Knowledge and Challenges of DDGS Use in the Swine Industry

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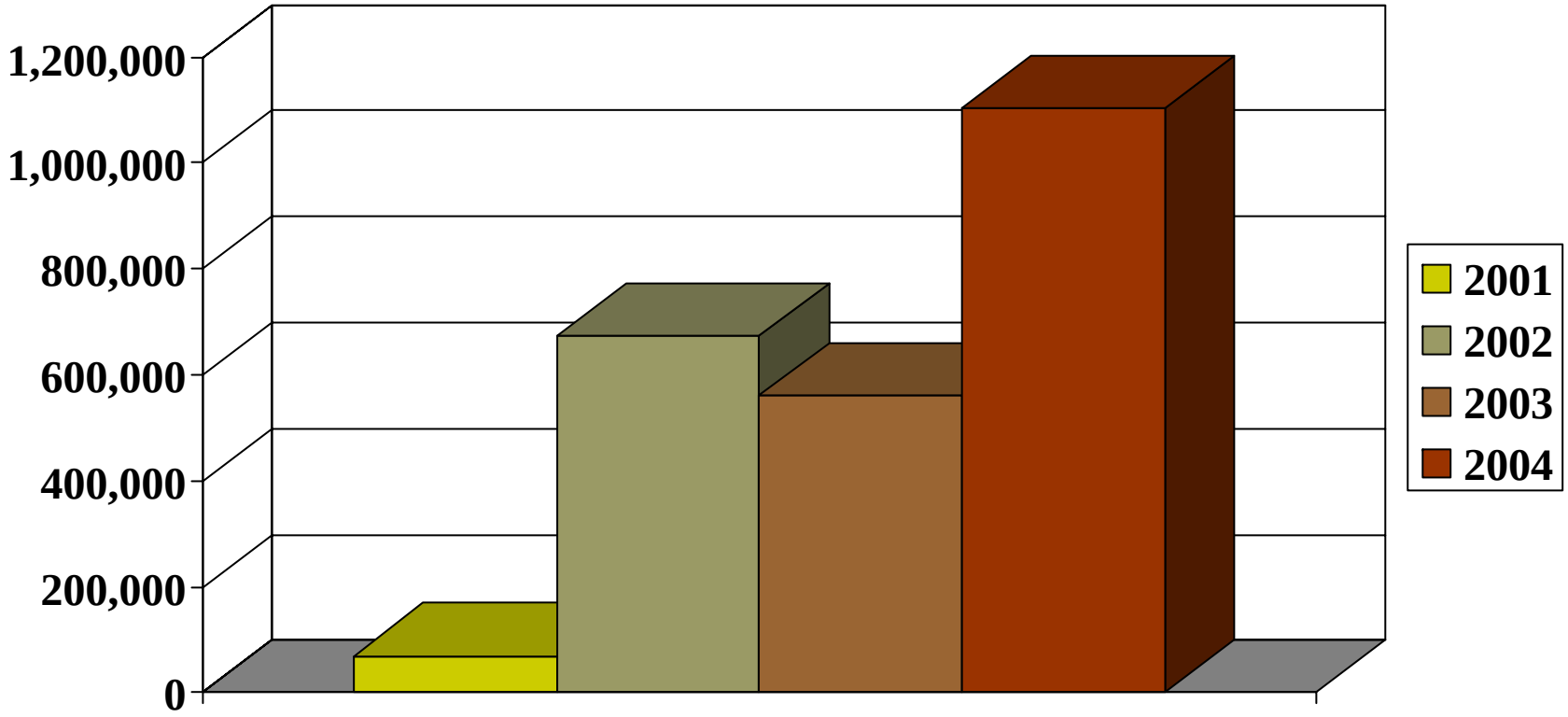
What Do We Know About DDGS Use in Swine Diets?

- Nutrient composition, digestibility, and physical characteristics vary among sources.
  - Energy $\geq$ corn
  - Light, golden color indicative of high lysine digestibility
  - Phosphorus digestibility is very high
- Economical partial replacement for
  - Corn
  - Soybean meal
  - Dicalcium phosphate
- Variability among DDGS sources > among soybean meal sources
- Maximum diet inclusion rates have been initially determined under specific diet formulation conditions.
- It works!
  - ~ 1.1 million metric tons were fed to pigs in 2004.

Estimated DDGS Usage in U.S. Swine Feeds 2001-2004 (Metric Tonnes)



DDGS Feeding Limitations Have Been Identified

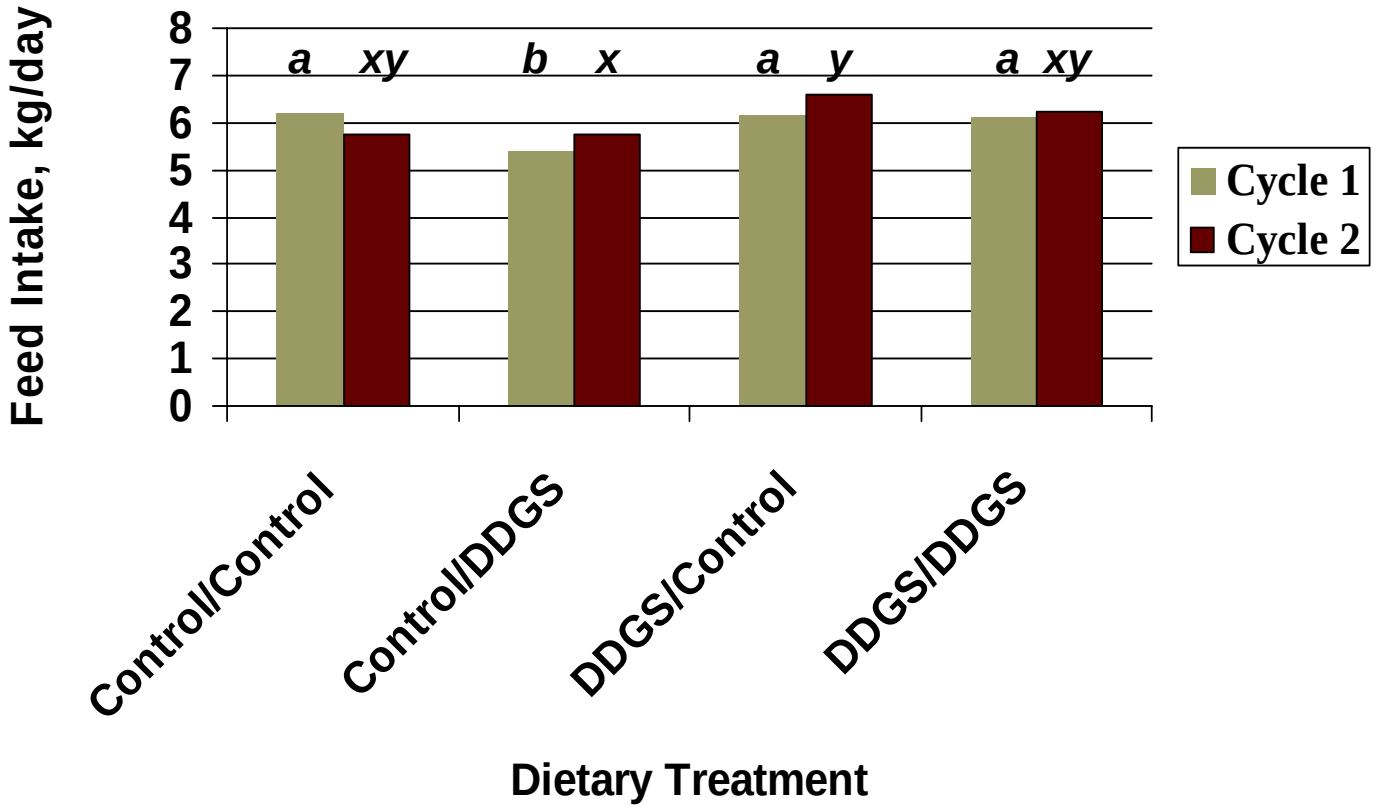
- Formulate diets on a digestible amino acid basis if > 10% is added to corn-SBM diets
- Adding DDGS to swine diets will generally:
  - reduce dry matter digestibility
  - slightly increase manure output
  - increase N excretion
  - reduce P concentration in manure if formulations based on available P
- Pork fat quality and belly firmness appear to be reduced as increasing levels are added to the diet
- Feed intake and growth rate may be reduced when added to diets for pigs weighing less than 15 lbs
- Sows require a short adaptation period when abruptly switching from a corn-soybean meal diet to a diet containing high levels of DDGS

