Tips for Successful Grain Storage

- Causes of grain storage problems are poor grain quality and poor storage practices.
- Grain temperature management is one of the most important factors to help avoid grain spoilage.
- Routine grain observations during storage should be conducted to look for changes in surface conditions, temperatures, grain condition, insects, and smell.
- Safety precautions should be used while handling grain.

Causes of Storage Problems

To 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. 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]

Table 1. Maximum percent moisture for safe corn and soybean grain storage.[1]

Grain type and storage time	Maximum moisture content for safe storage
Shelled corn	
Sold by spring	**15.5%**
Stored 6—12 months	**14%**
Stored more than 1 yr	**13%**
Soybeans	
Sold by spring	**14%**
Stored up to 1 year	**12%**
Stored more than 1 yr	**11%**

Moisture percentages for good quality grain: reduce 1% for poor quality grain (drought, disease, frost, harvest damage, etc.)

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 aeration is not working and grain starts to heat up.[2]

Grain Cooling and Aeration

If grain has been 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 constant, 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 warm grain is stored and outside temperatures are cold. In the bin, the grain is well insulated and without proper temperature management, the grain and surrounding air can hold the initial temperature when put into the bin (50-80° F). No matter what time of year, grain should be maintained within 15-20° F of the average monthly temperature.[1]

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 zone completely through the bin. Once a cycle has begun, the fan should operate continuously until the zone moves completely through the bin. The time required for one full cycle depends on aeration airflow rate. Generally, two to three full cycles are needed to cool or warm grain to desired storage temperatures.

On-farm storage systems may be equipped to move air between1/10 cfm (cubic feet of air per minute)/bu to over 1 cfm/bu. The rate depends on bin type, air distribution system, desired storage moisture percentage, and proper management

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procedures. The time it takes to complete a full cycle depends on the aeration rate and time of year and can be figured with the following formulas by season:

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

Grain Checks and Observation

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, be sure to make weekly observations to grain in bins. This can be reduced to every two or three weeks throughout the winter. Establishing a specific day of the week and time of day can make it easier to remember.

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 ice or frost accumulation and/or heating can be a sign of poor conditions and spoilage. Condensation or frost on the underside of roof, hatches, and vents on cold days 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 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 cannot 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 and lose quality.

Insect Control

Insect infestations can arise from residue in combines, handling equipment, and old grain left in storage. In addition to all other management precautions, be sure to watch for insect activity during regular observation. Some preventative measures that may help prevent insect issues in stored grain include:

- Clean debris from harvesting, handling, and drying equipment, and from 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.
- DO NOT put new grain on top of old grain – just a few insects in the old grain can infest the entire bin.

Safety

The dangers of grain handling cannot be stressed heavily enough. NEVER enter a bin when 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] Dorn, T. 2010. Ensure quality grain storage by starting with clean equipment, bins. University of Nebraska-Lincoln. http://cropwatch.unl.edu.
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