

Irrigation Research Solutions for Your Life



THE IRRIGATOR NEWSLETTER

Frost Protection of Strawberries

The United States is the second largest producer of strawberries in the world and Florida ranks second for strawberry yield in the U.S., producing 10%-15% of the crop. The strawberry growing season typically occurs over the winter, but can suffer from frost damage when temperatures fall to critical levels. To protect the crop, farmers typically apply overhead sprinkler irrigation during frosts so that the heat produced during the freezing process will minimize damage to the harvesting potential of the strawberries. As a result, strawberry farms pump millions of gallons of water for frost protection in just a few days of the year with no contribution to the overall plant water need. Finding ways to reduce this stress on our water resources would be greatly beneficial. Thus, a study was designed to determine the impact on harvests from changes to typical overhead sprinkler systems used for frost protection such as sprinkler spacing and system pressure.

Five treatments were selected with three replications per treatment, totaling 15 plots where each plot has five planted rows that are 16 to 24 linear feet. The harvest area for all plots consisted of 12 linear feet of plants in the middle three planted rows (rows 2 through 4) whereas the remaining areas of the plot (top and bottom of all rows, row 1, row 5) were considered guard row areas. Sprinkler spacings of 48 feet on center and 40 feet on center were both evaluated at a system pressure of 50 psi and were activated at 38°F

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*Did you know...
Irrigation accounts for nearly 65% of a homeowner's irrigation bill?*

A note from Dr. Michael Dukes



Welcome back to the IrriGATOR newsletter: Summer 2012 edition. Due to the graduation of a few of my students combined with maintaining a steady flow of research activities, the newsletter has been on a short hiatus. However, I feel strongly that the effort to convey research results to you must continue. Please enjoy this issue of the IrriGATOR.

Happy reading,
Michael D. Dukes

Determining Landscape Water Use in Southwest Florida

Messages of water conservation directed toward residential irrigators in the Southwest Florida Water Management District [SWFWMD], from TV commercials to billboards along the I-75 corridor, have been steady and strong over the last decade. However, not much is known about how the homeowner processes that information and applies it to their irrigation techniques. As a result, our research team partnered with SWFWMD and Tampa Bay Water to quantify residential irrigation water use and determine the overall patterns in irrigation habits throughout the entire district.

Water utilities within SWFWMD that were designated as significant water providers were asked to provide customer billing data for analysis. Significance in water provisions was determined using the criteria of more than 0.5 million gallons per day and averaging 70 gallons per capita-day, both statistics specific to the residential sector, based on the [2008 Estimated Water Use Report](#). Ultimately, seventeen utility service areas supplied a combined total of over one million unique customers with monthly billing records from 1998 to 2010.

All billing records were in the form of total water use, thus having combined indoor water use (showers, dishwashers, etc.) and outdoor water use (irrigation, filling pools, etc.). For the purposes of this analysis, it was assumed that indoor water use was based on the average per capita indoor use and average utility service area household size. Irrigation was calculated by subtracting each monthly billing record by the estimated monthly indoor water use value to get outdoor water use and assuming the result was irrigation in its entirety.

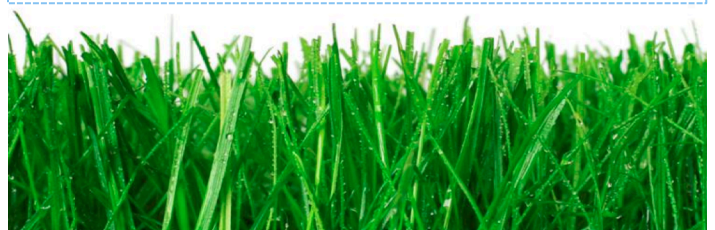
For all utilities analyzed, the median values

for residential irrigation (0 to 2,981 gal/month) were less than the corresponding means (1,349 to 8,665 gal/month) thus indicating that a small number of extremely high water users were inflating the averages. Additionally, a portion of the customer databases contained landscape areas that were used to convert irrigation volumes to depths. Based on this calculation, at least 75% of the customers are under irrigating or meeting the irrigation demand that was calculated for Hillsborough County ([Romero and Dukes, 2011](#)). As a result, a majority of the customers are not considered over-irrigators at this time.