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).

Effect of Feeding 0 and 50% DDGS Gestation Diets and 0 and 20% DDGS Lactation Diets on Sow Lactation ADFI



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

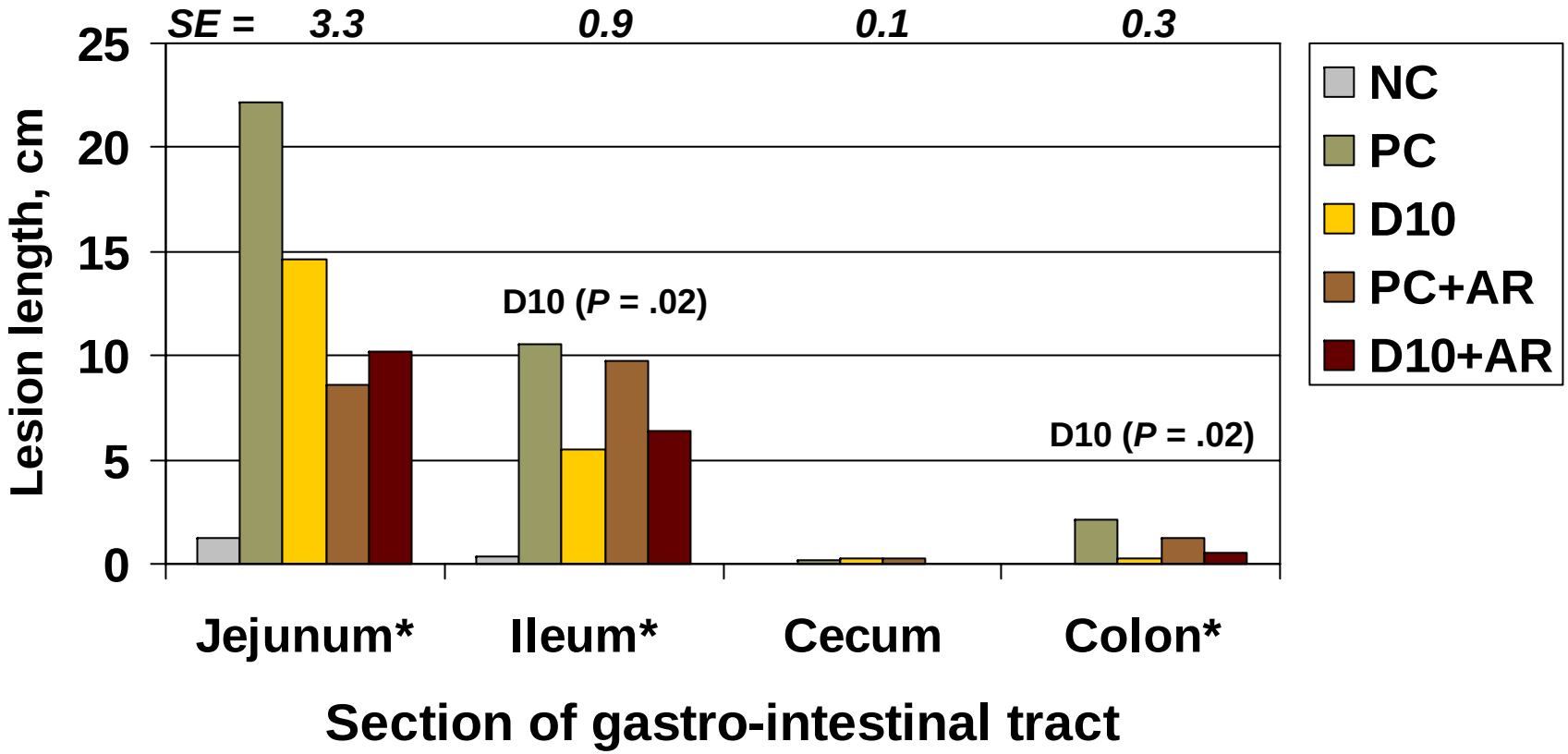
Unique, Value-Added Attributes of DDGS Have Been Identified

- Improvements in gut health related to *Lawsonia intracellularis*
- Increased litter size weaned when high levels are fed to sows
- Manure P concentration is reduced

