MICHIANA IRRIGATION ASSOCIATION

MICHIGAN-INDIANA IRRIGATION NEWSLETTER

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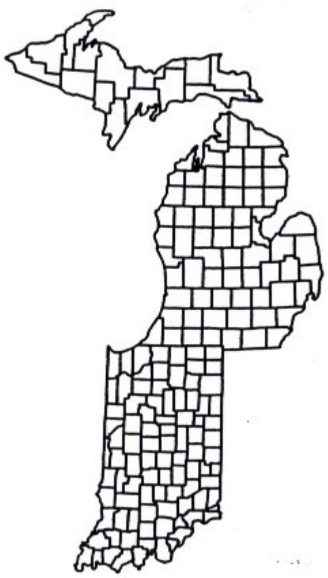

Irrigation - great opportunities and challenges.

Michigan and most of Indiana on upward trend for rainfall, an uncommon blessing in most of the United States. The added water and longer growing seasons is expanding crop production opportunities in sandy, well-drained soil fields that are irrigated. As production input costs rise the desire to reduce risk increases, driving the need for irrigated land to higher levels than ever seen before.

One of our greatest challenges is the perception that we're running out of water. Driven by the news and disasters of the arid west many people believe that the irrigated land of Michigan and Indiana is connected to the same problems.

The topics in this year's agenda for the Michigan Irrigation Association's annual meeting and the following newsletter articles is to serve as a resource to help the producer and irrigation industry professional prepared to talk about the sustainability and benefits of correctly managed irrigation in Indiana and Michigan.

Send us your questions: The Michiana Irrigation Association Board wants to make sure we're educating on the topics members want. Please add your questions to the bottom of the registration form or send an e-mail to Lyndon Kelley at Kelleyl@msu.edu. Time permitting, we will address your question at the end of this year's annual meeting, if it's more detailed or takes more time then available we will add it as a topic in next year's meeting agenda or provide a response in future newsletters.

History of the Michiana Irrigation Association (MIA): The MIA was formed in 1980 as a nonprofit professional organization with the primary objectives:

A. To promote:
    1. The development, proper use, management and acceptance of irrigation equipment practices.
    2. Educational activities and materials related to efficient irrigation.
    3. Water and soil conservation and more economical crop production through the use of irrigation.

B. To acquaint public and private sectors with developments in the irrigation industry, as well as the part the industry occupies in both the economy and the development of the nation.

C. To counsel with industry leaders and others on desirable legislative changes which affect the irrigation industry and irrigators.

D. To advise government regarding irrigation-related areas that affect, either directly or indirectly, the public and the irrigation industry.

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Enhancing Crop Productivity and Water Efficiency through Irrigation Scheduling

Brenden Kelley, Lyndon Kelley, and Dr. Younsuk Dong

Irrigation scheduling, whether based on weather data or soil moisture sensor technology, can be a transformative component of modern agriculture. Proper irrigation management is essential to maximize crop yields while conserving valuable water resources. Irrigation scheduling methods significantly reduce the potential for over-irrigation, preventing nutrient leaching into the groundwater, which is not only economically wasteful but also environmentally harmful. These practices also enhance the predictability of crop yields and improve the overall resilience of the agriculture sector to climatic variations.

The use of weather-based irrigation scheduling, which factors in meteorological conditions such as evapotranspiration and precipitation, helps align irrigation with the specific needs of the crops. In most areas local weather stations report an evapotranspiration value that can be modified with a crop coefficient to estimate the water losses each day. Subtracting these values from your soils field capacity after the last profile filling rain can provide a reference as to the current soil water available to the crop. Provided adequate rainfall is not in the forecast, when the projected soil water availability is below the crops needs, it's time to irrigate.

Sensor-based scheduling takes irrigation management to the next level by providing real-time data on soil moisture levels. By continuously monitoring soil conditions, it enables precise and timely irrigation decisions. Soil moisture sensors can provide a foundation for making more informed irrigation choices, allowing irrigators to more precisely tailor their applications to the soils, crops, and conditions in each field.

In conclusion, the adoption of irrigation scheduling is crucial for modern agriculture. Whether based on weather data or soil moisture sensors, these techniques have the potential to improve water efficiency, crop health, and overall productivity. They play a pivotal role in mitigating the challenges of water scarcity and promoting sustainable farming practices, making them indispensable tools for the agriculture industry. As climate change intensifies, the adaptive capacity provided by sensor-based scheduling becomes paramount. Farmers can respond more effectively to erratic weather patterns, optimizing crop management and minimizing water waste.

Practical Gaps

Todd Feenstra

A practical gap has existed for the past 15 years in Michigan between the Mi-WWAT models used to predict aquifer and stream depletion and the data needed to verify those models. There simply is not sufficient data, there is virtually no defendable data, to ground-truth the model predictions. The USGS water watch site for Michigan lists only 26 active groundwater monitoring wells across the entire State. Yet, the MI-WWAT continues to tighten water restrictions across the State as more and more watersheds are predicted to "run out" of available water.

