KSU Swine Day 2016

K·STATE
Research and Extension

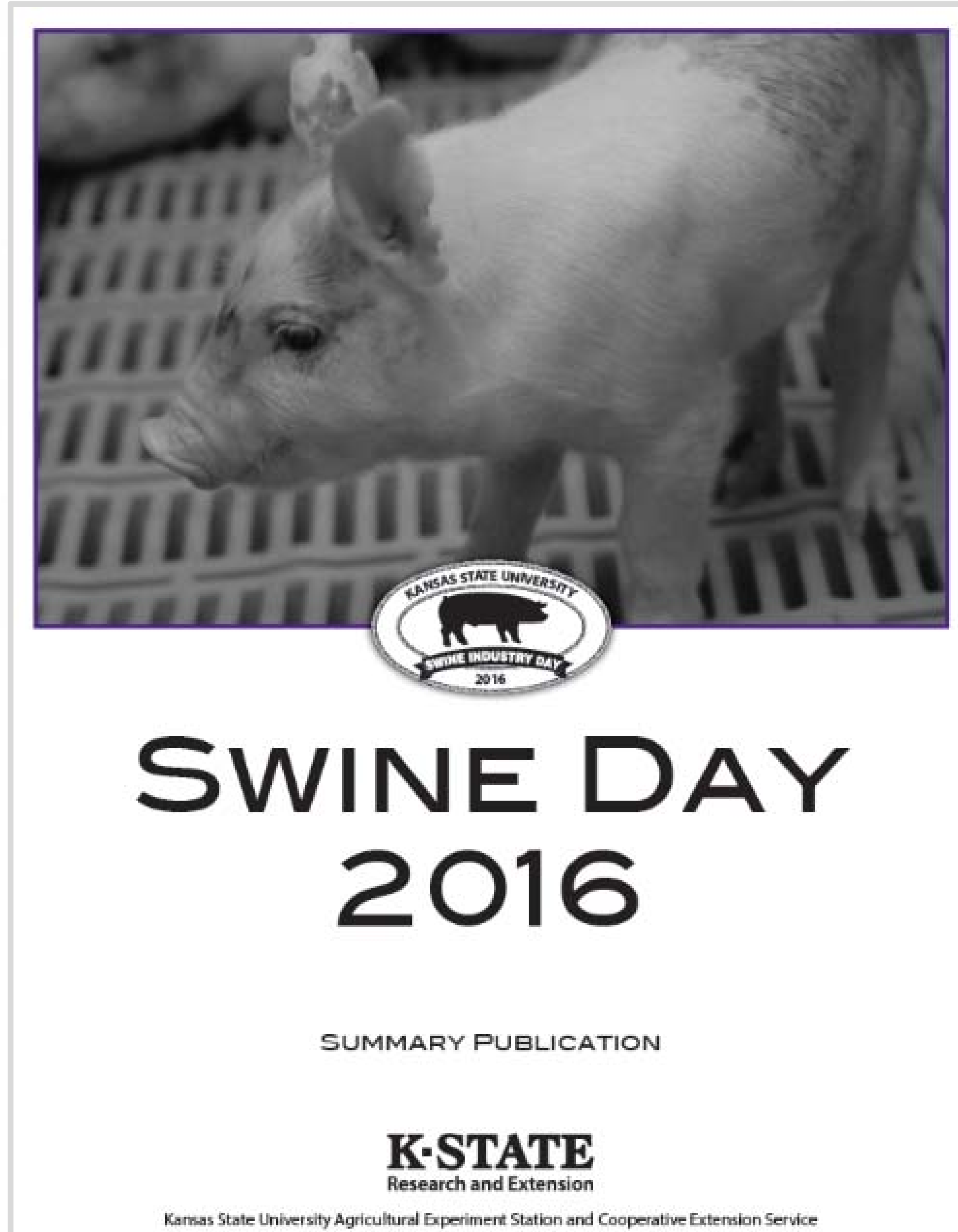
K·STATE
Research and Extension

Knowledge for Life

2016 Swine Day Report

available at:
www.KSUswine.org

- 42 papers
- 47 experiments
- 24,894 pigs



Congratulations!

- Undergraduate Student Achievements
  - Carine Vier - Midwest ASAS 1st oral undergraduate presentation
- Graduate Student Achievements
  - Dr. Jon DeJong - Midwest ASAS Young Scholar
  - Dr. Josh Flohr - Midwest ASAS Young Scholar
  - Annie Clark - Midwest ASAS 1st place MS oral presentation and K-State Donoghue Graduate Scholarship
  - Lori Thomas - 1st place MS poster presentation, Pinnacle Award (International Ingredients Corp.) and Feed Energy Scholarship
  - Jordan Gebhardt - Midwest ASAS 1st place PhD poster presentation

Congratulations!

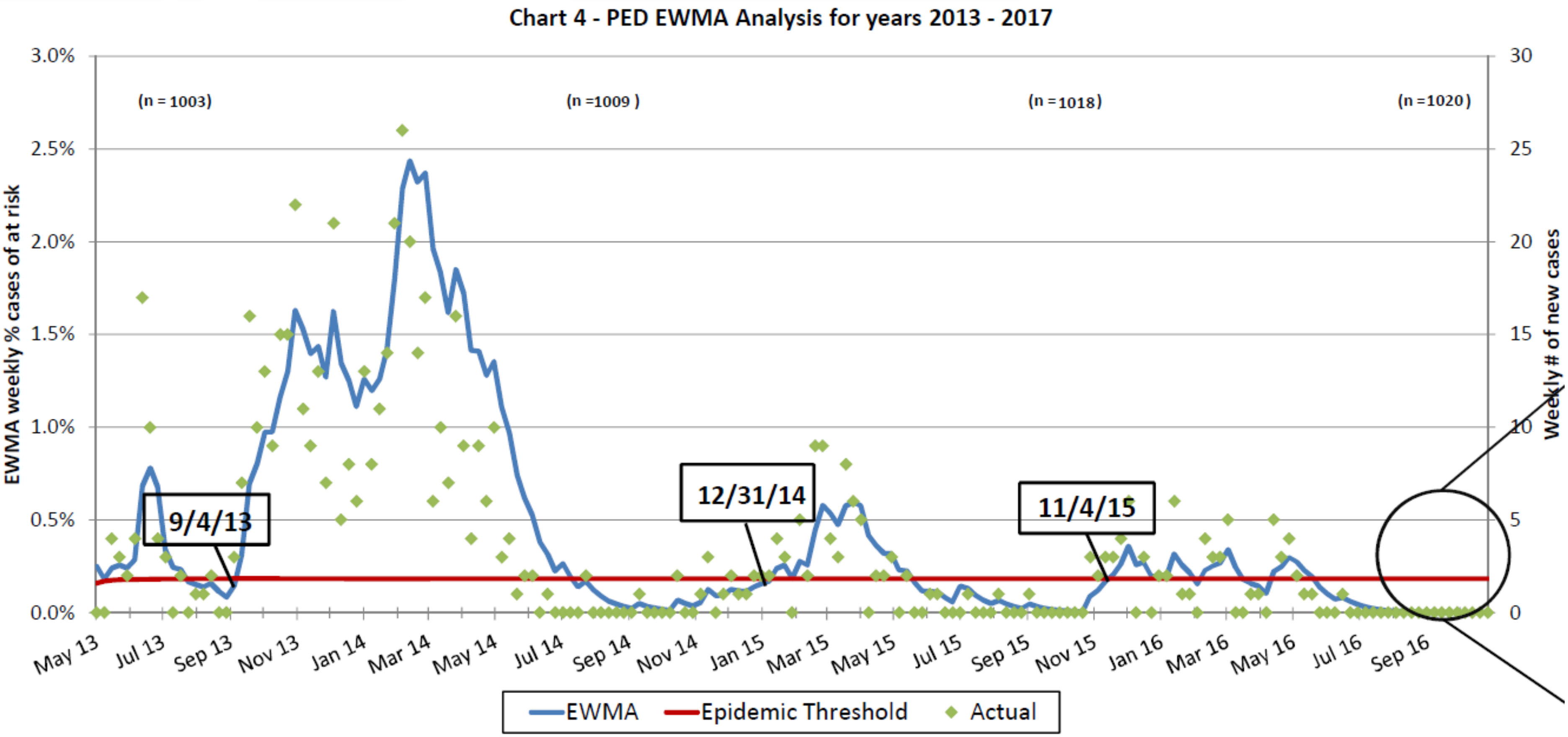
- Graduate Student Achievements
  - Dr. Loni Schumacher, ASAS Midwest NPB Innovation Abstract award
  - Corey Carpenter – K-State Presidential Doctorial Scholarship and Feed Energy Scholarship
  - Rodger Cochrane - K-State Presidential Doctorial Scholarship
  - Arkin Wu - Bob and Karen Thaler Graduate Student Swine Nutrition Scholarship
  - Mariana Menegat – Leman Conference – Best paper award
- Alumni Achievements
  - Casey Neill - ASAS Midwest Early Career Agribusiness Award

Feed Mill Biosecurity

Cassie Jones
Jason Woodworth
Kansas State University

November 17th, 2016
K-State Swine Day

What is the value of safe feed?

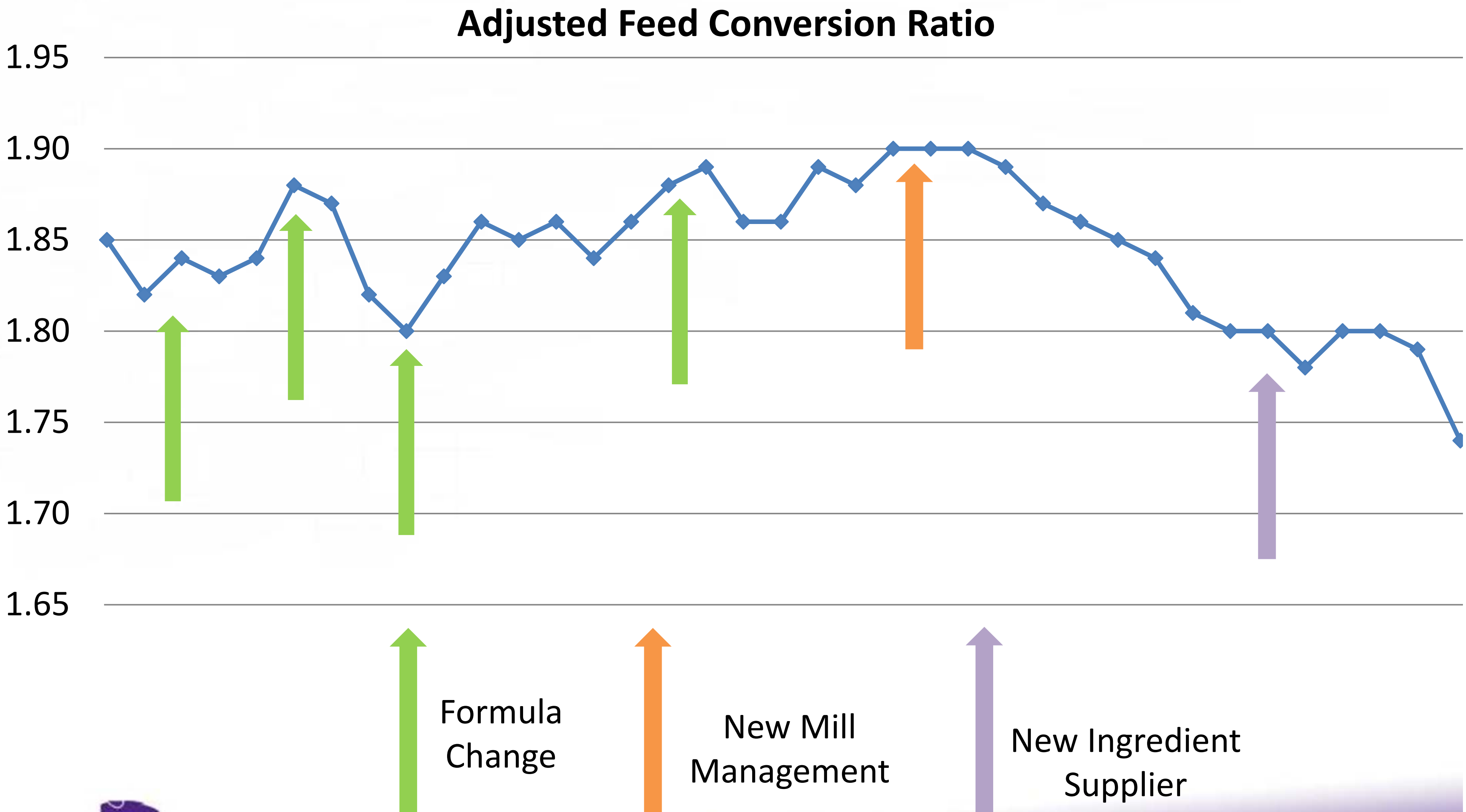


K-STATE Research and Extension

Swine Health Monitoring Project

Knowledge for Life

What is the value of safe feed?



K-STATE Research and Extension

Knowledge for Life

Feed Mill Biosecurity

nppc.org aasv.org pork.org

Swine Health Producer Guide

The Role of PEDV in Feed: Current Knowledge and Understanding

Roger Cochrane and Dr. Cassie Jones, Department of Grain Science and Industry, Kansas State University
Reviewers: Scott Dee, Joel DeRouchey, Steve Dritz, Phillip Gauger, Laura Greiner, Anne Huss, Eric Nelson, Mike Tokach, Henry Turlington, Pedro Urriola, and Jason Woodworth

COMMENTARY PEER REVIEWED

Feed mill biosecurity plans: A systematic approach to prevent biological pathogens in swine feed

Roger A. Cochrane, MS; Steve S. Dritz, DVM, PhD; Jason C. Woodworth, MS, PhD; Charles R. Stark, MS, PhD; Anne R. Huss, MS, PhD; Jean Paul Cano, DVM, PhD; Robert W. Thompson, DVM, MS; Adam C. Fahrenholz, MS, PhD; Cassandra K. Jones, MS, PhD

Summary
Development of a feed mill biosecurity plan

through a number of means, including ingredients, manufacturing equipment, or people, so controls must aim to prevent or reduce

and sanitation procedures. The objective of this review is to describe biological hazards that may be present in swine feed, locations

Feed Mill Biosecurity

Prevention

- Receiving procedures
- Dust control
- Personnel zoning
- Flushing and sequencing

Intervention

- Point-in-time
    - Thermal processing
    - Radiation
- Chemical additive application

Postvention

- Facility decontamination

K·STATE
Research and Extension

Feed Mill Biosecurity

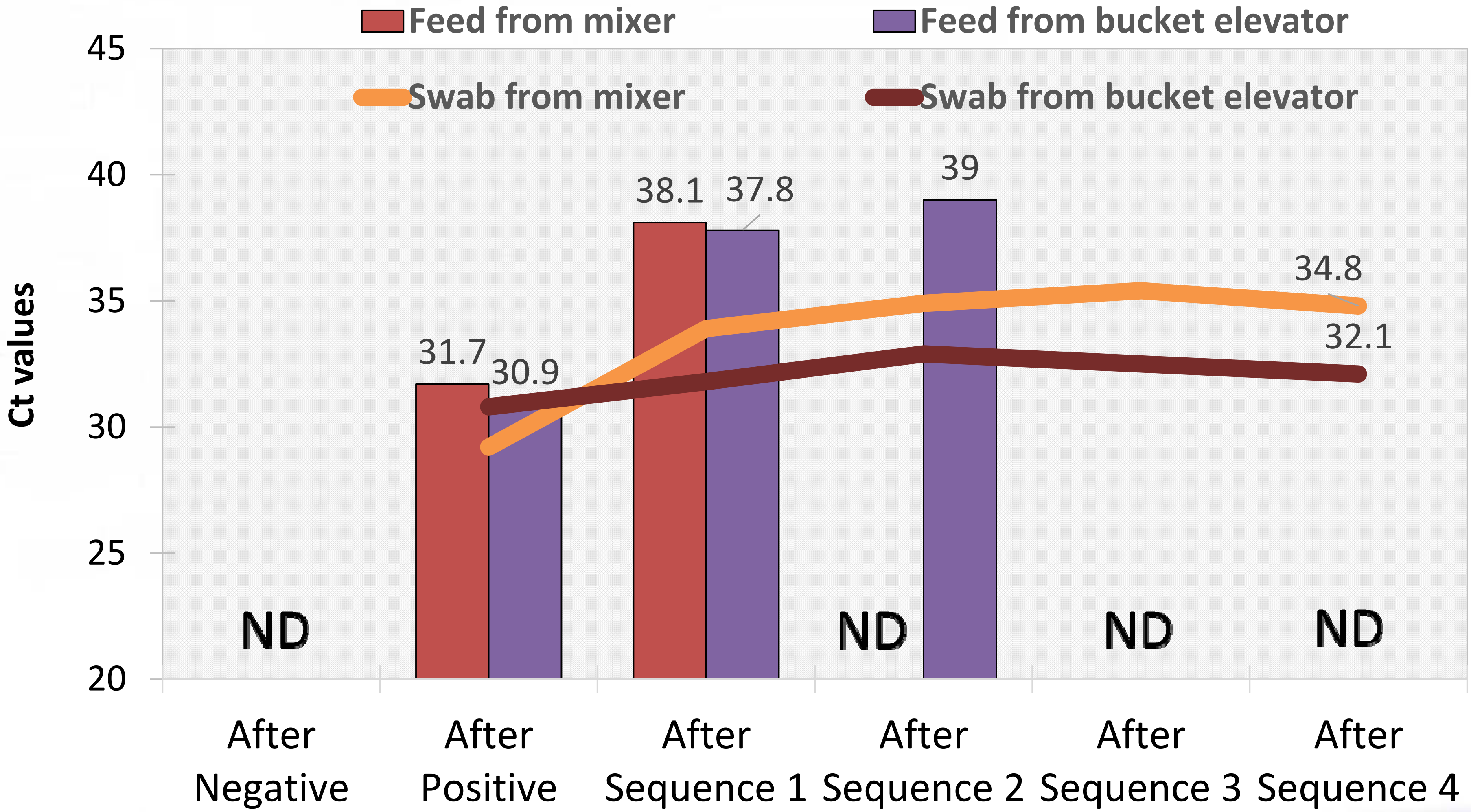
Prevention

- Receiving procedures
- Dust control
- Personnel zoning
- Flushing and sequencing

Feed Mill Biosecurity

- Do <u>NOT</u> add dust back to feed to save on shrink
- Control traffic

Feed and feed equipment surface Ct values



Schumacher et al., 2015

K-STATE Research and Extension

Knowledge for Life

Sequencing to prevent PEDV infectivity

Item	Feed inoculum	0 dpi	2 dpi	4 dpi	6 dpi	7 dpi	7 dpi Cecum
		PEDV detected in pigs, # of pigs					
After non-PEDV feed	Neg	0/9	0/9	0/9	0/9	0/9	0/9
After PEDV feed	Pos	0/9	**9/9**	**9/9**	**9/9**	**9/9**	**9/9**
After Sequence 1	Pos	0/9	**1/9**	**3/9**	**3/9**	**3/9**	**3/9**
After Sequence 2	Neg	0/9	**1/9**	**3/9**	**3/9**	**3/9**	**3/9**
After Sequence 3	Neg	0/9	0/9	0/9	0/9	0/9	0/9
After Sequence 4	Neg	0/9	0/9	0/9	0/9	0/9	0/9

