PHYSIOLOGICAL RESPONSES OF COMMON COTTON CULTIVARS TO WATER-DEFICIT STRESS

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Abstract

Little information exists regarding the drought tolerance of current commercial cotton cultivars. One mechanism employed by many plants to tolerate water-deficit stress is osmotic adjustment. Osmotic adjustment is defined as the increase in cellular solutes to maintain turgor and water potential gradients. In this study, osmotic adjustment was expressed as the percentage decrease in osmotic potential of the stressed plants rehydrated to full turgor compared to well-watered control plants. In an effort to characterize drought tolerance in commercial US cotton *(Gossipium hirsutum* L.) germplasm pools, seven cultivars representative of the major cotton areas were chosen. These included Sphinx (southwest), Deltapine Nu33B (Mississippi river delta), Paymaster 1218 (east), Stoneville 747 (Mississippi river delta), Sure-Grow 474 (Mississippi river Delta), Fibermax (midsouth), and Maxxa (west). An Australian cultivar, Siokra L-23, was also included because it represents a known level of osmotic adjustment. All studies were performed in Fayetteville, Arkansas under a controlled environment. Plants were grown in 2 L plastic pots containing a soilless horticultural mix. Plants were given half-strength Hoagland's nutrient solution to maintain adequate nutrients and water. At four weeks after planting, half the plants were subjected to water-deficit stress past the point of stomatal closure to full wilt. After full rehydration, osmotic adjustment was measured using end-window thermocouple psychrometry. Means of three experiments indicated a narrow range of osmotic adjustment in the US commercial germplasm pool. The only significant difference in osmotic adjustment was between Maxxa (12 percent) and Sphinx (23 percent). Future research will include drought-tolerance characterization at a molecular level.

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