The experiments included trees on UV reflective mulch on conventional drip irrigation in Lake Alfred, Florida.

Deficit irrigation in HLB-affected citrus trees

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Deficit irrigation practices can reduce water and energy costs, thus potentially increasing water-use efficiency and water savings in citrus production. Irrigation management through deficit applications, if timed at periods of reduced water demand, could help trigger increased root water and nutrient uptake while synchronizing citrus flush patterns. These are useful practices for improving tree growth and pest control, such as Asian citrus psyllid.

Recently, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) researchers conducted two experiments to understand the impact of reducing irrigation amounts in 1- to 3-year-old HLB-affected citrus trees.

EXPERIMENT 1: GREENHOUSE STUDY

The first study was conducted in a split plot factorial design. Two irrigation treatments equivalent to a 100% evapotranspiration (full irrigation) and 80% evapotranspiration (deficit irrigation) were the main plot factors. HLB-affected and healthy trees were randomly assigned as subplots to the main plots. The trees under full irrigation treatment were irrigated at 100% of their water requirement while those at deficit irrigation were irrigated at 80% of their requirement (20% less water). Each irrigation rate by HLB tree status combination was repeated five times.

Water use was determined using sap-flow measurements taken in fall 2020, spring 2021 and summer 2021 using the stem heat balance technique with sap-flow sensors connected to a data logger. The sap flow was measured every hour for a minimum of seven days in four of the five trees. Daily water use was evaluated for every 24-hour window (12 a.m. to 11:59 p.m.) and compared among treatments.

Sap-flow measurement for spring and summer showed that healthy trees subjected to full and deficit irrigation had greater sap flow as compared to HLB-affected trees under these two treatments. Reduction in root length and volume for

HLB-affected trees was possibly the reason that their use of irrigation water was reduced by 21% to 28% compared with healthy trees at both irrigation rates in spring and summer 2021.

This study was conducted under a controlled environment. Therefore, the variability observed between the water use of HLB-infected and healthy trees was more of a function of the tree health indicators such as root and canopy growth and less likely from the weather conditions outdoors which further contribute to the plant function.

The highest water use occurred between 11 a.m. and 4 p.m. for HLB-affected trees. This was associated with high daily temperatures, suggesting elevated water use during this time.

EXPERIMENT 2: FIELD STUDY

Irrigation treatments were applied to 1- to 3-year-old trees independently, as follows:

- Conventional microsprinkler irrigation, irrigated daily and fertigated weekly, with the microsprinkler placed at about 6 inches perpendicular to the tree row providing 10.5 gallons per hour (gph)
- Conventional drip irrigation, irrigated three times daily and fertigated daily in small pulses to meet tree water requirements with two drip emitters per tree each delivering water at 0.5 gph with the emitters spaced at 6 inches from both sides of the tree
- Regulated deficit irrigation, irrigated three times daily and fertigated with the dripper placed at about 6 inches perpendicular to the tree row that receives 75% of the conventional drip irrigation

Half of the plots were established with metallized reflective mulch treatments randomly. After recommended site preparation, 7.8-foot-wide sheets of mulch were laid on the mulch-assigned plots, and soil was back-filled to about 6-inches depth on the sides of the row. The plots with mulch included either conventional drip irrigation or regulated deficit irrigation. Selected plots with no mulch included conventional drip irrigation, regulated deficit irrigation or conventional microsprinkler irrigation