A total of 3 replications/treatment with 3 pigs/replicate

-Sequencing reduced PEDV detection in feed

-However, carry over of infectivity did occur

Flushing to prevent PEDV infectivity

	Rice hull treatment			
Item	Untreated	Formaldehyde	2% MCFA	10% MCFA
Prevalence, % positive				
Negative feed	0/3	NA	NA	NA
Positive feed	3/3	NA	NA	NA
Laboratory scale mixer				
Rice hull flush	3/6	1/6	2/6	0/6
Subsequent feed	0/6	0/6	0/6	0/6
Production scale mixer				
Rice hull flush	NT	NT	NT	0/3
Subsequent feed	NT	NT	NT	0/3
Production scale bucket elevator				
Rice hull flush	NT	NT	NT	1/3
Subsequent feed	NT	NT	NT	0/3

Feed Mill Biosecurity

Intervention

- Point-in-time
  - Thermal processing
  - Radiation
- Chemical additive application

K·STATE Research and Extension

Knowledge for Life

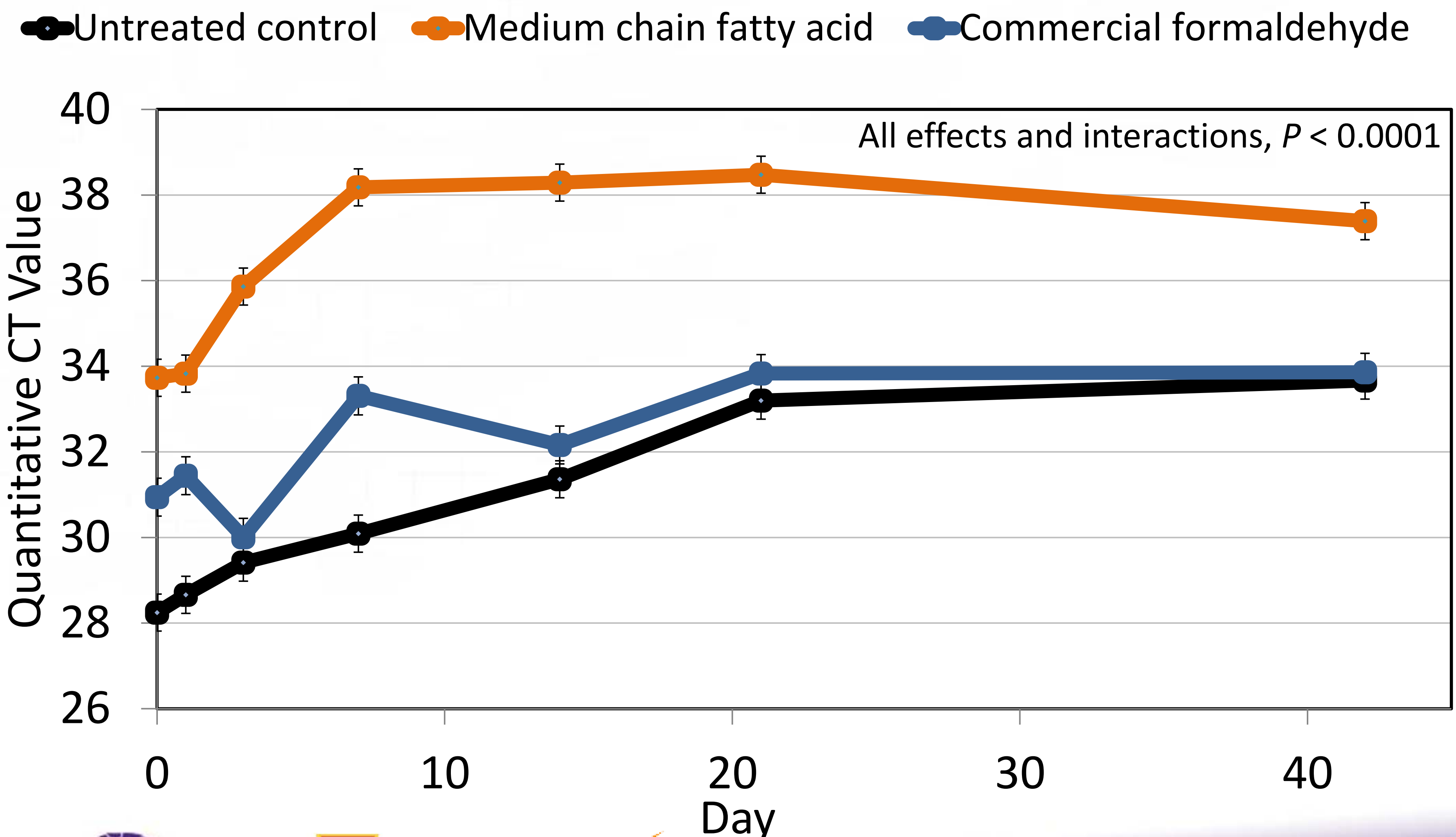
Pelleting to Reduce PEDV

Number of Pigs Infected with PEDV by Bioassay

	Feed	0 dpi	2 dpi	4 dpi	6 dpi	7 dpi	7 dpi Cecum
No PEDV	0	0	0	0	0	0	0
100°F	9/9	0	1/9	3/9	3/9	3/9	3/9
115°F	9/9	0	3/9	3/9	3/9	3/9	3/9
130°F	9/9	0	0	0	0	0	0
145°F	8/9	0	0	0	0	0	0
160°F	8/9	0	0	0	0	0	0

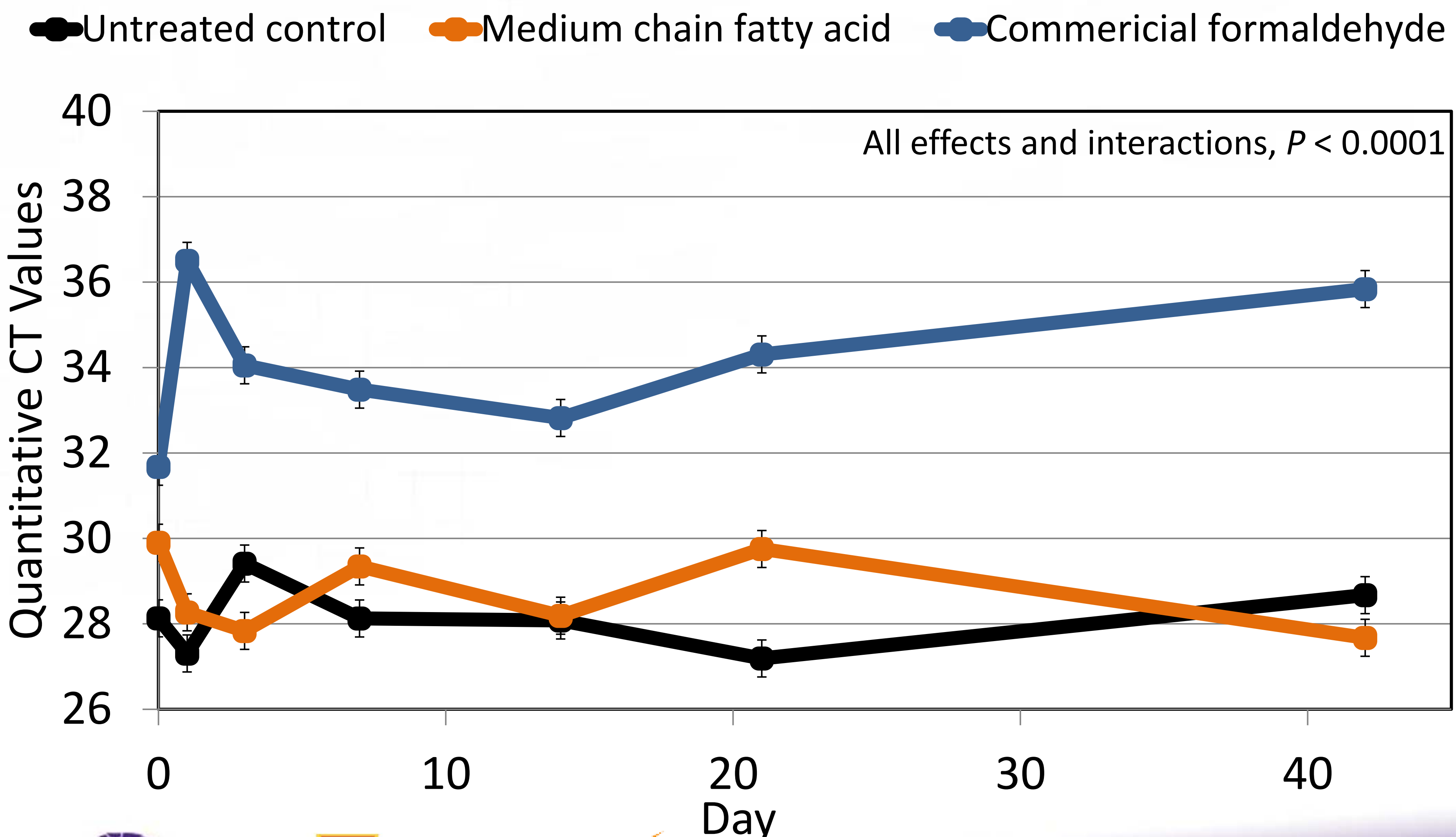
Infectivity developed in diets pelleted below 130°F

Complete Diet



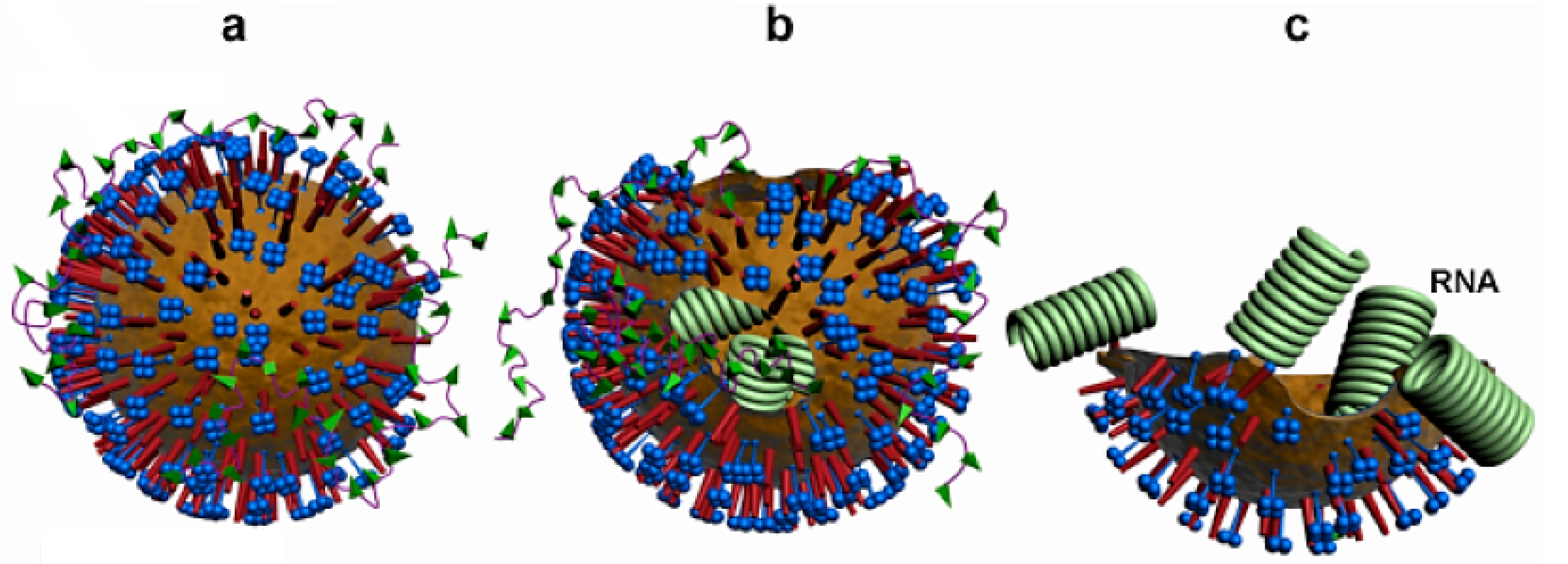
Cochrane et al., 2015

Spray-Dried Animal Plasma

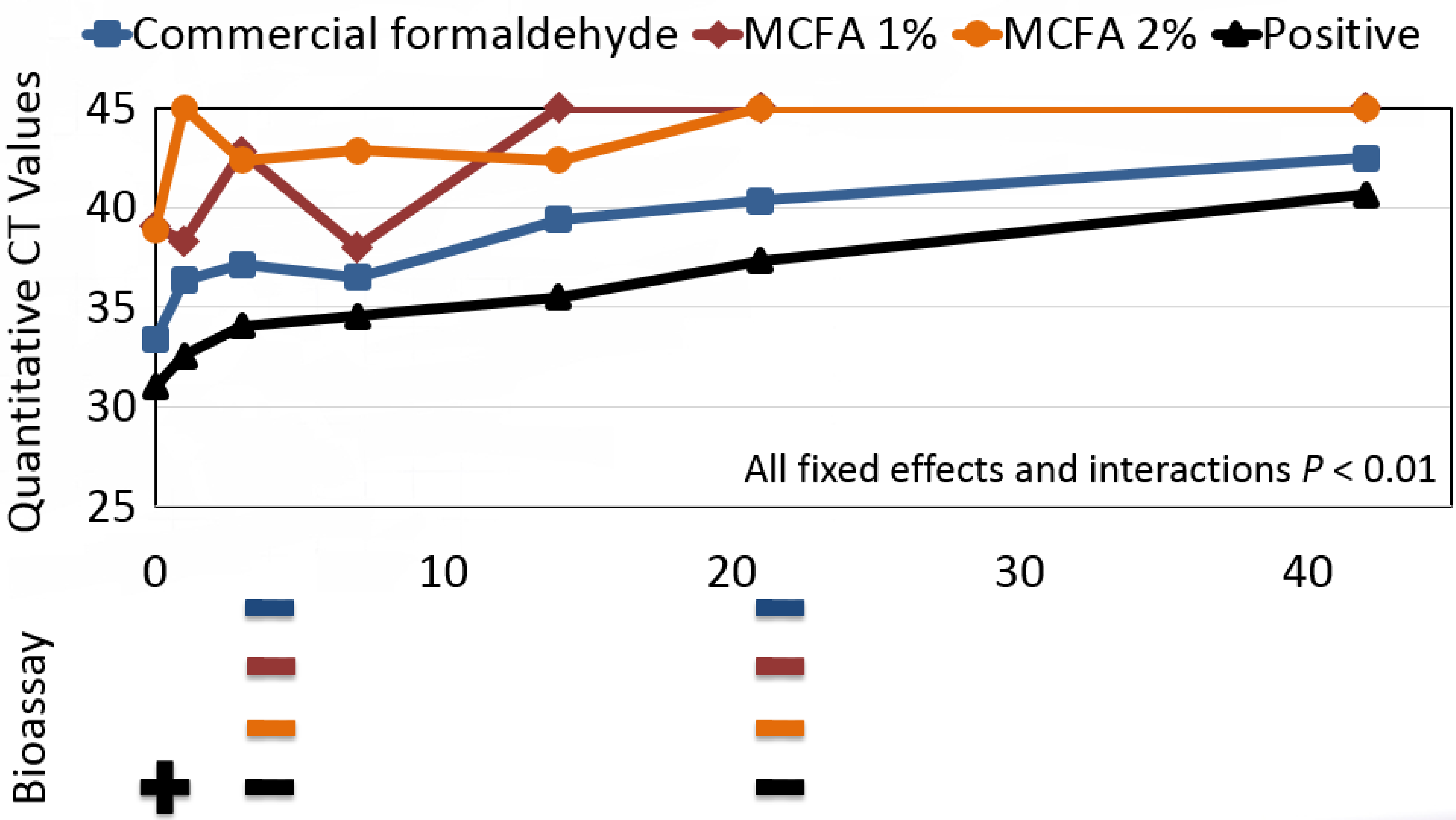


Medium Chain Fatty Acids

- Antiviral properties
  - Bind with cell membrane proteins
  - Incorporation into the cell membrane
  - Causes destabilization of the cell membrane bi-layer



