

RESULTS OF THE FLINT RIVER WATER CONSERVATION PROGRAM: CENTER-PIVOT IRRIGATION IMPROVEMENT

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Abstract. The Georgia Soil and Water Conservation Commission (GSWCC) recognizes that Georgia's vitality relies on our water resources. As agriculture is both a substantial consumer of these resources and the backbone of the state's economy, agricultural irrigators are obvious partners in water conservation. The GSWCC, with the aid of several cooperating agencies, has piloted an irrigation evaluation and cost-share program that assesses basic performance characteristics of center-pivot irrigation systems that would likely contribute to over-watering cropland. This paper reports the procedure and results of the first year of this pilot program. Focusing cost-share efforts on uniformity of water application and end-gun application, the program aims to eliminate irrigating in excess of crop water-requirements and off-site water application. The program experienced high interest and participation response from eligible counties, with producers and landowners eager to sign up more irrigation systems for assessment and rehabilitation.

INTRODUCTION

The Georgia Soil and Water Conservation Commission has identified protection of the ground and surface water resources as a priority natural resource objective. This paper reports the progress of this pilot program by describing its procedure and results. The Flint River Water Conservation Program aims water resource conservation efforts at the heaviest water-consumers in the area—agricultural irrigators. The program allows the GSWCC to both improve poorly performing irrigation systems and examine the current condition of irrigation systems tested in the program. Eleven counties were included in the pilot cost-share program, including Baker, Calhoun, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, and Terrell. These counties are located in the southwestern corner of

Georgia, where agricultural water consumption has become a priority issue of examination.

BACKGROUND

Water resources in southwest Georgia fuel concern over the quantity of water available and the quality of these supplies. In Southwest Georgia and across the entire Dougherty Plain physiographic province, water quality and water quantity constitute a linear relationship. As rainfall decreases, greater demand is placed on surficial and ground water supplies to meet crop water requirements on irrigated cropland. Irrigation water and agricultural chemicals applied to the land seep into the shallow, unconfined surficial aquifer below the sandy soils in southwest Georgia. The surficial aquifer is in turn connected to the unconfined Floridan aquifer system. The vast amounts of irrigation water applied over large areas of the sandy cropland soils increase the potential for agricultural chemicals, including nutrients and pesticides, to be transported into surface and ground waters. Due to the drought conditions experienced in recent years, farmers have relied extensively on irrigation water to accommodate crop-water requirements. Facilitating better management of irrigation water resources, will likely aid in deterring future contamination and depletion of these waterways, as there are approximately 561,391 acres of irrigated cropland in this eleven-county region of southwest Georgia alone. (Cooperative Extension Service, 2001) Producers are often required to divert their attention to seemingly more pressing or immediate matters on the farm, and they do not usually have the monetary or technical resources or expertise, in regard to water conservation, to ascertain or improve such operations as irrigation systems. Therefore, the GSWCC developed the Flint River Water Conservation Program to encourage responsible use of agricultural water resources.

OBJECTIVE

The objective of the Flint River Water Conservation Program is to implement irrigation system changes to decrease the potential for runoff, leaching, and erosion on irrigated cropland fields and conserve irrigation water sources. The program also serves to increase awareness and understanding of the importance of irrigation system maintenance and improvement. Irrigation system evaluations are not a new concept; however, they have not been widely implemented in the most heavily irrigated areas in Georgia. Such programs have previously enjoyed wide support. This project takes the process an important step forward by providing financial assistance, as an incentive for producers to make needed improvements to increase application efficiency in their irrigation systems.

