Use of "New Generation" Corn DDGS in Feeds for Swine, Poultry, and Aquaculture

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Overview – Part 2

- Recommended maximum inclusion rates of "new generation" DDGS in swine diets
- Nursery feeding trial results
- Highlights of grow-finish feeding trial
- Highlights of gestation-lactation feeding trial
- Effects of DDGS and phytase on reducing dietary inorganic P supplementation and manure P levels
- Effects of feeding diets containing DDGS on manure gas and odor emissions
- U of M DDGS web site
- New corn distiller's feed ingredients

Why is there so much interest in feeding DDGS to swine?

- "New Generation" DDGS is high in digestible nutrients
- Economical partial replacement for:
  - corn
  - soybean meal
  - dicalcium phosphate
- Increasing production and supply
- Unique properties
  - reduce P excretion in manure
  - increase litter size weaned/sow
  - gut health benefits?

Maximum Inclusion Rates of "New Generation" 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 20%

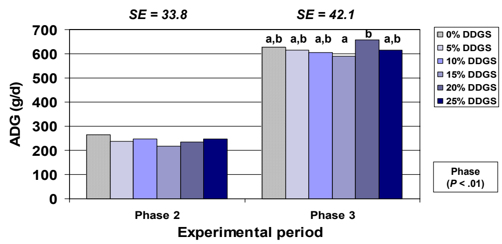
Assumptions: no mycotoxins
formulate on a digestible amino acid and available phosphorus basis

Feeding "New Generation" DDGS to Weaned Pigs

Materials and Methods – Nursery Experiments

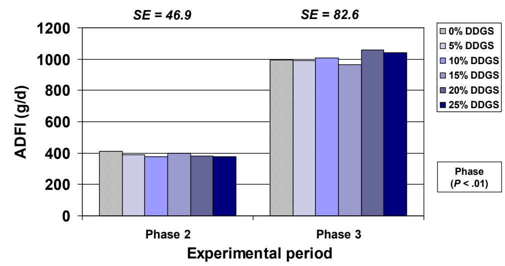
- Experiment 1
  - Pigs weaned at 19.0 ± 0.3 d of age
  - Weighed 7.10 ± 0.07 kg
- Experiment 2
  - Pigs weaned at 16.9 ± 0.4 d of age
  - Weighed 5.26 ± 0.07 kg
- Pigs were fed a commercial pelleted diet (d 0 to 3 postweaning)
- Phase II (d 4-17) and Phase III (d 18 – 35) diets were **formulated on a digestible amino acid basis.**
  - Diets contained 0, 5, 10, 15, 20, or 25% DDGS

Effect of DDGS Level on Growth Rate (Experiment 1)

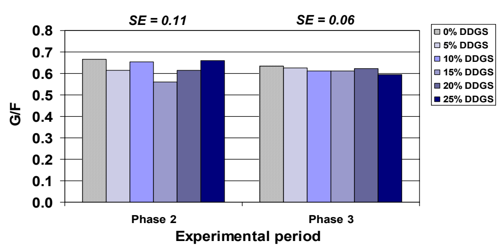


Means not sharing a common superscript letter are significantly different ($P < .05$)

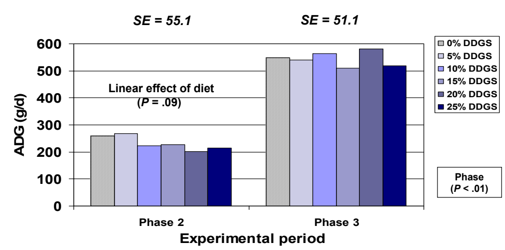
Effect of DDGS Level on ADFI (Experiment 1)



