WATERLOGGING TOLERANCE IN SIX COTTON GENOTYPES AT THE SEEDLING STAGE

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Abstract

Cotton is grown in arid and semi-arid regions, where abiotic stresses such as waterlogging is a production issue due to intensive irrigation, poor soil drainage, or excessive rains. Cotton is not considered as a waterlogging tolerant crop. The effect of waterlogging on cotton depends on duration of waterlogging and the cotton growth stage. Waterlogging stress reduces cotton leaf area, chlorophyll content and photosynthetic rate, and decrease boll number and yield. However, there is a lack of information regarding waterlogging tolerance in commercial cotton cultivars grown in the US. This greenhouse study evaluated six cotton cultivars and breeding lines including, three Upland: Acala 1517-08, Acala 1517-20, and NM 13G2019; and three Pima: Pima S-7, PHY 841 RF, and DP 358 RF. Two replicated tests each with three replications were performed in a randomized complete block design. The waterlogging duration was set at seven levels, i.e., 2, 4, 6, 8, 10, 12, and 14 days. For each level, one tray was submerged in water in a plastic container at the 2-true leaf stage when treatments were initiated. Control treatments were watered daily with tap water for each level. At the end of each level, measurements were taken on plant height (PH, cm), fresh shoot weight (FSW, g plant^{-1}), and dry shoot weight (DSW, g plant $^{-1}$), and chlorophyll content reading (CHL) using a SPAD meter. Genotypic significant differences (at $p<0.05$) were detected for all the traits. The highest reduction was observed at 14 days of waterlogging treatment (DOT), indicating that the longer the waterlogging, the higher the percentage of reduction, as expected. At 14 DOT, FSW had the highest reduction (30%), followed by PH (24%), DSW (22%), and CHL (16%). At 4 and 6 DOT, lower but significant differences in the percentage of reduction were observed among the six cotton cultivars. However, 2 DOT did not significantly reduce seedling growth. At 14 DOT, DP 358 RF had the highest reduction in PH (30%), FSW (35%), DSW (20%), and CHL (16%). Both Acala 1517-08 and Pima S-7 had the lowest percentage of reduction in PH (20%), FSW (20%), DSW (13%), and CHL (10%). Based on the two replicated tests, Acala 1517-08, Pima S-7, Acala 1517-20, and PHY 841 RF were more tolerant than NM 13 G2019 and DP 358 RF. Our results indicated that waterlogging tolerance existed in both Upland and Pima cotton at the seedling stage.