Chapter 14

Harvesting Soybeans

by G. Huitink

Combine operation requires an expert. A skilled operator may add more than $50 profit per hour of harvest. However, surveys indicate that only 10 percent of all combine operators check their combine adjustments regularly and match forward speed to soybean conditions. Constantly changing weather conditions affect soybeans and require that certain combine adjustments be fine-tuned to get the best operation. Large combines are costly to own and maintain. Harvesting is the single most costly operation of soybean production. Table 14.1 highlights one aspect of the worth of a skillful operator.

Make a commitment to be an expert combine operator. Every extra bushel saved at harvest is profit. In fact, the value of expert combine operation compared to average operation is impressive. Evaluate where you can improve as follows:

1. Know how to operate and adjust your combine properly in order to keep your harvest loss low.
2. Know how to quickly measure soybean field loss.
3. Know what losses are reasonable from each combine component.
4. Identify how much soybean damage and foreign matter content are allowed without getting market dockages.
5. Know how to reduce foreign matter dockage, field loss and soybean damage using proper cultural practices and helpful combine options.

Harvest Management

An expert operator adjusts for varying crop conditions, including weedy or droughty areas. In spite of costly attempts in the past 20 years to automate controls for forward speed, threshing and separation adjustments, an expert operator is still more reliable. Experiments indicate that adjustments are needed every two or three hours during most days to maintain combine efficiency. Frequent fine-tuning of combine forward speed, reel speed and reel height can increase soybean income by several hundred dollars per day. In addition, weedy areas, daily moisture fluctuations and changing fields are reasons to recheck your thresher speed, concave spacing and fan speed.

Characteristics of Expert Combine Operation

- No skipped (uncut), standing soybean strips between combine passes.
- Gathering loss is roughly 90 percent of all field loss when operating during favorable harvesting conditions.
- Very little foreign matter (f.m.) reaches the grain tank in a weed-free field. Soil is often the most common f.m. dockage. An expert combine operator slows forward speed to reduce foreign matter in soybeans harvested from weedy spots in the field.
- Few, if any, split soybeans in the grain tank (fewer than 1 split per 50 soybeans).

Table 14.1. The Value of Improving Combine Operation and Reducing Soybean Field Loss Using a 40 Bushel Per Acre Example of Soybeans Selling for Either $5 or $6 Per Bushel

Operator Skill Level	Combine Operation Loss, Bu/A	Acres Per Hour	Soybean Loss, $ Per Hour	Gain (Over New Operator), $ Per Hour, at Soybean Price of *$5/Bu*	Soybean Loss, $ Per Hour	Gain (Over New Operator), $ Per Hour, at Soybean Price of *$6/Bu*
New	2.6	10	$130	---	$156	---
Average	1.6	10	$80	$50	$96	$60
Expert	.9	10	$45	$85	$54	$102

- Soybean stalks that discharge from the combine fairly intact, not "chewed up," suggest that threshing adjustments are good. (If you operate a straw chopper on your combine, this check isn't useful.)
- Of the soybeans that are gathered, fewer than 1 percent leave the rear of the combine. Only immature "green" beans are left in pods behind the combine.
- Soybeans are no more than half of the recycled material in the tailings system. The tailings system should be only moderately loaded.
- If the combine separator is suddenly stalled or "killed," chaff should be spread evenly on the chaffer, the straw walkers and across the width of rotary components or the cylinder/concave.
- Skilled control of the combine loading rate, fan speed and sieve settings may eliminate light, low-quality seed or other foreign material, thus improving soybean market value.

Timely Harvest

To avoid moisture discounts from the quoted market price per bushel, soybeans must contain 13.5 percent, wet basis, or less moisture. However, a small loss of water affects soybean value above and below 13.5 percent moisture content (m.c.). The entries in the second column of Table 14.2 show the weight loss per bushel at moisture contents below 20 percent m.c.

Management Tip

If the content of the tailings is mostly soybeans, careful combine readjustment is needed. If the tailings system is fully loaded, check thresher adjustments first, then sieve openings and, finally, fan speeds to reduce the amount of recycled soybeans.

Obviously, every grower receives less income than the quoted price because he cannot afford enough combines, grain carts, trucks and grain-handling facilities to cut every bushel at 13.5 percent m.c. One option is to utilize farm grain drying and handling facilities to aerate or remove some soybean moisture. Another approach is to examine moisture discounts at local grain terminals to determine the range of harvest moisture that provides greater income for the entire crop.

