

# **The Value of Distiller's Dried Grains with Solubles in Swine Feeding Programs**

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# **“New Generation” DDGS is Nutritionally Different Compared to Other Grain Co-products**

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# Comparison of Nutrient Composition of “New Generation”, Corn Gluten feed, Corn Gluten Meal, Corn Germ Meal, and Brewer’s Dried Grains (nutrient values on 100% dry matter basis)

	“New” DDGS (UM)	Corn Gluten Feed (NRC)	Corn Gluten Meal (NRC)	Corn Germ Meal (Feedstuffs)	Brewer’s Dried Grains (NRC)
Protein, %	30.6	23.9	66.9	22.2	28.8
Fat, %	<b>10.7</b>	3.3	3.2	1.1	7.9
NDF, %	43.6	37.0	9.7	No data	52.9
DE, kcal/kg	<b>4011</b>	3322	4694	No data	2283
ME, kcal/kg	<b>3827</b>	2894	4256	3222	2130
Lys, %	0.83	0.70	1.13	1.00	1.17
Met, %	0.55	0.39	1.59	0.67	0.49
Thr, %	1.13	0.82	2.31	1.22	1.03
Trp, %	0.24	0.08	0.34	0.22	0.28
Ca, %	0.06	0.24	0.06	0.33	0.35
Available P, %	<b>0.80</b>	0.54	0.08	0.17	0.21

# Frequently Asked Questions about Feeding DDGS to Pigs

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- “How much will I save in feed costs if I use DDGS”?
- “Are there any other benefits of using DDGS”?

# How Much Will I Save in Feed Cost by Using “New Generation” DDGS?

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- It depends on:
  - Nutrient values of your DDGS source
    - Energy - most expensive nutrient
    - Total and digestible amino acids – 2<sup>nd</sup> most expensive
    - Total and available phosphorus – 3<sup>rd</sup> most expensive
  - DDGS price relative to prices of:
    - Corn
    - Soybean meal
    - Dicalcium phosphate
  - Level of DDGS used in the diet
  - Diet formulation method

# Comparison of Energy Values for DDGS (88% Dry Matter Basis)

	"New" DDGS Calculated	"New" DDGS Trial avg.	"Old" DDGS Calculated	DDGS NRC (1998)
DE, kcal/lb	1582 Range 1550-1604	1600 Range 1349-1853	1546	1564
ME, kcal/lb	1434 Range 1400-1458	1527 Range 1279-1776	1405	1212

Corn: DE (kcal/lb) = 1580, ME (kcal/lb) = 1534 (NRC, 1998)

# Economics is Partly Dependent on DDGS Energy Value

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- “New generation” DDGS
  - 1,527 kcal ME/lb
    - some nutritionists use a slightly more conservative value (1,500 kcal ME/lb)
    - 97% ME value of corn (1,550 kcal ME/lb)
- “Old generation” DDGS
  - 1,405 kcal ME/lb (92% of ME in “new generation” DDGS)
- NRC (1998)
  - 1,210 kcal/lb (79% of ME in “new generation” DDGS)

# How Does DDGS Energy Value Affect Economic Value?

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- Energy is the most expensive nutrient in the diet.
- Use of “new generation” DDGS
  - requires no additional supplemental fat to maintain desired dietary energy levels
- Lower energy DDGS
  - requires additional supplemental fat to be added to the diet to:
    - maintain dietary energy levels
    - avoid reductions in growth and feed conversion

# Economic Importance of DDGS

## Energy Values (Swine Update, Fall 2002, KSU)

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- Adding 15% “new generation” DDGS to the diet:
  - > \$1/pig increase in margin over feed costs vs. feeding typical corn-soybean meal diets
- Adding 15% “old generation” DDGS with no dietary energy adjustments:
  - - \$0.04/pig margin over feed cost vs. feeding typical corn-soybean meal diets

# Comparison of Amino Acid Composition of DDGS

(88% dry matter basis)

	<b>"New" DDGS</b>	<b>"Old" DDGS</b>	<b>DDGS (NRC, 1998)</b>
Lysine, %	0.75 (17.3)	0.47 (26.5)	0.59
Methionine, %	0.63 (13.6)	0.44 (4.5)	0.48
Threonine, %	0.99 (6.4)	0.86 (7.3)	0.89
Tryptophan, %	0.22 (6.7)	0.17 (19.8)	0.24
Valine, %	1.32 (7.2)	1.22 (2.3)	1.23
Arginine, %	1.06 (9.1)	0.81 (18.7)	1.07
Histidine, %	0.67 (7.8)	0.54 (15.2)	0.65
Leucine, %	3.12 (6.4)	2.61 (12.4)	2.43
Isoleucine, %	0.99 (8.7)	0.88 (9.1)	0.98
Phenylalanine, %	1.29 (6.6)	1.12 (8.1)	1.27

Values in ( ) are CV's among plants

# Comparison of Apparent Ileal Digestible Amino Acid Composition of DDGS (88% dry matter basis)

	<b>"New" DDGS</b>	<b>"Old" DDGS</b>	<b>DDGS (NRC, 1998)</b>
Lysine, %	0.39	0.00	0.27
Methionine, %	0.28	0.21	0.34
Threonine, %	0.55	0.32	0.49
Tryptophan, %	0.13	0.13	0.12
Valine, %	0.81	0.45	0.77
Arginine, %	0.79	0.53	0.77
Histidine, %	0.45	0.26	0.40
Leucine, %	2.26	1.62	1.85
Isoleucine, %	0.63	0.37	0.64
Phenylalanine, %	0.78	0.60	0.96

# Economics is Partly Dependent on Total and Digestible Amino Acid Levels in DDGS

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- Lysine is the most variable of all amino acid levels in “new generation” DDGS
  - Lowest = 0.63%
  - Highest = 0.90%
  - Average = 0.75%
- “Old generation” DDGS
  - Average = 0.47%

