AgriLife NEWS

April 30, 2010

Engineers: Smart irrigation controllers get a little smarter

But an AgriLife Extension study showed most still over-water

By: Robert Burns, 903-834-6191
Contact(s): Charles Swanson, 979-845-5614 , clswanson@ag.tamu.edu

View All Media/Resolutions

COLLEGE STATION -- In the second year of a two-year study of 10 "smart" irrigation controllers, Texas AgriLife Extension Service experts found some performed well, some needed work and others were still not so smart at all.

"When looking at total seasonal irrigation amounts for the entire landscape, only two controllers were within the recommendations of TexasET (Texas Evapotranspiration Network)," said Charles Swanson, AgriLife Extension program specialist. "The remaining eight controllers put out significantly more water that would have been needed."

"Also, total irrigation volumes for each zone, instead of being about the same, ranged from three to five times as much water from controller to controller," said Dr.Guy Fipps," Agrilife Extension engineer with the Texas A&M University department of biological and agricultural engineering.

Smart controllers refer to irrigation units that use weather data and calculate the correct amount of water needed by lawns and landscape plants. Ordinary "dumb" controllers rely on timers and require human intervention, Swanson said. Smart controllers have been heralded as environmentally sound to ordinary, timed controllers, which, due to human error or lack of management, often apply two to three times more water than necessary.

There are four types of smart controllers: historic ET, sensor-based, ET real-time and centrally controlled, he said.

Evapotranspiration, commonly abbreviated as "ET," is an estimate of the total amount of water needed by plants. The estimation includes the water that plants transpire and the water that evaporates from the soil surface. ET is affected by many factors, including the type of a particular plant, and the climate, particularly temperature, solar radiation, wind and relative humidity, Swanson said.

Historical ET controllers apply water according to data that is digitally stored within the units' electronics. Sensor-based controllers use one or more sensors – usually measuring temperature and solar radiation -- to compute ET values. Controllers may also have rain sensors to either measure rainfall or simply detect rainfall to suspend irrigation. ET real-time units use data acquired either through the Internet, telephone or pager from a regional weather station to estimate landscape water requirements. Centrally controlled units rely on a separate on-site weather station equipped with sensors that record temperature, relative humidity, wind speed and solar radiation to calculate ET, Swanson said.

As in the first year of the study, controllers with onsite sensors irrigated closer or within the recommendations of TexasET. Also, as in the first-year results, controllers that received ET and rain information remotely irrigated much higher than the recommendations, he said. We are working with these manufacturers to identify the reasons for this, Fipps said.

During the first year of the study in 2008, Swanson and Fipps tested six smart controller models, all of which were currently on the market. They found the six smart controllers applied from about one-third to two-and-a-half times more water than was recommended, according to Swanson.

Four more brands were added in 2009 and the evaluation period was lengthened from about eight weeks to 13 weeks, July 20 through Oct. 18. Five sensor-based units and five ET real-time units were enrolled in the study.

As in the first year, the 10 controllers were programmed for College Station conditions using a "virtual landscape," Swanson said. In the virtual landscape, no water is actually applied. Instead, the runtimes of the controllers are recorded by a computer and used to calculate the amount of water each controller would have applied. Water needs were calculated using the standard scientific formula to estimate ET. The amount of water which would have been applied by the tested units was compared to the amount prescribed by using the weather station data and ET formulas on the TexasET Network.

Each controller was assigned six stations in the virtual landscaped zone, each with unique combinations of fescue, Bermuda grass, woody shrubs, trees and ground cover, soil and full sun or shade.

"Programming the controllers according to these virtual landscapes proved to be problematical, as not all of the controllers had the option of programming all of the required parameters," Swanson and Fipps note in their official report.

Ideally, all controllers would have applied the about the same amount of water for any given virtual zone, but that was not the case, Swanson said.

"There was significant variation between the irrigation amounts, ranging from three to five times as much water for the same station produced by these controllers," he said.

Overall, the sensor type controllers performed better in our study than the ET real time controllers, but most sensor controllers still applied too much water. The S sensor-based controllers exceeded the recommended amount 76 percent of the time, which was unchanged from year-one results, applying on average 2.64 inches more water than was called for in year two, and 1.88 inches in the year one, Swanson said.

However, two of the sensor controllers were within the TexasET recommendations for most of the zones.

One criticism from commercial irrigators of the study is that it didn't account for what's known as sprinkler system "uniformity," Swanson said.

Uniformity refers to how evenly an irrigation system applies water, he said. No system is 100 percent uniform, and systems where uniformity is in the 50 percent to 60 percent range are more the rule than the exception. Irrigators often over-compensate for non-uniformity, either perceived or measured, and this can lead to excessive water use and runoff.

"In our testing program… we set all controllers to 100 percent uniformity (where allowed) so we could evaluate the controllers ability to calculate the plants' water requirement," Swanson said. "Ideally all the numbers should come out very close since we ignore the irrigation system by telling the controller its 100 percent uniform, but we see some controllers recommending large amounts of irrigation."

Swanson and Fipps are not disclosing the specific brands of the controllers tested in their report, pending further work with the manufacturers, they said.

They are currently continuing the evaluation through 2010 with some changes to the testing protocol. First, they will track the performance of the units throughout the full growing season (about 9 months) in south central Texas. They will also devise a new virtual landscape, "one that more accurately depicts typical Texas landscapes," they said.

Another change will be made to many of the indoor-tested controllers themselves. New Texas regulations require that all new controllers are equipped with a rainfall sensor.

"The sensor-based controllers already came equipped with rain sensors but the indoor tested ET controllers received rainfall information along their ET data. Having these controllers able to account for on site rainfall should lead to a more accurate utilization of rainfall," Swanson said.

"Our emphasis is on an ‘end-user' evaluation, that is to develop a program that will be able to evaluate controller performance as it is installed in the field," he said. The full report is posted on the irrigation technology Website at http://itc.tamu.edu .

-30-"