www.ag.ndsu.edu/extension-aben/irrigation/water-spouts

water spouts

No. 324 August 2022

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Upcoming

2022 NDSU Field Days

Details for the field day at each location listed below will be posted to their websites.

Aug. 25 **Northern Plains Potato Growers Association Potato Field Day** – various locations (7 a.m. CDT breakfast and research presentations at Hoverson Farms, Larimore; noon lunch and field research tour at Forest River Colony, Inkster; 5:30 p.m. barbecue and research presentations of chips and fresh potatoes, Oberg Farms, Hoople)

Sept. 10 **NDSU Horticulture Research Farm near Amenia**, pre-registration required (10 a.m.-3 p.m. CDT, trees and ornamentals)

NDSU | EXTENSION

Northern Plains Potato Growers Association Field Day

North Dakota State University and University of Minnesota potato research will be highlighted during the Northern Plains Potato Grower Association (NPPGA) field day on Thursday, Aug. 25.

The field day tour will travel to three locations. The day will begin at 7 a.m. with breakfast at Hoverson Farms near Larimore. Research presentations will begin at 8:15.

A noon lunch at the Forest River Colony near Inkster will be provided followed by research presentations at the NPPG Irrigated Research site starting at 1:30 p.m.

The last stop will be at Oberg Farms near Hoople starting at 5:30 p.m. The final stop will include research poster/displays and an evening meal.

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The NDSU Arboretum Experience

The NDSU Department of Plant Sciences will host an educational event called “Branch Out: The NDSU Arboretum Experience” at the Dale E. Herman Research Arboretum on Saturday, Sept. 10 from 12:30 to 5 p.m.

The 35-acre arboretum is tucked into the countryside near Absaraka, North Dakota, and contains the largest collection of trees and shrubs in the northern Great Plains with over 5,000 species, cultivars and selections.

New this year, the event will feature four separate walking tours. Todd West, professor and the leader of the NDSU Woody Plant Improvement Program, and Connor Hagemeyer, research specialist, will lead the tours.

In addition to walking tours, presentations will include tree planting and aftercare as well as how to attract pollinators.

Unlike previous years, advance registration will be required to facilitate a more intimate learning experience. Registration is $10 and will be capped at 100 participants. Registration will close on Sept. 6 at noon or once capacity is reached. No refunds will be provided for this event unless it is cancelled by the organizer. To view the event schedule and to register, visit ndsu.ag/branch-out.

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Crop Water Use in August

August is typically our hottest and driest month of the growing season, but it is also the month when crops are developing their ears, pods, tubers, etc. where availability to water is most important for good yields. Irrigation water management during August is very important for long season crops like corn, dry beans, potatoes, sugarbeets and soybeans.

In normal years, crops use more water in July than August and the average rainfall amounts are correspondingly greater in July. However, this year is quite different in that our planting dates were generally two weeks behind normal.

The average rainfall in July is 2.75 inches at 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 generally greater in August than in July. Couple this together with declining water levels in wells and streams during August and it becomes obvious that irrigation water management becomes very important.

Normal water use for the months of July and August of common irrigated crops is shown in table 1.

Even though our growing season is about 2 weeks behind "normal," according to the crop water use estimates on the North Dakota Agricultural Weather Network (NDAWN: **https://ndawn.ndsu.nodak.edu**) website, corn water use in July assuming a May 20 emergence date was greater than average as shown in Figure 1.

As crops mature, it is common to cut back on irrigation during the latter part of August. This can be an expensive mistake. Research has shown that corn, moderately water stressed toward the end of the growing season, had an average yield reduction of 13% compared to corn that was fully irrigated to maturity.

Crop water use tables published in AE-792, Irrigation Scheduling by the Checkbook Method (www.ag.ndsu.edu/publications/crops/irrigation-scheduling-by-the-checkbook-method-1) show that water use is similar for most full season crops during August. See table 2 for estimated daily water use based on maximum air temperature.

Site-specific crop water use estimates (for each weather station) can be obtained from NDAWN website. Click on *Applications* in the left side menu. Remember the table above and the values from the website give the estimated water use by the crop. Applied irrigation water must be greater to compensate for evaporation and drift losses. For center pivot irrigation, research has shown that 85% application efficiency is reasonable for North Dakota. This means that almost 0.26 inches per acre must be pumped to get a net 0.22 inches into the soil for the crop to use. Likewise, if you pump 1.18 inches of water per acre only 1 inch will infiltrate into the soil for crop use.

