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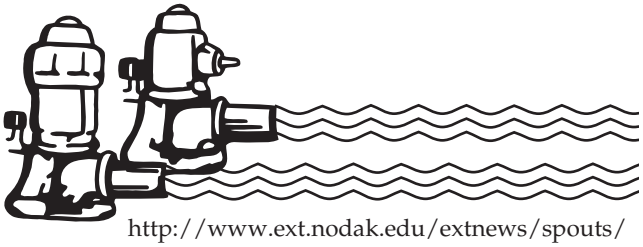

# water spouts

No. 210 JULY 2004

http://www.ext.nodak.edu/extnews/spouts/

## Field Days and Irrigation Tours for 2004

| | | |
|---|---|---|
| **Hettinger**<br>Research Extension Center | July 6 | (701) 567-4323 |
| **Dickinson**<br>Research Extension Center | July 7 | (701) 483-2348 |
| **Williston**<br>Research Extension Center | July 8 | (701) 774-4315 |
| **Casselton**<br>Agronomy Seed Farm | July 12 | (701) 347-4743 |
| **Carrington**<br>Research Extension Center<br>*Irrigation Research* | July 13 | (701) 652-2951 |
| **Sidney, Montana**<br>Eastern Ag Research Center | July 13 | (406) 433-2208 |
| **Minot**<br>North Central<br>Research Extension Center | July 14 | (701) 857-7677 |
| **Langdon**<br>Research Extension Center | July 15 | (701) 256-2582 |
| **Tappen**<br>Irrigated Potato Field Day<br>*I-94, Pettibone exit, north side* | July 22 | (218) 773-3633 |
| **Williston – Ag Open**<br>Mon-Dak Tours | Aug. 4 | (800) 735-6959 |
| **Oakes**<br>*Irrigation Research Site* | Aug. 16 | (701) 742-2189 |

## Missouri Slope Irrigation Development Association (MSIDA) Annual Tour

The annual MSIDA irrigation tour will be Thursday, July 8. The destination will be South Dakota to view no-till crop rotations and residue management. One of the stops will be at the Dakota Lakes Research Farm in Pierre, S.D. No-till farming is the main emphasis of the tour but much of the research farm is irrigated. The Morton County Soil Conservation District (SCD) organized the tour and graciously agreed to cooperate with the MSIDA.

The tour registration fee is $20 per person and includes a seat on the bus, a box lunch and dinner. For more information and to register, call the Morton County SCD at (701) 667-1163, Extension 3.

### Tour Agenda – July 8

| | |
|---|---|
| 6:15 a.m. | Bus leaves Mandan NRCS office (2610 Old Red Trail) |
| 11:00 a.m. – 1 p.m. | Tour Dakota Lakes Farm, Pierre S.D., Dwayne Beck, manager |
| 2:30 p.m. | Tour Mark Stiegelmeir Farm, Selby, S.D. |
| 4:30 p.m. | Tour Leo Vojta Farm, Glenham, S.D. |
| 6:30 p.m. | Mobridge for dinner at the Fireside Restaurant |
| 9:30 p.m. | Mandan |

## Irrigated Potato Field Day at Tappen

The Northern Plains Potato Growers Association will be hosting its annual Irrigated Potato Field Day at the irrigated research site three miles east of Tappen Thursday, July 22, from 9 a.m. to noon. The research site is located on the north side of I-94 at the Pettibone exit.

A tour of research and demonstration plots will include variety trials, sugar end trials, weeds and herbicides, disease plots and planting configurations to improve irrigation water management. The field day will be followed by a noon lunch.

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## Basics of Irrigation Scheduling

Irrigation water management for agronomic crops has three major components that directly affect when water can be applied to a crop. The three components are equipment, crop cultural management and irrigation scheduling.

Equipment constraints to water management can involve electric load management that shuts down the pump, equipment breakdown, low water levels in reservoirs, plugged pump inlets, poor sprinkler uniformity, low design application rates and many others. Every year, lightning and high winds cause many irrigation equipment problems. Lightning is particularly hard on electric drive center pivots and water pumps.

