

Economics of Residue



Residue matters: It begins with you

If you are removing corn stover for bedding, feed or as a biofuel source, consider the value of residue to your farming operation. Keeping residue on your field is a great way to protect soil from erosion and improve soil organic matter. Studies have shown that residue provides many benefits to the soil and the environment.

The amount of residue on the field fluctuates due to farm management practices, intensity of stover removal, crop, yield, climate, soil type and slope.



Benefits of residue

- Reduces runoff, nutrient loss and soil erosion
- Builds soil organic carbon and fertility
- Retains soil moisture
- Protects soil from water and wind erosion
- Improves soil aggregate stability
- Provides a source of food for wildlife

Hidden costs of residue removal

- Nutrient replacement (rates will depend on soil sample results)
- Loss of valuable topsoil
- Decrease in soil and water quality
- Decrease in water infiltration
- Extra fuel and equipment needed to harvest residue
- Increase in soil compaction
- Soil crusting or surface sealing due to lack of residue to protect the soil



Let's take a closer look at the economics of stover removal.

Harvesting corn stover

To determine the economic value of corn stover to your farm, consider the cost of removal, the value of the nutrients and organic matter being removed as well as the impact to soil conditions. Then, compare that to the market price of stover.

Machinery costs to harvest an acre of stover

Farm Operation	Above-ground biomass Residue Removal Percentage			Cost [#]
	30%	50%	70%	
Chop stalks			X	\$11.05
Rake stover		X	X	\$6.20
Bale stover	X	X	X	\$21.25/ton
Move	X	X	X	\$6.25/ton
Total \$	\$38.50	\$72.20	\$110.75	

Costs of removal: The direct cash outlay to harvest stover is the first point to consider. Harvesting just 30 percent residue can be accomplished by switching off the residue spreaders on the combine, which leaves the residue in a crude swath to be baled later. Harvesting a higher percentage of residue may require additional operations such as raking and stalk chopping.

[#]For this analysis, costs are for custom work. Most of the prices are quoted in per acre costs, while baling is charged per ton or per bale. This analysis assumes 175 bu/acre corn yield and 1200-pound round bales. The residue removed is estimated at 1.4, 2.4, and 3.4 tons per acre.

Value of nutrients contained in stover: With stover harvest, potassium and phosphorus are removed from the field, although they may not need to be replaced by fertilizer in the following crop season. Fertilizer requirements will depend on crop rotation, soil characteristics, fertilizer application history and soil sample results.

Nutrient value per ton of corn stover

Nutrient	Pounds	Value/lb	Total value
Nitrogen	16	\$0.62	\$9.92
Phosphate (P ₂ O ₅)	4.7	\$0.65	\$3.06
Potash (K ₂ O)	20	\$0.51	\$10.20
Total			\$23.18

Note: These nutrient values are based on corn stover harvested at 20 percent moisture. Nutrient values will fluctuate depending on harvest conditions.

For more information about nutrients and fertilization:

“General Guide for Crop Nutrient and Limestone Recommendations in Iowa”

www.extension.iastate.edu/Publications/PM1688.pdf



Contribution to soil loss: Removing corn stover from your field affects the soil beyond the removal of nutrients. Removing residue exposes the soil to the forces of wind and rain, which lead to higher erosion rates. The erosion rate is dependent upon soil type, slope and tillage system, but can be estimated broadly for each soil region.

Amount of soil loss using different tillage systems (tons/acre/year)

Tillage system	Residue removal percentage			
	0%	30%	50%	70%
No-till	0.43	0.46	0.49	0.59
Strip-till	0.58	0.62	0.67	0.76
Disk-till	1.48	2.17	2.40	2.77
Chisel-till	2.07	2.84	3.08	3.43

Note: The table shows amount of soil loss under different tillage systems in a northwest Iowa field with Clarion Loam soil and an average slope of 2.6 percent. This table is available for all Iowa soil regions at: www.extension.iastate.edu/ilf/conservationwater.html

When removing corn stover from your fields, consider the difference between predicted erosion with 0 percent residue removal and the amount of residue that you plan to remove. If the stover is used on-farm and returned to the soil, the nutrient loss will be less, but soil erosion should still be taken into account. Cover crops can be a useful alternative to protect the soil when it otherwise would be left bare.