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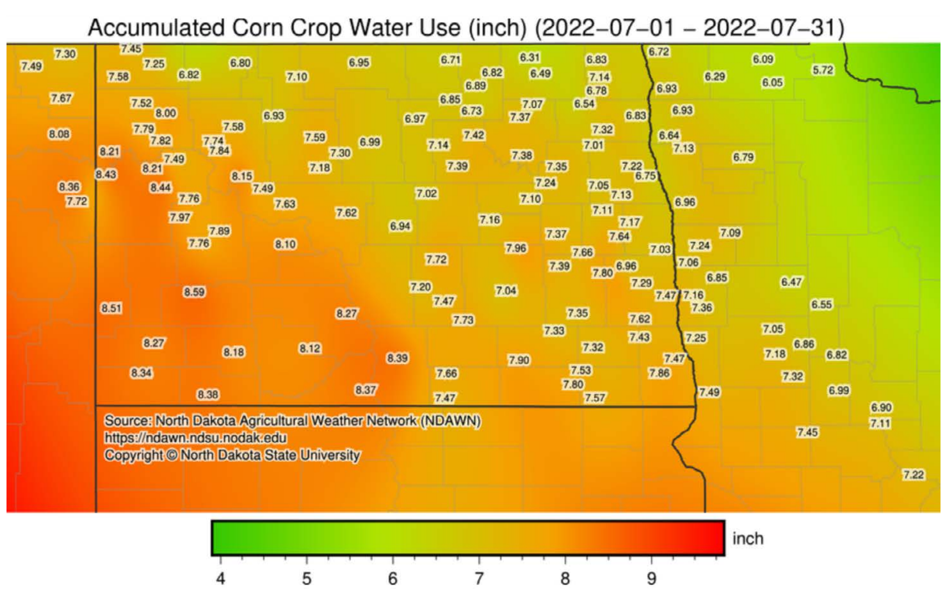
Table 1. Average Water Use (inches)

	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

Table 2. Estimated Daily Water Use

Maximum Air Temperature	Long Season Crops in August
50-59° F	0.08 inch
60-69° F	0.13 inch
70-79° F	0.19 inch
80-89° F	0.24 inch
90-99° F	0.29 inch

Figure 1. Estimated corn water use for July 1 to July 31 assuming no water stress.



Selecting the Right Size Pipe for Irrigation

When designing or retrofitting the pipeline and fittings needed to supply water to an irrigation system, one of the key decisions is picking the proper diameter of pipe for the desired flow rate. The best pipe size is not always the one with the lowest initial cost. With rising energy costs, the friction loss in the pipe at a given flow rate can affect the long-term cost of the pipeline. The objective of selecting the right size pipe is to minimize the sum of the initial capital investment and the annual energy costs.

In general, the cost to install an irrigation pipeline consists of capital costs and the annual operating or variable cost. The capital cost is determined by the installed purchase price of the pipe and fittings along with the service life of the pipe. PVC pipe installed below ground should last at least 40 years. The annual cost of the pipe can be found by amortizing the purchase price over the service life of the pipe and fittings. Amortization is similar to repayments on a loan. Actually, if a loan were taken out to purchase the pipe and fittings, the annual cost would be the loan repayment.

The annual operating cost of a pipeline depends on the number of hours pumping water and the friction loss in the pipeline at the design flow rate. At a given flow rate, smaller diameter pipe and fittings will have greater friction loss than larger diameter pipe. The friction loss depends on the pipe diameter, pipe material, length of pipeline and the flow rate passing through the pipeline.

An example of using economics and engineering to select an appropriate pipe diameter is shown in Figure 1. The example uses the following conditions:

1. Flow rate is 750 gallons per minute.
2. The electric motor and pump run for 900 hours during the growing season.
3. The cost of electricity is $0.10 per kilowatt hour (includes annual and demand charges)
4. The length of the PVC pipeline is 1,600 feet.
5. Pumping plant wire to water efficiency is 60 percent.
6. Life expectancy of the buried PVC pipe is 40 years.
7. The interest rate is 7%.

