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Stored Grain Management

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Proper management practices will help to insure success in short-term or year-around storage of grain. Most spoilage in stored grain is caused by *mold growth* and *insect infestation*, often prompted by *moisture migration*. Grain can be successfully stored if it is *clean*, *dry* and *cool*.

Start by thoroughly cleaning the bin and grain handling equipment and removing trash and debris from the bin and equipment. Take special care to clean out underneath the aeration floor.

Start with Clean Grain

Proper harvest is the first step in obtaining clean grain. Follow the manufacturer's recommendations for combine adjustments and check regularly. Keep ground speed at manufacturer's recommendation to avoid overloading the combine.

Broken pieces of grain are more susceptible to mold growth. The broken pieces also cause a greater resistance to airflow. The resulting decrease in aeration airflow will increase the fan operation time required for proper temperature management.

Load grain to be stored for more than one year into storage using a center fill method. The fines and small pieces will congregate in the center of the bin, forming a spoutline. Withdraw the spoutline, and keep the top of the grain level to get an even airflow distribution through all the grain.

Dry Uniformly

Grain needs to be *uniformly* dry when put into storage. The storage should be filled as rapidly as possible to keep uniform moisture throughout. Store good quality grain at the moisture content indicated in the following table. Store grain, especially shelled corn, artificially dried at high temperatures 1% lower moisture. Store poor quality grain at 1% lower moisture. In a non-aerated system, store grain at 1% lower moisture.

Recommended Moisture Content for Grain Storage.

	Thru Winter (till April)	*Thru Summer*
Shelled Corn	15	14
Soybeans	14	12
Edible Beans	18	16
Wheat, Rye, Barley, Oats	14	13
Grain Sorghum	13	12
Sunflower Seeds	10	8

Keep it Cool!

Proper temperature management is very important for successful grain storage. Ideally, the grain should be held within 10° of the average outdoor temperature. Moisture migration occurs when the outer layers of grain are colder than the rest of the grain. The cold air settles and causes air circulation and moisture transfer within the storage.

After the harvest or drying, cool grain to 50-60°. When the temperature drops in late fall, cool the grain to 30-35°. Frozen grain is very difficult to thaw and can present severe handling problems when unloaded from storage. In early to mid spring, as the temperatures begin to rise, warm the grain to 45-50° if you plan to hold it all summer. Grain can be successfully held into late spring without warming.

Grain must be cool before being stored in a non-aerated structure. Attempt to cool the grain to 35-40° at time of harvest or drying. This may mean not filling the storage until late fall. Remember that the grain from the dryer may be 10° above the outside temperature.

Fan Operation

An airflow of 1/10 to 1/5 cfm (cubic feet/minute)/bu is needed for farm stored grains. An airflow of 1/10 cfm/bu is adequate for clean, dry grain. For higher than recommended moistures or poor quality grain, use an airflow of 1/5 cfm/bu for an adequate airflow distribution.

While filling the grain storage, it is often a good idea to *blow* air through the grain continuously. This will help establish uniform moisture and temperature throughout the grain. After the storage is full, reverse the airflow (by reversing the fan), withdraw the spoutline and level the top of the grain.

When aerating the grain, run the fan continuously. (The only exception is during a prolonged rainstorm; one which you think will last more than 8 hours.) A fan operated by 1/10 cfm/bu will cool grain in 5-8 days. Monitor grain temperatures by holding a good thermometer in the fan exhaust. The temperature change will be complete when the exhaust temperature is nearly equal to the outside temperature. Inadequate aeration time will result in a sharp temperature difference within the grain mass which will be a potential point of mold growth. Do not operate the fan for extended periods during the summer. All the grain needs to be maintained at 55° or less.

It is a good idea to cover the fan when it is not running. This prevents a "chimney effect" draft through the grain. It also keeps snow from being blown into the aeration duct and possibly reducing the effective airflow.

Inspect Regularly

One key component of successful grain storage is regular inspection which will help to spot problems before they become too serious. *LOOK* at the grain, especially near the top where condensation and crusting are most likely to occur. *FEEL* around for any hot spots which may be developing. Trouble spots are likely to be 1-3 feet beneath the surface. In the winter, they will be near the center of the storage. In the summer, they will more likely be near the side walls. Use a steel rod or grain probe to check for wet spots. When the probe hits a wet spot, it will be much harder to push through the grain.

SMELL for any odors which may be developing. Once a month, run the fan for 15 minutes and sniff the exhaust for any off odors. This will help to catch any problems which may be developing in the center of the bin, but will not be a long enough time period to create any temperature associated problems. Running the fan periodically also helps keep the motor bearings dry. Watch for insect infestation, particularly in mid-August.

