis* inoculation. This investigation reveals the potential of *B. subtilis* in mitigating salt-induced oxidative stress in soybean plants through modulating the antioxidant defense and glyoxalase system along with maintaining ion homeostasis and osmotic adjustments.

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