DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Agriculture and Natural Resources

FSA1048

Importance of Minimizing Field Losses During Soybean Harvest

Subodh Kulkarni, Ph.D.
Program Associate - Machinery

Economic Value of Soybean Harvesting Losses

Harvested yields of soybeans in many Arkansas fields can be increased by 5 to 10 percent by leaving fewer beans in the field when combining. Combine operation requires an expert. A skilled operator may add more than $150 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 field conditions. Table 1 illustrates the economic value of a skilled combine operator.

Evaluate your operation and decide where you can make improvements.

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

Reduce Soybean Harvest Losses

Field losses are commonly around 10 percent of yield. However, North Carolina State University estimated that sometimes 15 to 20 percent losses are possible due to careless harvest operations. See <http://ipm.ncsu.edu/soybeans/agronomy/soybean_loss.html>. The machine losses can be reduced to 3 to 4 percent (1.25 to 1.5 bushels/acre in the 40-bushel beans) with careful equipment operation.

Typically, soybean harvest loss occurs at four stages. The **pre-harvest losses** occur in the form of loose beans or detached pods that have fallen to the ground prior to harvest.

Table 1. Value of Improving Combine Operations and Reducing Soybean Field Loss. Example of 40 Bushel Per Acre Soybeans Selling for $15 Per Bushel (Soybean price based on forecast in July 2008, from <http://www.msu.edu/~hilker/soyfut.htm>.)

Operator Skill Level	Combine Operation Loss, bushels/acre	Harvest Rate, acres/hour	Value of Soybean Loss, $/hour	Gain (Over New Operator), $/hour
New	2.6	10	$390	---
Average	1.6	10	$240	$150
Expert	0.9	10	$135	$265

Arkansas Is Our Campus

Visit our web site at:
https://www.uaex.uada.edu

The **gathering losses** occur because of shatter during harvest and when beans remain attached to the stubble. The pods on lodged stalks remain in the field and are cut, but loose stalks sometimes do not reach the threshing unit. **Cylinder losses** occur when the beans remain in the pods after being threshed by the combine, and **separation losses** are threshed beans that fail to be separated from trash and are discharged out the back of the combine along with trash and any unthreshed pods.

Procedure for Checking Losses

An estimate of the bushels/acre of soybeans lost is based on the number of beans per square foot left in the field after harvesting. About four average-sized beans (per square foot) is equivalent to one bushel/acre. Bean size is also a factor. It may require up to 10 very small beans or only two very large beans (per square foot) to equal one bushel/acre.

A procedure to check losses in the field was originally presented by Dr. E.O. Beasley <http://ipm.ncsu.edu/soybeans/agronomy/soybean_loss.html> as follows:

Counts beans left in the field in a 10-square-foot area. The width of the rectangle should equal the swath width of the combine header; i.e., a 20-foot header would require a 20-foot-wide rectangle (by 6 inch length [see Table 2] to enclose 10 square feet).

Table 2. Dimensions for Rectangular 10-Square-Foot Frame.

Swath Header Width (feet)	Distance Along Row to Enclose 10 Square Feet (inches)
8	15.0
10	12.0
12	10.0
13	9.25
14	8.6
15	8.0
16	7.5
18	6.7
20	6.0

1. Determine the total field loss.

Stop the combine during the harvest operation well in from the end of the field, where the crop is typical of the whole field. Disengage the gathering unit and back up about 15 feet (see Figure 1). Place the rectangular frame across the harvested swath at the rear of the machine (at least 20 feet behind the combine). Count all beans within the frame area and record in Column A, line 1 of Table 3. Divide by 40 (if average-sized beans) to get bushels/acre of pre-harvest plus harvesting loss, and record in Column B, line 1.

Locations to check various field losses are illustrated in Figure 1.

If the total field loss is not more than 3 percent of yield (1.2 bushels/acre in 40 bushels/acre beans), then continue harvesting. If total loss exceeds 3 percent, follow steps 2 through 5 to see where the losses occur and make adjustments to reduce them.

2. Determine the pre-harvest loss.

Place the rectangular frame in standing soybeans in front of the combine, and count all beans lying loose on the ground within the frame, both in and out of pods. Record the total count in Column A, line 2 of Table 3. Divide by 40 to get bushels/acre, and enter in Column B, line 2.

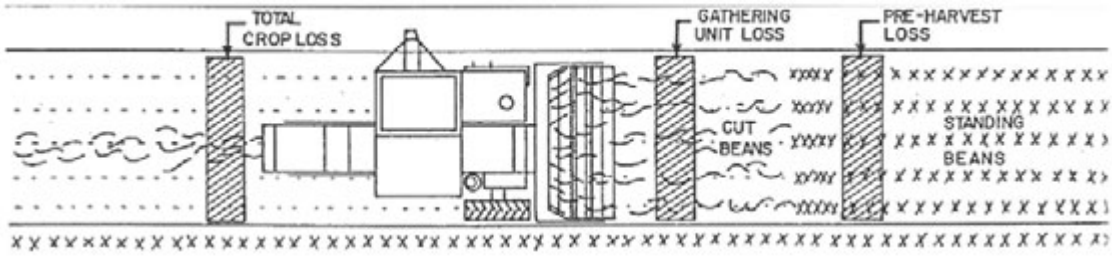

Figure 1. Aerial view of combine swath illustrating the locations for checking various components of harvest loss.

Table 3. Soybean Field Loss Data Template (for 40 bushels/acre beans).