# How Does DDGS Lysine Level Affect the Economic Value of DDGS?

- Using the following feed ingredient prices:
  - corn = \$2.00/bu
  - DDGS = \$85/ton
  - soybean meal 44% = \$165/ton
  - dicalcium phosphate = \$12.50/cwt
  - limestone = \$1.75/cwt
  - salt = \$6.90/cwt
  - L-lysine HCl = \$1.00/lb
  - VTM premix = \$117/cwt
- DDGS lysine level 0.80% vs 0.66%
  - \$0.31/ton of complete feed advantage for 0.80% lysine in a 10% DDGS diet
- Low lysine DDGS (0.66%) = \$83.45/ton
- High lysine DDGS (0.80%) = \$86.55/ton
  - \$3.10/ton difference in DDGS value

# How Does Diet Formulation Method Affect the Value of DDGS in Swine Diets?

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- Total amino acid basis?
- Apparent digestible amino acid basis?
- True digestible amino acid basis?
- Currently,
  - no true amino acid digestibility estimates are available for “new generation” DDGS
  - only apparent amino acid digestibility values have been determined for “new generation” DDGS
- Total phosphorus vs available phosphorus basis?

# How Does Diet Formulation Method Affect the Value of DDGS in Swine Diets?

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- Using the following feed ingredient prices:
  - corn = \$2.00/bu
  - DDGS = \$85/ton
  - soybean meal 44% = \$190/ton
  - dicalcium phosphate = \$15.00/cwt
  - limestone = \$1.75/cwt
  - salt = \$6.90/cwt
  - L-lysine HCl = \$1.00/lb
  - VTM premix = \$1.17/lb
- \$1.40/ton advantage in diet cost (10% DDGS diet)
  - diets formulated on a total lysine and P basis vs corn-SBM-lysine diet
- \$0.62/ton advantage in diet cost (10% DDGS diet)
  - diets formulated on apparent digestible amino acid and available phosphorus basis compared to corn-SBM-lysine diet

# Comparison of Formulating DDGS Diets on a Total Lysine and P Basis vs. Digestible Lysine and Available P Basis

Ingredient	Typical Corn-SBM-Lysine Diet	10% DDGS Total Lysine Total P	10% DDGS Digestible Lysine Available P
Corn, lbs	1463	1301	1286
Soybean meal 44%, lbs	482	446	463
DDGS, lbs	0	200	200
Dical. phosphate, lbs	24	19	17
Limestone, lbs	14	17	17
Salt, lbs	6	6	6
L-lysine HCl, lbs	3	3	3
VTM premix, lbs	8	8	8
TOTAL, lbs	2000	2000	2000
Total Cost, \$	109.80	108.40	109.18
<b>Difference, \$</b>	-	<b>-1.40</b>	<b>-0.62</b>

# Why is Feed Cost Savings Higher When Formulating Diets on a Total Amino Acid and Phosphorus Basis?

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- Formulating on a total lysine and P basis replaces:
  - 15 lbs less corn (\$0.036/lb)
  - 17 lbs more soybean meal 44% (\$0.095/lb)
  - 2 lbs less dicalcium phosphate (\$0.15/lb)
- compared to formulating on a digestible amino acid and available phosphorus basis

# Comparison of Phosphorus Level and Relative Availability of DDGS (88% dry matter basis)

	"New" DDGS	"Old" DDGS	DDGS NRC (1998)	Corn NRC (1998)
Total P, %	0.78 Range 0.62-0.87	0.79	0.73	0.25
P Availability, %	90 Range 88-92	No data	77	14
Available P, %	0.70	No data	0.56	0.03

# How Does Available P Content in DDGS and Use of Phytase Affect Diet Cost?

- Using the following feed ingredient prices:
  - corn = \$2.00/bu
  - DDGS = \$85/ton
  - soybean meal 44% = \$190/ton
  - dicalcium phosphate = \$15.00/cwt
  - limestone = \$1.75/cwt
  - salt = \$6.90/cwt
  - L-lysine HCl = \$1.00/lb
  - VTM premix = \$1.17/lb
- Corn+SBM+3 lbs lysine diet vs. 20% DDGS+3 lbs lysine diet
  - **\$0.38/ton cost savings when feeding DDGS**
- Corn+SBM+3 lb lysine vs. 20% DDGS+phytase+4.2 lb lysine
  - **\$0.72/ton cost savings when feeding DDGS**
- Corn+SBM+3 lb lysine vs. 18.8% DDGS+phytase+3 lb lysine
  - **\$0.11/ton cost increase** using 376 lbs DDGS/ton to replace all of the dicalcium phosphorus in the diet with lysine supplementation at 3 lbs/ton

# Diet Compositions and Cost Comparison from Adding 376 lbs/ton of DDGS and Phytase

Ingredient	Corn-SBM-3 lbs Lysine	376 lbs DDGS + Phytase
Corn, lbs	1596.6	1272.6
Soybean meal 44%, lbs	353.7	318.8
DDGS, lbs	0.0	376
Dicalcium phosphate, lbs	23.2	0.0
Limestone, lbs	14.5	19.6
Salt, lbs	6.0	6.0
L-lysine HCl, lbs	3.0	3.0
VTM premix, lbs	3.0	3.0
Phytase, 225 FTU/lb	0.0	1.0
TOTAL, lbs	2000.0	2000.0
Total Cost, \$	96.25	96.36
<b>Difference, \$</b>	<b>-</b>	<b>+ 0.11</b>

# DDGS Reduces the Need for Supplemental Inorganic P

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- Adding 400 lbs/ton of DDGS to a grower diet:
  - reduces dicalcium phosphate use by 12 lbs/ton vs. a typical corn-SBM-3 lb synthetic lysine diet
- Adding 376 lbs/ton of DDGS + phytase to a grower diet
  - reduces dicalcium phosphate use to 0 lbs/ton