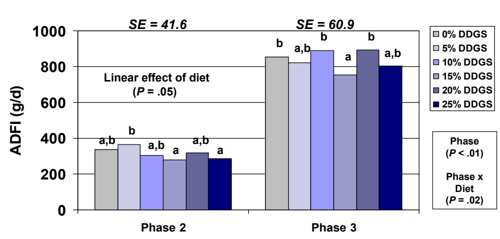
Effect of DDGS Level on Gain/Feed (Experiment 1)



Effect of DDGS Level on Growth Rate (Experiment 2)



Effect of DDGS Level on Feed Intake (Experiment 2)



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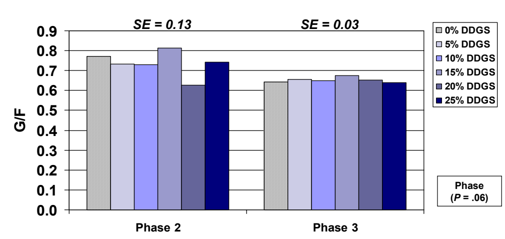
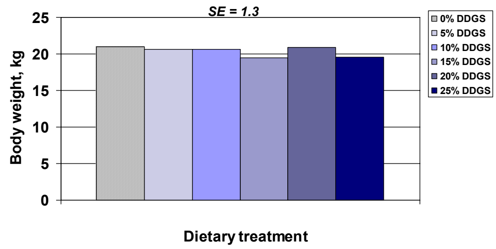
Effect of DDGS Level on Gain/Feed (Experiment 2)



Effect of DDGS Level on Final BW (Experiment 2)



Feeding "New Generation" DDGS to Grow-Finish Pigs

Materials and Methods

- 240 crossbred pigs (approx. 28.3 kg 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**
  - 24 pens, 10 pigs/pen, 6 replications/trt

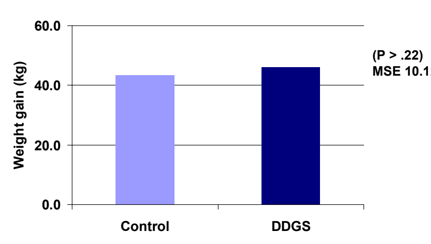
Fat Quality Characteristics of Market Pigs Fed Corn-Soy Diets Containing 0 to 30% DDGS

	0 %	10%	20%	30%
Belly thickness, cm	3.15[a]	3.00[a,b]	2.84[a,b]	2.71[b]
Belly firmness score, degrees	27.3[a]	24.4[a,b]	25.1[a,b]	21.3[b]
Adjusted belly firmness score, degrees	25.9[a]	23.8[a,b]	25.4[a,b]	22.4[b]
Iodine number	66.8[a]	68.6[b]	70.6[c]	72.0[c]

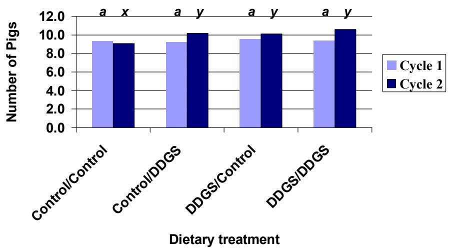
Means within a row lacking common superscripts differ (P < .05).

Feeding "New Generation DDGS to Sows"

Effect of Feeding a 50% DDGS Diet on Sow Weight Gain During Gestation (Reproductive Cycle 1)

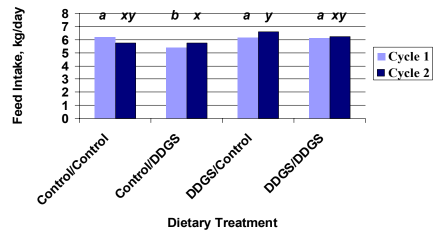


Effect of Feeding 0 or 50% DDGS Gestation Diets and 0 or 20% DDGS Lactation Diets on Pigs Weaned/Litter



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

Effect of Dietary Treatment Combination on Sow Lactation ADFI



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

Does Feeding DDGS Improve Gut Health?

