IRRIGATION WATER CONSERVATION EFFORTS AT THE UGA C.M. STRIPLING IRRIGATION RESEARCH PARK

Calvin Perry and Radford Yager

AUTHORS: University of Georgia, Stripling Irrigation Research Park, Camilla, Georgia, 31730.
REFERENCE: *Proceedings of the 2011 Georgia Water Resources Conference*, held April 11–13, 2011, at the University of Georgia.

Abstract. Persistent drought, energy costs, urban expansion, and interstate litigation are collectively threatening irrigation water supplies in many parts of the U.S. Efficient agricultural water use is critical for sustainable economic development in rural areas – even in the humid southeast where annual precipitation exceeds 50 in. If irrigated agriculture is to survive in this competitive environment, we must conserve irrigation water use. UGA developed the C.M. Stripling Irrigation Research Park (SIRP) as a state-of-the-art irrigation research and education center to assist farmers in managing irrigation and the general public in understanding the role of water in the economy of the southwest Georgia region. One of the goals for the Park is to find more efficient ways to apply irrigation water. Currently, SIRP and its associated researchers are evaluating several tools, techniques, and/or practices that have the potential to conserve considerable amounts of irrigation water. These tools/practices include low pressure drop nozzle retrofits, variable-rate irrigation controls on center pivot irrigation systems, advanced irrigation scheduling (including use of remote soil moisture monitoring via sensors), subsurface drip irrigation, and conservation tillage. Partnerships with various like-minded groups have enabled many of the tools/practices to be transferred to working farms for further evaluation. Education and outreach activities by SIRP personnel help irrigators better understand the opportunities for adopting the tools/practices on their farms.

INTRODUCTION

Persistent drought, energy costs, urban expansion, and interstate litigation are collectively threatening irrigation water supplies in many parts of the U.S. Efficient agricultural water use is critical for sustainable economic development in rural areas – even in the humid southeast where annual precipitation exceeds 50 in. If irrigated agriculture is to survive in this competitive environment, we must conserve irrigation water use. In 2000-2001, under the leadership of Jim Hook, Kerry Harrison and Dan Thomas, the University of Georgia developed the C.M. Stripling Irrigation Research Park (SIRP) as a state-of-the-art irrigation research and education center to assist farmers in managing irrigation and the general public in understanding the role of water in the economy of the southwest Georgia region. The goal for SIRP was for scientists, engineers, extension specialists, and staff to collaborate to define crop water needs, improve food, feed, and fiber production under irrigation, and find more efficient ways to apply irrigation water.

The SIRP facility is located in western Mitchell County in southwest Georgia, approximately 3 miles from the Flint River. The Park encompasses 130 acres and includes 70 acres of plot / crop land. The remainder is in perennial grass or pine timber. The Park is hydrologically situated in the Lower Flint sub-basin of the Flint River Basin; This area is part of the broad, level Dougherty Plain, an area USGS has designated as Subarea 4 in their recent studies. In the karst topography of the Dougherty Plain, the Floridan aquifer is recharged through porous overburden, sinkholes and other geologic features while the Flint River is incised into the top of the aquifer.

The basic irrigation equipment at the Park includes four 2-tower center pivot systems (5 ac each), two 3-tower lateral move systems (11 ac and 9 ac), one 4-tower center pivot system fitted with Variable-Rate Irrigation (VRI) controls (12.5 ac), as well as 7 acres of plot area configured for surface drip irrigation. The lateral move systems are each divided into 12 individually-controlled irrigation management zones (4 sprinklers each) along the mainline. The 4-tower center pivot with VRI controls is divided into 13 zones of 3 sprinklers.

The Park also has a main headquarters building that provides offices, a classroom/meeting room, storage, and workshop space. A separate “Pesticide Storage, Washout and Containment Building” was built to provide state-of-the-art safety and protection against pesticide contamination. A ten member advisory committee of local individuals offers continuing guidance on relevant research and education programs.