The next phase of the study includes selecting a subset of 1,000 to 1,200 single family properties from the customer records that have automatic, in-ground irrigation system connected to a potable water source and have either traditional landscapes or [Florida-friendly landscapes](#) (FFL). Properties were considered to have FFL landscapes if they were recognized by the Florida-friendly Landscaping program which encourages nine conservation principles including “right plant, right place” and efficiency in landscape management such as irrigation and fertilization.

Five clusters were proposed based on their location, landscape type, and water use category. Due to the small number of customers able to be classified as over-irrigators throughout SWFWMD, the highest water users are not being targeted. The

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What's Up with the Research Team?

Dr. Michael Dukes has been selected as the interim director of the Center for Landscape Conservation and Ecology. The CLCE was established in 2006 with a mission to protect and conserve Florida's natural resources through research-based sustainable urban landscape practices. The center conducts a wide variety of research, from soil organic matter to regional public water supply management, and also supports gardeners all over Florida through their involvement in various extension programs. For more information about the Center for Landscape Conservation and Ecology, or to learn about Florida-friendly landscaping, please go to

<http://gardeningsolutions.ifas.ufl.edu/clce/>

Where are they now?

The IrriGATOR research team would like to wish the best of luck to *Cecilia Romero* who is moving to Nebraska this summer. Cecilia has been a part of our research team for 7 years while working on post-doctoral activities and countless research studies. Her abilities for data analysis rarely went unnoticed in our department, where she branched out from irrigation to work part-time with the Climate Institute over the last few years. We would like to thank Cecilia for her hard work and dedication while at UF!

Another member of the IrriGATOR research team, *Alessandra Smolek*, moves forward in a new direction this summer. Alessandra was an undergraduate researcher who graduated from the Agricultural and Biological Engineering department with honors in May. She plans to begin her Master's degree at NC State this summer where she will be hanging up her irrigation raincoat (to dry!) and putting on an urban stormwater management sweater. We would like to congratulate Alessandra and wish her the best on future endeavors!



Meet Michael Gutierrez!

Currently in repose from fast-lane living in Miami, Michael moved to Gainesville this past spring to join our research team. Before relocating, his final project at UF's Tropical Research and Education Center (TREC) was a five-year affair researching the water saving potential of irrigation control devices in urban landscape settings. As a member of Miami-Dade's Urban Conservation Unit, he assessed hundreds of dreadful landscape irrigation systems in every corner of Miami-Dade County. While at TREC, Michael also honed his skills in visual media: still and video. His field pictures have appeared in various water-related publications and his educational videos can be found on Youtube (keyword: Miami-Dade irrigation) - one of which is fast approaching 15,000 views. A first order cineaste when not in the field, Michael can be found in the darkness of his second home, the movie house. However, as he is most comfortable outdoors amidst the high-stakes urban ballet of water, turf and concrete, perhaps it's only fitting that Michael left his heart in Miami to spend a season or three assisting with the ambitious work going on in Dr. Dukes' irrigation research program.

