SeedSCOOP

POST HARVEST GRAIN STORAGE MANAGEMENT

- Grain storage problems can start with harvest and occur due to poor grain quality and poor storage practices. If grain storage is not managed correctly, a severe quality and financial loss can occur.
- Lack of grain temperature management is the main cause of grain spoilage.
- Stored grain should be checked routinely for changes in surface conditions, temperature, grain condition, insects and smells.
- Safety precautions and emergency plans should be in place before handling grain or entering any grain storage bin.

Causes of Storage Problems

To help avoid grain quality issues, first and foremost, grain should be dried to the proper moisture content before storage. The recommended moisture contents for corn and soybean at various storage periods are shown in Table 1. According to the University of Nebraska, corn at 19% moisture content and a starting temperature of 75°F can lose a market grade in approximately five days if aeriation is not working and grain starts to heat up.[2]

Other causes of grain quality issues during storage involve storage management, and include:

- Inadequate grain cooling and aeration.
- Improper grain checks.
- Poor initial grain quality.
- Improper insect control.[1]

Grain Cooling and Aeration

If the grain has dried to the proper moisture content, improper temperature management is the primary reason for spoilage. When the grain temperature in the bin does not remain consistent, moisture in the bin can migrate and accumulate in areas resulting in grain spoilage. Spoilage from moisture migration can occur at any time temperatures vary in the bin but is more common when the warm grain is stored, and outside temperatures are cold. Inside the bin, the grain is well insulated and without proper temperature management, the grain and surrounding air can hold the initial temperature when putting into the bin (50-80°F). Regardless of the time of year, grain should be maintained within 15-20°F of the average monthly temperature.

Aeration is used to control grain temperature by moving air through the grain. In general, aeration should not be used to dry grain; although the moisture content may slightly change. Aeration is used to cool grain in the fall or help to warm it in the spring. Grain that is cooled in 10-30°F increments for winter storage should be less subject to mold growth and insect reproduction.

The area of the grain that follows the temperature change through the bin during aeration is known as the cooling or warming zone. One cooling/warming cycle is the amount of time needed to move a cooling/warming completely through the bin. Once a cycle has begun, the fan should operate continuously until the zone moves completely through the bin.

On-farm storage systems may be equipped to move air between 1/10 cfm (Cubic feet of air per minute)/bu to over 1 cfm/bu. The rate depends on the bin type, air distribution system, desired storage moisture percentage, and proper management procedures. The time it takes to complete a full cycle depends on the aeration rate and time of year and can be figured with following formulas by season:

- Fall hours = 15/(cfm/bu)
- Winter hours = 20 /(cfm/bu)
- Spring hours = 12/(cfm/bu)

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Table 1. Maximum percent moisture content for safe corn and soybean grain storage.[1]	
Grain and Storage time	**Maximum moisture content for safe storage**
Shelled Corn:	
Sold by Spring	15.5%
Stored 6-12 months	14%
Stored > 1 year	13%
Soybeans:	
Sold by spring	14%
Stored up to 1 year	12%
Stored > 1 year	11%
Moisture percentages for good quality grain. Reduce 1% for poor quality grain (drought, disease, frost, harvest damage, etc.) McKenzie, B., and Van Fussen, L. 1995, Purdue University	

Grain Checks and Observations

Taking multiple grain samples when filling the bin and during storage can help account for variable moistures and reduce the risk of storage molds. Use the highest moisture content value to determine management options that can reduce the risk for storage molds, hot spots, and spoilage. Averaging sample values may not adequately address pockets of grain with higher moisture content.

When temperatures are quickly changing in the fall and spring, stored grain should be checked weekly. This can be reduced to every two or three weeks when temperatures are more consistent and tend to be colder throughout the winter.

Keep an eye on the surface conditions, temperatures, grain condition, and be mindful of different smells, both in the grain and exhaust air. Grain that is crusting, wet, or slimy as well as has ice or frost accumulation and/or heating can be a sign of poor conditions and spoilage. Condensation or frost on the underside of the roof, hatches, and vents on a cold day almost always indicate a moisture migration problem. If crusting occurs, stir the surface to break up the crust or if severe, remove the spoiled grain.

Once the grain is cooled, continue checking exhaust air for smells to help identify grain that could be beginning to spoil. Regardless of the season or weather, if signs of heating or hot spots are detected, run the fan continuously until no further issues can be detected. If hot spots can't be remedied with aeration, grain may have to be removed, cleaned, dried, or even sold. It may be better to sell at a lower price than to allow an entire bin to go out of condition.

Managing Stored Grain During Fluctuating Temperatures in the late Fall and Winter.

Be aware of the major daily temperature fluctuations in your area. It's typical during the fall and winter to have cooler, moist morning with temperatures in the 30°F that rise to sometimes in the 50's, 60's and even 70's °F during the afternoon hours. There are parts of the country that are experiencing this on a regular basis. The disadvantages of running the fans continuously during this type of temperature variation are over-drying or rewetting the grain from the fluctuations in temperature and dewpoint.

A controlled and automated grain management system constantly measures and assesses these conditions and only pushes air in the bin during the periods of the day when the air is at its desirable period: not too moist and not too dry. Trying to do this manually is a very difficult task. As a result, you may notice your automated system may run the fans for a few hours in the morning and again in the late afternoon. This avoids the cost of over-drying and rewetting that would take place if fans were running all day.

Another important thing to consider is that automated systems can also help manage grain if you just need to cool it. Some growers may have their grain come in at optimal moisture but need to cool it in order to increase its storage life. Warm and dry air may not be the optimal fix, but an automated system can help run through cool air at certain times of the day to cool the grain down to the desired temperature and maintain moisture content.

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Insect Control

Insect infestations can arise from residue in combines, handling equipment, and old grain left in storage.[2] In addition to all the other management precautions, observations for insect activity should be conducted. Some preventive measures that may help prevent insect issues in stored grain include:

- Clean debris from harvesting, handling, and drying equipment, and from the inside and outside bins before putting in new grain.
- Repair any areas in the bin that may cause leakage.
- Apply an approved insecticide to surfaces of clean, empty bins before filling.
- New grain should NOT be put on top of old grain-just a few insects in the old grain can infest the entire bin.
- If insects had infested the previously-stored crop, fumigate the empty bin to kill insects under the floor and in aeriation ducts.

Safety

The dangers of grain handling cannot be stressed heavily enough. NEVER enter a bin when the grain is flowing and be extremely cautious around all grain handling structures and equipment. Be sure to have safety precautions and emergency plans in place and make them known to all workers and bystanders on the farm.

Sources:

[1]McKenzie, B. and Van Fossen, L. 1995, Managing dry grain in storage. Midwest Plan Service. AED-20. Purdue University. www.extension.purdue.edu.

[2]Dom. T. 2010. Ensure quality grain storage by starting with clean equipment bins. The University of Nebraska-Lincoln. http://cropwatch.unl.edu.

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