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Nebraska Fact Sheet

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Harvesting Crop Residue: What's it worth?

Dollar Value of Crop Residue

The plant residue left in the field after harvest is a valuable resource. Increasing demand for harvested crop residue has left many producers wondering whether they should bale and sell their crop residue or leave it in the field. To make that decision producers need to consider the following:

1. **Cost of harvesting the residue** – Based on a custom baling price of $11.50 per big round bale, the cost of harvesting crop residues can range from $60-$70/acre depending on how many bales there are per acre. If the average bale weighs 1,200 lbs that works out to about $20/ton.

2. **Value of removed nutrients** – Based on data from the University of Nebraska (Wortmann et al, 2008), a ton of corn residue contains about 17 lbs. of nitrogen (N), 4 lbs. of phosphorous (P_2O_5), 50 lbs. of potassium (K_2O) and 3 lbs. of sulfur (S). Based on fertilizer prices from the spring of 2008 the estimated cost of nutrients removed would be about $26/ton (see table). If you remove 3-4 tons of residue per acre (5-6 round bales) the value of nutrients removed would be $75 - $100 per acre.

3. **Erosion control** – The value of maintaining crop residue on the soil surface to control soil erosion is well documented, and all NRCS conservation plans for highly erodible land (HEL) require that a minimum amount of crop residue be present to control soil erosion. The amount of residue required varies depending on soil type, crop rotation, tillage system and existing conservation practices. Producers with HEL fields should contact their local NRCS office to review their conservation plan and discuss the potential impact of harvesting crop residue before they remove any from the field.

Photo by: Shanda Weber, NRCS

*Fertilizer Value of Nutrients in One Ton of Corn Residue**

Element	Concentration in residue (%)	Pound per ton	Fertilizer nutrient price ($/lb)**	Value of nutrients in residue (s/ton)
a	b	c = (b/100) x 2,000	d	e = c x d
N	0.800	16.0	$0.70	$11.20
P_2O_5	0.20	4.0	$0.96	$3.84
K_2O	1.45	29	$0.35	$10.15
S	0.17	3.4	$0.27	$0.92
Total Value				$26.11

** Based on Table 1 from Wortmann et al, 2008.*
***Based on spring 2008 fertilizer prices. Substitute current prices in column d and multiply by column c to get value of each nutrient per ton of corn residue.*

4. **Soil Organic Matter/Soil Health** – Perhaps the most important factor to consider before harvesting crop residue is the impact on soil organic matter. Soil organic matter contributes directly to the nutrient availability, nutrient holding capacity, and water holding capacity of a soil. It also plays a significant role in the formation of water stable aggregates in the soil which affects infiltration, aeration and drainage.

Soil organic matter also plays a significant role in soil health as it provides carbon and energy for soil microorganisms. Soil microorganisms are essential for nutrient cycling in the soil, and some form mutually beneficial relationships with plant roots providing nutrients to the plants in exchange for energy in the form of simple sugars.

Removing crop residue in excess of what the soil can tolerate will ultimately result in the deterioration of the soil resource and declining yields. Research by the USDA-Agricultural Research Service at the University of Nebraska Agricultural Research and Development Center found an average yield decrease of 6% over five years for continuous no-till corn when an average of 50% of the crop residue was removed each year (Varvel et al, 2008). While the nutrients removed can be replaced, the functions of soil organic matter are not so easily mitigated.

5. **Impact on Available Water and Crop Water Use Efficiency** – Leaving crop residue on the soil surface provides many benefits in terms of soil water. It protects the soil surface reducing the effect of raindrop impact and improving infiltration. It keeps the soil cooler and minimizes evaporation leaving more water available for plant uptake, and it traps snow in the winter keeping it evenly distributed across the field resulting in more uniform soil moisture conditions and soil temperatures the following spring.

   A study in Kansas on the impact of crop residue cover on soil water evaporation found that leaving the residue in place resulted in a savings of 3.5 inches of soil water (Klocke et al, 2008). In a dryland situation, each additional inch of available water could translate into 12 bushels of corn per acre for a total of about 40 additional bushels of corn per acre. Alternatively, saving that 3.5 inches of water could significantly reduce irrigation costs. With irrigation costs averaging from $7 to $10 per acre-inch the resulting savings would be $25 to $35 per acre.

Ways to Reduce the Impact of Residue Removal

Producers who do decide to harvest crop residue have several options to reduce or minimize the impact of crop residue removal.

1. **Reduce or eliminate tillage operations** – Tillage operations could bury much of the remaining crop residue and increase the rate of residue decomposition adding to the negative effects of crop residue removal. Switching to a no-till system would reduce the negative impacts of crop residue removal.
2. **Reduce the number of years low residue crops are grown in the crop rotation** – The negative impact of harvesting crop residue is greater if the rotation includes low residue crops such as soybeans. Switching from a corn-soybean rotation to a continuous corn, corn-corn-soybean or corn-soybean-wheat rotation would somewhat offset the negative impact of removing crop residue.
3. **Consider growing a cover crop** – Establishing a cover crop prior to harvest or immediately after harvesting crop residue would minimize the negative impact of crop residue removal. Cover crops protect the soil surface, enhance soil biology, capture remaining nutrients and, if legumes are included, add nitrogen back into the system.
4. **Consider adding manure** – Manure will not only replace some of the nutrients that were removed with the crop residue but will also add some organic matter back into the system. Manure alone would not be adequate for soil erosion control on HEL fields because it would not provide enough cover to protect the soil. Manure would work best in combination with a cover crop.

References:

Klocke, Norman L., Randall S. Currie, Troy J. Dumler. 2008. Water Savings from Crop Residue Management. Proceeding of the 2008 Cover Your Acres Winter Conference, Oberlin, KS. pp. 50-54.

Varvel, G.E., K.P. Vogel, R.B. Mitchell, R.F. Follet, and J.M. Kimble. 2008. Comparison of corn and switchgrass on marginal soils for bioenergy. Biomass & Bioenergy 32:18-21.

Wortmann, Charles S., Robert N. Klein, Wallace W. Wilhelm, and Charles Shapiro. 2008. Harvesting Crop Residues. NebGuide G1846. University of Nebraska-Lincoln Extension.