8 – Corn Harvesting

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A combine equipped for corn is the starting point for successful harvesting. In the midsouth, combine components vary, requiring you to confirm that your combine has proper options to obtain full capacity and efficient cleaning in corn. Plan to **harvest the bulk of your corn between 15 and 18 percent moisture content,** for an economical choice based on recent grain terminal moisture discounts and long-term Arkansas weather patterns. Other considerations, such as scheduling rice harvest, are briefly noted in the section "Corn Harvest Moisture." Fine tune the combine in the field. Have a bit more handling and drying capacity than shelling capacity to prevent field delays.

Corn Equipment

A corn head and rasp-bar cylinder or rotor modifications are needed for corn. Check your combine before purchasing a corn head. New costs for conversion to corn vary from $25,000 to $50,000. The cost is lower if you already have some of the corn options and if good used equipment can be found. Due to differences between combine models, your dealer can help identify corn features appropriate for your combine. Certain models require a corn head drive and feed elevator. A variable speed header drive allows faster synchronized (with the stalk roll speed) forward speed. If your combine has a feed elevator compatible with corn, conversion cost is less.

To equip a combine for corn, check with your dealer after determining:

- Combine model
- Serial number
- Thresher (Rasp, Spike or Rotor)
- Header drive option

Corn Head

Row spacing should match the planter. Research indicates gathering loss can increase 2 1/2 bushels per acre if the gathering opening is 4 or 5 inches off the row. If damage from windstorms or corn borers causes ears in misaligned rows to drop off, field losses often exceed 10 bushels per acre. Corn heads aligned with combine wheels and matched with planters and row bedders improve combine performance.

Rasp-Bar Cylinder or Threshing Rotor

A rasp-bar cylinder, concave and filler bars or a threshing rotor are needed for corn. Check your operator's manual for the correct concave wires or rotor grates and transport vanes. Converting from a spike-tooth to a rasp-bar cylinder reduces the combine's ability to handle downed rice, weedy fields and rank, green stalk. A rasp-bar cylinder normally improves head rice yield and reduces field loss in corn, grain sorghum, wheat and soybeans.

Counterbalance Weights

Due to the extra weight of a corn head, steering improves by adding extra rear weights and/or fluid in the rear tires.

Corn Harvest Moisture

Harvesting causes some kernel damage; the relationship of kernel damage to moisture content is summarized in Figure 8-1. Depending on the variety and seasonal conditions, minimum kernel damage occurs between 19 and 24 percent moisture content (m.c.). In some cases, damaged corn has been discounted as foreign material or dockage.

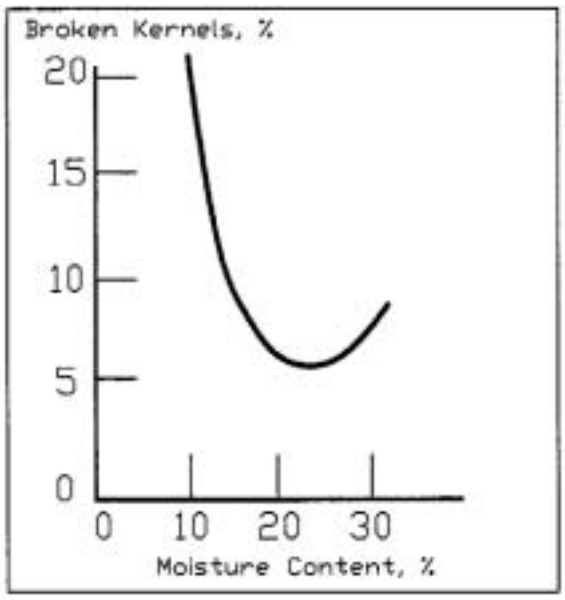


Figure 8-1. Broken Kernels vs. Corn Moisture Content

Preharvest and gathering losses vary with insect damage, lodging and how tightly ears are held. Ear droppage begins in the 20s (percent m.c.) and accelerates as corn dries. Storms come without much warning; therefore, verify if stalk rot or insect damage exists in each corn field. If the risk of lodging is high, harvest early (around 20 percent m.c.) to avoid a potential 10- to 20-bushel per acre field loss.

