Beyond osmotic stress: salinity and drought shape early seedling performance of sweet corn cultivar 'Bonanza' across germination, growth, and physiological responses

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Abstract

Salinity and drought impair maize seedling growth through osmotic and physiological stress. This study evaluated the effects of NaCl and PEG 6000 on early growth of sweet corn (Zea mays L.) cv. 'Bonanza'. Two independent completely randomized experiments were conducted using NaCl (0–150 mM) and PEG (0–15%) treatments with five replications. Increasing stress intensity significantly reduced seedling performance. Germination decreased by 44% under salinity and 36% under drought. Plant height declined by up to 30% and 25%, respectively, while chlorophyll content and relative water content also decreased. Root growth traits were reduced by 20–30% under severe stress. However, DPPH scavenging activity increased by 142% under salinity and 121% under drought. Proline accumulation increased by 37.63% and 35.92%, catalase activity by 25.24% and 19.64%, while malondialdehyde increased by 54.67% and 71.05% under salinity and drought stress, respectively. Multivariate analysis showed coordinated reductions in growth and biomass traits alongside enhanced antioxidant responses, suggesting a trade-off between growth maintenance and stress defense. These findings

provide physiological insights for early stress screening and support the development of climate-resilient maize management strategies (SDG 2 and 13). Further studies using biostimulants or plant growth regulators are needed to clarify tolerance mechanisms under salinity and drought stress.

Author keywords

Abiotic stress; antioxidant activities; drought stress; lipid peroxidation; salt stress; stress tolerance

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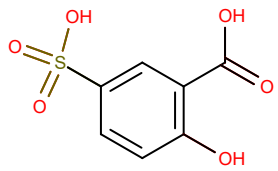

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Abstract

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