Harvesting, Drying, and Storing Wheat

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Kentucky farmers have not widely harvested wheat above 15 percent moisture content. In a double-cropping system, however, significant profit potential exists for earlier wheat harvesting because of the increased yields of the second crop. After June 10, each one-week delay in planting soybeans decreases yields between 4 and 7 bushels per acre in Kentucky. This potential yield loss alone provides enough incentive to offset the cost of drying high-moisture wheat. Other advantages for harvesting wheat early are fewer weather-related delays and increased yields owing to higher test weight and less shatter loss at the header during combining.

Harvesting

Although wheat is typically harvested in the moisture content range of 13 percent to 15 percent in Kentucky, it can be harvested successfully at higher moisture contents, provided it is dried quickly enough to prevent spoilage and/or sprouting. The moisture content at which harvest begins depends heavily on the drying system available and the threshing capacity of the combine. Your goal should be to harvest as early as possible, provided the wheat can be dried safely. Some guidelines for matching beginning harvest moisture contents to drying systems are given in Table 10-1. If this is your first time harvesting high-moisture wheat, start at a lower moisture content and gradually increase it as you gain experience.

When To Start?

Begin wheat harvest as soon as the crop has field dried enough that it can be handled safely. A moisture meter is useful in giving a quick determination of crop condition. Most hand-held meters are calibrated for corn or soybeans and have charts for converting readings to other crops. If a meter is not available, weigh a 0.25- to 0.5-pound sample, dry it on a cookie sheet in a 260°F oven overnight (about ten hours), and reweigh the sample. Calculate the moisture content by the following formula:

$$\text{seed moisture (\%)} = \frac{\text{wet weight - dry weight}}{\text{wet weight}} \times 100$$

For example, if a 0.5-pound sample weighs 0.4 pounds after drying, seed moisture is 20 percent.

Table 10-1. Guidelines for matching wheat harvest moisture content to drying system.

Drying system	Wheat moisture content, %
High-speed dryer	21 - 24
Bin dryers with heat/stirring equipment	15 - 20
Bin dryers without heat	Less than 15

Operating the Combine

The most important combine adjustments for harvesting wheat are cylinder speed, concave clearance, screen openings, and fan speed. Set the combine according to the manufacturer's recommendations before entering the field. Then, if necessary, adjust the cylinder or fan speed in the field to improve threshing and cleaning. Lower cylinder speeds reduce kernel damage. Increased fan speed cleans wet chaff more easily, but more grain can be blown out with it. Be willing to dry some chaff if your drying system has adequate airflow.

Shatter—when the cutter bar shakes the stalk, causing the grain to fall on the ground—is the major source of wheat harvest loss, regardless of the type of header used. One USDA study in which a conventional cutter bar header was used showed that shatter losses were reduced in high-moisture wheat. Researchers have observed that header losses increase as much as 1.7 bushels per acre as wheat dries in the field from 23 percent moisture content to 13 percent.

Header Choices

Limited studies have been conducted to compare the performance of rotor stripper headers and conventional cutter bar headers for soft red winter wheat. However, a recent report from the northwestern United States on harvesting other types of wheat indicates that ground speed has more influence on header losses than the speed of the stripper header rotor. Compared to a conventional cutter bar header, the stripper header had higher losses at low ground speeds but comparable losses as ground speed increased (Figure 10-1). Average losses for all ground speeds were 10.1 percent of total yield for the stripper header but only 5.8 percent for the cutter bar (all data not shown). As ground speed increased, stripper header losses were nearly equal for both rotor speeds.

Figure 10-1. Effect of combine header, ground speed, and stripper header rotor speed on wheat loss.

