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Efficient Corn and Sorghum Harvesting

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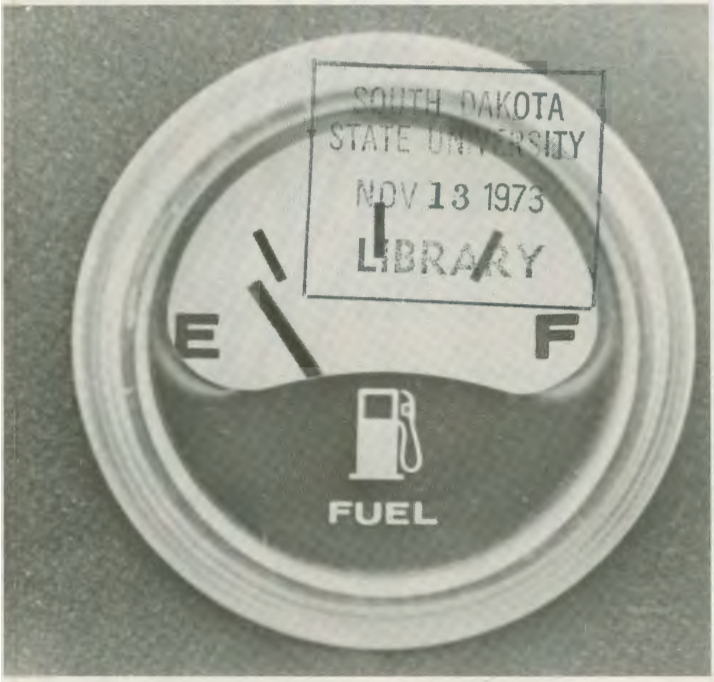

Cooperative Extension Service
South Dakota State University, Brookings
U. S. Department of Agriculture

Efficient Corn and Sorghum Harvesting

By
G. R. Durland, agricultural engineer, Cooperative Extension Service,
South Dakota State University.

Choice of Harvesting Methods

Corn or sorghum is harvested as grain to use either as feed or to sell it as a cash crop. These pre-determined uses influence choice of storage method which, in turn, influences the harvesting method.

If the grain is to be sold it will usually be harvested dry, or it can be harvested wet and dried in the storage facility.

If the grain is going to be fed, then several alternatives are available. It can be harvested dry or wet. It will usually be harvested wet and stored at high moisture.

While the use of the crop is a primary consideration in the choice of harvesting method, other factors must be considered. The amount of acres or bushels to be harvested annually and the time available to the operator during harvest season are other factors to be considered. He must also consider the amount and type of storage, as well as the type of equipment already on the farm and his available financing.

The choices available for harvesting equipment are corn pickers, either one-row or two row; picker-sheller; combine; or silage field chopper.

In making the final choice of systems, the operator should plan to harvest his crop within a 28-day period immediately after the crop has reached the desired moisture content and maturity. This period includes Sundays. Bad weather should also be considered for lost days. In eastern South Dakota during an average year, four days can be expected to be lost because of weather and field conditions. Therefore, four Sundays and four "bad weather days" should be subtracted from the 28-day period which allows 20 working days to harvest the corn.

With these considerations in mind, the different harvesting methods can be analyzed and an efficient method selected for a particular operator. Table 1 shows capacity of combines which should aid in determining the size needed to harvest the crop within the "good days" period available for harvest.

Comparison of Harvesting Method

Field Efficiency

Field efficiency is defined as the ratio of the amount of crop actually processed in a given time (based on total field time) to the amount that would be processed if the machine performed its function 100% of the time at rated operating speed using 100% of its rated width. The range in field efficiences for combines is 60%-75%; and for corn pickers the range is 55%-70%. The operator should strive to obtain this higher efficiency for his particular machine. Efficiency can be improved by eliminating lost time in machine operations, except for turns and required stops for unloading, lubrication, and machine adjustment. Planting the long way in the field and performing a good preventive maintenance check on the machine, prior to its operation, are two ways of cutting down on lost field time. Turning time alone can amount to 25% of actual field time. Turning space should be adequate so that one continuous motion can turn the machine back onto the desired center line. A turn that requires backing of the machine for completion, can add as much as 50% more time to the turn. Wasted machine operating time is also caused by a rough field condition, and obstructions or ditches in the field. Improving the field efficiency of the machine will save machine wear, fuel consumption and operating time during the harvesting operation.

Table 1—Rate of corn and sorghum harvest with various size combines.

