The Society for engineering in agricultural, food, and biological systems

This is not a peer-reviewed article

Paper Number: 022021
An ASAE Meeting Presentation

A Mobile Irrigation Lab (MIL): Bringing Education and Technical Assistance to the Farm in the Computer Age

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Written for presentation at the
2002 ASAE Annual International Meeting / CIGR XVth World Congress
Sponsored by ASAE and CIGR
Hyatt Regency Chicago
Chicago, Illinois, USA
July 28-July 31, 2002

Abstract: *Successful transfer of information and technology to farmers and farm managers can occur in many ways. However, improved adoption of technology occurs when individuals have first-hand experience with the technology. This involves hands-on training and in-field evaluation using computer-based decision-making and analysis tools. The goal of the mobile irrigation lab (MIL) is to bring high tech training and evaluation opportunities to the field. A classroom and equipment storage trailer is equipped to allow one-on-one and small group training, while at a site to gather field information. The initial emphasis of MIL is irrigation scheduling and evaluation of center pivot sprinkler uniformity. Irrigated agriculture contributes heavily to the economy of Kansas and is especially important in western areas of Kansas. In many irrigated areas, water supplies are being depleted. Adoption of best management practices can help extend the life of existing water supplies*.

Keywords. *Irrigation, center pivot, scheduling, field evaluation, uniformity, water management, computer software training, mobile unit*

Introduction

The Mobile Irrigation Lab (MIL) project is the outgrowth of experiences gained from long-term on-farm demonstration projects in south central and western Kansas. Evapotranspiration (ET)-based irrigation scheduling has been promoted as an irrigation scheduling method for over two decades, but has never been adopted on a wide-spread basis by Kansas irrigators. Various reasons for non-adoption have been given, including the difficulty in accessing ET information and somewhat tedious data processing requirements. However, the age of computers and information networks, along with establishment of several weather station networks in the state, have minimized information access and processing barriers.

Remaining barriers to ET-based irrigation scheduling adoption by producers include lack of familiarly of ET-based irrigation scheduling procedure, confidence in the process, and general use of computer based decision-making software. Incorporating irrigation scheduling into the management routine requires a commitment to a daily decision-making process. Many other management decisions might be better classified as seasonal or periodic. Surveys of producers have indicated that most have computers and have or could have web-access but most only have a narrow range of use or only a specific type of use. Our experience indicated acceptance of a computer-based decision-making tool was greatly enhanced when the producer was able to have hands-on computer training on the targeted software.

Irrigation scheduling is the determination of when and how much water to apply to meet specific management goals. Most often in Kansas, this means trying to maintain yield potential without waste of irrigation water by applying just enough water at just the right time. One of the usual assumptions of an efficient irrigation system is that the individual plants in the field have an approximately equal opportunity to share the applied water. This seemed a logical assumption as more and more of the irrigated acres were converted from flood to center pivots. About 75 percent of all irrigated land in Kansas is center pivot irrigated. Center pivot irrigated fields allow more irrigation scheduling flexibility over flood irrigated fields. However, recent full-scale testing of several center pivots revealed a number of instances where the nozzle package was performing at less than desirable uniformity.

The initial focus of the MIL is to be able to provide hands-on computer training for individuals with KanSched, an ET-based irrigation scheduling program, and to conduct on-site field evaluation of center pivot irrigation systems. The evaluations will be often conducted as a training event to demonstrate the evaluation procedure so that others can conduct their own additional evaluation tests. As illustrated in Figure 1, the MIL is a combination classroom (front half) (Figure 2) and field laboratory with the primary purpose of training individuals on improved water management practices using hands-on and in-field experience.

While training can occur in the MIL trailer itself, Figure 2, the MIL computers can also be set up in a regular conference room, Figure 3, to accommodate larger groups. The field laboratory section of MIL carries the field test equipment which is currently focused on conducting center pivot uniformity evaluations (Figure 4).

Figure 1: MIL is a combination classroom and field laboratory.

Figure 2: The front portion can be used as either office space or small classroom.

Figure 3: MIL's computers can also be transferred to a conference room for on-hands computer software training for larger groups.

