Benefits and Limitations of Using DDGS in Swine Diets

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North American DDGS Production

Source: Sean Broderick, Commodity Specialists Company
U.S. DDGS Consumption

**Estimate 2002**
- Dairy: 45%
- Beef: 35%
- Poultry: 5%
- Swine: 5%

**Estimate 2003**
- Dairy: 46%
- Beef: 39%
- Poultry: 4%
- Swine: 11%

**Estimate 2004**
- Dairy: 44%
- Beef: 37%
- Poultry: 16%
- Swine: 3%

**Estimate 2005**
- Dairy: 45%
- Beef: 37%
- Poultry: 13%
- Swine: 5%
Estimated DDGS Usage in U.S. Swine Feeds 2001-2005 (Metric Tonnes)
Current Commercial Dietary DDGS Inclusion Rates and Estimated Usage

- Grower-finisher diets ~85-90%
  - 10-15% dietary inclusion rates

- Sow diets ~5-10%
  - Gestation - up to 30% dietary inclusion
  - Lactation - 5-10% of the diet

- Late nursery diets < 5%
  - Added at 5-10% of the diet
Maximum Inclusion Rates of Golden High Quality U.S DDGS in Swine Diets
(Based Upon University of Minnesota Performance Trials)

- Nursery pigs (> 7 kg)
  - Up to 25%

- Grow-finish pigs
  - Up to 20% (higher levels may reduce pork fat quality)

- Gestating sows
  - Up to 50%

- Lactating sows
  - Up to 30%

Assumptions: no mycotoxins
formulate on a digestible amino acid and available phosphorus basis
# Benefits and Limitations of Feeding DDGS Diets to Swine

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Energy value = corn</td>
<td>- Low protein (lysine) quality&lt;br&gt;  - add other supplements high in lysine and tryptophan</td>
</tr>
<tr>
<td>- High available P&lt;br&gt;  - Reduce diet P supplementation&lt;br&gt;  - May reduce manure P excretion</td>
<td>- Variability in nutrient content and digestibility among sources</td>
</tr>
<tr>
<td>- Partially replaces some corn, soybean meal, and dicalcium phosphate and reduces diet cost</td>
<td>- Manure N excretion increases</td>
</tr>
<tr>
<td>- Commonly fed at 10% of diet&lt;br&gt;  - Higher levels can be used if amino acids are supplemented</td>
<td>- Belly firmness and pork fat quality may be reduced when &gt; 20% in the diet</td>
</tr>
<tr>
<td>- Only “golden” DDGS should be used&lt;br&gt;  - High amino acid digestibility</td>
<td>- Fine particle size causes flowability problems in bins and feeders</td>
</tr>
<tr>
<td>- Appears to reduce gut health problems due to ileitis</td>
<td>- Difficult to pellet and maintain throughput of pellet mills</td>
</tr>
<tr>
<td>- May increase litter size weaned when fed at high levels to sows</td>
<td>- Mycotoxin free grain should be used to produce ethanol and DDGS</td>
</tr>
<tr>
<td>- Increases pig weight gain when fed to sows during lactation</td>
<td>- Short-term feed intake may be reduced when feeding high DDGS diets to sows</td>
</tr>
</tbody>
</table>
DDGS Varies in Nutrient Content and Digestibility, Color, and Particle Size Among U.S. Sources
### Averages, Coefficients of Variation, and Ranges of Selected Nutrients Among 32 U.S. DDGS Sources (100% Dry Matter Basis)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Average</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter, %</td>
<td>89.3</td>
<td>87.3 – 92.4</td>
</tr>
<tr>
<td>Crude protein, %</td>
<td>30.9 (4.7)</td>
<td>28.7 – 32.9</td>
</tr>
<tr>
<td>Crude fat, %</td>
<td>10.7 (16.4)</td>
<td>8.8 – 12.4</td>
</tr>
<tr>
<td>Crude fiber, %</td>
<td>7.2 (18.0)</td>
<td>5.4 – 10.4</td>
</tr>
<tr>
<td>Ash, %</td>
<td>6.0 (26.6)</td>
<td>3.0 – 9.8</td>
</tr>
<tr>
<td>Swine ME, kcal/kg</td>
<td>3810 (3.5)</td>
<td>3504 – 4048</td>
</tr>
<tr>
<td>Lysine, %</td>
<td>0.90 (11.4)</td>
<td>0.61 – 1.06</td>
</tr>
<tr>
<td>Phosphorus, %</td>
<td>0.75 (19.4)</td>
<td>0.42 – 0.99</td>
</tr>
</tbody>
</table>
Standardized Ileal Lysine Digestibility Coefficients Among 10 “Golden” Corn DDGS Sources (Stein et al, 2005)
Fig. 1. Regression of digestible lys (%) and color (L*, b*)

