Considerations for the Harvest of Corn Stover

Harvest of corn stover has increased in recent years and demand is likely to grow. Grazing of corn stalks by cattle is a long-standing practice on many fields. Harvesting of corn stover for feeding beef cattle has increased with reduced feeding of alfalfa hay and corn silage and increased use of distillers grain in the diet of cattle on feed. Harvesting stover for cellulosic ethanol production is anticipated in the near future. While grazing corn stalks usually results in little nutrient or organic matter removal unless heavily grazed, other harvest methods remove nutrients and organic matter important to maintaining soil productivity.

When deciding whether to harvest corn stover, consider the effect on soil nutrient availability; soil organic matter, water erosion and runoff, wind erosion, and soil water.

The Value of Removed Nutrients

The cost mostly easily estimated is the value of nutrients removed in stover harvest. The concentrations of nutrients in stover varies and is less if a greater proportion of the harvested stover is stalk rather than leaves and husks. The typical nutrient content is about 16 lb N, 4.0 lb P₂O₅, 29 lb K₂O and 3.4 lb S per ton of harvested corn stover. Table 1 can be used to calculate the value of the nutrients, given current fertilizer prices.

Soil Organic Matter

Maintenance of soil organic
matter is important to nutrient supply as well as to soil physical properties that critical to soil tilth, water infiltration and soil water-holding capacity. The information basis for estimating the amount of crop residues needed to maintain soil organic matter is weak. In one eastern Nebraska study, corn yield increased by 4.6 bushel for each ton of crop residual left in the field. Soil organic matter is maintained by decomposition of plant biomass returned to the soil. Both above and below ground plant parts, i.e., shoots, roots and root exudates, contribute to soil organic matter but the relative importance of each component is unknown. An estimated annual average of 2 to 3 ton per acre of crop residues should be left in the field for soil organic matter maintenance with reduced tillage or no-till systems.

### Water Erosion and Runoff

The value of maintaining ground cover to reduce water erosion and slow runoff is well recognized. Crop residues or a growing cover crop can provide the needed soil protection. On soils of medium and high erodibility with rainfed production, little if any corn stover should be harvested. On soils of low erodibility, leaving 2 to 3 tons per acre for maintenance of soil organic should be sufficient to protect against erosion.

### Wind Erosion

Wind erosion is best controlled by keeping a protective soil covering with crop residues or a growing cover crop. Maintaining standing crop residue is important to reducing wind velocity at the soil surface and to trapping soil particles. Stover removal could eventually result in less soil aggregate stability and reduced size making the soil more erodible. Ground covers of 30% and 60% are estimated to be sufficient to reduce wind erosion by 70% and 90%, respectively, compared to bare soil. For more

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**Table 1. The fertilizer value of nutrients in one ton of corn stover. Substitute current fertilizer nutrient prices as appropriate in column d and calculate the $ values in column e.**

<table>
<thead>
<tr>
<th>Element</th>
<th>Concentration in residue</th>
<th>Pounds per ton lb/ton</th>
<th>Fertilizer nutrient price $/lb</th>
<th>Value of nutrient in stover $/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>0.800</td>
<td>16.0</td>
<td>$0.50</td>
<td>$8.00</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>0.20</td>
<td>4.0</td>
<td>$0.42</td>
<td>$1.68</td>
</tr>
<tr>
<td>K₂O</td>
<td>1.45</td>
<td>29</td>
<td>$0.14</td>
<td>$4.06</td>
</tr>
<tr>
<td>S</td>
<td>0.17</td>
<td>3.4</td>
<td>$0.25</td>
<td>$0.85</td>
</tr>
</tbody>
</table>

\[ c = \frac{b}{100} \times 2000 \]

\[ e = c \times d \]

Total value \$14.59

### Soil Water

Crop residue affects soil water by reducing evaporation, catching snow and reducing runoff. Soil water loss associated with increased stover removal may be the greatest short-term cost of corn stover harvest. Under water limiting conditions, a corn crop is expected to produce approximately 7 bushel of corn per inch of available water. Soil water losses to evaporation may be increased by 1 to 5 inches, depending on the amount of residue left in the field (Figure 1). The snow trapping effect of erect crop residues may also equal one or more inches of water. Good ground cover often will result in reduced runoff and increased infiltration for further improvement in soil water availability. In water deficit situations, the reduced soil water conditions with stover harvest could often result in yield decreases of more than 40 bushel per acre the following year. In irrigated situations, pumping costs will be increased.

### Manure Application

Some of the negative effect of stover harvest can be overcome with regular manure application so nutrients are returned to the soil. Manure is highly variable but the amount of carbon added to the soil with an application of 10 tons per acre of feedlot manure, dry weight, may be similar to the carbon removed in the harvest of 5 tons of stover. Manure application is valuable for improving soil physical properties, resulting in improved water infiltration, reduced runoff and reduced erosion. It may not have the benefit of crop residues in reducing evaporation and won’t have the benefit of stand stover in trapping snow.
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