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ARE OKLAHOMA COMBINES OPERATING EFFICIENTLY?

by

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A study by the Agricultural Engineering Department during the 1985 wheat harvest indicates many Oklahoma farmers could improve combine efficiency. Eleven different combines around the state were evaluated for harvest losses. Of these, ten were farmer operated and one was operated by OSU. The OSU combine was adjusted to factory specifications by a dealer, and readjusted as necessary in the field.

Pre-harvest losses were estimated in fields where the combines were operating. The machines were then checked for header and threshing losses. Threshing loss data were divided into loose grain and unthreshed heads.

Acceptable Harvest Losses

Acceptable harvest losses have long been considered to be in the range of 3 to 5 percent of harvest yield. Acceptability, however, depends largely on the combine operator. If bad weather is forecast, losses in excess of five percent would probably be acceptable. Ohio State University extension information suggests that total loss should not exceed one and one-half percent under good harvest conditions. It should be noted that these acceptable levels all include pre-harvest losses.

Loss Data

The data collected in the OSU study (see Table 1) illustrates that at least one-third of the combines evaluated were losing more than an acceptable amount of grain. The average machine loss for the combines was 5.8 percent. Total harvest loss is determined by adding machine and pre-harvest losses. The average total loss is 7.6 percent which is well above the accepted range. Figure 1 shows total wheat loss for individual combines. Total loss has been divided into machine and pre-harvest losses.

Machine loss for each combine is shown in Figure 2. Losses ranged from one-third to almost four bushels per acre. The largest loss was almost 16 percent of yield while the lowest was less than one percent. Figure 3 compares average pre-harvest, header, and threshing losses. Each accounts for approximately one-third of the total loss.

Table 1. Machine Loss

Combine	Bushels/Acre	% of Yield Lost
1	1.60	3.64
2	2.04	4.64
3	.32	.73
4	3.99	15.96
5	1.93	3.16
6	3.07	5.03
7	1.66	5.72
8	1.46	3.40
9	2.65	9.46
10	3.20	8.21
11	1.53	3.56
AVG	2.13	5.77

Pre-harvest losses ranged from almost none to as high as two bushels per acre. These losses are often unavoidable and are usually due to weather and timeliness of harvest. Fields showing high pre-harvest losses had some lodging or were harvested late.

Header losses averaged about one bushel per acre and ranged from zero to nearly three bushels per acre. Header loss can be partially due to timeliness of harvest, but is most likely due to cutting height, reel speed, and ground speed. All of these factors can be easily adjusted from the operator's seat. Cutting height should be watched very closely when the heads of the wheat are turned down.

Threshing losses ranged from .2 to 3.8 bushels per acre with the average being 1.2. Approximately one-fifth of threshing losses were in unthreshed heads. These losses are easily identifi-

