Using Corn Ethanol Byproducts in Beef Rations
Corn Ethanol By products
Grain Milling/Processing Operations

- Generally want to remove the starch portion of the grain
- Residue remaining (byproducts) are generally contain high levels of digestible fiber and protein
- Dry milling process used for ethanol wet milling for corn sweetner
Corn Composition

- Water 13%
- Crude protein 9%
- Starch 62%
- Fiber (NDF) 18%
- Fat 7%
- Ash 2%
Dry Corn Milling
Corn Milling Procedures

- Dry milling
  - Corn is hammer milled without prior soaking in water
- End products
  - Food grade: Corn grits, hominy, alcohol
  - Industrial grade: Ethanol, alcohol
Dry Milling Schematic

Corn (whole) → [Grind, wet, cook]

Fermentation of starch → [Enzymes, yeast]

Still → [Centrifugation]

Stillage → [Evaporation]

Distillers grain
Wet and dried

Wet distiller grain with solubles (or)
Dried distillers grain with solubles

Distillers solubles

Ethanol

CO₂
U.S. Ethanol Biorefinery Locations

Source: Renewable Fuels Association
North Dakota Ethanol Development
Contact Information for DDGS

• Alchem, Ltd Grafton
  1-888-488-2778

• ADM Walhalla
  1-888-541-1062

• Blue Flint Ethanol Underwood
  1-701-442-7505

• Red Trail Energy Richardton
  plant 1-701-974-3308
  Commodity Specialists 1-800-769-1066
Ethanol Production Capacity in the United States

- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- Present

Millions of Gallons

- Yellow: Ethanol Production Capacity
- Red: Capacity Under Construction

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CORN NET EXPORTS (+) AND NET IMPORTS (-), 15-16

Table:

<table>
<thead>
<tr>
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<th>Rail &amp; Truck</th>
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<th>Total</th>
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<td>79</td>
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<td>14-15</td>
<td>10</td>
<td>71</td>
<td>92</td>
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<td>15-16</td>
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<td>93</td>
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<tr>
<td>Change</td>
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Legend:
- Pacific NW Corn Exports:
  - 13-14: 368
  - 14-15: 430
  - 15-16: 435
  - Change: 6

- US Corn Exports:
  - 13-14: 24
  - 14-15: 28
  - 15-16: 28
  - Change: 0

- US Atlantic Corn Exports:
  - 13-14: 4
  - 14-15: 5
  - 15-16: 5
  - Change: 0

- US Grains Council

Map:
- Key states and cities with corn export data
- Circles represent export volume with larger circles indicating higher volume
- Map shows distribution of corn exports and imports across the United States

Note: The actual values and data points are visualized in the map, and the numbers mentioned in the table correspond to the size of the circles on the map.
Corn Acreage and Production in ND

- Bushels (Million's)
- Acres (1000's)

Graph showing the increase in corn acreage and production from 1993 to 2005.
One Bushel of Corn Produces:

- 2.7 Gallons of ethanol
- 18 Pounds of DDG
- Or 54 Pounds of WDG
- 18 Pounds of carbon dioxide
Dry Distillers Grain For Sale
$70.00 F.O.B. The Plant - Good Availability
Wet Distillers Grain For Sale
$17.00 F.O.B. The Plant - 33% Dry Matter

North Country Ethanol
Rosholt, SD
Tom Lane, Commodity Manager
Corn/Distillers Grains
605-537-4585
Corn Condensed Distillers Solubles

• Also referred to as ‘corn syrup’
  • Feed industry = CCDS
• Highly variable nutritional content
  • DM
  • CP
  • Fat
  • Energy
  • Minerals
• Sometimes being given away if freight is paid
Corn Condensed Distillers Solubles

- Contains (DM basis):
  - 20 to 30% CP
    - 20% UIP (highly degradable)
  - 80 to 93 NE\textsubscript{g} (Mcals/100 lbs)
  - 9 to 15% fat
  - 1.30 to 1.45% P
  - 1.75 to 2.25% K
  - 0.37 to 0.95% S
# Nutrient Content of CCDS

<table>
<thead>
<tr>
<th></th>
<th>Product A</th>
<th>Product B</th>
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<tbody>
<tr>
<td>Fat, % DM</td>
<td>4.2</td>
<td>17.4</td>
</tr>
<tr>
<td>CP, % DM</td>
<td>15.4</td>
<td>21.6</td>
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</table>

- Plant to plant variation
- Day to day variation within plant
Corn Condensed Distillers Solubles

- Liquid byproduct
- Need liquid handling capability
- Can freeze
- Best results when tanks are buried
- Excellent ration conditioner
  - Controls dust
  - Improves palatability
Effect of High Fat CCDS on Feed Intake in Forage Based Diets

Lin, P = 0.01

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Gilbery et al., 2006
Buried Tank System
Dried Distillers Grains Plus Solubles

• Contain:
  • 25 to 32% CP
    • 47 to 57% UIP
  • 68 to 70 NE\(_g\) (Mcals/100 lbs)
  • 8 to 10% fat
  • 0.4 to 0.8% P
  • 0.87 to 1.33 K
  • 0.37 to 0.46 S
Dried Distillers Grains with Solubles
Dried Distillers Grains Plus Solubles

