The Value of Midwestern Produced DDGS in Swine Diets

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3.2 to 3.5 million metric tonnes of DDGS are produced in North America/year

- ~ 900,000 MT produced in MN-Dakota region
- ~ 700,000 MT exported to the EU
- ~ 2.65 million MT fed in U.S. and Canada
  - ~ 2,580,000 MT (80%) fed to ruminants
  - ~ 45,000 MT fed in MN turkey industry
  - ~ 30,000 MT used in swine diets
14 plants:
- Use 130 million bu. of corn
  - 13% of MN corn production
- Produce 240 million gallons of ethanol
- Produce 1 million tons of DDGS
  - 30% of total DDGS in North America

Plants are:
- Small - 13 to 34 million gallon capacity/year
- New - < 10 years old
- Farmer owned - 8,945 farmer members
Why Hasn’t DDGS Been Used in Swine Diets?

- Low protein quality (poor amino acid balance)
- Low amino acid digestibility
- High fiber content
- Nutrient variability among sources
- Cost competitiveness with corn and soybean meal
- Image that DDGS is an inferior ingredient
Why is There Renewed Interest in Feeding DDGS to Swine?

- Rapid growth of the ethanol industry has increased the quantity and local supply
  - 24 million gallons of ethanol produced in 1994
  - 220 million gallons produced in 2000
- New ethanol plants are producing higher quality DDGS
  - Higher nutrient content and digestibility than DDGS values listed in NRC (1998)
- A cost effective partial replacement for corn, SBM and dicalcium phosphate
Why is There Renewed Interest in Feeding DDGS to Swine?

- Use reduces phosphorus content of manure
- Appears to improve gut health of grow-finish pigs
Quality Considerations for Selecting DDGS Sources

- Golden color DDGS is much better suited for swine diets than darker colored DDGS due to higher amino acid digestibility

- DDGS produced by new Midwestern plants is higher in nutrient content and digestibility than DDGS from older plants
Quality Considerations for Selecting DDGS Sources

- Nutrient Specifications
  - Moisture – maximum 12%
  - Protein – minimum 26.5%
  - Fat – minimum 10%
  - Fiber – maximum 7.5%
Quality Considerations for Selecting DDGS Sources

- Physical characteristics
  - Bulk density – 34 to 37 lb/cubic foot
  - Particle size:
    - maximum coarse particles - 10% on 2000 screen
    - maximum fine particles - 15% on 600 screen & in pan
  - Smell – fresh, fermented
  - Color – goldenrod
How Do Nutrient Levels of MNSD DDGS Compare to Published Values?
MNSD DDGS Has Higher Nutrient Levels and Digestibility than Other DDGS Sources

- **Energy**
  - Digestible energy (DE) and metabolizable energy (ME) > corn
  - Increase in fiber content is offset with increase in fat content

- **Amino acids**
  - Poor amino acid balance
  - Higher digestible amino acids levels
MNSD DDGS Metabolizable Energy (kcal/kg) vs. DDGS from an Older Midwestern Plant and Published Values

C.V. = 34.0
MNSD DDGS Apparent Digestible Amino Acid Levels vs. DDGS from an Older Midwestern Plant and Published Values

<table>
<thead>
<tr>
<th>App. Dig. AA</th>
<th>MNSD</th>
<th>MW</th>
<th>NRC (1998)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysine, %</td>
<td>.44</td>
<td>.00</td>
<td>.31</td>
</tr>
<tr>
<td>Methionine, %</td>
<td>.32</td>
<td>.24</td>
<td>.39</td>
</tr>
<tr>
<td>Threonine, %</td>
<td>.62</td>
<td>.36</td>
<td>.56</td>
</tr>
<tr>
<td>Tryptophan, %</td>
<td>.15</td>
<td>.15</td>
<td>.14</td>
</tr>
<tr>
<td>Valine, %</td>
<td>.92</td>
<td>.51</td>
<td>.88</td>
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</tbody>
</table>
MNSD DDGS is Higher in Phosphorus Availability Compared to Corn and Published Values

- Available P in DDGS is dramatically improved compared to corn (0.80% vs 0.04%).