Crop cultural management refers to tillage practices (cultivation) and pesticide spraying that interferes with the application of water. For example, to control late and early blight in potatoes requires a weekly application of fungicide. If a ground-based sprayer is used, prior to spraying, the irrigation system must be turned off to allow the soil to firm up or else the sprayer could become stuck. After spraying, the irrigation system can't be turned on right away because it might wash the fungicide off the plants.

The third irrigation component is irrigation scheduling, the topic of this article. ***Irrigation scheduling is the science and/or art of applying the proper amount of water, at the proper time to provide the maximum useable soil moisture in a plant's root zone without causing harmful stress.*** Irrigation scheduling is a balancing act between applying too much water or not enough to meet plant needs at a particular stage of growth. This means we don't want to over-irrigate because it increases pumping costs and can increase disease pressure on the crop. We also don't want to under-irrigate because this will cause crop stress and affect yields. This is not easy to do. The practice of irrigation scheduling is basically a decision methodology. Each irrigator has had to learn to develop an irrigation scheduling method that works in his situation

We are constantly trying to schedule irrigations around rainfall events, crop growth stages, crop cultural practices, electric load control and equipment problems. Implied in the definition of irrigation scheduling is the notion that the irrigator wants to obtain an acceptable yield. However, an acceptable yield for one farmer is not necessarily acceptable to another. Irrigation scheduling should be about maximizing the beneficial use of water.

### Essential information for irrigation scheduling

Whatever irrigation scheduling method is used, an irrigator always needs to have four essential pieces of information prior to scheduling. The first is knowledge of the soil types in the field. The water-holding capacity, depth and thickness of soil layers are the most important. Fortunately, this information is readily available in the county soil survey available at the local Natural Resource Conservation Service (NRCS) office. The concept of water-holding capacity of soil was covered in detail in the previous two issues of Water Spouts (May and June).

Thickness and depth of soil layers determine where roots grow and have a definite effect on irrigation scheduling. For instance, if your soil is a sandy loam that is four feet thick, all crops grown on it will develop a full root zone. However, if your neighbor's field has a gravel layer starting at two feet below the surface, then corn, alfalfa, small grains, sugar beets and sunflowers will not develop a normal root zone and he will have to manage his water and nutrients differently than you. Generally, with a center pivot, he would apply less water per revolution than you but make more revolutions during the growing season. If he were growing potatoes, dry beans or soybeans, then he would manage his irrigation water the same as you because these crops only have a two-foot root zone.

#### *Measure rainfall*

The second essential piece of information is accurate measurement of the amount of rain received on the field. For accurate measurement, each field should have at least one rain gauge with a two-inch diameter opening. Rain amounts should be recorded after each rain event (preferably on a calendar). You may wonder how much rain it takes to make a difference in soil water content. Generally, in July and August a rain that totals less than a tenth of an inch will be intercepted by the foliage and won't affect soil moisture content.

### *Irrigation system application capacity*

The third essential piece of information is how much water your irrigation system can apply in a certain period of time. For gravity irrigation systems (gated pipe, siphon tubes and flooding) it is almost impossible to apply less than four inches per irrigation. Often there is more concern with the amount of time it takes for the water to reach the end of the field. For moving sprinkler systems (center pivots and big guns) with a fixed flow rate, the speed of the system determines the amount applied. The faster the system, the less water applied but more acres are covered. What you need to know is what depth of water the sprinkler system can apply each day. This can be determined from the gallons per minute of flow rate per acre (pumping capacity) as shown in Table 1.

**Table 1. Pumping capacity that represents an equivalent daily application amount (assumes 85 percent application efficiency).**

| Pumping Capacity | Application Amount |
|---|---|
| (gpm/acre) | (inches/day) |
| 4.0 | 0.18 |
| 4.5 | 0.20 |
| 5.0 | 0.23 |
| 5.5 | 0.25 |
| 6.0 | 0.27 |
| 6.5 | 0.29 |
| 7.0 | 0.32 |
| 7.5 | 0.34 |
| 8.0 | 0.36 |

The best way to explain this table is with an example. For example, you have a center pivot that covers 115 acres and your sprinkler package is sized for a flow rate of 700 gallons per minute. Dividing 700 by 115 gives you a pumping capacity of 6.09 gpm/acre. From Table 1, your system can apply 0.27 inches of water per day that will get into the soil. If you set the timer to make a revolution in three days, the total amount applied over the entire field by the center pivot will be 0.81 inches. Since it takes three days to make a revolution, it's the same as if the center pivot applied 0.27 inches over the whole field in one day.

