The Interaction Between Renewable Energy Production and the Livestock Industry

Texas Ag Forum
Austin, TX
February 23, 2007

David P. Anderson
Associate Professor and Extension Economist - Livestock and Food Products Marketing
Overview

• Ethanol and By-Products
• Overview of By-Product Characteristics
• Supply and Demand
• Issues
• Inevitable Interactions
For Starters...

- This Isn’t New
  - Brewers and distillers fed forever
- Can’t Just Feed it Alone
  - Not many feeds you can feed exclusively
- Price it Right and it Will All be Fed
Location, Location, Location …

- Where’s the Feed?
- Where are the Livestock?
Two Types of Processing

• Wet mills
  – Very large and costly to construct
  – Multiple products
    • High Fructose Sweetener, corn oil, ethanol
    • Corn gluten meal, *corn gluten feed* and others

• Dry mills
  – Generally smaller and less costly
  – Two products
    • Ethanol
    • *Distillers grains and solubles*
### Products of *Wet* Corn Milling

- One bushel of corn yields

<table>
<thead>
<tr>
<th>Product</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch</td>
<td>31.5</td>
</tr>
<tr>
<td>Gluten feed</td>
<td>13.5</td>
</tr>
<tr>
<td>Gluten meal</td>
<td>2.5</td>
</tr>
<tr>
<td>Corn meal</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Further processed into 33# of sweetener or 2.5 gallons of ethanol.
Corn Gluten Feed (CGF)

- Corn bran + steep
- Can be wet or dry
- Moderate crude protein, CP = 16-23%
  - 80% of CP is DIP (ruminally degradable)
- Low fat, moderate fiber, TDN = 80
- 101-115% of energy value of dry-rolled corn
- Product variation is significant within and across plants due to amount of steep added back to the corn bran
- Looks like oatmeal
Products of Dry Corn Milling

• One bushel of corn yields
  
  - Ethanol 2.75 gallons
  
  - Distillers grains & solubles 17-18 pounds

  • DGS are one third the weight of the corn and all but the starch is concentrated into this one-third

  • Sulfur is concentrated and may have been used in the fermenting process

  • Mycotoxins, if they existed in the corn are also concentrated 3:1
Distillers Grains + Solubles (DDGS)

- About 65% Distillers Grains & 35% Solubles (DM basis)
- May be wet or dried
- Higher crude protein, CP = 30%
  - 65% UIP (undegraded, “bypass”, protein)
- High fat (11%), low fiber, TDN = 70-110
- Concentrates nutrients 3-fold from corn
  - 0.8% P, 0.35-1.0% Sulfur (variable)
- WDGS looks like mashed potatoes
# Nutrient Composition of Selected Corn Milling Co-Products

<table>
<thead>
<tr>
<th>Feedstuf:*a</th>
<th>DRC*</th>
<th>WCGF-A</th>
<th>WCGF-B</th>
<th>DDGS*</th>
<th>WDGS*</th>
<th>CCDS*</th>
<th>MWDGS</th>
<th>steep*4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>90.0</td>
<td>44.7</td>
<td>60.0</td>
<td>90.4</td>
<td>34.9</td>
<td>35.5</td>
<td>45-50</td>
<td>49.4(49.0)*</td>
</tr>
<tr>
<td>SD</td>
<td>0.88</td>
<td>0.89</td>
<td>0.05</td>
<td>1.7</td>
<td>3.6</td>
<td>1.4</td>
<td>NA</td>
<td>1.0(0.58)*</td>
</tr>
<tr>
<td>CP, % of DM</td>
<td>9.8</td>
<td>19.5</td>
<td>24.0</td>
<td>33.9</td>
<td>31.0</td>
<td>23.8</td>
<td>NA</td>
<td>35.1</td>
</tr>
<tr>
<td>SD</td>
<td>1.1</td>
<td>0.63</td>
<td>0.51</td>
<td>1.3</td>
<td>0.9</td>
<td>1.5</td>
<td>NA</td>
<td>1.1</td>
</tr>
<tr>
<td>UIP, % of CP</td>
<td>60.0</td>
<td>20.0</td>
<td>20.0</td>
<td>65.0</td>
<td>65.0</td>
<td>65.0</td>
<td>NA</td>
<td>20.0</td>
</tr>
<tr>
<td>P, % of DM</td>
<td>0.32</td>
<td>0.66</td>
<td>0.99</td>
<td>0.51</td>
<td>0.84</td>
<td>1.72</td>
<td>NA</td>
<td>1.92</td>
</tr>
<tr>
<td>SD</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
<td>0.08</td>
<td>0.06</td>
<td>0.27</td>
<td>NA</td>
<td>0.11</td>
</tr>
<tr>
<td>TDN, %</td>
<td>90.0</td>
<td>90.0</td>
<td>94.5</td>
<td>101</td>
<td>112</td>
<td>112</td>
<td>NA</td>
<td>113</td>
</tr>
<tr>
<td>NEg, Mcal/lb</td>
<td>0.70</td>
<td>0.71</td>
<td>0.80</td>
<td>0.78</td>
<td>0.87</td>
<td>0.87</td>
<td>NA</td>
<td>0.88</td>
</tr>
</tbody>
</table>

