THE IRRI*GATOR* NEWSLETTER

This newsletter aims to provide the latest information on irrigation controller research at the University of Florida. Research includes: general irrigation efficiency, technology-based irrigation control of landscapes, and technology-based drip irrigation control on vegetables.

A note from Dr. Michael Dukes…

Welcome to the inaugural issue of the IrriGATOR Newsletter. This bi-annual publication was developed to ideally provide the missing link between the University of Florida research team, led by myself, and those who can expand and implement our research results into better irrigation practices in the residential, commercial, and agricultural sectors. Our concentration on water conservation is an important topic internationally with growing interest at both local and state levels. This issue focuses on highlighting all areas of our research. Subsequent issues will spotlight current events and updates – so stay tuned!

Enjoy,

Michael D. Dukes

IN THIS ISSUE

Did you know… Residential water use comprises 61% of the public supply category. The mostly groundwater derived public supply is responsible for the largest portion, 43%, of groundwater withdrawn in Florida. Nearly 30% of the public water is withdrawn April through June.

Current Irrigation Controller Research

Urban landscape water use in Florida is expected to continually grow over the coming decades. Due to high demand for aesthetically pleasing urban landscapes from continually increasing population in Florida, new methods must be explored for outdoor water conservation.

Landscape Irrigation by Evapotranspiration-based Irrigation Controllers under Dry Conditions in Southwest Florida

Three brands of evapotranspiration (ET) controllers were selected based on positive water savings results in arid climates. ET controllers were evaluated on irrigation application compared to a time clock schedule intended to mimic homeowner irrigation schedules. The study period, August 2006 through November 2007, was dry compared to 30-year historical average rainfall. The ET controllers averaged 43% water savings compared to a time-based treatment without a rain sensor and were about twice as effective, reducing irrigation compared to a rain sensor alone. There were no differences in turfgrass quality across all treatments over the 15-month study. The controllers adjusted their irrigation schedules to the climatic demand effectively, with maximum savings of 60% during the winter 2006–2007 period and minimum savings of 9% during spring 2007 due to persistent dry conditions. [HCWRS, FDACS, FNGLA]

Investigation and Development Methods to Determine Urban Landscape Irrigation for Planning and Permitting in Central Florida

With the development of a more precise approach to water allocation for landscape irrigation, more water could become available for other demands. This project addresses five objectives to aid in establishing acceptable landscape aesthetic quality while reducing water demand. [SWFWMD]

Smart Irrigation Controller Demonstration and Evaluation in Orange County

The county utility is interested in determining types of smart irrigation technologies that could potentially reduce landscape irrigation water use. The smart irrigation technologies will include soil moisture based control systems, single system ET controllers, and at least one centrally controlled ET controller across a range of residential and commercial properties and soil types found in the county. This project may also evaluate multiple levels of contractor training and follow-up on controller operation and performance. [OCU, SJRWMD, SFWMD, WRF]

Evaluation of Soil Moisture Based On-Demand Irrigation Controllers, Phase II

The objective of this study is to determine if soil moisture sensors or rain sensors will reduce water use compared to the homes without these irrigation controls while maintaining acceptable landscape quality. Soil moisture sensors and rain sensors were established on residential irrigation systems utilizing the potable water supply in Pinellas County. There are four treatment locations where each location has an in-house weather station. Each residential cooperator has a water meter dedicated to irrigation and datalogger that records irrigation water use on a sub-daily level. [SWFWMD, PAB]

Evaluation and Demonstration of Evapotranspiration-Based Irrigation Controllers, Phase II

The objective of this study is to determine if ET controllers can effectively and efficiently maintain urban landscapes in Hillsborough County. ET controllers are installed on residential landscapes in three locations and irrigation water use is compared to residential cooperators without ET controllers. Preliminary results of Phase II show that ET

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Current Turfgrass Research Projects

Water conservation potential of smart irrigation controllers on St. Augustinegrass

Smart technologies such as evapotranspiration-based irrigation controllers (ET controllers), soil moisture based control systems, and even rain sensors, can reduce residential irrigation water use. This research was performed to evaluate the effectiveness of these technologies by looking at water savings compared to a time-based irrigation schedule without a rain sensor on St. Augustinegrass field plots. [FTGA, GCSAA]

