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water spouts

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Oakes Irrigation Research Site Field Day Aug. 18

A field day will be held at the NDSU Oakes Irrigation Research Site – Robert Titus Research Farm on Thursday, Aug. 18. The recently expanded 40-acre site 4.5 miles south of Oakes on North Dakota Highway 1 is a substation of the NDSU Carrington Research Extension Center.

Some highlights for the field day include demonstrating the new state-of-the-art lateral-move irrigation system with individual sprinkler controls, the recently installed horizontal well and cutting-edge unmanned aerial vehicle (UAV) sensing systems.

The field day will begin with refreshments at 8:30 a.m. The tour will run from 9 to noon, with lunch following.

Topics that will be covered and the presenters are:

- **Welcome and how the Oakes Irrigation Research Site complements the NDSU Research Extension Center system** – *Blaine Schatz*, Carrington Research Extension Center director
- **Overview of the Oakes site's projects and how the new irrigation system is being utilized to provide new opportunities for research** – *Kelly Cooper*, Oakes Irrigation Research Site manager
- **Potato variety development at the site** – *Susie Thompson*, NDSU potato breeder

- **Given the fluctuations in corn prices, what are possible agronomic management decisions?** – *Greg Endres*, area Extension cropping systems specialist at the Carrington center
- **Improving white mold management in soybeans, and field pea research at the Oakes site for statewide benefit** – *Michael Wunsch*, plant pathologist at the Carrington center
- **The NDSU soybean variety development program** – *Ted Helms*, NDSU soybean breeder
- **Horizontal wells and new opportunities for irrigation** – *Tom Scherer*, NDSU Extension agricultural engineer
- **UAV technologies, including high-resolution (1.25-inch) images taken at the Oakes site, with a demonstration if weather permits** – *Paulo Flores*, nutrient management specialist at the Carrington center

Tour participants also will have the opportunity to review the site's irrigated corn hybrid and soybean performance tests.

For more information, contact the Carrington Research Extension Center at (701) 652-2951 or visit its website at www.ag.ndsu.edu/CarringtonREC.

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The Impact of an Extra Inch of Irrigation Water

At this time of year, the temperature is hot, the crop is fully developed and total seasonal crop water use exceeds rain plus stored soil moisture. Have you ever wondered what impact each inch of applied irrigation water has on the final yield?

Fortunately, through the years, many researchers have performed experiments to determine water productivity. Water productivity is the crop response to water at critical growth stages. It is the slope of crop water use vs. yield graph and indicates the additional amount of yield for each additional inch of water.

In the following table are yield estimates obtained from several research reports (mainly from North Dakota, Minnesota and South Dakota) for each crop. The table shows a range of yield responses probably due to soil types, growing conditions, crop varieties and geographic locations where the research was performed.

These numbers assume that stored soil moisture and rainfall are less than the required seasonal crop water use during the growing season and that the difference is provided by irrigation. You can look at seasonal crop water use estimates using the North Dakota Agricultural Weather Network (NDAWN) website at <https://ndawn.ndsu.nodak.edu/>. Go to Applications on the left-side menu and select Crop Water Use, then Tables.

Crop	Yield increase per inch of applied water per acre	Water use for the growing season
		(inches)
Wheat	4 to 5 bushels	15 to 16
Corn	8 to 14 bushels	18 to 20
Corn silage	1.25 to 1.75 tons	18 to 20
Alfalfa	0.2 to 0.25 ton	22 to 24
Pinto beans	250 to 300 pounds	15 to 17
Potatoes	2,200 to 2,900 pounds	17 to 19
Soybean	4 to 5.5 bushels	17 to 18
Sunflower	170 to 190 pounds	15 to 16
Sugar beet	1.5 to 1.7 tons	21 to 23

Here is something to remember about these yield increase estimates: They are only accurate for irrigation water applied to bring the growing season crop water use total to its maximum. Applying more water than the seasonal crop water use plus the water lost due to the application efficiency of the irrigation system will have a very small yield return per inch applied. It is the law of diminishing returns.

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Irrigation Scheduling and Small Rainfall Events

The rain gauge reads 0.12 from yesterday's light rain, you received no rain the day before and you do not expect rain today. Should you enter this amount in your irrigation scheduling program or worksheet?

The purpose of this article is to simplify your irrigation scheduling practices by discussing small rainfall events

and their impact on the soil water balance used for irrigation scheduling.

