DDGS Days at Long View

Land O’ Lakes Purina Feed, LLC
Dr. Harold Tilstra
Disclaimer:

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Corn Kernel
(Kent Tjardes, Ph.D., SDSU)
Dry Grind Process
(Dry Mill refers to processing dry corn into corn flour, grits, corn bran, etc.)

From: Renewable Fuels Assn.
Dry-Grind Average Yield Per Bushel

- 2.7 gallons Ethanol
- 18 lbs DDGS
- 18 lbs CO₂

1 bushel becomes
Dry Grind Process

(Fractionation areas: de-germing, eliminate cooking, and oil decanting.)

From: Renewable Fuels Assn.
Dry Grind Ethanol Production

- Most of the new growth in ethanol production is from dry grind plants.
- New Generations plants are very efficient and in most cases profitable.
- Rate of growth has many observers wondering how the marketplace will handle changing demands on corn supply and increasing availability of by-products.
United States Ethanol Outlook
Nutrients Concentrate:

- 56 pounds of corn.
- remove the starch.
- add remnants of enzymes and yeast added to process.
- nutrients “concentrated” into 17 - 18 pounds of DDGS
Dry-Mill Ethanol Co-products

- Spent Mash
  - Grains Fraction
    - Dried Distillers Grain
    - Wet Distillers Grain
  - Solubles Fraction
    - Condensed Solubles (Syrup)
    - Dried Solubles
- Modified Wet DGS
- DDGS
  - Wet distillers grain with solubles
  - Dried distillers grain with solubles
- Corn Oil
- Modified Wet DGS
- Corn Oil
## DDGS Nutrient Profile Comparison

Grains fraction compared to Solubles fraction*

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Grains Fraction</th>
<th>Solubles Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter, %</td>
<td>34.3</td>
<td>27.7</td>
</tr>
<tr>
<td>Crude protein, %</td>
<td>33.8</td>
<td>19.5</td>
</tr>
<tr>
<td>Crude fat, %</td>
<td>7.7</td>
<td>17.4</td>
</tr>
<tr>
<td>Crude fiber, %</td>
<td>9.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Ash, %</td>
<td>3.0</td>
<td>8.4</td>
</tr>
<tr>
<td>Calcium, %</td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Phosphorus, %</td>
<td>0.56</td>
<td>1.30</td>
</tr>
</tbody>
</table>

*Goihl, Knott, and Shurson: Random samples from 6 Minnesota ethanol plants taken over a three week period and tested at Iowa Testing Laboratories, Eagle Grove, Iowa. Mean values reported.
Fractionated Corn

- “Taking” something out of the corn or DDGS changes the product.
- Affect of de-germing corn on nutrient profile of distillers grains.
- De-canting oil off of solubles.
- Current claims of higher value co-products not widely accepted by feed industry.
Using Corn Distillers Grains in Animal Feed

- How much can we use
  - Theoretically?
    - Good source of protein and energy for dairy and beef cattle.
    - Good source of protein, fiber, phosphorus, and energy for swine and poultry.
    - Formulate diet to maximize use of nutrients when economically advantageous.
Using Corn Distillers Grains in Animal Feed

How much can we use

- Practically?
  - High phosphorus levels can limit use in areas where soil phosphorus level management is necessary.
  - Low lysine levels require amino-acid balancing, especially at levels of more than 10% of the diet for dairy, swine, and poultry.
  - High vegetable oil levels can have negative effects on feed intake and carcass characteristics.
  - Nutrient variation results in limiting inclusion levels by nutritionist to minimize potential nutrient variation in finished rations.
Using Corn Distillers Grains in Animal Feed

- How much can we use
  - Practically?
    - Physical characteristics challenges; flowability, micron size, pellet strength, etc.
    - Geography may limit timely access to dependable amounts of quality product.
    - Price compared to primary ingredients.
    - Price compared to other mid-protein ingredients.
Potential use of DDGS

(Land O’ Lakes 2002)

Potential DDGS Demand

- Catfish
- Layers
- Broilers
- Swine
- Ruminant
- Total

Million Tons
2004 DDGS Use

- 6.928 million tons of distillers grains produced
- 6.078 million tons were consumed domestically
  - ruminants consumed about 75-80% of the production (approx. 4.862 million tons)
  - swine, poultry, aquaculture and companion animals (approx. 1.216 million tons)
- 786,603 tons were exported
DDGS Exports

According to FAS’s Export Trade Data (US Customs), total exports of DDGs (including brewers and distillers) were as follows (Calendar Year):

- 2005: 900,000 metric tons (LOL est.)
- 2004: 786,603 metric tons
- 2003: 741,639 (FAS/USDA)
- 2002: 842,141
- 2001: 797,466
- 2000: 807,908
- 1999: 714,775
DDGS Exports

- US Grains Council is promoting DDGS
  - Pacific rim countries
  - Europe
  - Canada, Mexico, Central, and South America
- Veracruz, Mexico DDGS demonstration in beef, dairy, and swine
  - Joint effort of Iowa Corn Growers DDGS promotion and USGC.
USGC DDGS Project in Mexico
Corn DDGS Value...