INITIAL RESEARCH ACTIVITIES

Initial studies at SIRP involved irrigation application “hardware”, automation options, and use of irrigation for maximizing crop yields. Irrigation application studies included uniformity of application, losses from high

pressure impact sprinklers vs. low pressure spray nozzles, and over- and under-pressurization issues.

Automation research involved evaluating center pivot controls, sensors, and communication across the entire farm. Products from several vendors that promised total integration of irrigation control functions were evaluated.

Several researchers utilized SIRP's unique irrigation capabilities to begin looking at how to maximize crop yields with irrigation and also studied crop and varietal response to irrigation vs. non-irrigated conditions.

WATER CONSERVATION EFFORTS

As SIRP has progressed and "matured", the research and demonstration projects conducted there have begun to look in earnest at irrigation water conservation. Since one of the goals for the Park is to find more efficient ways to apply irrigation water, SIRP and its associated researchers are evaluating several tools, techniques, and/or practices that have the potential to conserve considerable amounts of irrigation water. These tools/practices include low pressure drop nozzle retrofits (Fig 1), variable-rate irrigation controls on center pivot irrigation systems, advanced irrigation scheduling (including use of remote soil moisture monitoring via sensors), subsurface drip irrigation, and conservation tillage. Partnerships with various like-minded groups have enabled many of the tools/practices to be transferred to working farms for further evaluation. Education and outreach activities by SIRP personnel help irrigators better understand the opportunities for adopting the tools/practices on their farms.

Recently, a 'white paper' entitled "Agricultural Water Conservation in the Lower Flint River Basin of Georgia" was released. This paper was a collaboration between the Flint River Basin Partnership, The Flint River Soil & Water Conservation District, The University of Georgia (SIRP and Cooperative Extension), USDA-NRCS, The University of Florida, and USDA-ARS (National Peanut Research Lab). In this paper, the authors discussed the water savings potential from the practices discussed above. The practices (and savings) are as follows:

• **Low pressure drop nozzle retrofits with end gun shut-off.** Savings are generated by applying irrigation water at a lower pressure nearer the soil surface to reduce evaporation and wind drift losses; installing end gun controls to keep irrigation inside the field boundary; and, repairing leaks. Retrofits reduce water use by up to 22.5%.

• **Variable rate irrigation**. Savings are generated by removing non–crop areas from irrigation; coordinating application amounts with variations in soil type and field topography; and, eliminating double application due to pivot overlap. Variable rate irrigation (VRI) reduces water use by an average of 15%.

• **Advanced irrigation scheduling**. Savings are generated by identifying precise periods of time in which a farmer can irrigate less by using objective field data such as soil moisture, soil temperature, crop growth stage and localized ET. Advanced irrigation scheduling reduces water use by up to 15%.

• **Conservation tillage**. Savings are generated by using a cover crop and leaving plant residue in the field, which modifies plant rooting structure and physiology to enable more efficient water use by crops; improves water holding capacity in the soil; increases water infiltration rates; and, reduces soil temperature, evaporative loss, and field run–off. Conservation tillage reduces water use by up to 15%.

These measures, while in many cases complementary, are not necessarily additive as per the savings generated. Water conservation estimates are based on an average application rate of 13 acre inches per field in a dry year. Estimated reductions in water use are based on field experience, ongoing research and the *Project Report 32: Irrigation Conservation Practices Appropriate for the Southeastern United States*. Many of these practices create economic and environmental benefits beyond water conservation which help to offset costs.

Subsurface drip irrigation was not included in the white paper as research is just beginning and potential water savings are not known for this practice under Southeast conditions.

SUMMARY

The University of Georgia C.M. Stripling Irrigation Research Park is working hard to find more efficient ways for Georgia's farmers to apply irrigation water. Stripling Park and its associated researchers continue to evaluate tools, techniques, and/or practices that have the potential to conserve considerable amounts of irrigation water while maintaining sustainable levels of production for the grower and support for agriculturally-based rural economies.

Figure 1. Center pivot irrigation system fitted with low pressure drop nozzle retrofit.