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DEVELOPMENT OF A SCREENING METHOD FOR DROUGHT TOLERANCE IN COTTON SEEDLINGS

Polly S. Longenberger, C. Wayne Smith and Peggy M. Thaxton
Texas A&M University
College Station, TX

Abstract

Drought tolerance is a complex, recalcitrant trait in upland cotton and crop plants in general. The first step in the selection of germplasm for a specific trait involves the development of an efficient and effective screening procedure. The purposes of this study were [1] to develop a protocol designed to evaluate cotton seedlings for drought tolerance on an individual plant basis and [2] evaluate the seedling drought tolerance across a number of upland cotton genotypes. Previous studies using soil-filled trays have had various problems including uniform stand establishment, rewetting capabilities of the soil, and the quantification of wilting symptoms. Two seeds were sown per 3.8 cm diameter Cone-tainer™ (Stuewe & Sons, Inc., Corvallis, OR) filled by volume with fritted clay (Absorb-N-Dry, Flatonia, TX) and thinned to one plant per cone-tainer after germination. Genotypes tested were converted race stocks (M-9044-0007, M-9044-0017, M-9044-0024, M-9044-0031, M-9044-0033, M-8844-0055, M-9044-0057, M-9044-0060, M-9044-0061, M-9044-0072, M-8844-0096, M-9044-0140, M-9044-0150, M-9044-0165, M-8744-0175, M-9044-0180, M-9044-0206, M-8744-0243, M-9044-0244, M-8744-0257, M-9044-0570) and two cultivars, Acala 1517-99 and DP 491. Twenty of the race stocks tested, excluding M-8844-0096, were determined to be the 10 most tolerant and 10 least tolerant CRS lines in the previous drought study using a mixed soil and trays 34 x 51 cm. M-8844-0096 was found to be heat tolerant in a previous field experiment testing seed set efficiency during the extremely hot growing season of 1998 in College Station, Texas. At 15 DAP the seedlings were subjected to three sequential cycles of drought. Each cycle consisted of withholding water until the moisture content of "indicator" cone-tainers, containing DP 491, averaged only 8.6 % water by weight. Plants were then watered to field capacity and percent recovery was recorded after 48 hours. The results using the new protocol did not match those from the previous study. The race stocks did not separate into the same most and least tolerant groups. DP 491 was found to be most drought tolerant of the genotypes tested with a percent recovery of 92. None of the CRS lines performed as well as DP 491. Fourteen of the race stocks tested performed better than the most susceptible check, Acala 1517-99. The remaining 7 race stocks were equal to or less tolerant than Acala 1517-99. Only 46% of M-8844-0096, the putative heat tolerant CRS, recovered from 3 cycles of drought stress, which placed lower half of the group that performed better than Acala 1517-99.