Row Unit	Acres Per Hour*	Acres Per 10-hour Working Day	Acres in 20 Working Days
2-40's	1.5	15	300
3-30's	1.7	17	340
4-30's	1.9	19	380
4-40's	2.5	25	500
6-30's	2.5	25	500
6-40's	3.4	34	680
8-20's	1.8	18	360

*Source: Byg, D. M., "A Study of Corn Harvest in Ohio," 1964-1967.

Field Losses

Field losses can be broken down into two categories. Pre-harvest losses and harvest losses.

Pre-harvest losses can be minimized by getting the crop harvested as soon as the moisture content is at the proper level for storage. If the corn crop is to

be mechanically dried, harvesting should begin when the ear is about 30% moisture content for pickers and 28% for field shelling. When field shelling, the mechanical damage increases when the corn is above 26% moisture content and field losses start increasing when moisture content drops below 22%. If allowed to field dry to 16%, field losses can be as high as 20% (See Chart 1).

If the crop is to be harvested and stored as high moisture grain then harvesting should be between 35% and 25% moisture content for both corn and sorghum. High moisture grain is usually harvested for feed, therefore, kernel damage is not a matter of concern, except in bottom unloader silos.

If the crop is to be harvested dry, for long term storage, the moisture content should be about 13%. Starting the harvest at 16% should be safe. More field losses can be expected at this lower moisture content.

Maximum moisture content for long term storage is 13% for shelled corn and 12% for grain sorghum. After it has dented, corn will dry at a rate of about 0.75% a day until it reaches 25% moisture content. Weather will usually not affect it at this stage. Below 25% however, if favorable weather conditions exist, corn will dry at a rate of 0.50% a day down to 20%. If the weather is too humid it might take much longer to dry to safe moisture content, and it is possible for sorghum to never reach a safe, storable level. On the other hand, exceptionally good drying weather can dry either corn or sorghum much faster than this rate.

After you have covered your cost in taxes, seed, fertilizer, equipment, chemicals, labor and other operational overhead, the grain you leave in the field, when harvesting at low moisture content, could easily amount to 50% of the net profit.

A handy guide to check field losses in corn is a circular entitled "A Guide for Measuring Corn Harvest Losses." Extension Fact Sheet 507, "A Guide for Measuring Sorghum Harvest Losses," can be used for checking field loss in sorghum. Both of these guides are available at your County Extension Office or can be ordered from the Bulletin Room, South Dakota State University, Brookings, South Dakota 57006.

Harvesting Expenses

Owning a harvesting machine can be either a very profitable or a very expensive proposition. Questions that must be answered to determine if ownership of a combine is justified:

- How many acres of all grain crops will be harvested. Are finances available for purchase of a machine? The more acres harvested, the lower the cost per acre will be for an owned combine.