Complete Diet

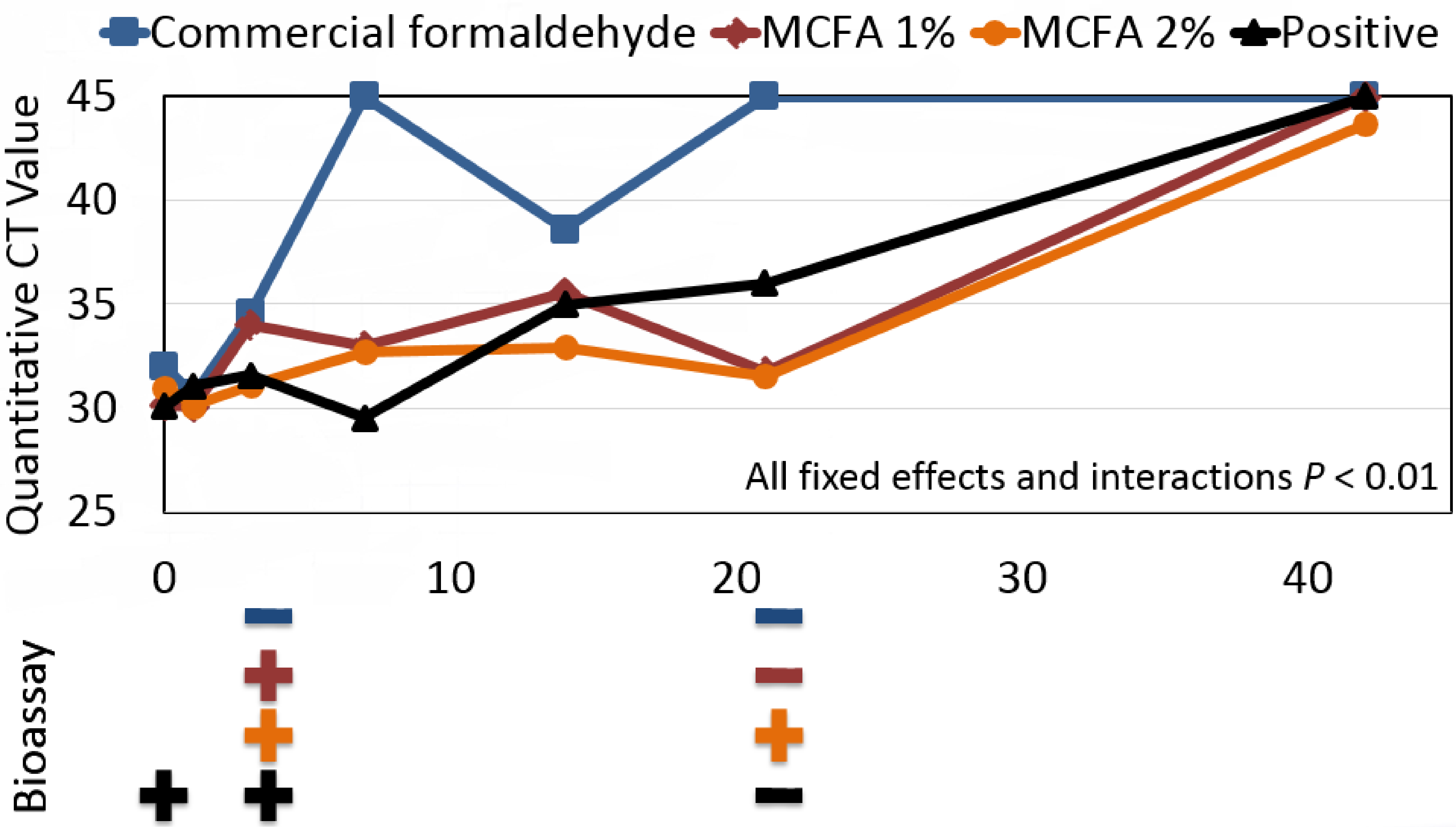


K·STATE Research and Extension

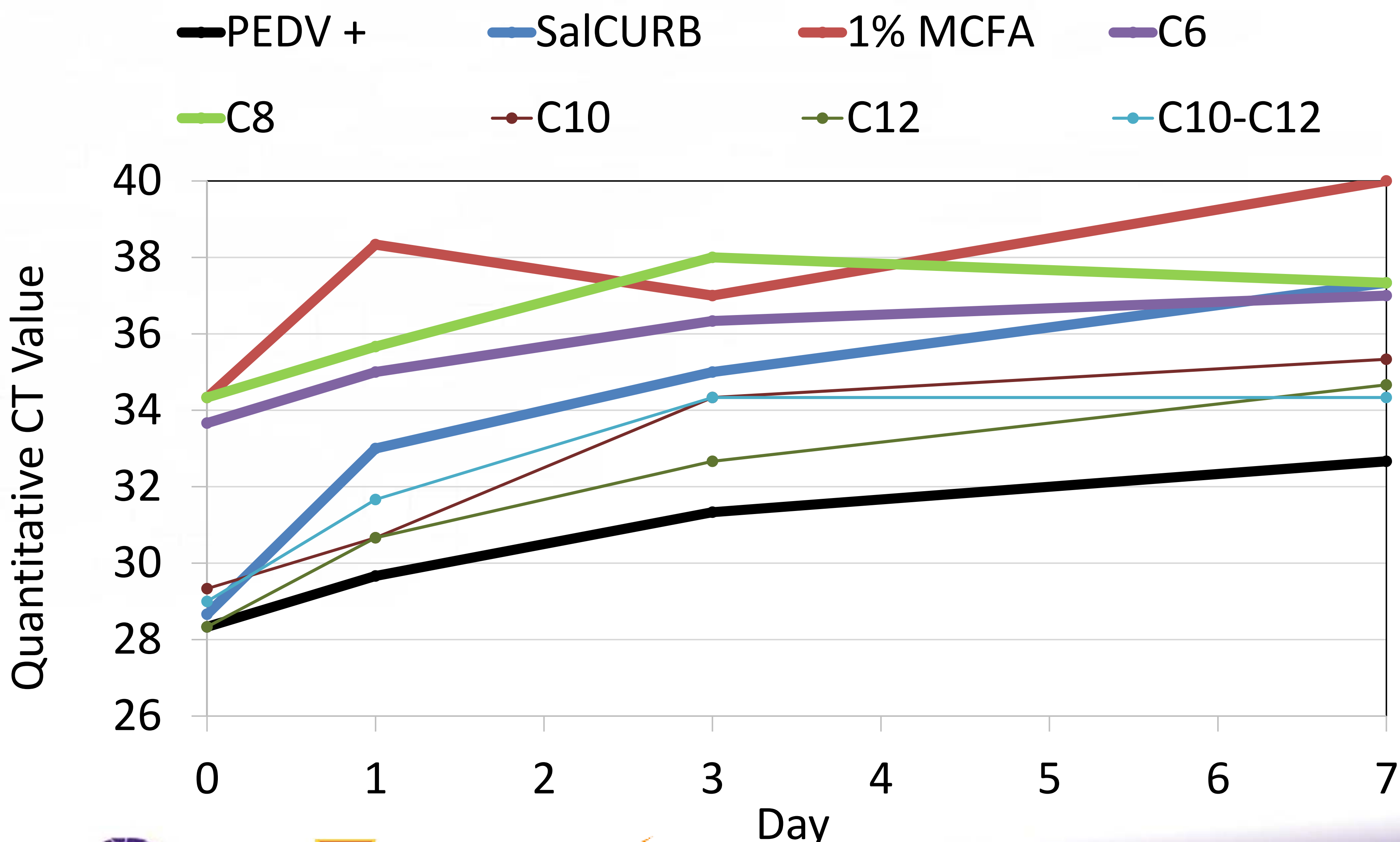
Cochrane et al., 2016

Knowledge for Life

Spray-Dried Animal Plasma



Synthetic MCFA Sources

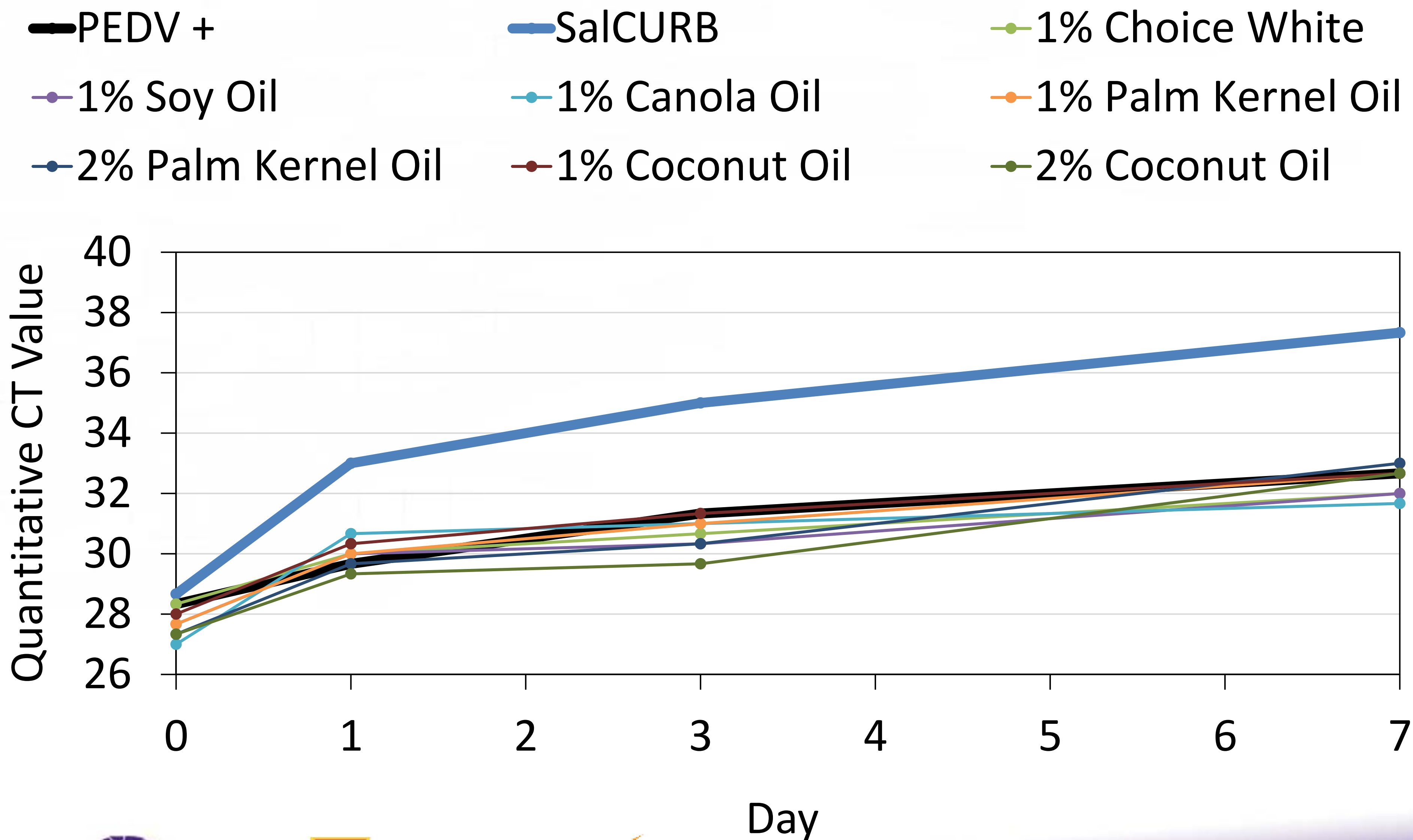


K-STATE Research and Extension

Cochrane et al., 2016

Knowledge for Life

Natural Fat Sources



Cochrane et al., 2016

Knowledge for Life

PEDV Infectivity of Synthetic and Natural Fat Sources

Treatment	CT Value	Infectivity of d 3
PEDV Positive	31	+
SalCURB	35	-
MCFA Blend	37	-
C6	36	-
C8	38	-
C10	34	-
C12	33	+
Palm Kernel Oil	31	+
Coconut Oil	32	+
Choice White	31	+
Soy Oil	30	+
Canola Oil	31	+

No Infectivity until d 7

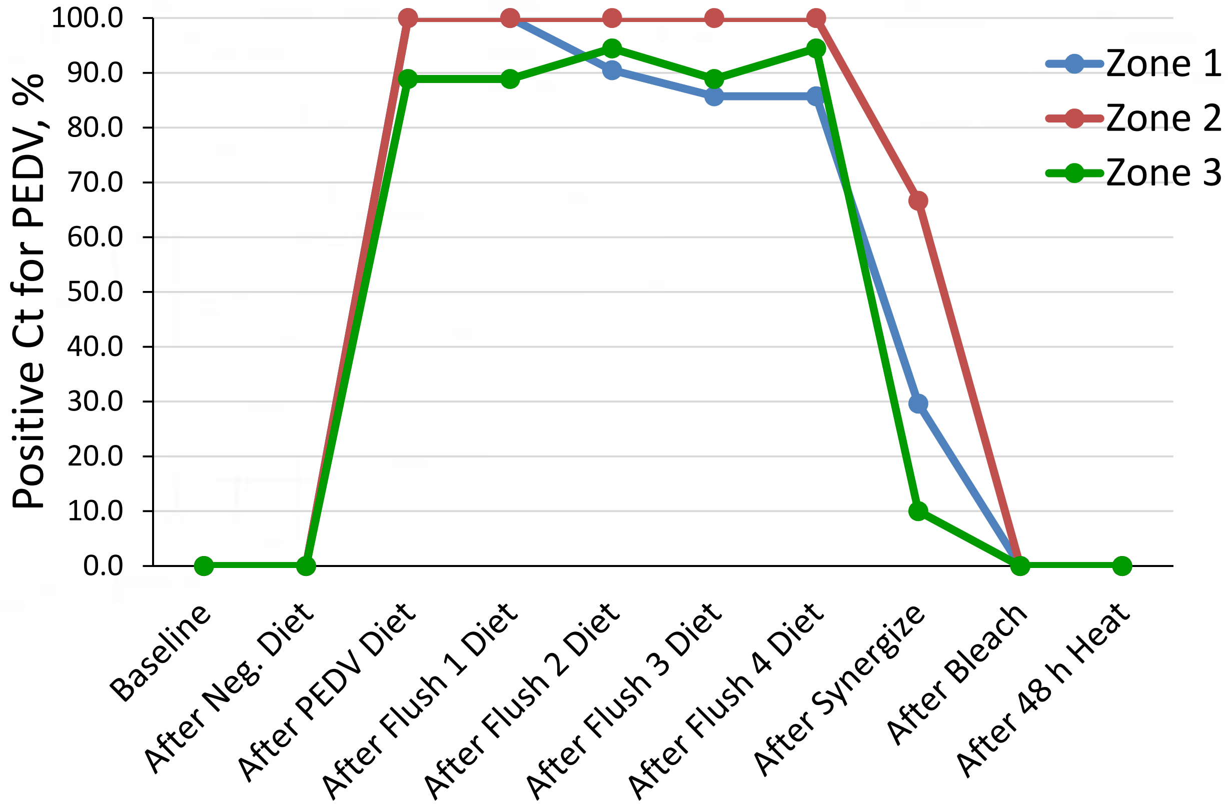
Feed Mill Biosecurity

Postvention

- Facility decontamination

K·STATE
Research and Extension

Environmental contamination after processing PEDV-inoculated feed



Zone 1 = direct feed contact surfaces- equipment interiors
Zone 2 = surfaces directly adjacent to zone 1
Zone 3 = structural surfaces- floors, walls

Schumacher et al., 2015

K·STATE Research and Extension

Knowledge for Life

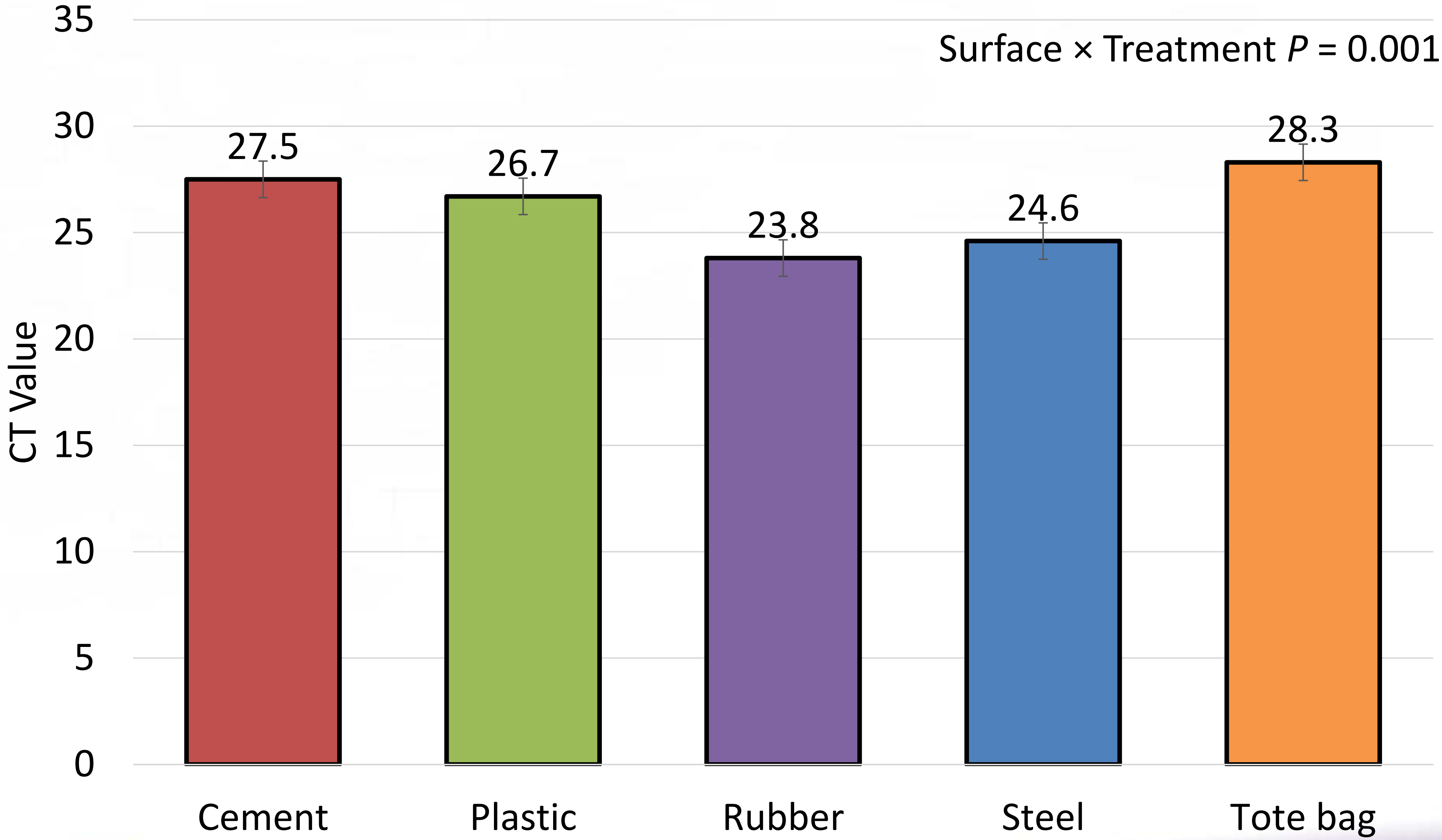
PEDV Decontamination of Surfaces

- Surfaces inoculated with 1 mL liquid PEDV 19338E P8 104 (CT 20.8), dried in biosafety cabinet before treatment application (Bowman et al., 2015)
- 5 Different Surfaces (25.8 cm^2)
- 15 g of dry or 1 mL of liquid applied to surface
- After 15 min, surfaces tapped to remove treatment
- Surface swabbed
- Swabs analyzed via qRT-PCR analysis

Muckey et al., 2016

K·STATE
Research and Extension

Effect of surface type on PEDV (Positive Controls)

