Pricing Corn Silage for Sale

Wisconsin Forage Symposium
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University of Wisconsin
http://corn.agronomy.wisc.edu/Extension/CC04
Overview

• Perspectives on Corn Silage Value
• Materials and Methods
• Biology of Corn Silage Quality
  ✓ Energy Pools
  ✓ Grain = Starch
  ✓ Stover = NDF digestibility
• Pricing Corn Silage
  ✓ Grain equivalents
  ✓ Silage Value = Base price + Starch + NDFD
  ✓ RFQ
• Comparison of methods
Perspectives on Corn Silage Value

Corn Producer

• Relative to other forages:
  ✓ Higher yield
  ✓ Less labor to produce
  ✓ Less machinery time
  ✓ Cost per ton of dry matter is lower
  ✓ Flexibility, dual purpose
  ✓ Few established markets

• Relative to corn grain:
  ✓ Greater nutrient removal
  ✓ Greater handling & hauling cost
  ✓ Narrow harvest window
  ✓ Difficult to achieve conservation requirements on HEL ground

Dairyman

• Relative to other forages
  ✓ More consistent quality
  ✓ Very palatable forage
  ✓ Higher energy content
  ✓ Manure application
  ✓ Lower protein

• Relative to corn grain
  ✓ Higher transportation costs
  ✓ Expensive storage facilities
  ✓ Greater storage losses
  ✓ Few established markets
  ✓ Maturity and kernel processing
Perspectives on Corn Silage Value
– How is it currently valued?

• Corn silage value = relative feed value of a known market such as corn grain or baled hay
  ✓ Silage ($/T) = ¼ to ½ value of hay
  ✓ Silage ($/T) = 6 to 8 times corn price if in field, 10 times corn price if harvested. i.e. 40% DM → 8 x $2.00 per bu = $16 per T; 30% DM = 6x
  ✓ Lower rate for higher forage moisture.

• Corn silage value = what it would cost to replace or substitute another feed.
  ✓ Calculated using market prices for energy, protein, and digestibility as measured by $N_{\text{EM}}$, crude protein and NDF. Prices of corn, soybean meal, and legume hay can be used.
  ✓ Calculated using other feed sources such as clover, alfalfa, lespedeza, ryegrass, etc.

• Corn silage value = contracted price agreed upon between grower and buyer that is above the cost of production ($275 to $325 per acre)
Silage Price is Affected by:

- Dry matter content
- Harvesting costs
- Availability and price of alternative feeds
- Hay and hay crop silage can be substitutes for corn silage
- Corn grain price
- Soybean meal price – corn silage requires supplement of protein feeds.
What makes a good forage? (Carter et al., 1991)
- High yield
- High energy (high digestibility)
- High intake potential (low fiber)
- High protein
- Proper moisture at harvest for storage

Ultimate test is animal performance
- Milk2000 is our best predictor for performance (Schwab - Shaver equation)
Perspectives on Corn Silage Value

• Milk per acre and yield are best for determining value and cost of production from the producer perspective

• Milk per ton is best for determining value from the dairyman perspective
Animal Performance Differences

- Little animal performance data available on various hybrid and management differences and what those differences might mean economically.
  - Hybrid turnover

- Dairy nutritionists have different views on importance of corn silage fiber.

- Recent NCR guidelines have established importance of NDFD (CWD) in formulating dairy rations.
Materials and Methods

• Sought a data set with a wider range for yield
  ✓ Changing technologies (hybrids)
  ✓ Numerous environments (1997-2002)
  ✓ Plant density
  ✓ Planting date
  ✓ Row spacing
  ✓ Interactions
  ✓ Numerous locations

• Split-plots:
  ✓ 4 rows → silage
  ✓ 4 rows harvested later → grain

• Description of data matrix
Description of Data Matrix used for Calculating Relationships for Corn Silage Value (n=1458)

<table>
<thead>
<tr>
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Biology of Corn Silage Quality
Corn Silage Energy Pools

**Grain** = ~40-45% DM

80 to 100% digestible
• Kernel maturity
• Starch digestibility

**Stover** = ~55-60% DM

Leaves = 15% DM
Stem = 20-25% DM
Cob + Shank + Husk = 20% DM

40 to 55% digestible
• Cell wall digestibility
What does an average corn silage hybrid look like in WI?