Figure 4: The  back portion of

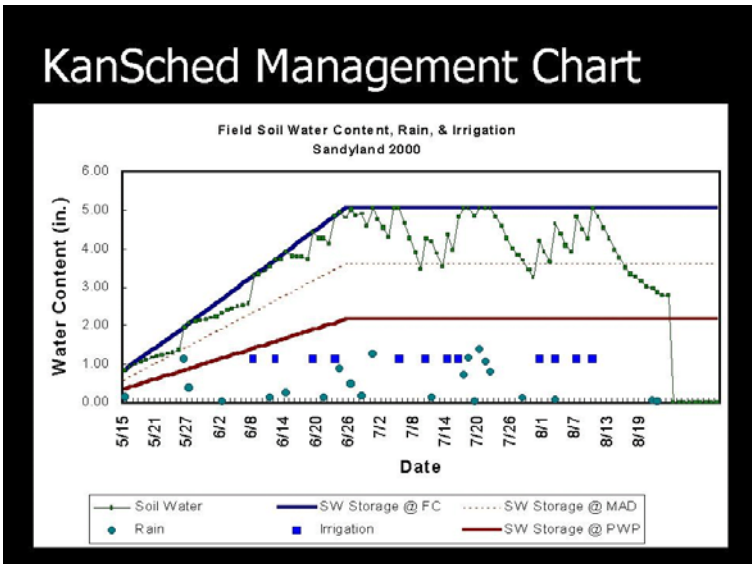
MIL carries equipment needed for field evaluations.

KanSched - An ET Based Irrigation Scheduling Tool

KanSched was originally developed as an educational tool for irrigators participating in a demonstration project to promote the use of ET-based irrigation scheduling. It proved to be very popular with a number of the producers, prompting an improved version to be developed. The new KanSched version is programmed as an executable file, meaning the user does not need to have a specific software package on their computer. The new version can also handle multiple fields and weather stations. The original version was designed to teach scheduling concepts and required a new file for each field. KanSched requires very few initial inputs to characterize the field soil and crop. Most of the characterization requirements have help screens to easily provide the necessary information.

Once the scheduling season begins, the soil water balance for the field is maintained by the producer by entering daily reference ET and rainfall or irrigation as they occur. KanSched also builds a daily management chart (Figure 5) on which a producer can quickly review the seasonal history but also quickly identify soil water trends.

Figure 5: KanSched Management Chart



IrriGages

K-State Research and Extension has conducted a number of farmer-field irrigation scheduling demonstrations in past years. One continuing difficulty for these projects was obtaining accurate information on rainfall values for multiple fields scattered over multiple counties. This situation led to the development of the IrriGage (Figure 6).

IrriGages are built to capture rainfall or sprinkler discharges using a cylindrical barrel as a traditional raingage. The captured water is then allowed to drain into a storage bottle beneath the catch barrel through a small diameter drainhole. After draining into a storage bottle, very little evaporation loss will occur; preliminary studies indicate less than 1 percent in a week, compared to losses of over 50 percent in a single day for a traditional raingage.

The major advantage for demonstration projects (and producers with a number of fields scattered over a large area) is that quick daily reading of the irrigage is not required to prevent loss of accurate information. The IrriGage, however, was quickly adapted for use to evaluate center pivot sprinkler application performance.

Center Pivot Evaluation

IrriGages can be used to check the depth of irrigation applications and used to evaluate center pivot sprinkler package uniformity.

Figure 6: The typical IrriGage consists of a 10.2 cm diameter collection barrel that drains into a small plastic bottle.