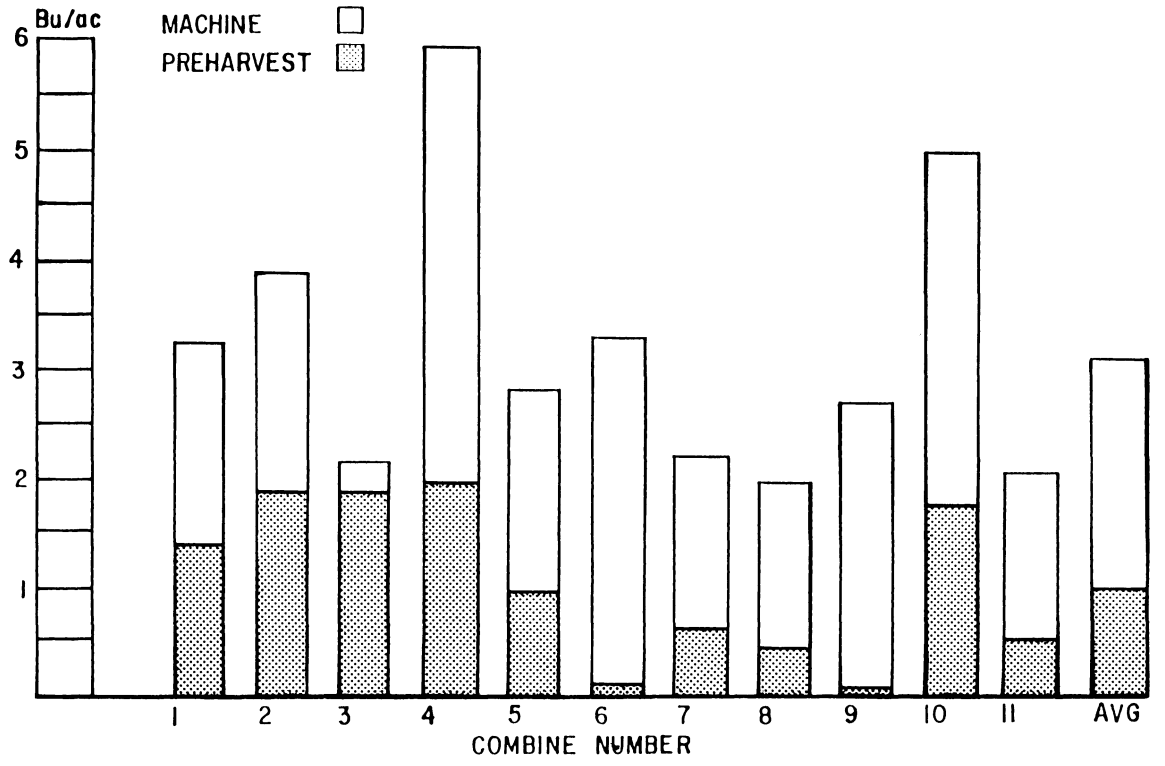

Figure 1. Total Wheat Loss.

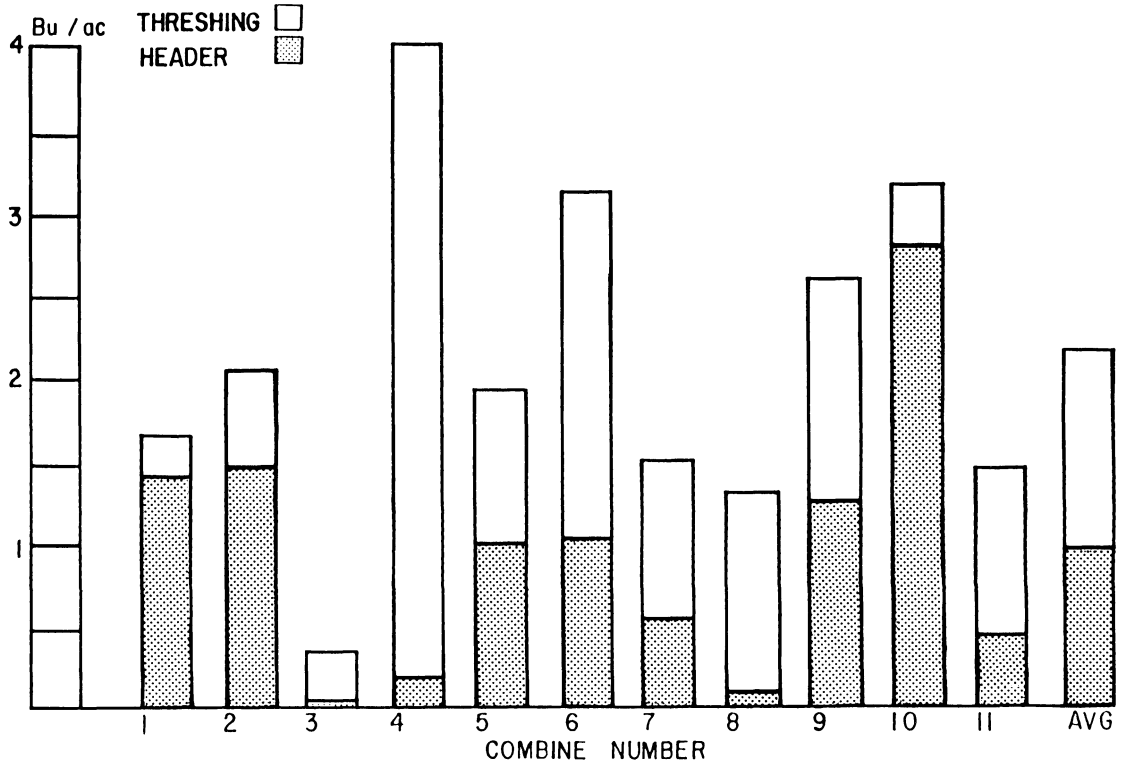

Figure 2. Wheat Loss - Machine Only.

