Using a Wireless Sensor Network to Automate Irrigation of Cotton using a Lateral Move Irrigation System

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In South Carolina, overhead sprinkler systems (mostly center pivots and a few lateral move systems) are typically used to irrigate row crops, which cover much of the state's irrigated land. Although farmers in South Carolina have adopted efficient irrigation systems (i.e., center pivot and drip), managing these systems to achieve their full potential is still challenging. This project's overall goal was to create and field-test an affordable system to help cotton farmers increase water use efficiency by automating irrigation based on real-time soil moisture data using a wireless sensor network. The specific objectives were to: (1) develop a wireless sensor network to automate irrigation scheduling of cotton, based on real-time soil moisture using a lateral move irrigation system and, (2) field-test the irrigation automation system by evaluating the response of cotton to three irrigation trigger points. A wireless soil moisture sensor network prototype created in 2019 to automate irrigation of cotton using a subsurface drip irrigation (SDI) system was modified and adapted to a lateral move irrigation system. A field experiment was conducted at the Edisto Research and Education Center in 2021 to field-test the irrigation automation system. In this experiment, three irrigation treatments were evaluated in which irrigation was automatically applied to cotton when the weighted-average soil moisture reached either 30, 40, or 50 kPa using four replications. Soil moisture was measured using Watermark moisture sensors installed at three depths in each plot. The electronics and software for the automation system were developed and installed in the field. Field tests conducted in 2020 and 2021 showed that the new automation system performed as expected.

Less is More: Eco-Intensification using Recycled Drainage Water for Fertigation

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Rainfall has traditionally been sufficient in the Eastern Corn Belt to support agriculture and replenish groundwater, but increasingly producers are considering supplemental irrigation as a method to buffer risk associated with water shortages. Despite increasing annual precipitation, short-term droughts are projected to increase due to shifting seasonality. More winter and spring precipitation may potentially overwhelm agricultural drainage systems and increase nutrient contributions to the Gulf of Mexico without alleviating drought stress during growth periods. Drainage water recycling (DWR) is the practice of capturing and storing water drained from fields in a pond, reservoir, or wetland, and using the stored water to irrigate crops when there is a water deficit. At its most basic this seems like a very simple solution to help farmers to increase production while minimizing downstream impacts. Although there are many benefits in implementing DWR, several barriers exist that may hinder adoption. Creating storage ponds is expensive and the yield benefit of supplemental irrigation in the portions of the Corn Belt with sufficient subsurface drainage to support DWR may not be sufficient to recover the costs. In addition, navigating the permitting process and cost-share programs can be confusing and overwhelming. This presentation will describe on-going research to evaluate the feasibility of ecologically intensifying corn and soybean management using existing depressional storage of drainage water for irrigation and fertigation to maximize crop production and profitability while enhancing nutrient use efficiency and minimizing downstream impacts. This will be accomplished through an in-field demonstration experiment at the Agronomy Center for Research and Education in West Lafayette, IN to quantify the effectiveness of drip fertigation using DWR, the water quality benefits of enhanced wetland storage and the economic feasibility of using DWR for supplemental fertigation.

Understanding Irrigation Patterns of Public Parks and Recreational Landscapes in College Station, TX

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Outdoor water use, and particularly landscape irrigation, has the potential to account for a significant portion of total urban water demand, including high levels of waste. Conservation programs are often used by water utilities looking to encourage their customers to save water. However little research has explored the extent to which municipalities respond to their own cries for water conservation by using water more efficiently. In this study we analyzed monthly irrigation patterns for various parks in the city of College Station, Texas, for 2015-2020. Estimates of over-irrigation (waste) were made by comparing data from designated outdoor water meters to an irrigation budget based on plant water requirements and remotely sensed landscape area measurements. We developed and applied irrigation efficiency ratios for parks to further investigate patterns of efficiency in relation to seasonality, park typology, and irrigation area. This study also examines the capacity of rain sensors to increase water-use efficiency on irrigated large landscapes.