What is occurring in Michigan reflects the fear peddled in the media. A recent New York Times series entitled Uncharted Waters is littered with multiple dramatic statements about how water use and crop irrigation are "squandering America's bounty" and "American is draining its groundwater like there's no tomorrow". But, is the fear reality-based? Is developing a large wellfield in northern Ohio going to deplete the MICHINDOH Aquifer and impact Indiana, Michigan, and Ohio water users? Is development of a proposed 30 MGD withdrawal for the LEAP project in Indiana going to dry up the Wabash River? Are crop irrigation pivots really drying up our aquifers and streams?

Crowds of 300 to 400 people have packed gymnasiums and halls for informational meetings and emphatically share their strong opinions and fears. Grassroot movements spring up and protesters print signs, create social media pages, and form picket lines. To what end? Are the protesters right? Are we running out of water, or stealing from our neighbors, or dooming the next generation by drying up streams and depleting the water resources, are we endangering our food security?

Growers across Indiana and Michigan are bridging the practical gap to answer those questions. "Measure and Monitor" has become the new mantra for high-capacity water users. The groundwater data needed to verify the models are being collected in over 200 farm fields, but far more is needed. Their water level meets USGS and State standards and is continuously collected every 15 minutes. These growers know their impact because they measure it. They know how far their wells draw the groundwater levels down. They know how far out their pumping effects spread. They know how long it takes the groundwater levels to recover when they stop pumping. They know the seasonal and annual variations from year-to-year. Several of these growers now have more than 10 years of continuous data.

Personal experience has proven how effective this data can be to take the heat out of a room. The data is the data, it is what it is. If we really want the answers to our questions, and we really want to know if our fears are justified, we need the defendable real-world data. We don't need more hypothetical models created for either developers or regulators. If the water resources are truly being depleted then we must make changes to our water use and pumping. If depletion is not happening we should continue to feed the world and be excellent stewards of our amazing water resources here in Michigan and northern Indiana. Measure and Monitor is sound, defendable science that bridges the Practical Gap.

Pumping Plants Considerations for Sprinkler Irrigation Systems

Dr. Younsuk Dong and Lyndon Kelley

The pumping plant generally accounts for a substantial portion of the initial cost and a major portion of the annual operating cost associated with a sprinkler irrigation system. Over 90% of the energy used by an irrigation system is used by the pump. The selection of the pumping plant, then, has a significant influence on the economics of irrigating. Careful planning and selection of this essential component helps to ensure both the adequacy, efficiency, and viability of the entire irrigation system. An irrigation pumping plant consists of a power unit, a pump, and all required accessories such as piping, valves, gauges, safety equipment, and mounting platforms. This article will focus on flow and pressure requirements for pumping plant.

Flow Requirement

The first step in planning a pumping plant is to determine the desired flow, the required pressure, and the type of water source. An acceptable method for determining irrigation flow requirements involves considering the peak daily water use of the crop to be irrigated. Daily peak use estimates for a variety of agricultural crops under Michigan conditions are presented in Table 1. This table is based on average reference evapotranspiration (rET) from the last 10 years. In addition to the daily peak use, some water evaporates before it enters the soil. For example, when corn is in the tassel emergence (VT) stage, evaporation occurs at a rate of 0.07 inch from the canopy and 0.03 inch from the soil surface. Thus, the peak daily water use and these evaporation rates should be considered. Table 1, along with equation A, can be used to estimate flow requirements. The ability to irrigate continuously during the peak crop water use period is assumed in this approach. If this ability does not exist with a particular system, the required flow should be increased by the appropriate percentage. In addition, the number of acres should include all future acres that may be added later to the site.

Table 1. Peak daily Water Use of Selected Crops in Michigan

Crop	Peak daily water use (inch)
Alfalfa	0.26
Blueberries	0.28
Carrots	0.25
Cherries	0.26
Corn	0.28
Cucumbers	0.23
Dry beans	0.26
Grapes	0.20
Green beans	0.24
Peaches	0.25
Pears	0.25
Peas	0.26
Potatoes	0.25
Soybeans	0.26
Squash	0.23
Strawberries	0.25
Tomatoes	0.26
Wheat	0.26

Equation A:

Field size (acres) x Peak daily use (inches) x 18.86 = Required flow (gallons per minute)

For example, assume a farmer wishes to irrigate a corn field. The field size is 80 acres, and the peak daily use (from Table 1) is 0.28 inches. Using equation A (80 x 0.28 x 18.86 = 422), the needed flow is 422 gallons per minute (gpm).

Pressure Requirement

Pumps are generally specified to supply a stated flow at a stated total discharge head, or the total pressure required of the pump. Three major components—operating head, friction head, and elevation head—are summed to determine the needed.

Operating head is the pressure required for satisfactory operation of the water application device. Typical ranges in operating heads for various devices are presented in Table 2. The needed operating head is determined by the type of application device selected.

