

# Irrigation controllers for citrus production

By A.W. Schumann and Tim Spann

**F**lorida citrus relies on supplementary irrigation for profitable fruit production, particularly during the dry spring season. Keeping many grove acres properly irrigated during the spring months can be quite demanding for both labor and equipment.

The required irrigation intervals can be as short as one or two days in soils where root systems are shallow and the water holding capacity is low. Some growers have groves distributed in many distant locations, so that managing irrigation at those sites is costly and inconvenient. In these cases, an investment in automatic irrigation controllers is justified.

As the third part of a series on citrus technology in *Citrus Industry*, this article summarizes some of the reasons why growers might consider converting to automatic irrigation systems. Advantages of modern automated irrigation systems include:

1) The systems monitor water flow rates, pressures, filters, battery voltages, and engine temperatures and will shut down pumps, valves and power units if unsafe or faulty operating conditions exist. Water filters also can be flushed automatically.

2) The operator has complete remote control over all automated pumps, so pumps can be manually operated from a distance, such as during freeze events.

3) All irrigation functions are logged to a database which can generate reports to evaluate performance, provide water consumption records, etc.

4) Irrigation can be automatically scheduled as needed with soil water sensors, evapotranspiration estimates, rainfall records, and other historical or real-time weather data.

5) Irrigation efficiency can be improved when using automatic controllers by irrigating at night, only when needed, and only for as long as necessary. If rain occurs during an irrigation event, the controller can automatically halt the irrigation, thus saving water.

6) Some utility companies will sell electrical power at cheaper rates during off-peak hours such as at night or during weekends, thus allowing additional cost savings by automatic off-peak irrigation with electric pumps.

7) More efficient irrigation can re-

tain more nutrients in the root zone by minimizing leaching.

8) Liquid fertilizer injection can be automated in the same system to also increase nutrient uptake efficiency with fertigation. Frequent small daily fertilizer doses are less susceptible to rain leaching events than large conventional dry fertilizer applications.

9) Automated fertigation is the cornerstone of intensively managed high density citrus production systems, offering early high yield returns and other advantages. In South Africa and other countries, these are known as “open hydroponics” systems.

Most irrigation control systems on the market today rely on manually adjusted timers to regulate watering schedules in residential properties. Simple timer-based controllers are easy to use and affordable, but lack the necessary sophistication to reliably operate expensive citrus grove pumps. Fortunately, there are modern irrigation controllers built for this task using the latest generation of embedded computer microprocessors and sensors. Brands include Hanna Instruments, Motorola, and Netafim. These controllers offer highly customizable irrigation systems, including hydraulically operated valves for improved lightning and power surge resistance, comprehensive PC-based irrigation management software, various methods of long-distance wireless communication and starter kits for diesel engines.

Despite their current sophistication, there is still room for improving these irrigation controllers, including:

1) Text messaging of alarms and events by the controllers to cellular phones and hand-held computers could become routine, and is required for immediate notification to operators.

2) Remote control of the irrigation system from hand-held computers and cellular phones would be useful for busy grove managers on the move.

3) Extended radio range is required for remote grove sites. The better radio systems are limited to about 25 miles in Florida conditions, and the lower priced 900 Mhz or 2.4 GHz radios generally will connect only at distances less than five miles. Fortunately, the cellular phone network can be used at any distance for this pur-



Figure 1. An example of a controller suitable for automated, remote-controlled citrus irrigation

pose, but is generally only connected during a call and therefore not ideal for continuous monitoring.

4) More rigorous protection of the electronic hardware from lightning strikes and power surges is required in Florida weather conditions.

5) Engine start kits need to routinely include clutch controls, so that the engine does not have to be cranked “in gear” while turning the pump. The extra load on the engine can lead to premature wear and failure.

Future generations of automatic irrigation controllers will be “smarter,” increasingly relying on weather and remotely sensed data collected wirelessly from the Internet. Real time data access, coupled with simulation models, will allow the controllers to automatically decrease the watering schedule on cold or humid days, increase applications on hot and dry days and to consider probability of rainfall in scheduling.

As the urbanization of Florida increases and competition for agricultural water allocations increases, water use and application efficiencies will have to increase. The levels of efficiency that will be required are virtually impossible to achieve without adopting some level of automation.

This automation will also help to offset ever increasing labor costs and shortages. However, the most important reason to consider irrigation automation is crop quality. The highest quality citrus, or any other crop for that matter, is

achieved when the proper amounts of water and nutrients are supplied to the grove when needed by the trees. Florida must continue to produce the best citrus in the world to remain competitive in the global market.

*Arnold Schumann and Tim Spann are at the UF/IFAS Citrus Research and Education Center in Lake Alfred. Thanks are due for support from SWFWMD. Email [schumaw@ufl.edu](mailto:schumaw@ufl.edu) for more information.*