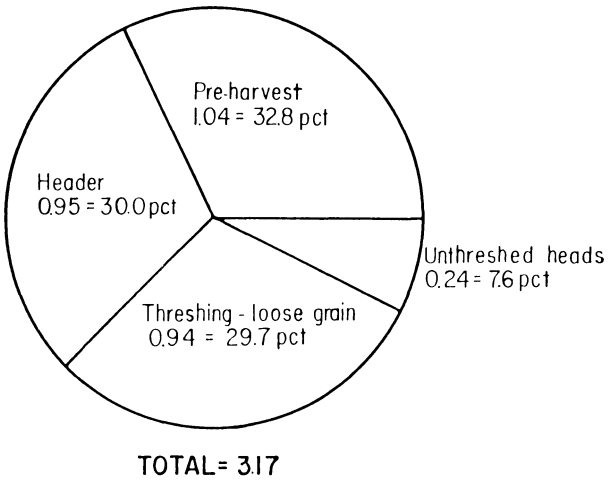

Figure 3. Average Wheat Losses (Bu/Ac).

able. The operator simply needs to check a few heads to make sure there is no grain left unthreshed. Loose grain losses are from either the straw walkers or the cleaning shoe. A close inspection is required to determine the source of these losses.

Combine Adjustments Can Increase Profit

Adjusting your combine properly can result in significant increases in harvested grain, and put more dollars in your pocket. Leaving less grain in the field can also reduce the amount of chemical and tillage required for weed control. The heavy mat of volunteer wheat and weeds that comes from excess loss can be greatly reduced.

Most combines are equipped to spread straw walker discharge, thus eliminating a windrow of straw. Unfortunately, chaff from the cleaning shoe is often neglected. Spreading chaff and other material coming over the cleaning shoe is an important method for decreasing the concentration reseeding in the strip behind the combine. If a combine is losing one bushel of wheat per acre it is putting as much seed on the ground as is normally planted. If all chaff and straw is not spread the full width of the combine, strips in the field may have several times this much seed, even though combine loss is only one bushel per acre. Table 2 shows the number of seeds per square foot in the strip behind the combine for different degrees of spreading. Average losses observed by OSU for both wheat and cheat are assumed. The heavy mat which would be created without spreading would probably require extra tillage and/or chemical to prepare the field for the next planting.

The economics of reducing grain loss and harvesting costs on Oklahoma wheatland are certainly compelling. Assuming an average per acre loss of one bushel, a statewide loss reduction of only 10% would produce an additional 530,000 bushels of wheat worth about 1.75 million dollars. Alternatively, a reduction in operating costs of only one percent would produce an additional 750,000 dollars.

Loss Monitors

Loss monitors are optional on most new combines. They are also available for most combines already in use. Loss monitors can be a valuable asset to the combine operator, but only if they are properly adjusted. Monitors must be calibrated to an acceptable loss before the information they report can be of any value.

To set loss monitors accurately, much time is needed to evaluate loss. There is so much variation in sampling that as many as five samples may be required. If time permits, several samples should be made. Your loss monitor should be ignored if you are not willing to take the time to set it properly.

Quick Loss Estimates

It is nearly impossible to quickly estimate losses if you are not familiar with your machine. A three percent loss for one machine may look like a five percent loss for another. The best way to familiarize yourself with your machine is to measure losses early in the season, then simple spot checks periodically can inform you if your machine needs adjusting.

As stated previously, unthreshed heads are probably the easiest and quickest loss to determine. Grain loss at the shoe is easy to catch but a bit more difficult to evaluate. The operator needs someone to walk beside the machine and hold a scoop shovel below the rear of the shoe for a

Table 2. Effect of Spreading Chaff and Straw Discharged from Machine On Reducing Concentration of Seeds in Strip Behind Combine.

Amount of Spreading	# of Wheat Seeds	# of Cheat Seeds	Total	% Reduction
None	175	345	520	---
Walker Discharge	124	226	350	33%
Walker and Chaffer	70	120	190	64%