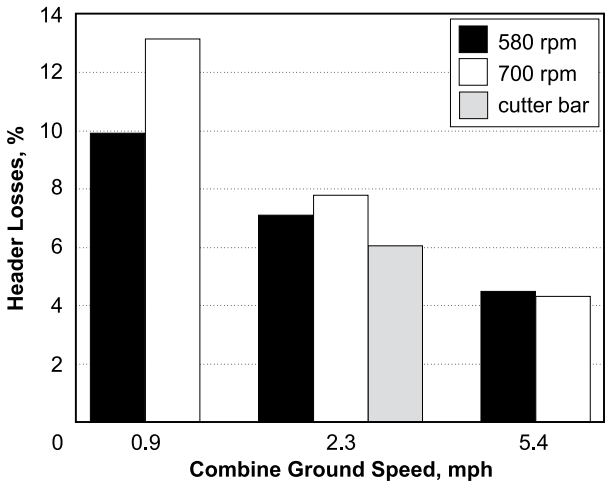
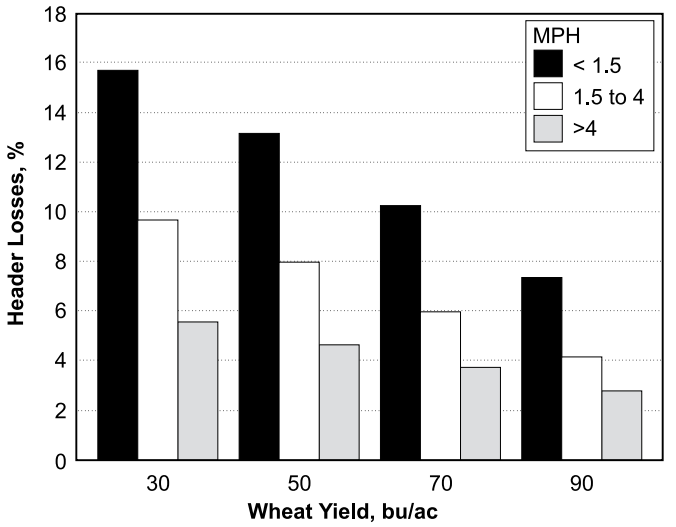


Figure 10-2. Effect of yield and ground speed on wheat header losses for the stripper combine.



Header losses for the stripper unit were also determined for various yield levels in this study and are shown in Figure 10-2. Losses generally decreased as yields and ground speed increased. Ground speeds that resulted in the lowest header losses for the stripper header were two to five times higher than those observed for the combine with the conventional cutter bar (all data not shown).

Other Techniques

Another harvest technique is to cut wheat with a swather as soon as it reaches physiological maturity at a moisture content of about 40 percent to 42 percent. It is allowed to field dry in the swath (or windrow) until it can be threshed with a combine. This technique requires specialized equipment (swather and pickup device) but has been shown to advance the harvest date by four to ten days when compared to direct combining with a cutterbar header. In recent years stripper headers have produced comparable advantages in harvest date with less equipment and fewer field operations. Thus, swathing is currently an infrequently used practice and is not addressed further in this publication.

Check Harvest Losses

Measure field losses by counting loose kernels on the ground. Look in front of the combine in standing wheat to measure preharvest losses. Wheat kernels found under the combine are both preharvest losses *and* header losses. Count kernels behind the combine to measure total losses (preharvest, header, threshing, and separating losses). Every 20 kernels found in a square-foot area represent losses of about 1 bushel per acre. A good goal is to limit harvest losses to no more than 5 percent of the crop yield. Adjust ground speed, header height, and reel speed, and position to control harvest losses.

Drying

Freshly harvested wheat should be dried to a moisture content of 12.5 percent for storage or 13.5 percent for immediate sale. High-moisture wheat (greater than 15 percent moisture) can be dried with both high-speed and bin drying equipment. Corn drying systems can be used to dry wheat if adjustments are made to maintain adequate airflow. The amounts of water in corn and wheat at different moisture levels are shown in Table 10-2.

Wheat has a higher resistance to airflow than corn but dries at nearly the same rate as corn. For commercial wheat, drying air temperatures should be below 140°F to avoid damage to milling quality. Seed wheat should be dried at 110°F or lower.