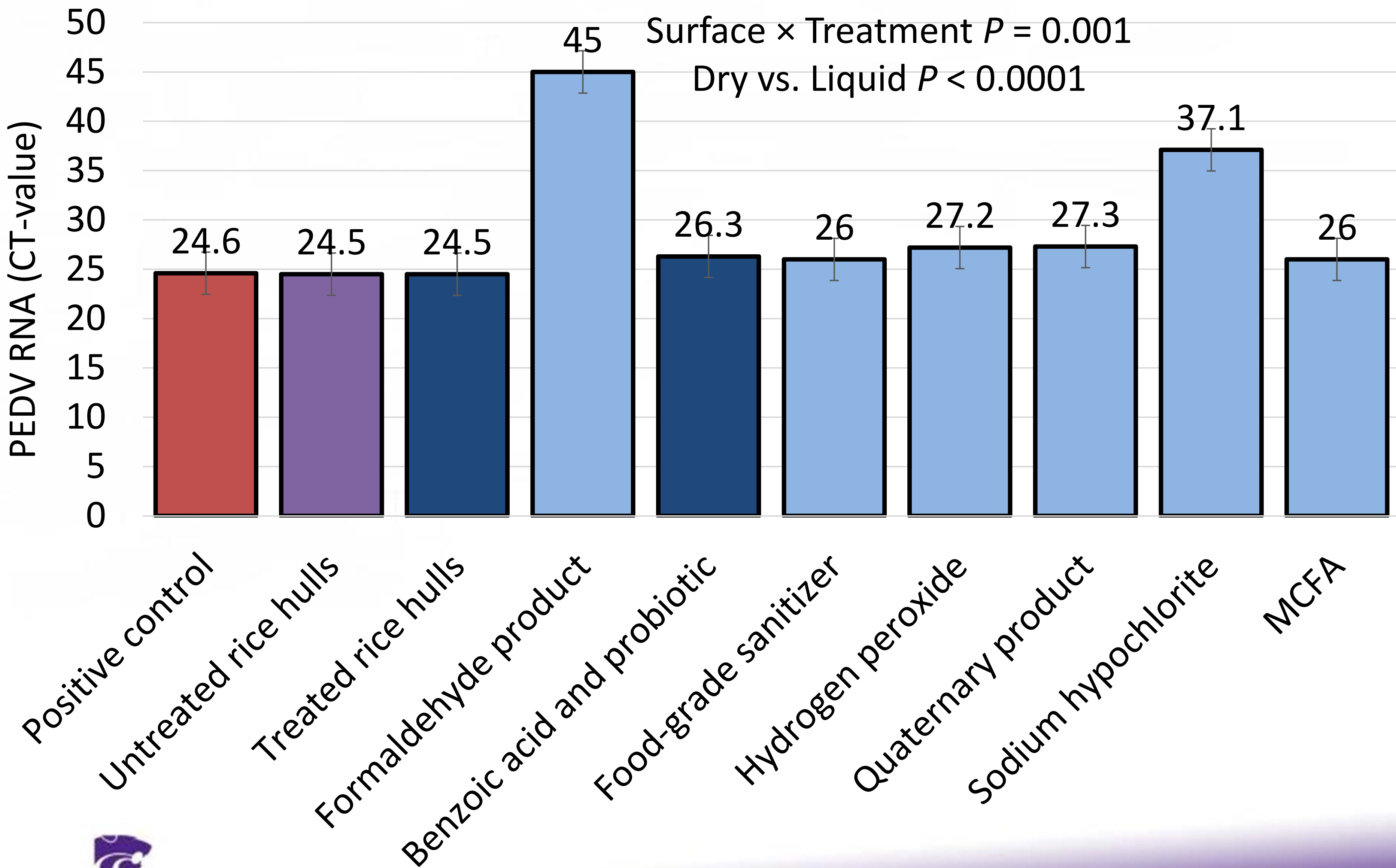


Muckey et al., 2016

K·STATE Research and Extension

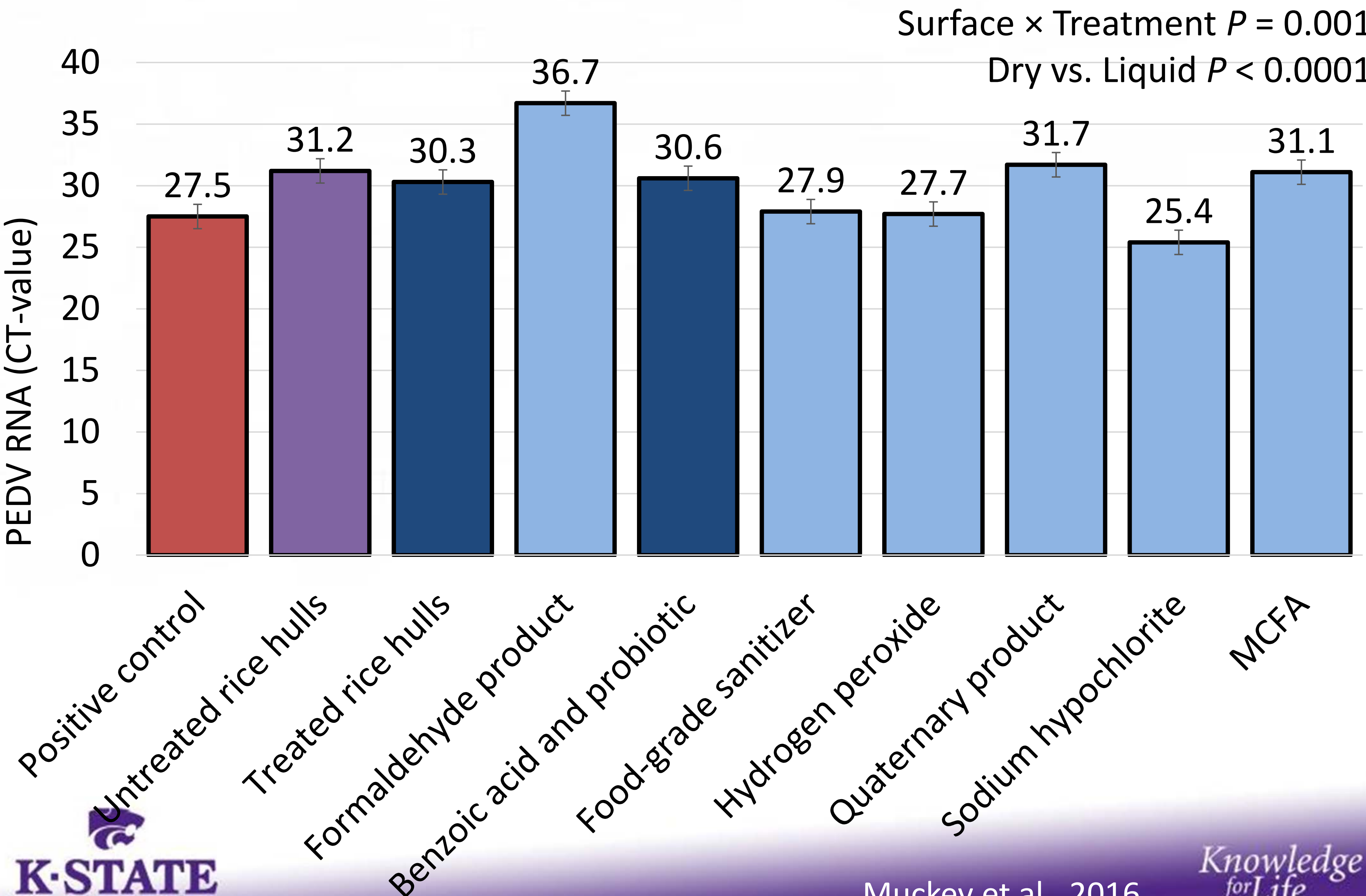
Knowledge for Life

Effect of sanitizer type on steel



Muckey et al., 2016

Effect of sanitizer type on cement



K·STATE Research and Extension

Muckey et al., 2016

Knowledge for Life

Take Home Messages

- Place as many prevention/interventions in feed mills as is economical and practical
  - Receiving procedures
  - Restrict traffic flow
  - Dust control
  - Flushing/sequencing
  - Pelleting
  - Chemical additives (commercial formaldehyde, 1% MCFA)

- Decontamination of mills is a challenge
  - Nearly all surfaces get contaminated by dust
  - Requires liquid sanitizing

Thank You!

COMMENTARY

PEER REVIEWED

Feed mill biosecurity plans: A systematic approach to prevent biological pathogens in swine feed

Roger A. Cochrane, MS; Steve S. Dritz, DVM, PhD; Jason C. Woodworth, MS, PhD; Charles R. Stark, MS, PhD; Anne R. Huss, MS, PhD; Jean Paul Cano, DVM, PhD; Robert W. Thompson, DVM, MS; Adam C. Fahrenholz, MS, PhD; Cassandra K. Jones, MS, PhD

Summary

Development of a feed mill biosecurity plan can minimize risk of introduction of biologic hazards and limit potential economic losses from animal or human pathogens such as *Salmonella* and porcine epidemic diarrhea virus. A biosecurity plan should be detailed and contain hazard controls at each step of the manufacturing process. Biologic hazards can cause illness or injury in humans or animals. These hazards can be introduced through a number of means, including ingredients, manufacturing equipment, or people, so controls must aim to prevent or reduce their prevalence. The Food Safety Modernization Act requires most feed mills to identify and control hazards. A biosecurity plan can serve as an effective prerequisite program to reduce the likelihood of a biological hazard occurrence by identifying ingredient specifications, sampling methods, analytical procedures, receiving guidelines, equipment cleanout, production parameters, load-out, and sanitation procedures. The objective of this review is to describe biological hazards that may be present in swine feed, locations of their potential entry, and suggested practices for a successful biosecurity plan for feed mills manufacturing swine feed.

Keywords: swine, feed, biosecurity, hazard analysis, pathogen control

Received: October 26, 2015
Accepted: December 2, 2015

May/June 2016

Journal of Swine Health and Production

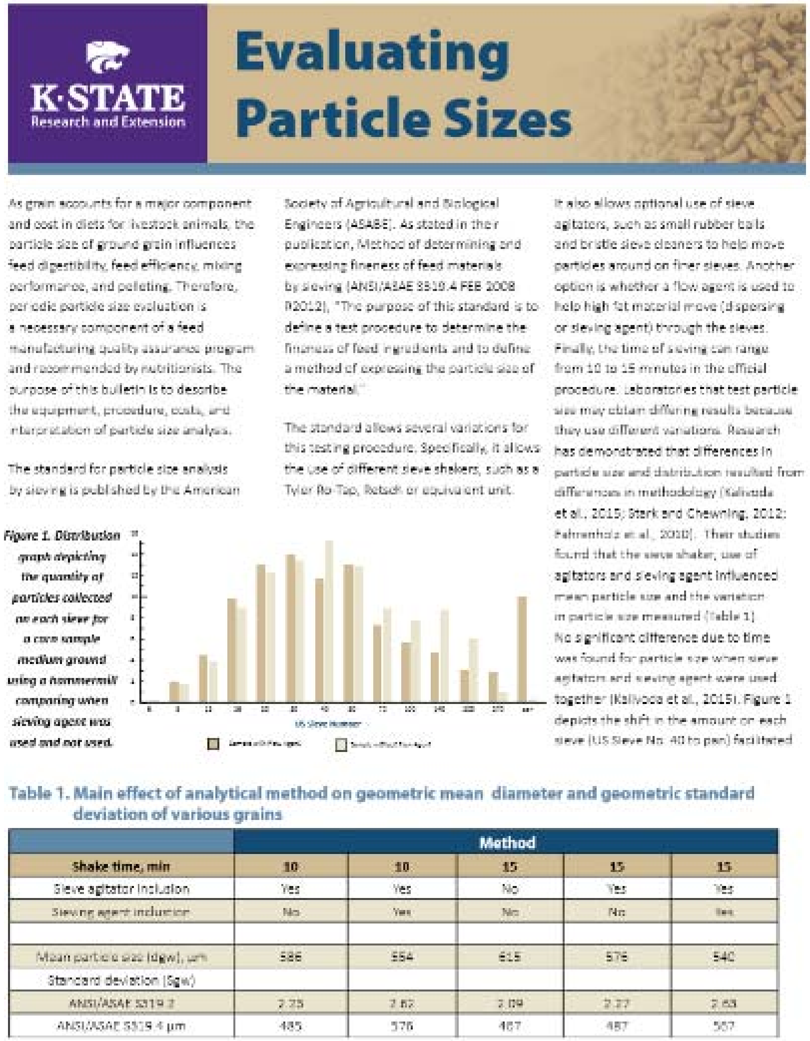
K·STATE
Research and Extension

Knowledge *for* Life

Feed Mill Quality Control
Particle Size Analysis
Uniformity of Mix

Charles Stark

New Extension Bulletin


K-STATE Research and Extension

Evaluating Particle Sizes

As grain accounts for a major component and cost in diets for livestock animals, the particle size of ground grain influences feed digestibility, feed efficiency, mixing performance, and pelleting. Therefore, periodic particle size evaluation is a necessary component of a feed manufacturing quality assurance program and recommended by nutritionists. The purpose of this bulletin is to describe the equipment, procedure, costs, and interpretation of particle size analysis.

The standard for particle size analysis by sieving is published by the American Society of Agricultural and Biological Engineers (ASABE). As stated in their publication, Method of determining and expressing fineness of feed materials by sieving (ANSI/ASAE S319.4 FEB 2008 R2012), "The purpose of this standard is to define a test procedure to determine the fineness of feed ingredients and to define a method of expressing the particle size of the material."

The standard allows several variations for this testing procedure. Specifically, it allows the use of different sieve shakers, such as a Tyler Ro-Tap, Retsch or equivalent unit. It also allows optional use of sieve agitators, such as small rubber balls and bristle sieve cleaners to help move particles around on finer sieves. Another option is whether a flow agent is used to help high fat material move (dispersing or sieving agent) through the sieves. Finally, the time of sieving can range from 10 to 15 minutes in the official procedure. Laboratories that test particle size may obtain differing results because they use different variations. Research has demonstrated that differences in particle size and distribution resulted from differences in methodology (Kalivoda et al., 2015; Stark and Chewning, 2012; Fahrenholz et al., 2010). Their studies found that the sieve shaker, use of agitators and sieving agent influenced mean particle size and the variation in particle size measured (Table 1). No significant difference due to time was found for particle size when sieve agitators and sieving agent were used together (Kalivoda et al., 2015). Figure 1 depicts the shift in the amount on each sieve (US Sieve No. 40 to pan) facilitated

Figure 1. Distribution graph depicting the quantity of particles collected on each sieve for a corn sample medium ground using a hammermill comparing when sieving agent was used and not used.

Table 1. Main effect of analytical method on geometric mean diameter and geometric standard deviation of various grains

	Method				
Shake time, min	**10**	**10**	**15**	**15**	**15**
Sieve agitator inclusion	Yes	Yes	No	Yes	Yes
Sieving agent inclusion	No	Yes	No	No	Yes
Mean particle size (dgw), μm	586	554	615	576	540
Standard deviation (Sgw)					
ANSI/ASAE S319.2	2.75	2.62	2.09	2.27	2.63
ANSI/ASAE S319.4 μm	485	576	467	487	567

Recommendations:

- Sieve agitators
- Dispersing/Flow agent
- 10 minutes sieving time

Available at:

www.KSUswine.org

Particle Size Analysis - Method

- ANSI/ASAE Method S319.4 (2012)
  "Method of determining and expressing fineness of feed materials by sieving"
- Procedure:
  - 100 ± 5 gram sample
  - Ro-tap for 15 minutes (10 minutes S319.2)
- Sieving agents (options)
  - Sieve agitators
  - Dispersing or flow agents
- d_{gw} – geometric mean diameter
  - Units = microns
- S_{gw} – geometric standard deviation
  - No units - S319.2
  - Microns – S319.4

Particle Size Analysis

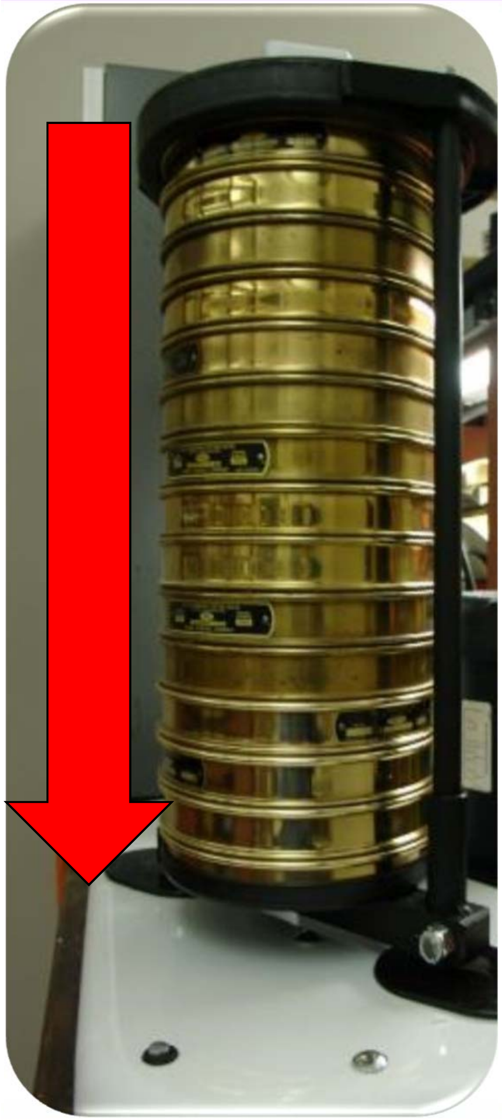
Step #1 Split Sample

Step #2 Weigh 100 g

Step #3 Rotap 15min

Step #4 Record Weight on Sieve

Ro-Tap Machine



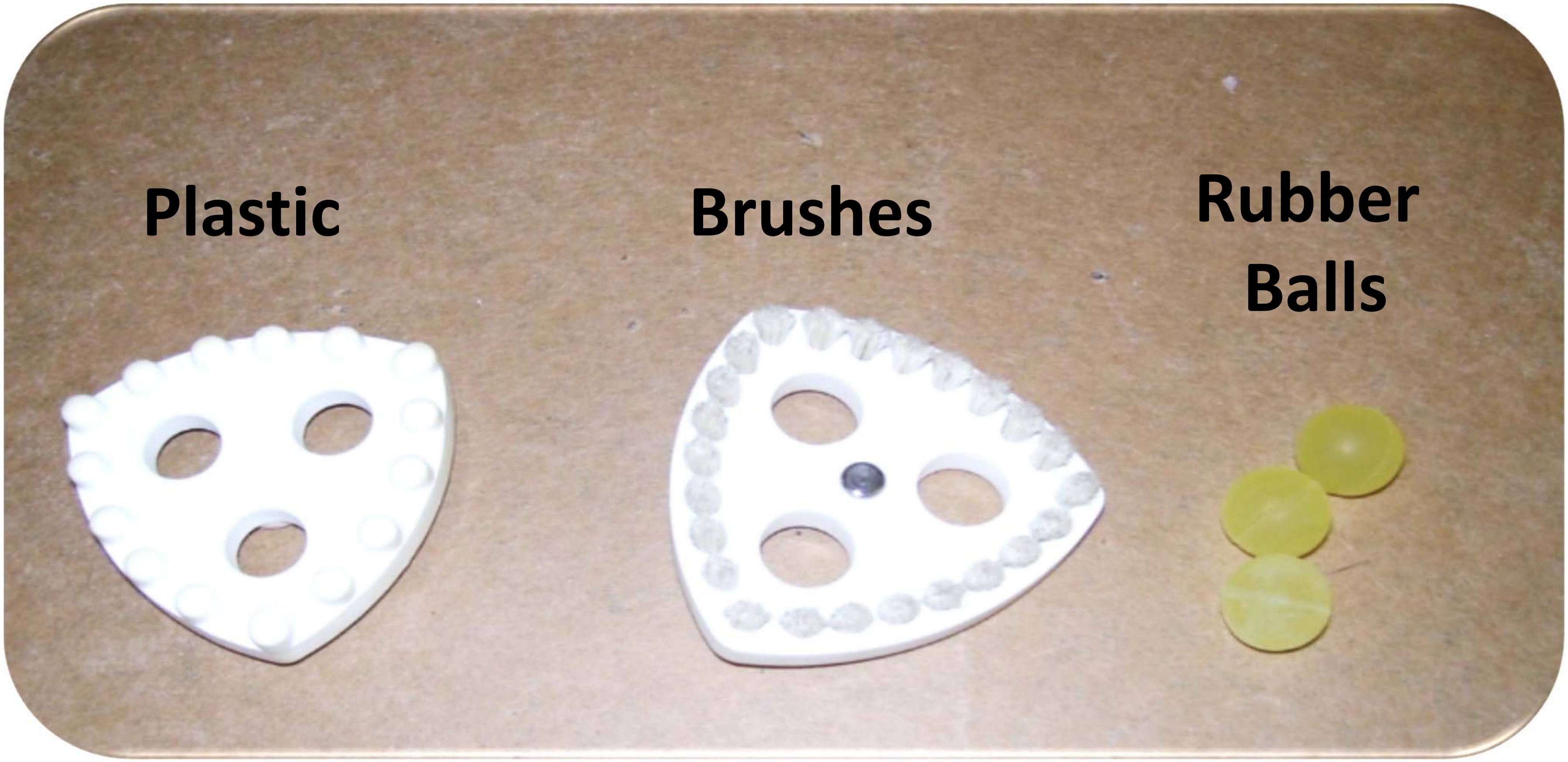
- Bar taps while circularly rotating
- Screen size opening decreases from top to bottom in sieve stack
- Particles continue moving down sieve stack until the sieve opening is smaller than the particle