From figure 1, you can see that both 8 and 10-inch diameter pipe would be economical choices for this example, but the 8-inch pipe would be the lowest cost. It is obvious that pipe less than 8 inches in diameter has much greater energy costs and that pipe larger than 10 inches in diameter have higher investment costs. But which diameter pipe would you choose for this example? If you expect energy costs to increase in the future, like the price of diesel fuel in recent years, and you could afford the higher capital investment costs, the 10-inch diameter pipe would be the better choice. Additionally, the 10-inch pipe would reduce energy costs if you decided to extend the pipeline to an additional center pivot in the future. However, if you expect energy costs to stay relatively constant over the next few years like electrical costs have done, then the 8-inch diameter pipe may be the best choice.

I did a survey of irrigation dealers to get the current installation costs for different diameter of PVC pipe used in this example. However, these costs can change because the price of PVC pipe can vary significantly depending on the price of petroleum, availability of resins, production capacity of pipe manufacturers and transportation costs.

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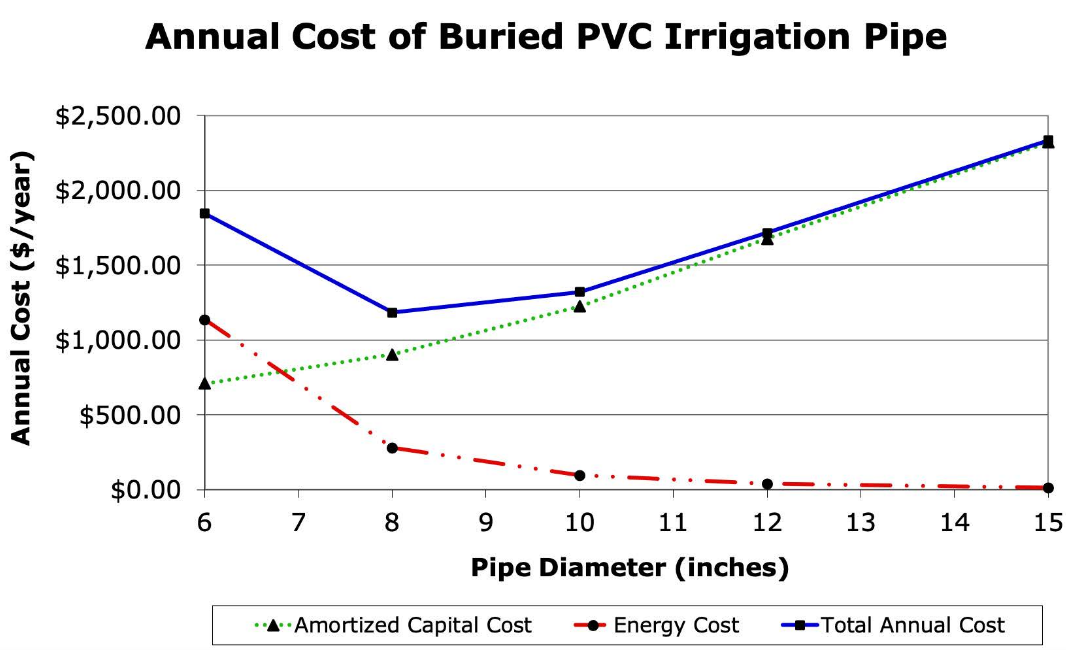
Figure 1. Annual irrigation pipeline cost for various diameter pipe using the example conditions in the text. Costs will change if the flow rate or interest rates change.



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Selecting the Right Size Pipe for Irrigation — Continued

There are so many variables that affect the economic selection of pipe that I created a spreadsheet in Microsoft Excel to explore how they affect selection of pipe size. In general, the two most important factors affecting the most economical pipe selection are the flow rate and cost of energy for pumping. I used the spreadsheet to generate the most economical pipe diameters based on capital investment costs and pumping energy costs. Using the pipe sizing spreadsheet the optimal pipe sizes for various flow rates are shown in Table 1.

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Table 1. Optimal pipe diameters for various flow rates.

Flow Rate (gallons per minute)	**Most Economical Pipe Diameter** (inches)
200	4
400	6 or 8
600	8
800	8 or 10
1000	10
1200	10
1400	10 or 12
1600	10 or 12