Rice harvest may also conflict with corn harvest. It may be desirable to harvest corn at 18 to 24 percent moisture to allow time to clean and empty equipment before handling rice. In most cases this requires farm drying, so allow sufficient time to dry the corn properly. If rice and corn production schedules aren't planned, inadequate drying or grain storage may prevent timely harvest. Corn drying rates in the field vary from 1/2 to 1 percent moisture content loss per day. Starting harvest at 24 percent instead of 18 percent moisture may get the combine into the field 6 to 12 days earlier (or more if high humidity conditions persist when corn nears 18 percent m.c.).

Aflatoxin isn't likely to be a problem in well-managed corn. However, aflatoxin proliferates so rapidly in midsouth fields that a grower should consider his options. If corn can be dried to 15 percent or below within a day, the spread of aflatoxin is minimized by early corn harvest. Corn with as much as 28 percent moisture can be harvested by adjusting the combine for reduced kernel damage and improved separation. See your county Extension agent for the options on harvest strategy and adjusting the combine to remove more aflatoxin-prone grain. More suggestions are included in Chapter 10, *Grain Storage and Aflatoxin in Corn*. The Arkansas State Plant Board will perform an analysis on a sample of corn to identify sample field aflatoxin levels, These tests are a good basis for evaluating your situation and avoiding severe discounts.

Drying costs or high-moisture market discounts cause some to wait too long to harvest corn. Corn that remains in the field too long suffers weight shrinkage, damage and field loss. Gathering loss increases as corn moisture falls below 20 percent; field loss may get unnecessarily high – above 5 bushels per acre.

Economical harvest timing depends on the drying cost or high-moisture discounts, field loss and damage penalty. Look at your circumstances, including the risk of field loss, how quickly all of your corn can be harvested and your drying and market options. Recover most of the drying cost by reducing field loss and kernel damage. On this basis, beginning corn harvest at 20 percent m.c. is a sound decision for some; starting harvest around 18 percent m.c. fits many situations. Exposure to weather risks, shrinkage, field loss and damage are compelling reasons to complete all corn harvest before it reaches 14 percent m.c.

Gathering Corn

Height

Operate the corn head low enough in good, upright corn that all gathering chains enter the row below the lowest ears. Lodged stalks may require lowering the gathering height so row dividers follow the ground contour freely. Keep the stalk rolls well above the soil to prevent rapid wear. Slowing forward speed recovers more ears that tend to drop easily from lodged stalks, etc.

Synchronize Speeds

Properly matching forward speed, stalk-roll speed and gathering chain speed reduces corn loss and plugging. Choose a forward speed that synchronizes with the gathering chain speed to guide stalks

gently into stalk rolls. Excessive chain speed can break stalks, plug the rear of the stalk rolls, increase chain wear and overload the combine. Synchronize the gathering chain flights, positioning the tip about 1/4 inch beyond the edge of the snapping plate.

Snapping Opening

Stalk rolls pull stalks down between two snapping plates that strip the ears from the stalks. The rear of all snapping plates needs a 1/8-inch wider gap than the front. Refer to your corn head manual; typically, adjust the front 1 1/4 to 1 3/8 inches apart and the rear 1 3/8 to 1 1/2 inches apart. Use narrow spacing for small ears. A wide spacing is one cause of shelling from the butt of the ear and may cause small ears to drop partially below the snapping plates. Check that stalk roll spacing and snapping plate spacing are the same on all rows.

Excessive forward speed

- Knocks ears off before they enter the gathering throat.
- May cause plugging in high-yielding corn due to overloaded gathering units.

Excessive stalk roll speed

- Chews stalks and may wedge ears on the snapping plates causing shelling loss along the row.
- May shake ears off before stalks are fully in the throat.

Inadequate stalk roll speed

- May break or pull up stalks, causing plugging at the back of the rolls.
- Extra stalks entering the combine potentially can overload separation.

The stalk roll gap should allow stalks to enter without restriction. The rolls have several flutes or adjustable knives that, properly adjusted, grip stalks and pull them down without slippage. Stalk roll replacement is expensive, but field capacity is reduced when flutes are worn. Field loss becomes high as rolls wear and “slip” in contact with corn stalks.