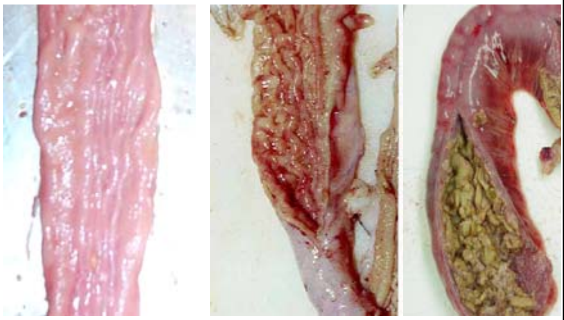
What is Ileitis?

- Porcine Proliferative Enteropathy
- Caused by *Lawsonia intracellularis*
  - Present in 96% of U.S. swine herds (Bane et al., 1997)
    - 28% of pigs affected (NAHMS, 2000)
  - Can be shed in infected pigs for up to 10 weeks
- Animals are infected by oral contact with feces from animals shedding the bacteria
- 7-10 days after infection:
  - Lesions of the intestinal wall begin to form
  - Lesions maximized around 21 days post-infection

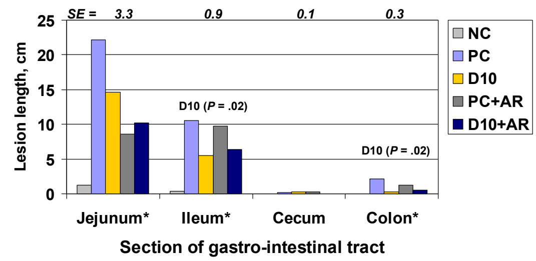
Clinical Forms of Ileitis

- Porcine Intestinal Adenomatosis (PIA)
  - Chronic form
  - Seen in growing pigs (6 - 20 weeks of age)
  - Decreased feed intake, lethargic
- Porcine Hemorrhagic Enteropathy (PHE)
  - Acute form, affects heavier pigs
    - Greatest frequency appears to be from 65 – 110 kg pigs
  - Massive intestinal hemorrhaging, bloody diarrhea, increase in mortality

Healthy / Ileitis

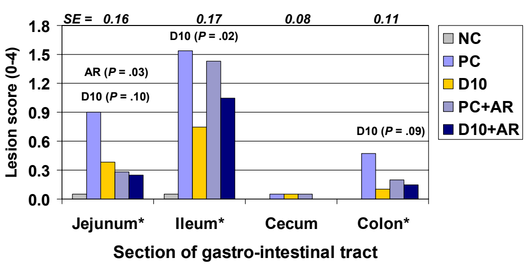


Effect of Dietary Treatment on Lesion Length (21 d Post-Challenge) Experiment 2



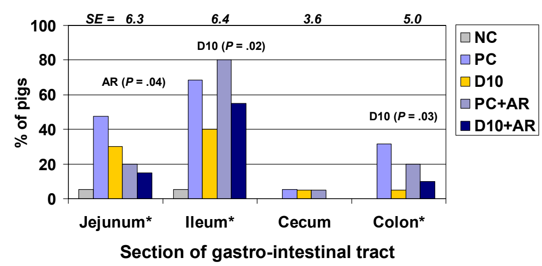
* Effect of disease challenge (P < .01).

Effect of Dietary Treatment on Lesion Severity (21 d Post-Challenge) Experiment 2



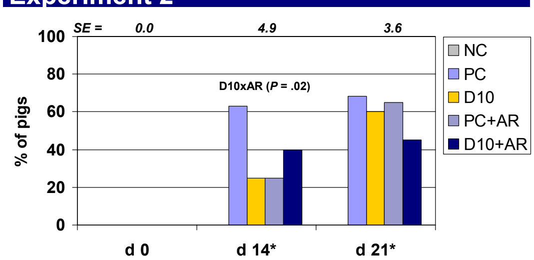
* Effect of disease challenge (P < .01).