Healthy

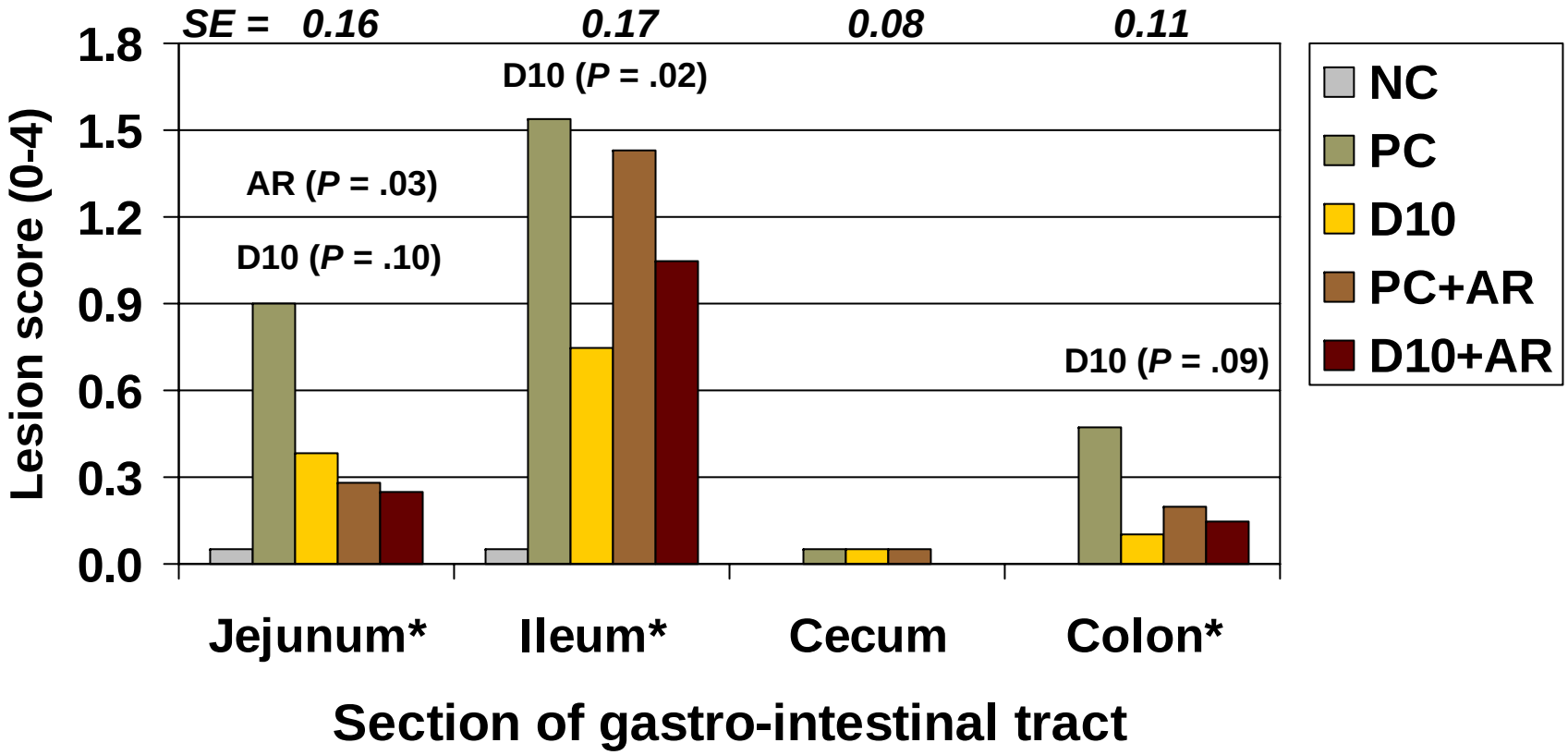
Ileitis

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



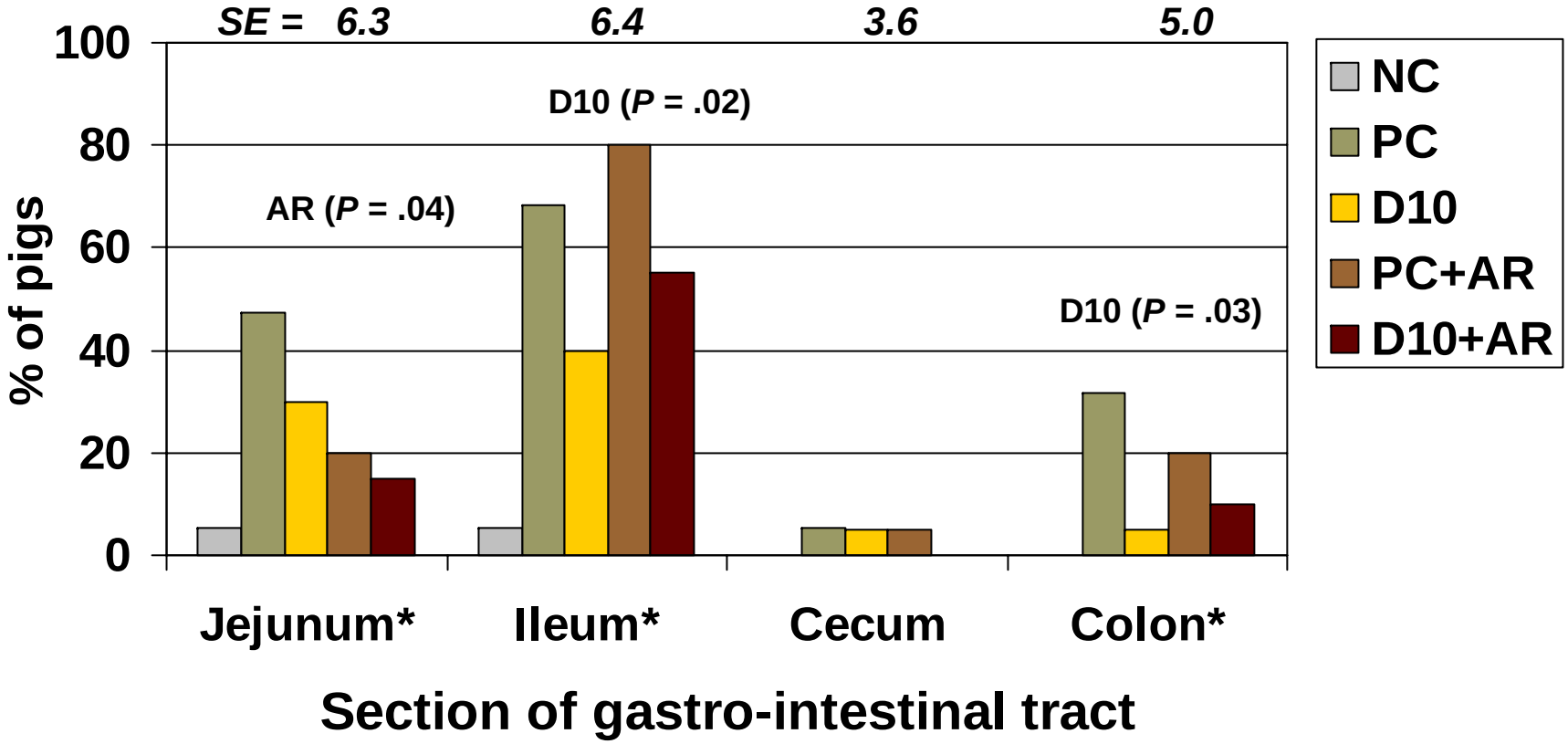
* Effect of disease challenge ($P < .01$).

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



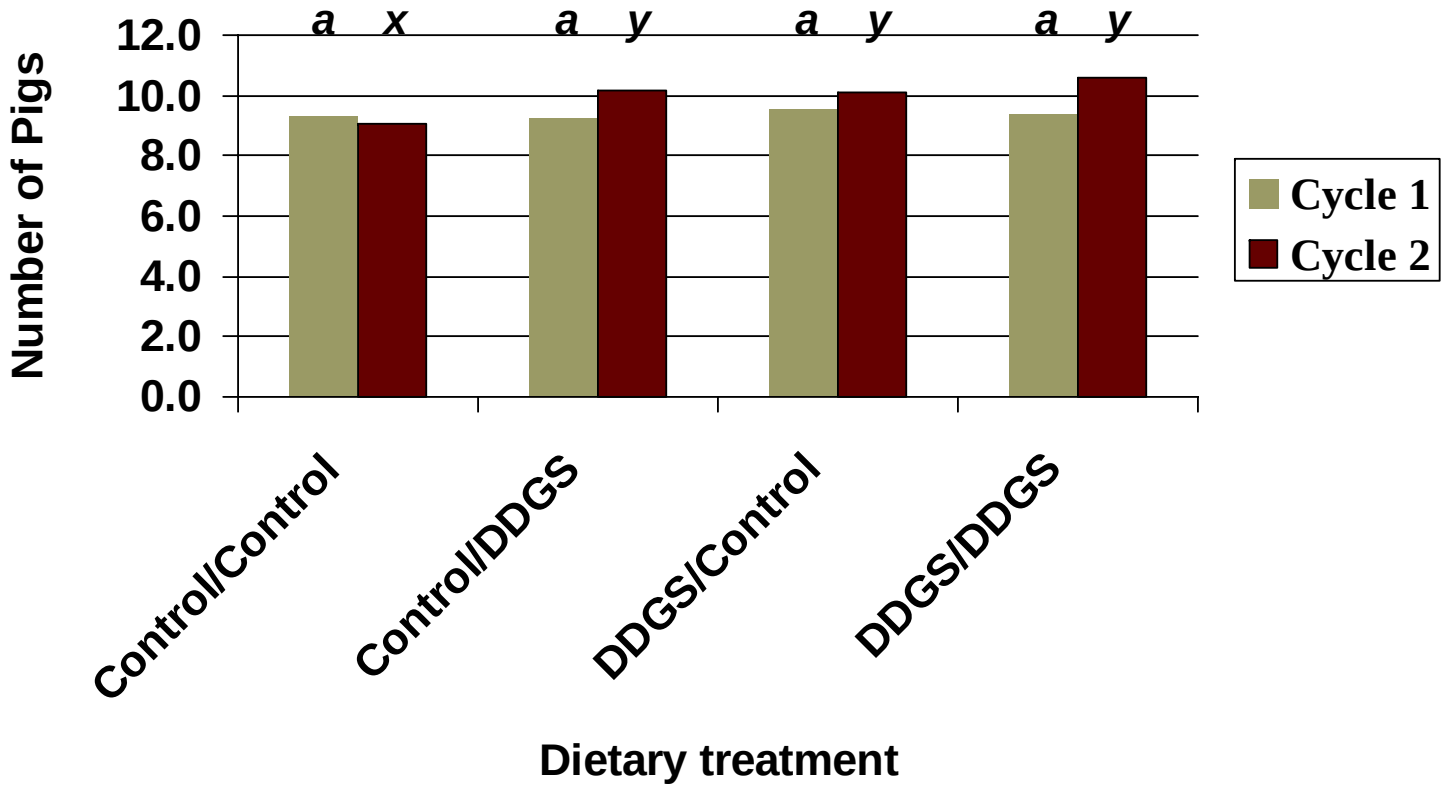
* Effect of disease challenge ($P < .01$).