# Quick Calculation of Feed Cost Savings

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**Thumb rule:**

**Additions/2000 lbs diet**

+ 200 lbs DDGS x \_\_\_\_\_ \$/lb = \$ \_\_\_\_\_

+ 3 lbs limestone x \_\_\_\_\_ \$/lb = \$ \_\_\_\_\_

**TOTAL ADDITIONS (A) \$ \_\_\_\_\_**

**Subtractions/2000 lbs diet**

- 177 lbs corn x \_\_\_\_\_ \$/lb = \$ \_\_\_\_\_

- 20 lbs SBM (44%) x \_\_\_\_\_ \$/lb = \$ \_\_\_\_\_

- 6 lbs dical. phos. x \_\_\_\_\_ \$/lb = \$ \_\_\_\_\_

**TOTAL SUBTRACTIONS (S) \$ \_\_\_\_\_**

**(S – A) = Feed cost savings/ton by adding 10% DDGS to the diet**

# Summary of Nutrient Content and Digestibility of “New Generation” DDGS

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- Energy value
  - appears to be similar to corn
  - higher than “old generation” DDGS
  - higher than values in NRC (1998)
- Amino acid content and digestibility
  - higher than “old generation” DDGS
    - especially lysine
  - higher than NRC (1998)
- Available phosphorus
  - higher than NRC (1998)
  - significantly greater than corn (20x)

# Summary of Diet Cost Savings from Adding DDGS to Growing Swine Diets

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- **\$0.62/ton feed cost savings**
  - Diets formulated on a dig. amino acid and avail. P basis
- **\$1.40/ton feed cost savings**
  - Diets formulated on a total amino acid and P basis
- **\$3.10/ton difference in DDGS value**
  - High (0.80%) vs. low (0.66%) lysine “new generation” sources
- **\$0.72/ton feed cost savings**
  - Phytase+18.8% DDGS+4.2 lb lysine
- **Diet cost increases by \$0.11/ton**
  - Adding phytase to a 20% DDGS+3 lb lysine diet w/o increasing synthetic lysine

# Averages and Ranges in Physical Characteristics Among 16 Sources of “New Generation” DDGS

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- Particle size
  - 1282 microns (range: 612 to 2125 microns)
- Bulk density
  - 35.7 lbs/cu. ft (range: 30.8 to 39.3 lbs/cu. ft)
- Color
  - Dark to golden
  - Light color highly correlated with high amino acid digestibility
- Smell
  - Burnt or smoky to sweet and fermented



**Low Quality,  
Less Digestible  
DDGS**



**High Quality,  
Highly Digestible  
DDGS**

# The Use of DDGS in Swine Diets



# Positive Attributes of Using “New Generation” DDGS in Swine Diets

- Cost effective partial replacement for corn, soybean meal, and dicalcium phosphorus
  - High energy
    - similar to energy value of corn
  - High available phosphorus
    - reduce dicalcium phosphorus supplementation
    - reduce P excretion in manure
  - Higher amino acid digestibility than other DDGS sources
    - golden color “New Generation” DDGS has improved amino acid digestibility
- Feeding high levels of DDGS to sows appears to increase litter size weaned
- May improve gut health (i.e. ileitis, gut edema)

# Negative Attributes of Using “New Generation” DDGS in Swine Diets

- Poor amino acid profile relative to pig’s amino acid requirements
  - same problem with corn grain
- High crude protein content
  - increases N excretion in manure
- High fiber content
  - should not be used in diets for young pigs (< 15 lbs)
  - high DDGS inclusion rates (50% in gestation and 20% lactation) and abrupt change from corn-soybean meal diets will temporarily (5 to 7 days) reduce sow feed intake

# Negative Attributes of Using “New Generation” DDGS in Swine Diets

- High oil content
  - may limit use to 20% in grow-finish diets due to reduced pork fat quality
    - belly firmness
    - softer fat - increased unsaturated fatty acids
- If mycotoxin contaminated corn is used to produce ethanol and DDGS
  - DDGS mycotoxin concentrations 2 to 3x more concentrated than found in corn used to produce it
  - risk may limit maximum inclusion rates in gestation and lactation diets
  - minimal risk for corn produced in northern “Corn Belt”

# Maximum Inclusion Rates of “New Generation” DDGS in Swine Diets

(Based Upon University of Minnesota Performance Trials)

- Nursery pigs (>15 lbs)
  - 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 and formulate on a digestible amino acid and available phosphorus basis



# Are There Any Other Benefits of Feeding DDGS?

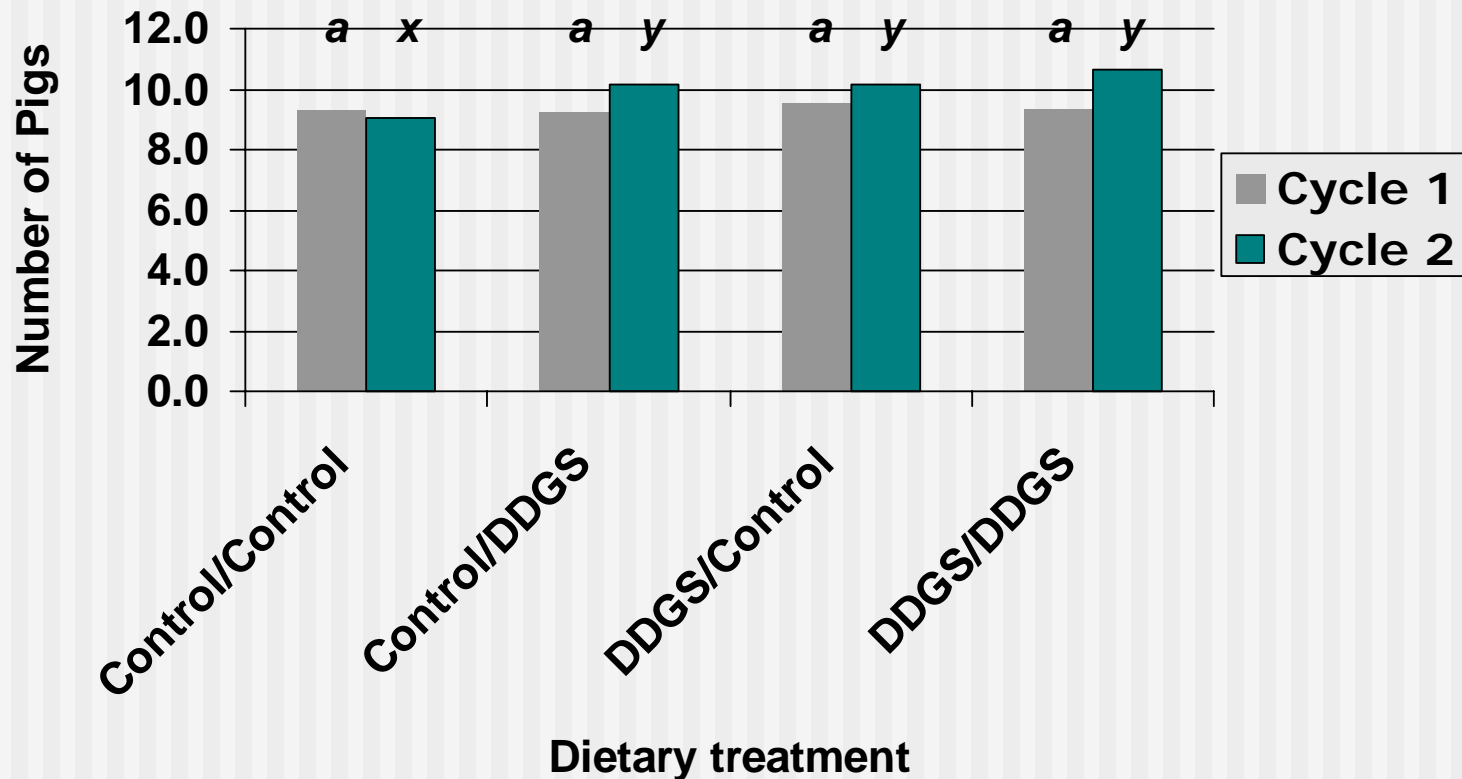
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- Manure management
  - decreases P excretion in manure
  - increases N excretion in manure
    - minimized by using synthetic amino acids
  - no apparent effect on reducing  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , or odor emissions
- Increased litter size weaned
- Improved gut health (e.g. ileitis)

