

Wheat and Barley Storage

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Preharvest

The first step in good stored grain management is to thoroughly clean bins and handling equipment three to four weeks before harvest. Since old grain and fines under perforated floors, in aeration ducts, in grain handling equipment, and inside and outside grain bins are likely to be contaminated with insects, remove this material to avoid immediate infestation of the new crop. Consider fumigating any areas that can't be cleaned. After the bin and equipment are cleaned, consider spraying the bin with an approved, residual-type insecticide.

Make sure grain is dry enough

Insects and molds are less active in dry grain, so make sure wheat is 14% moisture or less for 9 months storage and 13% moisture or less for more than 9 months storage. Barley should be about 0.5 percentage points drier than these values.

Insecticide treatment

If grain will be stored into next summer or if you often have problems with insects, consider applying a grain protectant as the crop is moved into storage. Contact your county extension office for the latest information on approved protectants. Contact potential buyers to see if they will accept treated grain—some will not.

Manage fines

Fines tend to congregate in pockets in storage bins, they restrict airflow, and they are more susceptible to attack by molds and

insects. Try to limit the amount of fines in storage by setting combines for minimum grain damage and maximum cleaning, operate grain augers slowly and full of grain to reduce kernel breakage, and consider cleaning grain before storage to remove fines. Either use a grain spreader to fill bins and distribute fines uniformly throughout the grain mass, or don't use a spreader and periodically remove fines that accumulate in the bin center during filling (**Figure 1**).

Use aeration to cool grain

Keeping grain cool reduces mold and insect activity. Activity slows at temperatures below 60°F and almost ceases below 40°F. Because daytime temperatures are usually greater than 60°F in late summer and early fall, it might be necessary to operate fans at night to start the cooling process. Don't worry too much about high nighttime relative humidity—grain rewetting is unlikely to be a problem.

Another reason for aerating grain is to keep its temperature within about 20°F of the average outdoor temperature to prevent moisture migration. If warm grain is stored in cold weather, natural moisture movement from warm grain to cold results in rewetting and spoilage of grain at the top of the bin (**Figure 2**). The recommended winter grain storage temperature in northern Minnesota is about 25°F. Watch forecasts for 20 to 30°F weather and operate aeration fans 24 hours/day in late fall to cool grain for winter storage.

The time required to cool a bin of grain depends on the airflow

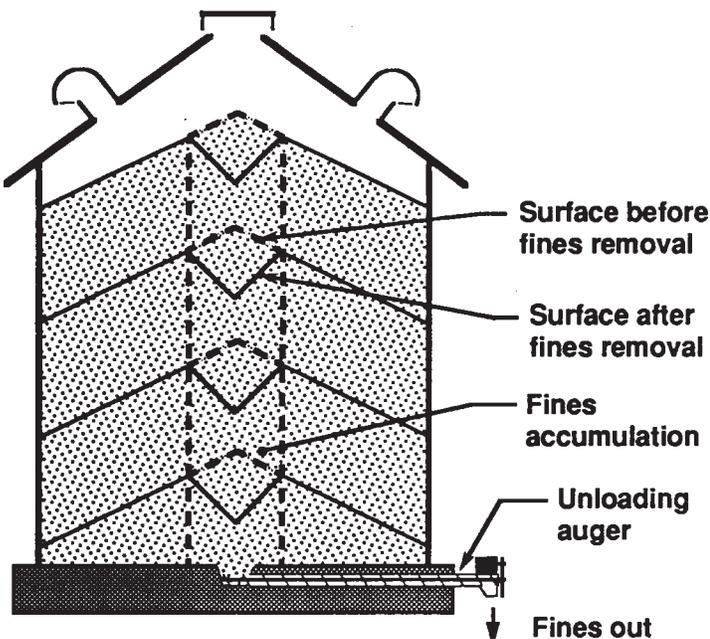


Figure 1. Removing fines during bin filling.

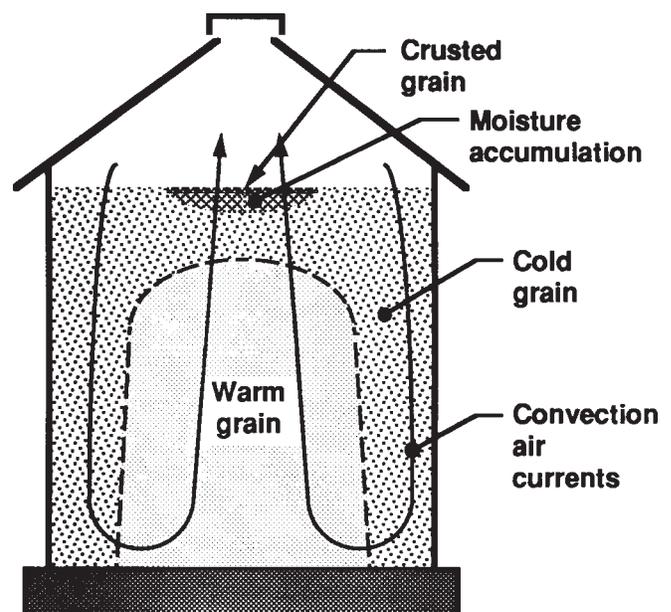


Figure 2. Moisture migration in unaerated grain.

