Corn Stalks Add Value for Nebraska

Charles Wortmann
Dept. of Agronomy and Horticulture
Harvesting Crop Residues

Charles S. Wortmann, Extension Nutrient Management Specialist; Robert N. Klein, Extension Western Nebraska Crops Soil Science — Crop Nutrition Specialist

For wheat, suggested values are 11 lb N, 3 lb P₂O₅, 15 lb K₂O, and 2 lb S. Harvesting crop residues also removes cations (positively charged ions) such as calcium, magnesium, and potassium, which help neutralize soil acidity. This suggests that more lime will be needed eventually. Harvesting 1 ton of corn residue removes about 2 lb of lime. Some values of these nutrients are given in Table I. The necessary corrective amounts will be given in Table II.
Considerations

• Value of nutrients removed

• Effects on
  – Erosion: water and wind
  – Soil water
  – Crop yield
  – SOM
  – Soil compaction

• Cover crops, double cropping for forage production, and manure application
Value of nutrients

How much crop residue is produced? Estimate 1 t per 40 bu corn, 30 bu soybean, 20 bu wheat.

<table>
<thead>
<tr>
<th>Element</th>
<th>%</th>
<th>Pounds Per ton</th>
<th>Fertilizer* Nutrient Price $/lb</th>
<th>Value of Nutrient In residue $/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>a N</td>
<td>0.85</td>
<td>17</td>
<td>$0.60</td>
<td>$10.20</td>
</tr>
<tr>
<td>a P₂O₅</td>
<td>0.2</td>
<td>4</td>
<td>$0.90</td>
<td>$3.60</td>
</tr>
<tr>
<td>a K₂O</td>
<td>1.7</td>
<td>34</td>
<td>$0.40</td>
<td>$13.60</td>
</tr>
<tr>
<td>a S</td>
<td>0.15</td>
<td>3</td>
<td>$0.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>Total value</td>
<td></td>
<td>70</td>
<td></td>
<td>$28.90</td>
</tr>
</tbody>
</table>

*Prices May 2012
## Nutrient contents (lb/t residue)

<table>
<thead>
<tr>
<th></th>
<th>Corn/milo</th>
<th>Soybean</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>17</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>$P_2O_5$</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>$K_2O$</td>
<td>34</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>S</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Figure 1. Crop residue needed to keep water erosion to below 5 ton/acre/year for silt loam and silty clay loam soil on three slopes in three counties of Nebraska. Bars reaching the upper limit of the chart indicate that more than 5 ton/acre of crop residue needs to remain as ground cover in the field.
Wind erosion
Residue needed for <5t/ac/yr erosion by wind
Soil water

• Crop residue benefits
  – Reduced evaporation
  – Trapped snow
  – Reduced runoff and increased infiltration

• How much reduction in crop available water with residue removal?
  – 0-5”
Soil organic matter

- Below ground biomass is especially important to maintaining SOM
- Results of two USDA-ARS studies at ARDC
  - Rainfed, marginal soil
  - Irrigated, good soil
Rainfed corn on 2% SOM soil: an increase in soil organic C with and without removal on 12 years!
Irrigated with >3% SOM:

- Disk compared to no-till
- Removal at 0, 40, 80%
- A small decrease in soil C over 10 yrs for all treatments except no-till with no removal
Residue removal and soil organic matter

- Concern for soil chemical, physical and microbial properties
- Suggested: leave an average of >2 t/yr
Water infiltration: dryland farming in CO

Sorptivity of 0.3 = ~0.4”/25 min

R² = 0.4966
Aggregates (water stable); 0-1” depth

$R^2 = 0.7204$

Total Aggregation (% Wt.)

Crop residue remaining (lb/ac/yr)

2 t/ac/yr
Soil Compaction (Brule NE)

Soil Compaction (0-1 inch Depth)

More compaction with baling to 5” soil depth; no effect on yield.

Mean yields
- Heavy Grazing: 159
- Baling: 152
- Light Grazing: 155
- No Residue Removed: 153
Effects on crop yields
No-till corn grain yield in the rainfed study at Mead, NE (2001-2010).

<table>
<thead>
<tr>
<th>N rate lb/ac</th>
<th>% stover removal</th>
<th>Grain yield bu/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>0</td>
<td>88</td>
</tr>
<tr>
<td>60</td>
<td>54%</td>
<td>82</td>
</tr>
<tr>
<td>120</td>
<td>0</td>
<td>116</td>
</tr>
<tr>
<td>120</td>
<td>53%</td>
<td>115</td>
</tr>
<tr>
<td>180</td>
<td>0</td>
<td>114</td>
</tr>
<tr>
<td>180</td>
<td>53%</td>
<td>116</td>
</tr>
</tbody>
</table>
Grain yield: irrigated continuous corn at ARDC (2009-2010; after 9-10 yrs).