For example, two discount rates for soybeans below 20 percent m.c. are shown in Table 14.2. Entries in the center and right columns are the net soybean values after taking the discounts above 13.5 percent m.c. and adjusting the weights to the 13.5 percent m.c. market standard. The net effect on deliveries for a $6.00 per bushel soybean price is shown in this table. Moisture discounts and the soybean weight loss above 13.5 percent m.c. have opposite effects on the payment received for "high"

Table 14.2. Two Discount Schedules for $6.00 Per Bushel Soybeans and the Weight/Value Lost From Soybeans at Moistures Other Than 13.5 Percent M.C. Standard

Soybean Harvest Moisture, %, Wet Basis	Weight of Water Loss (+) or Gain (-), Lbs/Bu to Convert Soybeans to 13.5% Moisture	Discount of $.12 Per Bushel Per Point of Moisture (2% Per Point of Moisture)			Discount of $.20 Per Bushel Per Point of Moisture (3.3% Per Point of Moisture)		
		$.12 Discount Per Bushel, $	Price Per Bushel, $	Value Per Bushel, $, Adjusted for Moisture	$.20 Discount Per Bushel, $	Price Per Bushel, $	Value Per Bushel, $, Adjusted for Moisture
19	4.33	-$.66	$5.34	$5.77	-$1.10	$4.90	$5.33
18	3.66	-$.54	$5.46	$5.83	-$.90	$5.10	$5.47
17	2.89	-$.42	$5.58	$5.87	-$.70	$5.30	$5.59
16	2.14	-$.30	$5.70	$5.91	-$.50	$5.50	$5.71
15	1.41	-$.18	$5.82	$5.96	-$.30	$5.70	$5.84
14	.70	-$.06	$5.94	$6.01	-$.10	$5.90	$5.97
13		0	$6.00	$6.00	0	$6.00	$6.00
12	-.68		$6.00	$5.93		$6.00	$5.93
11	-1.35		$6.00	$5.86		$6.00	$5.86
10	-2.00		$6.00	$5.80		$6.00	$5.80
9	-2.64		$6.00	$5.74		$6.00	$5.74
8	-3.26		$6.00	$5.67		$6.00	$5.67

moisture soybeans. The "penalties" for soybeans delivered at less than 13.5 percent m.c. are shown for both $.12 and $.20 discounts for each 1 percent m.c.

The discount schedule used by your grain terminal is the key factor in planning what is the best moisture to begin soybean harvest. One approach or goal is to balance the high moisture discounts of early harvest with late season value reductions from low moisture sales. Often moisture discounts are quoted as a percent of the "points" or moisture level of the soybeans. This ties the moisture discount to the soybean market price. In other words, as the price increases, the cash discount per bushel for "wet" soybeans increases proportionately. When soybean prices rise, a slightly greater return is realized from selling soybeans nearer to 13.5 percent m.c. Essentially, each grower should examine his local terminal's discount schedules carefully, evaluate his ability to "condition" soybeans on the farm and then plan his harvest timing. Planning may reduce the impact of market terminal moisture discounts if it is possible to begin soybean harvest at higher moistures or to obtain an extra combine, if discounts justify this, for more rapid harvest.

If harvesting begins at 16 percent soybean moisture, the income penalty (depending on discounts, on-farm drying, weather, etc.) may be less than marketing extremely dry soybeans later. During a wet harvesting season the penalty for late harvest is much costlier. Every grower knows how wear and repair expenses increase in muddy fields. In addition, a delayed harvest may result in high field shatter loss. Gathering loss increases from field deterioration, and possibly storms, sometimes as much as 5 bushels per acre. This cost may easily exceed the loss from early season moisture discount reductions. If soybeans deteriorate and become moldy and sprout in the field, further damage occurs during threshing and handling. Buyers and soybean crushers are apt to discount these soybeans for field deterioration or excessive splits.

Management Tip

Plan to maximize net crop income by balancing the high moisture discount early season with the soybean weight loss penalty later when soybeans dry. High moisture discounts at terminals may justify aerating or drying soybeans to avoid severe moisture penalties.

Gathering Soybeans Is Challenging

Getting all of the soybeans into the header is challenging. Bean pods may set low on the stalk – close to the ground. Dry soybeans, especially those that are dry and then get a rain, tend to shatter. Research shows that beans lost at the header account for more than 90 percent of the total loss. Gathering loss is the sum of shatter, stubble, lodged and stalk loss.

Cutting across flat-planted rows at an angle helps feed soybeans into the header more smoothly, thus reducing gathering loss. Drilled soybeans usually feed more uniformly into the header than 30- or 38-inch rows. This tends to keep gathering loss lower in drilled soybeans.

Header Options

A flexing cutterbar with automatic height control provides excellent gathering for fields with drain furrows, levees or low pods. Use care not to damage the header height sensor; for some models, this can occur if the header is down when backing. Follow the manufacturer's procedure to set the response time and position control.

