water spouts

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Upcoming NDSU Field Days and Other Crop-related Events

Oakes Irrigation Research Site	Aug. 14	(701) 742-2189
Carberry, Manitoba Potato Tour	Aug. 14	(204) 834-6000
Tappen Irrigated Potato Field Day I-94, exit 217 (Pettibone), north side	Aug. 27	(701) 231-7076
Onion Tour Oakes area	Aug. 28	(701) 223-8332

Irrigation and Onions the Focus of Final '07 Water Tour

On Aug. 28, the North Dakota Water Education Foundation will conclude the 2007 summer water tour series with a tour focusing on the state's blossoming onion industry. Onions provide one of the highest potential cash returns per acre of any crop in the state grown on a commercial scale, and the door is open for future expansion.

Registration will be at 8:45 a.m. at the Buffalo Museum in Jamestown. Departing from Jamestown, the tour will visit the Oakes Field Site, Oakes Irrigation Research site, J.R. Palmer and Sons Produce Processing Plant and the Vculek Farm. Several experts representing all aspects of onion production from seed to storage to processing will be on hand to speak about this up-and-coming industry and answer producers' questions about growing onions in North Dakota. The tour will return to Jamestown about 5 p.m.

The public is invited to attend the tour, which costs $15 per person and includes transportation via air conditioned motor coach, informational materials, a lunch at the Pizza Ranch in Oakes, refreshments and a one-year subscription to the *North Dakota Water* magazine. Preregistration is highly encouraged to reserve a place on the bus and help make plans for meals, refreshments and materials. For more information or to register, contact Julie Ellingson at (701) 223-8332 or visit *www.ndwater.com* and click on the water tour link.

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Irrigated Potato Field Day at Tappen

The Irrigated Potato Field Day will be held on Monday, Aug. 27, at the irrigated potato research site near Tappen, N.D. The field day will begin at 4 p.m. and end with a meal sponsored by the Potato Associates.

The irrigated site is used by potato scientists at NDSU to conduct research plot trials for disease management, variety evaluation and production under irrigated conditions for the benefit of the irrigated potato industry primarily in central North Dakota. Researchers from NDSU will be present to explain and discuss the trials. The speakers this year will include Gary Secor, plant pathologist; Susie Thompson, potato breeder; Harlene Hatterman-Valenti, high-value irrigated crops specialist; and Neil Gudmestad, potato pathologist.

The irrigated research site is owned and supported by the Northern Plains Potato Growers Association to conduct irrigated potato research. The research site is on the north side of I-94 at Exit 217 (Pettibone exit). The public is welcome and the field day is open to all interested people.

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Oakes Irrigation Research Site Field Day

The annual field day at the Oakes Irrigation Research Site will be held on Tuesday, Aug. 14. Refreshments and rolls will be served at 9 a.m. with the tour starting at 9:30 a.m. The research site is 4.5 miles south of Oakes on North Dakota Highway 1.

Strip-till research will be presented. No-till continuous corn and corn on soybean ground utilizing fall strip-till will be shown by Walt Albus, Oakes research site supervisor. Richard Jenny, agronomist with Ag-Vise laboratories, will discuss nitrogen recommendations for corn. Visitors will be able to view no-till cabbage, carrots and onions planted on strip-tilled ground. Jim Loken and Sarah Gegner, NDSU, will present their weed control studies in onions. Ted Helms, NDSU, will discuss the soybean breeding program. A sugar beet variety trial will be a stop on the tour. Marcelo Carena, NDSU corn breeder, will present his work in the corn breeding program. Guests will be able to view row width and plant population studies in corn and soybeans, inoculation studies in soybeans and control of sclerotinia in sunflower.

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Potato Tour at CMCDC-Carberry in Manitoba

A potato tour will held at the Canada-Manitoba Crop Diversification Centre on Aug. 14 at Carberry. The research site is at the junction of Highways 1 and 5. A free barbecue will be served from noon to 1:30 p.m., followed by an on-site potato tour. Topics will include nutrient management, nitrogen mineralization and potassium fertilizer studies, soil and water management, pest management, variety trials, potato rotations, potato disease management (early blight and PVY), green manure and nematodes. The tour also will include a discussion about the Assiniboine Delta aquifer agri-environmental plans, soil compaction and irrigation trials.