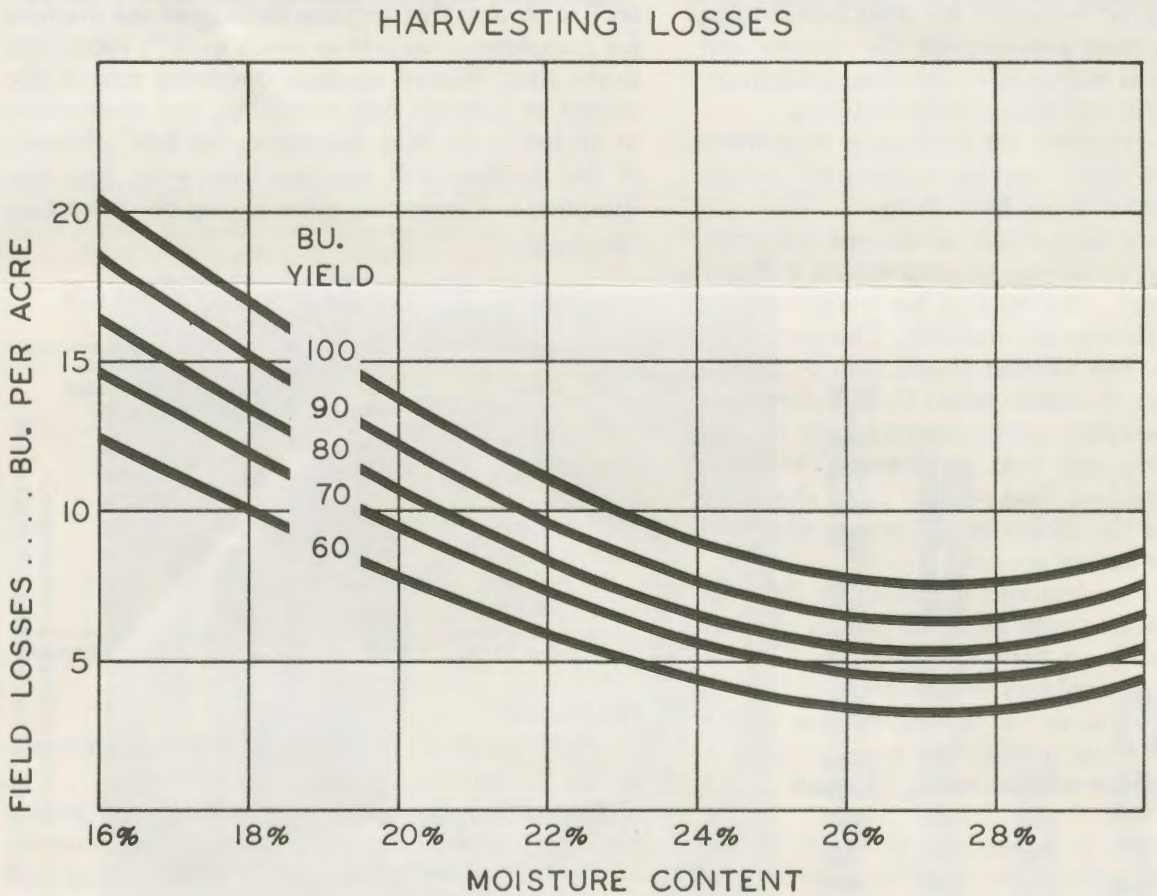

Chart 1—Harvesting losses in field at different moisture levels.

- How long to wait for a custom operator? Late combining can increase harvesting losses rapidly.
- Is leasing a possibility?

Harvesting machine costs are a combination of three items. One is the fixed cost of owning the machine which includes depreciation, interest on invested capital, taxes, insurance and housing. The second item is the operating costs which include fuel, lubrication, repairs and labor. The third item is the risk-loss from delayed harvesting, which is a cost only when the owner must wait for a custom operator to do the combining.

Another choice that the owner has is to lease a combine for the harvest season. This can be arranged through his local dealer. A recent purchasing demand for machinery has depleted inventories of some dealers to the extent that they have nothing available for lease.

An estimate of cost comparison for the different harvesting methods is shown in Table 2. These estimates can vary considerably between areas.

Fuel Consumption

In light of an apparent fuel shortage, consideration should be given to fuel consumptions for the various operations (See Table 3).

Combines and corn pickers should always be operated at manufacturers recommended speed, usually full throttle, to obtain optimum performance from the machine. For this reason, shifting to higher gear and throttling down, to conserve fuel, is not recommended for these two operations. Table 3 shows estimates of fuel needs.

For estimates on fuel consumption for the total harvesting system, see Fact Sheet 605, "Corn Harvesting Alternatives and Associated Fuel-Energy Requirements," and FS 606, "Grain Sorghum Harvesting Alternatives and Associated Fuel-Energy Requirements."

Handling Conveniences

Too much emphasis is often given to the ease and convenience obtained from handling shelled corn as compared to ear corn. This comparison is often made between a modern shelled-corn handling system and an old out-dated ear corn handling system. With proper study and planning an ear corn handling system can be designed to provide equivalent features of shelled corn systems. Shelled-corn systems do have the advantage of more flexibility as the corn can be handled by a greater variety and combination of methods.

Table 3—Estimated fuel needed for various operations

	FUEL—Gallons per acre		
	Gasoline	Diesel	L.P. Gas
Combining* (1)	1.45	1.04	1.74
Corn Picking* (1)	1.53	1.10	1.84
Transportation† (2) Field to Storage	.8	.6	.96

*Modern Concepts of Farm Machinery Management, Wendell Bowers, 1968.
†Fact Sheet on Fuel, No. 4, ES-USDA.

Transportation

Trucks and wagons are the two most used methods of moving grain from field to storage. These vehicles should be located strategically at the end of the field so the machine operator can unload his hopper with a minimum of time and inconvenience. Unloading a combine "on the go" with the truck or wagon alongside may save a little field time but it also contributes to more fuel used in the transportation vehicle. More practically, the time spent unloading at the end of the field can be put to good use by the combine operator, checking, lubricating and adjusting his machine. It also gives the operator a "break" from his routine and ultimately can result in a more efficient job with less chance of accident because of carelessness brought on by weariness.

The fuel used to move the grain from the farm to market has been estimated by the University of Nebraska. For a yield of 75 bu/acre this estimate is that it will take an average of 0.8 gallons per acre to transport the grain from farm to market.