Stalk Roll Spacing

- Wide for dry crops
- Narrow when stalks are damp and tough (to reduce snapping plate shelling)
- Center all snapping plate gaps over center of roll openings to avoid breaking weak stalks

Troubleshooting

(Refer to your Corn Head Operator’s Manual)

Excessive Shelling at Stalk Rolls

1. Snapping plate gaps should be narrower at the front than at the rear to avoid wedging ears into stalk rolls.
2. Adjust stalk rolls to pull stalks firmly down through the snapping area. Ears should snap off quickly about half way up the snapping plates.
3. Excessive wear on stalk rolls. Replace.
4. Loose gathering chains. Adjust tension.

Pulling Up Stalks

1. Forward speed may be too fast in relation to gathering chain speed.
2. The snapping plate gap may be too narrow. Spread the snapping plates a little farther apart to get stalks to feed through freely and snap the ear cleanly. Try 1/8-inch adjustment increments on each side of the row.
3. Not operating on rows planted together; i.e., rows not centered.

Weeds, etc., Wrapping Stalk Rolls

1. Shields on the front of the stalk rolls should cover half of the spiral points to minimize wrapping.

2. Weed knives along the back side of the stalk rolls should be adjusted just as close as possible without touching rolls. Replace missing, worn or bent knives.

Row Alignment

1. Select harvest speed to keep units centered on the row.

2. Pick "matched rows." Rows not planted together have spacing variations that may increase stalk breakage or plugging.

Plugging

Never allow anyone to work on a corn head while it is running. Plugged stalk rolls can be cleared one stalk at a time while the rolls are stationary.

1. If stalks break in the snapping rolls, recheck that the snapping plates are centered over the roll opening.

2. Operating too fast in high-yielding corn may overload gathering units or the cross auger. Stalks should move through smoothly. Check whether your header has a faster speed option for cross auger.

Threshing and Separating

Thresher speed and concave gap are basic to good shelling. Whole cobs with some attached kernels behind the combine are a clue that a narrower concave spacing or a faster thresher speed may improve shelling. If a few soft, immature cobs break up without removing all the kernels, don't be concerned.

A fast thresher speed breaks cobs excessively and increases kernel damage. If too many wet cobs shell poorly, don't thresh too aggressively. Delaying harvest to allow more field drying may solve this. Splitting cobs down their length is usually due to a narrow concave gap.

Corn Quality

Within the typical harvest moisture range, threshing is the likely cause for cracked kernels. Concave gaps narrower than 5/8 inch or thresher surface speeds above 3500 feet per minute can lower corn below USDA Grade No. 2 requirements. "Fines" or broken kernels are the primary cause of "heated," "sour" and "weevily" corn, especially if they are allowed to remain in the center of the bin.

Table 8-1. Converting Thresher Surface Speed to Thresher RPM

Thresher Diameter (inches)	Thresher Surface Speed (feet per minute)			
	2500	3000	3500	4000
20	480	570	670	760
22	430	520	610	700
24	400	480	560	640
26	370	440	510	590
30	320	380	450	510

Research indicates that damaged shelled corn deteriorates in storage three times faster than undamaged samples. Corn damaged, either by a combine or handling, develops mold and may deteriorate from No. 2 corn to No. 3, 4 or 5 corn, depending on the storage conditions. If adequate aeration is available in storage, corn kernel damage essentially determines the maximum allowable storage time.

About 90 percent of the separation should occur at the thresher. Gentle threshing aids corn recovery on the grates or walkers and sieves. Corn carries out over the straw walkers or chaffer sieve if they become plugged with cobs. Walker risers ("fishbacks") or walker grate covers may help, especially when the crop is damp.

Cleaning requires a high-speed fan. Use the operator's manual for initial combine settings and fine tune fan speed for field conditions.

Table 8-2. Initial Corn Setting Suggestions	
Thresher speed:	3000-3500 fpm (See Table 8-1)
Concave spacing:	5/8 inch or greater
Chaffer sieve:	1/2 - 5/8 inch
Cleaning sieve:	5/8 - 9/16 inch

(Consult operator's manual for specific adjustments.)

Field Loss

Field loss was sampled behind 84 combines in Iowa (Table 8-3). Failure to gather ears was the greatest loss (cost) category in Iowa and may be in Arkansas. Separating losses and shelling at the stalk rolls are other common problems. Some producers may increase corn income by reducing field loss by several bushels per acre.