# Feeding High Levels of DDGS Appears to Increase Litter Size Weaned

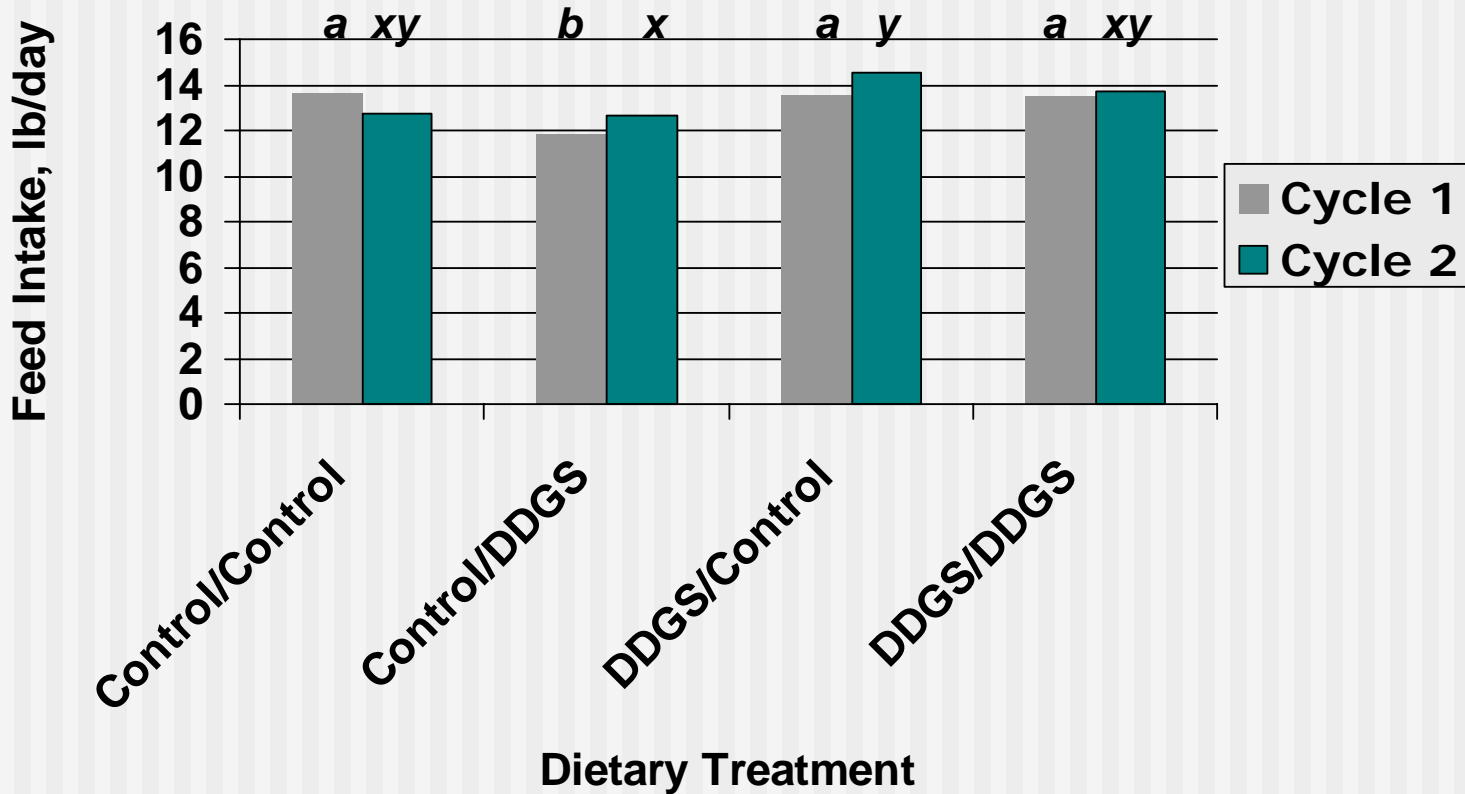
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# Effect of Feeding a 0 or 50% DDGS Gestation Diet and 0 or 20% DDGS Lactation Diets on Pigs Weaned/Litter



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

# Effect of Dietary Treatment Combination on ADFI of Sows During Lactation



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

# Feeding DDGS Diets During the Grow-Finish Period May Reduce the Incidence and Severity of Ileitis

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# What is Ileitis?