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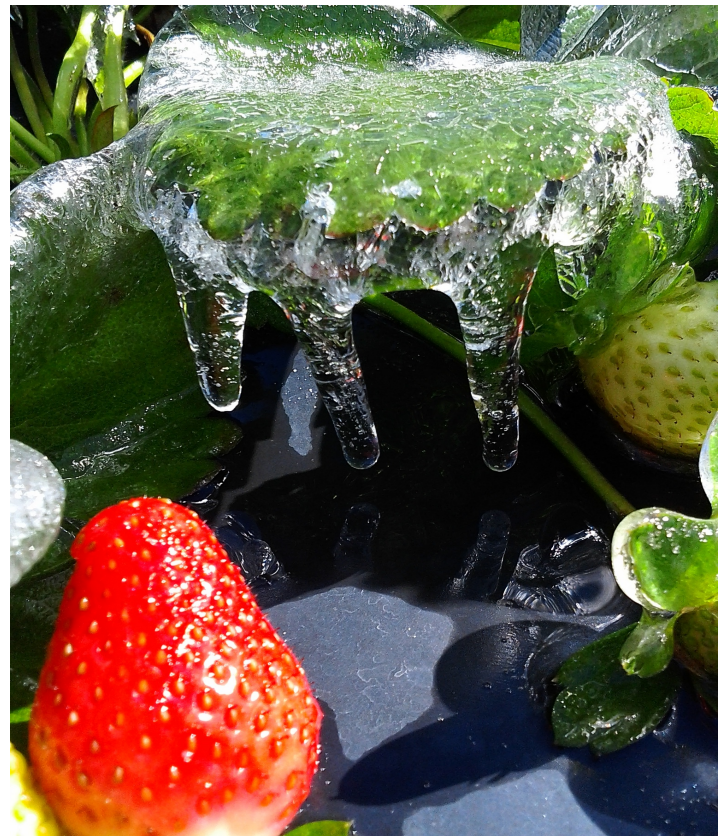
using a thermostat directly connected to a valve. Additionally, the 48 feet spacing was evaluated at 30 psi with the same thermostat-valve configuration. Another treatment with 48 feet spacing was implemented so that frost protection began once the temperature reached a dynamic value, determined from the critical temperature for an open blossom (30°F) and the average dew point temperature. Wireless temperature sensors were used for this automated treatment with one device in each treatment plot. Frost protection continued for all irrigated treatments until the temperature exceeded 34°F. The final treatment did not receive frost protection.

Thermocouples were installed in each plot that measured the temperatures below the canopy, within the canopy, and above the canopy with a maximum height of 12 inches. These devices were used for monitoring only and did not control an irrigation treatment. Data was evaluated for freeze events only, where the air temperature was less than 34°F, with a total of 20 possible events and 8 significant freeze events from December through March 2012. Harvests occurred twice weekly during this period.

Compared to the treatment consisting of 48 feet spacing and 50 psi system pressure, reducing the pressure to 30 psi resulted in 22% water savings whereas automating the system based on dew point resulted in 5% water savings. Decreasing the sprinkler spacing to 40 feet produced the opposite effect by increasing water usage by 44%. The treatment that received no irrigation for frost protection resulted in significantly less yield whereas water savings of up to 22% by reducing the pressure did not affect overall yield results. Though total irrigation application varied by the end of the season,

all four irrigated treatments applied similar volumes of water during the 8 significant freeze events that fell below the critical temperature of 30°F. This indicates that all four treatments adequately protected the crop during the freeze events, but some treatments may waste water by irrigating too much on days where the temperature is below 34°F but above the critical temperature of 30°F.

According to this year's results, water savings of 22% could reduce water use by almost 440,000 gallons per acre of crop per season without affecting yield. Considering 57,470 acres of strawberries were harvested in Florida in 2011, farmers could experience a seasonal savings of over 25 billion gallons. However, these results are from year 1 and the experiment will be repeated again at the end of this year. Please look forward to a future issue of the IrriGATOR newsletter with an updated discussion about frost protection of strawberries.



