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Special Issue Reprint

Molecular Mechanisms in Plant Stress Tolerance

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This Reprint presents current advances in understanding the molecular basis of plant stress tolerance and resilience. It brings together research and review articles that examine how plants perceive, integrate, and respond to major abiotic and biotic stresses, including drought, salinity, waterlogging, heat, cold, heavy metal toxicity, and pathogen attack. Particular attention is given to signaling networks controlled by phytohormones, reactive oxygen species, calcium, and nitric oxide, as well as to the regulation of stress responsive genes by key transcription factors and non-coding RNAs. The Reprint also highlights the roles of epigenetic regulation, stress memory, metabolic reprogramming, antioxidant defense, osmolyte accumulation, and secondary metabolite biosynthesis in sustaining plant performance under adverse conditions. In addition, it covers protein quality control systems, autophagy, and beneficial plant microbe interactions that enhance adaptation and recovery. By integrating findings from genomics, transcriptomics, proteomics, metabolomics, and related approaches, this Reprint provides a timely overview of the mechanisms that can support the development of climate resilient and stress tolerant crops for sustainable agriculture.

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