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Silicon Defensive Role in Maize (*Zea mays* L.) against Drought Stress and Metals-Contaminated Irrigation Water. (2020)
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Abstract

Purpose Irrigation water rarity and its contamination with toxic metals are increasing gradually and have become imperious issues for the environment at personal and governmental levels. Silicon (Si) can increase plant tolerance to abiotic stressors and beneficially affect plant growth and productivity. The main purpose of the current study was to investigate the effect of Si as a foliar application on growth, photosynthetic efficiency, plant-water status, metals accumulation, water-use efficiency (WUE) and yield of maize grown under drought and metals-contaminated irrigation water stresses.

Methods We conducted two-season field experiments in 2017 and 2018 summer seasons on maize grown under two irrigation regimes (Full irrigation (FI = 100%) and deficit irrigation (DI20% = 80%) of crop evapotranspiration) combined with 0 (Si0), 2 (Si2), and 4 (Si4) mM of Si in form of Na2SiO3 applied at 40 and 60 days after planting as a foliar application. In both seasons, maize plants were irrigated with metals-contaminated redundant water (Ni2+; 5.5 ppm, Cd2+; 0.27 ppm, and Cr3+; 5 ppm).

Results Exogenous application of Si increased drought stress tolerance in maize by enhancing photosynthetic efficiency, stomatal conductance (gs) and cell membrane integrity as evaluated by membrane stability index. These results were positively reflected in improving plant growth, WUE, and productivity along with decreasing accumulation of Ni+2, Cd+2, and Cr+3 in leaves and grains under drought stress by metals-contaminated irrigation water.

Conclusion Deficit irrigation and metal-contaminated irrigation water conditions reduced growth and productivity of maize plants. However, foliar application of Si was effective in enhancing the physiological performance, water use efficiency, and productivity of maize under drought and/or contaminated irrigation water conditions. Therefore, Si may, in future, find value as a potential plant growth stimulant under different abiotic stresses.

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