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



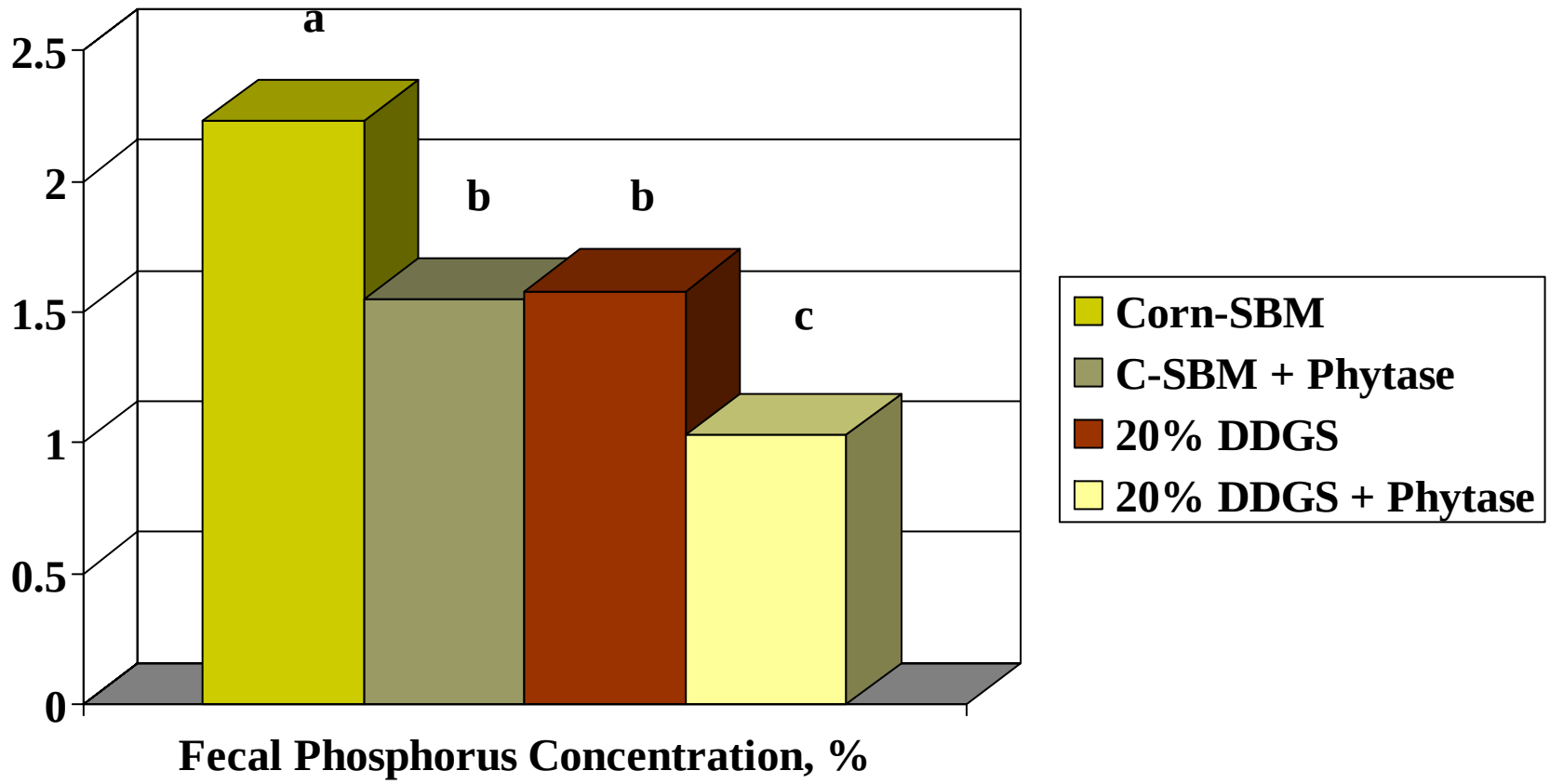
* Effect of disease challenge ($P < .01$).

