Estimating Harvest loss
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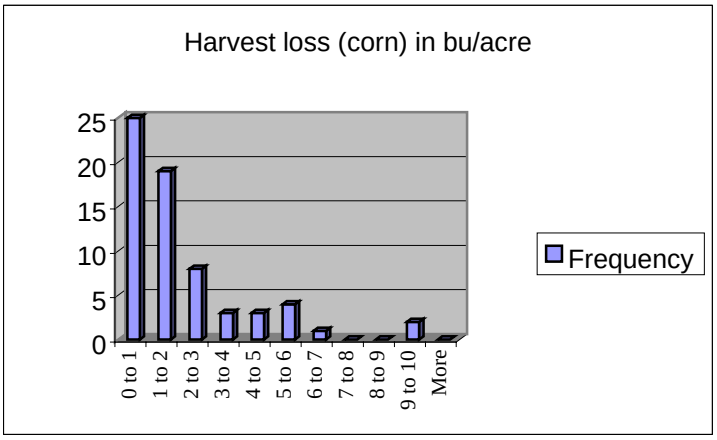
Executive Summary

Most farmers and agronomists feel a sense of pride and accomplishment while watching a combine harvesting a grain field. Would any one of these farmers or his agronomist feel the same pride of accomplishment if he knew that his combine was not setup/adjusted properly and was losing 3 to 5 bu/acre? Ensuring that a combine is setup/adjusted properly is both a science and an art. It requires an attention to detail and constant checking. The efficiency of a combine can be checked by estimating the amount of grain left on the ground behind the combine. The objective of this paper is to ensure that every farmer/agronomist is able to quickly and easily make an estimate of harvest loss on the ground behind a combine.

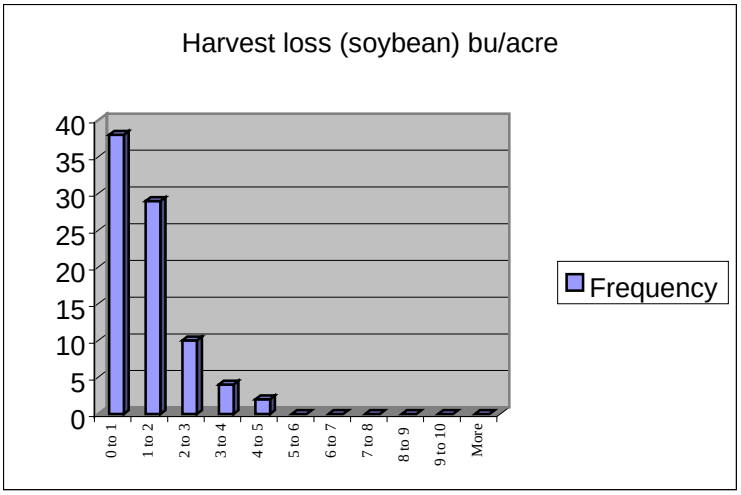
Harvest loss can be substantial

A 2001 harvest season survey behind 30 combines located in Eastern South Dakota, Western Minnesota, and Northwest Iowa showed that in the median behind combine loss for corn was 1.3 bu/acre (standard deviation 2.01 bu/acre). The median, behind combine loss, for soybeans was 1.1 bu/acre (standard deviation .97 bu/acre). Clearly these losses are significant. In a 160 acre field (corn @ $2.00/bu and soybeans @ $4.50/bu) these median losses amount to a little over $400 of corn and a little less than $800 of soybeans. Unfortunately, as indicated by the large standard deviations, there were many fields in which the losses were far greater.

How good of a job of combining corn can you expect to do? Look at the frequency distribution of 65 different measurements from 30 different fields of corn in the figure below. The median harvest loss was 1.3 bu/acre. Clearly there should be an expectation of losing less than 1 to 2 bu/acre



How good of a job of combining soybeans can you expect to do? Look at the frequency distribution of 83 different measurements from 30 different fields of soybeans in the figure below. The median harvest loss was 1.1 bu/acre. Clearly there should be an expectation of losing less than 1 to 2 bu/acre



Estimating Harvest loss

Making a rough estimate of how much grain is left behind in a harvested field can be accomplished with a few simple steps.

Step1. Place a 1 ft by 1 ft (inside dimension) box on the ground and count the kernels, beans, or seeds found within the box. To improve the accuracy of the estimate, three counts (one behind the left side of the header, one behind the center of the combine, and one behind the right side of the combine) are better.