The attached table summarizes problems observed during the regular inspection, the probable cause and a recommended action or solution. Use it as a guide for what to do if a problem is developing.

Safety Tips

Remember that moldy grain can produce an allergic reaction and may cause respiratory problems. If you have to work in or around moldy grain, it is best to wear a good tight fitting dust mask.

NEVER enter a bin of flowing grain. An adult can be hopelessly trapped in a matter of minutes; a child even quicker! Be aware of the hazards of flowing grain—YOUR LIFE MAY DEPEND ON IT! Here are some safety measures that can help protect you:

—*Install ladder inside and outside all bins.*

—*Always use a rope and safety harness when entering a dangerous bin situation. Have two men standing by to assist you.*

—*If you should become trapped in a grain bin, stay near the outer wall and keep moving until the bin is empty and flow stops.*

Diagnosing Dry Stored Grain Problems.

Observation	Probable Cause	Solution/Recommended Action
Musty or spoiled grain odor.	Heating, moisture accumulation in one spot.	Run the fan, smell the exhaust while in the bin or in front of the exhaust fan—run the fan to cool any hot spots. Severe damage: remove grain.
Hard layer or core below grain surface.	High moisture or spoiled, caked grain mass.	Run aeration or drying fan, check to see if caked or compacted mass blocks airflow. Cool out and dry if airflow is adequate, otherwise unload to remove all spoiled grain.
Warm grain below the top surface.	Moisture content too high.	Run the fan, irrespective of weather conditions until exhaust air temperature equals the desired grain temperature.
Slight skiffs of grain on bin surface sticking together, dragging on shoes.	Early signs of moisture migration, often noticeable only 1-2 weeks after binning.	Run aeration fan—Cool grain until exhaust temperatures equal desired grain temperature or outside air temperatures.
Hard surface crust, caked, and blocking airflow, possibly strong enough to support a man.	Severe moisture migration and condensation in the top surface.	Remove the spoiled layer. *Wear a dust mask to filter mold spores.* Run the fan to cool grain when spoilage is removed. Sample grain with probe to determine condition throughout center mass below the crust. Consider marketing grain to arrest further spoilage.
Under-roof condensation, drip back, surface wetting.	Warm grain in cold weather severe convection circulation and moisture migration.	Run the aeration until exhaust air temperature equals desired grain temperature or approximate cooling air temperature at beginning of aeration cycle.
Wet or spoiled spots on grain surface outside center point.	Condensate drip from bolt end or under roof fixture that funnels condensate flow; possible roof leak.	Check grain for heating. Check roof under surface at night. Check for caulking around roof inlets, joints.
Wet, spoiled spot directly under fill cap.	Leaking roof cap. If gravity spout, condensate from gravity spout.	Check bin cap seal, hold down. Block or disconnect gravity spout so air from bin and grain cannot flow up tube. Marginal solution: Hang bucket under spout inlet, check bucket for water accumulation.
No air flow through grain with aeration fan running.	Moldy, caked grain mass blocking flow; possible moldy grain layer immediately above perforated aeration duct or floor on pressure system.	Try to determine location and scope of spoilage. Unload storage and market or re-bin good grain.
White dust visible whenever grain is stirred.	Mold on grain but not sufficient spoilage to seal top surface.	Evaluate grain condition throughout bin where possible. Observe caution in continued storage because grain condition has deteriorated to some degree.
Cooling time required much longer than usual.	Increased fines in grain resisting and reducing airflow, increased fines can cause airflow resistance to increase as much as 2-4 times over that of clean grain.	Run the fan longer time; operate fan until grain and exhaust air temperature readings indicate grain is at desired temperature, *irrespective of the fan time required.*
Exhaust air temperatures in center of bin surface warmer than storage of those away from center.	Fine material accumulation in storage center resisting airflow; through center mass grossly reduced compared to relatively clean grain around outside of storage.	Run the fan sufficient time to cool the center, irrespective of the outside grain temperatures. Draw down the bin center to remove fines and decrease the grain depth for easier air passage in the center core.
Unknown grain conditions in the bin center.	Too deep to probe; bin too full to access; no temperature sensing cables installed.	Withdraw some grain from all bins and feed or market. Observe (look, feel, smell) *first* grain to flow in each withdrawal, since it was resting in the center core. Withdraw any storage fill above level full, as soon as possible following harvest, to reduce moisture migration tendencies and permit access for observation and sampling.

Adapted from MWPS—AED20 "Managing Dry Grain in Storage."

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