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



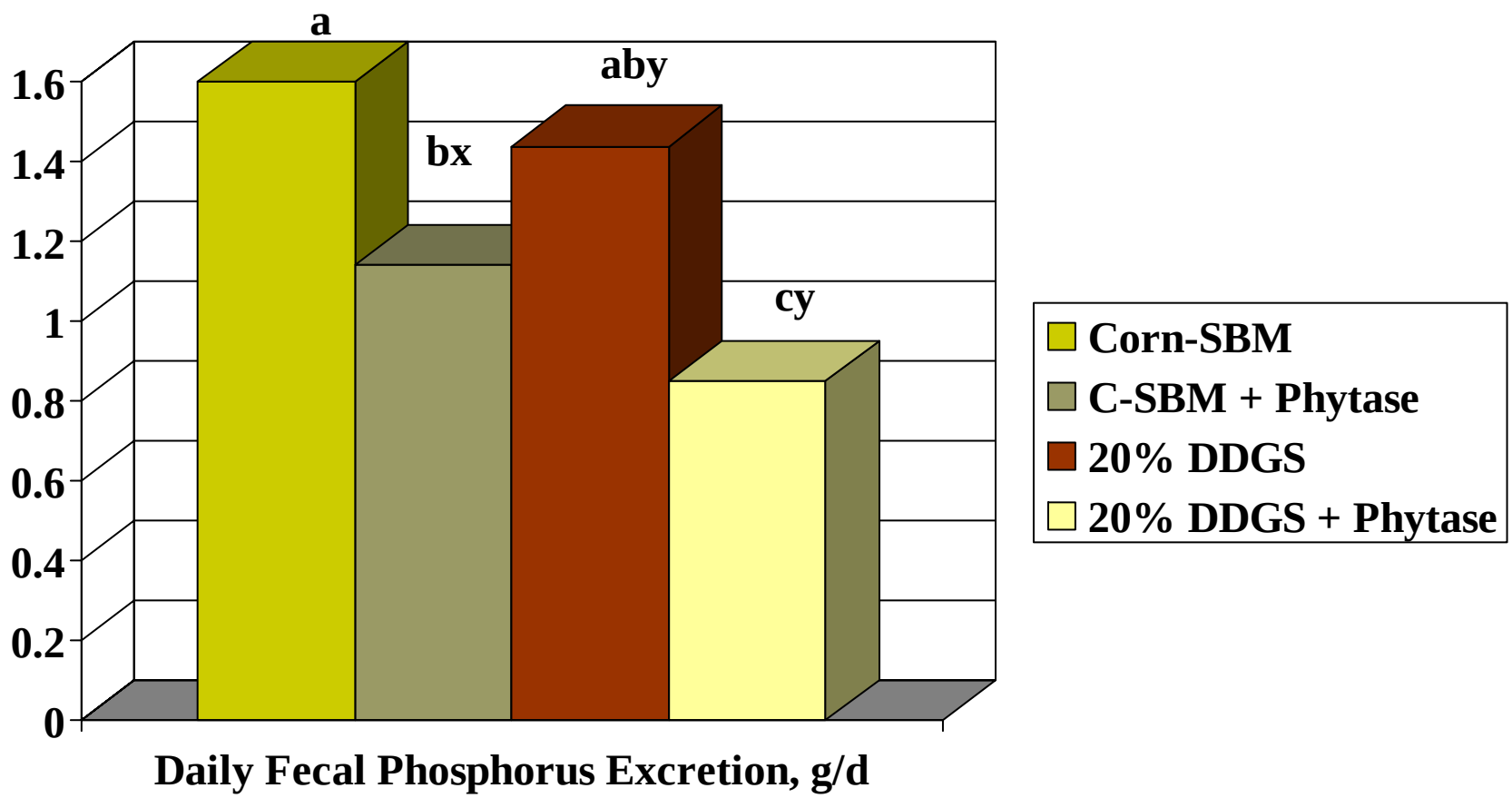
[a,b,x,y] Different superscripts indicate significant difference (P < .10).

Effect of Feeding Corn-SBM Diets With or Without 20% DDGS or Phytase on Fecal Phosphorus Concentration (%)



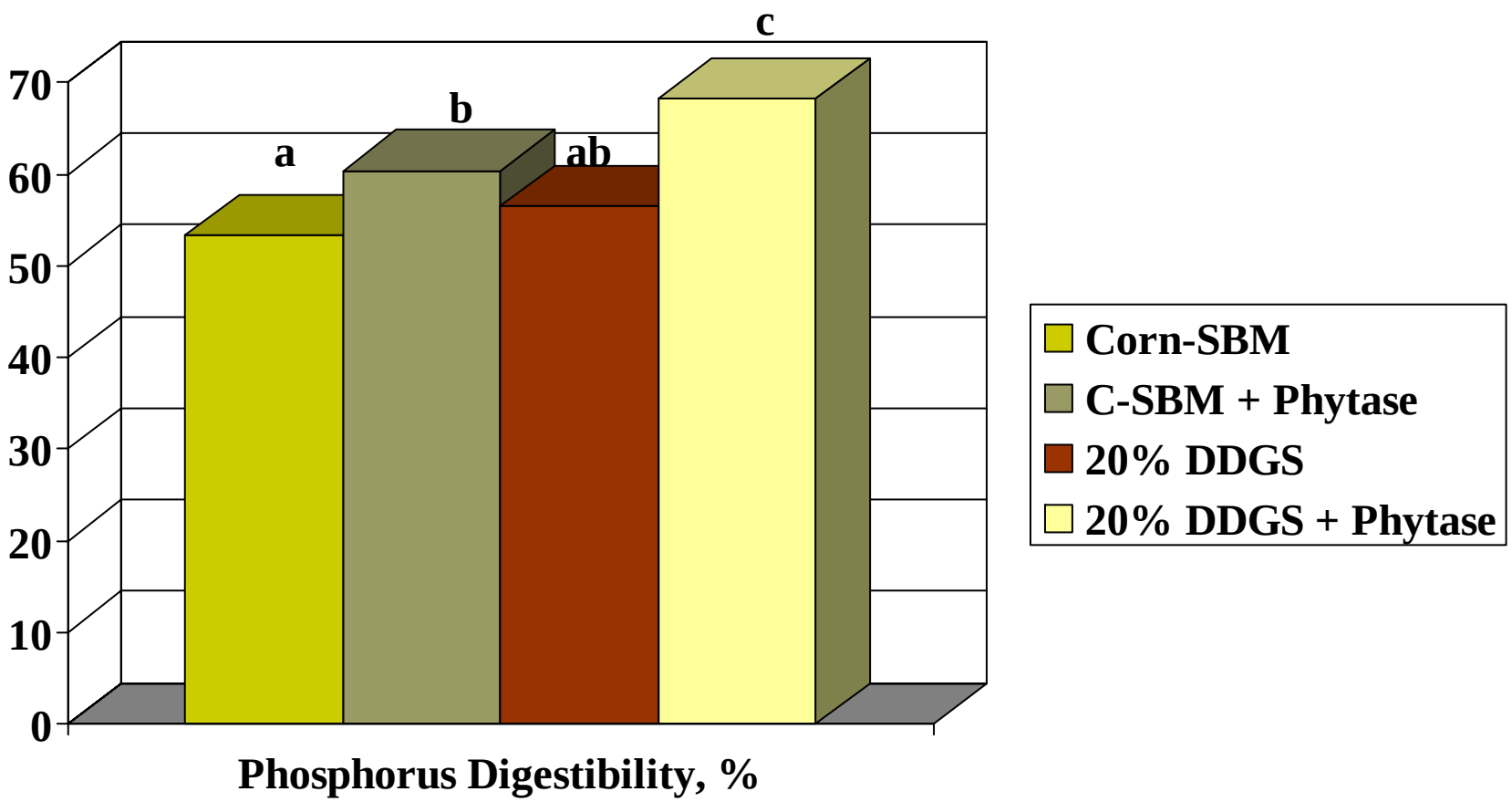
a,b Means with different superscripts are significantly different (P < .05).

Effect of Feeding Corn-SBM Diets With or Without 20% DDGS or Phytase on Daily Fecal Phosphorus Excretion (g/d)



a,b,c Means with different superscripts are significantly different (P < .05).
x,y Means with different superscripts are significantly different (P < .15).

