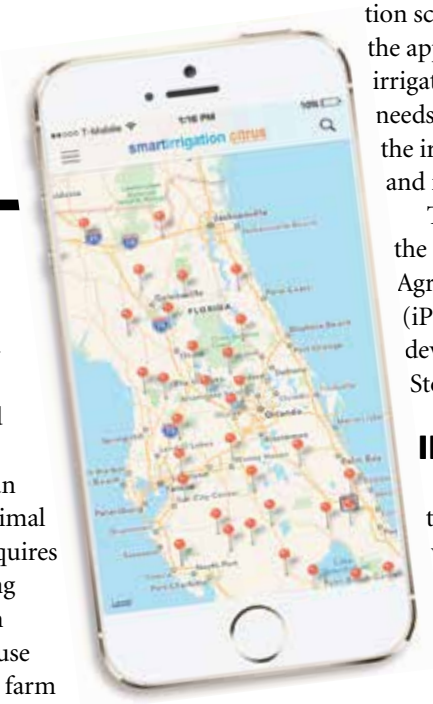
App improves irrigation scheduling

By Kelly T. Morgan



Studies in Florida have shown significant water savings for many agricultural crops with improved irrigation methods. Recent studies have demonstrated that to provide for an adequate supply of irrigation water for optimal citrus production of HLB-affected trees requires more intensive management and scheduling of irrigation. This more intensive approach requires more frequent irrigation, but not use of more water. Large citrus operations that farm thousands of acres could save more than $330,000 per year, simply assuming 20 percent fuel savings.

Weather data coupled with computer algorithms are used to quantify and predict crop water use based on evapotranspiration (ET). Daily estimates of ET are used in a simple water balance equation to summarize water use over a given period to determine irrigation timing and amounts. Use of ET-based irrigation scheduling models has been shown to reduce water volumes applied by as much as 30 percent, without compromising tree health or productivity.

Unfortunately, citrus growers are still hesitant to implement them due to lack of comfort with the technology, and the belief that more water equals greater productivity. The potential for water savings with these models could provide much needed stress relief for HLB-affected citrus trees. Adoption of more frequent irrigation practices, which satisfy ET-required water use, can also improve water quality by reducing chemical applications (fertilizers and pesticides per irrigation) and reducing nutrient and pesticide leaching into subsurface aquifers. Improved irrigation scheduling can also improve water quality by minimizing potential runoff that occurs with over-irrigation transporting contaminants with water into surface water and groundwater supplies.

CITRUS SMARTIRRIGATION APP

Mobile smart devices (e.g., smartphones and tablets) have become commonplace in society because of their convenience and ease of use, making them ideal for disseminating information on a regular basis with real-time data. Tools developed for use on mobile smart devices are typically called "apps" and are available for a variety of functions. Apps can be personalized so that the information output fits the user's needs.

Our goal was to provide users with an easy-to-use mobile app to access current weather data that would improve irrigation scheduling for agricultural producers. By using the app instead of a set time-based schedule for irrigation, more accurate assessments of irrigation needs could be provided. Using the app to modify the irrigation schedule can reduce irrigation costs and nutrient leaching, as well as conserve water.

The Citrus SmartIrrigation app developed by the University of Florida's Institute of Food and Agricultural Sciences is compatible with iOS (iPhone, iPad and iPod Touch) and Android devices and is available to download at the App Store and Play Store free of charge.

INFORMATION REQUIRED

The irrigation schedules provided by the app require user inputs and site specific weather data obtained from the closest Florida Automated Weather Network (FAWN; http://fawn.ifas.uf.edu). Once the app has been downloaded and installed on your phone or tablet, select the FAWN station nearest the grove location. Next, site-specific information for each irrigation zone can be saved under different names. There is no limit on the number of zones that can be managed separately.

The site-specific information required to run the app includes:

- The spacing of trees in-row and between rows
- Irrigation emitter output, pattern angle (choice of 45, 90, 180 or 360 degree patterns) and diameter
- Irrigation efficiency (90 percent default for microsprinklers)
- Soil type from a list that is most similar in water-holding capacity to the soil in the irrigation zone
- Irrigation depth

The irrigation depth entered by the user is the soil depth to be wetted by each irrigation event. The irrigation depth or rooting depth of mature citrus prior to HLB affecting trees was 18 to 24 inches on the Flatwoods and 36 inches on the Ridge. The most recent rooting depth data now suggests that roots of mature citrus trees affected by HLB extend to a soil depth of about 12 inches for Flatwoods soils and 18 to 24 inches for Ridge soils. These numbers can be adjusted based on soil samples taken in your grove.

A number for irrigation target depth is also required as an app input variable. The target depth is the depth at which the highest root density occurs. It is typically 6 inches deep on Flatwoods soils and 12 inches deep for Ridge soils.

HOW IT WORKS

In the app, irrigation schedules are determined by

averaging the last five days of ET provided by FAWN. Every 15 days, a new schedule is determined and a notification is sent to the app users.

In addition to providing a real-time irrigation schedule, the app also provides current conditions, forecast of temperature and rainfall probability for the next few hours, and estimates of high and low temperature, relative humidity, rainfall probability and wind speed predictions for the next five days. Irrigations can be delayed, saving water and fuel costs, if rainfall probability is high for the next few hours.

APP EVALUATION

The citrus app was evaluated in four replicated blocks at three commercial citrus groves on both Ridge and Flatwoods soils of Central and South Florida. App evaluations were conducted for two production seasons and continuously compared the citrus app irrigation schedules with conventional calendar-based schedules.

Fruit drop in each of the three groves and scheduling treatments were determined in October of each year. In these test groves, no significant differences in fruit drop were noted among blocks within the app or grower irrigation schedules six months after the different scheduling treatments began. However, fruit drop for trees irrigated with the grower schedule were significantly greater than trees irrigated with the app schedule at two of the three locations 18 months after the start of the irrigation project. Yields (ranging from 2.1 to 3.7 boxes of fruit per tree) were similar for all treatments, with no significant difference among irrigation methods.

The range of annual water use was 19,895 to 23,543 gallons per grove acre for the groves scheduled with the citrus app, and 22,986 to 28,554 gallons per grove acre for the grower-scheduled blocks. These numbers indicate a significant water savings of 11 to 24 percent annually when the app method was used to schedule irrigation.

The SmartIrrigation-managed irrigation schedule had greater measured sap flow than the grower-scheduled irrigation at two of the three sites. Likewise, stem water potential was greater for SmartIrrigation-managed trees than trees grown with the grower-scheduled irrigation at two of the three sites. The higher sap flow and stem water potential — measures of the tree's ability to uptake water — suggest higher water use by the SmartIrrigation-scheduled trees. The higher use also indicates that the trees irrigated using the citrus app were better hydrated than trees receiving irrigation following the grower schedule.

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