- Available P in MNSD DDGS is higher than published values (0.80% vs. 0.59%)
Summary of DDGS Nutrient Level Comparisons vs. NRC (1998)

- MNSD DDGS is higher in:
  - crude fat
  - crude fiber
  - DE and ME
  - crude protein
  - total and apparent digestible lysine
  - total and apparent digestible threonine
  - phosphorus

- MNSD DDGS is lower in:
  - dry matter
  - apparent digestible methionine
## Comparison of Fiber Characteristics of MNSD DDGS with Other High Fiber Ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Crude Fiber, %</th>
<th>NDF, %</th>
<th>ADF, %</th>
<th>Soluble Fiber, %</th>
<th>Insoluble Fiber, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>2.6</td>
<td>9.0</td>
<td>3.0</td>
<td>1.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>7.0</td>
<td>13.3</td>
<td>9.4</td>
<td>1.6</td>
<td>13.2</td>
</tr>
<tr>
<td>MNSD DDGS</td>
<td>9.9</td>
<td>44</td>
<td>18</td>
<td>0.7</td>
<td>42.2</td>
</tr>
<tr>
<td>Beet pulp</td>
<td>19.8</td>
<td>54</td>
<td>33</td>
<td>11.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Soybean hulls</td>
<td>40.1</td>
<td>67</td>
<td>50</td>
<td>8.4</td>
<td>5.5</td>
</tr>
</tbody>
</table>
What Are the Effects of DDGS on Manure Nutrient Management and Air Quality?
Effects of DDGS on Manure Nitrogen Excretion

THE BAD NEWS

- Manure N content increases due to:
  - high crude protein:lysine ratio
  - reduced a.a. digestibility compared to corn & SBM
- High levels of DDGS may reduce pig performance due to the energy cost of removing excess N
- However, excess N can be minimized by adding synthetic amino acids to diets.
Effects of DDGS on Manure Phosphorus Excretion

THE GOOD NEWS

- Manure P content is reduced due to:
  - DDGS has more available P compared to corn and soybean meal
  - Need for supplemental inorganic P and/or phytase in the diet is decreased
    - Decreases diet cost
Effects of DDGS on Air Quality

- Feeding DDGS has no positive or negative effects on gas and odor emissions.
Effect of Dietary Treatment on Manure Odor Detection Threshold

MSE ± .1152  P > .10
Effect of Dietary Treatment on Ammonia Emission

Graph showing the comparison of NH₃ emissions between Control and DDGS treatments over 9 weeks. The graph includes a linear trend line for each treatment, with NH₃ emissions ranging from 0 to 20 ppm. The MSE ± .0876 and P > .10 indicate the statistical analysis of the data.
Effect of Dietary Treatment on Hydrogen Sulfide Emission

Week MSE ± .0426 P > .10

Control
DDGS
# Recommended Maximum Inclusion Rates for DDGS

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<tr>
<td>Nursery</td>
<td>5 %</td>
<td>5 %</td>
</tr>
<tr>
<td>Growing pigs (18-55 kg)</td>
<td>7.5 %</td>
<td>10 %</td>
</tr>
<tr>
<td>Finishing pigs (55 kg to mkt)</td>
<td>10 %</td>
<td>10 %</td>
</tr>
<tr>
<td>Gestating sows</td>
<td>50 %</td>
<td>40 %</td>
</tr>
<tr>
<td>Lactating sows</td>
<td>20 %</td>
<td>10 %</td>
</tr>
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</table>
DDGS in Grow-Finish Diets

- Formulate on a digestible amino acid basis to optimize performance
- No effect on carcass or meat quality when fed up to 30% of the diet.
- Reduces belly thickness, firmness, and increases fat softness
- Appears to help alleviate gut health problems
DDGS is Often an Economical Addition to Swine Diets

- 200 lbs of DDGS and 3 lbs of limestone replaces:
  - 177 lbs of corn
  - 20 lbs of soybean meal (44%)
  - 6 lbs of dicalcium phosphate
Conclusion

- DDGS produced in MN and SD ethanol plants is:
  - higher quality than other sources
  - often a cost effective replacement for corn, soybean meal and dicalcium phosphate
  - abundant quantities are available locally
  - effective in minimizing P excretion in manure
  - may improve gut health of grow-finish pigs
Acknowledgements

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