IMPACT OF DROUGHT ON HIGH TEMPERATURE PROTECTION SYSTEMS OF COTTON SEEDLINGS

John J. Burke and Bobbie L. McMichael
Plant Stress and Germplasm Development Unit
USDA-ARS
Lubbock, TX

Abstract

Cotton production on the High Plains of Texas during the 1998 growing season was devastated by a severe drought. Severe soil water deficits and elevated soil temperatures at planting and during stand establishment contributed to the loss of the crop. This study evaluated the impact of water stress on the high temperature protection systems of cotton seedlings. Polyethylene glycol (PEG) was used to establish a water stress of -0.4 MPa. Seeds were germinated in water-moistened paper towels and transferred to paper towels saturated with the PEG solutions 20 hours after planting. PEG-treated seedlings showed reduced hypocotyl elongation and root growth compared with well-watered controls. Temperature response curves for chlorophyll accumulation upon exposure to light revealed significant reductions in the ability to accumulate chlorophyll in the PEG-treated seedlings. PEG-treated seedlings maintained elevated HSP101 and HSP17.6 protein levels long after their disappearance from cotyledons of well-watered seedlings. Characterization of acquired thermotolerance levels revealed no enhancement in seedling protection in the water-stressed seedlings despite the presence of HSP101 and HSP17.6 proteins. The findings of this study show that water-stressed cotton seedlings are greatly reduced in their ability to accumulate chlorophyll upon emergence, and that the high temperature protection systems are not enhanced over that of well-watered seedlings, despite the presence of HSP101 and HSP17.6 proteins.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:508-509 (1999)
National Cotton Council, Memphis TN