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When Can You Stop Irrigating?

Sometimes determining when to shut off the irrigation system at the end of the growing season can be difficult. It often is a balancing act between ensuring the soil has sufficient moisture to take the crop to physiological maturity and reducing pumping costs. Applying irrigation water beyond maturity often is unnecessary and increases pumping costs.

Crop physiologic development is related to heat units received during the growing season, which are referred to as growing degree days (GDDs). Fortunately, accumulated GDDs for most irrigated crops can be found on the North Dakota Agricultural Weather Network (NDAWN – *http://ndawn.ndsu.nodak.edu/applications.html*). By comparing this year's GDDs with the amount accumulated in a normal year, you can determine when a crop is developing faster or slower than normal.

Knowing the physical indicators of physiological maturity of the crops being irrigated and checking soil moisture levels will help you determine when irrigation no longer is needed.

Corn should be irrigated until sufficient soil moisture is available to ensure that the milk layer of the kernel moves down to the tip of the kernel or black-layer formation (physiological maturity). With normal GDDs, physiological maturity is reached about 55 days after 75 percent of the plants have visible silks. The grain moisture may range from 32 percent to 40 percent at the time, depending on the hybrid. Yellow dent corn usually is well-dented at physiological maturity. Once corn is physiologically mature, the dry-down rate is approximately 0.5 percent moisture loss per day.

Dry edible beans: The last irrigation should be when the first pods are filling, or irrigation stopped when 50 percent of the leaves are yellowing on the plants. When overwatered, indeterminate varieties (pinto) may continue to vine and set flower with delayed maturity. For navy beans, physiological maturity is reached when at least 80 percent of the pods show yellowing and are mostly ripe, with 40 percent of the leaves still green. Pinto beans are physiologically mature when 80 percent of the pods show yellowing and are mostly ripe, and only 30 percent of the leaves still are green. Beans within pods should not show evidence of any green. If the beans have begun to dry, irrigation will not be needed because the beans no longer are removing much water from the soil profile.

Soybeans should be irrigated until sufficient moisture is available to allow full bean development and pod fill.

This stage is when leaves are yellowing (75 percent to 80 percent) and all pods are filled, with the lower pods just starting to turn brown. At physiological maturity, pods are all yellow and more than 65 percent of the lower pods have turned brown. Beans within pods should have little evidence of green and should be shrinking. Studies show that yellow pods sprinkled with brown are the best clue of physiological maturity. Usually if one or two pods show this symptom on the upper two or more nodes of the plant, it has reached physiological maturity. Also, soybeans should be tolerant of a killing frost at this time.

Sunflowers should be irrigated until sufficient moisture is available for the sunflower achenes (seeds) to fill. This is when the backs of the heads turn from a lime green to yellow green and ray petals are completely dried.

Potatoes will utilize soil moisture until harvest. Maturation stage begins with canopy senescence as older leaves gradually turn brown and die. Research has shown final irrigation can be used to reduce bruising during the harvesting process. On sandy soils, soil moisture content between 60 percent and 80 percent of field capacity (40 percent to 20 percent moisture depletion) provides conditions for a desirable soil load into the harvester with optimum separation of potatoes and soil and a minimum of physical tuber damage. If soil is dry before harvest, a final irrigation should be applied at least one week prior to harvest to raise the soil moisture level and also raise the tuber hydration level.

Alfalfa should be irrigated to maintain active growth until growth is stopped by a hard frost. Alfalfa going into the winter with adequate soil moisture has a much better chance of little or no winterkill.

Sugarbeets will utilize moisture until harvest time. Irrigation usually is terminated seven to 14 days before harvest to allow the soil to dry.

Reprinted and edited from a previous Water Spouts article by Duane R. Berglund, NDSU Extension agronomist (retired).