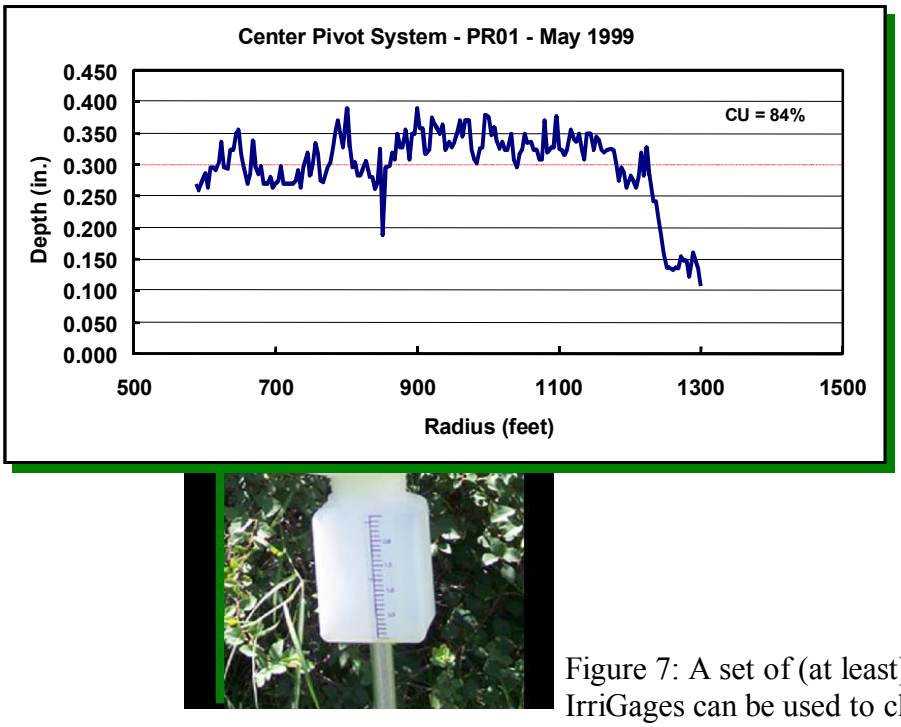


Figure 7: A set of (at least) three IrriGages can be used to check the application depth. One hundred or more are needed to evaluate the center pivot system nozzle package uniformity.

Figure 8: Recent center pivot evaluations have indicated that many may have less then desirable (90%) uniformity.

A set of at least three IrriGages (Figure 7) could be grouped under the center pivot to obtain an independent measure of the application depth. At least three should be used due to the irregularities in nozzle package overlaps. This average depth catch should approximate the application depth determined by the flow rate and speed control setting. A wide variance could indicate a reading or control problem of the other instruments.

A series of IrriGages placed along the center pivot lateral, allows an evaluation of the center pivot uniformity performance. Normally IrriGages are spaced at about 80 percent of the nozzle spacing. This may require 100 to 200 IrriGages to conduct a full-size center pivot evaluation.

Using IrriGages for testing center pivots has helped streamline the testing procedure. The IrriGages can be set up in advance and left unattended while waiting for the center pivot pass to occur. They also do not have to be immediately read following the irrigation event since minimal evaporation loss occurs from the bottles. This also means the data can be collected after the soil surface has soaked up the applied water, making data collection much less messy. The procedure can now be done with fewer man-hours of time, making it more likely to be conducted. Extensive evaluation of center pivot uniformity will allow development of a data base that could lead to improved package design and recommendations. However, an individual test will help producers identify any performance weakness due to installation or maintenance errors.

After collection of the catch data, the data is plotted and analyzed to calculate the coefficient uniformity (CU), Figure 8. In this example, an area near the outer edge of the pivot was receiving about one half of the average applied depth. The deficit irrigated area represented approximately 6 ha (15 ac) of the field. Yields in this area of the field may have been suppressed by as much as 1 to 1.2 kg/ha (60 to 80 bu/ac) per year due to the mis-installation and sizing of nozzles in this portion of the nozzle package.

Other Activities

Other decision-support software and information flyers are being developed as part of the MIL. Information is distributed through posters displays at conferences, written flyers, computer CD's and website, in addition to the meetings and field evaluations discussed previously. The MIL CD and website (www.oznet.ksu.edu/mil) contain all computer software and written materials.

Kansas State Research and Extension coordinates the activities of the MIL with other water related agencies, include the Kansas Water Office, the Division of Water Resources, the Natural

Resources Conservation Service, the State Conservation Commission, and various groundwater management districts. Requests for information have been received and shared with extension and other agency personal from neighboring states, including Nebraska, Colorado, Missouri, and Oklahoma. Information regarding the MIL will also be presented at national and international professional meetings.