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water spouts

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Virtual Irrigation Workshop

Normally, we hold an irrigation workshop in conjunction with the North Dakota Water Users Convention and Irrigation Expo, but due to COVID-19, we have to adapt. The North Dakota Water Users Association is planning a virtual conference and we are planning to hold a virtual irrigation workshop the third week in December. Look in the October issue for more information.

Fall Maintenance for Irrigation Equipment

With the early frost in September, the irrigation season is basically over. We hope we will have a normal harvest season.

But now is not the time to park and forget about the irrigation system. Proper maintenance will extend the useful life of irrigation equipment. Fixing small problems in the fall is much less expensive than repairing a major breakdown next year.

To winterize your irrigation system, consult the service manuals and the following checklist. If you don't feel confident doing the maintenance or you don't have the time, contract with an irrigation dealer to do the service.

Water Delivery System

If your water source is a well and you have iron in the water, fall is the proper time to chlorinate it. Chlorine will control iron bacteria that, if left unchecked, will plug the screen and reduce the production capability of the well.

The chlorination procedure is outlined in NDSU Extension publication AE97, "Care and Maintenance of Irrigation Wells." You can obtain a copy from the Extension office in your county or the NDSU Agriculture Communication Distribution Center at 701-231-7882. You also can find it online at www.ag.ndsu.edu/publications/crops/irrigation-drainage.

Pipes, valves, tanks, centrifugal pumps, etc., should be drained or pumped out to prevent damage from freezing. Underground pipelines need to be drained or pumped. Drains and pump-out risers should be capped following draining or pumping to keep water from seeping back into the line.

Pipeline pump-out locations should be checked a couple of days after pumping. If the pipe is full of water, it will need to be pumped again. Protect pump-out risers and other equipment from livestock. Close or cover any openings that might invite rodent entry.

Electrical Motors and Control Panels

- Check all motor openings to see they are screened properly to keep rodents out. If a screen is damaged or missing, replace it with 1/4-inch metal mesh screen. This screen can be left in place during operation without plugging with dust and debris. Electric motors do not need to be covered. Leaving them open to free air movement will keep moisture condensation in the motor to a minimum.
- Lubricate all bearings.
- Lock the control box in the "OFF" position.
- Spray electrical contacts with contact cleaner to displace dirt and moisture and prevent corrosion.
- Replace or repair panel door seals if hard or broken to keep out moisture, dust and rodents.
- Check the oil level in the reservoir and change if discolored.

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Pumps

- Lubricate all bearings. If oil lubricated, after the pump is cold, open the oiler and let oil drip into the line shaft bearings. Rotate the shaft to distribute the oil over the entire bearing. The cold oil will adhere to the bearings and provide good winter protection.
- Drain water from the pump and connecting pipelines, and replace the plugs.
- Loosen the packing gland if used.
- Lubricate the shaft.
- Loosen any belts. Insert grease-proof paper between the belts and pulleys.
- If possible, remove the flow meter and pressure gauges and cover the holes. If the flow meter or pressure gauges do not work, this would be a good time to have them repaired or replaced.

Aluminum Pipe

Pipes should be stored on racks so that one end is above the ground to permit drainage and air circulation. If possible, store at your farmstead to deter thieves. If left in the field, store them so they are out of sight.

Protect pipes from livestock. Remove gaskets, inspect and if any are damaged or leaked during use, obtain replacements before next year's irrigation season. Store the gaskets in clean water in a place that will not freeze. This prevents them from cracking and drying out. Do not store gaskets on a nail or hook. If they cannot be stored in water, place them over a tube about the same size as the gasket and keep out of direct sunlight. Covering the gaskets to restrict air movement also will help prevent drying out and cracking. Loosen connectors of pipe remaining in the field.

Sprinkler Systems

- Each sprinkler head should be inspected. Make sure the nozzle is not chipped or broken. Look for any broken parts on the sprinkler. Note the location of damaged sprinkler heads and tag with a colored ribbon. Replace or fix them before the next irrigation season.
- Check all gearboxes for moisture accumulation and make sure each contains the proper amount of grease. Drain off any moisture present. If excessive moisture is evident, drain and replace the grease because water mixed with the grease will decrease its lubrication ability and not provide the needed protection.
- Lubricate all fittings.

- Check the water drain valve at each span of a center pivot system.
- Remove and clean the system end cap. Here is where sand, scale and other debris collect during the summer. Remove the sand trap, flush the system and replace the trap. Drain all water-carrying lines. Drain the booster pump case.
- On open fields, park the center pivot facing into or with the prevailing wind, either the northwesterly or southeasterly direction. If a windbreak is nearby, park the center pivot next to it for wind protection.

Chemical Injector Pumps

- Flush with water. If belt driven, loosen the belt. If transportable, store in a clean, dry place.
- Drain and refill the gearbox; lubricate the pump.

Internal Combustion Engines

Internal combustion engines need special attention regarding lubrication, the cooling system, ignition system, engine openings and fuel system. If it is moveable, storing it in a building would be ideal, but most irrigation engines are stationary, so proper winterization is especially important.