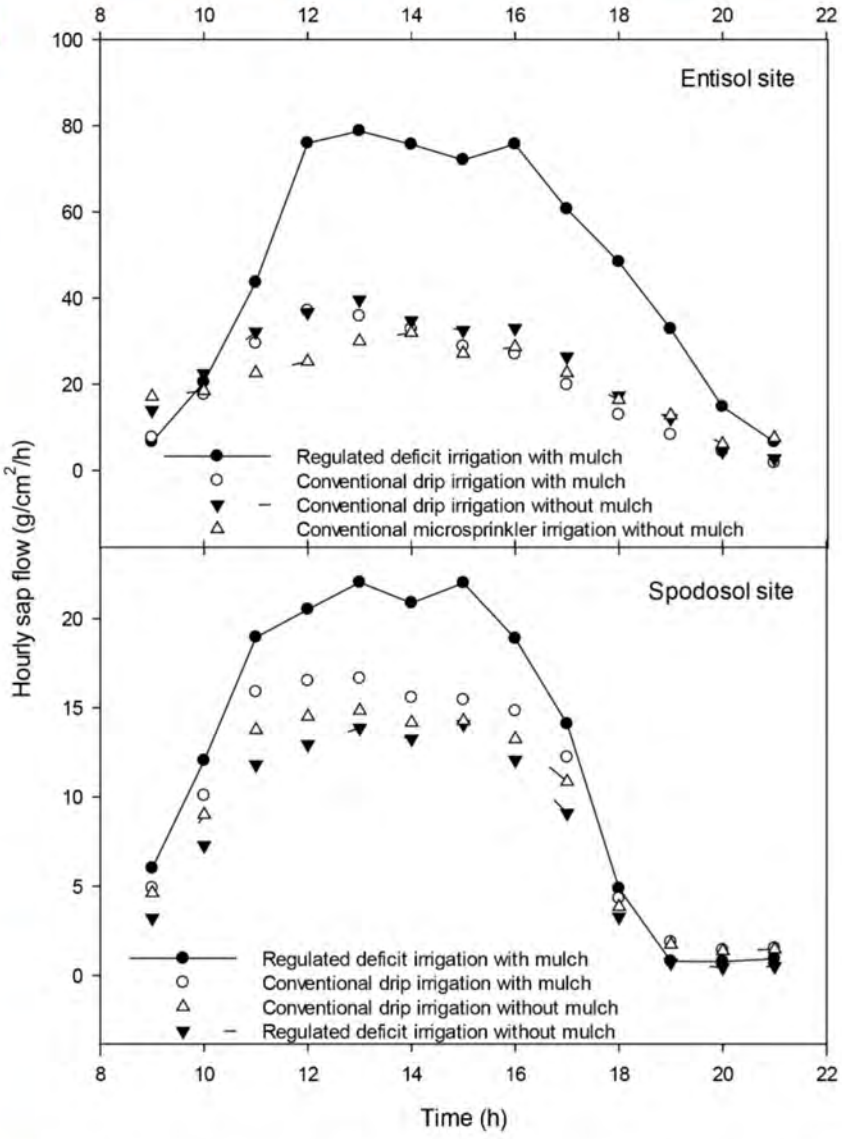

Figure 1. Sap flow or water use at Lake Alfred (Entisol site, top) and Immokalee (Spodosol site, bottom)

with nutrients applied through fertigation at periodic intervals.

Water uptake was measured in 2021 using sap-flow sensors on one branch in each of four trees per treatment at Lake Alfred (Entisol soil-type site) and Immokalee (Spodosol soil-type site) Aug. 11–23 and Nov. 23–Dec. 6, respectively. The sap-flow sensors were set to record data every hour on a data logger. Sap-flow data obtained from the logger were then converted to water flow per unit stem area per unit time.

At Immokalee, hourly sap flow ranged from 0.9 to 1.11 g cm^{-2} h^{-1} between 6 a.m. and 7 a.m., rising to 22.03 g cm^{-2} h^{-1} at 1 p.m., declining steadily to 0.93 g cm^{-2} h^{-1} at 9 p.m. for regulated deficit irrigation with mulch in November 2021. In August 2021, the hourly sap-flow values for regulated deficit irrigation with mulch at Lake Alfred were 99% to 179% greater than conventional drip with no mulch between 12 p.m. and 6 p.m. (Figure 1).

The frequent daily irrigation in small pulses using conventional drip or regulated deficit irrigation along with mulch increased soil water content. This might have resulted in increased sap flow for mulched treatments with conventional drip or regulated deficit

A sap-flow system was used to measure water use.

irrigation. The sap-flow data suggest that mulched regulated deficit irrigation systems resulted in higher water use than conventional drip in either mulch or no-mulch systems.

SUMMARY

In summary, deficit irrigation practices with mulching would be helpful for trees to increase uptake of water in HLB-affected trees. This practice could be implemented during periods of low water demand, such as winter months. This practice could also help growers save water and minimize nutrient leaching, thereby helping growers implement best management practices.

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