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Irrigation App for Container Nurseries

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Container plant irrigation run times should be adjusted daily to match plant water needs. However, this is difficult without the use of irrigation management tools such as CIRRIG (Container Irrigation) a web-based program that uses plant parameters and onsite weather to output daily irrigation application amounts. We developed a mobile device irrigation app based on CIRRIG principles; however, the app acquires weather data from FAWN (Florida Automated Weather Network) stations rather than a weather station onsite. Inputs include container size (trade #1 ≈ 2.4 L or trade #3 ≈ 10 L), container diameter, container spacing, spacing arrangement, plant canopy density, irrigation-capture ability, plant width, and irrigation application rate to obtain the irrigation run time, in minutes. Example screenshots are presented along with summary of workshops and irrigation run time determinations from producers of container-grown plants.

A web-based, container irrigation program (CIRRIG) has been developed that outputs daily irrigation run times for sprinkler-irrigated, container-grown nursery plants (Million and Yeager, 2015b). Inputs include weather data collected onsite, container size, container spacing, plant size, plant canopy capture ability, irrigation application rate, and target leaching fraction. CIRRIG was tested at a commercial nursery in central Florida where two adjacent areas were irrigated. One area was irrigated manually by the nursery manager and the other automatically by CIRRIG. After six months, plant size of *Viburnum odoratissimum* was similar in both irrigation areas, while 20% less irrigation water was applied using CIRRIG (Million and Yeager, 2015b).

Based on CIRRIG, we developed a mobile container irrigation app for iOS and Android platforms. A major difference between the app and CIRRIG is the app downloads weather data from the Florida Automated Weather Network (FAWN) rather than from a weather station onsite. Output from the app provides sprinkler irrigation run times for trade #1 or trade #3 containers (trade #1 container ≈ 2.4 L; trade #3 container ≈ 10 L). The objective of this paper is to provide an overview of how the app is used to determine daily irrigation run times in a container nursery.

**Inputs for the App**

The app has three main pages (irrigation, settings, and weather) plus information viewed or used often. The app opens to the irrigation page (Fig. 1) where the user can find an array of irrigation run times for different-sized plants in trade #1 or #3 containers. Specific production conditions for trade #1 and #3 containers can be changed on the settings page (Fig. 2). Settings for plants in a given irrigation zone are likely to remain the same unless plants are pruned or spaced. The weather page provides daily weather for the past 24-h period plus the past seven calendar days (Fig. 3). To begin, the user opens the app and, near the bottom of the main page, selects settings. On the settings page, the nearest FAWN station is selected either automatically (via GPS) or manually from a dropdown list. The app automatically downloads the most recent weather data from FAWN. For run time outputs on the irrigation page, the app uses weather data for the past 24-h period (Fig. 3). There is an option to override rain amount as actual rain onsite is often different than that reported by FAWN.

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Fig. 1. The main page of the container irrigation program (CIRRIG) app is used to select irrigation run time.
The following inputs are available on the settings page for both #1 and #3 containers (Fig. 2).

**Container top diameter (inches)** — Measure the distance across the inside top of the container and enter results to the nearest 1/4 inch.

**Spacing (inches between containers)** — Measure the average distance between the top outer edge of adjacent containers. For containers arranged in the offset pattern, measure the distance between containers along the axis parallel with plant production beds and measure the distance between containers diagonally to the previous measurement. Enter the average for the two measurements.

**Spacing arrangement (offset or square)** — Containers placed in a square arrangement are equal distance from each other, whereas the offset pattern resembles a triangle.

**Plant canopy density (low, medium, high)** — Plant canopy density is a judgement about thickness of the canopy as seen from above.

**Irrigation rate (inch/hour)** — An irrigation application rate test is performed to determine the depth of irrigation water falling on an area per unit of time (Million and Yeager, 2015c).

Because settings can greatly affect output irrigation run times, it is important to ensure inputs are entered correctly.

**Outputs for the App**

Irrigation run times are given on the irrigation page (Fig. 1) after the app downloads the weather data. Because weather data downloads occur every 15 min. and irrigation run times are based on the past 24-h period, irrigation run time outputs will also change every 15 min. After selecting #1 or #3 containers, select the irrigation-capturing ability of the plant species (negative, nil, low, medium, and high). Icons provide a clue relative to the shape of the plant and its ability to capture irrigation water. While this factor plays a major role in determining the irrigation requirement, the irrigation-capturing ability has only been measured for a limited number of plant species (Million and Yeager, 2015a). Below the irrigation-capturing ability icons is a table of irrigation run times for a range of plant canopy widths for both jammed (touching containers) and spaced containers.

**Education and Evaluation**

We conducted three workshops at container nurseries in Fall 2015. Each participant downloaded the app prior to the workshops. Inputs for the app were discussed and participants used the app to determine irrigation run time for plants in the nursery. Ninety-four percent of participants (n = 18) found the app easy to use and 94% (n = 17) noted on a questionnaire that they wanted to explore further use of the app.

In Spring 2016, personnel from two nurseries tested the app by recording the run time output from the app and the actual irrigation run time used by the nursery. Average run times for the app deviated 3–10 min. from the actual run times. Because plants of different irrigation requirements are often mixed within an irrigation zone, it is important to choose the group of plants with the highest irrigation requirement when using the app in this situation.

When using the app or any other objective method of determining irrigation application amounts, producers should check to ensure the irrigation schedule is maintaining adequate substrate...
moisture levels. Monitoring irrigation effectiveness can be accomplished by weighing plants, removing the container and visually observing the root ball and substrate, using a moisture rating scale on substrate core samples, or conducting leaching fraction tests (Million and Yeager, 2015d). Without adequate substrate moisture, plant growth will be suppressed and time to finish a crop increased.

Conclusion

We developed a mobile device app to output daily sprinkler or irrigation run times for plants grown in #1 or #3 containers in Florida nurseries. Producers testing the app found that irrigation system run time outputs agreed with their experience. The app will be available from iOS and Android suppliers in Spring 2017.

Literature Cited