Effect of Dietary Treatment on Lesion Prevalence (21 d Post-Challenge) Experiment 2



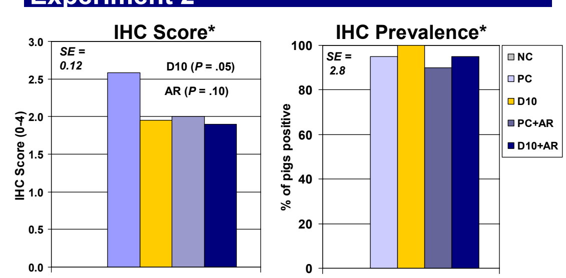
* Effect of disease challenge (P < .01).

Effect of Dietary Treatment on Fecal Shedding (PCR Analysis) Experiment 2



* Effect of disease challenge (P < .01).

Effect of Treatment on *L. intracellularis* Infection (IHC Analysis) Experiment 2



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Summary of Results, Experiment 2

- Inoculation level was close to goal
- DDGS inclusion (10%) or antimicrobial regimen had a positive effect on the pig's ability to resist an ileitis challenge
- No beneficial additive effects of combining DDGS and BMD®/Aureomycin® regimen

DDGS and Phytase are a Key Part of Manure Phosphorus Management

- Adding 20% DDGS to a corn-soy diet and formulating on an available P basis
  - can reduce manure P by > 12%
- Adding phytase to a corn-soy diet
  - increases P bioavailability from 15% to > 45%
- Lowering dietary P, adding 20% DDGS & phytase
  - can reduce manure P excretion by 40 to 50%

Diet Composition When 18.8% DDGS and Phytase are Added to the Diet

Ingredient	Corn-SBM-1.5 kg Lysine	18.8% DDGS + Phytase
Corn, kg	798.3	636.3
Soybean meal 44%, kg	176.9	159.4
DDGS, kg	0.0	188
Dicalcium phosphate, kg	11.6	0.0
Limestone, kg	7.2	9.8
Salt, kg	3.0	3.0
L-lysine HCl, kg	1.5	1.5
VTM premix, kg	1.5	1.5
Phytase, 500 FTU/kg	0.0	0.5
TOTAL, kg	1000.0	1000.0

U of M DDGS Web Site www.ddgs.umn.edu

We have developed a DDGS web site featuring:

* research summaries
  - swine, poultry, dairy, & beef
  - DDGS quality
* presentations given
* links to other DDGS related web sites
* international audiences


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Economics of Ethanol Production

The Value and Use of Distillers Dried Grains with Solubles (DDGS) in Livestock and Poultry Feeds

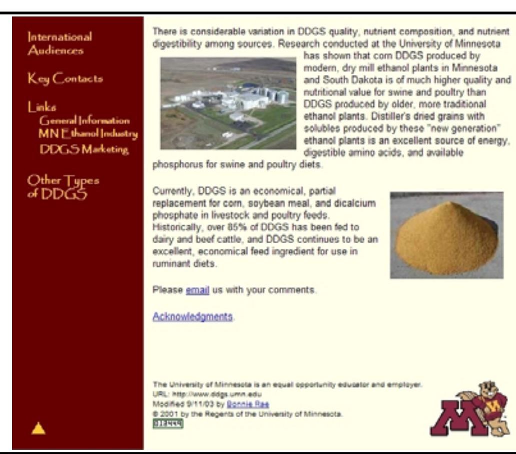
Welcome to the University of Minnesota DDGS Web site!

This site was developed to provide its users a "one stop" place to find all of the most current information related to using DDGS in dairy, beef, swine and poultry feeds.