Upcoming Events

International American Society of Agricultural and Biological Engineers Meeting

Dallas, Texas
July 29 - August 1, 2012



American Water Works Association Annual Conference and Exposition

Dallas, Texas
June 10 - 14, 2012



Irrigation Show and Education Conference

Orlando, Florida
November 2 - 6, 2012

The IrrigATOR team will be presenting five papers at the **2012 Irrigation Show** in Orlando, FL:



Implementation of Smart Controllers in Orange County, FL: Results from Year One
Stacia L. Davis and Michael D. Dukes

Water They Saving? Quantifying Florida-Friendly Landscaping Irrigation Use
Mackenzie J. Boyer and Michael D. Dukes

Soil Moisture Sensors to Reduce Reclaimed Water Irrigation of Landscapes
Bernardo Cardenas-Lailhacar and Michael D. Dukes

Optimizing Sprinkler Irrigation Cold Protection in Strawberries
María I. Zamora Re, Dr. Michael D. Dukes and Dr. Craig Stanley

A Method to Estimate Irrigation in Residential Areas: A Case Study in Orlando, Florida
Consuelo C. Romero and Michael D. Dukes

Smithsonian Folklife Festival

Washington, D.C.
June 27 - July 1
and July 4 - 8, 2012



A group of University of Florida researchers will travel to the nation's capital this summer to educate attendees of the **Smithsonian Folklife Festival** about the importance of IFAS. The festival draws thousands to the National Mall in Washington, D.C. This year, the festival will commemorate the 150th anniversary of the founding of land-grant universities as well as the USDA. UF will host a large, hands-on display to pique visitors' interest about water and show them ways UF is working to find solutions for global challenges such as ensuring water quality, quantity and access.

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clusters are divided into the northern, central, and southern portion of SWFWMD, with the central portion divided into low water users in the 0 to 25 percentile range and medium water users in the 25 to 75 percentile range. The fifth cluster consists of FFL homes located throughout the entire district.

All properties selected for evaluation will receive an automatic meter recording (AMR) device installed on the potable water meter that will measure and record all water use on a sub-daily timestep. This information will be used for more accurate indoor water use estimations, characterizing overall irrigation habits (days per week, time of day, etc.), and determining differences in irrigation volume and habits between clusters within SWFWMD. Installations of AMRs are estimated to occur in the fall - look for an update in the next newsletter!

New Publications

If you'd like to stay updated on our publications between newsletters or want to browse previously published materials, then please visit our website at

<http://abe.ufl.edu/mdukes/publications/index.shtml>.

We have a new method for organizing the publications coming this summer!

- Multiple contributions were made to an [Irrigation Special Collection](#) to *Transactions ASABE* by B. Cardenas-Lailhacar, S.L. Davis, and M.D. Dukes
- [Performance of Rain Delay Features on a Signal-Based Evapotranspiration Irrigation Controller](#)
Journal of Irrigation and Drainage Engineering
D. C. Rutland and M. D. Dukes
- [Expanding-Disk Rain Sensor Dry-Out and Potential Irrigation Savings](#)
Journal of Irrigation and Drainage Engineering
L. Meeks, M.D. Dukes, P.E., K. White Migliaccio, P.E., and B. Cardenas-Lailhacar
- [Long Term Expanding-Disk Rain Sensor Accuracy](#)
Journal of Irrigation Drainage Engineering 138, 16 (2012)
L. Meeks, M.D. Dukes, P.E., K. White Migliaccio, P.E., and B. Cardenas-Lailhacar
- [Validation of Landscape Irrigation Reduction with Soil Moisture Sensor Irrigation Controllers](#)
Journal of Irrigation Drainage Engineering 138, 135 (2012)
M.B. Haley and M.D. Dukes, P.E.
- [Irrigation Scheduling for Green Bell Peppers Using Capacitance Soil Moisture Sensors](#)
Journal of Irrigation Drainage Engineering 137, 73 (2011)
L. Zotarelli, Ph.D.; M.D. Dukes, Ph.D., P.E.; J.M.S. Scholberg, Ph.D.; K. Femminella, M.S. and R. Muñoz-Carpena, Ph.D.



If you are interested in receiving this newsletter, please email irrigation@ifas.ufl.edu

Further information can be found on our website <http://abe.ufl.edu/mdukes>