PROCEDURE

An irrigation performance evaluation is a comprehensive review of a particular center-pivot irrigation system on an operation. The GSWCC's Mobile Irrigation Lab (MIL), implemented by the agency's irrigation specialists and technicians, conducts irrigation performance evaluations on individual center-pivot irrigation systems. The evaluations focus most intently on water application uniformity, application rates of the system, and end-gun offsite application waste. These areas have

proven to be high areas of interest for the producers, contributing to higher participation numbers, and may be determined to great accuracy. However, the evaluation also reviews several other technical areas of interest concerning the irrigation systems. The MIL procedures and software were adapted from a similar program utilized by the Suwannee River Resource Conservation and Development Council in Florida to evaluate center-pivot irrigation systems.

All producers participating in the program submitted an application for an irrigation performance evaluation. The application for the evaluation also constituted application for financial assistance, if the results of the performance evaluation indicated necessary improvement of the irrigation system.

Once an irrigation performance evaluation is completed, the irrigation specialists develop a report of the results for the farmer. The results include general information regarding the irrigation system and its characteristics, power source, energy consumption, hardware, as well as general field, crop and crop-water requirement information. The reports also include detailed documentation of all dysfunctional or abnormal aspects of the irrigation system, focusing mainly on the nozzles, sprinklers and end-gun coverage and performance. The uniformity of water application is included on the report in a percentage format, calculated using Christiansen's Coefficient of Uniformity. This uniformity of water application is also presented in a graphical format, so the landowner

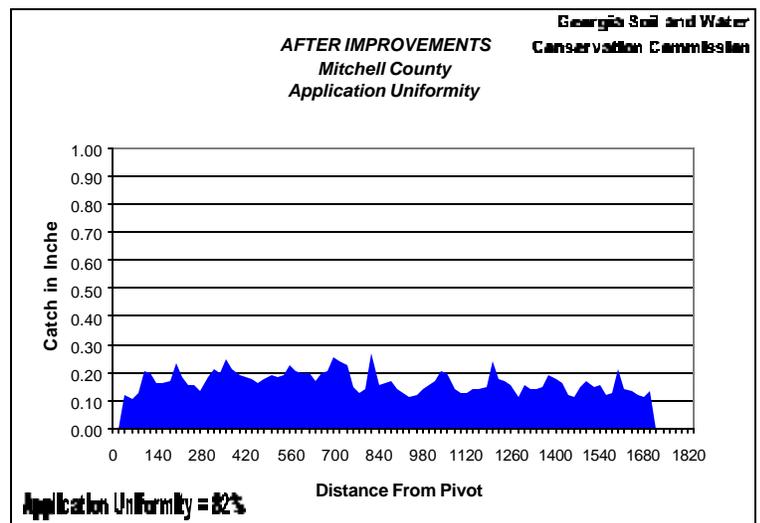
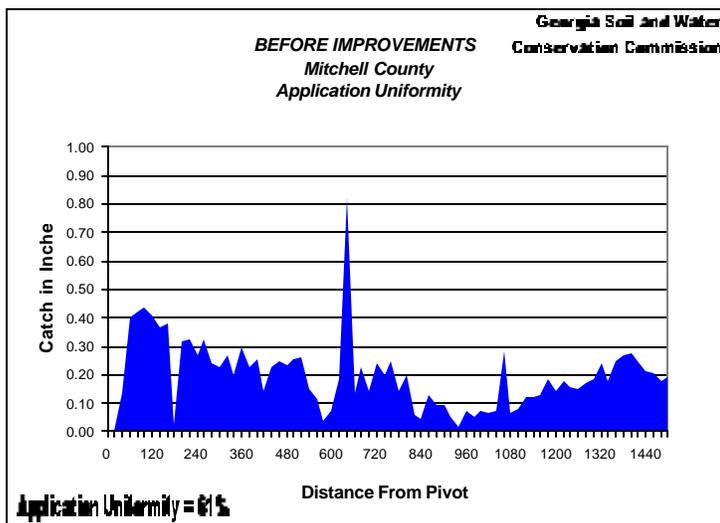


Figure 1. This Application Uniformity graph, based on Christiansen's Coefficient of Uniformity, illustrates the depth of water applied down the length system before improvements were made to the nozzle package. Variations in uniformity, as shown above, contribute to over watering areas of the field, because producers usually irrigate based on the driest portions of the field.