Table 10-2. Water (lb/bu) in corn and wheat at various moisture levels.

	Moisture content, % wet basis														
Grain	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Corn	5.3	5.9	6.5	7.1	7.8	8.4	9.1	9.8	10.5	11.2	11.9	12.7	13.4	14.2	15.0
Wheat	5.8	6.4	7.1	7.8	8.5	9.2	9.9	10.6	11.4	12.2	13.0	13.8	14.6	15.5	16.4

(using a base moisture level and test weight of 15.0% and 56 lb/bu for corn and 13.5% and 60 lb/bu for wheat)

Table 10-3. Equilibrium moisture content (EMC) of soft red winter wheat at different temperature and relative humidity levels.

Temperature (°F)	Relative humidity (%)									
	10	20	30	40	50	60	65	70	80	90
35	7.3	8.9	10.2	11.3	12.3	13.4	14.0	14.7	16.1	18.2
40	7.1	8.7	10.0	11.1	12.1	13.2	13.8	14.4	15.9	18.0
50	6.8	8.4	9.6	10.7	11.8	12.9	13.4	14.1	15.5	17.6
60	6.5	8.1	9.3	10.4	11.4	12.5	13.1	13.7	15.1	17.2
70	6.2	7.8	9.0	10.1	11.1	12.2	12.8	13.4	14.8	16.9
80	6.0	7.5	8.7	9.8	10.8	11.9	12.5	13.1	14.5	16.6
90	5.8	7.3	8.5	9.6	10.6	11.6	12.2	12.8	14.2	16.3
100	5.6	7.1	8.3	9.3	10.3	11.4	12.0	12.6	14.0	16.0

Source: American Society of Agricultural Engineers, 1996.

In-bin Drying

Bin drying methods are easily adapted for wheat drying. However, wheat depths should be only half of those used for corn because of the increased resistance to airflow. Heat is required if bin drying wheat with a moisture content higher than 15 percent. You can use stirring devices, recirculators, or automatic unloading augers to increase capacities. Generally, moderate airflows (2 to 5 cubic feet of air per minute for each bushel) and temperature rises (less than 20°F) are used. Excess heat can cause severe overdrying.

If high-moisture wheat is to be dried and stored in the same bin, extra care is advised. If the initial moisture content is 20 percent to 24 percent, use heat to dry the top layer below 15 percent before adding more grain. Several bins may be needed to dry a large crop. After drying to 15 percent moisture content, use unheated air to dry to 12.5 percent (if stored) or 13.5 percent (if sold immediately) by running the fan only during low humidity hours to finish drying. This management scheme minimizes the amount of overdried grain in the bottom of the bin. Table 10-3 shows the moisture content soft winter wheat will approach when exposed to the temperature and relative humidity levels shown. Moisture levels decrease with lower humidity and higher temperature conditions.

High-speed Dryers

High temperature batch or continuous flow dryers usually have adequate airflow capacity for drying wheat. These units typically have high airflow rates, so supplemental heat may not be required for daytime drying when harvesting in the moisture range of 18 percent to 20 percent. Heat is required when drying high moisture wheat during periods of high humidity (above 70 percent at night or during cloudy days). When heat is used, you can limit the drying air temperature by cycling the burner on and off or by reducing the size of the gas burner orifices.