Source: Dr. Sally Noll (2003)
Prediction of Digestible Lysine from Color ($L^*$, $a^*$, and $b^*$) Among DDGS Sources for Swine

$R^2 = 0.12$, $\text{RMSE} = 0.10$, $\text{PC} = 1$

Urriola et al. (2006)
Prediction of Digestible Lysine from Color $L^*$, $a^*$, and $b^*$ (L* < 50 in Corn DDGS)

$R^2 = 0.40$, RMSE = 0.07, PC = 1

Urriola et al. (2006)
Prediction of Digestible Lysine Content of DDGS Using Optical Density

0.77% digestible lysine
0.54% digestible lysine
0.33% digestible lysine
Prediction of Digestible Lysine from Optical Density (400 to 700 nm)

$R^2 = 0.86$, $RMSE = 0.05$, $PC = 14$

Urriola et al. (2006)
Prediction of Digestible Lysine in DDGS Using Front Face Fluorescence

R² = 0.98, RMSE = 0.07, PC = 9

Urriola et al. (2006)
Variation in Particle Size Among DDGS Samples Representing 25 U.S. Ethanol Plants 2005
Variation in Particle Size Among Soybean Meal Samples Representing 6 U.S. Plants 2005
Variation in Bulk Density (Lbs/Cubic Ft.) Among DDGS Samples Representing 25 U.S. Ethanol Plants
1/05
Variation in Bulk Density (Lbs/Cubic Ft.) Among Soybean Meal Samples Representing 6 U.S. Plants 2003
Feeding High Quality DDGS to Weaned Pigs
Materials and Methods – Nursery Experiments

- **Experiment 1**
  - Pigs weaned at 19.0 ± 0.3 d of age
  - Weighed 7.10 ± 0.07 kg

- **Experiment 2**
  - Pigs weaned at 16.9 ± 0.4 d of age
  - Weighed 5.26 ± 0.07 kg

- Pigs were fed a commercial pelleted diet (d 0 to 3 postweaning)

- Phase II (d 4-17) and Phase III (d 18 – 35) diets were formulated on a digestible amino acid basis.
  - Diets contained 0, 5, 10, 15, 20, or 25% DDGS
Effect of DDGS Level on Growth Rate

Means not sharing a common superscript letter are significantly different ($P < .05$)
Effect of DDGS Level on ADFI

Experimental period

ADFI (g/d)

Phase 2

Phase 3

Range: 0% DDGS to 25% DDGS

Phase (P < .01)

SE = 46.9

SE = 82.6
Effect of DDGS Level on Gain/Feed

Experimental period

Phase 2

Phase 3

SE = 0.11

SE = 0.06

0% DDGS
5% DDGS
10% DDGS
15% DDGS
20% DDGS
25% DDGS

G/F

0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

0% DDGS
5% DDGS
10% DDGS
15% DDGS
20% DDGS
25% DDGS
Effect of DDGS Level on Growth Rate (Experiment 2)

- **Phase 2**
  - Linear effect of diet ($P = .09$)
  - Experimental period
  - ADG (g/d)
  - SE = 55.1

- **Phase 3**
  - Linear effect of diet ($P < .01$)
  - Experimental period
  - ADG (g/d)
  - SE = 51.1
Effect of DDGS Level on Feed Intake (Experiment 2)

Means not sharing a common superscript letter are significantly different ($P < .05$)