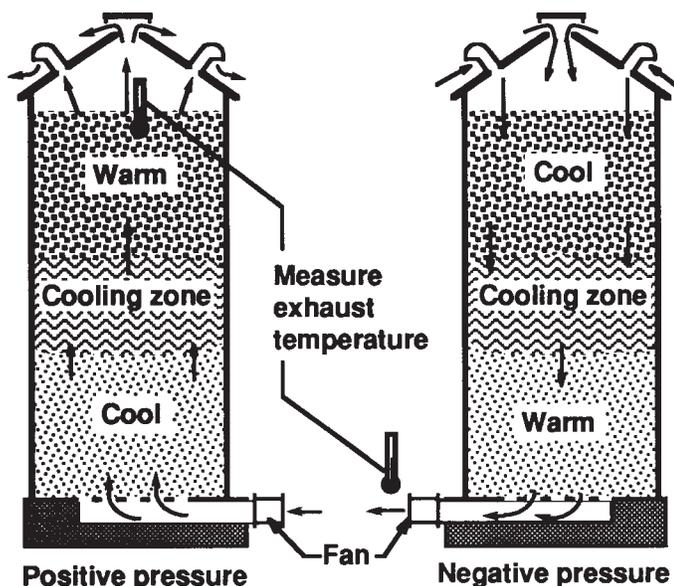


Figure 3. Measuring exhaust-air temperature.

per bushel provided by the aeration fan. The recommended aeration rate for farm bins is 0.1 cfm/bu (cubic feet of air per minute per bushel of grain in the bin). The rule of thumb for number of hours to cool grain is 15 divided by the aeration rate in cfm/bu. If the aeration rate is 0.1 cfm/bu, approximate cooling time is $15 \div 0.1 = 150$ hours. The only way to know for sure that cooling is complete, though, is to actually measure the grain temperature or temperature of air exhausting from the grain (Figure 3). If grain isn't cool enough after a cooling zone has moved completely through the bin, you need to repeat the aeration cycle again when the weather gets colder.

Full perforated floors are not required for aerating dry stored grain—simple duct or pad systems are adequate. Either positive or negative pressure systems can be used to aerate dry stored grain.

Warm grain in spring?

The answer to this controversial question seems to depend on how far you cooled grain during winter and when the bin will be unloaded. The colder grain is, the more likely it is that condensation will occur during storage or handling in warm weather. If grain was cooled to less than 25°F during winter and it will be kept until summer, aerate the grain in early spring to warm it to 40 to 50°F. But if grain will be fed or sold by summer or if its temperature is not less than 25°F, aeration to warm grain probably isn't necessary.

Check stored grain frequently

Check stored grain monthly during cold weather and every 2 weeks during warm weather. Look for evidence of mold on the surface and in probe samples. Also, use probes and insect traps to check for insects. Measure and record temperatures at several

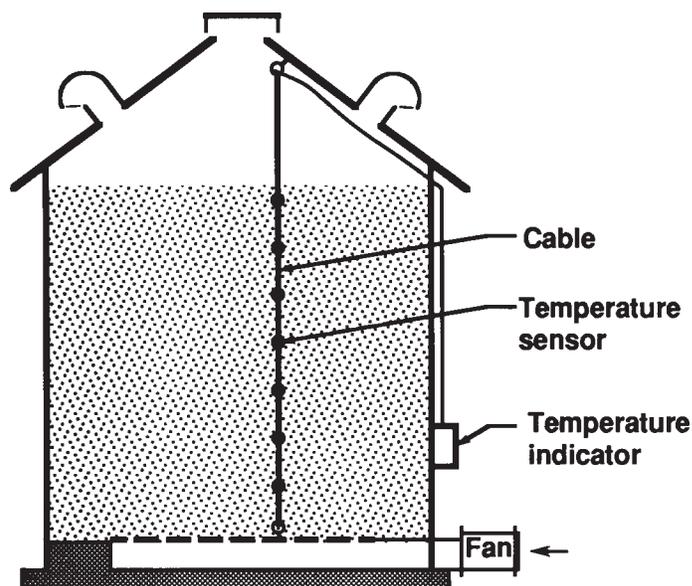


Figure 4. Permanently-installed grain temperature cables.

locations and watch for spontaneous heating—a sure sign of mold or insect activity. Permanently installed temperature cables make this job a lot easier (Figure 4). Also, start the fan briefly on cool, dry days and smell the first exhaust air leaving the bin for musty or sour odors.

If you find storage problems, try to use the aeration fan to reduce the grain temperature. If the problem is mold and cooling doesn't solve the problem, move, redry, feed, or sell the grain as soon as possible. (Check moldy grain for mycotoxins before feeding it.) Keep in mind that using bleach or some other chemical to hide a musty odor is illegal. Also, breathing mold spores can cause both short and long-term health problems, so make sure you wear a respirator or dust mask that is designed to filter mold spores or other toxic dusts.

If insects are causing the problem and the outdoor temperature is above 50°F, consider fumigating the grain. Because fumigants are dangerous chemicals, we recommend hiring a commercial fumigator. Fumigants do not provide any residual protection against insects, so if grain is warm, damp, or moldy, insects will reappear as soon as the fumigant dissipates.

Contact the Minnesota Extension Service for more information. The following bulletins discuss grain drying and storage.

Management of stored grain with aeration, AG-FO-1327

Wheat and barley drying, AG-FS-5949.

Selecting fans and determining airflow for crop drying, cooling, and storage, AG-FO-5716.

A computer program, FANS, Version 2.0, is also available to help you select fans and determine airflow for grain bins.



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