Effects of Silicon on Zea mays Plants Exposed to Water and Oxygen Deficiency

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Abstract:

Effects of shoot and root supplementation with silicon on the response of Zea mays L. plants to matric water potential (Ψm) and oxygen deficiency (waterlogging) stresses were studied. The soil water limitation (Ψm) and oxygen deprivation significantly reduced shoot dry weight, chlorophyll (Chl) content, ascorbic acid content, as well as leaf relative water content. Both soil drying and waterlogging caused a significant increase in the leaf membrane injury by heat (51°C) and dehydration (40% PEG) stresses. The levels of lipid peroxidation (POL) and hydrogen peroxide (H2O2) content were increased by excess soil drying and oxygen deficiency. Supplementary silicon at 1.0 mM significantly increased Chl content and improved water status. Concentrations of H2O2, MDA, and proline and leaf membrane injury were significantly reduced by Si application. The reverse helds true for ascorbic acid. The results of this study indicate that application of silicon might improve growth attributes, effectively mitigate the adverse effect of drought and waterlogging, and increase tolerance of maize plants. The silicon-induced improvement of drought and anoxia tolerance was associated with the increase in oxidative defense abilities.

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