A lateral-tilt header gathers more low-podded soybeans if the combine chassis doesn't remain parallel to the terrain. For example, this header gathers more soybeans in areas where wheels on one side of the combine are on a row and wheels on the other side follow a low middle. Lateral-tilt may gather more soybeans near irrigation levees, in muddy fields or on terrain with varying side slopes. One end of a wide header may be a foot high. If your soybeans pod low, as Group IVs often do, and your fields have levees, ditches or ridges, the lateral-tilt option may recover enough soybeans to offset this option's cost.

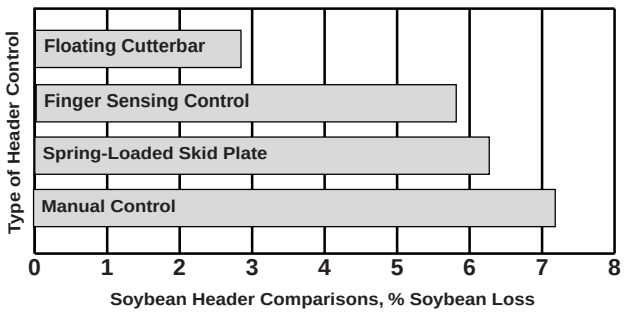

Figure 14.1. Harvest losses with various combine headers for soybeans.
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Draper headers do not follow the terrain like flexible headers. The big advantage of draper headers is the capability to cut all Delta crops well – soybeans, rice, wheat, grain sorghum, etc. In addition, Case, Ford-New Holland, Honey Bee, John Deere and MacDon drapers feed soybeans very uniformly into the thresher. This increases the effective capacity of any combine. However, a full, uniform rate is most critical with Axial Flow™ threshers. Uniform feeding reduces combine field loss and utilizes a combine's capacity. Obtaining more return on combine investment is essential with new combine prices approaching $200,000.

Suggestions for Improved Gathering

Gradually increase forward speed while checking both soybean stubble loss and separation loss (soybeans leaving the rear of the combine). Keep the combine speed below the point where gathering loss or separating loss increase rapidly. Speed should be slower in short, droughty soybeans to limit gathering loss well below 2 bushels per acre. An expert operator needs to be especially alert in well-watered, high-yielding soybeans to avoid high soybean loss out the rear of the combine. Every combine, no matter how large or how new, has a harvest capacity that varies with field conditions. Increasing feed rates (often a travel speed increase) increases field loss suddenly when a combine's capacity is exceeded.

Cutterbar

As forward speed increases, soybean cutting height increases (rapidly, at times), causing more gathering loss. Excessive forward speed may also cause excessive shatter and stubble loss. Combines have a fixed sickle speed. When the combine exceeds its practical speed limit, the sickle begins stripping stalks as it cuts. Soybean pods, stripped from the stalk, shatter and fall to the ground. Uneven stubble height is one hint that forward speed may be too fast for the sickle speed. Headers with 1 1/2-inch sickle section spacing may reduce gathering loss at high forward speeds compared to the common 3-inch spacing.

A sharp, well-adjusted cutterbar is vital to speeding harvest and minimizing gathering loss. Four items need to be checked: (1) all sickle sections are sharp, (2) all sickle hold-downs are gapped properly, (3) all guards are in alignment (if a guard is bent up, align it by tapping with a hammer). Misalignment causes rapid wear and ragged cutting on adjacent guards. And (4) inspect the sickle to assure it is in correct guard register. Refer to your operator's manual for specifications.

A proper cutterbar angle with the soil surface reduces gathering loss. Frequent sinkage (ruts) under muddy conditions, small diameter drive tires or an improper feed elevator/header combination may position the cutterbar too flat with respect to the soil. High row beds or an accumulation of residue worsen this problem. The bottom of the header may push soil when trying to cut low.

Large tires or a short, mismatched feed elevator add more tilt to the cutterbar. A steep cutting angle is easily noted. Residue is quick to hang in the cutterbar and soil is readily pushed onto the cutterbar, sometimes contributing to soil reaching the grain tank and causing f.m. discounts.

Most manufacturers offer a long divider option for both ends of the header. If soybeans are drilled, lodged or weedy, this option is especially helpful. Cleaner cutting and gathering at both ends of the header reduce both field stoppages and gathering loss.

Reel

Improper reel speed and reel position cause more shattered soybeans than any other maladjustment. Maintain reel tip speed 10 to 25 percent faster than travel speed. If the reel fingers are angled back slightly, it is even more important that the reel is operated at the slowest speed that tilts stalks slightly toward the cutterbar. From an operator's viewpoint, it appears as if the reel is slowly pulling the combine into standing soybeans. Probably the most useful option on a combine is an automatic reel control that maintains a constant forward/reel speed ratio as forward speed is adjusted for the incoming crop.

Figure 14.2. Reel adjustment for gentle soybean handling is more critical after soybeans have dried down once (or with certain Maturity Group IV varieties).

The reel should be lowered in areas where soybeans did not grow tall. If reel speed matches forward speed and the reel contacts the top one-third of the plant, soybeans are seldom flailed out of their pods.