Irrigation scheduling – determining when and how much water to apply – is discussed here in the context of irrigation scheduling tools (three methods available online at www.ag.ndsu.edu/irrigation/irrigation-scheduling). These tools contain worksheets in which the user records rainfall and net irrigation, and crop water use is computed by the program or entered by the user. The models then compute an estimate of the amount or balance of water available to the crop.

The rainfall that enters the soil is net rainfall. The crop canopy intercepts and holds some rainfall, where it evaporates before it enters the soil. Because this rain does not reach the root zone, it does not contribute to the soil water balance and should not be entered into the worksheet.

As the first water droplets hit dry foliage, they splatter, with most of the water dropping off. However, some water adheres to the plant and forms a film. Based on computer modeling and lysimeter studies, Allen Thompson, agricultural engineer at the University of Missouri, estimated that a fully developed corn crop can hold between 0.05 and 0.10 inch of water on the leaves and stalks. The amount depends on wind speed, air turbulence and other atmospheric conditions.

He suggests neglecting rainfall events smaller than 0.10 inch for irrigation scheduling purposes. This does not mean you should subtract 0.10 from larger rainfall events because you would gain little accuracy by doing so.

To put this amount in perspective, suppose a sprinkler irrigation system applies enough water to supply the irrigated area with 1 inch of water. An efficiency of 85 percent translates into a loss of 0.15 inch. For applications of 0.50 to 0.75 inch, the efficiency may drop to 80 percent, which translates into losses of 0.10 to 0.15 inch.

In addition to canopy evaporation, irrigation system inefficiencies include losses from drift and evaporation as water droplets travel through the air. Other factors influence the contribution of small rainfall events to the soil water balance. Even if the top inch of soil is wet from a small rain, evaporation from the soil surface may make this additional water unavailable to the crop.

The rate of evaporation from the soil surface increases when the surface is wet because the ability of water to move through soil increases with the wetness of the soil. Common experience tells us that rainfall is variable with location, even within a single field. When small amounts are measured in a rain gauge, some areas within a field may have received no rain. Thus, you simply may want

to neglect amounts less than 0.10 inch to avoid the risk of under-irrigating parts of a field.

Another way to address this problem is to install more than one rain gauge in each field and schedule irrigations accordingly.

In summary, a general guide is that rainfall amounts smaller than 0.10 inch can be ignored for irrigation scheduling purposes. These small rainfall amounts do not need to be entered into soil water balance calculations.

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Water Use of Irrigated Crops

During most growing seasons, lack of water available to plants in July and August can have detrimental effects on yield. Irrigation can overcome those effects to ensure that you harvest the best yield possible.

In general, you could say that July is for vegetative growth and August is for developing the “fruit” of the crop. In other words, good irrigation water management is very important during these two months.

Below is a chart showing the average water use for many of the full-season irrigated crops in North Dakota. Note that for all of these crops, the water use is about 70 percent of the growing season’s total from emergence to harvest.

Average Water Use	July	August	Total
	inches		
Corn (grain and silage)	6.6	6.3	12.9
Pinto beans	7.0	5.8	12.8
Potatoes	7.0	5.5	12.5
Soybeans	6.5	5.9	12.4
Sunflowers	6.6	6.0	12.6

The corn water use for the first 20 days of July (assuming a May 10 emergence date) is shown in Figure 1, which was obtained from the North Dakota Agricultural Weather Network (NDAWN) website. Note that corn in the western half of North Dakota easily will surpass the average water use for July, and the eastern part of the state is using about the average amount (assuming the corn is irrigated).

However, irrigation management is highly dependent on the texture and depth of soil. Generally, sandy loams and loamy sands (the two most commonly irrigated soil