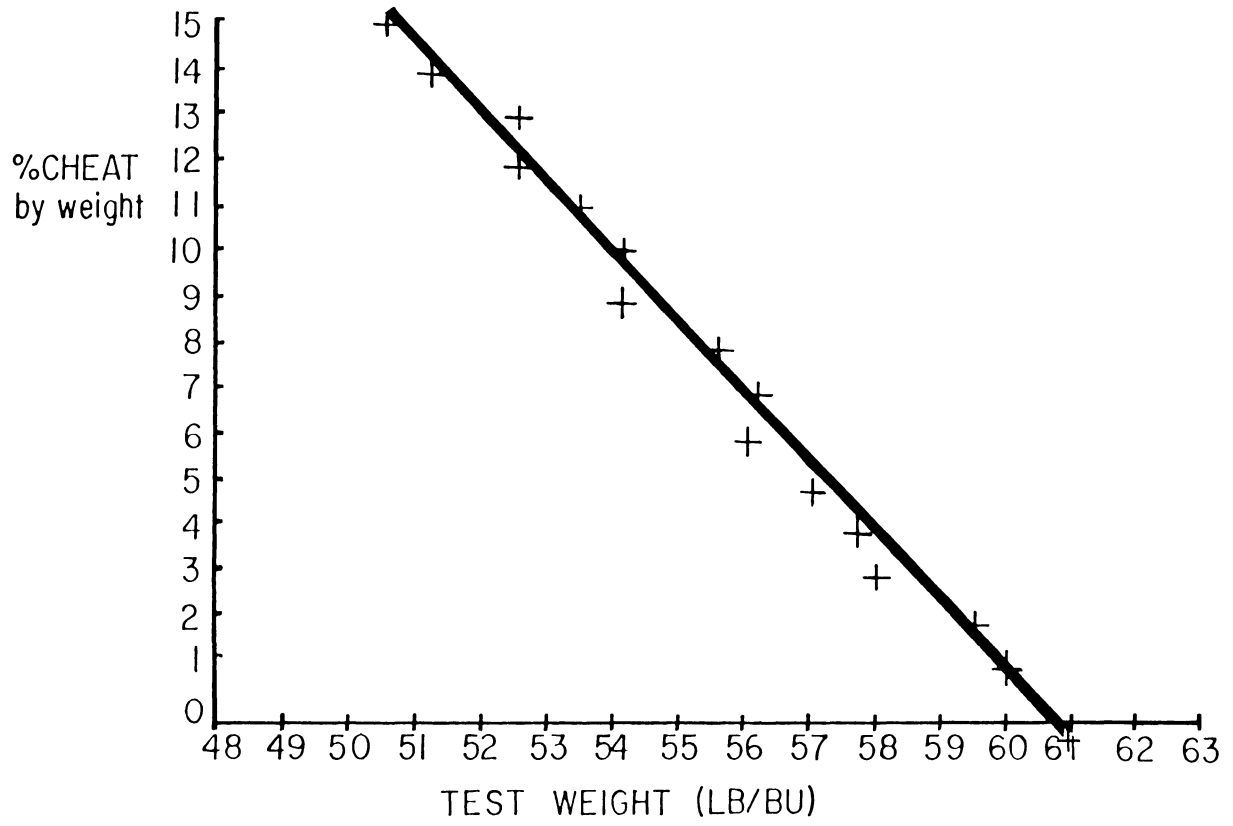

Figure 4. Effect of Cheat Contamination on Test Weight (approx. 60 lb/bu test weight)

few seconds. If the combine is properly adjusted, there should be few kernels found. This method will not determine the amount of loss, but it will determine the presence of one. Methods for determining loss can be obtained in "Combine Harvesting" from John Deere's Fundamentals of Machine Operation series and "Combines and Combining" from Ohio State University's Department of Agricultural Education. Oklahoma State University Agricultural Engineering Extension is working on a publication to aid in determining combine losses.

Control of Cheat

Cheat has become a major problem regardless of tillage practices. In the OSU field tests cheat yield averaged almost six bushels per acre. This is about 15% of the average wheat yield. Besides reducing overall grain yields, the grower may suffer dockage at the elevator if his wheat is contaminated with cheat. Figure 4 shows the effect of cheat contamination on test weight.

A common harvest practice, turning up the fan to blow out cheat, results in increased grain losses, as well as reseeding the cheat passing through the machine. The producer must decide whether to take the dockage at the elevator or be prepared for the possibility of extra tillage in the fall.

The possibility of using the combine to help control cheat should be considered. One method would be to put as much cheat as possible in the bin and clean the grain before transporting it to the elevator. Another would be to separate cheat from grain before it enters the combine bin. The cheat could be treated either mechanically or chemically and returned to the field.

Summary

As Oklahoma farmers, along with those across the nation, begin to tighten their belts, the combine on their farm might offer some potential. The time required to adjust a combine could be time well spent. Most operators could save a portion of their operating expenses and possibly more if they would take this time.

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