Using the Irrigators Formula for Water Management

The simple, effective irrigators formula can be used to calculate two important parameters needed for good irrigation water management. This simple formula has been used for more than 100 years, primarily with surface irrigation methods, to determine either the average depth of water application or the time needed to apply a certain depth of water to a field. It assumes the entire surface of the soil will receive water, so it works best with surface and sprinkler irrigation. However, with some modifications, it also can be used with drip irrigation. The formula takes the following form:

Flow rate x application time =
average depth of application x irrigated area

Using variables: $QT = DA$

Where: Q – Flow rate in cubic feet per second
D – Average depth of water application in inches
T – Time of water application in hours
A – Area of water application in acres

To use it with flow rate in gallons per minute (gpm), the formula is:
$QT = 453DA$

This formula can be rearranged easily and used with surface irrigation, sprinkler irrigation and drip irrigation water management.

Surface irrigation

The irrigators formula, as presented above, works with surface irrigation systems in areas with no or very little runoff (tailwater), such as level basins or sloping fields with blocked ends. For systems with tailwater, the volume leaving the field has to be measured or accurately estimated and subtracted from the volume applied. To use this formula with surface irrigation, the important variable usually is the depth, D, so the formula takes this form:

$D = QT/(453 \times A)$

For example, say you have an alfalfa field where the borders are 60 feet apart and 1,200 feet long. Each border would be about 1.65 acres in size (60 x 1,200/43,560). If your pump put out 1,500 gallons per minute and this was applied to one border at a time, after two hours an average application depth of 4 inches would be applied (1,500 x 2/(453 x 1.65)). This assumes the water can flow to near the end of the border in two hours. However, if the field had not been leveled in a few years and the water took five hours to reach the end of the field, then an average depth of about 10 inches of water would be applied to the border.

Sprinkler irrigation

For sprinkler irrigation systems, quite often the time to apply a certain depth of water is the necessary variable to calculate. For this situation, the formula takes the following form:

$T = 453\ DA/Q$

For example, you have a center pivot that covers about 128 acres, a well and pump that produces 800 gpm and you want to determine the number of hours needed to pump 1 inch of water to the field. Using the formula above, you need about 72.5 hours (453 x 1 x 128/800). Of course, with sprinkler systems, the pumped amount of water that actually gets into the soil is less than 1 inch.

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The sprinkler application efficiency for center pivots is about 85 percent, so that means you need 72.5 hours to get about 0.85 inch of water into the soil for the plants to use.

Let's look at another example, this time using the irrigators formula with a traveling big- gun sprinkler system. If you have a big gun on a field with 400-foot spacing between travel lanes 1,300 feet long and are supplying 400 gpm to the big gun, how long does applying 1.5 inches of water take? The area covered is about 12 acres (400 x 1,300/43,560). Using the formula shows the travel time down the length of the lane will be about 20 hours (453 x 1.5 x 12/400). However, the average application efficiency of big- gun sprinklers is about 70 percent, so only a little more than an inch of the pumped water gets into the soil.

Drip irrigation

To use the irrigators formula with drip systems, you often have to make some adjustment to the area term in the formula. Drip irrigation, sometimes called trickle irrigation, often is used in situations where the rows of plants are spaced far apart and water need not be applied to the entire surface area. For example, on grapevines, the drip lines may be 8 feet apart but water is needed only in a 4-foot-wide band near the roots. In this case, the area covered is half an acre out of one acre of grapevines. Drip irrigation is designed with zones and often the length of time to apply a certain depth of water is needed to program the controller. With smaller drip systems, the depth of water applied is needed. For example, if you have a row of raspberries 800 feet long being irrigated from a farm hydrant that produces about 10 gpm, and during a dry period, you want to apply 1 inch of water. Assuming the root width is about 4 feet wide, the area covered is about 0.075 acre (4 x 800/43,560). The time needed to apply 1 inch at 10 gpm is 3.4 hours (453 x 1 x 0.075/10). In a situation like this where the raspberries shade the ground, the drip irrigation system has an application efficiency of about 98 percent, so just about all the pumped water gets into the soil for the raspberries to use.

These are just a few examples, but you can see the irrigators formula is very useful and can be manipulated easily to help efficiently manage irrigation water.

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