Effects of Feeding Wet Distiller’s Grains on Nutrient Excretion & Emissions

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Background

How “Green” Is Ethanol?
Effects of Land Use Change on CO$_2$ Equivalents per MJ of Energy in Fuel

Loss of soil OM?

What about when we feed the DGs?

Feed in.....bovine co-products out.....

Courtesy of Mike Brown
Effects of DG on Manure Production & Composition

Collection, hauling, distribution
(5-10% of operating expenses)
WDGS Effects on SFC-diet DMD

![Bar chart showing digestion percentages for different conditions. Each group is labeled as Greene et al. or Brown & Cole. The chart includes SFC Control and various WDGS conditions (10% WCDG, 10% WSDG, 15% WSDG). The digestion percentages are 80.5%, 76.6%, 75.7%, and 76.7% for the respective groups.](image-url)
Effects of WDGS & Corn Processing on DM Digestion (MacDonald & Cole, 2008)
Effects of WDGS & Corn Processing on Manure Collected (MacDonald et al., 2008)

WDGS: P < 0.01

Process: P < 0.03

DRC -0%  DRC - 20%  SFC- 0%  SFC-20%

<table>
<thead>
<tr>
<th></th>
<th>lb./head</th>
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<tbody>
<tr>
<td>DRC -0%</td>
<td>847</td>
<td>924</td>
<td>590</td>
<td>708</td>
</tr>
<tr>
<td>DRC - 20%</td>
<td></td>
<td>+9%</td>
<td></td>
<td>+20%</td>
</tr>
<tr>
<td>SFC- 0%</td>
<td></td>
<td></td>
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<tr>
<td>SFC-20%</td>
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</table>
Effects of 15% Sorghum WDGS on Calculated DM Collected (Brown & Cole)

SFC control: 297 lb./head

15% WDGS: 354 lb./head, +19%
Effects of Corn WDGS on Manure Composition (MacDonald et al., 2008)
Effects of Sorghum WDGS on Manure Composition (Brown & Cole)

![Bar chart showing the effects of Sorghum WDGS on Manure Composition](chart.png)

- **Manure N %**
  - SFC Control: 2.68
  - 15% WDGS: 3.08
  - P < 0.01

- **Manure P %**
  - SFC Control: 0.64
  - 15% WDGS: 0.65

- **Manure N:P**
  - SFC Control: 4.2
  - 15% WDGS: 4.7
  - P < 0.01
Effects of WDGS on P Excretion and Land Needed for Manure “Disposal”

- Increased Manure DM
- Increased Manure P
- P-based Applications
Effects of DG on P Excretion & Land Required for Manure Disposal: Trials

- Geisert et al. (2005): DRC 0 vs. 30%
- Benson et al. (2005): DRC 0, 15, 25, & 35%
- Brown & Cole (2008): SFC 0, 15%
- MacDonald et al. (2008): DRC 0, 20%
- MacDonald et al. (2008): SFC 0, 20%
- ISU, IBC29 (2006): DRC 0, 15, 25, 40%
- Kissinger et al (2006): DRC 0, 20, 40%
P Excretion (g/d): 6-Trial Summary

\[ Y = 20.32 - 0.0892X + 0.013X^2; \ r^2 = 0.45^* \]

\[ Y = 19.09 + 0.34X; \ r^2 = 0.38^{**} \]
Land Requirements - Summary

Y = 1.043X + 0.029X^2: r^2 = 0.97
Y = 1.933X: r^2 = 0.96
Cost vs. Market Value of Manure: WDGS/P Effects (Kissinger et al., 2006)

Kissinger et al (2006): Corn /SBM rotation, 4 yr P basis/Northern Plains
Air Quality

Nitrogen Volatilization Losses
WDGS Effects on N Volatilization
MacDonald & Cole., 2008
WSDGS & N Volatilization (Brown & Cole)

- Feeding 15% Wet SDGS in SFC-based diet
  - Decreased N volatilization as % of N intake
    - 50 vs. 43.5% of NI
  - Did not affect total N volatilization
    - 17.7 vs. 17.6 lb / head
  - Increased fecal N excretion but not urine N
  - Increased manure OM excretion
  - Decreased pH of feces (7.13 vs. 6.87) and manure (8.32 vs. 8.07)
NH3 Losses at FdYd A, % of NI

Todd and Cole

64
57
Daily NH3 Losses at FdYd A, g/hd

![Bar chart showing daily NH3 losses from February to August 2007 and 2008. The chart compares the g/hd values for each month, with the highest losses in June for both years.]

Todd and Cole
C Losses: Assumptions

- Land: 50%
- CO₂: 49%
- CH₄: 1%
- Land: 50%
- CO₂: 33%
- CH₄: 1%
- CO₂: 60%
- CH₄: 5%
- Land: 20%
- CO₂: 67%
- CH₄: 15%
# Carbon Balance, % of original corn

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>WDGS</th>
<th>WDGS^</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal</td>
<td>15</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Manure to field</td>
<td>10</td>
<td>6.7</td>
<td>6.4</td>
</tr>
<tr>
<td>CO₂</td>
<td>69.8</td>
<td>79.8</td>
<td>79.4</td>
</tr>
<tr>
<td>CH₄</td>
<td>5.2</td>
<td>3.5</td>
<td>4.1</td>
</tr>
<tr>
<td>Global Warming Potential</td>
<td>199.8</td>
<td>167.3</td>
<td>181.9</td>
</tr>
</tbody>
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^ = If WDGS increases enteric CH₄ production 20%. 
Conclusions

- Environmental effects of feeding DG are partially dependent upon the basal diet
  - SFC vs. DRC
  - High concentrate vs. high roughage
- Feeding DG will increase land requirements for manure disposal by about 20% for each 10% of diet DM
  - Increased DM / OM / P excreted
  - Little apparent effect on N:P ratio of manure
Conclusions

- Although not entirely clear
  - DG effects on ammonia emissions may depend on DG concentrations, season, and corn processing method
    - Little or no effect on NH$_3$ losses as % of N intake at low DG inclusion rates
  - Potentially significant effects on total NH$_3$ emissions at higher DG inclusion rates
Conclusions

- At higher inclusion rates
  - DG may increase hydrogen sulfide emissions
    - Benson et al. (2005)
    - Varel et al. (2009)

- Effects on greenhouse gas emissions – not clear but feeding DG may have little, if any, effect on global warming potential
Thank You