Linear effect of diet ($P = .05$)

Phase ($P < .01$)
Phase x Diet ($P = .02$)

Experimental period

$SE = 41.6$ $SE = 60.9$
Effect of DDGS Level on Gain/Feed (Experiment 2)

![Bar chart showing the effect of DDGS level on gain/feed for different phases.](chart)

- Phase 2: SE = 0.13
- Phase 3: SE = 0.03

- **0% DDGS**
- **5% DDGS**
- **10% DDGS**
- **15% DDGS**
- **20% DDGS**
- **25% DDGS**

Phase (P = .06)
Effect of DDGS Level on Final BW (Experiment 2)

Body weight, kg

Dietary treatment

SE = 1.3
Effects of Feeding DDGS to Grow-Finish Pigs on Growth Performance, Carcass, and Pork Quality
Materials and Methods

- 240 crossbred pigs (~ 63 lbs initial BW)
  - Grow-finish facilities at WCROC – Morris, MN
  - Blocked by weight, gender and litter
  - Blocks randomly assigned to 1 of 4 diet sequences
    - 5-phase feeding program
  - 0, 10, 20, or 30% DDGS diets formulated on total lysine basis
  - Diets contained up to 4% soybean oil as a supplemental fat source
  - 24 pens, 10 pigs/pen, 6 replications/trt
Effect of Dietary DDGS Level on Overall ADG of Grow-Finish Pigs

0 % and 10 % DDGS > 20% and 30% DDGS (P < .10)
Effect of Dietary DDGS Level on Overall ADFI of Grow-Finish Pigs

No significant differences among dietary treatments
Effect of Dietary DDGS Level on Overall G/F of Grow-Finish Pigs

0 %, 10 % and 20% DDGS > 30% DDGS (P < .10)
Effect of Dietary DDGS Level on % Carcass Lean

No significant differences among dietary treatments
## Effect of Dietary DDGS Level on Carcass Characteristics of Grow-Finish Pigs

<table>
<thead>
<tr>
<th></th>
<th>0% DDGS</th>
<th>10% DDGS</th>
<th>20% DDGS</th>
<th>30% DDGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slaughter weight, lbs</td>
<td>258</td>
<td>263</td>
<td>249</td>
<td>247</td>
</tr>
<tr>
<td>Carcass weight, lbs</td>
<td>189&lt;sup&gt;c&lt;/sup&gt;</td>
<td>191&lt;sup&gt;c&lt;/sup&gt;</td>
<td>180&lt;sup&gt;d&lt;/sup&gt;</td>
<td>178&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Dressing %</td>
<td>73.4&lt;sup&gt;c&lt;/sup&gt;</td>
<td>72.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>72.1&lt;sup&gt;d&lt;/sup&gt;</td>
<td>71.9&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Fat depth, in.</td>
<td>0.85</td>
<td>0.87</td>
<td>0.84</td>
<td>0.82</td>
</tr>
<tr>
<td>Loin depth, in.</td>
<td>2.26&lt;sup&gt;ac&lt;/sup&gt;</td>
<td>2.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.19&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.06&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>% Lean</td>
<td>52.6</td>
<td>52.0</td>
<td>52.6</td>
<td>52.5</td>
</tr>
</tbody>
</table>

<sup>a, b</sup> Means within row with unlike superscripts differ (P < .05).
<sup>c, d</sup> Means within row with unlike superscripts differ (P < .10).
Muscle Quality Characteristics from Grow-Finish Pigs Fed Diets Containing 0, 10, 20, and 30% DDGS