Usually, positioning (fore and aft) the reel as close to the auger as possible provides the most uniform feed rate to the combine. This may seem trivial, and with some soybeans, fore and aft positioning isn't important. However, improper reel position may clump or cause uneven feeding that usually increases separator loss and reduces harvesting capacity. Check the fore/aft reel position when entering fields with substantial soybean height changes or when the pickup fingers must be angled back for lodged soybeans. It takes an expert operator to remedy uneven or "slug" feeding, but it pays off handsomely with better combine performance.

In short, droughty soybeans, lower the reel to reduce soybean "stacking" on the cutterbar. If a dense crop is not feeding across the header uniformly, check the reel position first. Then check if the sickle is sharp and cutting cleanly. Sometimes a header slip clutch or drive belt causes momentary hesitation, thus an uneven feed rate. LEXION™ has retractable fingers across the full header width to improve crop flow into the feed elevator.

Header Auger

Finally, observe if the auger fingers are aggressive. The gap between the auger fingers and the header floor should be 5/8 inch. For best performance, adjust the auger finger timing for soybean height, size of lower branches, etc. Check that the auger is properly positioned, especially notice the clearance above the bottom of the header.

Threshing

With proper adjustment, up to 90 percent of the soybeans pass through the concave or rotor grate, greatly simplifying separation. Threshing and separation losses are usually nil if the thresher is adjusted properly. Threshing loss is unthreshed beans remaining in pods that pass through the combine. When pods are green or damp, check that mature, unthreshed pods do not leave the rear of the combine, especially in weedy areas. Thresher speed and concave spacing or rotor/grate spacing should be re-evaluated when soybean moisture content changes and when starting into a different soybean variety. Cutting across a field that has both irrigated and non-irrigated crop is one reason for accepting a little threshing loss.

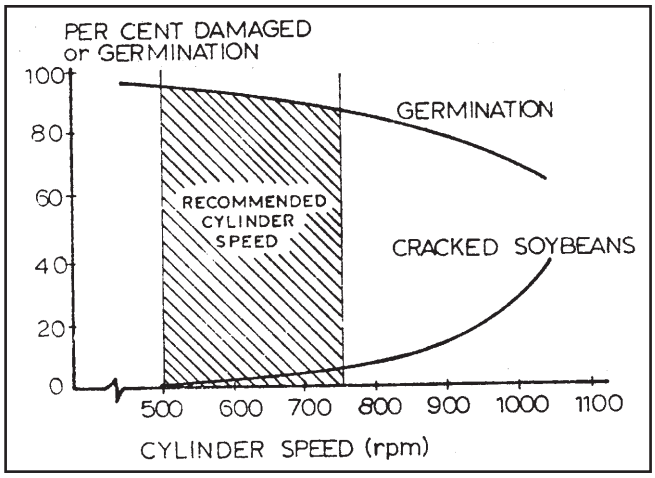

Figure 14.3. Effects of thresher speed on damage and germination.

However, over-threshing is a common oversight in Arkansas, especially with spike tooth cylinders. Since increasing thresher speed increases threshing severity, choose the slowest thresher speed that beats soybeans out of the pods. Pods and stalks should not be pulverized. Another indication of over-threshing is excessive chaff and stalk returning in the tailings. Over-threshing simply increases the chaff and fine stalk material on the chaffer sieve and may complicate cleaning soybeans. Always look for a few immature green soybeans and leave these in the pods.

To avoid over-threshing, start by narrowing the thresher to concave or rotor grate spacing to the position recommended in the operator's manual and then reduce it further if some unthreshed pods are leaving the rear of the combine. For seed beans, a thresher rpm slower than the recommendation in the manual may be practical. Research indicates that soybean germination declines at roughly the same rate as damage (splits, etc.) increases when threshing is too aggressive (Figure 14.3). Dry soybeans (8.5-13 percent moisture) need very gentle threshing.

Don't take poor threshing of soybeans as an acceptable diagnosis until you've checked whether the header dropped the unthreshed pods, examined carefully all threshing components for excess wear and narrowed the concave/grate to thresher gap. During rice harvest or during soybean harvest when soil is pushed into the combine, rapid wear occurs. Thresher components, the impeller feeding the Axial-Flow™ rotor and accelerator cylinders ahead of the thresher must be maintained to obtain full combine capacity. Worn spike teeth can cut combine capacity roughly by one-half, resulting in poor

threshing, poor separation and damaged soybeans, all at once. Growers remark that their combine threshes like a new one after replacing worn threshing components.

Always make only one adjustment at a time. Then check combine performance under normal load. Count losses in the field, evaluate the bin sample and monitor the tailings throughout the harvest day.

