



This value would have to be discounted by the cost to the cattle producer of transporting the bales to the site of the cattle.

The weight of a bale will vary considerably depending on the type of baler used and the dryness of the stover. Large round corn stover bales typically contain about 8 to 10 pounds of dry matter per cubic foot. Using this factor, the weight in (wet) pounds of a large round bale of 20 percent moisture stalks can be estimated as follows:

$Weight \text{ (pounds)} = diameter \text{ (inches)} \times diameter \text{ (inches)} \times width \text{ (inches)} \times .005$

### Example 3

Assume a large round bale measures 72 inches in diameter and 60 inches wide.

$72 \times 72 \times 60 \times .005 = 1,555 \text{ lb. per bale}$

$1,555 \text{ pounds per bale} \div 2,000 \text{ lb. per ton} = .78 \text{ tons per bale}$

Large square bales have been estimated to contain 10 to 12 pounds of stover per cubic foot. The wet weight of a 20 percent moisture square bale can be estimated as follows:

$Weight \text{ (pounds)} = width \text{ (inches)} \times height \text{ (inches)} \times length \text{ (inches)} \times .008$

### Example 4

Assume a large square bale measures 3 feet wide by 4 feet high by 8 feet long (36 inches by 48 inches by 96 inches).

$36 \times 48 \times 96 \times .008 = 1,327 \text{ lb. per bale}$

$1,327 \text{ lb. per bale} \div 2,000 \text{ lb. per ton} = .66 \text{ tons per bale}$

## Cost Value

The costs for windrowing, baling, collecting and transporting corn stover can be estimated from typical farm custom rates such as those reported in *File A3-10, Iowa Farm Custom Rate Survey*. Chopping and raking are two alternatives for accumulating material into a windrow. If bales must be transported to the point of sale, that cost should be included, as well. Wrapping round bales with plastic netting instead of twine adds about \$1 per bale to the total cost.

Example 5 shows an estimate of total costs for harvesting and transporting large square bales based on custom rates. More details can be found in fact sheet *PM 3053B, Economics of Harvesting and Transporting Corn Stover*.

### Example 5

Custom hire machinery rates:

Custom stalk chopping = \$ 11.40 per acre

Assuming four bales/acre = \$ 2.85 per bale

Custom baling = \$ 11.70 per bale

Moving/collecting = \$ 3.55 per bale

Total harvesting cost = \$18.10 per bale

Transport to point of sale = \$ 6.25 per bale

(25 miles @ \$.25/mile/bale)

Total harvest + transport = \$24.35 per bale

In addition, extra nutrients removed by harvesting must be replaced for future crops. Research results vary, but Sawyer and Darr have reported removal rates of about 2 to 4 pounds of phosphate and 8 to 20 pounds of potash per ton of dry matter stover harvested. If stover contains 80 percent dry matter, the removal rates are 1.6 to 3.2 pounds of phosphate and 6.4 to 16.0 pounds of potash per ton of wet stover harvested. These rates can vary widely depending on the hybrid planted, yields obtained, how much of the stover is harvested, and rainfall patterns. A forage laboratory test can be performed to find the specific analysis. Stover also contains some micronutrients, such as sulfur, that may need to be considered.

The effect of harvesting stover on nitrogen fertilizer requirements is less certain. Some research shows that removing stover can actually increase the availability of nitrogen to the succeeding crop.

The value of the nutrients being removed can be based on the cost of commercial fertilizer, as shown in Example 6. Replacement costs of \$.53 per pound for P and \$.50 per pound for K and removal rates of 2.64 lb. of P and 13.6 lb. of K per wet ton are assumed.

**Example 6**

Assume the following:

Weight of round bale is 1,200 lb. (.6 tons)		
Phosphate removal value		
= 2.64 lb. @ \$.53 x .6T.	= \$	.84
Potash removal value		
= 13.6 lb. @ \$.50 x .6T.	= \$	<u>4.08</u>
Total value of nutrients removed per bale	= \$	4.92
Total harvesting cost per bale	= \$	<u>24.35</u>
Total cost per bale	= \$	29.27

The total cost per bale represents the minimum amount the crop producer would be willing to accept, and the feed value represents the maximum the livestock producer would be willing to pay. The actual price paid may be negotiated somewhere within this range. In the examples above, the range would be from \$29.27 to \$43.20 per 1,200-pound bale.