<table>
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<td>Yield (T/A)</td>
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<tr>
<td>Moisture (%)</td>
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<td>62</td>
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<tr>
<td>Kernel milk (%)</td>
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<tr>
<td>Crude protein (%)</td>
<td>7.0</td>
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<tr>
<td>ADF (%)</td>
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<tr>
<td>NDF (%)</td>
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<td>46</td>
</tr>
<tr>
<td>IVD (%)</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>NDFD (%)</td>
<td>60</td>
<td>62</td>
</tr>
<tr>
<td>Starch (%)</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Milk per Ton (lb/T)</td>
<td>3420</td>
<td>3490</td>
</tr>
<tr>
<td>Milk per Acre (lb/A)</td>
<td>28900</td>
<td>27500</td>
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The Starch Pool

• Assume corn is about 72% starch on a dry matter basis

• Value of starch (grain) pool
  ✓ Kernel maturity
  ✓ Starch vitreousness

• Grain:stover ratio (starch content)
  ✓ Influenced by hybrid, environment and management
  ✓ Managing corn for silage should be the same as corn for grain.
Relationship between corn starch content and forage yield (1997-2002)

\[
\text{Starch} = -18.9 + 10.8(FY) - 0.562(FY)^2
\]

\[R^2 = 0.52\]

\[N = 426\]
Value of Grain –
Predicted Total Tract Starch Digestibility

*Based on data of Bal et al., 2000; Dhiman et al., 2000); Rojas-Bourrillon et al.1987
The Stover Pool

- Value of stover pool
  - bmr versus all other
- Differences in the value of corn silage comes down to the value of the stover as perceived by the dairyman.
- How many tons do you handle?
  Handling, hauling and storage costs
  - Bmr: 1 Ton = 3100 lbs milk
  - Leafy: 1 Ton = 2700 lbs milk
- Currently not important to most dairyman
- Becomes more important as dairies become larger.
  - Handling costs
  - Less manure to handle??
Relationship between corn NDF and forage yield (1997-2002)

\[ NDF = 66.6 - 4.11(FY) + 0.177(FY)^2 \]

\[ R^2 = 0.52 \]

\[ N = 426 \]
Relationship between corn NDF digestibility and forage yield (1997-2002)
Pricing Corn Silage
Relationship between corn grain yield and forage yield (1997-2002)

\[ GY = -72.7 + 42.3(FY) - 1.53(FY)^2 \]

\[ R^2 = 0.63 \]

\[ N = 426 \]
Bushels of grain contained in a ton of corn silage (1997-2002 n=426)

<table>
<thead>
<tr>
<th>Grain yield</th>
<th>Silage at 0% moisture yield</th>
<th>Grain equivalent per ton of silage</th>
<th>Silage at 65% moisture yield</th>
<th>Grain equivalent per ton of silage</th>
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<tbody>
<tr>
<td>Bu/A</td>
<td>T/A</td>
<td>Bu/T</td>
<td>T/A</td>
<td>Bu/T</td>
</tr>
<tr>
<td>25</td>
<td>2.5</td>
<td>9.8</td>
<td>7.3</td>
<td>3.4</td>
</tr>
<tr>
<td>50</td>
<td>3.3</td>
<td>15.2</td>
<td>9.4</td>
<td>5.3</td>
</tr>
<tr>
<td>75</td>
<td>4.1</td>
<td>18.3</td>
<td>11.7</td>
<td>6.4</td>
</tr>
<tr>
<td>100</td>
<td>5.0</td>
<td>20.1</td>
<td>14.2</td>
<td>7.0</td>
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<tr>
<td>125</td>
<td>6.0</td>
<td>21.0</td>
<td>17.0</td>
<td>7.3</td>
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<tr>
<td>150</td>
<td>7.1</td>
<td>21.2</td>
<td>20.2</td>
<td>7.4</td>
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<tr>
<td>175</td>
<td>8.4</td>
<td>20.8</td>
<td>24.1</td>
<td>7.3</td>
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<tr>
<td>200</td>
<td>10.3</td>
<td>19.5</td>
<td>29.3</td>
<td>6.8</td>
</tr>
</tbody>
</table>
Pricing Corn Silage
Linn (Minnesota)

Silage value ($/T) =

Base price + Starch adjustment + NDFD adjustment

• Base price = Cost of production
  ✓ $60 per DM Ton

• Starch adjustment =
  
  \[(\text{starch}\% - 29\%) \times (0.5 \text{ bu/starch}) \times (\text{corn price }$/\text{bu})\]
  ✓ 29\% = average starch content of corn derived from Dairyland Labs
  ✓ 0.5 bu/T = 1\% change in starch content

