Using Corn Ethanol Byproducts in Beef Rations
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]

CO₂

Ethanol

Still

[Centrifugation]

Stillage

[Evaporation]

Distillers grain
Wet and dried

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

Distillers solubles
One Bushel of Corn Produces:

- 2.7 Gallons of ethanol
- 18 Pounds of DDG
  - Or 54 Pounds of WDG
- 18 Pounds of carbon dioxide
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
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) (97TDN)
  - 9 to 15% fat
  - 1.30 to 1.45% P
  - 1.75 to 2.25% K
  - 0.37 to 0.95% S
<table>
<thead>
<tr>
<th></th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<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>
</tr>
</tbody>
</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

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

- Contain:
  - 25 to 32% CP
  - 47 to 57% UIP
  - 60 to 70 NEg (Mcals/100 lbs) (86TDN)
  - 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 .80 to .90 Mcal NEg/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 mon pg.5 ADG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Hay (45)</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>CRP Hay (35)</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Oat Straw (25)</td>
<td>5</td>
<td></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>
</tr>
</tbody>
</table>

NDSU Animal and Range Sciences
Future Opportunities
<table>
<thead>
<tr>
<th>Material</th>
<th>%DM</th>
<th>%CP</th>
<th>%TDN</th>
<th>$/T</th>
<th>$/CP</th>
<th>$/TDN</th>
<th>$/BU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola Meal</td>
<td>0.9</td>
<td>0.41</td>
<td>0.69</td>
<td>$116.0</td>
<td>0.1571</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>0.88</td>
<td>0.1</td>
<td>0.9</td>
<td>$125.0</td>
<td></td>
<td>0.0789</td>
<td>$3.50</td>
</tr>
<tr>
<td>Barley</td>
<td>0.88</td>
<td>0.135</td>
<td>0.84</td>
<td>$126.3</td>
<td></td>
<td>$3.03</td>
<td>86.%</td>
</tr>
<tr>
<td>Oats</td>
<td>0.91</td>
<td>0.13</td>
<td>0.75</td>
<td>$116.3</td>
<td></td>
<td>$1.86</td>
<td>53.%</td>
</tr>
<tr>
<td>Barley Malt</td>
<td>0.89</td>
<td>0.14</td>
<td>0.74</td>
<td>$115.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDGS</td>
<td>0.9</td>
<td>0.28</td>
<td>0.86</td>
<td>$173.0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wet DG</td>
<td>0.3</td>
<td>0.28</td>
<td>1.15</td>
<td>$72.63</td>
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<td></td>
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<tr>
<td>Peas</td>
<td>0.88</td>
<td>0.23</td>
<td>0.88</td>
<td>$158.1</td>
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<td>$4.75</td>
<td>135.%</td>
</tr>
<tr>
<td>Screenings</td>
<td>0.86</td>
<td>0.14</td>
<td>0.7</td>
<td>$105.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Midds</td>
<td>0.88</td>
<td>0.14</td>
<td>0.78</td>
<td>$119.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soy Hull</td>
<td>0.92</td>
<td>0.12</td>
<td>0.8</td>
<td>$121.9</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hay</td>
<td>0.86</td>
<td>0.09</td>
<td>0.54</td>
<td>$63.53</td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

*With 10% waste*
<table>
<thead>
<tr>
<th></th>
<th>%DM</th>
<th>%CP</th>
<th>%TDN</th>
<th>$/T</th>
<th>$/CP</th>
<th>$/TDN</th>
<th>$/BU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola Meal</td>
<td>0.9</td>
<td>0.41</td>
<td>0.69</td>
<td>$0.00</td>
<td>0.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>0.88</td>
<td>0.1</td>
<td>0.9</td>
<td>$125.00</td>
<td>0.0789</td>
<td>$3.50</td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>0.88</td>
<td>0.135</td>
<td>0.84</td>
<td>$116.67</td>
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<td>$2.80</td>
<td>80%</td>
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<tr>
<td>Oats</td>
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<td>0.13</td>
<td>0.75</td>
<td>$107.72</td>
<td></td>
<td>$1.72</td>
<td>49%</td>
</tr>
<tr>
<td>Barley Malt</td>
<td>0.89</td>
<td>0.14</td>
<td>0.74</td>
<td>$103.95</td>
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<td></td>
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<tr>
<td>DDGS</td>
<td>0.9</td>
<td>0.28</td>
<td>0.84</td>
<td>$119.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet DG</td>
<td>0.3</td>
<td>0.28</td>
<td>1.15</td>
<td>$54.66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peas</td>
<td>0.88</td>
<td>0.23</td>
<td>0.88</td>
<td>$122.22</td>
<td></td>
<td>$3.67</td>
<td>105%</td>
</tr>
<tr>
<td>Screenings</td>
<td>0.86</td>
<td>0.14</td>
<td>0.7</td>
<td>$95.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Midds</td>
<td>0.88</td>
<td>0.14</td>
<td>0.78</td>
<td>$108.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soy Hull</td>
<td>0.92</td>
<td>0.12</td>
<td>0.8</td>
<td>$116.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td>0.86</td>
<td>0.09</td>
<td>0.54</td>
<td>$65.97</td>
<td></td>
<td></td>
<td>with 10% waste</td>
</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 + Vit 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
Wheat Midds
The Make Up of Midds

