SDSU Extension

iGrow Corn

BEST MANAGEMENT PRACTICES

Chapter: 53

Corn Storage and Drying

Gregg Carlson (Gregg.Carlson@sdstate.edu)

In many years, corn drying is required to ensure that the crop will be of high quality and available to market in the future. Harvesting corn with moisture content > 22% requires special precautions, such as providing enough airflow to keep the corn cool and drying within days after harvest. Prior to storing corn, the bin should be cleaned and potential pest problems controlled (See Chapter 52). This chapter discusses corn drying and storage. Rules of thumb are provided in Table 53.1.

Table 53.1 Corn drying rules of thumb:

- Determine the desired moisture content of the grain, and the short and long-term storage requirements.
- Clean all equipment that will contact the grain (Ess et al., 2005).
- Minimize the number of broken kernels placed into the grain bin (Hanna, 2008).
- Grain with high moisture content (> 22%) needs to be dried prior to storage. The corn moisture content is a function of air temperature and relative humidity.
- If corn will be sold as #2 grain by the spring, it can be stored at 15.5% moisture. However, if it will be stored for 6-12 months, the moisture content should be reduced to 14%, and if storage is a year or longer, the moisture content should be 13%.
- Periodically, at least every two weeks, monitor the grain bin and electronic monitoring devices, if problems are detected, immediately resolve them, waiting will worsen the problem or make the problem uncontrollable.
- The most typical problems result from:
  - Improper grain cooling.
  - Poor initial quality.
  - Inadequate monitoring and failure to take immediate action.
  - Inadequate insect management.
  - Failure in the automatic temperature control system.

Grain Drying

High-moisture corn should be dried prior to storage. If the moisture content is > 22%, the grain should be dried within days after harvest. In South Dakota, due to low fall temperatures or inadequate airflow, natural air drying may not dry the corn fast enough to complete drying prior to winter. However, if drying can be delayed until spring, natural drying systems may be adequate.

High-temperture systems can be used to rapidly dry corn grain. These systems become more efficient as the drying air temperature increases. During drying it is not recommended to increase the kernel temperature to greater than 140oF. Details on different drier designs are available in Hellevang and Wilcke (2013).

The length of time that grain can be held before grade loss occurs is dependent on the grain moisture content and grain temperature (Table 53.2). At 60°F, corn at 18% moisture can be held for 63 days, whereas corn at 22% moisture can be held only for 16 days. Corn at 18% moisture can be held for 195 days if it is held at 50°F, whereas corn at 22% moisture can be held for 54 days. If the corn is at 28% moisture, it can be held for 20 days at 40°F but only 5 days at 60°F.

Storage

In South Dakota, grain is placed in grain bins or piles, when the temperature ranges from 20°F to 50°F. Each system has unique problems and advantages. In a grain bin, corn grain should not be stored if the moisture content is > 22%, and any grain peaks should be removed.

Grain bin storage: As temperatures decrease during fall and winter, the cooling process starts near the bin's edges and walls. Differential cooling can result in water migration from the center of the bin to the edges, and convection currents then occur that cause moisture movement to the top center of the bin. Even if you have an electronic monitoring system, it is recommend that the bin be checked weekly. Wet slimy grain, crusting, and condensation on vents, hatches, and the roof can be symptoms of serious problems. If the surface seals, severe spoilage can result. If crusting has occurred, stir the surface and in extreme cases remove the spoiled grain. Use aeration to cool the grain as outdoor temperatures decrease. Maintain the grain temperature within 15 to 20 degrees of the monthly average temperature during the fall (McKenzie and Van Fossen, 1995).

Bag storage: Storage of grain in plastic bags is becoming popular. However, these bags can be susceptible to mold and insect problems. If the moisture content is high (> 25%), ensiling can occur if the temperatures are above freezing. The temperatures in these bags generally mirror the average outdoor air temperatures. It is not recommend to store high-moisture grain (> 24%) in these bags until the air temperatures have decreased below 32oF. To prevent molding, high-moisture corn should be dried prior to spring warm-up. To prevent problems, the temperatures in the bags should be monitored periodically.

