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Understanding Molecular Mechanisms: Recent Advancements in Plant Resilience to Drought and Salinity

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Abstract

Plant stress, drought, and salt reduce agricultural output and food security worldwide. Rising cultivable land salinity is expected to reduce land availability by 30% in 25 years and maybe 50% by 2050. Therefore, plant biotechnology initiatives must prioritize drought and salinity stress tolerance in agricultural plants (to assure food security) and forest trees (which are vital to world ecology). Salt and drought stress have a large impact on plant development, photosynthesis, ionic equilibrium, and oxidative balance than each stress alone. CRISPR/Cas9, which stands for clustered regularly interspaced short palindromic repeats, is a new way to edit plant genomes correctly and quickly. The metabolic abilities of several plant growth-promoting microorganisms (PGPM) may reduce the impacts of abiotic stresses. Plant-microbe interaction impacts non-living stress factors, and PGPR (Plant Growth-Promoting Rhizobacteria) such as mycorrhizal fungi and endophytes manage these stresses to enhance agricultural productivity and minimize losses. We also discuss their role in aquaporin water absorption and transport. Drought stress mobilizes plant energy to produce defense components and osmo-protectants like proline, which damages plant development. This review aims more research into plant-microbe interactions and stress tolerance ways at the molecular level. By improving our knowledge in this domain, we can develop innovative solutions to reduce soil salinity and drought stress, ensuring food security and sustainable agriculture in changing climates.,

Keywords: *Abiotic Stress; Drought; Salinity; Plant Biotechnology; Plant Immunity; Botany*