- Fall or spring: Change the oil and filter when the engine is warm, then run the engine briefly to circulate the oil. Clean and replace the air cleaner.
- Remove and clean the spark plugs, pour 2 ounces of oil into each plughole and replace the plugs. Rotate the crankshaft several turns to allow the oil to coat the cylinder walls thoroughly.
- The cooling system should be flushed and refilled with the proper anti-freeze solution. This will prevent rust and scale from forming in the cooling system.
- For gasoline engines, add fuel stabilizer and run the engine, or drain all fuel from the tank, lines and carburetor. For diesel engines, fill the tank. Do not drain. Replace the fuel filter and leave all lines and injectors filled with diesel fuel. For LP gas engines, drain the vaporizer-regulator (both fuel and water lines).
- Seal all openings (air cleaner inlet, exhaust, distributor cap and crankcase breather tube) with weatherproof tape.
- Lubricate all accessories. Loosen belts. Remove the battery, charge it and store it in a cool, dry place.

Tom Scherer, 701-231-7239

NDSU Extension Agricultural Engineer

Thomas.Scherer@ndsu.edu

Automatic Control of Irrigation for Watermelons and Tomatoes

The increased interest in local foods and farmers markets results in a demand for timelier and higher-quality vegetable production in North Dakota. For successful, sustainable, consistent and high-quality crop production, the grower must overcome major climate limitations.

The two most limiting factors are water supply and cold temperatures during the growing season. These limitations often delay or hinder timely production of high-value vegetable crops. Without proper water management and warm temperatures, making specialty crops, especially vegetables, become commercially profitable for North Dakota growers is very difficult.

Funded by a grant from the North Dakota Specialty Crops program, we developed a study to evaluate the use of different types of mulch on the production of watermelons and tomatoes. Included in the study was the design and installation of a low-cost automatically controlled drip irrigation system.

Using automatically controlled drip irrigation with mulch can provide better growing conditions by maintaining

optimal soil moisture and warmer soil temperatures early in the season, and extending the growing season.

With mulch application, soil evaporation is reduced due to the cover. The total crop evapotranspiration also is reduced due to reduced net radiation and energy balance re-distribution.

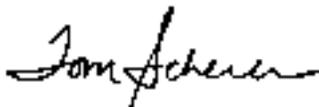
Typical irrigation scheduling based on weather data and reference evapotranspiration may not work for this drip-mulch situation. However, by installing soil moisture sensors in the root zone, the measured in-situ moisture value can be used to determine when irrigation is needed.

The actual irrigation time and amount can be estimated based on the soil, area of coverage and the crop type and stage. This setup can schedule the irrigation and automatically control the drip-mulch system, and eliminate the concerns of variable soil moisture and crop water demands.

Many products are on the market that can schedule an irrigation using soil moisture sensors, especially in the landscape and turfgrass industries. However, for an agricultural field with no electricity, no internet connection and many control zones, our options were limited. **Figure 1** shows the drip-mulch field and one control system.



Figure 1. Drip-mulch field and one controller with irrigation water flow direction marked on the pipe. (Xinhua Jia, NDSU)



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For more information on this and other topics, see www.ag.ndsu.edu

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

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This publication will be made available in alternative formats for people with disabilities upon request, 701-231-7881.

The low-cost Watermark™ sensor measures soil water potential. Two were installed at the 15 and 30 centimeter depth in the center of each control plot for each crop/mulch combination.

When the average of the two sensors read below minus 25 kilo pascals (kPa) of soil water potential in the root zone, a signal was sent to the controller that irrigation was needed. The controller was programmed to irrigate early in the morning every day, depending on the vegetable type.

However, if the soil water sensor indicated no irrigation was required that day, the controller did not open the valves. This low-cost system, the two controllers, two soil moisture sensors and the valve are all battery powered, with a total cost of less than \$300. It automatically can irrigate the vegetables with a pressured water supply.

The drip-mulch system with eight zones was tested using watermelons and tomatoes with three types of mulch plus no-mulch plots in 2019 and 2020 in Fargo. The preliminary results showed that irrigation can be supplied precisely as it is programmed. In 2019, due to

plenty of rainfall, irrigation was needed only two times in the no-mulch and fabric mulch plots, while for black and clear plastic mulched plots, no irrigation was needed.

The watermelons performed much better with the clear plastic mulch with much higher yield and sugar content, compared with the other three mulches. For tomatoes, however, the black plastic mulch produced a greater number of tomatoes per plant and higher fresh yield. Both the clear plastic and black plastic mulch produced earlier maturing produce.

With the positive results from these two years, the future of drip-mulch in the North Dakota cold is bright. The combination of irrigation with warmer soil can help farmers grow better specialty crops that produce a better quality and yield. Therefore, more research and demonstration sites are needed to test this type of system for different soil types and specialty crops at different locations.

Xinhua Jia, 701-231-6453

Professor, NDSU Agricultural and
Biosystems Engineering

Xinhua.Jia@ndsu.edu