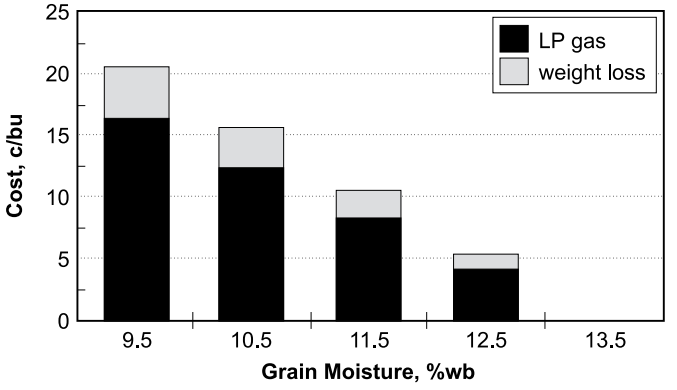
A Word of Caution

Some in-bin corn drying systems are operated by filling the bin completely full within two to five days. *Under no circumstances should you attempt to follow this practice when drying wheat above 15 percent moisture content.* Rapid bin filling works for corn only when temperatures and moisture contents are low enough to prevent spoilage. Outside air temperatures (and grain temperatures) are 20° to 40° higher when harvesting wheat than during the fall corn harvest. In-bin drying at moistures above 15 percent should only be done as a layer-fill, batch, or continuous flow process. Rapidly filling an entire bin with wet wheat is a sure route to spoilage.

Avoid Overdrying When Possible

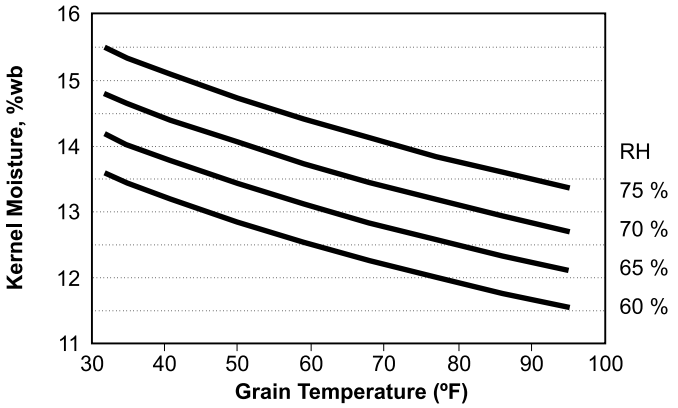
Avoid drying wheat below the base market level of 13.5 percent moisture wet basis (wb) if the crop is sold immediately. Estimates of overdrying costs for wheat (at $3.75 per bushel) are shown in Figure 10-3. However, if the crop is held through the summer, when average temperatures approach 80°F, wheat should be dried to 12.5 percent to keep conditions dry in the bin (less than 65 percent relative humidity) and thereby prevent problems with spoil-

Figure 10-3. Cost of overdrying wheat (@ $3.75/bu and $0.60 per gallon for liquid propane).



age and sprouting during storage (Figure 10-4). Consequently, this additional cost should be considered as a cost of storage and not directly attributed to drying since it is usually recovered when the crop is sold.

Figure 10-4. Equilibrium moisture content for soft red winter wheat at various temperature and relative humidity levels.



Storing

Sanitation, aeration, and monitoring are the watchwords to remember when storing grain during the summer months. Totally remove the old crop before placing newly harvested wheat into a bin. Thoroughly sweep the bin wall and floor (including under aeration ducts, if possible) to remove grain kernels that may contain insect larvae or mold spores. Apply an approved insecticide both inside and outside the bin to delay insect population development before placing wheat in the bin.

Aeration should be used to cool wheat after drying with heated air. To a small degree, aeration will control grain temperature if it starts heating during storage, but this may only be a short-term solution. If heating cannot be controlled by running the fan, the crop must be moved to another bin (if possible) to break up hot spots in the bin that usually cause the problem.

Check the condition of stored wheat once a week during hot weather to guard against deterioration from molds or insects. Run the fan for a few minutes to check for off odors of the air from the grain pile. Lock out unloading auger motor switches before looking inside any bin to check for wet spots on the grain surface. Feel the top 6 to 12 inches of wheat to monitor temperatures and insect and mold activity. Always wear dust protection masks when cleaning bins and during inspections. See Extension publications *Principles of Grain Storage* (AEN-20) and *Aeration, Inspection, and Sampling of Grain in Storage Bins* (AEN-45) for more information on grain storage and safety considerations when inspecting stored grain.