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"Reconcile land system changes
with planetary health"

Abiotic stress responses in sorghum: Exploring root metabolic networks and BR signaling for sustainable agriculture

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Abstract

Diversifying crop cultivation by incorporating new species and cultivars across spatial and temporal dimensions has been shown to enhance soil metabolic activity and organismal diversity, contributing to improved climate resilience and pest suppression. This diversification also influences the metabolic profile of plant roots and aboveground biomass, including seeds, through interspecies interactions and in response to varying climatic conditions. To investigate these dynamics at the organismal level, the metabolic responses of crops to abiotic stress on an omics scale we focused on *Sorghum bicolor* (Moench), a drought-resilient species native to tropical and subtropical Africa. Sorghum's adaptability to warmer climates has led to its use in the tropics and subtropics and increasing adoption in industrial agricultural systems. Recent studies, including those by Fontanet et al. (2024), have revealed that sorghum's metabolic pathways are key to coping with abiotic stress. These pathways can be modulated to enhance efficiency without compromising growth, notably through brassinosteroid (BR) signaling mechanisms. Our research extends this work by examining brassinosteroid receptor mutants of the Sorghum cultivar BTX623 in high temperature. These mutants display altered root metabolism, seed composition, and growth responses under high-temperature conditions. We highlight how metabolic networks in sorghum roots respond to combined drought and heat stress, with a particular focus on plant hormones that regulate development and mediate interactions with other organisms.These findings form the foundation for an upcoming project aimed at dissecting root metabolic networks in intercropping systems involving legumes. The goal is to understand how these networks contribute to water and nutrient use efficiency in complex, climate-resilient agroecosystems.

Keywords: Abiotic stress, agricultural diversification, metabolism, sorghum

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