The ethanol industry is one of the most rapidly growing agricultural industries in the U.S. Currently, dry mill ethanol plants produce over 3.8 million metric tonnes of DDGS annually. Industry experts predict that the volume of DDGS produced will increase to over 5.5 million metric tonnes by the year 2005. Because of the large supply of DDGS available to the feed and livestock industry, researchers at several Land Grant Universities have been conducting experiments to evaluate the nutritional value of DDGS in order to develop feeding recommendations for dairy, beef, swine, and poultry. In addition to DDGS research conducted by scientists in the Department of Animal Science at the University of Minnesota, we are pleased to provide you with research and technical publications from researchers at:

University of Georgia
Kansas State University
University of Nebraska-Lincoln
South Dakota State University

The majority of DDGS produced by ethanol plants in the US today is derived form corn. However, there is also a small but increasing amount of DDGS that is produced from sorghum (milo). The majority of information included on this Web site involves the evaluation of corn DDGS in livestock and poultry feeds. However, we have also included a section for research and technical information specific to sorghum DDGS (see Other Types of DDGS).


International Audiences

Key Contacts

Links
General Information
MN Ethanol Industry
DDGS Marketing

Other Types of DDGS

There is considerable variation in DDGS quality, nutrient composition, and nutrient digestibility among sources. Research conducted at the University of Minnesota has shown that corn DDGS produced by modern, dry mill ethanol plants in Minnesota and South Dakota is of much higher quality and nutritional value for swine and poultry than DDGS produced by older, more traditional ethanol plants. Distiller's dried grains with solubles produced by these "new generation" ethanol plants is an excellent source of energy, digestible amino acids, and available phosphorus for swine and poultry diets.

Currently, DDGS is an economical, partial replacement for corn, soybean meal, and dicalcium phosphate in livestock and poultry feeds. Historically, over 85% of DDGS has been fed to dairy and beef cattle, and DDGS continues to be an excellent, economical feed ingredient for use in ruminant diets.

Please email us with your comments.

Acknowledgments.

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URL: http://www.ddgs.umn.edu
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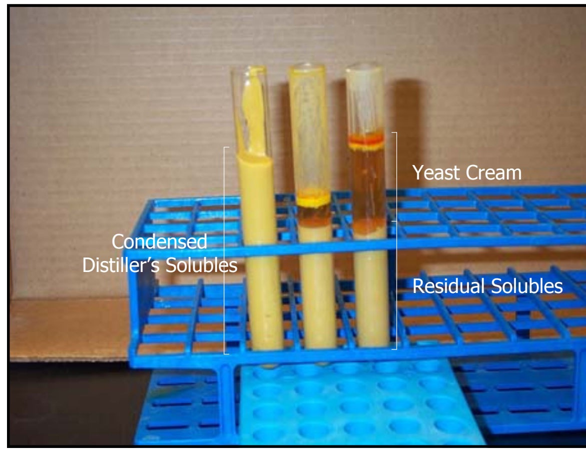
Research on the Use of Spray Dried Distiller's Solubles Fractions in Baby Pig Feeds



Materials and Methods

- Utilized 560 pigs weaned at 18 days of age
  - 10 pigs per pen
  - 8 replications/treatment
  - 7 dietary treatments
- One pig from each pen (total of 56 pigs) was slaughtered at day 10 to determine effects of diet on intestinal morphology

Materials and Methods

- 7 dietary treatments fed from day 0 to 10 post-weaning
  - **NC = negative control**
  - **DS = spray dried distiller's solubles**
    - **15% of the diet**
  - **YC = spray dried yeast cream**
    - **7.5% of the diet**
    - **replaced animal fat**
  - **RS = spray dried residual solubles**
    - **15% of the diet**
  - **AB = carbadox**
    - **50 g/ton**
  - **PP = spray dried porcine plasma**
    - **6% of the diet**
  - **PC = spray dried porcine plasma + carbadox**
    - **6% PP + 50 g/ton AB**