Table 8-3. Summary of Corn Field Losses (Iowa)		
Sources of Loss	**Average growers (bushels/A)**	**Top 10% of growers (bushels/A)**
Failure to gather ears	1.5	0
Shelling from stalk rolls	0.9	0.3
Separating loss	1.3	0.2
Total combine loss	3.7	0.5
Ears dropped before harvest	2.1	1.0
Total field loss	5.8	1.5

Estimating Field Loss

Everyone wants to do an expert job of harvesting. One way to gain expertise is to check field losses and compare them to top growers. Field loss can be estimated quickly. Losses are determined by counting shelled corn and ears left in the field.

Corn normally dries at the rate of 1/2 to 1 percent moisture content per day in the field. Approximately two weeks before harvest is a good time to begin measuring corn moisture and counting field ear loss. Counting ears on the ground prior to harvest as well as behind the combine provides facts to optimize harvest profit. If loss is high, the kind of loss is a clue to making adjustments. Keeping losses low doesn't cost; it pays!

Procedure

To count field loss, choose a representative field portion at least 100 yards from the end. Disconnect the straw spreader or straw chopper to aid in diagnosing the source of loss. Otherwise, kernels thrown into adjacent rows will add confusion about where the loss really occurred.

Ear Loss

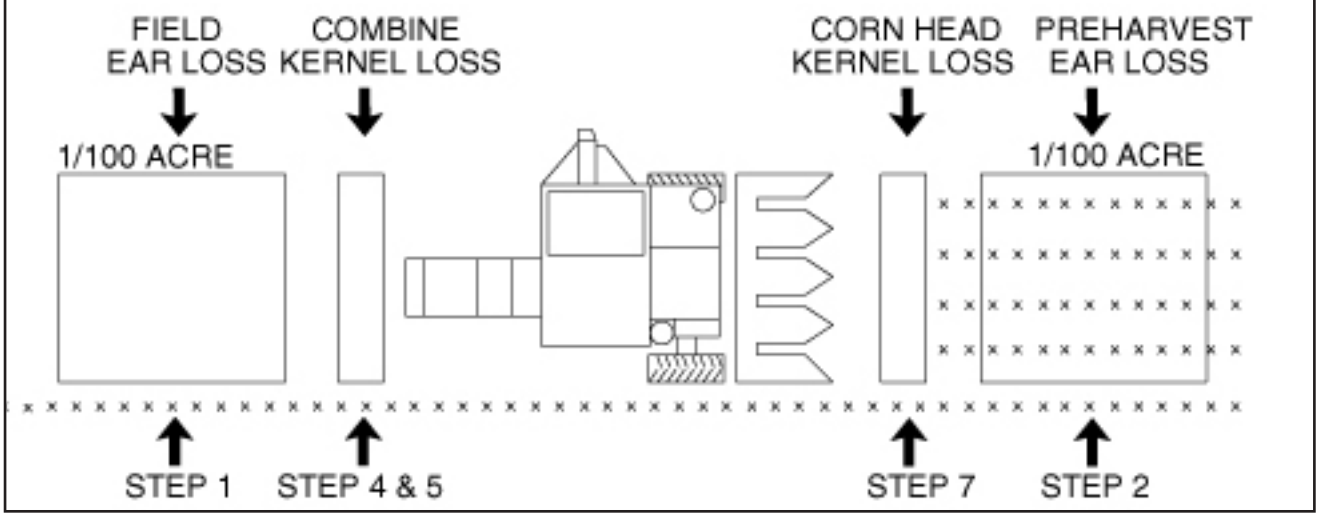
Ear loss is sampled in 436 square foot areas (1/100 acre) (Table 8-4) and kernel loss in 10 square foot areas. Sample the field ear loss first and then determine what portion occurred at the corn head.

Then measure preharvest ear loss. In fact, making early preharvest loss samples prior to entering the field with the combine helps to identify which field to harvest first and, possibly, when to start.

Table 8-4. Row Length, Feet, to Obtain 1/100th of an Acre						
Row Spacing (inches)	**Distance, Feet, for Measuring 1/100 Acre According to the Number of Rows on Corn Head**					
	3	**4**	**5**	**6**	**8**	**12**
28	62.2	46.7	37.3	31.1	23.3	15.6
30	58.1	43.6	34.8	29.0	21.8	14.5
36	48.4	36.3	29.0	24.2	18.2	
38	45.8	34.4	27.5	22.9	17.2	
40	43.6	32.7	26.1	21.8	16.3	

Step 1: Field Ear Loss. Back the combine about 10 feet out of the row to provide space to count loss. Due to extra discharge when stopped, note how far behind the combine to count loss (Figure 8-2). Step off the correct distance behind the combine according to your corn head and row spacing (Table 8-4). Mark this distance down the row and count all whole or broken ears (not those that have been threshed). Estimate the number of full ears (one 3/4-pound ear in 436 square feet

Figure 8-2. Where to measure corn harvest losses.



equals one bushel per acre). Record the field ear loss in bushels per acre in Table 8-5.