*a DRC= dry rolled corn with NRC (1996) values, WCGF= wet corn gluten feed from two plants, DDGS= dried distillers grains + solubles, WDGS= wet distillers grains + solubles, CCDS= condensed corn distillers solubles (corn syrup), MWDGS= modified wet distillers grains + solubles, steep is steep liquor from wet milling plants.

*b DRC values based on NRC (1996) values with approximately 3500 samples

*c Values are from spring, 2003 from only one plant in Nebraska that produces DDGS, WDGS, and CCDS with standard deviation based on weekly composites.

*d DM values represent variation from daily composites for a 60-d period. Other nutrients are based on monthly composites for 2002 and half of 2003.

*e Values in parentheses are monthly composites for 2003 from one plant in Nebraska, with assumptions that it is a mixture of steep and distillers solubles.
Starch Removal Concentrates - Other Nutrients

% of Corn Grain

Nutrient

Protein NDF Starch Fat P K S

Source: Dan Loy, ISU
Issues
DDGS Issues

• Storage and handling is more costly
• High levels of feeding management is required
  – Bunk management and mixing
  – Nutrient balances
• Nutrient (manure) management is more costly
• Existing Infrastructure
  – Steam flaking, etc.

Source: Dan Loy, ISU
DDGS Issues

• Wet vs. Dry Distiller’s Grains
  - Nutrient content of DM is the same
  - Wet Distiller’s Grains Considerations
    • Usual storage period is 5-7 days
    • May require preservatives (e.g. propionic acid)
    • Limited hauling distance
    • May make rations too wet
      - Limits total DM intake especially when silages are used
DDGS Issues

- Must be golden brown
  - Dark brown is over heated and ties up lysine
- Pellet quality
- Flowability
- Requires another bin for storage
- Need Standards in Industry
  - Highly variable product hinders market
- But, New Products are Coming
- Protein and Energy More Than the “Old Book Values”
Storing WDGS

- Storing wet DGS product
  - Often delivered in truck load lots
  - Can store wet DGS in bunker, silage bag or in pile covered with plastic to protect from air
  - Should mix with tub-ground forage and stored in bunker or bag
  - Have to have the “mix” right
Economics: A Little Supply and Demand
Distillers Grains and Corn Gluten Feed Production
## Potential DDGS Use

<table>
<thead>
<tr>
<th>Species</th>
<th>Limit %</th>
<th>Use b/lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fed Cattle</td>
<td>35</td>
<td>28.9</td>
</tr>
<tr>
<td>Cows/Stockers</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>Dairy</td>
<td>10</td>
<td>15.0</td>
</tr>
<tr>
<td>Hogs</td>
<td>10</td>
<td>9.0</td>
</tr>
<tr>
<td>Sows</td>
<td>15</td>
<td>3.0</td>
</tr>
<tr>
<td>Broilers</td>
<td>10</td>
<td>13.0</td>
</tr>
<tr>
<td>Turkeys</td>
<td>10</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>74.5</strong></td>
</tr>
</tbody>
</table>
Distillers Grains and Corn Gluten Feed Production and Use

Potential
Realistic

DGS  CGF
Ratio of Corn to DDGS Prices

[Graph showing the ratio of corn to DDGS prices over time from 1/5/2006 to 2/5/2007.]
Interactions - Economic Realities

• Higher Feed Costs
  – By-products offer some mitigation

• Markets Respond Through Price
  – Feeder cattle and calf prices

• Reduced Production
  – Weights, exit business

• Livestock Industry Less Competitive
  – World market, regionally in U.S.

• Higher Food Costs for Consumers

• Transitional Period Critical
  – Supply response, energy, technology, food and feed markets