The Value of DDGS in Swine Feeding Programs

Dr. Jerry Shurson
Department of Animal Science
University of Minnesota
3.2 to 3.5 million metric tonnes (MT) 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
  - ~ 2.58 million MT (80%) fed to ruminants
  - ~ 45,000 MT fed in MN turkey industry
  - < 27,000 MT used in swine diets
Distribution of Use of DDGS Produced in North America

- Ruminants
- MN Turkey
- Swine
- Exported EU
Why Hasn’t DDGS Been Used in Swine Diets?

- Variability of nutrient levels
  - type of grain used
  - variability of corn quality
  - amount of solubles added

- Low amino acid digestibility
  - variable heating and drying temperatures
  - excessive heating = dark color

- High crude fiber
  - low and variable DE and ME estimates
Why Hasn’t DDGS Been Used in Swine Diets?

- **Amino Acid Profile**
  - amino acid balance not well suited to the pig
    - low lysine
  - amino acid imbalance is amplified 3 fold in DDGS vs corn

- Limited recent information on use of DDGS in swine diets

- Cost competitiveness relative to commonly used energy and amino acid ingredients
Why is There Renewed Interest in Feeding DDGS to Swine?

- Increasing quantities of DDGS
  - increased ethanol production to meet oxygenated fuel demand
- New ethanol plants
  - improved fermentation technology and processing = higher feeding value?
- Reduced nutrient variability?
  - corn supply from smaller geographic regions
- Higher P availability = reduced P excretion in manure
- Reduced odor emissions?
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%)
MNSD DDGS Available Phosphorus Levels vs. Published Values

% Available P

- MNSD
- NRC

0 10 20 30 40 50 60 70 80
DDGS is Often an Economical Addition to Swine Diets

- Replaces a portion of:
  - Corn
  - Soybean meal
  - Dicalcium phosphate
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
- Excess N minimized by adding synthetic amino acids to diets
- High levels of DDGS may reduce pig performance due to the energy cost of removing excess N
- May increase ammonia emissions?
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
  - Amount of supplemental inorganic P or phytase in the diet is decreased.
    - Decreased 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

![Graph showing the effect of dietary treatment on manure odor detection threshold. The graph displays a line plot with ODU on the y-axis and Week on the x-axis. Two lines are plotted: red for Control and blue for DDGS. The graph indicates an increasing trend in ODU over weeks for both treatments. The legend shows MSE ± 0.1152 and P > 0.10.]
Effect of Dietary Treatment on Ammonia Emission

![Graph showing the effect of dietary treatment on ammonia emission over 9 weeks. The graph compares Control and DDGS treatments, with a curve for each. The graph indicates that there is no significant difference between the treatments (MSE ± .0876, P > .10).]
Effect of Dietary Treatment on Hydrogen Sulfide Emission

![Graph showing the effect of dietary treatment on hydrogen sulfide emission. The graph plots H₂S (ppm) against weeks, with two treatment groups: Control (red) and DDGS (blue). The graph shows a significant increase in H₂S levels for the DDGS group compared to the control group, with the highest emission observed in week 8. The figure includes the MSE ± .0426 and P > .10 values at the bottom right corner.]
Recommended Usage Rates of DDGS in Swine Diets

- Nursery pigs – up to 5%
- Grow-finish pigs – up to 20%
- Gestating sows – up to 50%
- Lactating sows – up to 20%
Summary

- MNSD DDGS:
  - has higher levels and digestibility of most key nutrients
  - has less variability in nutrient levels
  - does not reduce or improve air quality
  - will reduce P excretion
  - is often can be an economical addition to swine diets
Evaluation of the Feeding Value of MNSD DDGS

- Ethanol plants participating in DDGS evaluation:
  - Aberdeen, SD
  - Bingham Lake, MN
  - Luverne, MN
  - Preston, MN
  - Winnebago, MN
  - Benson, MN
  - Claremont, MN
  - Morris, MN
  - Scotland, SD
  - Winthrop, MN
U.S. Approved GMO Crop Species

- Canola
- Chicory
- Cotton
- Papaya
- Radichio
- Soybean
- Sugar beet
- Cantaloupe
- Corn
- Flax
- Potato
- Rice
- Squash
- Tomato
U.S. Production of GMO Grains

- > 30 genetically engineered plants are permitted for sale by law world-wide.
- > 40% of corn produced is genetically modified
- > 50% of soybeans are genetically modified
- 3 agencies regulate GMO crops and foods:
  - Environmental Protection Agency
  - Food and Drug Administration
  - U.S. Department of Agriculture
GMO Grains Produced

- Insect protection – Bt corn
  - Increased quality
  - Less pesticide use
  - Improved yields
  - Increased profits
  - Reduced mycotoxins
  - Increased number of beneficial insects
GMO Grains Produced

- Herbicide protection - glyphosate-tolerant soybeans
  - Increased seed quality (6 to 20%)
  - Less herbicide use (improves weed control by 9%)
  - Improved yields (+5%)
  - More efficient use of fertilizers
  - Increased profits (10 to 20%)
  - Reduced foreign material in grain (-33%)
  - Reduces erosion (-90%)
GMO Grains Produced

- Disease resistance – *Fusarium graminearum*
  - Corn
  - Wheat
GMO Grains Produced

- Enhance protein quality
- Increase protein conc. (decrease amino acid suppl.)
- Modify amino acid composition (lysine and methionine)
- Modify starch and oil composition
- Increase oil content
- Reduce oligosaccharides
- Increase oligofructans (decrease antibiotic use)
- Increase phosphorus bioavailability
Added Value of 6 genetic Modifications of Corn in Swine/ Poultry Diets ($/ kg)

<table>
<thead>
<tr>
<th>Modification</th>
<th>Baby pigs</th>
<th>Finisher hogs</th>
<th>Broilers</th>
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<tbody>
<tr>
<td>High protein</td>
<td>1.16</td>
<td>0.61</td>
<td>2.26</td>
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<tr>
<td>Enlarged germ</td>
<td>0.00</td>
<td>0.41</td>
<td>1.89</td>
</tr>
<tr>
<td>High starch dig.</td>
<td>-----</td>
<td>-----</td>
<td>1.57</td>
</tr>
<tr>
<td>High methionine</td>
<td>-----</td>
<td>-----</td>
<td>0.29</td>
</tr>
<tr>
<td>High lysine</td>
<td>0.00</td>
<td>0.20</td>
<td>-----</td>
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<tr>
<td>High avail. phos.</td>
<td>0.07</td>
<td>0.07</td>
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Pig Performance When Fed Genetically Enhanced Soybean Meal

- Low saturates = low linolenic = high oleic
- Low Kunitz inhibitor > uncooked soybeans
- Lectin free > uncooked soybeans
- Low oligosaccharide > soybean meal
- Low phytate soybeans > soybean meal