Bahiagrass crop coefficients from eddy correlation measurements in central Florida

Bahiagrass, a warm season grass used primarily in pastures and low maintenance public areas in Florida, can survive many moisture conditions ranging from no irrigation to very wet. In this study, bahiagrass crop coefficients (K_c) for an irrigated pasture were determined for July 2003 through December 2006 in central Florida. The recommended K_c values for bahiagrass are 0.35 for January–February, 0.55 for March, 0.80 for April, 0.90 for May, 0.75 for June, 0.70 for July–August, 0.75 for September, 0.70 for October, 0.60 for November, and 0.45 for December in central Florida. [SJRWMD]

Current Agricultural Research

Agricultural water use is the largest single category of water use in Florida, and as population pressure continues to grow, irrigation water users are being forced to become more efficient.

Evaluation and Demonstration of Soil Moisture Based On-Demand Irrigation Controllers for Vegetable Production

One potential method to increase irrigation water use efficiency is to improve irrigation scheduling. Soil moisture sensors configured to provide feedback with an irrigation control system have been shown to reduce water use for tomato production and green bell peppers with minimal or no impact on vegetable yields. This project identifies and then tests a commercially available on-demand soil moisture based control system for vegetable production under Florida conditions. [SWFWMD]

Tomato yield, biomass accumulation, root distribution and irrigation water use efficiency on a sandy soil, as affected by nitrogen rate and irrigation scheduling

Florida is the largest producer of fresh-market tomatoes in the United States. Production areas are typically intensively managed with high inputs of fertilizer and irrigation. The objectives of this 3-year field study were to evaluate the interaction between N-fertilizer rates and irrigation scheduling on yield, irrigation water use efficiency and root distribution of tomato cultivated in a plastic mulched/drip irrigated production systems. [FDACS]

Nitrogen Uptake Efficiency & Growth of Bell Pepper in Relation to Time of Exposure to Fertilizer Solution

Irrigation of high-value vegetable crops on sandy soils with poor water-retention capacities may result in fertilizer nitrogen (N) displacement below the effective root zone prior to complete crop uptake. As a result, fertilizer N-uptake efficiency of vegetable crops is often relatively low, thereby increasing the potential risk of groundwater contamination. The objective of this study was to

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Publications: Hot Off the Press

New Controller Publications

Water Conservation Potential of Smart Irrigation Controllers on St. Augustinegrass
Agricultural Water Management 2009

Landscape Irrigation by Evapotranspiration-Based Irrigation Controllers Under Dry Conditions in Southwest Florida
Agricultural Water Management 2009

Irrigation by Evapotranspiration-Based Irrigation Controllers in Florida
Irrigation Association Annual Meeting 2008

Evaluation of Soil Moisture-Based On-Demand Irrigation Controllers
SWFWMD Final Report 2008

New Agricultural Publications

Tomato Yield, Biomass Accumulation, Root Distribution, and Irrigation Water Use Efficiency on a Sandy Soil as Affected by Nitrogen Rate and Irrigation Scheduling
Agricultural Water Management 2009

Tomato Nitrogen Accumulation and Fertilizer Use Efficiency on a Sandy Soil, as Affected by Nitrogen Rate and Irrigation Scheduling
Agricultural Water Management 2009

Nitrogen Uptake Efficiency and Growth of Bell Pepper in Relation to Time of Exposure to Fertilizer Solution
Communications in Soil Science and Plant Analysis 2009

Comparing Theoretical Irrigation Requirement and Actual Irrigation for Citrus in Florida
Agricultural Water Management 2009

New Turfgrass Publications

Bahiagrass Crop Coefficients From Eddy Correlation Measurements in Central Florida
Irrigation Science 2009

Sensor-Based Automation of Irrigation on Bermudagrass During Wet Weather Conditions
Journal of Irrigation and Drainage Engineering 2008