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Stover removed</th>
<th>Grain yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Disk</td>
<td>0</td>
<td>202</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>207</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>212</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>207</td>
</tr>
<tr>
<td>No-till</td>
<td>0</td>
<td>181</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>206</td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>202</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>196</td>
</tr>
</tbody>
</table>
Yields with grazing of stalks: no-till corn-soybean rotation; 17 years

<table>
<thead>
<tr>
<th>Study years</th>
<th>Following crop</th>
<th>Spring grazed</th>
<th>Fall grazed</th>
<th>Ungrazed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-2011</td>
<td>Soybean</td>
<td>61.7</td>
<td>62.4</td>
<td>60.4</td>
</tr>
<tr>
<td></td>
<td>Corn*</td>
<td>207</td>
<td>209</td>
<td>206</td>
</tr>
</tbody>
</table>

*The corn yield was for the second crop after grazing.
Manure and cover or forage crops

• Manure application supplies nutrients and organic material
• Cover crops and double cropping with forages can be valuable in reducing water and wind erosion and may contribute to SOM
Stover removal and N rates

- Can we reduce N rates because of less N immobilization?
- Research at 3 sites in 2013 and 2014:
  - 0 and ~75% stover removal
  - 6 N rates
  - Will the N response curves differ?
Double-cropping for forage production: on-farm trials

• Brassica B/C sown into seed corn
  – when male rows are taken out
  – Corn harvested by early September
  – Brassica and stover grazed by steers Nov-Feb

• Drill-sown winter rye after corn silage
  – Spring grazing by cows/cow-calf pairs

• Effects on animal performance, yield of following crop, potential for nitrate leaching, depletion of soil water
Recap:

• Crop residue cover is important to erosion control

• Rainfed Site – Marginal Soil
  – Increase SOM to 5’ with and without stover removal for 10 yr

• Irrigated Site – Productive Soil
  – Reduced SOM for all treatments except for no-till with no residue removed

• 2 t/ac/yr generally adequate to maintain soil productivity if erosion is controlled
Recap

• In Corn Belt, an average corn yield increase with residue harvest; small soybean yield increase with grazing
• In semi-arid western Nebraska, a 30 bu yield loss occurred in one rainfed case
• No yield loss after 4 years with irrigation at Brule NE
Baling Corn Residue

A Decision Support Tool to Evaluate the Economics

Simon J. van Donk, Extension Water Resources/Irrigation Specialist
Robert N. Klein, Extension Western Nebraska Crops Specialist
Bo Liu, Extension Cropping Systems Disease Management Specialist
Tim M. Shaver, Extension Nutrient Management Specialist
Aaron Stalker, Extension Beef Range Systems Specialist
Matt C. Stockton, Extension Agricultural Economist
Steve L. Young, Extension Weed Ecologist

Removing corn residue by baling is widely practiced in the cattle industry’s feedlots on which cattle are fed. Corn residue also may increase evaporation and runoff of water, and it can reduce soil aggregation (Figure 1). Removing residue also may increase erosion and weed pressure, and it can reduce nutrients from the field, resulting in increased fertilization costs. Conversely, removing residue may decrease disease pressure and, if sufficient amounts of residue are present, make planting the next crop easier.

Considering all the relevant factors can make decisions about harvesting corn residue challenging. That’s why a decision support tool (Microsoft Excel® spreadsheet) was developed to help producers estimate the costs and returns associated with removing corn residue. The user-friendly tool requires data that producers can easily obtain and provides information to help producers decide whether to bale corn residue. This publication includes a step-by-step guide to completing each worksheet.

Grazing Cornstalks

A Decision Support Tool to Evaluate the Economics

Aaron Stalker, Beef Range Systems Specialist
Robert N. Klein, Western Nebraska Crops Specialist
Bo Liu, Cropping Systems Disease Management Specialist
Tim M. Shaver, Nutrient Management Specialist
Matthew C. Stockton, Agricultural Economist
Simon J. van Donk, Irrigation/Water Resources Specialist
Steve L. Young, Weed Ecologist

This tool was designed to be helpful to producers across the state. Because conditions vary widely, not all features of the tool will be applicable in every instance. If a particular feature does not apply to your situation, just leave that segment blank.

This tool is similar to one designed to evaluate the economics of baling cornstalks called Baling Corn Residue — A Decision Support Tool to Evaluate the...
Thank you!

Questions or comments??