Damage from worn auger flighting is another source of soybean splits and damage. Augers handling the grain behind the sieves are prone to wear rapidly when harvesting rice, so they may need replacement.

Cleaning

Fan Adjustment

Fan speed is the key adjustment for cleaning. Fine-tune the fan speed frequently, as stalk moisture varies and the amount of material other than soybeans changes. Be alert to possibly needing additional fan speed when harvesting larger areas with weed infestations. Check the grain tank and the losses behind the combine to evaluate your fan speed setting. If the sample in the grain tank contains too many soybean stalk or weed portions, this suggests that the fan speed should be increased, if the sieves are set properly.

The first indication that fan speed is too high is an excessive amount of threshed soybeans in the tailings return. Too much air velocity pushes soybeans off the chaffer and cleaning sieves, into the tailings return. Soybeans may also begin leaving the combine with the chaff, causing high separation loss. Separation loss consists of soybeans discharged from the combine separator, already hulled out of the pods.

Reduce the fan speed as stalks dry. If you expect to cut at less than full capacity for some time, determine whether the fan speed should be reduced. Separation of soybeans from chaff is done primarily with air by using sufficient velocity to tumble the mixture. Soybeans, which are heavier, fall through the sieve. High air velocity keeps the chaff tumbling and moving off the rear of the combine. The denser, heavier soybeans should fall through this airflow, onto the cleaning sieve.

If anything disrupts the air passing through the sieves, soybean cleaning will suffer. Cleaning fan inlets covered with chaff starves the fan, preventing uniform tumbling on the sieves. Large weeds hanging in the air path disrupt the air velocity; thus, it's important to keep the path from the fan clear of any kind of blockage that hinders separation.

Separation Through the Sieves

Start with the chaffer and cleaning sieve openings suggested in your operator's manual for soybeans. Later you may wish to **reduce the chaffer (upper) sieve opening first**, if too many stalk portions are reaching the grain tank. Remember, the fan speed should be in the proper range and then fine-tune sieve openings to get the best cleaning. Sieve settings close to the manual's suggestions normally perform very well. Damaged chaffer or cleaning sieves need repair or replacement to avoid excessive foreign matter and dockage.

The cleaning (lowest) sieve openings should be somewhat smaller than the chaffer setting. This sieve's task is to keep small stalk sections, unthreshed pods and cockleburs from getting into the grain tank. Never make two adjustments at once in order to identify the effect of your fine-tuning.

Soybeans are not hard to separate from chaff. However, maintaining expert cleaning really requires tweaking the fan speed throughout the day, whenever situations require it. Never be concerned about using fan speeds higher or lower than suggestions in the operator's manual, as long as separation loss remains low and the grain tank sample is clean.

Figure 14.4. Uneven wheat emergence and growth are evidence of poor combine distribution of soybean residue.

Soybean Residue

Stalks and chaff should be discharged uniformly behind the combine to minimize seedbed preparation for the next crop. Adding a chaff spreader is simple on certain combines. Observe the soybean residue behind your combine if you plan to begin seeding no-tillage wheat. Soybeans provide little residue, even from well-irrigated plants. However, when soybeans are never rotated with another warm-season crop, there are situations where certain diseases overwinter in the dense "windrow" of soybean thatch behind a combine. Spreading soybean residue uniformly provides some soil protection from erosion without hindering a good no-tillage drill.

Wheat, rice or soybeans can be seeded with a no-tillage drill if the combine discharge isn't concentrated. Maintain the straw spreader properly, so it pitches stalks across roughly two-thirds of the header width. Chaff spreaders distribute the sieve discharge. An inexpensive chaff spreader is available for Case combines. Growers with recent models of Ford-New Holland, John Deere and LEXION™ combines have a chaff spreader option. With a good chaff spreader, residue from high-yielding soybeans does not hamper a good no-till drill (even for drilling wheat immediately after a soybean crop), unless the combine stops while threshing. Straw choppers pulverize soybean stalks without affecting the chaff while increasing combine engine load and operation cost.

Performance Evaluation

Loss monitors and yield monitors have become valuable management tools; calibrating them properly maximizes their benefit. Loss monitors require re-indexing (validating) for changes in seed moisture. Sensitivity settings are relative, but a loss monitor is an excellent diagnostic tool to confirm that your combine is at its capacity. One indicator of excess forward speed is separation loss; the signal from a loss monitor helps harvest more acres without blowing too many soybeans off the rear of the sieve.

Combine Loss Monitors

Grain loss monitors may help optimize operating adjustments and forward speed. Grain loss sensors must be installed properly in the straw and chaff discharge to intercept soybeans leaving the combine. The sensitivity must be set to assure that only grain and not straw segments trigger the indicator. To check whether a sensor is functional, tap it lightly while someone watches the monitor needle in the cab. For precision, reset the indicator for swings in soybean moisture content. Calibrate the monitor for soybeans by occasionally checking behind the combine to prove that actual separation loss is proportional to the signal in the cab.