Source of Loss	Column A No. of Beans in 10-Square-Foot Frame Area	Number of Soybeans Equal to Loss of 1 Bushel/Acre	Column B Measured Soybean Loss, Bushel/Acre	Column C Acceptable Loss (for 40 Bushels/Acre Yield), Bushel/Acre
1. Total Field Loss		40		1.3
2. Pre-Harvest Loss		40		0.1
3. Combine Loss				1.2
4. Gathering Loss Total of:				1.1
a. Shatter		40		0.4
b. Stubble		40		0.3
c. Lodged		40		0.2
d. Loose Stalk		40		0.2
5. Threshing and Separation Loss				0.1

3. Determine the overall machine loss.

Subtract the pre-harvest loss (line 2) from the total field loss (line 1) in Columns A and B, respectively, of Table 3. If the machine loss is not more than about 3 percent of yield (1.2 bushels/acre in 40 bushels/acre beans), continue harvesting. If more, proceed with the remainder of the loss analysis and make adjustments to reduce losses where needed.

4. Determine the gathering unit losses.

Place the frame across the harvested swath between the combine header and the standing beans (in the area that was cut by the header). Make counts as follows:

a. Shatter loss. Count all loose beans and beans in detached pods lying on the ground. Subtract pre-harvest loss (Column A, line 2) and record remainder in Column A, line 4a. Divide by 40 and enter bushels/acre in Column B, line 4a.

b. Stubble loss. Count beans in pods attached to stubble, and enter in Column A, line 4b. Divide by 40 and enter bushels/acre in Column B, line 4b.

c. Lodged stalk loss. Count beans in pods attached to stalks which were not cut, and enter in Column A, line 4c. Divide by 40 and enter bushels/acre in Column B, line 4c.

d. Loose stalk loss. Count beans in pods attached to loose stalks or portions of stalks which were cut but not gathered by the header, and enter in Column A, line 4d. Divide by 40 and enter bushels/acre in Column B, line 4d.

Determine total gathering unit losses by adding the number of beans representing shatter, stubble, lodged and loose stalk loss (Column A, lines 4a-4d). Enter total in Column A, line 4. Divide by 40 and enter bushels/acre (total gathering unit loss) in column B, line 4.

5. Determine cylinder and separating losses.

Subtract gathering unit loss (Column B, line 4) from overall machine loss (Column B, line 3) and record in Column B, line 5. This represents the soybeans that were gathered by the combine but were deposited back on the field with the trash (cylinder and separating loss).

Some researchers suggest the use of a one-square-foot frame to calculate the soybean losses in the field. The random samples are taken by throwing the frame in the field and counting the beans in the frame.

Operational Guidelines

Examine the measurements of the various types of gathering unit losses and the cylinder and separating losses to check where adjustments need to be made. Comparison with the “acceptable” losses in Column C, lines 4a-4d should be helpful in identifying the problem source. If your yield is much different from 40 bushels/acre, these “acceptable” bushel-per-acre losses should be adjusted accordingly.

Based upon the loss mechanism you are trying to reduce, select an operating parameter to adjust (i.e., reel speed, reel height, ground speed, cutter bar height, cylinder speed, concave clearance, etc.). Refer to the combine dealer or manufacturer’s guidelines (operator’s manual) for suggestions and methods

for adjustment. Make only one change in combine adjustment at a time; then recheck losses to see if that change improved performance. If not, go back to the original setting and try another approach, rechecking losses after each change. Only with this systematic approach can you isolate and correct the cause of excessive harvesting losses. Although this method is time-consuming, the economic value of the improved yield may justify the extra time.

Typically, more than 75 percent of soybean machine harvesting losses are gathering losses, so the greatest attention should be given to proper header adjustment and operation. Depending upon field/crop conditions, decreased gathering losses may be visually apparent to a careful operator who takes the time to get down from the cab and look at the stubble. Losses typically go up as travel speed increases.

Other Hints to Decrease Losses

- Make sure knife sections, guards, wear plates and hold-down clips are in good condition and properly adjusted.

- Make a note for the upcoming season to try to keep the seedbed level. Do not pile up soil around beans when cultivating.

- Operate the cutter bar as close to the ground as possible at all times. A floating header unit or an automatic header control is nearly essential on self-propelled combines.

- Use a ground speed of 2.8 to 3.0 mph. To determine ground speed, count the number of 3-foot steps taken in 20 seconds while walking beside (and keeping pace with) the combine. Divide this number by 10 to get the ground speed in mph or use the formula below:

  Speed, mph = [Distance (ft) x 60] / [Time (sec) x 88]

- Use a reel speed about 25 percent faster than ground speed. For example, for 42-inch diameter reels use a reel speed of 11 rpm for each 1 mph of ground speed. Refer to the combine operator's manual.

- Reel axle should be 6 to 12 inches ahead of the cutter bar. Reel bats should leave beans just as they are cut. Reel depth should be just enough to control the beans.

- A six-bat reel will give more uniform feeding than a four-bat reel.

- Complete the harvest as quickly as possible after beans reach 15 percent moisture content to prevent yield reduction due to excess in-field drying.

- A pick-up type reel with pick-up guards on the cutter bar is recommended when beans are lodged and tangled.

Good luck with your harvest!

Acknowledgments are given to Dr. Dennis Gardisser, professor and associate department head - Extension engineer, and Dr. Thomas A. Costello, associate professor, Biological and Agricultural Engineering, and Vaughn Skinner, resident director, Arkansas Agricultural Research and Extension Center, Fayetteville, for reviewing the fact sheet. A part of this fact sheet was taken from Chapter 14, "Harvesting," from the *Arkansas Soybean Handbook* (MP197).

DR. SUBODH KULKARNI is program associate - machinery, Biological and Agricultural Engineering, University of Arkansas Division of Agriculture, Cooperative Extension Service, Little Rock.

FSA1048-PD-8-08N