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Effects of Allantoin, A Stress-related Purine Metabolite, on Salt Stress Mitigation in Maize (*Zea mays L.*) During Early Germination Stage

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Abstract

Soil salinity is a major constraint on global agricultural productivity, particularly affecting salt-sensitive crops like maize (*Zea mays L.*). This study investigated the potential of allantoin, a purine metabolite, to mitigate salt stress during maize seed germination and early seedling development. Maize seeds were pretreated with varying concentrations of allantoin (0, 0.5, and 1 mM) and subsequently subjected to 150 mM NaCl stress under controlled conditions. Morphological parameters, including shoot and root length, fresh and dry weight, germination percentage, and vigor index, were assessed. Biochemical analyses quantified oxidative stress markers (malondialdehyde, hydrogen peroxide), photosynthetic pigments, protein content, osmolyte accumulation, and antioxidant enzyme activities. Salt stress significantly inhibited germination and seedling growth, increased oxidative stress, and disrupted biochemical homeostasis. However, allantoin pretreatment, particularly at 0.5 mM, effectively alleviated these adverse effects. Allantoin-treated seedlings exhibited improved germination, enhanced growth, reduced oxidative damage, and modulated biochemical responses. This research demonstrates that allantoin can enhance salt tolerance in maize during germination. These findings suggest that allantoin pretreatment represents a promising strategy for improving maize establishment and productivity in saline environments.

Key Words: Maize, Salt stress, Allantoin, Germination, Oxidative stress