Brief monitor fluctuations should be overlooked. However, observing a monitor and the field conditions will quickly highlight conditions that increase soybean separation loss. An alert operator fine-tunes thresher speed and forward speed to use his combine capacity while avoiding excess soybean loss.

Figure 14.5. Yield monitors can be especially helpful in documenting the differences between well-watered soybeans and those receiving inadequate rainfall or those growing in soils that remain too wet at times.

Yield Monitors

A yield monitor basically provides dry weight yields, based on data gathered from the moisture sensor and the grain flow sensor. The processor estimates yield at every point in the field. It is vital to calibrate for soybeans to get useful management data. Take several soybean samples to a moisture meter like those used at grain terminals. Calibrate the yield monitor, compare the readings and confirm the moisture content of each. Yield monitor information helps to identify the benefits of good drainage, irrigation, variety selection, subsoiling, and a variety of fertility or herbicide applications. New uses continue to develop.

Where levees and point rows are few, yield monitors can be very accurate. Both the differential global positioning system (DGPS) with the mapping capability and the non-recording, instantaneous non-DGPS models provide valuable management

data. However, harvesting a constant width (near full header width) is essential to get accurate acreage data, thus correct yield per acre data.

Soybean moisture is displayed on the monitor throughout the harvest day. The processor typically adjusts soybean weight to 13.5 percent m.c. if it is calibrated properly. If moisture is not properly calibrated or it is biased by residue, the processor converts the data to incorrect yields. If soil enters the header, be alert that soil can accumulate on the moisture sensor in the clean grain delivery. Residue typically has high moisture and converts its data to unrealistically high soybean moistures. The processor then adjusts the dry weight (13.5 percent soybeans) down and, consequently, records lowered yields (without real reason). If the display moisture content rises more rapidly than justified, it is wise to check the metal sensor for residue. Plant residue may stick on the metal sensor without an apparent cause. When sampling in the grain tank, always check that the metal sensor is smooth and shiny (no residue). Until the sensor is thoroughly clean, erroneous readings persist, *even for years*! Moisture errors are one of the most common errors that exceed 2 percent.

Safe Operation and Overall Combine Management

Always make only one adjustment at a time. Then check the combine performance under normal operation. Count losses in the field, evaluating the bin sample and monitoring the tailings throughout the harvest day.

If the cutterbar or feed elevator entry plugs, stop the combine engine before reaching into the header to remove the obstruction. Never attempt to remove obstructions or perform maintenance with the thresher turning. Replace all shields and covers after repairing or adjusting combine components. Do not engage power before all guards and shields are in place. Don't fail to give ladders and overhead work your full attention. Falls from combines are the most common combine accident. They may cause lifetime paralysis and have caused death to a number of farmers.

Never work under a combine header without securely blocking the lift cylinder. Men have been crushed under a header making adjustments when the hydraulic system failed. Others have been pinned when someone else bumped the header lift control.

Management Tip

Six combine performance evaluation points:

1. Soybean field loss.
2. Soybeans in tailings.
3. Material other than soybeans in tailings.
4. Foreign material in grain tank sample.
5. Soybean splits, damaged seed or reduced germination.
6. Degree of stalk destruction behind combine (if not flailed through a straw chopper).

Use auxiliary flashing lights when operating a combine on a public road. Combines are large and motorists are not alert to equipment moving less than 25 mph. Make every effort to move on roads during well-lit daylight hours.

Reducing Soybean Field Loss

Soybeans are fairly easy to harvest when the soil is dry. A skillful operator can maintain loss at reasonable levels. Indeterminant soybean varieties have traditionally set higher on the plant than determinant varieties commonly grown in the Midwest. Table 14.3 (on the next page) illustrates several comparisons that relate to the type of soybean production. Pre-harvest loss samples averaged slightly higher at Illinois locations due to their climate and a tendency of determinant varieties to shatter readily. Also, flood-irrigated soybeans in Arkansas tend to pod higher and have less gathering loss than similar varieties in Mississippi that haven't been irrigated. Another important observation is that field losses do not necessarily correlate with yields or moisture content at harvest. Probably, an expert operator is the key influence on the level of field loss in higher yielding, irrigated soybeans. However, harvesting muddy fields tends to increase gathering loss; consequently, total field loss rises significantly.