Effect of Feeding Corn-SBM Diets With or Without 20% DDGS or Phytase on Phosphorus Digestibility (%)



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

Barriers for Increased DDGS Use in Swine Diets

- Variability in nutrient content and digestibility
- Low particle size and flowability problems
- Perceived risk of mycotoxins (sows)
- Ability to pellet DDGS diets
- Understanding and managing effects on pork fat quality

DDGS Varies Nutrient Content and Digestibility, Color, and Particle Size Among U.S. Sources

Comparison of Nutrient Composition of Golden Corn DDGS to Other "DDGS Sources" (100% Dry Matter Basis)

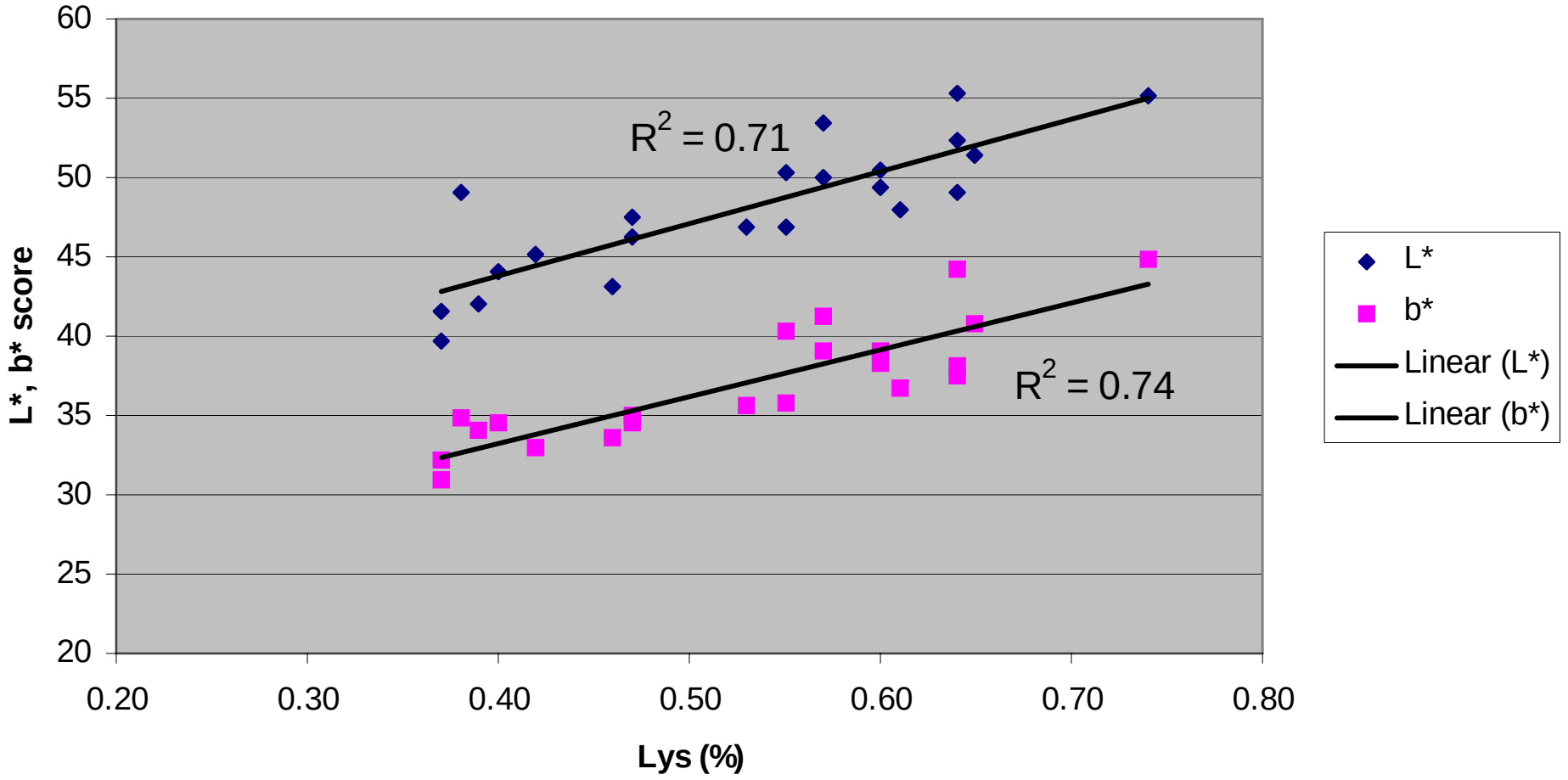
	Golden Corn DDGS	Solulac	Badger State Ethanol	ADM - Peoria	Extruded DDGS/Soy (XDS Plus)	AGP Pelleted
Protein, %	31.82	29.32	31.62	30.12	34.44	27.0
Fat, %	11.32	3.52	15.25	8.96	13.33	9.00
Crude fiber, %	6.25	7.90	No data	7.77	7.78	15.10
ADF, %	12.37	11.80	17.91	20.95	14.44	No data
Ash, %	6.93	5.29	4.58	7.30	5.56	4.28
DE, kcal/kg*	4053	3808	No data	3796	No data	No data
ME, kcal/kg*	3781	3577	No data	3560	3749	No data
Lys, %	0.92	0.61	0.90	0.83	1.67	No data
Met, %	0.62	0.54	0.54	0.66	0.61	No data
Thr, %	1.17	1.01	1.04	1.13	2.50	No data
Trp, %	0.25	0.18	0.23	0.25	0.39	No data
Ca, %	0.07	0.12	0.06	0.51	0.22	0.17
P, %	0.77	0.78	0.89	0.68	0.72	0.62

*Calculated energy values for swine

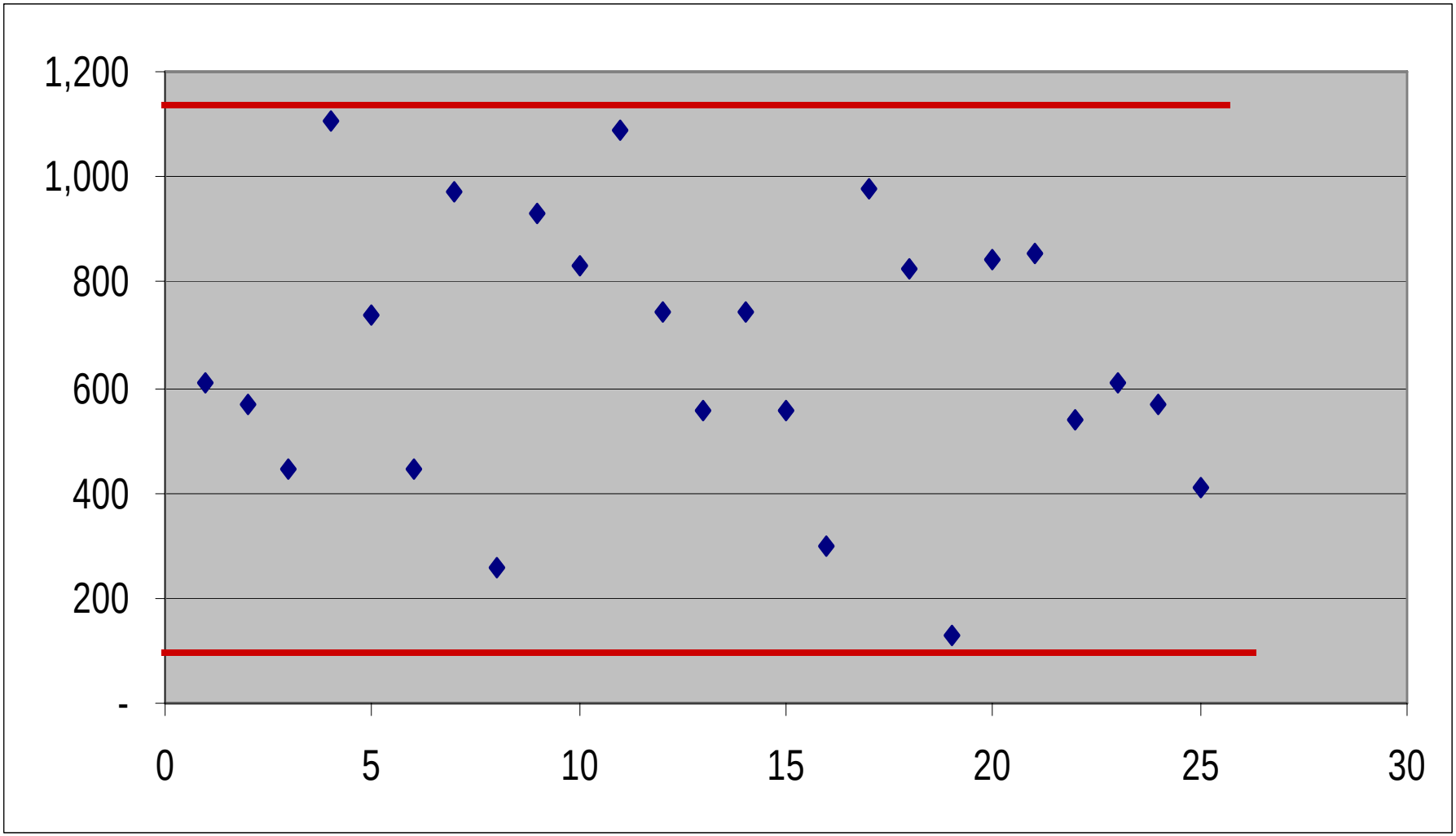
Variability (CV, %) of Selected Nutrients Among U.S. DDGS Sources vs. U.S. Soybean Meal Sources