**Feedstock for Ethanol Production**

Corn stover can also be used as a feedstock for the production of ethanol and other products. However, special care must be taken to avoid incorporating dirt, rocks and other foreign material into the bales. For stover to be suitable for conversion to biofuel, it must also be kept dry. This means that special harvesting and handling methods may have to be used, and extra costs will be incurred that must be factored into the market price. On the other hand, the value of corn stover to the processor will depend on the costs of operating the plant and the price of substitute feedstocks.

**Market Value**

Although market prices for harvested corn stover are not reported on a regular basis, bales are sometimes sold at hay auctions. Some auctions report prices on their websites, which can be located by searching on "hay auction." Recent auction prices in Iowa for large round bales of corn stover have ranged from \$30 to \$40 per bale, with some sales as high as \$45 per bale. Processors who wish to utilize corn stover for producing biofuels or other products generally will pay a higher price

in order to assure they receive clean, dry material in timely fashion. Rates are usually set in advance by contract.

**Price for Unharvested Cornstalks**

Some corn producers have stover to sell but do not have a baler. They may prefer to sell unharvested stover and let the buyer do the harvesting. The maximum net value to the buyer can be estimated as the feed value (\$43.20) minus the cost of harvesting and transporting the bales (\$24.35), or \$18.85 per bale, as shown in Example 7.

**Example 7**

Assume the following:

Feed value of stover	= \$43.20 per bale (Example 2)
Harvesting cost per bale	= <u>\$24.35 per bale (Example 5)</u>
Feed value of standing stover to be harvested	= \$18.85 per bale

The added cost to the corn producer would simply be the value of the nutrients removed. In Example 6, that was estimated at \$4.92 per bale, so the range of values for negotiating a selling price would be \$4.92 to \$18.85 per bale harvested. Establishing a price based on the number of bales harvested is probably more accurate than establishing a price by the acre because it reflects the quantity of material actually removed.

**Price for Grazing Corn Stover**

Sometimes it is easier to bring the cows to the stover than it is to take the stover to the cows. If fences and water are adequate, stalk fields can simply be rented for grazing. Although rates vary widely, beef cows typically need about 2 acres per cow per month.

Corn stover can replace about 25 pounds of hay equivalent per day for a medium-sized cow with no calf nursing, or .375 tons per month. If hay is priced at \$100 per ton, the cost is \$37.50 per cow per month, so each acre of stover grazed replaces \$18.75 worth of hay. However, the person renting the stover may incur some costs for providing water or fencing, and for moving the cows to the field, which reduces the affordable rent.

**Example 8**

Assume 2 acres of corn stover replace 25 pounds of hay per day.

25 lbs. of hay/day x 30 days per month  
= 750 lbs. or .375 tons of hay per month

.375 tons x \$100 per ton/2 acres = \$18.75 per acre

Some phosphorus and potassium are removed when stalks are grazed, but part of it is returned in the form of animal waste. Cattle will generally remove less stover than is removed by baling. If cattle remove 1,500 pounds of stover during the grazing season, that is the equivalent of 1.25 bales. Based on nutrient removal costs of \$4.92 per wet ton (Example 6), the removal cost per acre would be \$6.15. However, many of these nutrients are returned to the land in the manure. Manure may need to be broken up and spread out using an implement such as a harrow after the grazing season is over.

Cash rental rates for grazing corn stover are reported in *File C2-10, Cash Rental Rates for Iowa Survey*. Typical rental rates are \$8.00 to \$12.00 per acre per year, or for as long as grazing is practical.

An electronic spreadsheet, *Decision Tool A1-70, Corn Stover Pricer*, is available to estimate a price for corn stover harvested, unharvested in the field or grazed.

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