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Irrigation Workshop in Bismarck Thursday, Dec. 6

The workshop will be at the Best Western Ramkota Hotel as part of the North Dakota Water User Association's annual convention. NDSU Extension, the North Dakota Irrigation Association and North Dakota Water Users Association sponsor the workshop.

The convention will include an irrigation and water products exposition. As part of the workshop, we are planning a special session on **technical innovations in irrigation**. More information about the workshop will be in the October issue of Water Spouts.

Irrigated Corn and Soybeans

North Dakota has about 300,000 acres of irrigated land. In 2017, the state had more than 110,000 acres of irrigated corn and almost 75,000 acres of irrigated soybeans. These two crops made up more than 61 percent of the irrigated land, and the totals are probably similar this year.

With the warm weather this year, harvest is earlier than normal, and with the onset of the trade negotiations

and resultant disruption in the overseas marketing, especially soybeans, the need for on-farm storage becomes very important. In this issue, I have included two articles to give you some options to consider.

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Alternative Grain Storage Methods

All storage options should keep the grain dry and provide adequate aeration to control the grain temperature. Grain must be dry and cool (near the average outdoor temperature) when placed in alternative storage facilities. Grain has an acceptable storage life before the quality is reduced enough to impact its value.

Allowable storage time is cumulative, so consider the amount of storage life remaining when deciding if you can store grain longer. Grain going into storage for a second year needs to have been kept cool and dry during the first year and have few broken or cracked kernels.

Structural Issues

Grain pushing against walls can damage buildings not built for grain storage. Consult with the building company. Before placing grain in a building previously used for grain storage, look for anything out of alignment, such as wall bowing and distortions in the roofline.

Bowing or bending indicates the load on the building exceeded the load for which it was designed and built. This weakens the structure. Also examine connections for separation or movement and add a gusset or splice to reinforce the connection if necessary.

Storing in Bags

Storing grain in poly bags is a good option, but it does not prevent mold growth in damp grain or insect infestations. Place grain in the bag at recommended storage moisture contents based on the length of storage and outdoor temperatures during the potential storage period.

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Grain in bags cannot be aerated to control grain temperature. The average temperature of dry grain in bags will follow the average outdoor temperature.

Select an elevated, well-drained site for the storage bags. Run the bags north and south so solar heating is similar on both sides. Sunshine on just one side heats that side, which can lead to moisture accumulation in the grain and spoilage on the cool side.

Grain Piles

Precipitation is a severe problem for uncovered grain in piles. A 1-inch rain will increase the moisture content of a 1-foot layer of corn by 9 percentage points. This typically leads to the loss of at least a couple of feet of grain on the pile surface, which is a huge loss. Aeration and wind blowing on the pile will not dry wet grain adequately to prevent spoilage.

Use a cover to prevent water infiltration. A combination of restraining straps and suction from the aeration system holds grain covers in place.

Drainage around the pile is critical. About 25,000 gallons of water will run off an area about 100 by 400 feet during a 1-inch rain. This water must flow away from the grain and the area next to it. When determining a location for a pile, examine the entire area to assure that flooding will not occur during major rain events.

The outdoor ground surface where grain will be piled should be prepared to limit soil moisture from reaching the grain. The storage floor should be higher than the surrounding ground to minimize moisture transfer from the soil into the grain. Make sure the ground surface is crowned.

Aeration

Aeration must provide adequate airflow to control grain temperature. Place perforated ducts on the grain under the cover to provide a controlled air intake for the aeration system and airflow near the cover to minimize condensation problems under the cover.

Place properly sized and spaced ducts under the pile on the ground to pull air through the grain. Some storage options use a perforated wall for the air inlet. Assure that the air does not “short-circuit” to the fan.

Cooling Stored Grain

Temperatures below about 60 F reduce insect reproduction, insects are dormant below about 50 F, and extended exposure to temperatures below about 30 F can kill insects.

Cooling grain as outdoor temperatures drop will reduce moisture migration and the condensation potential near the top of the grain pile. Also, the grain should be cooled because grain moisture content and temperature affect the rate of mold growth and grain deterioration. The allowable storage time approximately doubles with each 10-degree reduction in grain temperature.

Grain should be cooled whenever the average outdoor temperature is 10 to 15 degrees cooler than the grain. It should be cooled to near or below 30 degrees for winter storage in northern states and near or below 40 degrees in southern states.

Aeration ducts need to have perforations sized and spaced correctly for air to enter and exit the ducts uniformly and obtain the desired airflow through the grain. The maximum spacing for aeration ducts is equal to the grain depth to achieve acceptable airflow uniformity.

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Enhancing Soybean Storage Starts With Harvest Moisture

Molds develop more rapidly in soybeans with seed coat cracks, so the amount of mechanical damage occurring during harvest affects the beans' deterioration rate. A moisture content of about 13 percent at harvest is optimal for mitigating mechanical damage. Field losses, splits and cracked seed coats increase significantly when seed moisture falls below 11 percent or when mature beans undergo multiple wetting and drying cycles.