...it depends on:

- Nutrient concentration
- Nutrient digestibility or bio-availability
  - Energy
  - Amino acids
  - Phosphorus
- Physical properties of product
- Species
- Market price of competing ingredients
- Other factors
Sources of DDGS variability:
- Incoming grain
- The fermentation process.
- Percent of the soluble production blended with the wet grains during the drying process.
- Drying process.
### Testing Variation

**One DDGS Sample – Six Labs**

<table>
<thead>
<tr>
<th>Split Sample</th>
<th>Moisture</th>
<th>Fat</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.69</td>
<td>13.73</td>
<td>26.00</td>
</tr>
<tr>
<td>2</td>
<td>10.48</td>
<td>10.01</td>
<td>26.30</td>
</tr>
<tr>
<td>3</td>
<td>10.09</td>
<td>10.04</td>
<td>27.30</td>
</tr>
<tr>
<td>4</td>
<td>10.64</td>
<td>8.73</td>
<td>26.13</td>
</tr>
<tr>
<td>5</td>
<td>13.30</td>
<td>10.15</td>
<td>26.29</td>
</tr>
<tr>
<td>6</td>
<td>12.60</td>
<td>9.40</td>
<td>25.00</td>
</tr>
</tbody>
</table>

Land O’ Lakes Purina Feed, LLC – April 2005
## Value of Using 200 lb Per Ton of Golden DDGS in Swine Feed

(available lysine in DDGS) ~63% ~90%

<table>
<thead>
<tr>
<th>Ingredient Prices</th>
<th>$/ton</th>
<th>$/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>$78.54</td>
<td>$2.20</td>
</tr>
<tr>
<td>Hi-Pro Soybean Meal</td>
<td>$190.00</td>
<td></td>
</tr>
<tr>
<td>Dicalcium Phosphate, 18.5%</td>
<td>$380.00</td>
<td></td>
</tr>
<tr>
<td>DDGS (Golden)</td>
<td>$95.00</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>$65.00</td>
<td></td>
</tr>
</tbody>
</table>

Savings from using 200 lb DDGS $0.47/ton of feed $1.02

Break-Even Price for DDGS $99.65/ton DDGS $105.23
DDGS Relative Value Differs Depending on Species

Assumptions:
- Corn $2.00 / bu
- SBM $175.00 / ton
- Urea $360.00 / ton
- Non-ruminant diets corn/SBM
- Ruminant diets typical diets with competing by-products.

<table>
<thead>
<tr>
<th>Feed</th>
<th>Dollars/ ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy Lactation</td>
<td>$114.24</td>
</tr>
<tr>
<td>Poultry Finisher</td>
<td>$100.09</td>
</tr>
<tr>
<td>Layer Diet</td>
<td>$104.66</td>
</tr>
<tr>
<td>Swine G-F Diet</td>
<td>$96.34</td>
</tr>
<tr>
<td>Beef Feedlot</td>
<td>$108.00</td>
</tr>
</tbody>
</table>
DDGS: other factors.

In poultry:

- 10% DDGS in diet maintains performance of layers, broilers, and turkeys.
- Can be used to produce darker yellow yolks
- Can be used to produce a yellowish fat and possibly breast meat (?)
- Know the sodium content
DDGS in Poultry

- Broilers could use about 1 pound per bird.
- Laying hens could consume about 8.7# per hen per year, or about 4300 tons of DDGS/million hens/year.
DDGS: other factors.

In swine:

- 10% DDGS in diet in grow/finish and up to 40% of sow gestation diets.
- See less use in nursery and lactation diets
- Many producers report a “gut health” benefit
Land O’ Lakes Feed Suggested Swine Ration Inclusion Levels:

Nursery: 5%
Grow-Finish: 10%
Sow Gestation: 20%
Sow Lactation: 5%
DDGS: other factors.

