



RESOURCE

Water-Use Efficiency: Advances and Challenges in a Changing Climate

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Description / Abstract

Water use efficiency (WUE) is defined as the amount of carbon assimilated as biomass or grain produced per unit of water used by the crop. One of the primary questions being asked is how plants will respond to a changing climate with changes in temperature, precipitation, and carbon dioxide (CO₂) that affect their WUE. At the leaf level, increasing CO₂ increases WUE until the leaf is exposed to temperatures exceeded the optimum for growth (i.e., heat stress) and then WUE begins to decline. Leaves subjected to water deficits (i.e., drought stress) show varying responses in WUE. The response of WUE at the leaf level is directly related to the physiological processes controlling the gradients of CO₂ and H₂O, e.g., leaf:air vapor pressure deficits, between the leaf and air surrounding the leaf. There a variety of methods available to screen genetic material for enhanced WUE under scenarios of climate change. When we extend from the leaf to the canopy, then the dynamics of crop water use and biomass accumulation have to consider soil water evaporation rate, transpiration from the leaves, and the growth pattern of the crop. Enhancing WUE at the canopy level can be achieved by adopting practices that reduce the soil water evaporation component and divert more water into transpiration which can be through crop residue management, mulching, row spacing, and irrigation. Climate change will affect plant growth, but we have opportunities to enhance WUE through crop selection and cultural practices to offset the impact of a changing climate.

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