The market moisture for soybeans is 13 percent, which is fine for storing soybeans through winter, but beans should be at 11 percent moisture to limit mold growth and deterioration if stored into spring and summer. The storage life is roughly doubled for each percentage point of reduction in moisture content. Soybeans at 11 percent moisture have similar storage characteristics as wheat or corn at 13.5 to 14 percent moisture.

Storage Temperature

Controlling soybean temperature during storage is critical. Free fatty acid percentages, a negative characteristic, tend to increase with storage moisture, temperature and time. At 12 percent moisture, free fatty acid percentages increase slowly with storage time if the beans are kept cool. In one study, the average free fatty acid content of 12 percent moisture beans stored at 50 F stayed below 0.75 percent but exceeded this level after only four months when stored at 70 F.

Soybeans should be cooled as they are stored through the fall and winter to maintain quality. Aerate to keep the soybeans within 10 to 15 degrees of the average outdoor temperature during the fall. Soybeans should be stored during the winter near 30 F in northern states.

During the spring and summer, aerate stored soybeans to keep the temperature as cool as possible – preferably cooler than 50 to 60 F. These temperatures enhance soybeans' storage life, and reduce mold and insect activity. Ventilate the top of the bin to reduce solar heating affecting the beans at the top of the bin.

Monitor soybeans at least once every two to three weeks during winter storage and every week to two weeks during the fall until the grain has been cooled to winter storage temperatures and again during the spring and summer. Measure the grain temperature and watch for indications of problems such as condensation, insect activity and increasing grain temperatures. Record the temperature and grain condition to help track any changes that may occur.

Use available tools, but don't turn everything over to automation. Temperature cables allow producers to monitor the stored grain temperature at several locations, and fan controllers can operate fans according to desired air conditions, but you still need to monitor the grain and verify that fans are operating as desired.

Operating an aeration fan will help move moisture from wet beans to drier beans. Moisture movement will be minimal without aeration airflow. Initially, fans will have to run longer to equalize the moisture content than to cool the grain. The moisture will not be all the same, but it should become more uniform.

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The Pressure Gauge and Flow Meter

The day-to-day indicators of irrigation system performance are an accurate flow meter and pressure gauges. The performance of irrigation systems that use wells for their water supply can vary during the growing season. Recording the pressure and flow readings will indicate how much the performance may change.

However, flow meters appear to be equipment that many irrigators don't use, don't repair and constantly overlook when managing their irrigation systems. Through the years, I've conducted pumping plant efficiency tests on many irrigation systems, and finding pumping plants without a flow meter or with a flow meter that's not working is common.

North Dakota winters are hard on flow meters, and the freeze/thaw cycles quickly cause the bearings and other moving parts to wear out. This also is true for the other parts of the irrigation system. Now probably is the time to repair the old flow meter (if that's possible) or purchase a new flow meter.

An accurate, working flow meter provides very valuable irrigation management information. Accurate flow measurement is important for chemigation, selection and modification of sprinkler nozzles, calculating the application rate of the pivot, checking the production of the well and tracking the performance of the pump.

However, the most important reason to have an accurate flow meter is that it records the amount of water pumped during the growing season. This is necessary for reporting to the North Dakota State Water Commission.

Having some irrigation wells that are valved-back due to seasonal changes in aquifer levels is not uncommon. When the well is valved-back and doesn't have a flow



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

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meter, you have no way to measure how much water is being applied to the crop.

If your flow meter doesn't work, have it repaired or buy a new meter. If your flow meter is working properly, consider removing it this fall and storing it in a warm place for the winter. During fall maintenance, an extra 15 minutes to remove the flow meter and cover the hole in the pipe is worthwhile.

Pressure Gauges

The pressure gauge is an often-overlooked and neglected instrument on many irrigation systems. Yet it probably is the most important indicator of irrigation pump operation readily available to you.

Every time you turn the pump on, the pressure gauge receives a "shot" due to pressure fluctuations from filling the pipeline. In addition to the bounce at turn-on, while the pump is operating, pressure fluctuations and vibrations often occur. Because of these conditions, pressure gauges (even liquid-filled types) lose their accuracy after a couple of growing seasons.

If your pressure gauges are old and you question their accuracy, now would be a good time to replace them. Many center pivots have a pressure transducer connected to the control box. The pressure is displayed in the panel along with other operations parameters. Having an accurate pressure gauge at the pivot point provides a check on the accuracy of the pressure transducer.

Because a pressure gauge only conveys useful information when you are looking at it, why not install a shut-off valve between the gauge and the pipeline? When you want to check the pressure, just open the valve. This will extend the life of the pressure gauge and ensure you are getting accurate readings. Plus, this makes removing the pressure gauge easy to do at the end of the season.

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