Combine manufacturers consider the maximum combine capacity to be the feed rate (weight) at 3 percent field loss. However, maintaining field loss between 1/2 and 2 bu/A is a realistic goal for every grower. For 20 bu/A soybean yields, the desired loss range varies from 1/2 bu/A under normal field conditions to 1 1/2 bu/A with either extremely droughty, low-podded soybeans or muddy fields. For 60 bu/A yields, a desirable loss range is from 1/2 to

Table 14.3. Summary of Harvest Comparisons Based on 35 Field Samples Gathered From Grower-Operated Combines
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Location	Champaign County, ILLINOIS	Shelby County, ILLINOIS	Arkansas County, ARKANSAS	Sunflower County, MISSISSIPPI
Number of Combines	**11**	**9**	**8**	**7**
Loss				
Pre-Harvest Loss, %	**.32**	**.24**	**.01**	**.15**
Gathering Loss, %	**6.26**	**3.86**	**2.24**	**11.05**
Threshing and Separating Loss, %	**3.17**	**1.11**	**1.31**	**1.69**
Total Field Loss, %	**9.44**	**4.97**	**3.54**	**12.74**
Total Yield, Bu/A	**49.38**	**36.07**	**36.87**	**21.13**
Stubble Height, Inches	**3.67**	**3.67**	**4.20**	**4.33**
Soybean Moisture Content at Harvest, %	**13.30**	**12.90**	**13.80**	**12.20**

Header width varied from 10 to 20 feet wide.

Table 14.4. Annual Samples of Soybean Field Loss in Arkansas.
Arkansas Agricultural Statistics Service*

Year	Field Loss (Bu/A)
1990	1.8
1991	1.1
1992	1.3
1993	1.5
1994	1.3
1995	2.5
1996	2.1
1997	1.5
1998	1.6
1999	1.1
10-Year Average	1.6

* Data collected from 74 small field plot samples across Arkansas. These unofficial averages are from randomly selected locations using a consistent sampling procedure.

1 1/2 bu/A with good harvesting conditions. When harvest is delayed and soybeans remain in the field, excessive shattering or severely lodged soybeans may cause unavoidable field loss levels up to 2 bu/A.

Table 14.4 shows total field losses in Arkansas that have been sampled and summarized annually. The dominant factor influencing total field loss over the decade appears to be **weather**. When rains occur during harvest, the losses rise, especially if combines "rut" the fields to finish. When the growing season is dry, the soybeans on non-irrigated fields set so low that they become a significant portion of the soybean yield. If efforts to recover low pods are successful, the harvested yield is raised and field losses don't "spike" as high.

A quick count of soybeans lying on the ground is a reliable estimate of field loss. Four to five soybeans per square foot spread uniformly across a field equal a bushel per acre loss. **To obtain a good sample, soybeans in 10 square feet should be counted**, and the number of soybeans found in that area should be divided by 40 or 50 (see Procedure section later in this chapter). Divide the number of large-seeded soybeans that you've counted by 40.

Table 14.5. Preliminary Guide That Includes a Few Soybean Sizes to Help Develop a Perspective of Whether 4 or 5 Seed Is the Appropriate Soybean Count to Use in Estimates of Field Losses

Four soybeans per square foot equal one bushel per acre loss.		Five soybeans per square foot equal one bushel per acre loss.	
Selected LARGE-seeded varieties that normally require LESS than 3,300 seed to weigh 1 pound.	**Seed Weight (Seeds/Lb)***	**Selected SMALL-seeded varieties that normally require MORE than 3,300 seed to weigh 1 pound.**	**Seed Weight (Seeds/Lb)***
Delta King 5961RR	2,500	Hutcheson	3,400
NK S46-44	2,500	Asgrow A5547	3,500
Pioneer 9594	2,500	Deltapine DP 3478	3,500
Terral TV4975	2,500	Hartz Variety H6191	3,500
HBK 5990	2,600	Asgrow A6297	3,600
UARK-5798	2,800	Delta King 5850	3,600
Accomac	3,000	Crowley	3,700
Manokin	3,000	Novartis NK59-V6	3,700
Asgrow 5959	3,100	Riverside Robin - 5	4,100
Caviness	3,200	Dyna-Gro 3576	4,600

*There are genetic differences among varieties, but seed size will vary considerably from lot to lot, depending upon environmental conditions.

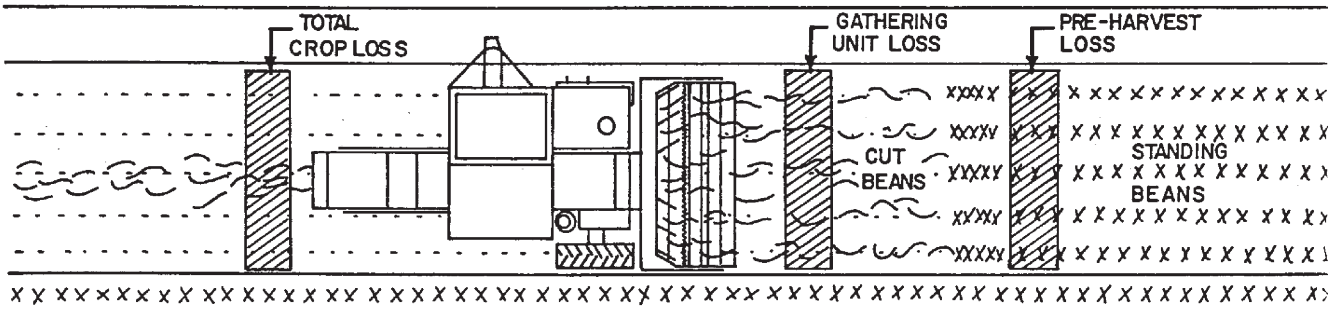
Small-seeded soybeans cannot amount to as great a loss. Divide the number of small-seeded soybeans in a 10 square foot area by 50.

