IRRIGATION WATER MANAGEMENT

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Water stress can adversely impact crop yield and quality making adequate root zone soil water availability essential to any crop production operation. Irrigation has become an important tool of choice by growers for drought risk management. The recommended approach to root zone soil water management includes the use of soil moisture tracking in combination with monitoring. Irrigation scheduling and rainfall forecasts can project soil moisture conditions into the near future (1-3 days) while monitoring can be used to ground truth scheduler predictions.

The Wisconsin Irrigation Scheduling Program (WISP) is an irrigation water management tool designed to help growers optimize crop water use efficiency by tracking the root zone water inputs and outputs. Using WISP's water balance predictions, along with soil moisture monitoring, a grower can plan irrigation timing and amount to take maximum advantage of natural rainfall while minimizing over-application of water. WISP uses the checkbook method to track water inputs (rainfall and irrigation) on a daily basis and losses through evapotranspiration (ET) and deep drainage.

Types of moisture monitoring systems include portable probes and sensors at fixed locations. Portable probes have the advantage that measurements can be taken at several locations, but require walking or driving to the desired location. Stationary probes are placed at several predetermined depths and can operate continuously. Stationary probes must be placed at locations considered to be representative of the management unit. Stationary probes need to be directly accessed in the field or they can continuously upload data for web access. Monitoring technologies range from relative inexpensive mechanical means to more costly electronic sensors. Common sensor technologies include: soil water tension, capacitance and time domain reflectively. The approximate cost, advantages and disadvantages of the various technologies will be presented and discussed.

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SUCCESS: PRODUCER IMPLEMENTED WATER QUALITY IMPROVEMENT IN THE DRIFTLESS AREA

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A project in southwestern Wisconsin has shown that producers' changes in management can lead to improvements in stream water quality. This project began in 2006 as a pilot to test the targeting ideas of the Wisconsin Buffer Initiative (WBI, CALS, 2005). This was a project with many partners in addition to producers: Dane, Green and Iowa County Land Conservation offices, University of Wisconsin, University of Wisconsin-Extension, The Nature Conservancy, The Natural Resources Conservation Service (NRCS), US Geological Survey, and private sector agronomists.

Two watersheds, both approximately 19 mi^2, with a similar mix of agriculture, grasslands and woods and similar soils and topography, were selected for the project. The WBI recommended focusing efforts on watersheds of about this size in order to see results relatively quickly. Both of the pair selected were in the upper 10% of the WBI ranking of Wisconsin most likely to benefit from conservation practices to reduce sediment and phosphorus from entering the stream (CALS, 2005). The streams at the outlets of the two watersheds have been monitored for flow, phosphorus and sediment since September 2006. One of the watersheds was picked for targeted conservation efforts, while the other was used as a reference. Having a nearby reference watershed without any special conservation efforts allows us to determine how the project itself affected water quality without having the results obscured by variations in weather and regional land management trends.

The project watershed was inventoried to locate areas that were contributing comparatively high amounts of sediment and nutrients to the stream. The tools used for identifying high loss areas were the Revised Universal Soil Loss Equation 2 (RUSLE2) and the Wisconsin Phosphorus Index in the SnapPlus nutrient management software (UW Soil Science, 2014). Dane County Land Conservation staff also used BARNY to rank barnyards by their potential phosphorus runoff. Using these inventories, the project identified ten operations estimated to be contributing the most total phosphorus in surface runoff to the streams.

Eight of the ten focus operations began working with the project in 2010, and one joined in later. They implemented a combination of in-field and off-field practices to reduce runoff phosphorus and sediment losses with cost-share funding from the NRCS and The Nature Conservancy. The main field management changes were no-till/reduced tillage and pasture/lot systems.

We kept track of cropland and pasture management throughout the project and maintained the SnapPlus databases from the inventory in order to estimate the effects of the project. Participating farmers cut their operations' estimated erosion and phosphorus delivery by half. We also observed that some land not identified as high runoff loss areas in the initial inventory became high loss areas due to management changes. Chief among these changes was conversion of Conservation Reserve Program (CRP) grasslands into tilled cropland. The reference watershed had similar land management trends with CRP conversion.

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In 2013, the first year after full implementation, there was a statistically significant reduction in phosphorus runoff event loads in the project stream compared to the reference stream. This project showed that it is possible to achieve water quality improvements in a relatively short time frame by focusing conservation efforts within watersheds of the WBI-recommended size. Through monitoring both a treatment and reference watershed with both watersheds subject to the same weather and land management trends, we were able to show that producers' management changes had a positive effect.

References

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UW Soil Science. 2014. SnapPlus: Wisconsin's Nutrient Management Planning Software. Available at snapplus.wisc.edu.