Sieve and Sieve Agitator Arrangement

U.S. Sieve No.	Sieve Opening (µm)	Sieve Agitator(s)
6	3360	None
8	2380	None
12	1680	Three Rubber Balls
16	1190	Three Rubber Balls
20	841	Three Rubber Balls
30	595	One Rubber Ball; One Brush Agitator
40	420	One Rubber Ball; One Brush Agitator
50	297	One Rubber Ball; One Brush Agitator
70	210	One Rubber Ball; One Brush Agitator
100	149	One Brush Agitator
140	105	One Brush Agitator
200	74	One Brush Agitator
270	53	One Brush Agitator
Pan	-	None

Goodband et al. (2006)

Sieve Agitator



Method Options

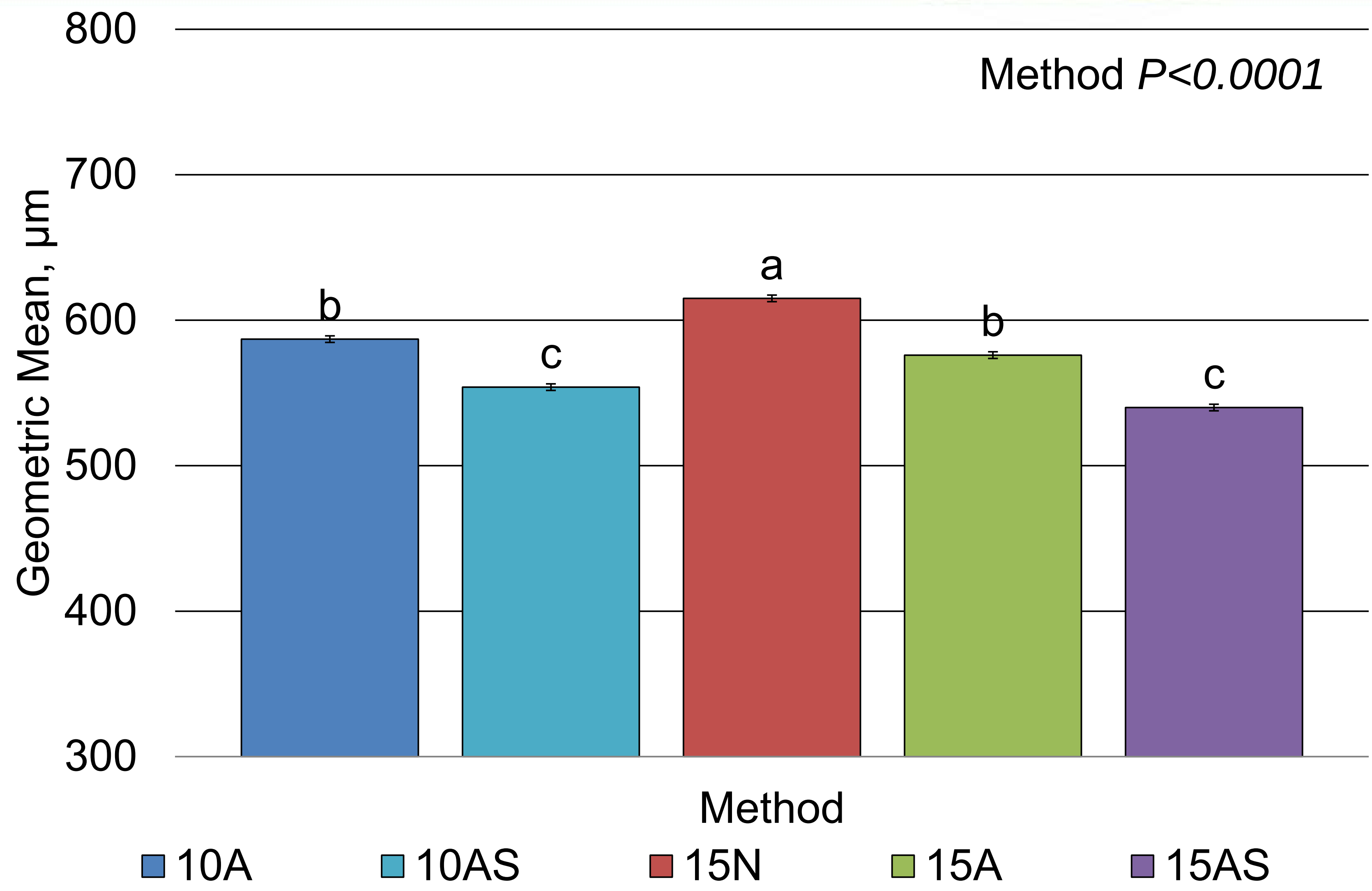
Sieve Agitator

Dispersing/Flow Agent

Effect of No Dispersion/Flow Agent

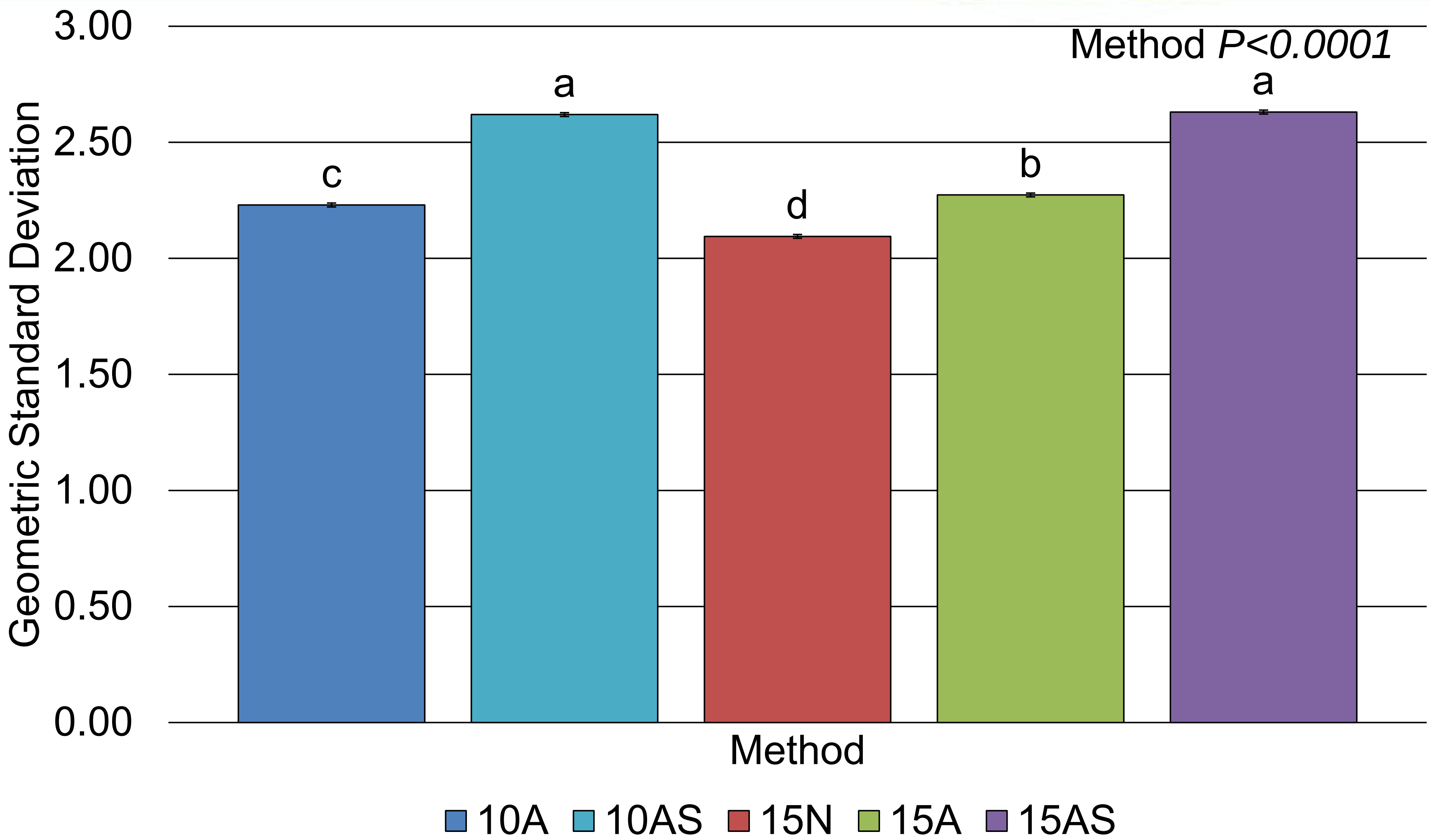
Kalivoda, 2015

Means for Particle Size



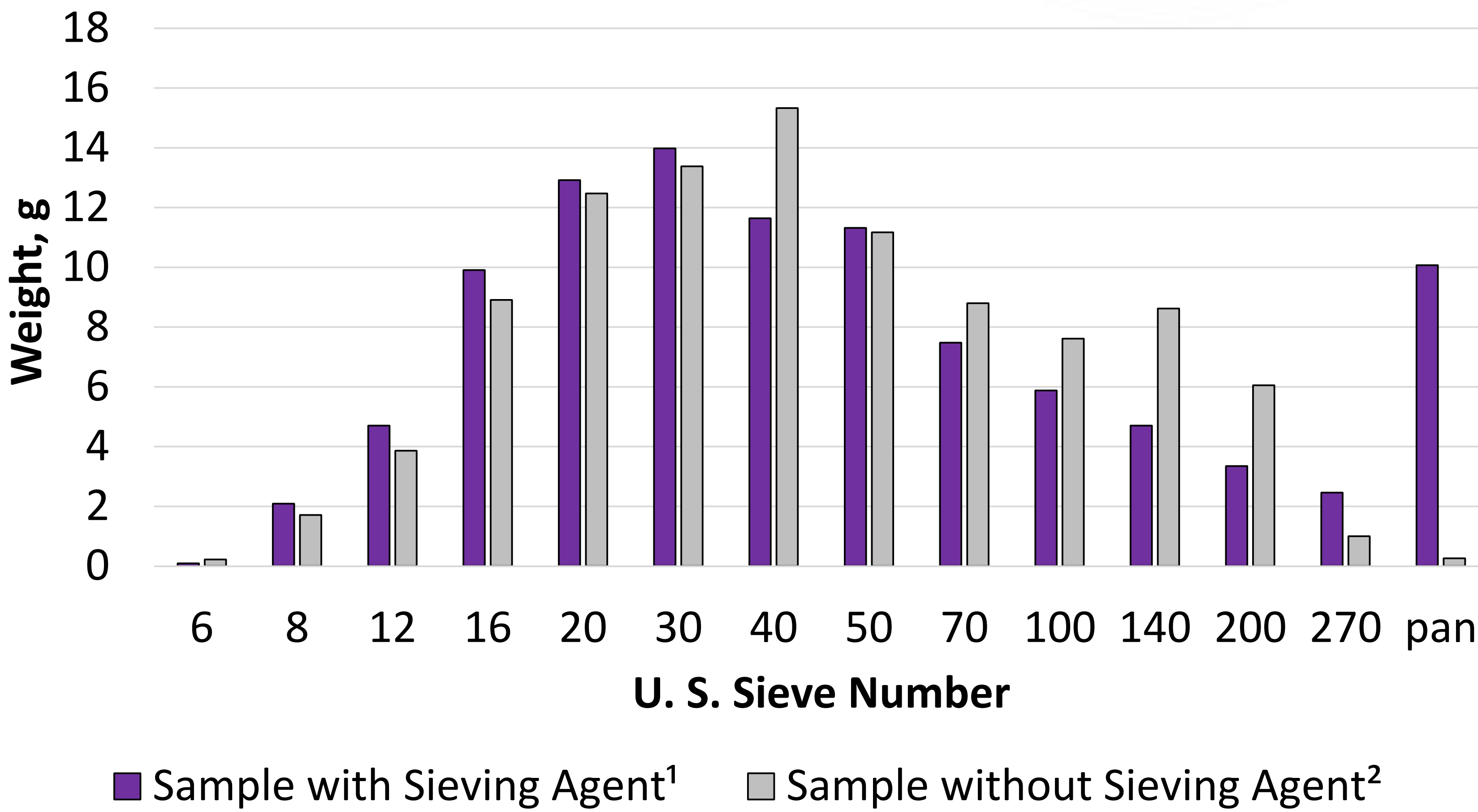
Kalivoda, 2015

Means for Standard Deviation



Kalivoda, 2015

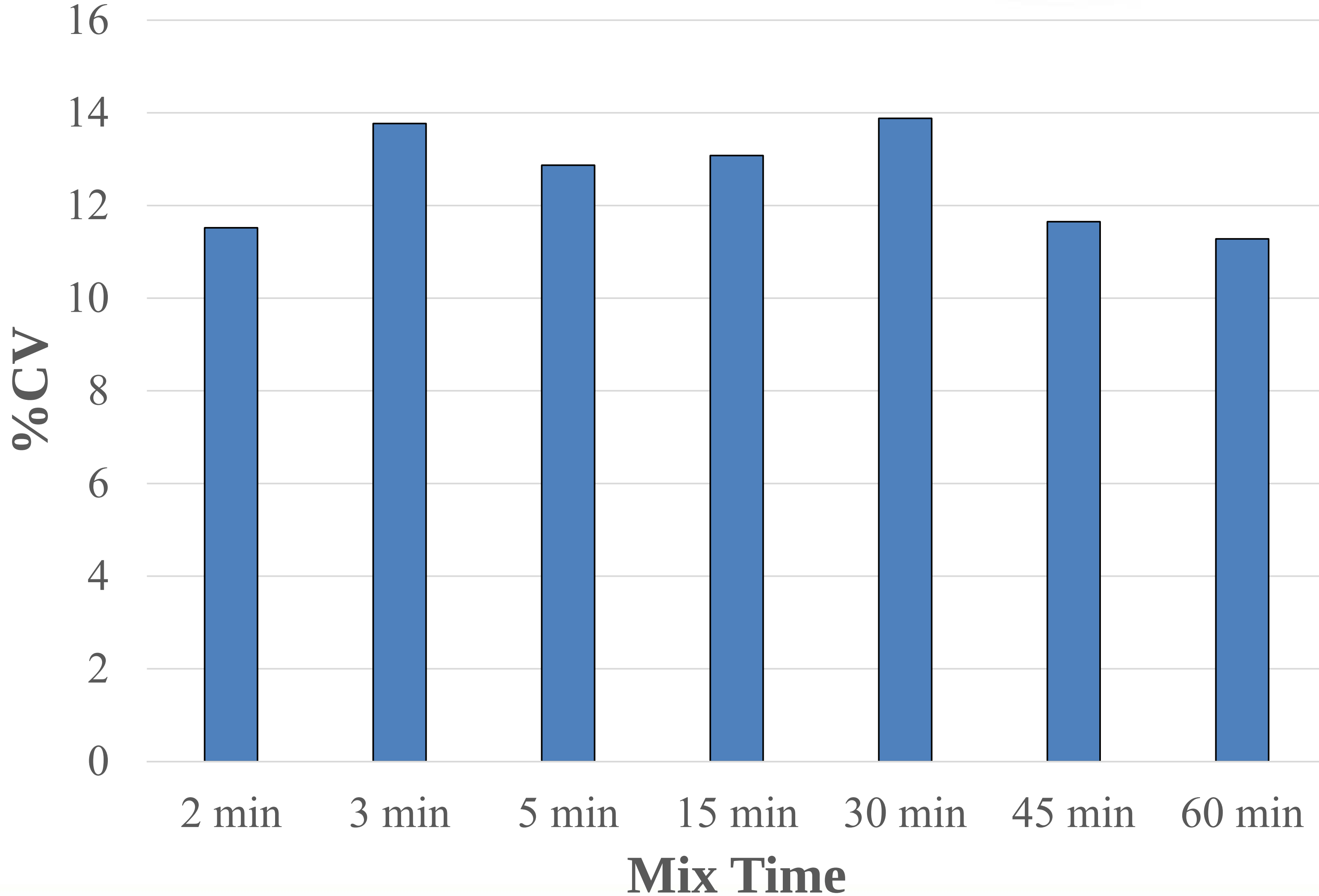
Sample Distribution



[1]dgw: 402 µm; Sgw (S319.2): 3.11; Sgw (S319.4): 561 µm;

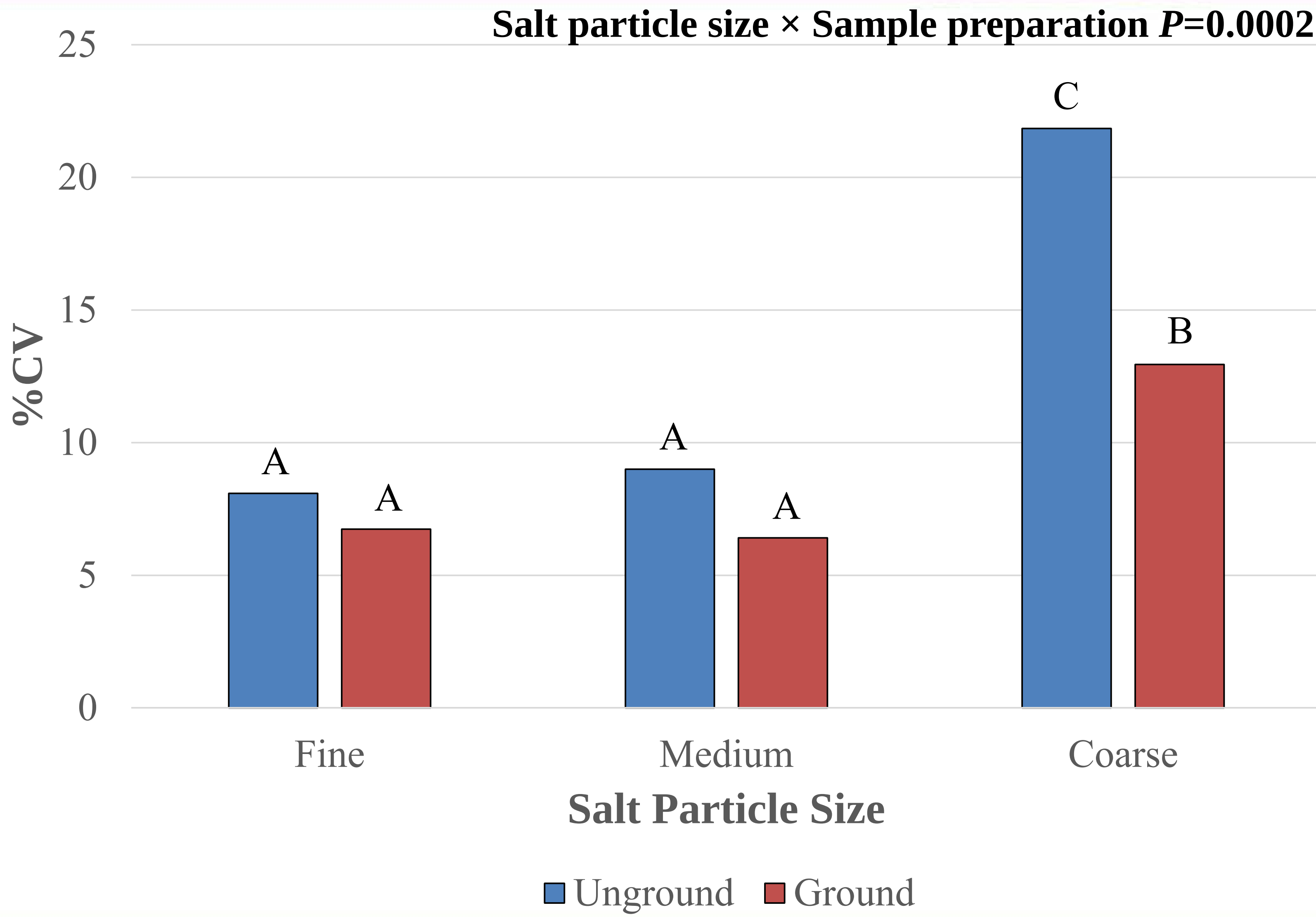
[2]dgw: 448 µm; Sgw (S319.2): 2.50; Sgw (S319.4): 470 µm;