All of these factors together show the full cost of harvesting corn stover:

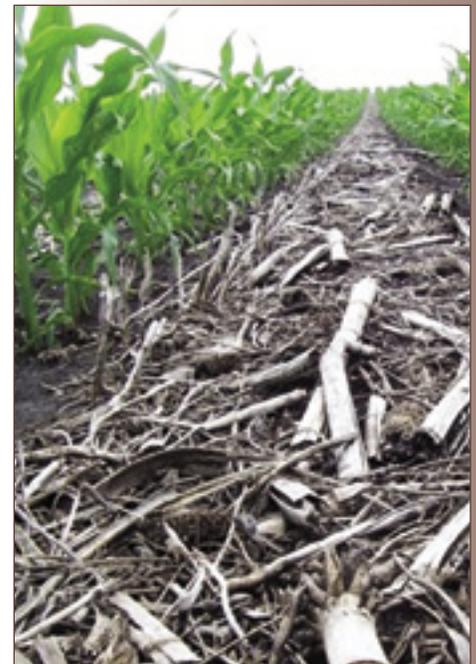
Costs of stover harvest – per acre

	Above-ground biomass Residue removal percentage		
	30%	50%	70%
Tons of corn stover removed	1.4	2.4	3.4
Value of nutrients removed in stover	\$32.45	\$55.63	\$78.81
Cost of corn stover harvest	\$38.50	\$72.20	\$110.75
Total cost (per acre)	\$70.95	\$127.83	\$189.56
Additional soil loss due to stover removal (tons/acre)*	0.69	0.92	1.29
Value of soil loss (assuming \$7.03/ton soil value)	\$4.85	\$6.47	\$9.07
Total costs per acre	\$75.80	\$134.30	\$198.63

*Assuming disk-till system, difference of 0% biomass removed and stated removal rate.

“We are building more residue, our yields increased as organic material increased and the biologicals really bloomed. I can’t imagine how we could manage our fields better.”

–Joel Zwiefel
Palo Alto County



Stover removal net gain (or loss) Per Acre

Price received of stover PER TON	Above-ground biomass Residue removal percentage		
	30% (1.4T)	50% (2.4T)	70% (3.4T)
	\$30	\$ (33.80)	\$ (62.30)
\$40	\$ (19.80)	\$ (38.30)	\$ (62.63)
\$50	\$ (5.80)	\$ (14.30)	\$ (28.63)
\$60	\$8.20	\$9.70	\$5.37

Market price for stover: The cost of harvesting an acre of stover can then be compared with a range of prices that might be offered in Iowa for a ton of stover. Although stover harvest at this time is profitable at \$40 per ton, the value for soil and water quality also should be part of your final decision.

Improving soil quality

Over time, residue removal will decrease soil fertility and organic matter. If stover harvest is necessary for your farm operation, consider the addition of cover crops or extended crop rotations to increase soil health. Cover crops function as a blanket to protect the soil from water and wind erosion and adds organic matter. Common cover crops used in Iowa are wheat, rye, oats or triticale.

Reducing tillage passes and tractor speed will increase the amount of residue cover on your field. Conservation farming practices such as no-till or strip-till can increase soil structure, reduce soil erosion, and save fuel and labor. Conservation structures such as grassed waterways, terraces and buffer strips, should be paired with conservation row-crop production systems to reduce nutrient and sediment loss and increase productivity. Your local NRCS office is able to assist you in farm conservation planning.

For more on yields and prices of stover, see the worksheets accompanying the ISU Extension publication *Estimating a Value for Corn Stover* at:

www.extension.iastate.edu/agdm/crops/html/a1-70.html

References

Hansen, L. and M. Ribaud. "Economic Measures of Soil Conservation Benefits." USDA, September 2008.

Zhou, B., M. Helmers, and H.M. Hanna. "Impact of Conservation Practices on Soil Erosion in Northwest Iowa."

ISU Extension Publication FM 1867
Estimating a Value for Corn Stover

ISU Extension Publication FM 1698
2009 Iowa Farm Custom Rate Survey

ISU Extension Publication FM 1712
Estimated Costs of Crop Production in Iowa – 2010

ISU Extension Publication PM 1688
A General Guide for Crop Nutrient and Limestone Recommendations in Iowa

For more information

Contact your area Iowa State University Extension Field Agronomist or Iowa Learning Farms for more information about residue management.

Iowa Learning Farms
219A Davidson Hall
Iowa State University
Ames, Iowa 50011-3080
ilf@iastate.edu



www.extension.iastate.edu/ilf

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