Table 2. Estimated machine costs of harvesting corn and sorghum§

Machine	Machine Costs per Acre* (thousands of bushels harvested) 5	10	20	30	40	50	Custom† cost per acre	Lease‡ cost per acre
2-row pull-type type picker	12.00	8.00	5.00	4.00	3.50	.....	3.75	.....
2-row mounted picker or picker sheller	13.00	9.00	6.00	5.00	4.50	.....	5.50	.....
2-row combine	.....	16.00	9.00	7.00	5.00	.....	7.75	6.60
4-row combine	.....	.....	13.00	9.00	7.50	6.50	7.75	6.60
8-row combine (20" rows)	.....	.....	.....	13.00	10.50	9.50	.....	.....
Sorghum (4-row combine) (no hauling)	.....	.....	13.00	9.00	7.50	6.50	5.50	6.60

*Based on 100 bu/acre yield, charges do not include labor.
†Average custom charges, these charges vary considerably between location. Some areas are now using a $5.00 per acre, plus fuel charge.
‡These charges include labor and operating costs.
§For more detailed information on machinery costs, see Extension Circulars 663 and 664.

TIPS FOR GREATER HARVESTING AND FUEL EFFICIENCY

- Tune your engine: Adjust carburetor for correct fuel-air ratio, correct timing, clean air cleaner, adjust plugs and clean cooling system to enable the engine to operate near maximum efficiency.
- Proper fuel storage: Storage tanks shaded, painted white and equipped with pressure vent cap can reduce evaporation losses to less than 1%.
- Keep machines in good mechanical condition with all parts adjusted properly and in good repair.
- Run combine engines at proper "governed" speed and pickers at proper "PTO" speed.
- Use a forward speed of 3 m.p.h.
- Run snapping rolls closed tightly on corn pickers.
- Close stripper plates or snapping bars only enough to prevent ears from passing through.
- Chain flights over stripper plates should extend beyond edge of plates by ¼ to ½ of an inch.
- Ears should be snapped near the upper third of the snapping roll. On combine, this is regulated by the agressiveness of the snapping rolls; on pickers, by forward speed.
- Drive accurately on paired rows spaced to match your harvesting machine.
- Gathering snouts should float on the ground and gathering chains should be just above the ground.
- Start harvesting early.
- Follow operator's manual for proper setting of shoe and cylinder adjustment.
- Measure losses and make corrective machine adjustments whenever crop conditions change.
- Strive to match field capacity of harvest equipment to acres of grain produced and rain-free days available for harvest.

Other Fact Sheets in This Series

This Fact Sheet is one of six in a series dealing with fuel-energy requirements in harvesting and storage of corn and grain sorghum. The entire series includes the following:

FS 605—Corn Harvesting Alternatives and Associated Fuel-Energy Requirements.
FS 606—Grain Sorghum Harvesting Alternatives and Associated Fuel-Energy Requirements.
FS 607—Drying the Crop with Less Fuel.
FS 608—Efficient Corn and Sorghum Harvesting.
FS 609—High Moisture Grain Storage
FS 610—Temporary Storage.

These fact sheets are available through your county Extension agent or the Bulletin Room, South Dakota State University, Brookings, S. D. 57006.

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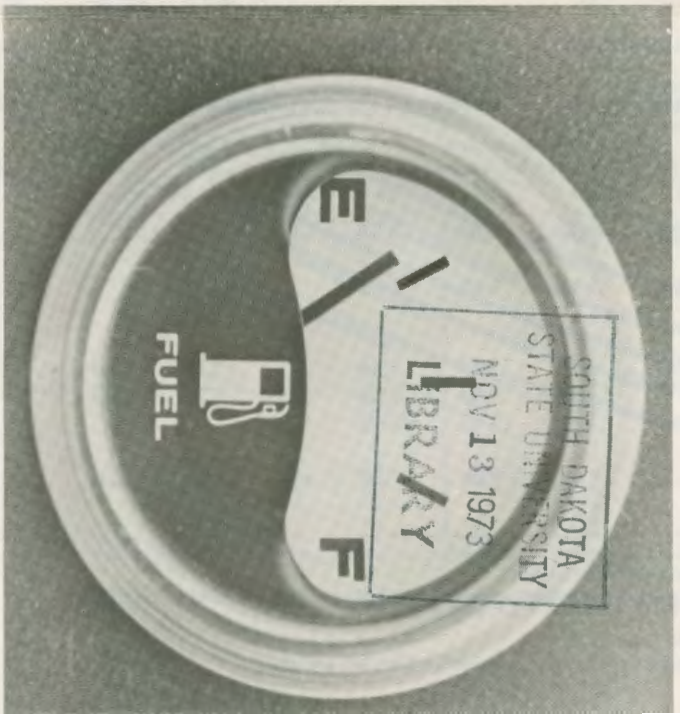

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