Results of Mix Time



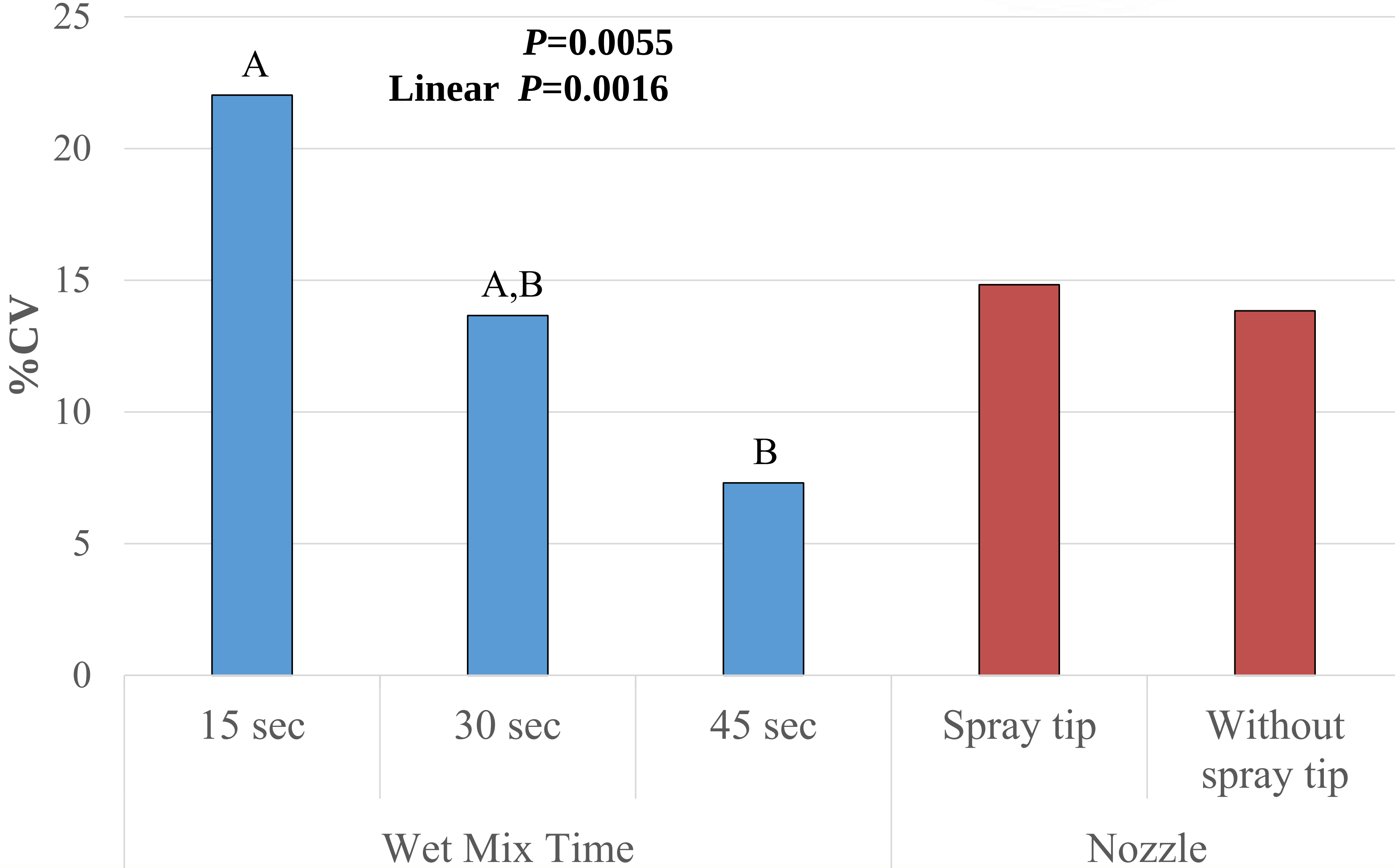
Saensukjaroenphon, 2016

Results of Salt Particle Size and Sample Preparation



Saensukjaroenphon, 2016

Results of Wet Mix Time and Nozzle



Saensukjaroenphon, 2016

Electronic Sow Feeding

K·STATE
Research and Extension

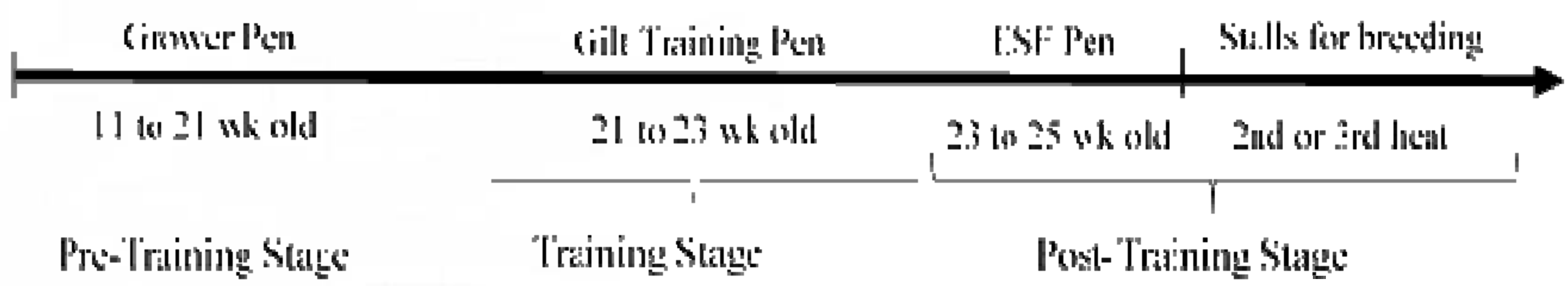
PIC

THOMAS LIVESTOCK CO.
T.L.C.
Creating Community Opportunities

Knowledge for Life

Objective: Training gilts and sows to use electronic sow feeders

Graduate Student: Carine Vier


Grower Pen
Gilt Training Pen
ESF Pen
Stalls for breeding
11 to 21 wk old
21 to 23 wk old
23 to 25 wk old
2nd or 3rd heat
Pre-Training Stage
Training Stage
Post-Training Stage

Pre-training Pen Set-up

Young gilts are exposed to the process of going through a feeding station in order to eat

Knowledge for Life

Training Pen. Gate similar to ESF. Left entrance gate open at 45° angle.

Objective: Evaluate the feed efficiency of gilts and sows under commercial conditions and their reproductive performance.

Graduate Student: Lori Thomas

This project was supported by Agriculture and Food Research Initiative Competitive Grant no. 2011-68004-30336 from the USDA National Institute of Food and Agriculture

K·STATE
Research and Extension

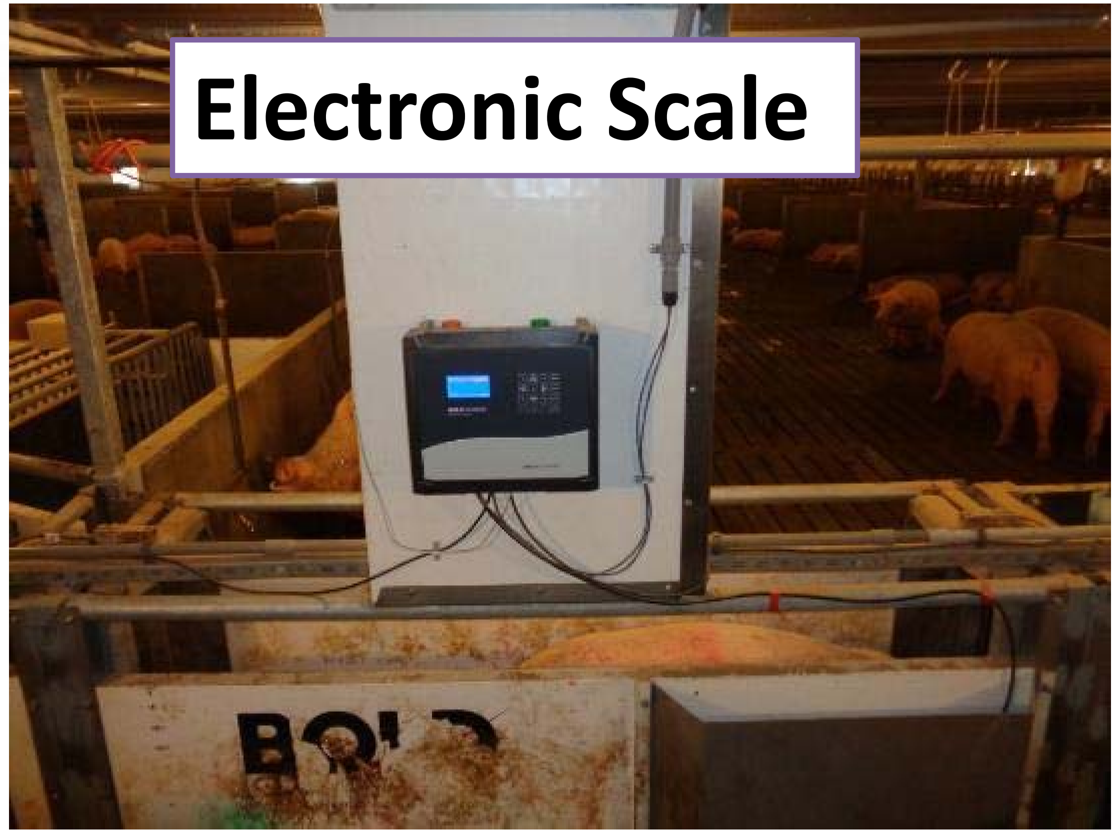
PIC

THOMAS LIVESTOCK CO.
T.L.C.
Creating Community Opportunities

Knowledge for Life

Procedures

- RFID Tags for Sow ID
- 296 Gilts
- 566 Sows
- ESF feed delivery
  - 4.4 lb/d
  - 5.0 lb/d
  - 6.6/lb/d
- ESF Daily Sow Body Weight
- 2 known points