Step 2: Preharvest Loss. Pace off the same distance in standing corn (Figure 8-2). This is the same sample size (Table 8-4), 1/100th acre, which was measured behind the combine. Gather and count all the dropped or "unrecoverable" ears in these rows and record this in bushels per acre in Table 8-5.

Step 3: Corn Head Ear Loss. In Table 8-5, subtract the preharvest loss from the field ear loss to determine loss caused at the corn head.

Table 8-5. Ear Loss Data

Loss Category	Number of Ears One ear = 1 bushel/acre
Step 1: Field Loss	
Step 2: Preharvest Loss	
Step 3: Corn Head Ear Loss	

Kernel Loss

Count **loose kernels** on the ground **and those still attached to threshed cobs**. Do this by measuring a distance down the row to enclose 10 square feet (Table 8-6), one row at a time. A frame appropriate for your row spacing can be constructed. A PVC pipe frame or a plastic clothesline, with pegs at the corners of a rectangle is helpful. Complete steps 4 and 5 (Table 8-8) for each row and then move the frame to sample the next row.

Table 8-6. Frame Dimensions to Enclose 10 Square Feet for Kernel Loss Counts

Row Width (inches)	Row Length (inches)
28	52
30	48
36	40
38	38
40	36

Step 4: Corn Head and Separation Loss. Place the frame behind the combine and **count loose kernels** (not those remaining on threshed cobs). Record the number of kernels as **corn head and separation loss**, by row, in Table 8-8. Convert the number of kernels in 10 square feet to bushels per acre by dividing by 20.

Step 5: Threshing Loss. Before moving the frame, **count kernels on threshed cobs** (not loose kernels) and record the number of kernels as **threshing loss**, by row, in Table 8-8. Ignore small kernels on the tips of cobs. Convert the number of kernels in 10 square feet to bushels per acre by dividing by 20.

Step 6: For each row, add the second (Step 4, Corn Head and Separation Loss) and third (Step 5, Threshing Loss) columns to obtain a **Combine Kernel Loss** value in the fourth column of Table 8-8. The average of all rows indicates the field shelling losses caused by the combine. These typically increase as corn dries in the field.

Step 7: Corn Head Kernel Loss. Place the 10 square foot frame over each harvested row in front of the corn head where the separator has not yet discharged. Count the loose kernels by row within the frame (disregard ears). This corn head kernel loss can also be converted to bushels per acre by dividing by 20. Note if there is a particular row that has an unusually high or low value.

Step 8: Separation Loss. For each row, subtract corn head kernel loss, Step 7, from corn head and separation loss, Step 4, and enter the value in the last column as **separation loss**. This is the corn that was not separated from chaff.

Table 8-7. Corn Loss Measurement		
Uniformly Distributed		
2 kernels / square foot	=	1 bu/A
One 3/4 lb ear / 436 square feet	=	1 bu/A

With timely harvest, field loss may be as low as 1 to 2 bushels per acre. Weak stalks, poor ear retention or lodged corn are causes of high preharvest loss and high gathering loss. Poorly equipped, maintained or operated combines may leave 5-10 bushels of corn per acre in the field. Preharvest repairs, field adjustments and careful operation prevent most costly field losses.

Evaluate both gathering and separating losses to determine the best field speed. Adjust for tough stalks, ears that drop easily and lodged fields. Time your harvest to balance field loss and damage with the costs of higher corn moisture using your drying cost or current market discounts.

Table 8-8. Kernel Loss Data

	Step 4		Step 5		Step 6	Step 7		Step 8
	Corn Head and Separation Loss		Threshing Loss		Combine Kernel Loss	Corn Head Kernel Loss		Separation Loss
Row Number	no. per 10 sq. ft.*	bu/A	no. per 10 sq. ft.*	bu/A	bu/A	no. per 10 sq. ft.*	bu/A	bu/A
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
Average loss								

*Divide by 20 = bushels per acre

Citations

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