New EDIS Publications

- Basic Repairs and Maintenance for Home Landscape Irrigation Systems
- Smart Irrigation Controllers: How Do Soil Moisture Sensor (SMS) Irrigation Controllers Work?
- LEED for Homes: Explanation of the Landscape Irrigation Budget Calculation for Florida
- Smart Irrigation Controllers: Operation of Evapotranspiration-Based Controllers
- Smart Irrigation Controllers: Programming Guidelines for Evapotranspiration-Based Irrigation Controllers
- Smart Irrigation Controllers: What Makes an Irrigation Controller Smart?
- Summary of IFAS Turf and Landscape Irrigation Recommendations
- Energy Efficient Homes: The Irrigation System

A complete collection of the UF-IFAS ABE Irrigation Research publications is on our website!

Current Agricultural Research (cont.)

determine how time of exposure of the root zone to the N fertilizer (which is referred to as "fertilizer residence time" or t_R), as related to irrigation management, affects N uptake, FUE, growth, and yield of bell pepper . [FDACS]

COMPARING THEORETICAL IRRIGATION REQUIREMENT AND ACTUAL IRRIGATION FOR CITRUS IN FLORIDA

Florida produces nearly 68% of all citrus grown in the U.S. in the 2005-2006 season. Most of the water allocation permitting for citrus production is in Highlands, Polk and Hillsborough counties and conducted by the Southwest Florida Water Management District; with quantities based on the District's AGMOD computer program. In 2003, the District implemented new permit criteria so that water allocations were more representative of actual water use. This study compared grower-reported citrus irrigation water use in Highlands, Polk, and Hillsborough counties from 1994-2005 with permitted and theoretical irrigation requirements. [SWFWMD]

Current Stormwater Research

Survey of Retention Basin Hydraulic Performance in Florida

A field survey was conducted to compare the current hydraulic performance to design infiltration rates of 40 retention basins. Basin locations were divided between Leon, Alachua, and Marion counties in both FL-DOT and residential sites. Basins ranged in age from 1 to 20+ yrs. Infiltration rates were measured using double ring infiltrometers in each pond. To evaluate the effectiveness of using multiple double ring infiltrometers for retention pond infiltration, water levels in ponds from each land use and location group were monitored using water level recorders and rainfall was measured using tipping bucket and cumulative rain gauges. Additional measurements, including multiple cone penetrometer profiles and soil moisture readings, soil texture, bulk density, porosity, and organic matter were also taken from each of the six test sites. Relationships between infiltration rates and subsequent measurements were analyzed to determine correlations to more efficiently evaluate retention pond performance. [FDEP]

Soil Amendments for Mitigation of Compacted Soils

Compaction of soils commonly occurs during construction by heavy equipment resulting in reduced porosity and infiltration rates and leading to increased runoff. This study determines the potential of two soil amendments chosen as compost and fly ash to mitigate compaction. Lysimeters (n=42) were filled with either Orangeburg Sandy Loam or Arredondo Sand and were compacted to levels representative of construction sites in North Central Florida. Runoff volumes and rates were monitored from both natural and simulated rainfall events. In addition, runoff and leachate water samples were collected for constituent analysis to determine potential water quality impacts. As a precursor, a column study analyzing leachate from various ratios of soil and amendment was conducted to determine potential runoff and leachate analytes for the lysimeter study. [FDEP]

Current Irrigation Controller Research (cont.)

controllers are not producing water savings due to deficit irrigation practices by the residential cooperators without ET controllers during drought conditions. [HCWRS, FDACS, FNGLA]

Irrigation Literacy Evaluation, Phase II

Developed as a Phase II of the Water-wise Irrigation Practices and Perceptions survey, this phase will implement a homeowner irrigation scheduling campaign based on communication efforts. Irrigation will be prompted at different interaction frequencies via various communication methods. [SWFWMD]

Evaluation of Soil Moisture Based On-Demand Irrigation Controllers Using Reclaimed Wastewater Irrigation, Phase III

Reclaimed wastewater contains high levels of salts as a result of the treatment process. Salts can interfere with the operation of some soil moisture sensors. This study tests several commercially available on-demand soil moisture based control systems under a number of test conditions. A soil moisture sensor control system will be selected for use on residential irrigation using reclaimed water in Pinellas County. [SWFWMD, PAB]