Step 2. Estimate how many individual beans, kernels of corn, or wheat seeds found in a ft^2 of area equal 1 bu/acre of grain left in the field. This is not simple but an estimate is possible. Three studies were conducted to determine the answer to this question.

The Seed Testing Laboratory

Data (density, gm/seed) from the Seed Testing Laboratory at South Dakota State University using samples submitted from June 1998 to August 2000 (several hundred samples of each species) was used to calculate the seeds/ft^2 per bu/acre . Using this information there were **20.9 seeds/ft^2 per bu/acre spring wheat seeds** (standard deviation 2.6 seeds/ft^2 per bu/acre), **22.4 seeds/ft^2 per bu/acre winter wheat seeds** (standard deviation 2.4 seeds/ft^2 per bu/acre), and **3.69 seeds/ft^2 per bu/acre soybeans** (standard deviation .49 seeds/ft^2 per bu/acre).

The Local Grain Storage Study.

Corn samples (10 random kernels) were taken from 8 local storage facilities. Mass/kernel was used to calculate the seeds/ft^2 per bu/acre. This data indicated that there were **2.18 seeds/ft^2 per bu/acre corn** (standard deviation 0.814 seeds/ft^2 per bu/acre)

The Field Study

Since it is questionable to assume that bin run, or seed quality grain represents grain being left behind in a field, we (South Dakota State University senior agronomy students) collected data from behind 30 different combines for both corn and beans. This data indicated that **2.34 seeds/ft^2 per bu/acre corn** (standard deviation .48 seeds/ft^2 per

bu/acre) and **5.26 seeds/ft^2 per bu/acre soybeans** (standard deviation 1.22 seeds/ft^2 per bu/acre).

Results

From the data above we shall determine constants to convert seeds/ft^2 to bu/acre loss. To assure simplicity, we will use whole numbers. It should be clear to the reader that there is significant variance in the data presented and that the use of a constant is a less than exact estimate but for purposes of field estimation it is an adequate estimate. The following are our conclusions.

Corn

2 seeds/ft^2 = 1 bu/acre

Wheat

22 seeds/ft^2 = 1 bu/acre

Soybeans

5 seeds/ft^2 = 1 bu/acre

Estimates of harvest loss should be conducted in a uniform part of the field where combining has been completed using the method described above. If losses are less than what you have concluded to be an acceptable standard, (perhaps .5 to 1.5 bu/acre) losses are about as low as possible and nothing else can be done. If harvest losses exceed this standard, there are three sources of harvest losses that should be investigated to identify the source of the excess loss.

1) Check, using the method discussed above, unharvested parts of the field to determine losses that have occurred prior to the arrival of the combine in the field. In corn, each ¾ of an ear in 1/100 of an acre represents approximately 1 bu/acre. See table 1 to estimate 1/100 of an acre. If most of the total losses are from preharvest damage, there is nothing that can be done to increase harvest efficiency. Note the hybrid and investigate to see if harvest loss is a genetic problem.
2) If preharvest losses are small, check to see if there are significant losses from the header. Losses from the combine header may be checked during combining. When a combine pass is being made in the field, stop in the row and back up. Use the method described above to take 3 or 4, 1-ft^2 measurements in the area between the uncut grain and the area where chaff was spread. Compare this to the 1-ft^2 measurements taken from behind the combine. This analysis will determine if the loss is from the combine header. If these losses are a significant part of the total harvest losses, check for worn parts and check the operators manual and/or dealer to learn how adjustments/repairs can be accomplished to reduce header yield losses.
3) If these losses are insignificant, then you will conclude that your losses results from less than perfect threshing/separation of grain within the combine. If this is the case, again there are a number of adjustments to the mechanics of the thrashing system that can be made that will have significant impact upon losses from within the combine. Check your operators manual and/or with your dealer to determine the corrective adjustments/settings to make.

Table 1. Row length for 1/100 acre

Row width	Length for 1/100 acre
20 inches	261.36
30 inches	174.2
40 inches	130.68

The authors wish to express their appreciation to South Dakota State University's Fall 2001 PS440 Precision Farming class for acquiring the multiple fields – combine data used in this paper and to the SDSU Seed testing laboratory for providing their data.