<table>
<thead>
<tr>
<th>Trait</th>
<th>0 %</th>
<th>10 %</th>
<th>20 %</th>
<th>30 %</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L^*$</td>
<td>54.3</td>
<td>55.1</td>
<td>55.8</td>
<td>55.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Color score</td>
<td>3.2</td>
<td>3.2</td>
<td>3.1</td>
<td>3.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Firmness score</td>
<td>2.2</td>
<td>2.0</td>
<td>2.1</td>
<td>2.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Marbling score</td>
<td>1.9</td>
<td>1.9</td>
<td>1.7</td>
<td>1.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Ultimate pH</td>
<td>5.6</td>
<td>5.6</td>
<td>5.6</td>
<td>5.6</td>
<td>0.2</td>
</tr>
<tr>
<td>11-d purge loss, %</td>
<td>2.1f</td>
<td>2.4fg</td>
<td>2.8g</td>
<td>2.5fg</td>
<td>1.2</td>
</tr>
<tr>
<td>24-h drip loss</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Cooking loss, %</td>
<td>18.7</td>
<td>18.5</td>
<td>18.3</td>
<td>18.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Total moisture loss, %</td>
<td>21.4</td>
<td>21.5</td>
<td>21.8</td>
<td>22.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Warner-Bratzler sheer force, kg</td>
<td>3.4</td>
<td>3.4</td>
<td>3.3</td>
<td>3.3</td>
<td>0.5</td>
</tr>
</tbody>
</table>

- $0 = \text{black}, 100 = \text{white}$
- $1 = \text{pale pinkish gray/white}; 2 = \text{grayish pink}; 3 = \text{reddish pink}; 4 = \text{dark reddish pink}; 5 = \text{purplish red}; 6 = \text{dark purplish red}$
- $1 = \text{soft}, 2 = \text{firm}, 3 = \text{very firm}$
- Visual scale approximates % intramuscular fat content (NPPC, 1999)
- Total moisture loss = 11-d purge loss + 24-h drip loss + cooking loss
## Fat Quality Characteristics of Market Pigs Fed Corn-Soy Diets Containing 0, 10, 20, and 30% DDGS

<table>
<thead>
<tr>
<th></th>
<th>0 %</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belly thickness, cm</td>
<td>3.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.00&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>2.84&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>2.71&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Belly firmness score, degrees</td>
<td>27.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>24.4&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>25.1&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>21.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Adjusted belly firmness score, degrees</td>
<td>25.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>23.8&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>25.4&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>22.4&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Iodine number</td>
<td>66.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>70.6&lt;sup&gt;c&lt;/sup&gt;</td>
<td>72.0&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Means within a row lacking common superscripts differ (P < .05).
U of M/Land O’ Lakes
Pork Fat Quality Field Study (2006)

- Facilities
  - Two commercial 1000 head finishing barns in southern MN
  - Separate sites, two independent producers
  - Each barn had 40 pens, double sided curtain
    - buildings with 8' pits
    - pit fans for ventilation
    - weighted baffle ceiling air inlets

- Genetics
  - Monsanto Genepacker sows
  - Monsanto EB terminal semen
Nutrition

- Provided by Land O’ Lakes
- Producer A fed typical corn-soybean meal diets
- Producer B fed corn-soybean meal diets containing 10% DDGS
- 7-phase mixed sex feeding program
- Last finisher diet contained 4.5g Paylean
- Diets contained similar nutrient levels with and without 10% DDGS
- All diets contained choice white grease as the supplemental fat source (1.25 to 3.75%).
Carcass Characteristics of Grow-Finish Pigs Fed 0 or 10% DDGS Diets (UM/LOL Field Trial)

<table>
<thead>
<tr>
<th>Measurement</th>
<th>0% DDGS Diets</th>
<th>10% DDGS Diets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass weight, lbs</td>
<td>212</td>
<td>210</td>
</tr>
<tr>
<td>Last rib backfat, in.</td>
<td>1.09</td>
<td>1.11</td>
</tr>
<tr>
<td>Tenth rib backfat, in.</td>
<td>1.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Ham, %</td>
<td>11.74</td>
<td>11.74</td>
</tr>
<tr>
<td>Loin, %</td>
<td>7.93</td>
<td>7.91</td>
</tr>
<tr>
<td>Belly, %</td>
<td>10.51</td>
<td>10.41</td>
</tr>
<tr>
<td>Loin depth, in.</td>
<td>2.72</td>
<td>2.72</td>
</tr>
<tr>
<td>Lean %</td>
<td>56.36</td>
<td>56.47</td>
</tr>
</tbody>
</table>