Grain pile storage: Under emergency situations, corn can be stored in piles (Hellevang, 1989). In these systems, water flow should be graded away from the pile, and a plastic sheet should be placed under the pile to prevent water migration from the soil to the pile. When designing a system, consider how much grain needs to be stored and if the grain will be stored as a conical, windrow, or constrained pile. Aeration should be provided to control grain temperature. It may also be possible to store grain in a machine shed.

Table 53.2 Approximate storage time of grains as influenced by moisture content and temperature (°F). (modified from Behlen. 2012)

% Moisture content	Temperature (°F)					
	30	40	50	60	70	80
	days					
14					200	140
15				240	125	70
16			230	120	70	40
17		280	130	75	45	20
18		200	90	50	30	15
19		140	70	35	20	10
20		90	50	25	14	7
22	190	60	30	15	8	3
24	130	40	15	10	6	2
26	90	35	12	8	5	2
28	70	30	10	7	4	2
30	60	25	5	8	3	1

However, when placing grain in a nonreinforced building it is not recommended to pile the grain higher than a couple feet up the wall.

Monitoring Temperature

Grain temperatures can be monitored by placing temperature sensors at various locations in the grain bin, piles, and plastic bags. Sensors can be placed along the walls of the bin and suspended from the bin rafters. Problems can be avoided by monitoring temperatures. Temperatures can be managed by using aeration to change the grain temperature. Aeration can be used to cool the grain following harvest and equalize the grain temperature in the spring. Fans that push air into (positive pressure) or remove air from (negative pressure) the chamber can be used. Fans can be placed at the bottom of the bin. To avoid moisture migration, aerate the grain to keep the grain temperature within 10 to 15 degrees of the average outdoor temperature during the fall. (This is true only for negative pressure systems.) When tracking temperatures, smell the exhaust air for odors. The time required to change the temperature depends on fan size, the season and desired temperature change. The hours required for one aeration cycle can be estimated by dividing 15 by the airflow rate (cubic feet per minute per bushel).

In South Dakota, grain should be cooled to below 35°F in the fall. This process should be started when the average daily temperature is 10 to 15 degrees cooler than the grain temperature. Cool the grain to 20 to 30 degrees for winter storage. If hot spots are detected during inspections, aerate the system until differential heating is not observed.

In the summer, the grain should be kept cool. The goal should be to limit grain temperature to near 40°F. High temperatures increase the risk of mold and insects.

Grain Moisture and Temperature Impact on Storage

Grain moisture content and temperature have a direct impact on grain storage. Generally, increasing the temperature or moisture content decreases storage life (Table 53.2).

Grain Bin Safety

1. To minimize grain bin problems, ask the question would I let my child do this?
2. Do not enter a grain bin when unloading a grain bin.
3. Check to make sure automatic unloading equipment is turned off prior to entering a grain bin.
4. Use a safety harness when entering a bin if you are not standing on the floor.
5. Let someone know – preferably someone observing – that you are entering the bin.
6. Be careful when stepping on crusts as there may be a void underneath and you could become buried.
7. Wear a respirator that will remove mold spores and grain dust.

Table 53.3 Troubleshooting guide. (Modified from McKenzie and Van Fossen, 1975)

Symptom	Probable cause	Possible solution
Bad odor	Heating and moisture accumulation problem	Run the fan; check grain temperature and moisture content.
Crust	Spoiled grain	Check to see extent of crust and aerate.
Grain is warming up	Moisture content is high	Run the fan – may need to dry grain.
Grain is slimy or wet on top surface	Moisture migration	Run the fan to dry grain and create uniform temperature.
Hard crust	Moisture migration	Remove spoiled grain and aerate.
Water condensation (on roof?)	Moisture migration – grain is warm	Aerate to cool the grain.
No air flow though grain when aerating	Air flow blocked by moldy grain	Determine location and scope of problem. Market or re-bin.
White dust on grain when stirred	Mold on grain	Assess extent of problem – remove molded grain.
Slow grain cooling	Fines may be blocking aeration	Run the fan longer – remove center core.

References and Additional Information

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