In beef cattle:

- Up to 15% DDGS in diet competes with other protein sources in value.
- Over 15% DDGS in diet competes with other energy sources in value.
- Reduces incidence of acidosis and associated problems.
FEEDING RECOMMENDATIONS

DISTILLERS GRAINS (Beef)

• Maximum 6-15% of diet DM as Protein Source (1-2 lbs/d)

• Maximum 20-40% of diet DM as Energy Source (4-8 lbs/d)

• Maximum 30% of diet DM for cows (8 lbs/d)

• Balance CP, DIP, UIP

• Watch Mineral Balance (Ca:P)

• Effective NDF content of distillers grains is limited

  ❖ Does not replace all roughage sources
DDGS: other factors.

In dairy cattle:

- Excellent protein source
- High by-pass protein.
- Replaces corn & soybean meal, not forage.
- Need to balance lysine.
- Reduces incidence of acidosis and related problems.
Example Ration Considerations for Dairy Cattle

Diets containing 50:50 forage:concentrate

1) If equal proportions of Alfalfa & Corn Silage:
   *Distillers Grain can replace most or all protein supplement*

2) If mostly corn silage:
   *More Distillers Grain can be fed but may need some other protein supplement, check Lysine, & P*

3) If mostly alfalfa:
   *Less Distillers Grains likely needed to supply diet CP*
United States Ethanol Outlook

- Corn (bil. Bu.)
- Ethanol (bil. Gal.)
- DDGS (mmt)
## Ethanol Taking More Corn in Top States

Grain Service Corp.  Top Producer p. 38 March 2005

<table>
<thead>
<tr>
<th>2004</th>
<th>Ethanol produced (mil. gal./yr.)</th>
<th>Corn for Ethanol (mil. bu.)</th>
<th>Future Corn need (mil. bu.)</th>
<th>Total Eth Corn (mil. bu.)</th>
<th>Proj. 04 Total Use (mil. bu.)</th>
<th>% State Corn Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa</td>
<td>1,258</td>
<td>361</td>
<td>142</td>
<td>503</td>
<td>2,200</td>
<td>23%</td>
</tr>
<tr>
<td>Illinois</td>
<td>818</td>
<td>307</td>
<td>20</td>
<td>327</td>
<td>1,870</td>
<td>17.5%</td>
</tr>
<tr>
<td>Nebraska</td>
<td>533</td>
<td>213</td>
<td>0</td>
<td>213</td>
<td>1,275</td>
<td>16.7%</td>
</tr>
<tr>
<td>Minnesota</td>
<td>521</td>
<td>210</td>
<td>50</td>
<td>260</td>
<td>1,050</td>
<td>24.8%</td>
</tr>
<tr>
<td>South Dakota</td>
<td>451</td>
<td>181</td>
<td>0</td>
<td>181</td>
<td>475</td>
<td>38.1%</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>210</td>
<td>52</td>
<td>32</td>
<td>84</td>
<td>380</td>
<td>22.1%</td>
</tr>
<tr>
<td>Kansas</td>
<td>102</td>
<td>41</td>
<td>17</td>
<td>58</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Missouri</td>
<td>100</td>
<td>40</td>
<td>0</td>
<td>40</td>
<td>370</td>
<td>10.8%</td>
</tr>
<tr>
<td>U. S.</td>
<td>2,810</td>
<td>1,124</td>
<td>301</td>
<td>1,425</td>
<td>10,770</td>
<td>13.2%</td>
</tr>
</tbody>
</table>
# Midwest Ethanol Production

Brock Report, Dec 3, 2004 (Millions of gallons)

<table>
<thead>
<tr>
<th>State</th>
<th>Current Production</th>
<th>Under Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Dakota</td>
<td>390</td>
<td>14</td>
</tr>
<tr>
<td>Minnesota</td>
<td>389</td>
<td>89.5</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>109</td>
<td>80</td>
</tr>
<tr>
<td>Illinios</td>
<td>615</td>
<td>70</td>
</tr>
<tr>
<td>Nebraska</td>
<td>422</td>
<td>112</td>
</tr>
<tr>
<td>Iowa</td>
<td>716</td>
<td>300</td>
</tr>
</tbody>
</table>
Ethanol Production for April 2005

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>April Production</strong></td>
<td>299.7 mil gal</td>
</tr>
<tr>
<td><strong>April Use</strong></td>
<td>291.3 mil gal</td>
</tr>
<tr>
<td><strong>Stocks</strong></td>
<td>286.6 mil gal</td>
</tr>
<tr>
<td><strong>US Exports</strong></td>
<td>0.47 mil gal</td>
</tr>
<tr>
<td><strong>US Imports</strong></td>
<td>3.1 mil gal</td>
</tr>
</tbody>
</table>