### *Daily crop water use*

The last essential piece of information is how much water the crop is using during the growing season. Water use by a crop is dependent on the stage of growth, availability of water in the soil, air temperature, solar radiation (amount of sunlight), relative humidity and other weather variables. The amount varies each day, depending on weather conditions.

Tables of estimated daily crop water use based on maximum air temperature are published in NDSU Extension Service publication AE-792, "Irrigation Scheduling by the Checkbook Method" (Table 2).

**Table 2. Example of estimated daily water use based on maximum air temperature and weeks past emergence from AE-792.**

| Maximum Air Temperature | Estimated Daily Corn Water Use |
|---|---|
| | (8th week past emergence) |
| 50-59° F | 0.08 inch |
| 60-69° F | 0.14 inch |
| 70-79° F | 0.19 inch |
| 80-89° F | 0.24 inch |
| 90-99° F | 0.30 inch |

The crop water use tables were derived from average weather conditions but have been shown through research to be useful for irrigation scheduling. More accurate, site-specific crop water use estimates can be obtained from the North Dakota Agricultural Weather Network (NDAWN) Web site:

*www.ext.nodak.edu/weather/ndawn/old-ndawn-home.html .*

Crop water use estimates are available in both graphical and numeric table formats at this Web site.

July and August are critical irrigation months and irrigation scheduling is very important for crop development and yield. Average monthly water use of some common irrigated crops in July and August are shown in Table 3.

**Table 3. Average monthly crop water use for common irrigated crops.**

| | Average Water Use (inches) | |
|---|---|---|
| | July | August |
| Corn | 6.6 | 6.3 |
| Alfalfa | 6.6 | 6.3 |
| Pinto Beans | 7.0 | 5.8 |
| Potatoes | 7.0 | 5.5 |
| Soybeans | 6.5 | 5.9 |

Crops use more water in July than August and the average rainfall amounts are correspondingly greater in July. The average rainfall in July is 2.75 inches in Carrington and 2.35 inches at Oakes, whereas the average rainfall in August for both locations is about 2 inches. This indicates that the irrigation water demand is probably greater in August than in July.

### *Irrigation scheduling methods*

With some or all of these essential pieces of information, you can make irrigation scheduling as simple or as precise as needed. Many people base their irrigation decisions by checking soil moisture. Often they obtain a soil sample from a certain depth with a soil probe and determine the soil moisture content by the "feel" method.

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Another common form of irrigation scheduling is the "replacement" method. People who follow this method record (usually on a calendar) rain and irrigation amounts and daily crop water use. Irrigation timing and amount is adjusted to replace the soil water used by the crop. Another form of the replacement method is to assume the average daily crop water use is 0.25 inches per day. The average total for a week in July and August is 1.75 inches. Rain amounts during the week are subtracted from 1.75 and that amount of irrigation water is applied. With access to the Internet, this method could be improved significantly by using the crop water use amounts from the NDAWN Web site.

Another method is the "checkbook" method which tracks daily changes in soil water status. Rain and irrigation amounts are "deposits" for storage in the root zone and crop water use is a withdrawal of water from that storage. Since 1977, the NDSU Extension Service has published a publication titled "Irrigation Scheduling by the Checkbook Method", AE-792. Many irrigators have used the information in this circular to develop their own irrigation decision method. A copy can be obtained from any county extension office.

In 2000, a computerized version of AE-792 was developed. The program includes the checkbook methods from both NDSU and the University of Minnesota, so it can be used in both states. For North Dakota, the program can be used to schedule irrigation on corn, wheat, barley, potato, alfalfa, soybean, sunflowers, sugar beets and sunflowers. For Minnesota, the program can be used to schedule irrigation on corn, wheat, soybean, sunflower, potato, sugar beets and dry bean.

The program will run on any computer using Windows 3.1, 95, 98 or XP operating system. The program requires about 5 megabytes of free hard drive space and 5 megabytes of memory. The program sells for $30, which includes the disks and a manual. If you would like to purchase a copy, please call (701) 231-7238.

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