Report as of FY2006 for 2005SD35B: "Water ConservationUsing Automated Irrigation Water Management for Center Pivots"

Publications

- Conference Proceedings:
    - Oswald, Jared, Hal Werner, and Todd Trooien, 2005, Automated Water Management for Center Pivot Irrigation Systems, North Central Region ASABE Annual Conference, Brookings, SD.
    - Oswald, Jared, Hal Werner, and Todd Trooien, 2005, Automated Water Management for Center Pivot Irrigation Systems, 26th Annual International Irrigation Show and Conference, Phoenix, AZ.
- Other Publications:
    - Oswald, Jared, 2006, Automated Water Management for Center Pivot Irrigation Systems, MS Engineering Thesis, Agricultural and Biosystems Engineering Department, College of Engineering, South Dakota State University, Brookings, SD, 97 pages.
    - Werner, Hal, Todd Trooien, and Jared Oswald, 2006, Irrigation Water Management UsingAutomated Center Pivots, Eastern South Dakota Water Conference, WRI, South Dakota StateUniversity, Brookings, SD.

Report Follows

Progress Report

State Water Resources Institute Program (SWRIP)
March 2006 to February 2007

Title: Water Conservation Using Automated Irrigation Water Management for Center Pivots

Investigators: Dr. Hal Werner and Dr. Todd Trooien

Introduction:

This project is a continuation project begun in 2005 with the goal to develop an automated irrigation management system for center pivot irrigation that will perform scientific irrigation scheduling. The expected outcome is that farmers will save water and energy, improve production and protect the environment. The first objective of the research to develop an irrigation scheduling model was completed during the initial year. Due to hardware problems and weather conditions, the system was not field tested in 2005. Plans were to attempt field testing again in 2006 but once again weather delayed field testing. The continuation project included a second objective to develop training software based on the simulation model.

Project Information:

Specific objectives of this continued research are to:
   Test the center pivot automation (CPA) system under field conditions to determine the effectiveness of the irrigation scheduling and the water conservation benefits.
   Develop a software package based on the automated irrigation management system that can be used as a training tool to assist farmers in scientific irrigation scheduling.

The irrigation scheduling model was developed using the ASCE Penman ET equation. Crop coefficients were adapted for corn, soybeans and potatoes. Initially about 4000 simulations were completed. The simulation model has been adapted to alfalfa/grass. The model has also been adapted to simulate part circle center pivots and multiple crops within the same center pivot coverage. Figure 1 shows the output screen for the simulator.

Limited irrigation water can impact the producer's water management. Results of the simulations for corn are being used to determine the impact of various inputs on crop yield. Future work will analyze how best to use limited irrigation water with center pivot irrigation systems.