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- 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
  - Can survive in the environment for at least 1 to 2 weeks at temperatures between 5 and 15 °C (Collins et al., 2000)
    - Most susceptible to a quaternary ammonium disinfectant

# What is Ileitis?

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- Pigs affected (Glock et al., 1994)
  - 40-100 lb growing pigs (most common)
  - Bred gilts
  - Sows and boars
  - Finishing pigs
- Generally affects 1 - 10% of herd
  - Infection may be as high as 50% in young pigs

# What is Ileitis?

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- 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

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- 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 140 – 240 lb finishers
  - Massive intestinal hemorrhaging, bloody diarrhea, increase in mortality

# PIA

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# Does Feeding DDGS Reduce the Incidence and Severity of Ileitis?

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- Field reports from several MN pork production operations have indicated:
  - Adding 5 to 10% DDGS to grow-finish diets in herds with recurring problems with ileitis
    - Improved performance
    - Reduced mortality (by as much as 50%)

# Possible Relationships Between DDGS and Gut Health

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- DDGS is high in fiber (Shurson et al., 2000)
  - High insoluble fiber (42.2 %)
  - Low soluble fiber (0.7 %)
- Feeding diets low in soluble non-starch polysaccharides reduce proliferation of pathogenic organisms in the GIT (Hampson, 1999).
  - Reduced pathogen substrate availability?
  - Fiber may influence the secretory function of the epithelium, which are implicated with bacterial adhesion (Smith and Halls, 1968)
  - May have a “cleansing” effect in gut through changes by reducing the viscosity of digesta (Lawrence, 1972)
- Presence of yeast cells in DDGS from fermentation
  - May have mannan oligosaccharide properties

# 3 Ileitis Challenge Experiments Have Been Conducted at the University of Minnesota

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## ■ Experiment 1

- Randomly allotted 80 (17d old) pigs to 1 of 4 treatments
  - (NC) Negative control corn-soybean meal diet
  - (PC) Positive control corn-soybean meal diet\*
  - (D10) 10% DDGS diet\*
  - (D20) 20% DDGS diet\*

## ■ Experiment 2

- Randomly allotted 100 (17 d old) pigs to 1 of 5 treatments
  - (NC) Negative control corn-soybean meal diet, no antimicrobial
  - (PC) Positive control corn-soybean meal diet, no antimicrobial
  - (D10) 10% DDGS diet, no antimicrobial
  - (A) Control diet with BMD/CTC
  - (D10+A) DDGS diet with BMD/CTC

## ■ Experiment 3

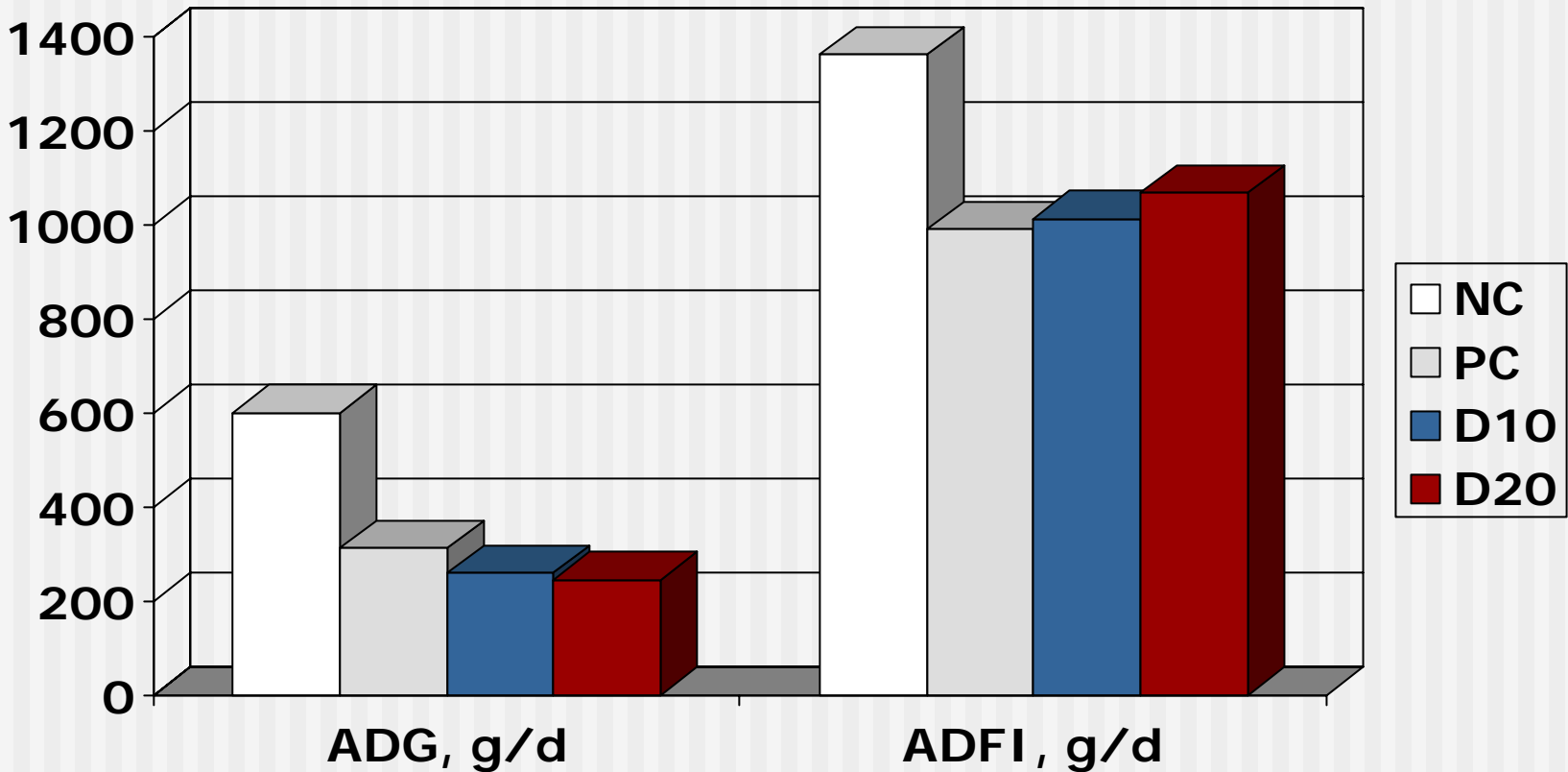
- Randomly allotted 100 (17 d old) pigs to 1 of 5 treatments
  - (NC) Negative control corn-soybean meal diet
  - (PC) Positive control corn-soybean meal diet
  - (D20) 20% DDGS diet
  - (SH) 5% soy hulls diet
  - (SH + PA) 5% soy hulls with a polyclonal antibody diet