Don't miss out on the next newsletter, make sure you are on our mailing list. Is there something you would like to read about in the next newsletter? Please feel free to contact us with any questions, requests, suggestions, or to change your subscription status via email: irrigation@ifas.ufl.edu

Meet the Research Team

Michael D. Dukes, Ph.D., P.E. – Associate Professor. Dr. Dukes holds degrees in Agricultural Engineering and Civil & Environmental Engineering specializing in water management and water quality of biological systems. He leads a research team investigating water conservation and water quality of urban and vegetable irrigated systems and well as low impact development methods to prevent stormwater runoff. He can be reached at mddukes@ufl.edu.

Kristen Riley, M.B.A. - Research Projects Coordinator. Kristen is the Project Manager for the Irrigation Research Team at the University of Florida. Her responsibilities include coordination of contract tasks and deliverables, schedules, budget adherence, and promotional activities. She received her bachelor's degree in Aerospace Engineering and Mechanics from the University of Minnesota, and a M.B.A. from Texas A&M (formerly East Texas State). She can be reached at kjriley@ufl.edu.

Lincoln Zotarelli, Ph.D. - Assistant Research Scientist. Dr. Zotarelli's is a Research Scientist of Agricultural and Biological Engineering Department at the University of Florida. He received his Ph.D. in Soil Science at the Universidade Federal Rural do Rio de Janeiro, Brazil. His research interests include irrigation water management of agricultural crops, soil and nutrient management and environmental quality. He is currently working on projects to improve irrigation water use efficiency of vegetable crops using soil moisture sensors to control irrigation. His research also involves evaluation of the impact of irrigation management on crop physiology and nitrate leaching. He can be reached at lzota@ufl.edu.

Consuelo Romero, Ph.D. – Post Doc. Dr. Romero is a Post-Doctoral Researcher whose specific areas of expertise are irrigation modeling, soil fertility, soil erosion, and water conservation. She holds degrees in Biology, Soil Science, specializing in Production Ecology and Resource Conservation. She can be reached at ccromero@ufl.edu.

Bernard Cardenas-Lailhacar, M.S. - Research Associate. Bernard holds B.S. and M.S. degrees in Agricultural and Biological Engineering, with a minor in Environmental Horticulture. His research is focused in water conservation, analyzing which of the state-of-the-art irrigation technologies are the most suitable for Florida conditions. He can be reached at bernardc@ufl.edu

Daniel Rutland, M.E., E.I. - Research Associate. Dan holds a B.S. and M.E. in Agricultural and Biological Engineering from the University of Florida. His master's research specialized in evapotranspiration irrigation controllers for Florida residential landscapes. His current focus is on irrigation technology and water conservation. He can be reached at conandan@ufl.edu

Eban Z. Bean, M.S., E.I. - Research Assistant, PhD. Eban attended North Carolina State University for his bachelor's and master's degrees in Biological and Agricultural Engineering. Eban's research has primarily focused on reducing stormwater runoff through low impact development techniques. During his master's, Eban focused on the water quality and quantity impacts of permeable pavements. His current research focuses on retention basin performance in Florida and soil amendments to mitigate soil compaction. He can be reached at ezbean@ufl.edu.

Melissa Baum Haley M.E., E.I. - Research Assistant, PhD. Melissa was awarded her B.S. and M.E. degrees from the University of Florida in Agricultural and Biological Engineering, focusing on land and water resources. She is currently a doctoral student in the ABE Department studying the interaction between the technical and social aspects of residential irrigation water-use conservation. With the Southwest Florida Water Management District, she has been working on project in efforts to reduce residential irrigation water application by incorporating sensor based controllers, educational materials water conservation practices and perceptions through

Meet the Research Team (cont.)

homeowner survey research, and effective behavioral change at household level interaction. She can be reached at mbhaley@ufl.edu.

Stacia L. Davis M.E., E.I. - Research Assistant, PhD.