Nutrient	DDGS	Soybean Meal
Crude protein	4.5	2.3
Crude fat	17.1	30.9
Crude fiber	18.9	9.5
Ash	27.2	6.6
Lysine	12.1	3.0
Methionine	8.5	5.3
Threonine	5.8	4.2
Tryptophan	12.0	7.3
Calcium	117.5	25.8
Phosphorus	19.4	9.1

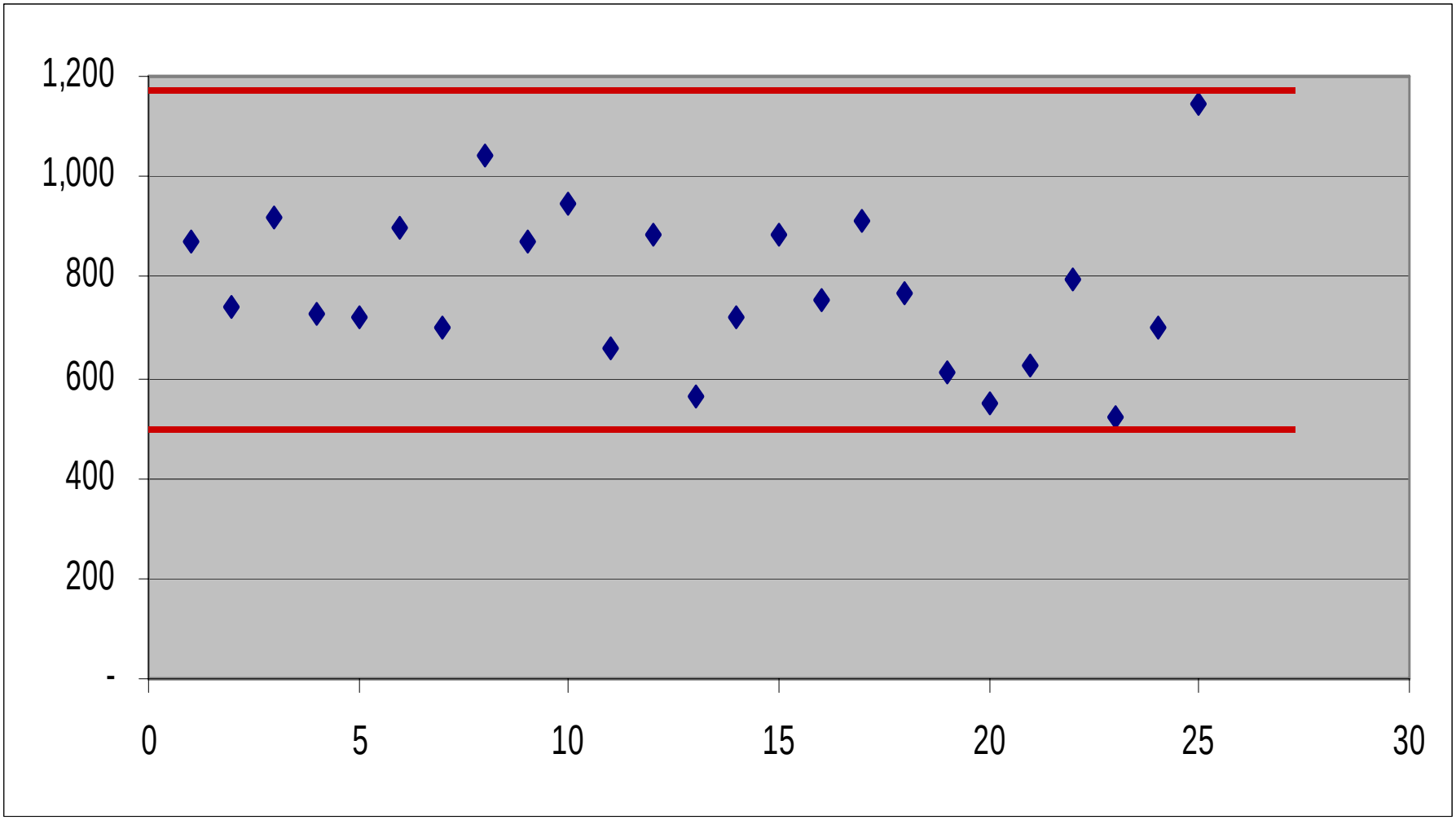
Fig. 1. Regression of digestible lys (%) and color (L*, b*)



Source: Dr. Sally Noll (2003)



Variation in Particle Size Among DDGS Samples Representing 25 U.S. Ethanol Plants
1/05