# Ileitis Challenge Methodology

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- 4 wk acclimation period to diets and isolation pens
- 1 day challenge period
  - Mucosal homogenate from infected porcine intestines
- Pigs maintained and observed for 3 wks after infection
- All pigs were euthanized and samples were collected
- Growth performance and feed intake data were collected
- Fecal samples collected on d 14 and d 21 post-challenge
  - Used PCR to determine rate of fecal shedding of the organism
    - Most accurate measure in live animal
- Necropsy
  - Pathologist determined the length and location of gross lesions
  - Severity of gross lesions (Score of 0 - 4)
  - Collected 4 inch tissue section of distal ileum
    - Immunohistochemistry to establish presence and prevalence of *L. intracellularis*-infected cells from the mucosa
    - IHC is most sensitive and accurate evaluation measure available

# Effect of DDGS on Growth and Feed Intake of Pigs Post-Challenge – Experiment 1



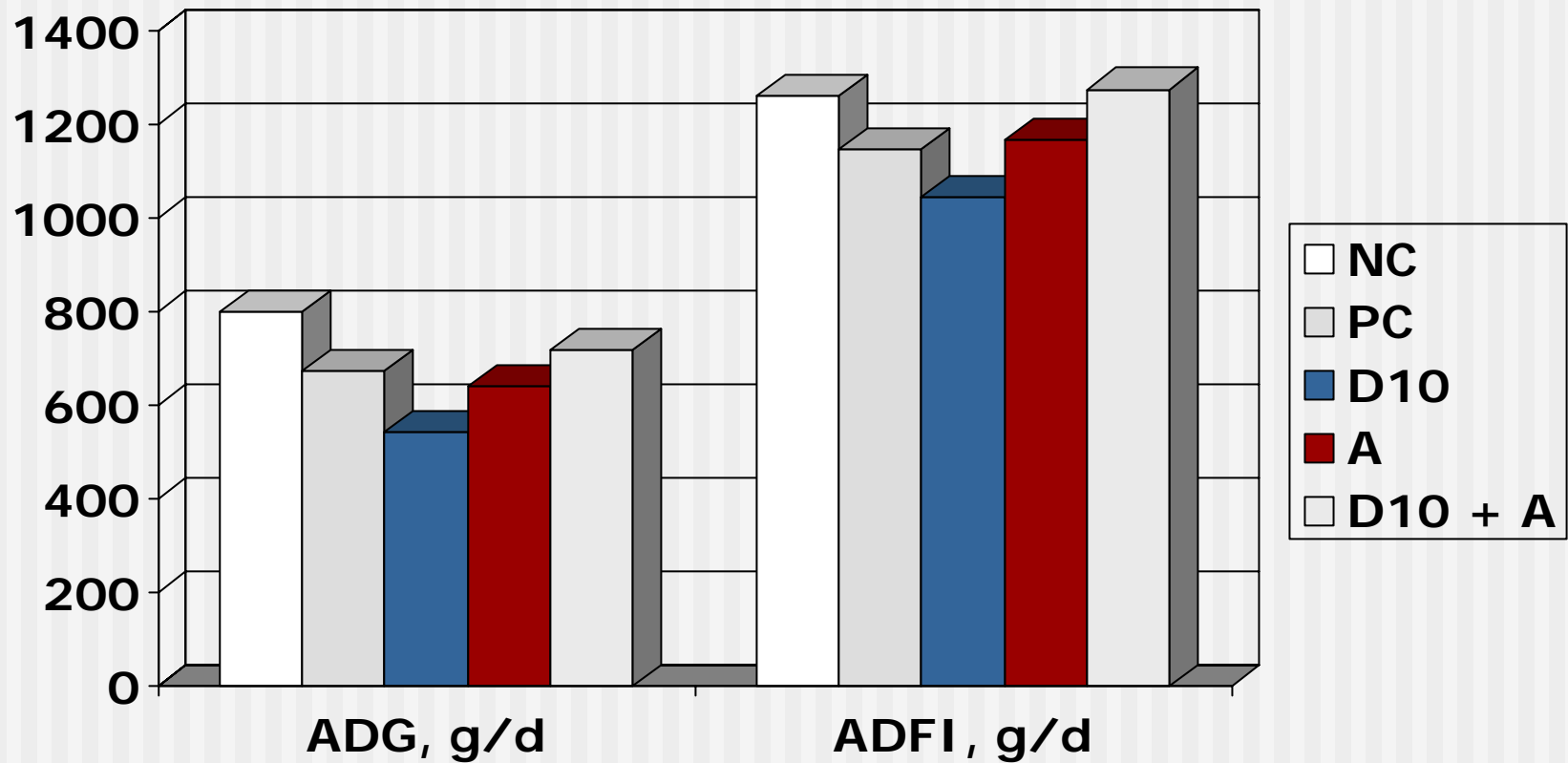
Pen was experimental unit, 2 pens/treatment