Stacia graduated from the University of Florida with an M.E. in Agricultural and Biological Engineering in 2008 and from the University of Pittsburgh with a B.S. in Civil and Environmental Engineering in 2005. She continues her graduate education by pursuing a PhD degree, also from the University of Florida Agricultural and Biological Engineering department, that concentrates on residential outdoor water conservation. Her current projects focus on the evaluation and implementation of smart controllers that use ET for scheduling irrigation. She can be reached at stacia@ufl.edu.

Thomas Olmsted, M.S. - Research Assistant, PhD.

Tom graduated from Michigan State University with a Masters Degree in Agricultural Technology and Systems Management. His Masters research consisted of evaluating daily evapotranspiration estimation methods. Tom served with the Peace Corps in Sierra Leone, West Africa and was later Research Equipment Manager for the DEKALB Genetics Corporation. His PhD research is looking at different irrigation strategies and the use of commercially available soil moisture sensors for the purpose of reducing irrigation water use on landscapes. He can be reached at olmsted@ufl.edu.

Leah Meeks, B.S., E.I. - Research Assistant, M.E.

Leah earned her B.S. from the BioResource and Agricultural Engineering department at Cal Poly, San Luis Obispo. Her M. E. research investigated rain sensors for urban irrigation water conservation. She can be contacted at lmeeks@ufl.edu.

We would like to thank the Following agencies for funding our Research.

[FDACS] Florida Department of Agricultural and Consumer Services

[FDEP] Florida Department of Environmental Protection

[FNGLA] Florida Nursery Growers and Landscape Association

[FTGA] Florida Turfrass Association

[GCSAA] Golf Course Superintendents Association of America

[HCWRS] Hillsborough County Water Resource Services

[OCU] Orange County Utilities

[PAB] Pinellas-Anclote Basin

[SFWMD] South Florida Water Management District

[SJRWMD] St Johns

[SWFWMD] Southwest Florida Water Management District

[WRF] Water Research Foundation

UPCOMING EVENTS

A number of the project team members will be presenting their research projects at upcoming conferences.

Low Impact Development 2010
Apr 11-14, 2010
San Francisco, CA

World Environmental & Water Resources Congress
May 16-20, 2010
Providence, RI

FL section ASABE
June 6-12, 2010
Jupiter, FL

IA / ASABE Irrigation Conference
Dec 5-8, 2010
Pheonix, AZ

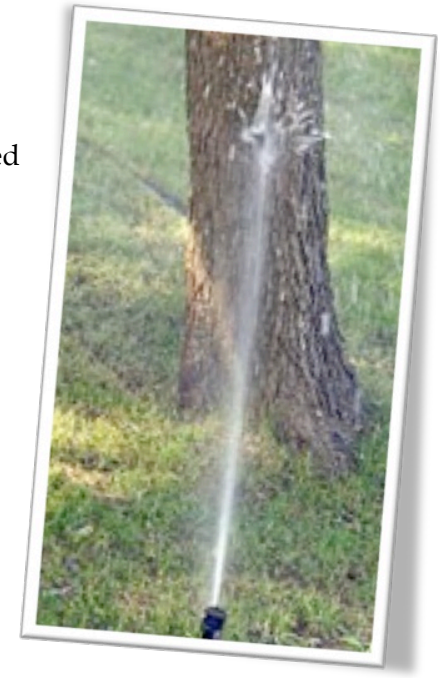
Multimedia Tools: Narrated Presentations & Videos

Interested in learning a bit more about some fundamental irrigation concepts? The irrigation.ifas.ufl.edu website has an array of multimedia tools. Narrated presentations are self-progressing and slideshow presentations with audio commentary. Current narrated presentations include:

- Evapotranspiration Controllers in Florida
- Irrigation Scheduling
- Irrigation System Components
- Irrigation Myth Busters
- Soil Moisture Sensor Controllers in Florida

The videos introduce and demonstrate the use of irrigation technology. These video presentations can also be integrated into your own seminars and workshops, etc. Current online videos include:

- Welcome
- Irrigation Controllers
- ET Controllers (You Tube)
- Rain Sensors
- Soil Moisture Controllers
- Soil Moisture Sensor Controllers (You Tube)
- Weather Based Controllers
- Smart Water Application Technology (UF/IFAS Virtual Field Day)



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