Table 2. Typical Operating Heads at Pump for Various Types of Irrigation Systems

Application device	Operating head (psi)
Standard center pivot	30–45
Center pivot with big gun sprinkler	85+
Cable-tow, soft-hose traveler	95–115
Hose-reel, hard-hose traveler	100–120
Big gun sprinkler	70–110
Standard large impact sprinkler	50–90
Standard small impact sprinkler	20–60
Low pressure impact sprinkler	20–80

Friction head consists of the pressure losses within the irrigation system due to the movement of water. It is greatly influenced by the velocity of flow and the type of pipe, and also by accessories such as tees, elbows, reducers, or valves. In most irrigation systems, the losses due to accessories are relatively minor. The primary losses, then, are due simply to friction losses within the water main. Friction heads for two of the more common pipeline materials are shown in Table 3.

Table 3. Friction Head Loss for Selected type and Diameter of Pipe at Various Flow Rates

Approximate loss, psi per 100' of Pipe								
	Standard PVC pipe (160#)				Standard aluminum tubing			
Flow (gallons/minute)	**3" dia.**	**4"dia.**	**6" dia.**	**8" dia.**	**4"dia.**	**5" dia.**	**6" dia.**	**8" dia.**
200	2.53	0.75	–	–	1.3	0.48	0.17	–
300	–	1.6	0.24	0.06	2.5	0.96	0.36	0.1
400	–	2.72	0.41	0.11	–	1.55	0.64	0.17
500	–	–	0.62	0.17	–	2.16	1.01	0.24
600	–	–	0.88	0.24	–	2.62	1.4	0.33
700	–	–	1.17	0.32	–	–	1.86	0.45
800	–	–	1.49	0.41	–	–	2.26	0.6
900	–	–	1.86	0.51	–	–	–	0.75
1000	–	–	2.24	0.62	–	–	–	0.99

Note: Blank values indicate applications not generally recommended.

Elevation head is the equivalent pressure gain or loss due to the difference in elevation from the surface of the water source (during pumping) to the point of water application. The elevation difference can be readily converted to a pressure by using equation B.

Equation B: ***Difference in Elevation (feet) x 0.433 = Elevation Head (psi)***

*This article is retrieved from E3485 MSU Extension Bulletin.

Irrigation Well Record

Dr. Younsuk Dong and Lyndon Kelley

An irrigation well represents a significant investment as the central component of a groundwater-based irrigation system. To ensure continued optimal performance throughout its lifespan, regular maintenance and servicing are imperative. In many cases, a well's productivity gradually declines and might go unnoticed until costly or unfeasible reclamation becomes necessary. Maintaining accurate and consistent records of the well's condition helps in early detection of pump issues and aids in diagnosing problems and prescribing appropriate treatments.

The essential equipment for gathering the required data includes a water meter and an access point into the well casing. Placing a water meter in the discharge pipe of the pump allows measurement of the well yield over a specific period. Utilizing a steel tape or a drawdown meter through the access point, both static water level and pumping water level can be accurately measured. During pump installation, adding an airline facilitates these measurements.

If the data reveals minimal water level fluctuation but a decrease in yield and pumping level, it suggests a potential issue with the pump. If adjusting the bowl doesn't resolve the problem, seeking assistance from the pump supplier might be necessary.

In cases where the data shows no significant change in static water level but a drop in pumping water level and yield, potentially leading to decreased specific capacity, the trouble might be due to an obstruction hindering water flow through the screen into the well or scaling on the rock well's surface. Initial steps involve chlorination to eliminate iron bacteria and their residue. If this proves ineffective, acidizing may be required to remove hardened iron bacteria residue and mineral deposits. In some cases, dynamiting might be necessary to remove encrustations on sandstone rock well surfaces.

If the data shows a drop in both static water level and pumping water level, aligning with the decrease in yield, but not exceeding the difference in static water level, this could indicate a declining water table. While it warrants monitoring, it doesn't proportionally correspond to the drawdown and explains the lowered pumping level. It's important to recognize that a pump is designed to deliver a specific volume of water against a specific head, lift, or pressure, and any increase in head will decrease the yield.

It's advisable for a well driller to assess the output and energy requirements every 3-5 years. The forms listed below, located at https://www.canr.msu.edu/irrigation/index#resources, are designed to assist in maintaining a comprehensive record of the well's condition, including service and maintenance activities.

Our water competitors sometimes claim that Irrigation Pumping is lowering the water level in wells in the area. To refute such claims, one effective strategy is to maintain a comprehensive record of water levels in your well. We suggest regularly measuring and documenting your water level on an annual basis. The static level should be measured prior to commencing any pumping activities.

- Irrigation Application Record
- Irrigation Well Service Record
- New Well & Pump Data
- Static and Pumping Water Level Record

Mark your calendars: The Annual Meeting of the Michiana Irrigation Association is planned for Friday, December 15, 2023 at Beacon Health and Fitness Center in Elkhart, IN.