# Experiment 1 - Conclusion

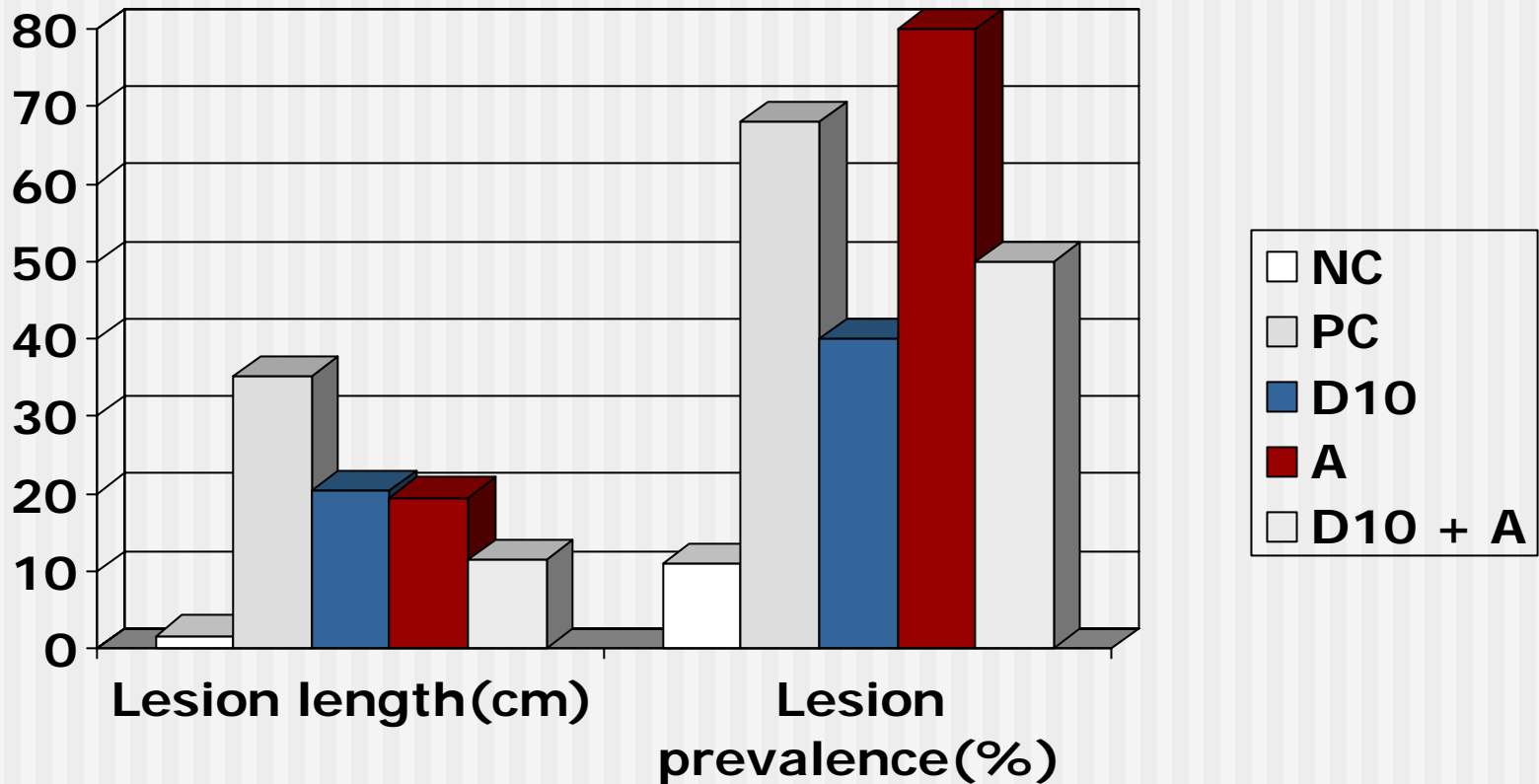
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- DDGS inclusion did not positively affect the pig's ability to resist an ileitis challenge
  - Feeding 10% DDGS resulted in greater prevalence, length, and/or severity of lesions in many portions of the G.I. Tract
- Dosage (inoculation) rate was higher than desired
  - Goal:  $1 \times 10^8$  dose of *L. intracellularis*
  - Actual:  $1.56 \times 10^9$  dose of *L. intracellularis*
  - Because of high dosage level, ability to detect dietary effects may have overwhelmed any dietary effects