A major limitation of any irrigation scheduling practice is obtaining soil moisture readings that can be used to index and validate the soil water balances. A number of methods for measuring soil moisture are available that are suited to automation. The accepted standard of measuring soil moisture using neutron scattering is not adapted to automation. A laboratory study of four different soil moisture instruments was begun. An undergraduate student developed and built the test apparatus, then conducted preliminary testing before the student was lost to graduation. Figure 2 shows the laboratory test setup for the soil moisture sensors. Figure 3 shows the installation of Watermark® sensors and radio equipment in the field.
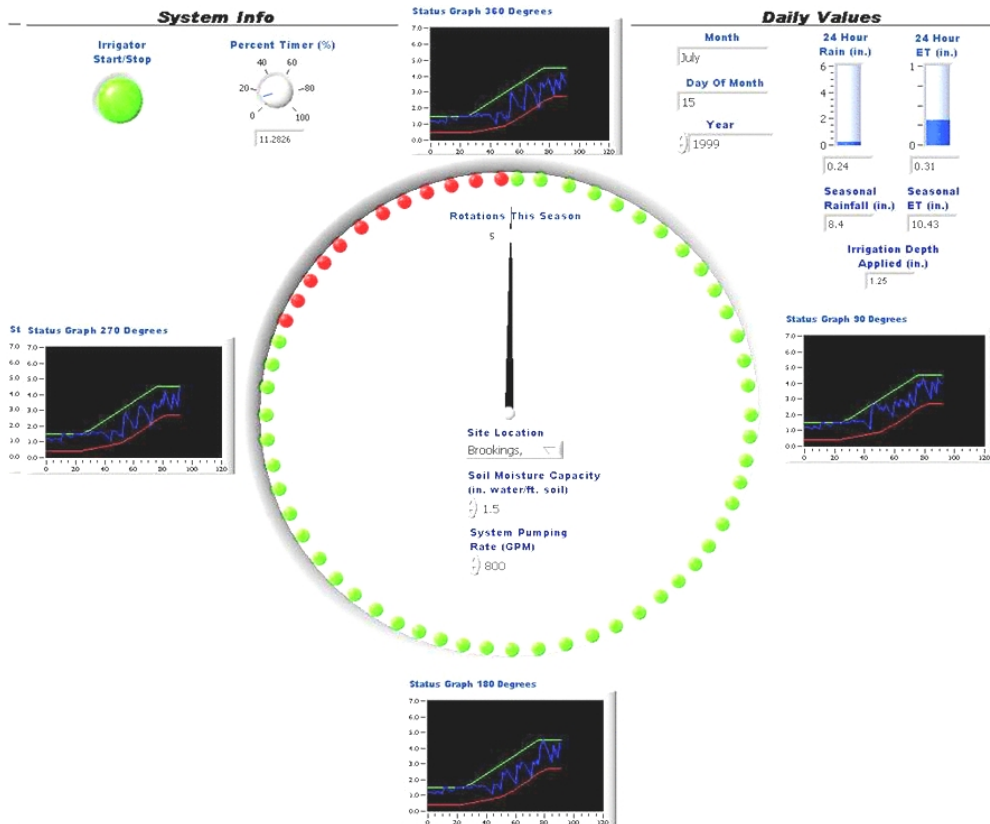
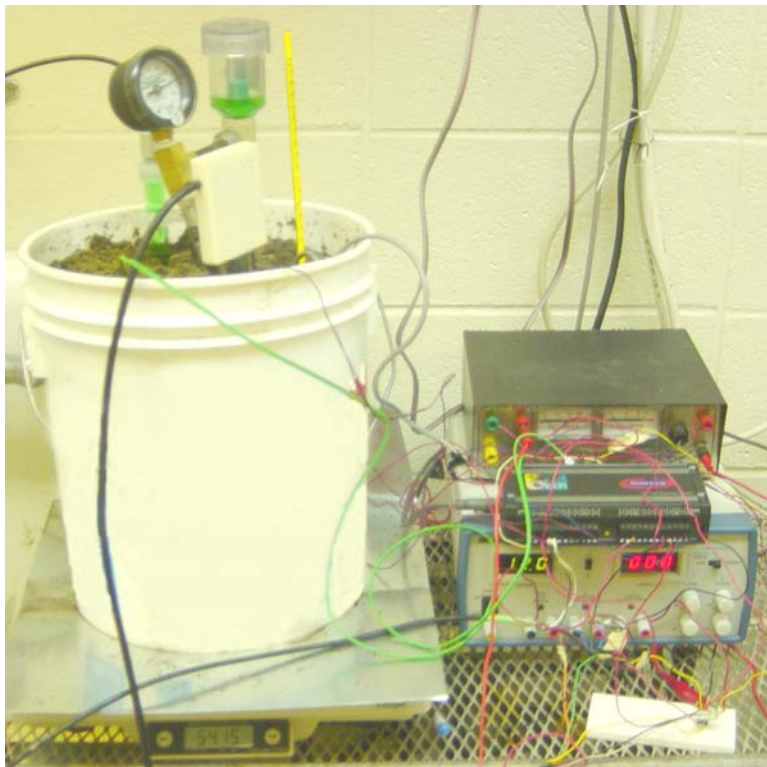**Figure 1 Simulator output screen.**

Figure 2 Laboratory setup for soil moisture sensors.

Figure 3 Field testing of Watermark sensor.

The second objective of the continuation project was to develop training software to assist producers with the concepts of irrigation water management. Two undergraduate students began development of the software but were not able to complete the project due to leaving for other commitments. Replacement students have not become available. Figure 4 is a screen shot of the prototype training software.
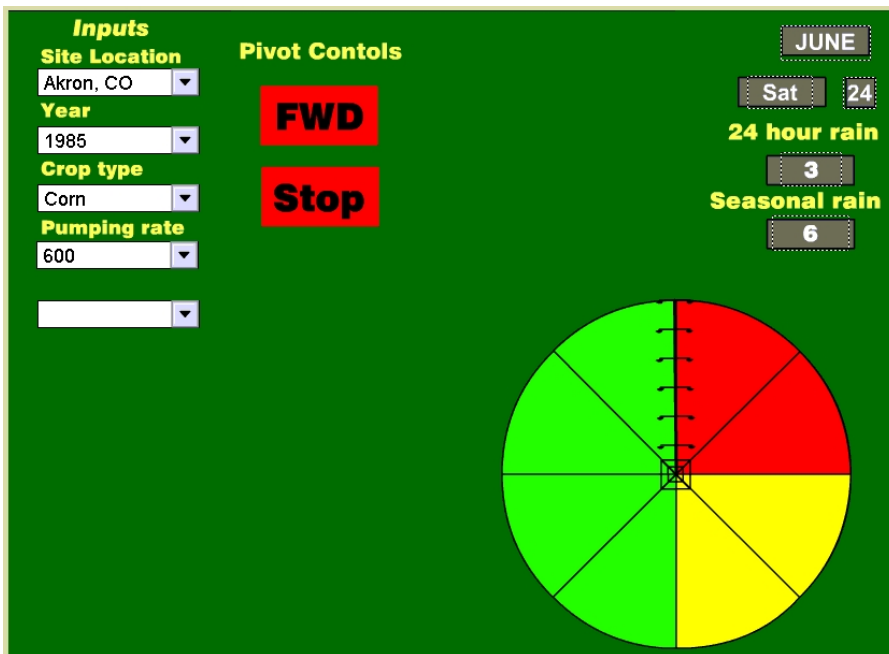

Figure 4 Screen shot of prototype training software.