The Integrated Amendment of Sodic-Saline Soils Using Biochar and Plant Growth-Promoting Rhizobacteria Enhances Maize (*Zea mays* L.) Resilience to Water Salinity.

The utilization of low-quality water or slightly saline water in sodic-saline soil is a major global conundrum that severely impacts agricultural productivity and sustainability, particularly in arid and semiarid regions with limited freshwater resources. Herein, we proposed an integrated amendment strategy for sodic-saline soil using biochar and/or plant growth-promoting rhizobacteria (PGPR; *Azotobacter chroococcum* SARS 10 and *Pseudomonas koreensis* MG209738) to alleviate the adverse impacts of saline water on the growth, physiology, and productivity of maize (*Zea mays* L.), as well as the soil properties and nutrient uptake during two successive seasons (2018 and 2019). Our field experiments revealed that the combined application of PGPR and biochar (PGPR + biochar) significantly improved the soil ecosystem and physicochemical properties and K^+, Ca_2^+, and Mg_2^+ contents but reduced the soil exchangeable sodium percentage and Na^+ content. Likewise, it significantly increased the activity of soil urease (158.14 ± 2.37 and 165.51 ± 3.05 mg NH_4^+ g^{-1} dry soil d^{-1}) and dehydrogenase (117.89 ± 1.86 and 121.44 ± 1.00 mg TPF g^{-1} dry soil d^{-1}) in 2018 and 2019, respectively, upon irrigation with saline water compared with non-treated control. PGPR + biochar supplementation mitigated the hazardous impacts of saline water on maize plants grown in sodic-saline soil better than biochar or PGPR individually (PGPR + biochar > biochar > PGPR). The highest values of leaf area index, total chlorophyll, carotenoids, total soluble sugar (TSS), relative water content, K^+ and K^+/Na^+ of maize plants corresponded to PGPR + biochar treatment. These findings could be guidelines for cultivating not only maize but other cereal crops particularly in salt-affected soil and sodic-saline soil.

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