# Effect of DDGS on Growth and Feed Intake of Pigs Post-Challenge – Experiment 2

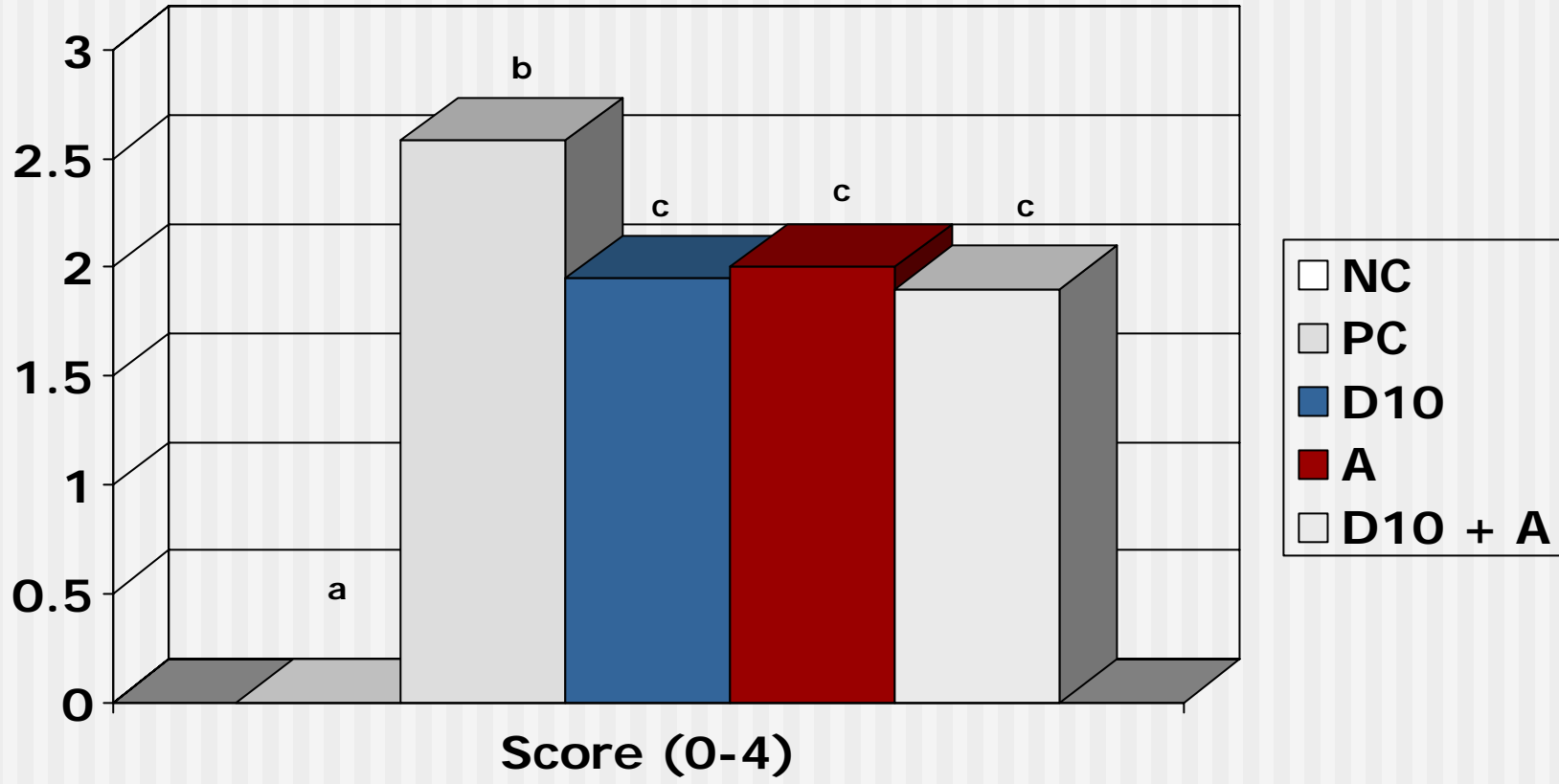


# Effect of DDGS on Overall Lesion Length and Lesion Prevalence of Pigs Post-Challenge – Experiment 2



Lesion length: DDGS effect ( $P < .14$ ), BMD + CTC effect ( $P < .11$ )  
Lesion prevalence: DDGS effect ( $P < .01$ )

# Effect of DDGS on Immunohistochemistry Score (0-4) of Pigs Post-Challenge – Experiment 2



a, b, c Bars with different superscripts are significantly different (P < .1)

# Experiment 2 - Conclusion

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- Inoculation dose was closer to our goal
  - 63% of challenged pigs had intestinal lesions
  - Lesions were less severe than in Exp. 1
- DDGS inclusion (10%) had a positive effect
  - Decreased lesion length, score and prevalence in the
    - Ileum
    - Colon
    - Total tract
    - Decreased IHC score
- BMD/CTC had a positive effect
  - Decreased lesion score and prevalence in jejunum
  - Decreased lesion length in total tract
  - Decreased IHC score
- DDGS x BMD interaction appeared to be minimal

# Exp. 3 – Effect of Dietary Treatment on Jejunum Lesions

Jejunum	NC	Challenged Trts				SH + PA	<u>P-value</u> (NC vs Chall)
		PC	D	SH			
Length, cm	0	78.2	53.6	26.8	68.0	.01	
Score (0-4)	0	1.20 <sup>a,b</sup>	1.41 <sup>a,b</sup>	1.09 <sup>b</sup>	1.80 <sup>a</sup>	.001	
Prev, %	0	55	55	50	68	.001	

<sup>a,b</sup> Different superscripts indicate difference between challenged means (P < 0.10)

# Exp. 3 – Effect of Dietary Treatment on Ileum Lesions

Ileum	NC	Challenged Trts				SH + PA	<u>P-value</u> (NC vs Chall)
		PC	D	SH			
Length, cm	0.65	15.9 <sup>a,b</sup>	13.5 <sup>b</sup>	13.2 <sup>b</sup>	19.6 <sup>a</sup>	.001	
Score (0-4)	0.05	1.85 <sup>a,b</sup>	1.65 <sup>b</sup>	1.50 <sup>b</sup>	2.32 <sup>a</sup>	.001	
Prev, %	5	85 <sup>a,b</sup>	75 <sup>a,b</sup>	65 <sup>b</sup>	90 <sup>a</sup>	.001	

<sup>a,b</sup> Different superscripts indicate difference between challenged means (P < 0.10)

# Exp. 3 – Effect of Dietary Treatment on Total Tract Lesions

Total Tract	Challenged Trts					<u>P-value</u> (NC vs Chall)
	NC	PC	D	SH	SH + PA	
Length, cm	0.65	98.1 <sup>a</sup>	68.6 <sup>a,b</sup>	40.7 <sup>b</sup>	89.1 <sup>a,b</sup>	.001
Score (0-4)	0.01	0.90 <sup>a,b</sup>	0.84 <sup>a, b</sup>	0.68 <sup>b</sup>	1.08 <sup>a</sup>	.001
Prev, %	5	85	80	70	90	.001

<sup>a,b</sup> Different superscripts indicate difference between challenged means (P < 0.10)

# Experiment 3 Conclusion

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- Pigs fed soybean hulls tended to have ↓
  - Length, severity, and prevalence of lesions in ileum
  - Severity of lesions in jejunum
  - Severity of lesions in the total tract  
vs. soybean hulls + PC antibody
  - Total tract lesion length vs. positive control
- DDGS and soybean hulls ↓
  - Lesion length and prevalence in colon  
vs. positive control

# Experiment 3 Conclusions

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- Inoculation doses
  - Goal =  $1 \times 10^8$  of *L. intracellularis*
  - Exp. 3 actual =  $8 \times 10^8$  of *L. intracellularis*
  - Exp. 2 actual =  $8 \times 10^8$  of *L. intracellularis*
  - Exp. 1 actual =  $1.56 \times 10^9$  of *L. intracellularis*
  - Dosages were much higher than desired
- Lesion prevalence
  - 81% of challenged pigs had lesions in Exp. 3
  - 59% of challenged pigs had lesions in Exp. 2
- Lesion length
  - Exp. 3 = 74 cm
  - Exp. 2 = 21 cm
- Lesion prevalence and length were more severe in Exp. 3 vs. Exp. 2 using the same dose

# U of M DDGS Web Site

## [www.ddgs.umn.edu](http://www.ddgs.umn.edu)

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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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