CORN AND VELVETLEAF TRANSPIRATION IN RESPONSE TO DRYING SOIL.

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Crop production in the Great Plains region is characterized by highly variable rainfall and soil water availability, which impacts all aspects of agroecosystems and their management, including the presence and abundance of weedy species. The supply of soil resources is critical for the establishment and long-term competitive success of a plant species. While there is considerable research on the effects of water supply on crop growth and productivity, there is little published research on the response of weedy and invasive plants to limiting soil water supply relative to that of the crop. The objective of this study was to determine the relative transpiration of corn 'Dekalb DKC60-19' and velvetleaf as the plants were subjected to drought stress. Four trials of a greenhouse experiment were conducted at differing stages of plant development. Corn and velvetleaf plants were seeded in pots (25 cm diam by 23 cm deep) filled with a constant 13.5 kg dry weight of a 8:1:1 mixture of soil:sand:perlite. Plants were thinned to one plant per pot and watered to saturation daily until the beginning of the experiment. Prior to the start of the experiment, pots were placed in 0.90 mil black plastic bags and sealed around the base of the plant stem so the only water loss was that due to transpiration. Sealed access tubes were inserted through the bags to allow periodic water replacement with minimal disturbance of plants. Daily transpiration was measured by weighing the pots at the same time each day. For each trial, five plants of each species were maintained at the well watered level by adding back the equivalent water loss each day, and five plants were subjected to drought stress by not replacing lost water. Leaf area was measured as leaves senesced, and at the culmination of the experiment. Actual leaf area on a given day of the trial was determined by subtracting the leaf area of senesced leaves on a daily basis for the drying plants. For the well-watered plants this was estimated by assuming the starting leaf area was equivalent to the average total leaf area of the drying plants. The difference between that and the total leaf area of each individual well-watered plant was added evenly for each day. Daily transpiration of the drought stressed plants was normalized relative to fully watered control plants (T_a/T_p) to offset any effect of environmental conditions. A second normalization was done to minimize any transpiration differences among individual plants and resulted in the final normalized transpiration ratio (NTR). Soil water content was expressed as the fraction of transpirable soil water (FTSW) and used as a measure of the level of drought stress. The relationship between NTR and FTSW was described using a logistic function and used to compare water use by corn and velvetleaf during drought stress conditions. Plants were considered stressed when NTR declined below 0.97. The FTSW at which NTR = 0.97 was 0.44 and 0.53 for corn and velvetleaf, respectively. This indicates that corn maintained normal, unstressed transpiration at lower soil water content than velvetleaf. The slope of the NTR vs. FTSW relationship is an indicator of how well the species can utilize the remaining soil moisture. The slope for corn was 4.84 while the slope for velvetleaf was 3.50, indicating that the velvetleaf, once drought stressed, proceeded to use the remaining soil moisture at a slower rate than the corn. Velvetleaf had a higher NTR than corn when the soil moisture was greatly diminished (FTSW<0.1) indicating that velvetleaf could survive better in a water deficit situation

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