Seventh Article: (Sharing with another inside and outside the specialization- Published).

Article title	Foliar-applied potassium silicate coupled with plant growth-promoting rhizobacteria improves growth, physiology, nutrient uptake and productivity of faba bean (*Vicia faba* L.) irrigated with saline water in salt-affected soil
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Abstract

The continuity of traditional planting systems in the last few decades has encountered its most significant challenge in the harsh changes in the global climate, leading to frustration in the plant growth and productivity, especially in the arid and semi-arid regions cultivated with moderate or sensitive crops to abiotic stresses. Faba bean, like most legume crops, is considered a moderately sensitive crop to saline soil and/or saline water. In this connection, a field experiment was conducted during the successive winter seasons 2018/2019 and 2019/2020 in a salt-affected soil to explore the combined effects of plant growth-promoting rhizobacteria (PGPR) and potassium (K) silicate on maintaining the soil quality, performance, and productivity of faba bean plants irrigated with either fresh water or saline water. Our findings indicated that the coupled use of PGPR and K silicate under the saline water irrigation treatment had the capability to reduce the levels of exchangeable sodium percentage (ESP) in the soil and to promote the activity of some soil enzymes (urease and dehydrogenase), which recorded nearly non-significant differences compared with fresh water (control) treatment, leading to reinstating the soil quality. Consequently, under salinity stress, the combined application motivated the faba bean vegetative growth, e.g., root length and nodulation, which reinstated the K^+/Na^+ ions homeostasis, leading to the lessening or equalizing of the activity level of enzymatic antioxidants (CAT, POD, and SOD) compared with the controls of both saline water and fresh water treatments, respectively. Although the irrigation with saline water significantly increased the osmolytes concentration (free amino acids and proline) in faba bean plants compared with fresh water treatment, application of PGPR or K-silicate notably reduced the osmolyte levels below the control treatment, either under stress or non-stress conditions. On the contrary, the concentrations of soluble assimilates (total soluble proteins and total soluble sugars) recorded pronounced increases under tested

treatments, which enriched the plant growth, the nutrients (N, P, and K) uptake and translocation to the sink organs, which lastly improved the yield attributes (number of pods plant^{-1}, number of seeds pod^{-1}, 100-seed weight). It was concluded that the combined application of PGPR and K-silicate is considered a profitable strategy that is able to alleviate the harmful impact of salt stress alongside increasing plant growth and productivity.

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