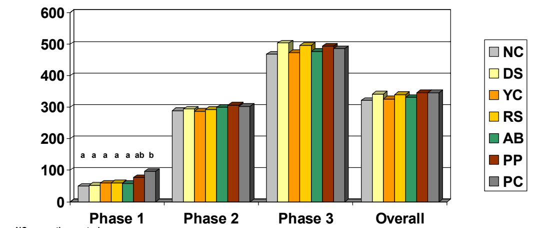
Materials and Methods

- All experimental diets contained:
  - Corn (13 to 36%)
  - Soybean meal 46%
    - 7.5% in PP and PC diets
    - 22.5% in all other diets
  - Lactose (20%)
  - Oat groats (12.5%)
  - Fish meal (11%)
  - Minerals and vitamins to meet or exceed requirements

Materials and Methods

- All experimental diets contained:
  - 3440 Kcal/kg ME
  - 6.2 to 7.48% crude fat
  - 1.6% lysine
  - 0.91% methionine + cystine
  - 1.03% threonine
  - 0.29% tryptophan
  - 0.87% calcium
  - 0.80% phosphorus
- Common phase 2 (days 10 to 21) and phase 3 (days 21 to 42) diets were fed for the remainder of the 6 week-trial

Average Daily Gain



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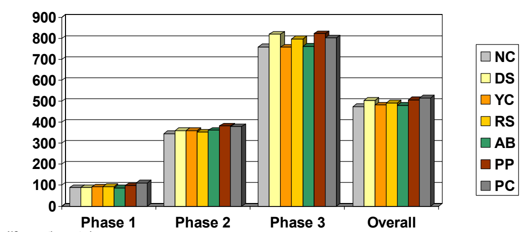
a, b = Least squares means with different superscripts are different (P < .05)

Average Daily Feed Intake



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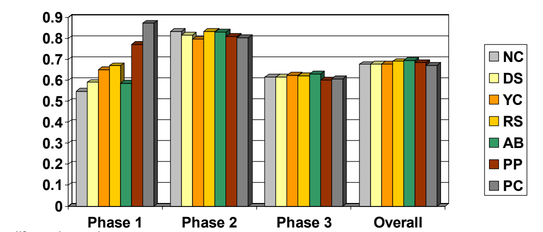
Gain:Feed



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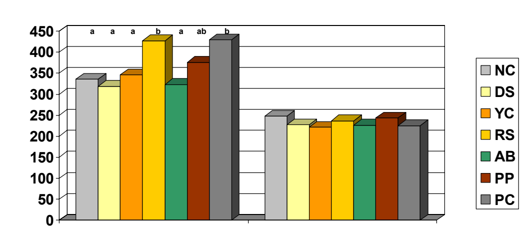
Villi Height and Crypt Depth in the Upper 25% of the Small Intestine



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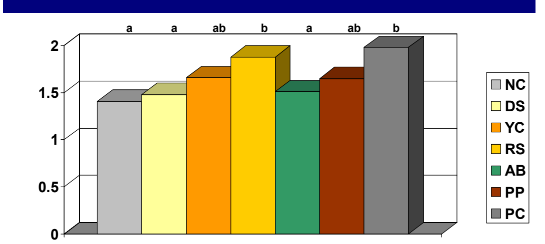
Villi Height:Crypt Depth Ratio in the Upper 25% of the Small Intestine



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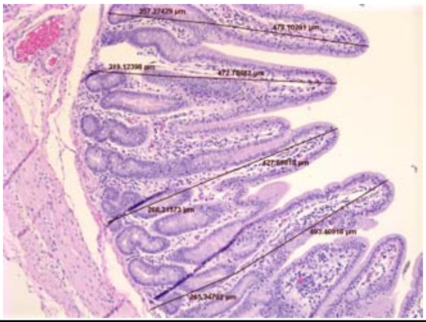
Villi Measurements from the Upper 25% of the Small Intestine from a Pig Fed the Residual Solubles Diet (10X)



Villi Measurements from the Upper 25% of the Small Intestine from a Pig Fed the Carbadox Diet (10X)