2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

OSMOTIC SHOCK INDUCED GENE EXPRESSION IN COTTON ROOTS

Bill L. Hendrix and James McD. Stewart
University of Arkansas
Fayette, AR
Thea A. Wilkins
University of California
Davis, CA

Abstract

Identification of the genes expressed during water-deficit stress is an important step for developing a strategy to improve the drought tolerance of cultivated cotton. The objective of this study was to define the osmotic-shock-responsive root transcriptome of the dry-land *Gossypium hirsutum* variety Siokra L23. Polyethylene glycol (PEG) was added to the hydroponic growth medium of 35-day-old Siokra L23 plants to induce water-deficit stress. A PEG-induced phenotype was described for the plants based on time-course measurements of photosynthesis and leaf temperature. A gene expression profile was then developed utilizing cotton-fiber-based microarrays from root RNA extractions taken at 0, 1, 4, 24, and 96 h after stress initiation. Siokra L23 progressed through two phases of PEG-induced stress, termed response (0 to 48 h) and recovery (48 to 96 h). Three hundred sixty three PEG-responsive genes were identified (FDR 1%). Global gene expression profiles revealed an adaptation to the stress after 96 h. Eight functional categories played distinct roles in the response and recovery phases. The expression profiles of seven aquaporins suggested an osmotic adjustment occurred between 4 and 24 h. The expression profile of sucrose synthase and several genes in the glycolytic pathway supported the hypothesis that sucrose was a solute involved in this osmotic adjustment. The genes identified in this study provide many candidate genes that may aid in improving the drought tolerance of cultivated cotton.