Figure 2. This Application Uniformity graph illustrates the depth of water application down the length of the same system as in Figure 1 after replacement of the nozzle package on the system. The producer now waters the crop more uniformly, less often, and is more likely avoid over watering portions of the field.

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may see a visual representation of where the system renders problems in uniformity. Uniformity is determined by placing 8-inch diameter buckets every 20 feet down the length of the system, starting 40 feet from the pivot point. The system is "walked" over the line of buckets, and the amount of water in each bucket is measured. A system with properly operating sprinklers or nozzles would have equal measures of water in each bucket. The specialists also provide a custom application chart that is specific for each system. The updated application chart indicates how much water is being applied to the crop (in acre-inches) on a given timer setting under certain environmental conditions.

If the irrigation performance evaluation indicates that improvements to an irrigation system have the potential to reduce water quality impairments, the producer is eligible for financial assistance for irrigation improvement implementation. Financial assistance is available for installation of end-gun shut-off mechanisms, replacement of nozzles where uniformity is very poor, and the replacement of sprinklers. The Christiansen's Coefficient of Uniformity and the number of acres in need of end-gun shut-off determine eligibility for financial assistance. The qualifications for financial assistance were set to ensure that funding was designated for the poorest performing or most wasteful systems. If the system scores 70% or lower in application uniformity, then the producer qualifies for nozzle package installation assistance. If the system's end-gun rotation includes more than a half-acre of off-site application or creates a public safety concern, such as spraying in a public road, the producer qualifies for end-gun shut-off assistance. A limit of \$5,000 of assistance is available for systems in need of new nozzle or sprinkler packages, \$3,000 for systems in need of end-gun shut-off installation, and a limit of \$8,000 if the system is in need of both types of improvement. Landowners were limited to two performance evaluations and were only allowed to receive cost-share assistance on one system per landowner, in order to increase participation and interest among different landowners. The cost-share funding was allotted to the program counties according to the number of irrigated acres in each county. This allotment was designed to prevent funding from disproportionately benefiting one county. Once improvements are made to an irrigation system, the MIL conducts a follow-up performance evaluation to ensure the proper installation of nozzle packages and end-gun shut-off mechanisms.

Applications were made available to farmers on February 1, 2002 and were accepted until April 1, 2002. The program attracted over 200 center-pivot owners, including applications for over 300 irrigations systems to be evaluated. Owners are limited to two performance evaluations on their irrigation systems in order to ensure that more pivot-owners had the opportunity for evaluations. The landowners were encouraged to enroll their poorest performing systems in order to increase their chances of qualifying for cost-share opportunities. Thus far, almost 200 of the systems have been evaluated by the MIL. According to the program employed by the MIL, these systems could potentially save approximately 700 million gallons of water with appropriate improvements to the nozzle and sprinkler packages. Installing end-gun shut-off on these systems would save almost 150 million gallons from off-site application waste each growing season. This cost-share program, funded by the National Fish and Wildlife Foundation and the U.S. Fish and Wildlife Service, has allowed GSWCC to contract with over 40 landowners to improve center-pivot irrigation systems. The systems under contract should save southwest Georgia approximately 400 million gallons of water through improved nozzle and sprinkler packages according to the MIL software program. Installation of end-gun shut-off on systems under contract will eliminate the wasteful application of over 60 million gallons of water each growing season.

The GSWCC also operates MIL offices in Cochran and Statesboro, which conduct performance evaluations on center-pivot irrigation systems. However, these offices lack the funding to administer a cost-share program as widespread as the Flint River Water Conservation Program. Due to the amount of interest and participation in the first year of the program in the Flint River area, the GSWCC hopes to both continue this program in the Flint River Basin and extend it across south Georgia and up into middle Georgia.

ACKNOWLEDGEMENTS

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