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—Scientific Note—

Effects of Irrigation Rate on Evapotranspiration Rates of Three Sweet Corn Cultivars

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Florida is one of the top producers of sweet corn in the United States. The crop is grown in soils that have low water holding capacity and highly permeability. Irrigation management is crucial as the state heavily depends on shallow aquifers for both drinking water and irrigation for crop production. Developing optimal irrigation management practices is critical for optimizing sweet corn yield and improving water conservation and water quality. Water stress responses of sweet corn vary between cultivars and geographic locations. Weather variability also plays a significant role in a plant's response to water stress. This study was conducted to investigate changes in crop evapotranspiration (ETc) rates of three sweet corn cultivars ('1170', '8021', and 'Battalion') under three irrigation rates targeted to replenish 50, 75, and 100% of the soil water deficit. The consumptive water use results presented in this study are a first approximation to establish the water requirements for these three cultivars and provide insights for developing irrigation strategies that conserve water without significantly affecting crop yield.

Materials and Methods

This study was conducted at the Tropical Research and Education Center (TREC) University of Florida, IFAS, Homestead, FL. The experiment was conducted in an open field using 3.79-L plastic containers filled with Krome gravelly loam soil. A 3 × 3 factorial experimental design was used with three irrigation rates, three cultivars, and four replications. This resulted in a total of 180 plants (3 cultivars × 3 irrigation levels × 4 replications × 5 plants per replication). Irrigation was supplied with an automated drip irrigation system with an average emitter delivery rate of 127 mL/min and distribution uniformity of 90%. Irrigation treatments were targeted to replenish 50, 75, and 100% of the soil management allowable depletion (MAD). Fertilization included 75, 65, and 125 kg/ha N, P, and K. Daily ETc rates were measured from 36 pots by monitoring daily weight loss of each replication (pot, soil, and plant) with a digital scale. Reference evapotranspiration (ETo) was calculated using the FAO-Penman-Monteith equation based on weather and crop-specific information. For each cultivar, crop coefficient (Kc) values were then calculated, for different crop growth stages, as a ratio of measured ETc and calculated ETo. Sub-hourly weather data was retrieved from a weather station of the University of Florida, IFAS Florida Automated Weather Network (FAWN) located approximately one mile from the study site <https://fawn.ifas.ufl.edu/>.

Results and Discussion

Total irrigation applied under the 50, 75, and 100% treatments were 116, 162, and 216 mm, respectively. Fully irrigated plants had the highest ETc, while plants that received 50% irrigation had the lowest ETc. Consumptive water use for the 100% treatment was 387 mm, followed by 75% with 333 mm and 50% with 287 mm. Cultivar 1170 had slightly higher ETc compared to '8021' and 'Batallion'. On average, a 25% reduction in irrigation resulted in a 10% reduction in ETc. During most of the sweet corn growth stages, Kc values were greater than 1 for the 75 and 100% IRRs regardless of cultivar. Peak Kc values reached as high as 1.5 during the vegetative growth stage for the three cultivars. Fresh ear weight was not significantly affected by irrigation rate or cultivar. Ear weight was slightly higher, but not significantly, in the 75% irrigation treatments compared to the 100% and 50% treatments. Among the three cultivars evaluated in this study, fresh biomass weight was lower for '8021' compared to '1170' or 'Battalion' for the same irrigation level.

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