No significant differences in carcass characteristics.
Mid-Belly Fat Quality Characteristics of Carcasses of Grow-Finish Pigs Fed 0 or 10% DDGS Diets (UM/LOL Field Trial)

<table>
<thead>
<tr>
<th>Measurement</th>
<th>0% DDGS Diets</th>
<th>10% DDGS Diets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese fat color score (1-4)</td>
<td>1.76</td>
<td>1.81</td>
</tr>
<tr>
<td>Mean melting point, °C</td>
<td>29.26</td>
<td>28.70</td>
</tr>
<tr>
<td>Iodine value</td>
<td>66.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>14:0, 16:0, 16:1, 17:0, 17:1, 18:0, %</td>
<td>No differences</td>
<td>No differences</td>
</tr>
<tr>
<td>18:1 oleic acid, %</td>
<td>47.39&lt;sup&gt;c&lt;/sup&gt;</td>
<td>45.12&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>18:2 linoleic acid, %</td>
<td>11.94&lt;sup&gt;c&lt;/sup&gt;</td>
<td>13.98&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>18:3, 18:4, 20:0, 20:1, 20:2, 20:4, %</td>
<td>No differences</td>
<td>No differences</td>
</tr>
<tr>
<td>Saturated fatty acids, %</td>
<td>33.99</td>
<td>34.26</td>
</tr>
<tr>
<td>Monounsaturated fatty acids, %</td>
<td>51.78&lt;sup&gt;e&lt;/sup&gt;</td>
<td>49.47&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>PUFA, %</td>
<td>14.02&lt;sup&gt;e&lt;/sup&gt;</td>
<td>16.11&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total Omega 3, %</td>
<td>0.98</td>
<td>0.96</td>
</tr>
<tr>
<td>Total Omega 6, %</td>
<td>13.02&lt;sup&gt;c&lt;/sup&gt;</td>
<td>15.14&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Omega 6:Omega 3 ratio</td>
<td>13.28&lt;sup&gt;c&lt;/sup&gt;</td>
<td>15.78&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a, b</sup> Means within rows with unlike superscripts differ (P < .05).

<sup>c, d</sup> Means within rows with unlike superscripts differ (P < .0001).
Effect of Formulating G-F Diets on a Digestible Amino Acid Basis, with Increasing Levels of DDGS, on Overall Growth Performance

<table>
<thead>
<tr>
<th></th>
<th>0% DDGS</th>
<th>10% DDGS</th>
<th>20% DDGS</th>
<th>30% DDGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial wt., lbs</td>
<td>49.7</td>
<td>50.3</td>
<td>49.7</td>
<td>49.7</td>
</tr>
<tr>
<td>Final wt., lbs</td>
<td>252</td>
<td>253</td>
<td>251</td>
<td>250</td>
</tr>
<tr>
<td>ADG, lbs</td>
<td>2.00</td>
<td>2.00</td>
<td>1.99</td>
<td>1.99</td>
</tr>
<tr>
<td>ADFI, lbs</td>
<td>5.76</td>
<td>5.58</td>
<td>5.55</td>
<td>5.45</td>
</tr>
<tr>
<td>F/G</td>
<td>2.88</td>
<td>2.80</td>
<td>2.79</td>
<td>2.75</td>
</tr>
</tbody>
</table>

Xu et al. (2006) unpublished
Data from 32 pens, 8 pens/treatment
Effects of Dietary DDGS Level on Last Rib Backfat

Xu et al. (2006) unpublished
30% DDGS tended to be lower than 0% DDGS (P = 0.09)
Effects of Dietary DDGS Level on % Carcass Lean

Xu et al. (2006) unpublished
30% DDGS tended to be higher than 0% DDGS (P = 0.11)
Adding DDGS to Grower-Finisher Diets Slightly Reduces Carcass Yield

Effect of Dietary DDGS Level on Dressing Percentage

Xu et al. (2006) unpublished
Linear effect (P < 0.01)
Adding Increasing Levels of DDGS to G-F Diets Reduces Belly Firmness