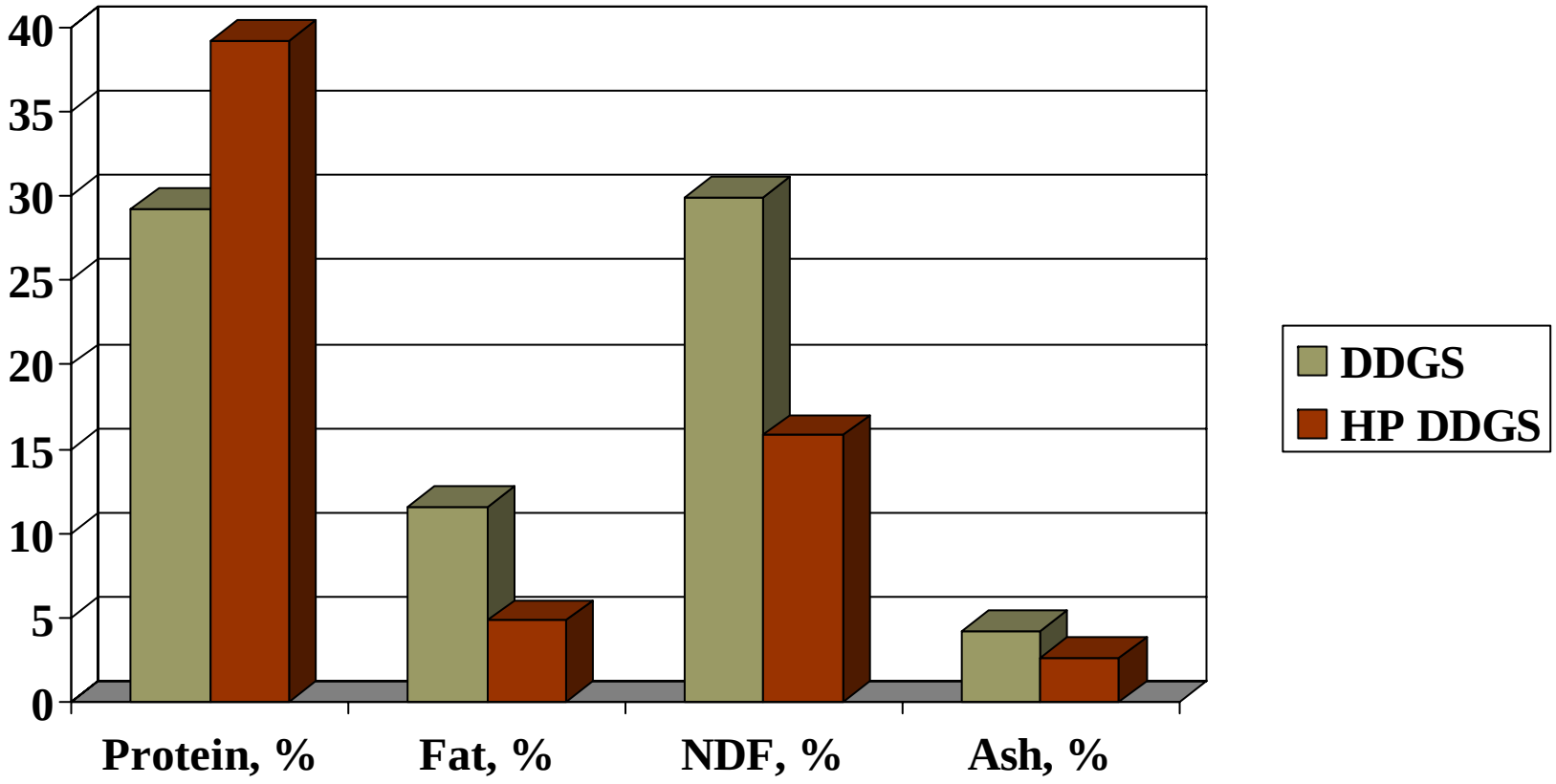


Variation in Particle Size Among Soybean Meal Samples Representing 6 U.S. Plants 2003

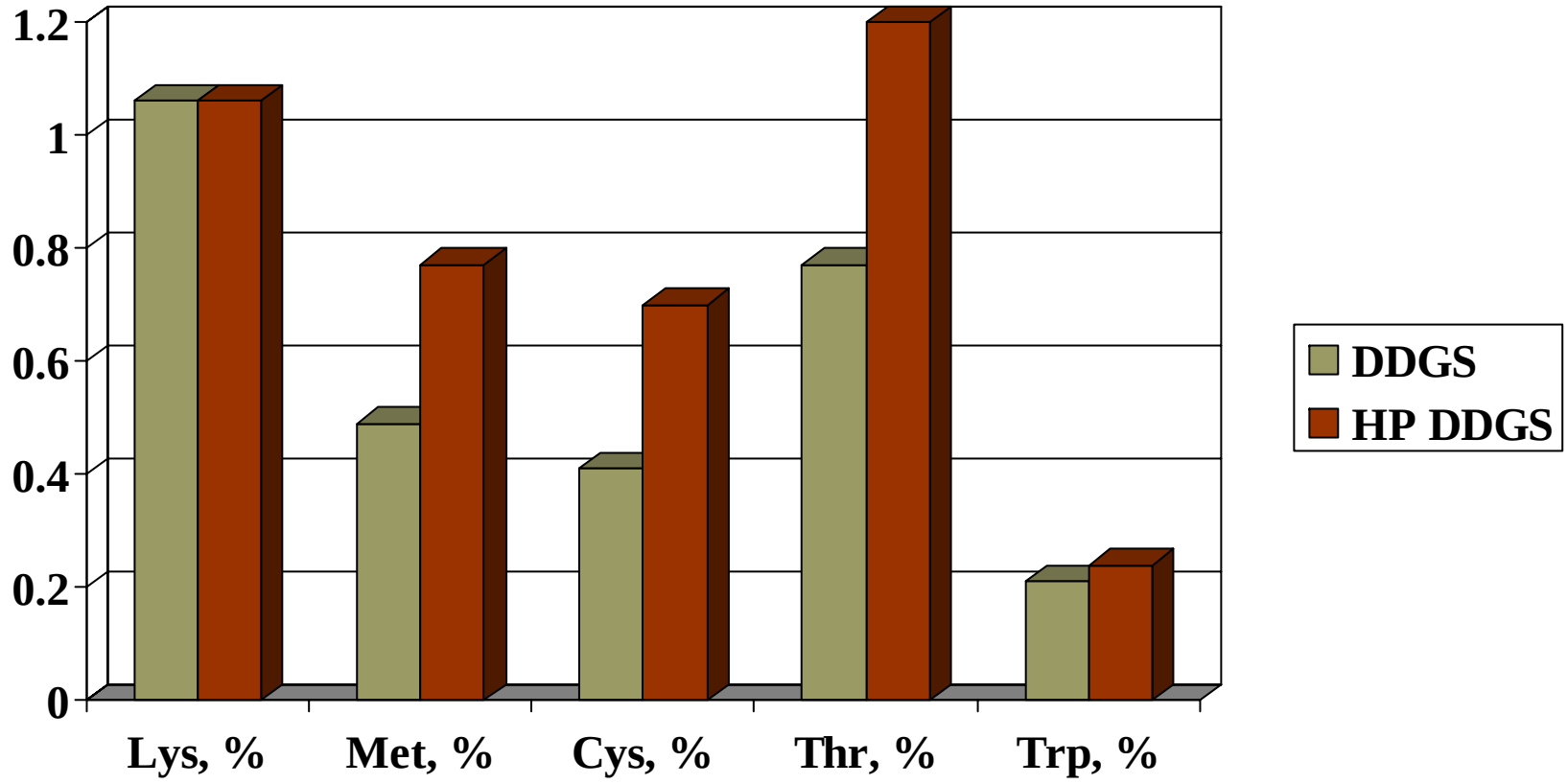
Barriers for Increased DDGS Use in Swine Diets

- Controversy over palatability and negative effects on feed intake at high dietary inclusion rates
- Fast, accurate, and inexpensive *in vitro* methods to estimate amino acid digestibility among sources
- Net energy values
- Need for research and education to avoid confusion over new types of DDGS

Comparison of Nutrient Content of Dakota Gold DDGS with High Protein Dakota Gold (100% DM Basis)



Comparison of Amino Acid Content of Dakota Gold DDGS with High Protein Dakota Gold (100% DM Basis)



Ongoing Research Addressing Key Issues

- Impact of feeding diets containing DDGS with & without phytase on manure P excretion, and P chemistry in manure and soil
  - University of Minnesota
- P digestibility among DDGS sources
  - South Dakota State University
- Amino acid digestibility among a large number of diverse corn and sorghum DDGS sources
  - SDSU and U of MN
- Evaluation of *in vitro* procedures for predicting amino acid digestibility among DDGS sources
  - SDSU and U of MN
- Flowability
  - NCERC – Southern Illinois University – Edwardsville
  - AURI - Minnesota

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

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