• NDFD adjustment =
  
  \[(\text{NDFD}\%) \times (0.6 \text{ lb milk/NDFD}) \times (\text{milk price }$/\text{lb})\]
  ✓ 0.6 lb milk = 1\% NDFD derived from Allen (48-hr digestion)
Changes in corn silage value using Minnesota approach. Base price = $60/T DM, corn price = $2.20/bu, milk price = $0.135/lb

<table>
<thead>
<tr>
<th>Starch % DM basis</th>
<th>NDFD(%) 49</th>
<th>53</th>
<th>57</th>
<th>61</th>
<th>65</th>
<th>69</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Corn silage value, $/ton DM</td>
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<td></td>
</tr>
<tr>
<td>20</td>
<td>54.07</td>
<td>54.39</td>
<td>54.72</td>
<td>55.04</td>
<td>55.37</td>
<td>55.69</td>
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<td>23</td>
<td>57.37</td>
<td>57.69</td>
<td>58.02</td>
<td>58.34</td>
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<td>58.99</td>
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<tr>
<td>26</td>
<td>60.67</td>
<td>60.99</td>
<td>61.32</td>
<td>61.64</td>
<td>61.97</td>
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<td>29</td>
<td>63.97</td>
<td>64.29</td>
<td>64.62</td>
<td>64.94</td>
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<td>32</td>
<td>67.27</td>
<td>67.59</td>
<td>67.92</td>
<td>68.24</td>
<td>68.57</td>
<td>68.89</td>
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<tr>
<td>35</td>
<td>70.57</td>
<td>70.89</td>
<td>71.22</td>
<td>71.54</td>
<td>71.87</td>
<td>72.19</td>
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</table>
Cost of Corn Silage Production in Wisconsin

- Typical harvesting costs $5/T in the field (total ~$100/A).
- Potassium (K$_2$O = $0.14$/lb) removal of stover (90 lb/A = $12.60/A)
- Moisture considerations
- Handling, hauling and storage costs of silage harvest differ from grain harvest
Average Division Production Costs For Farmers in PEPS (1999-2003)

Cost ($/A)

- **Cash Corn** Total = $285/A
- **Livestock Corn** Total = $248/A

- Seed: $37/ha, $36/ha
- Fertilizer: $44/ha
- Chemical: $24/ha, $27/ha
- Other: $4/ha, $3/ha
- Custom: $8/ha
- Interest: $9/ha, $7/ha
- Equip Var: $14/ha, $16/ha
- Equip Fix: $26/ha, $27/ha
- Harvesting: $59/ha
- Land: $60/ha, $58/ha
Relationship between corn total digestible nutrients and forage yield (1997-2002)

\[ \text{TDN} = 49.2 + 4.66 \times \text{(FY)} - 0.252 \times (\text{FY})^2 \]

\[ R^2 = 0.42 \]

\[ N = 416 \]
Relationship between corn relative feed quality and forage yield (1997-2002)

RFQ = 50.4 + 27.0(FY) - 1.35(FY)^2

R^2 = 0.40
N = 416
Relationship between corn Milk per Ton and forage yield (1997-2002)

MT = 1984 + 327(FY) - 17.7(FY)^2

R^2 = 0.41

N = 426
Proposed Method to Determine Silage Value

Production costs = $265 per A, breakeven = 120 bu/A at $2.20/bu

<table>
<thead>
<tr>
<th>Grain yield</th>
<th>Forage yield</th>
<th>Grain equivalent</th>
<th>Value of grain in forage ($2.20 bu)</th>
<th>Milk per ton</th>
<th>Milk per ton adjustment</th>
<th>Selling price</th>
</tr>
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<tbody>
<tr>
<td>50</td>
<td>3.3</td>
<td>15.2</td>
<td>$33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>4.1</td>
<td>18.3</td>
<td>$40</td>
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<tr>
<td>100</td>
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<tr>
<td>125</td>
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<td>21.0 (red)</td>
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<tr>
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<td>175</td>
<td>8.4</td>
<td>20.8</td>
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<td>200</td>
<td>10.2</td>
<td>19.5</td>
<td>$43</td>
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<td>50</td>
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<td>$43</td>
<td>3477</td>
<td>+5%</td>
<td>$45</td>
</tr>
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Marketing Strategies

• Deliver corn to buyer as silage is harvested
• Store purchased crop on-farm until late spring when forage supplies are tight
  ✓ Better price
  ✓ Need to market prior to new crop hay
• Sell silage early in year, store on farm and deliver as needed by buyer
  ✓ Handling and hauling costs need to be recovered
  ✓ Next step is delivering complete ration mixed to specifications.
• USE WRITTEN CONTRACTS!!