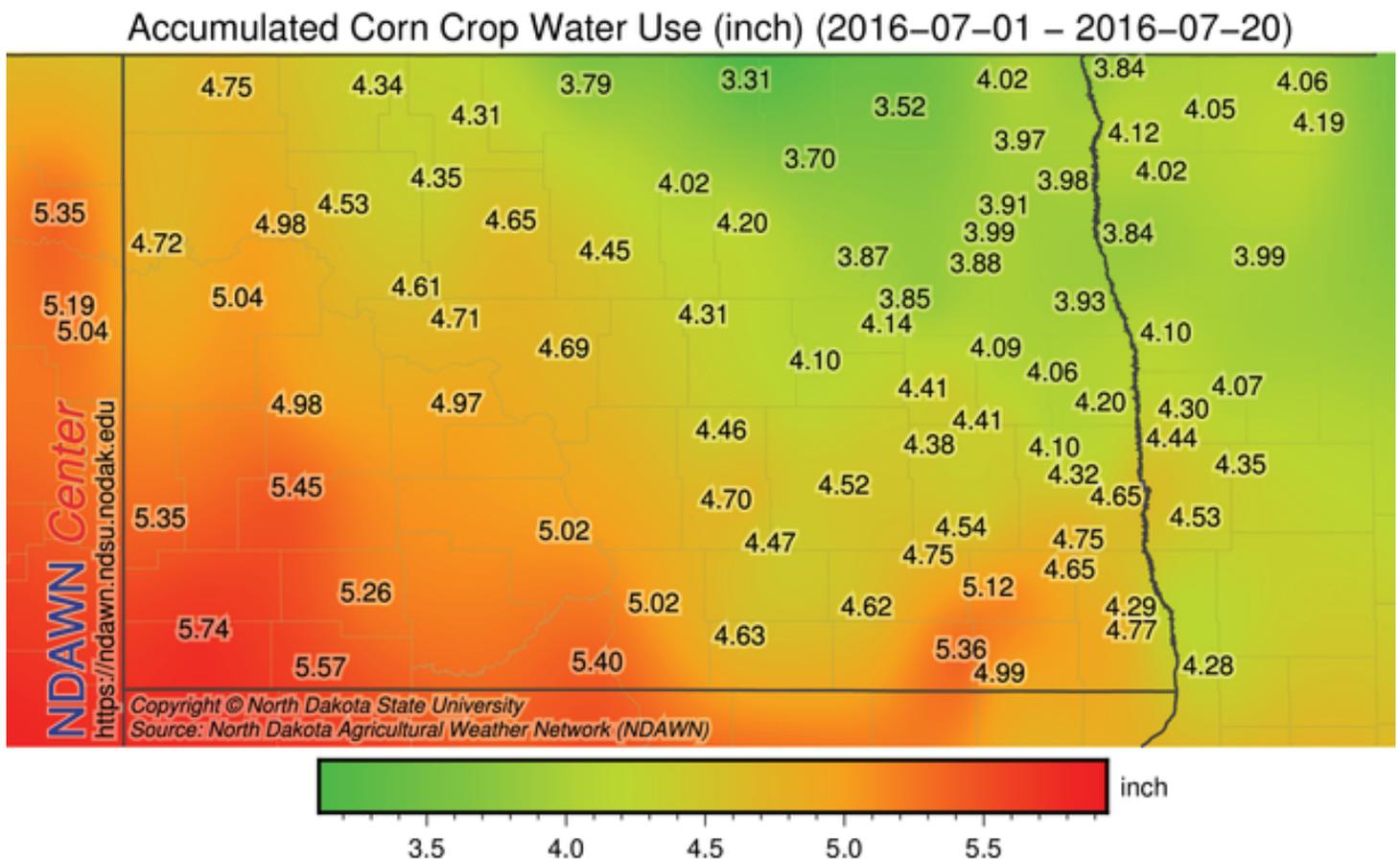


Figure 1. Corn water use for first 20 days of July, assuming a May 10 emergence date.



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County commissions, North Dakota State University and U.S. Department of Agriculture cooperating.

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textures) have about 1.5 inches of plant-available water per foot of soil depth.

The storms that have passed through the state the last couple of weeks have provided some very timely rain amounts, but with hot weather, crop water use will be greater than average. So be watchful; you may have to start irrigating sooner than expected.

More site-specific crop water use estimates can be obtained from the NDAWN website, <http://ndawn.ndsu.nodak.edu>. Click on Applications on the left side of the page and select crop water use on the pull-down menu.

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Summer Water Tours – North Dakota Water Education Foundation

Clean water is important for the development of North Dakota, and the best way to learn about water projects is to see them in person via a tour.

These tours provide a firsthand look at North Dakota's critical water issues. Registration is \$20 per person and includes tour transportation, meals, refreshments, informational materials and a one-year subscription to *North Dakota Water* magazine.

Current tours offered are:

- **Missouri River Expedition** – Aug. 3
- **Fargo-Moorhead Flood Facilities Tour** – Sept. 21 (full day)

For more information about each tour and to register, go to www.ndwater.com/programs and click on "Summer Water Tours" on the left-hand menu or send a check to NDWEF, PO Box 2254, Bismarck, ND 58502. Please indicate which tour or tours you want to attend and include the number of people who will attend.

For more information, give us a call or send an email.

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