Thomas et al. 2016

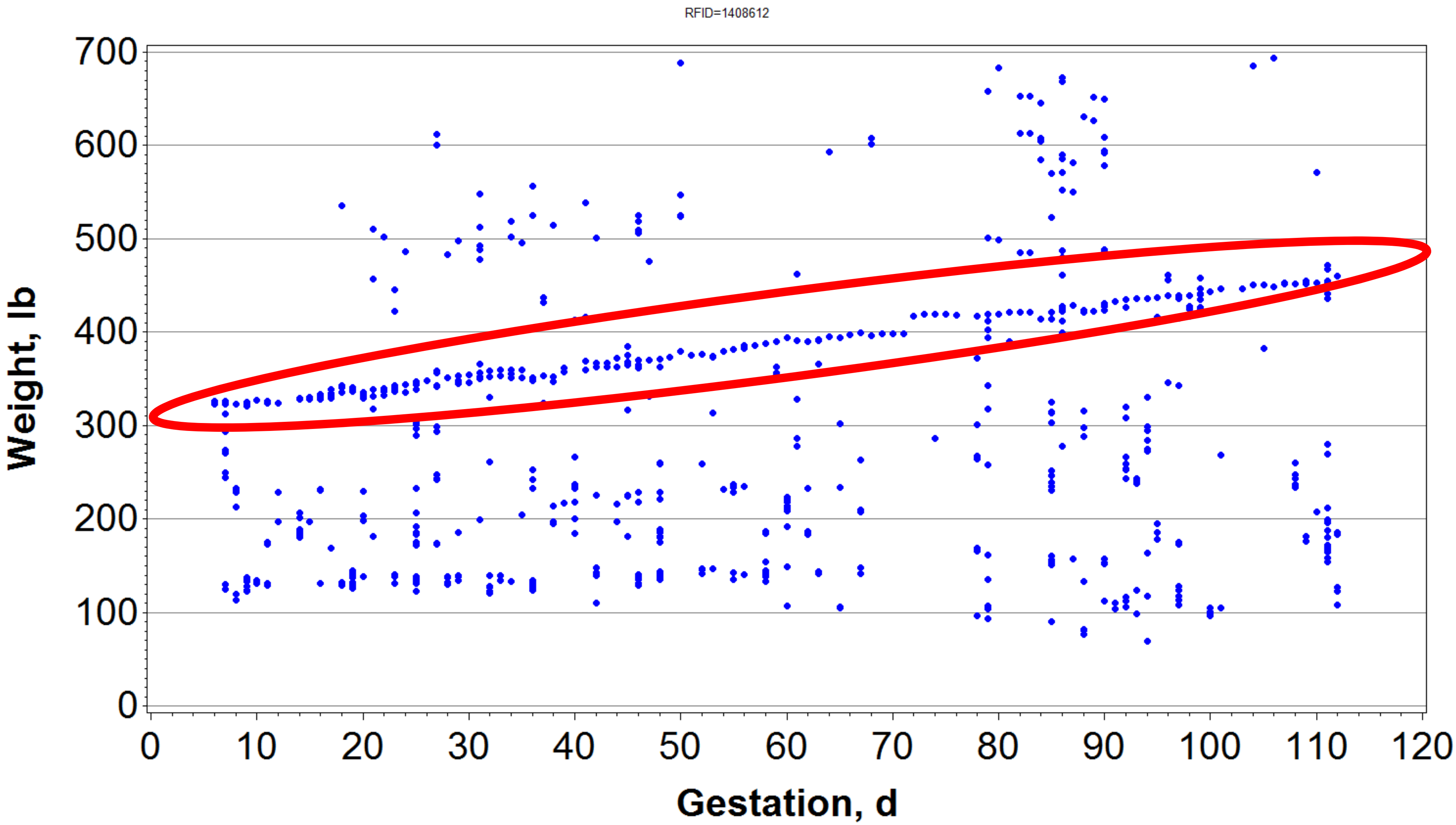
Scale set-up

After the going through the feeding station, females walk over a scale

Thomas et al. 2016

Knowledge for Life

Example sow: Raw Data

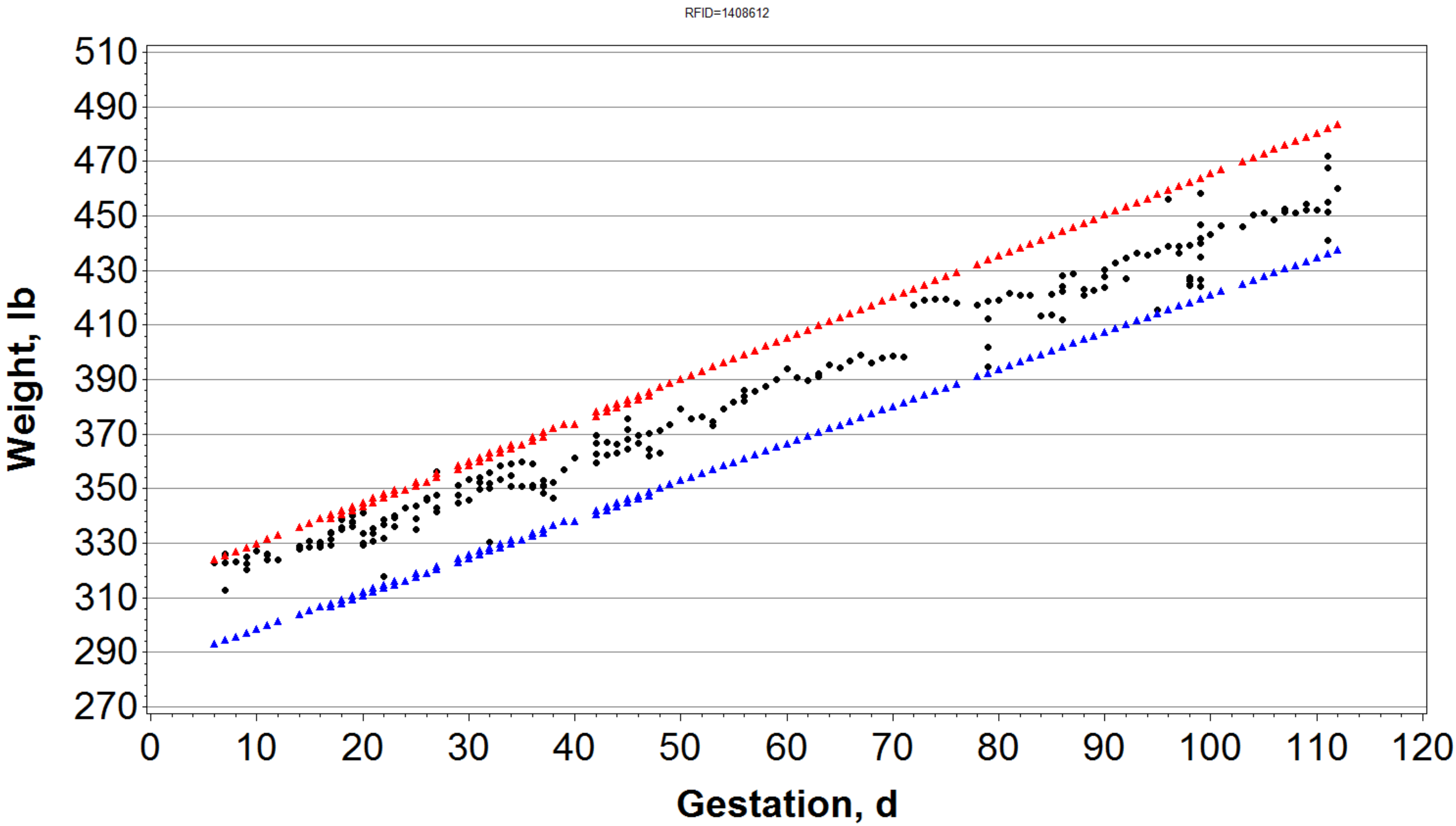


Thomas et al. 2016

K·STATE Research and Extension

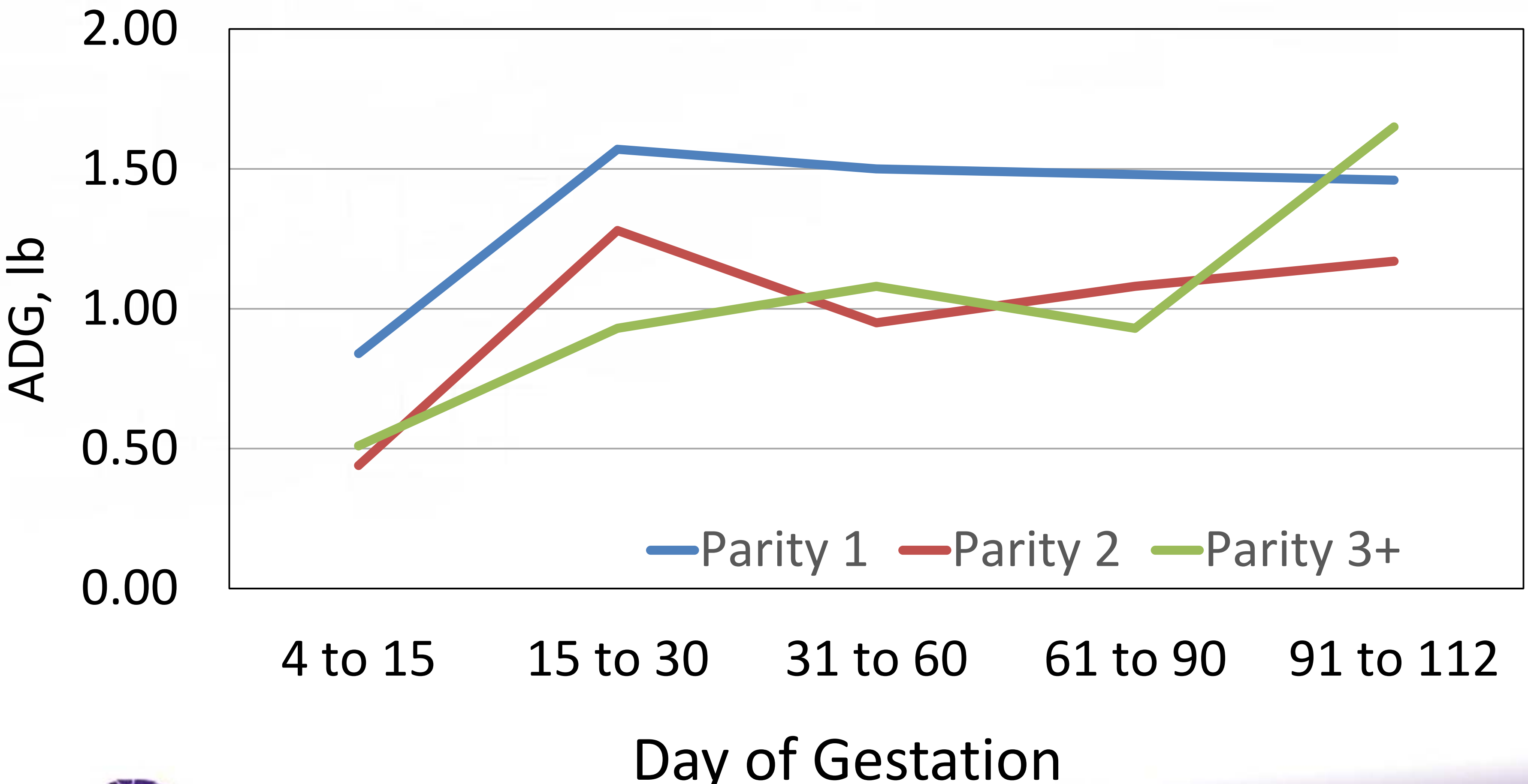
Knowledge for Life

Example sow: Raw Data



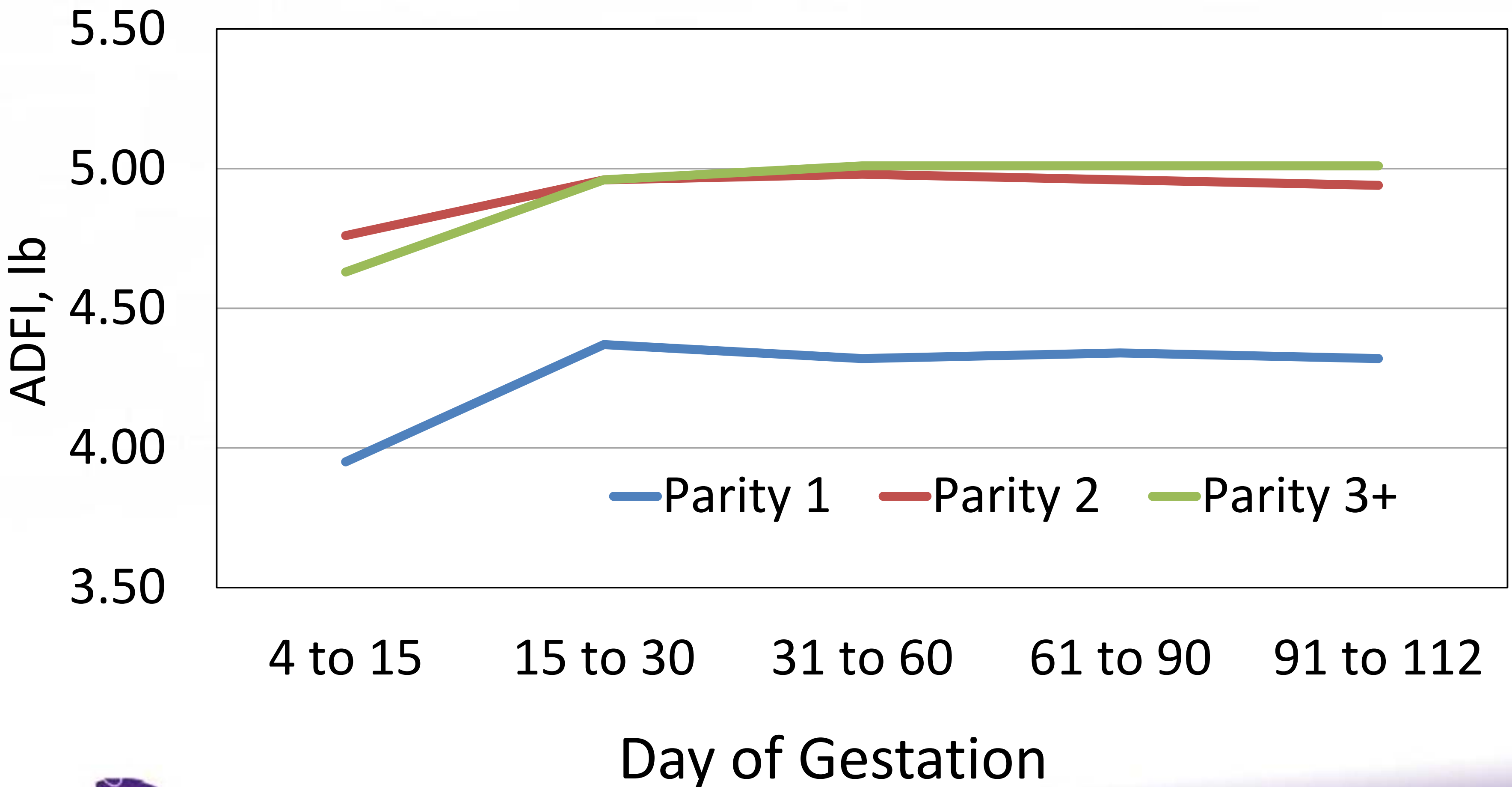
Thomas et al. 2016

Gestating Sow Average Daily Gain



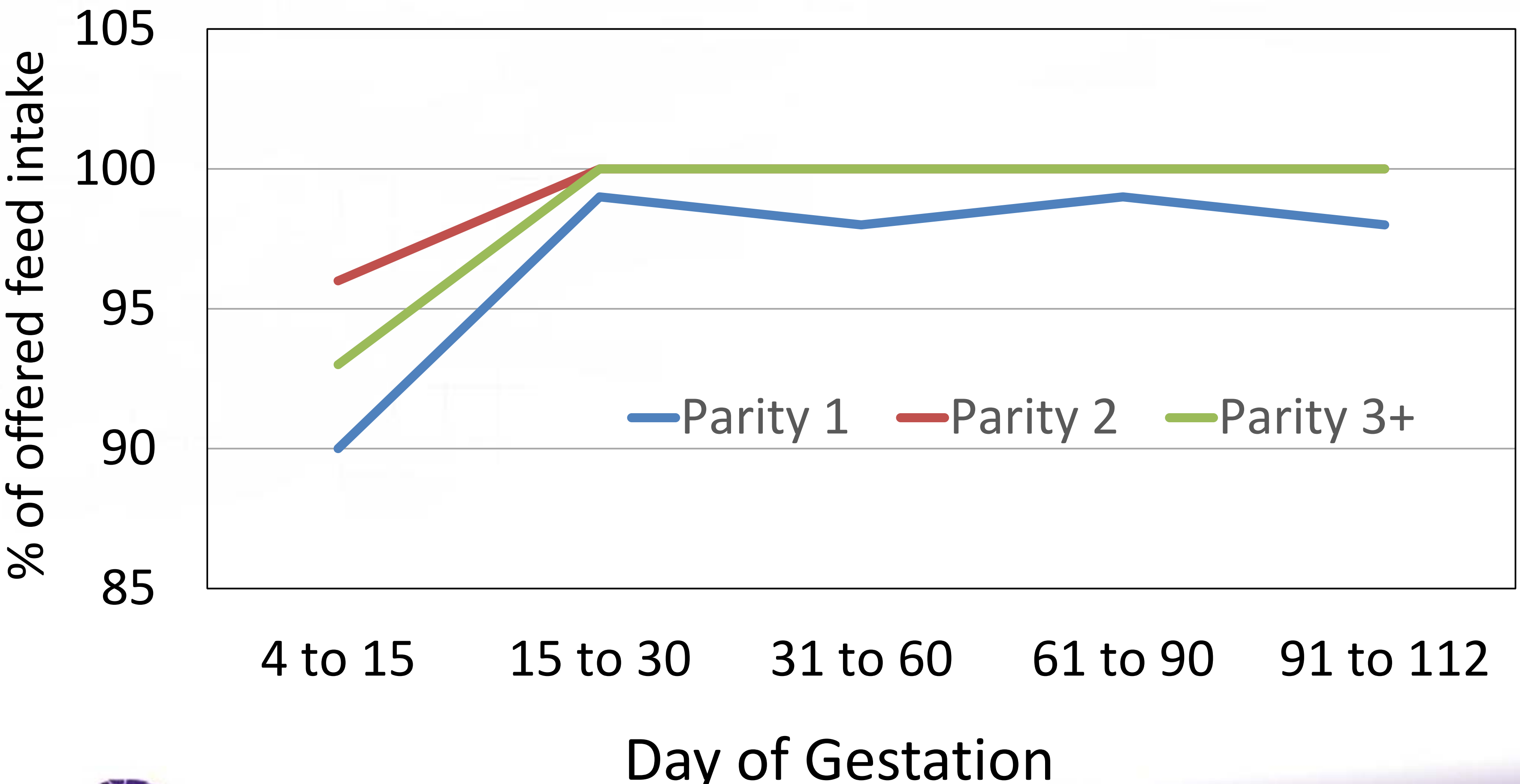
Thomas et al. 2016

Average Daily Feed Intake



Thomas et al. 2016

Percentage of Feed Intake of Total Offered

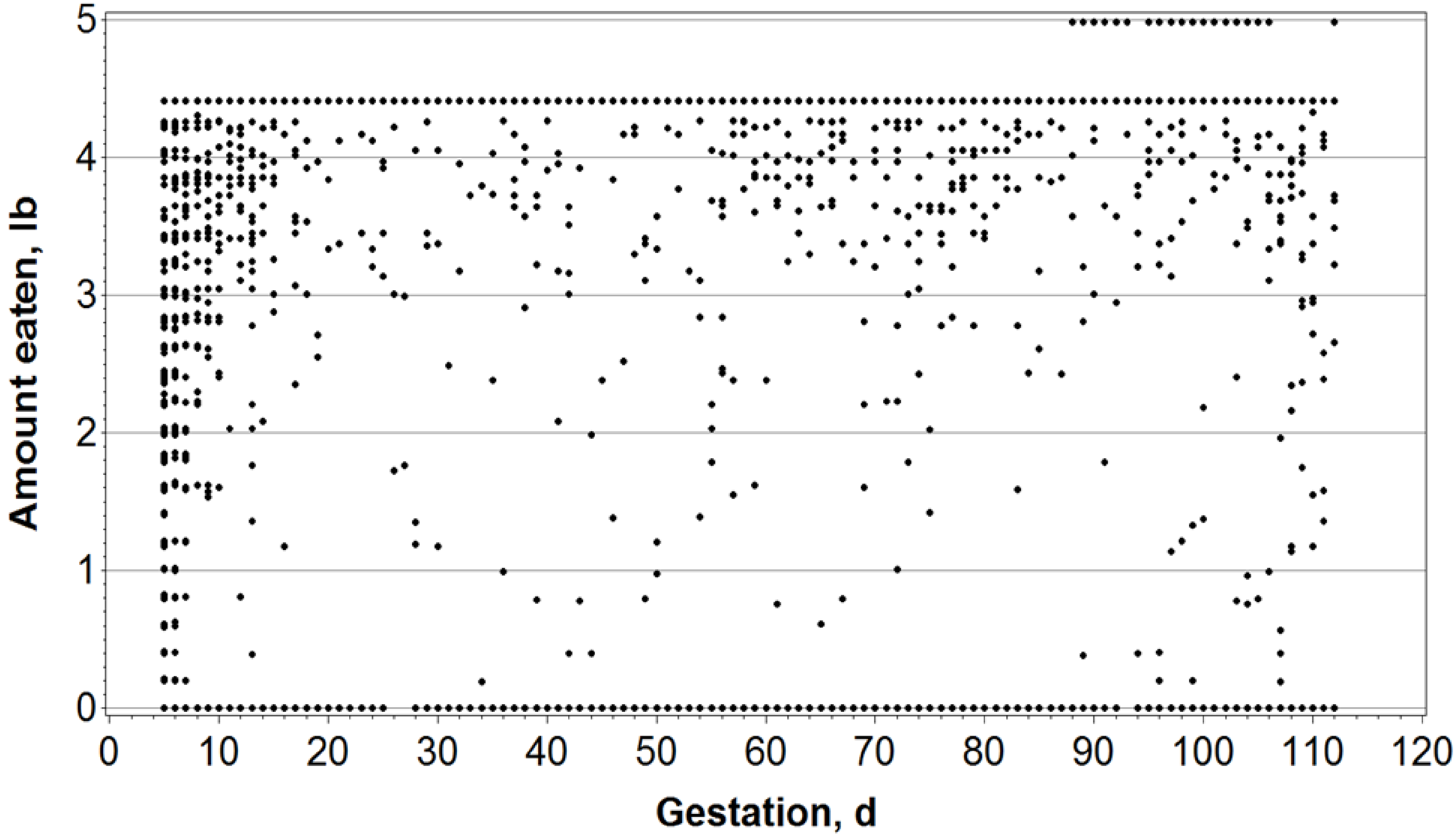


Thomas et al. 2016

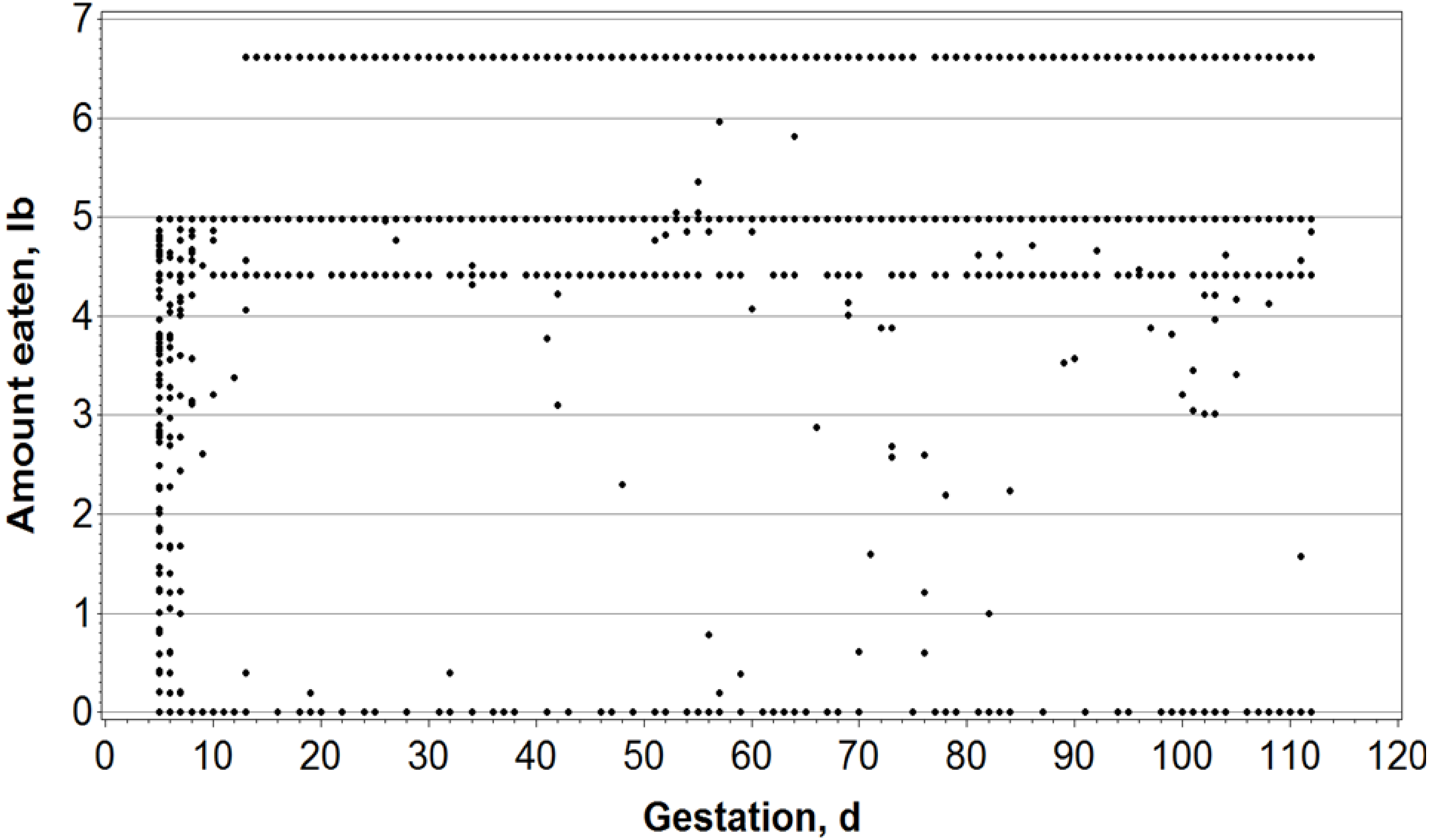
K·STATE
Research and Extension

Knowledge for Life

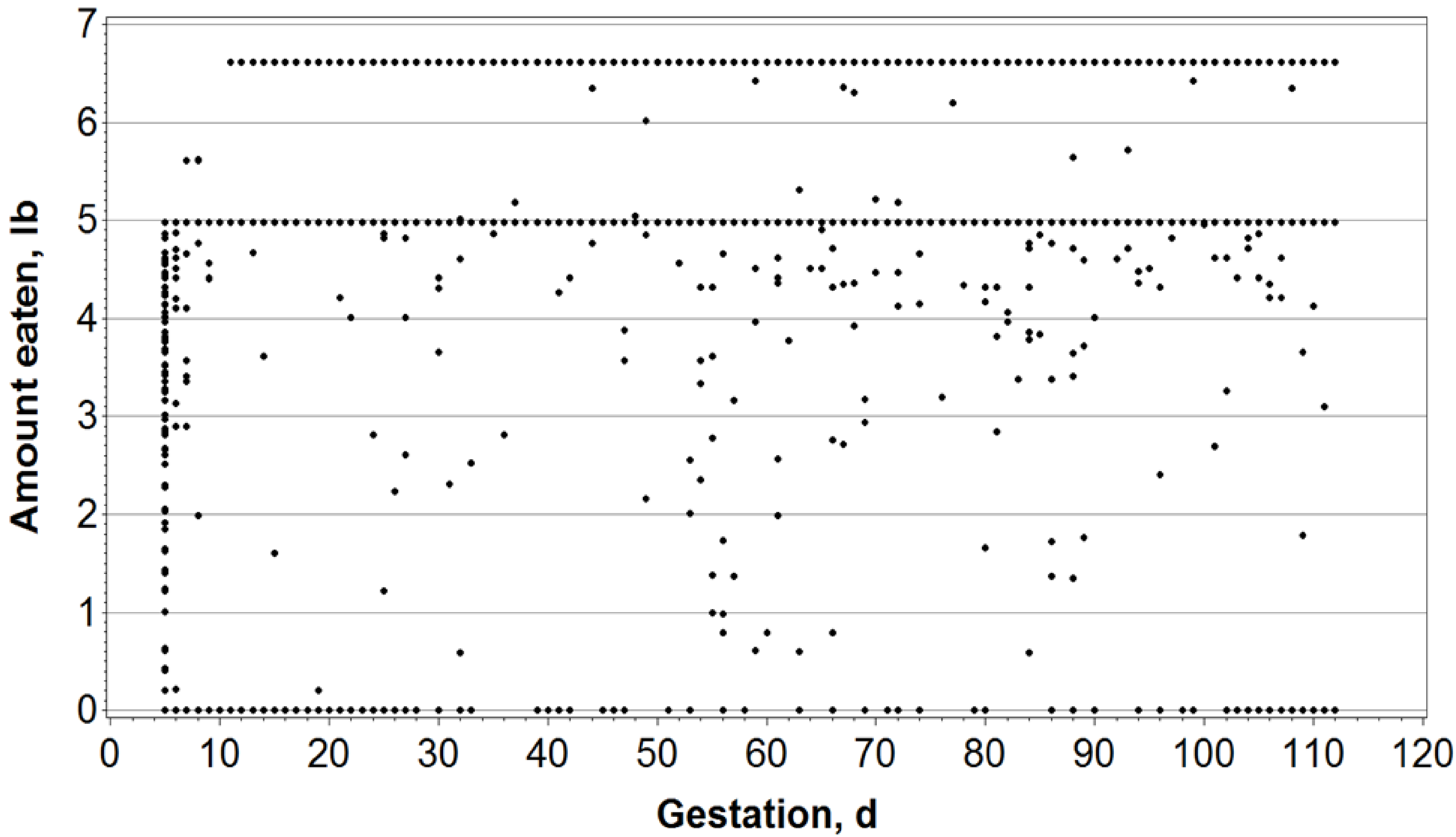
Feed intake throughout the course of gestation, Parity 1