- Range from 14 to 18 percent protein
  - Often guaranteed at 14% - usually higher
- Protein high in rumen degradability
- Highly digestible fiber
  - Extremely small fiber particle size –
  - so less effective in rumen,
  - not a forage replacement
- Energy level is less than oats – but higher than legume hay
- High in phosphorous and potassium
- Good source of trace minerals
  - Copper, zinc, magnesium & selenium
  - Low in calcium – would need to supplement
<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>89%</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>16.5%</td>
</tr>
<tr>
<td>Fat</td>
<td>4.5%</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>7.5%</td>
</tr>
<tr>
<td>Neutral Detergent Fiber</td>
<td>32.0%</td>
</tr>
<tr>
<td>Acid Detergent Fiber</td>
<td>9.9%</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.1%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.80%</td>
</tr>
<tr>
<td>Total Digestible Nutrients</td>
<td>72.8%</td>
</tr>
<tr>
<td>Net energy—Lactation</td>
<td>83.8 Mcal/100 lbs.</td>
</tr>
</tbody>
</table>
What are Wheat Midds?

• A co-product of milling flour
• Generally include screenings, bran, germ and flour remnants
• Higher levels of fiber, protein & minerals than wheat ~ but less starch
Availability of Midds

- **Dakota Growers Pasta Company** Carrington, ND 701-652-2855 $115/ton pellets - 14% CP guaranteed (usually 17-18% CP) few tons left

- **Minot Milling** Minot, ND 701-852-8964 $95/ton pellet - 14% CP guaranteed (usually 15.2% CP) ~ contracted out until March

- **Noodles by Leonardo Cando**, ND 701-968-4464 meal only (not pelleted), most sold to Hubbard Feeds, limited availability - call first

- **SunPrairie Grain** Velva, ND 701-338-2013 Pellets, $120/ton pelleted good supply on hand
Type of Product

- Loose Meal
  - Fine, dusty difficult to handle
- Pellets
  - Increased density
  - Easier to handle, haul, mix, store
  - Usually ¼ or ½ inch in diameter
  - Minimize handling to reduce crumbling
  - Costs about $4-7 a ton to pelletize
Storage

- They readily take on moisture, swell, soften, lose their ability to flow in high humidity
- Extended storage in warm, moist weather can result in bridging or spoilage
- Pellet deterioration, mold growth & insect activity common on hot humid conditions
Storage Continued

• Summer storage
  • Start small – experiment with your storage capabilities
  • Away from concrete floors or soil
  • Properly sealed bins with no leaks
  • Aerate the bin to dry – not just cool - the pellets
    • Do within first month of storage
  • Level the surface
    • Steep peak contains fines which interfere with moisture movement
Palatability

- Relatively palatable and readily consumed by all classes of cattle
- Since higher in fiber w/ reduced starch – digestive disturbances less of a concern
- Few problems with acidosis or bloat
  - May cause loose cattle
Feeding Midds to Beef Cows

- Well matched with low quality forage for gestating cows
- 5-6 pounds per day
- 40% NDF
  - Highly digested in the rumen
  - Does not cause decrease cow’s forage consumption like high starch feedstuffs might
## Example Rations with Midds

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>600 lb steer 2.5 ADG</th>
<th>1300 lb cow 7 mon pg.5 ADG</th>
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<tbody>
<tr>
<td>Grass Hay (45)</td>
<td>9.5</td>
<td>15</td>
</tr>
<tr>
<td>CRP Hay (35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oat Straw (25)</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Midds (80)</td>
<td>9.5</td>
<td>5</td>
</tr>
<tr>
<td>DDGS (90)</td>
<td></td>
<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>
</tr>
</tbody>
</table>

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Biodiesel Co-Products

Canola Meal
A protein supplement

- Alfalfa hay at $65.00/ton at 18% protein
  - .18 cents per pound of protein
- Canola meal at $121.00/ton at 40% protein
  - .15 cents per pound
- Soybean meal at $192.00/ton at 46% protein
  - .21 cents per pound of protein
Canola meal

- protein: 39-40%
- 12% moisture: 12%
- Fat: 2-3%
- Fiber: 11-12%
- TDN: 69%
Canola meal in rations

- Calves 20% of the ration
- 25% of the grain mix for dairy cows
- 20% of the grain mix for beef cows
Canola meal

- $121.00 per ton for meal or pellets
- Availability is good, call in advance
- Produce 1,200 ton per day
- 7:30-4:30 pm pickup times

- ADM, Velva ND  701 338-2491
Example Rations with Canola Meal

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>600 lb steer 2.5 ADG</th>
<th>1300 lb cow 7 mon pg.5 ADG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Hay (45)</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>Corn Silage (25)</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Oat Straw (25)</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Corn (120)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Canola M (125)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Salt/Min (500)</td>
<td>.35</td>
<td>.2</td>
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<tr>
<td>Cost/hd/day</td>
<td>$.76</td>
<td>$.79</td>
</tr>
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</table>

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For More Information:

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

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