Table 14.5 provides a general guide to soybean size. Soybeans vary in size, according to their growing conditions. When purchasing seed, the number of soybeans in a bushel may differ in different lots. The table is an example that is provided to help select whether 40 or 50 is the best choice to use as the divisor.

Management Tip

Four soybeans per square foot distributed uniformly equal 1 bushel per acre loss if there are **2,904 seed per pound**. If **3,630** seed weigh a pound, then **5 seeds per square foot** spread uniformly across a field equal 1 bushel per acre loss. When estimating, use 5 seeds for small soybeans requiring at least 3,300 seed to weigh 1 pound.

Figure 14.6. Locations for Checking Various Components of Harvest Loss.



Procedure

Observe your grain loss indicator where you plan to sample loss in order to relate the position of the monitor needle to threshing and separating loss. (However, pre-harvest and gathering losses cannot be measured with a loss monitor.)

1. Stop combine at least 300 feet from field borders where **soybeans** and **combine operation** are **typical** of most of the field. Back combine about 15 feet from standing soybeans. Place rectangular frame enclosing 10 square feet across swath harvested behind the combine. Count all beans in frame and enter this count in cell 1-A of the soybean field loss data table (Table 14.6). Divide this number by 40 or 50 to enter ***total field loss*** in bushels per acre in cell 1-B. If total field loss is below 3 percent of yield, continue harvesting. If loss is greater, then pinpoint the cause of the loss and remedy it.

2. Sample ***pre-harvest loss*** by laying rectangular frame in standing soybeans. Count the beans on the ground, both loose and in pods. Enter this number in cell 2-A and then divide by 40 or 50 to get pre-harvest loss in bushels per acre. Enter this pre-harvest loss in cell 2-B.

3. Estimate ***combine loss*** by subtracting pre-harvest loss from total field loss. Subtract cell 2-B from 1-B. If loss is high, check further by counting gathering losses.

4. Sample ***gathering losses*** by placing rectangular frame between your parked combine and standing soybeans. Then make soybean loss counts as follows:

    a. ***Shatter loss*** – Count all loose beans and beans in pods on the ground and enter this number in cell 4a-A. Refer to your count in cell 2-A to subtract pre-harvest loss from the number in 4a-A before dividing by 40 or 50 to enter the bu/A shatter loss in column 4a-B.

    b. ***Loose stalk loss*** – Count all beans in pods attached to stalks that were cut but weren't gathered. Enter this number in cell 4b-A and divide by 40 or 50 to enter the bu/A loss in cell 4b-B.

    c. ***Lodged loss*** – Count all beans in pods on lodged stalks (lodged soybean stalks, still rooted). Enter this count in cell 4c-A and divide by 40 or 50 to enter the bu/A loss in column 4c-B.

    d. ***Stubble loss*** – Count all beans in pods still on the stubble. Enter this number in cell 4d-A, divide by 40 or 50 and enter bu/A stubble loss in cell 4d-B.

5. Total **gathering losses** by adding shatter, loose stalk, lodged and stubble losses in column B. Enter this total in cell 4-B.

6. **Threshing and separation losses** are obtained by subtracting gathering loss from combine loss. Enter this difference (3B - 4B) in cell 5-B.

7. Compare your loss sample levels to those in column C. As you harvest, put emphasis on operating practices and combine adjustments that reduce the total field loss. Repeat loss counts in other field areas to improve the reliability of your loss estimate.

Table 14.6. Soybean Field Loss Data				
Source of Loss	COLUMN A Number of Beans Found in a 10 Sq. Ft. Area	Number of Soybeans Equal to 1 Bu/A	COLUMN B Your Soybean Loss Bu/A	COLUMN C Acceptable Loss for a 40 Bu/A Yield (Bu/A)
1. Total Field Loss		40 or 50		1.3
2. Pre-Harvest Loss		40 or 50		0.1
3. Combine Loss				1.2
4. Gathering Loss Total of:				1.1
a. Shatter		40 or 50		0.4
b. Loose Stalk		40 or 50		0.2
c. Lodged		40 or 50		0.2
d. Stubble		40 or 50		0.3
5. Threshing and Separation Loss				0.1