Effects of Dietary DDGS Level on Belly Firmness

Xu et al. (2006) unpublished
Unique, Value-Added Attributes of DDGS Have Been Identified

- DDGS may improve gut health related to *Lawsonia intracellularis*

- Phytase and DDGS can reduce manure P excretion

- Feeding high levels of DDGS to sows may improve litter size weaned
Effect of Dietary Treatment on Lesion Length (21 d Post-Challenge) Experiment 2

* Effect of disease challenge ($P < .01$).
Effect of Dietary Treatment on Lesion Severity (21 d Post-Challenge) Experiment 2

* Effect of disease challenge ($P < .01$).
Effect of Dietary Treatment on Lesion Prevalence (21 d Post-Challenge) Experiment 2

* Effect of disease challenge ($P < .01$).
Effects of Feeding DDGS to Swine on Dry Matter Digestibility (Manure Volume)
## Diet Composition When 18.8% DDGS and Phytase are Added to a Swine Grower Diet

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Corn-SBM-1.5 kg Lysine</th>
<th>18.8% DDGS + Phytase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, kg</td>
<td>798.3</td>
<td>636.3</td>
</tr>
<tr>
<td>Soybean meal 44%, kg</td>
<td>176.9</td>
<td>159.4</td>
</tr>
<tr>
<td>DDGS, kg</td>
<td>0.0</td>
<td>188</td>
</tr>
<tr>
<td>Dicalcium phosphate, kg</td>
<td>11.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Limestone, kg</td>
<td>7.2</td>
<td>9.8</td>
</tr>
<tr>
<td>Salt, kg</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>L-lysine HCl, kg</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>VTM premix, kg</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Phytase, 500 FTU/kg</td>
<td>0.0</td>
<td>0.5</td>
</tr>
<tr>
<td>TOTAL, kg</td>
<td>1000.0</td>
<td>1000.0</td>
</tr>
</tbody>
</table>
Effects of Adding Phytase and/or 20% DDGS to Corn-SBM Diets on DM Digestibility in G-F Pigs

Xu et al. (2006)
Effect of Adding Phytase and/or 20% DDGS to Corn-SBM Diets on DM Digestibility in Nursery Pigs

DDGS reduced DM digestibility 3.3% (P = .01)
Effect of Feeding Corn-SBM Diets With or Without 20% DDGS or Phytase to Nursery Pigs on Fecal Phosphorus Concentration (%)

Fecal Phosphorus Concentration, %

Corn-SBM
C-SBM + Phytase
20% DDGS
20% DDGS + Phytase

a, b Means with different superscripts are significantly different (P < .05).
Effect of Feeding Corn-SBM Diets With or Without 20% DDGS or Phytase to Nursery Pigs on Daily Fecal Phosphorus Excretion (g/d)

- **Corn-SBM**
- **C-SBM + Phytase**
- **20% DDGS**
- **20% DDGS + Phytase**

a, b, c Means with different superscripts are significantly different (P < .05).

x, y Means with different superscripts are significantly different (P < .15).
Feeding High Quality DDGS to Sows
Effect of Feeding 0 and 50% DDGS Gestation Diets and 0 and 20% DDGS Lactation Diets on Sow Lactation ADFI

Dietary Treatment

a,b,x,y Different superscripts indicate significant difference (P < .10).
Effect of Feeding 0 or 50% DDGS Gestation Diets and 0 or 20% DDGS Lactation Diets on Pigs Weaned/Litter

Dietary treatment

a,b,x,y Different superscripts indicate significant difference (P < .10).

Number of Pigs

0.0 2.0 4.0 6.0 8.0 10.0 12.0

Cycle 1
Cycle 2
Effects of Feeding Increasing Levels of DDGS to Lactating Sows on Average Daily Feed Intake and Average Pig Weight at Weaning

Utilized 323 lactating sows (65 sows/dietary treatment)
Song et al. (2006), unpublished
We have developed a DDGS web site featuring:

* nutrient profiles and photos of DDGS samples
* research summaries
  - swine, poultry, dairy, & beef
  - DDGS quality
* presentations given
* links to other DDGS related web sites
* international audiences