- Feed at 10 to 15% of the diet as a source of supplemental protein
- Feed at higher levels as an energy source
  - Economics determine appropriate level
- Maximum recommended level = 40% of the diet
  - N and P will be above requirements and could cause nutrient management problems
  - Sulfur issues
Dried Distillers Grains Plus Solubles

• Can be used as a protein supplement for forage fed cattle
• Majority of the protein is escape or bypass protein
  • Rely on urea recycling to use the escape protein in DDGS
• Stalker et al. (2004)
  • No differences in animal performance with urea inclusion in supplements based on DDG
Handling DDGS

- Doesn’t pellet well
- If you want to try pelleting
  - Add wheat midds, soybean hulls or other byproducts
    - 40% or more of the pellet?
- Storage
  - Will bridge and cause problems with conventional storage
  - Flat storage works best
Feeding Dried Distillers Grains on the Ground

- Concern
  - Feed waste
- Fat content may prevent some blowing when fed in meal form
- Feeding on used conveyor belts may be an option
Wet Distillers Grains

- Contain 25-35% DM (65-75% moisture)
- Contain 30 to 35% CP on a DM basis
- Contain 70 to 80 Mcal NEd/cwt
  - 100 to 115% value of corn
- 8 to 12% fat
- 0.5 to 0.8% P
Transportation and Storage

- Haul in end dump or live bottom trucks
- Will store 7-10 days in summer before mold, in winter freezing an issue
- Plants now selling modified wet at 50% DM which is more economical to truck
- Some success in bagging or packed pile in blends with stover, straw or hay to stockpiling for latter use
Ration Mixing

• Ration mixing is important in forage based diets
• Separation of DDGS from forages increases likelihood of sulfur related problems
Commodity Bay Storage
High corn prices create challenges for cowmen
## Example Rations with DDGS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>600 lb steer (2.5 ADG)</th>
<th>1300 lb cow (7 mo, pg.5 ADG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Hay (45)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>CRP Hay (35)</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Oat Straw (25)</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Corn (120)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DDGS (90)</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Salt/Min (500)</td>
<td>.35</td>
<td>.2</td>
</tr>
<tr>
<td>Cost/hd/day</td>
<td>$.68</td>
<td>$.68</td>
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</tbody>
</table>

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## Example Rations with Midds

<table>
<thead>
<tr>
<th></th>
<th>600 lb steer</th>
<th>1300 lb cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Hay (45)</td>
<td>9.5</td>
<td>15</td>
</tr>
<tr>
<td>CRP Hay (35)</td>
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<td></td>
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<td>Oat Straw (25)</td>
<td>9.5</td>
<td>11</td>
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<td>Midds (80)</td>
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<td>5</td>
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<tr>
<td>DDGS (90)</td>
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<td></td>
</tr>
<tr>
<td>Salt/Min (500)</td>
<td>.35</td>
<td>.2</td>
</tr>
<tr>
<td>Cost/hd/day</td>
<td>$.65</td>
<td>$.72</td>
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</table>

For a 600 lb steer with a 2.5 ADG gain, and a 1300 lb cow gaining 7 mon at a 5 ADG rate.
## Example Rations with Canola Meal

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>600 lb steer</th>
<th>1300 lb cow</th>
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<tr>
<td></td>
<td>2.5 ADG</td>
<td>7 mon pg.5 ADG</td>
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<tr>
<td>Grass Hay (45)</td>
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<td>Corn (120)</td>
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<td>Canola M (125)</td>
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NDSU Animal and Range Sciences
<table>
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<tr>
<th></th>
<th>%DM</th>
<th>%CP</th>
<th>%TDN</th>
<th>$/T</th>
<th>$/CP</th>
<th>$/TDN</th>
<th>$/BU</th>
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<tbody>
<tr>
<td>Canola Meal</td>
<td>0.9</td>
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<tr>
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<td>Hay</td>
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<td>$63.53</td>
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<td>$65.97</td>
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</tr>
</tbody>
</table>

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Harvested Stover

- Often too moist for storage
- Wait till field cured or late with cool temps
- Some headers don’t windrow much quantity
- May be difficult for some balers to bale
- Quality is less than when selectively grazed
- Porous bales do not keep well
Grazing Corn Residue

- Fence, water, shelter
- Grain > husk & leaf > stalk
- TDN 70 – 40 %
- CP 8 – 4 %
- Salt + Phos + Ca + Vitamin A + ? CP
- 20 to 60 days grazing per acre
- Mud & snow reduce access and create waste
- Once grain is gone, limit to mid gestation mature cows + CP
- Compaction concerns??
Summary

• Ethanol coproduct availability will continue to increase
• Ethanol coproducts are good sources of nutrients for beef cattle
• Pay attention to nutrient analysis and variability
• Transportation economics are important
DDGS Sources

- AlChem, Ltd  Grafton  888-488-2778
- ADM  Walhalla  888-541-1062
- Blue Flint  Underwood  442-7505
- Red Trail  Richardton  974-3308
  - Commodity Specialists  800-769-1066
- Heartland  Aberdeen  800-774-6537
- North Country  Rosholt  605-537-4585
- James Valley  Groton  605-397-2726
For More Information:

http://www.ext.nodak.edu/extpubs/beef.htm
Questions?
Philosophy

‘Life is a series of choices,
Be sure you read the road signs…
....Or Be Ready to Deal With Problems!!!