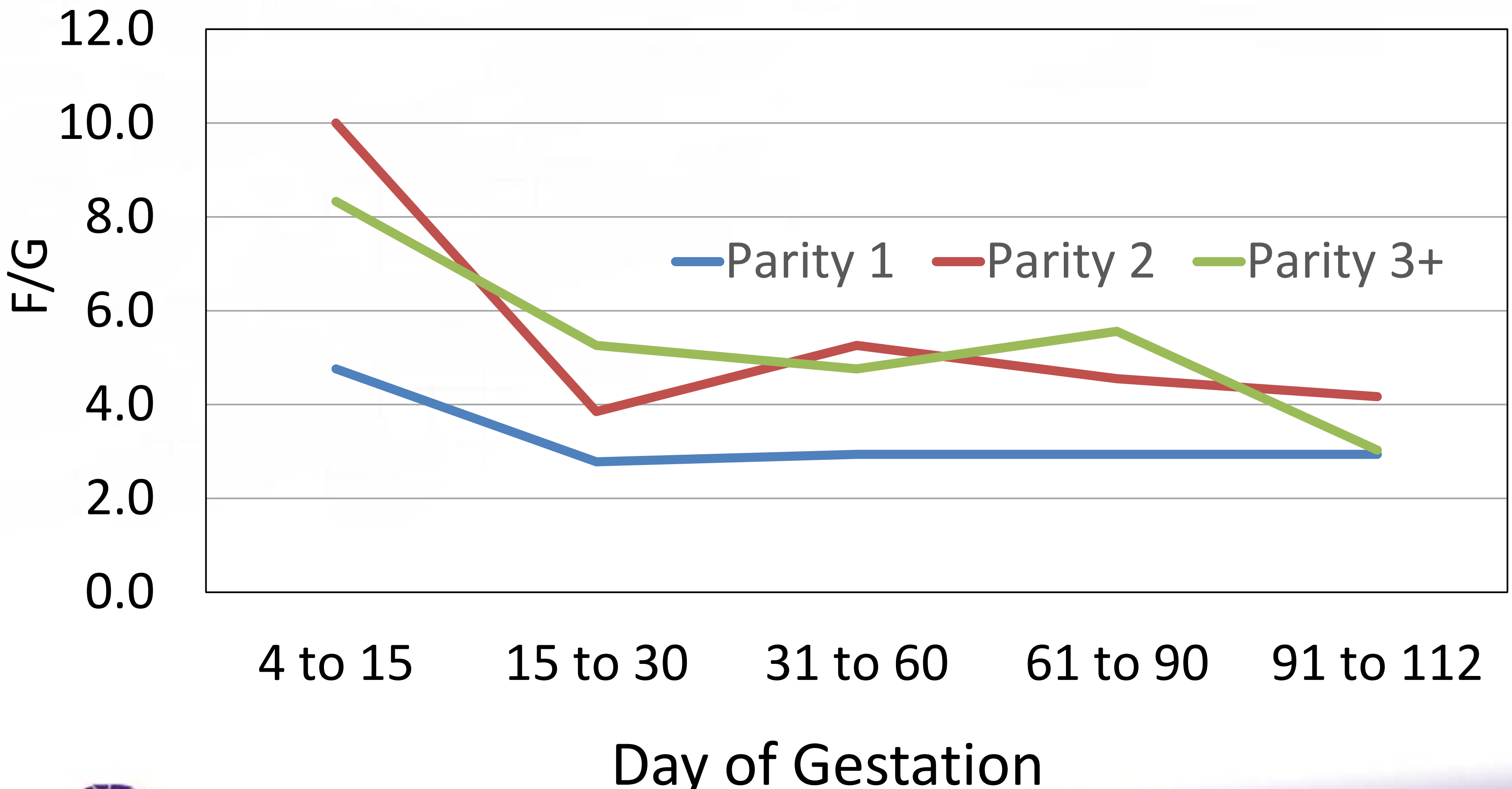
Feed intake throughout the course of gestation, Parity 2



Feed intake throughout the course of gestation, Parity 3+



Gestating Sow Feed Efficiency



Thomas et al. 2016

Electronic Sow Feeding Implications

ESFs allow for numerous research opportunities modelling protein and lipid growth during gestation

Gilts, but even parity 2 and 3+ females have challenges going through the ESFs the first few days after placement

Will initial feed intake affect litter size?

K·STATE Research and Extension

PIC

Thomas Livestock Co. T.L.C. Creating Community Opportunities

Thomas et al. 2016

Knowledge for Life

Overview of amino acid research from the last year

- Nursery pigs
  - Lysine
  - Valine
  - Isoleucine
  - Validation of amino acid ratios
  - Aminogut
- Late finishing pigs
  - DNA Lys response
  - Minimum crude protein required?

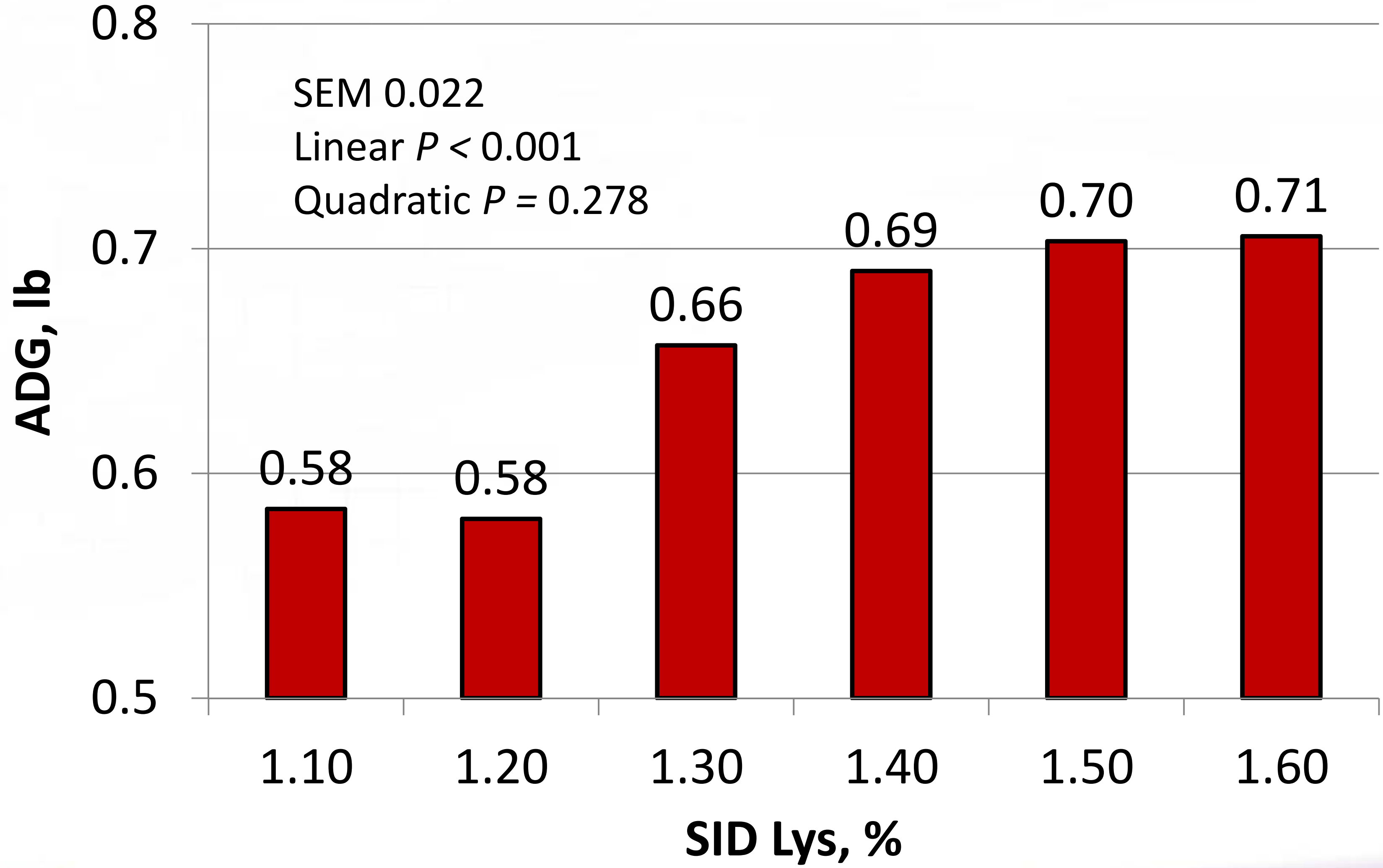
AJINOMOTO
AJINOMOTO HEARTLAND, INC.
AJINOMOTO ANIMAL NUTRITION

KALMBACH FEEDS
SINCE 1963

HOLDEN farms

NHF
NEWHORIZONFARMS

SID Lysine in diets for nursery pigs from 15 to 25 lb

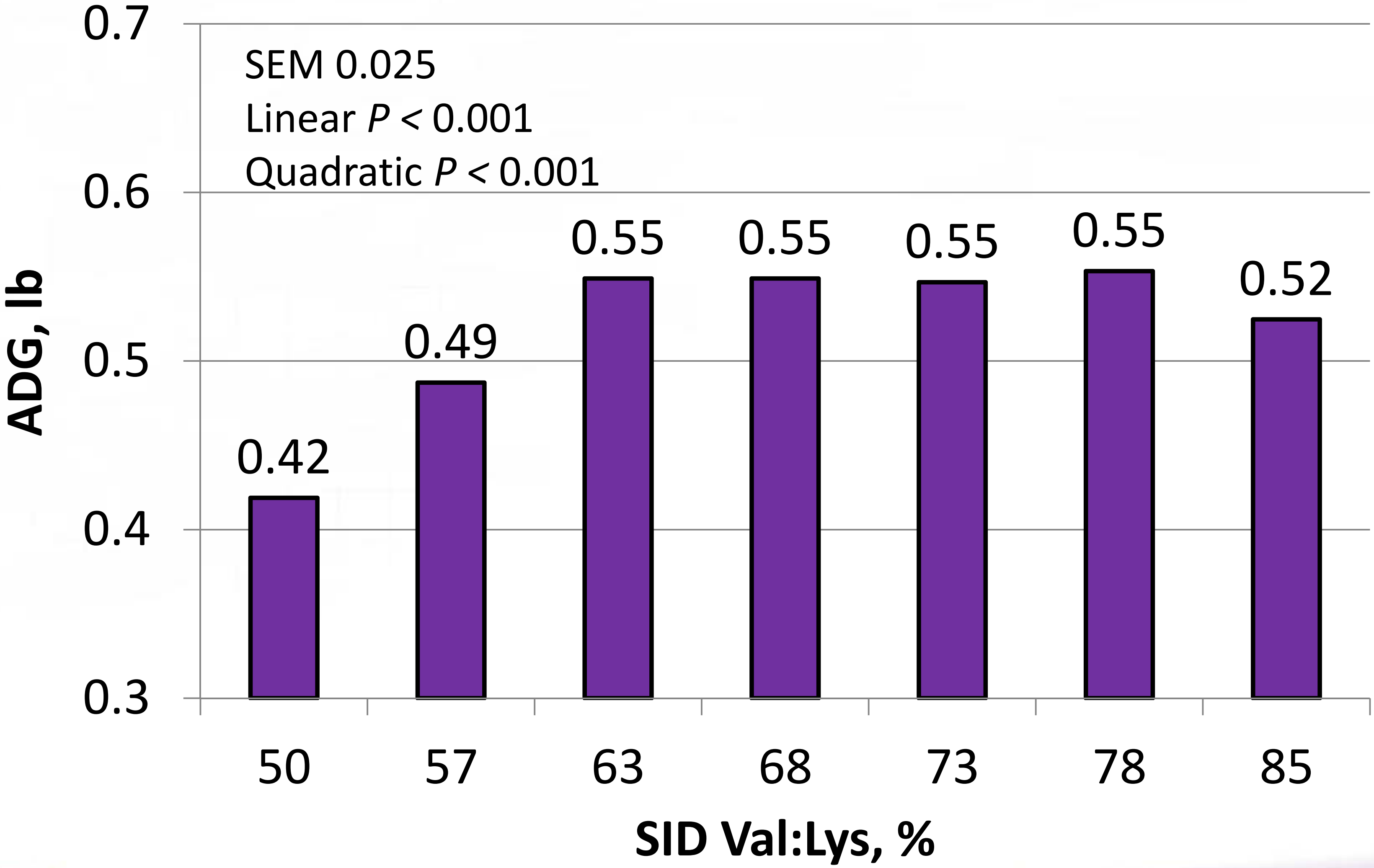


K-STATE Research and Extension

Clark et al. 2016

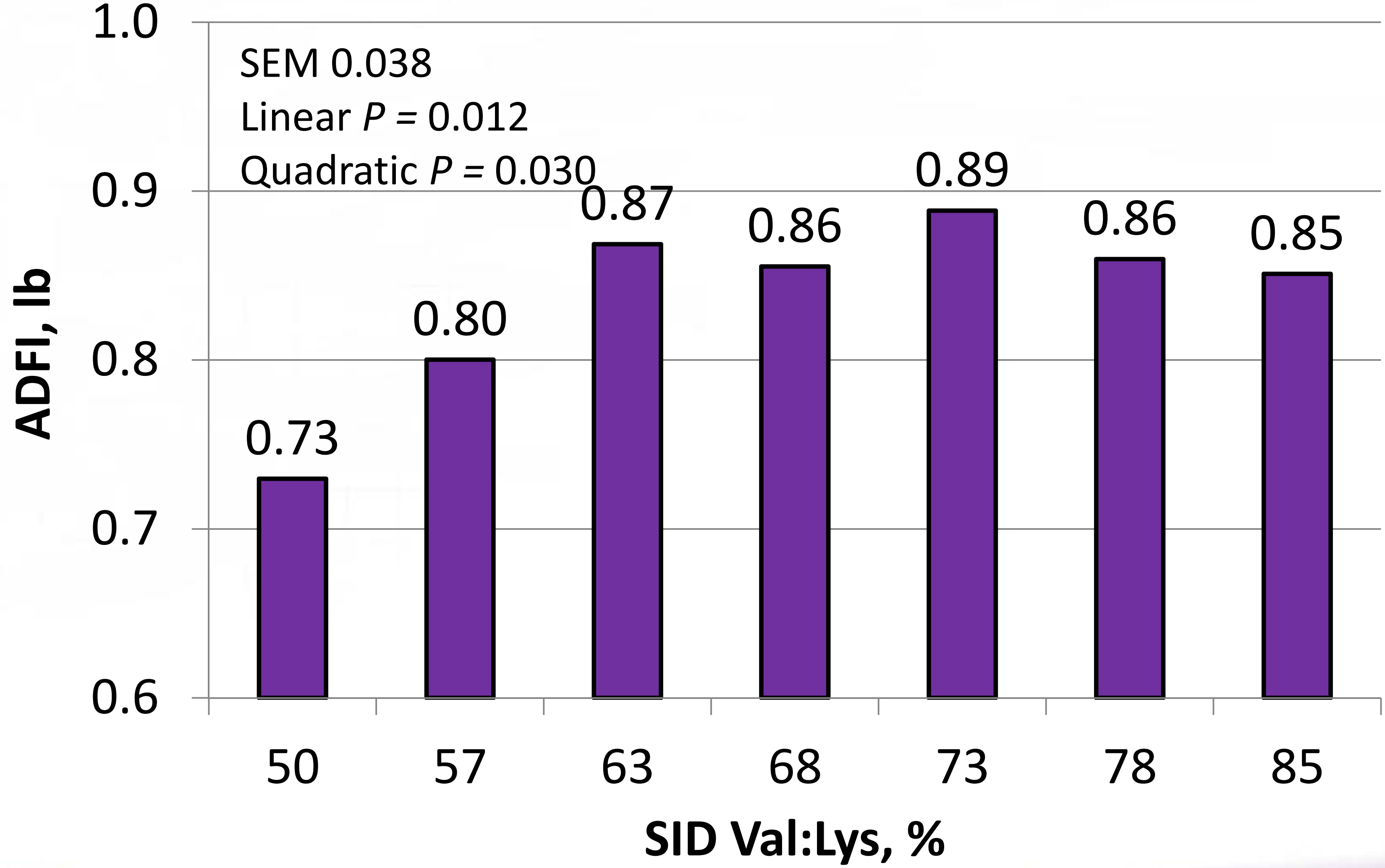
Knowledge for Life

SID Val:Lys in diets for nursery pigs from 15 to 25 lb



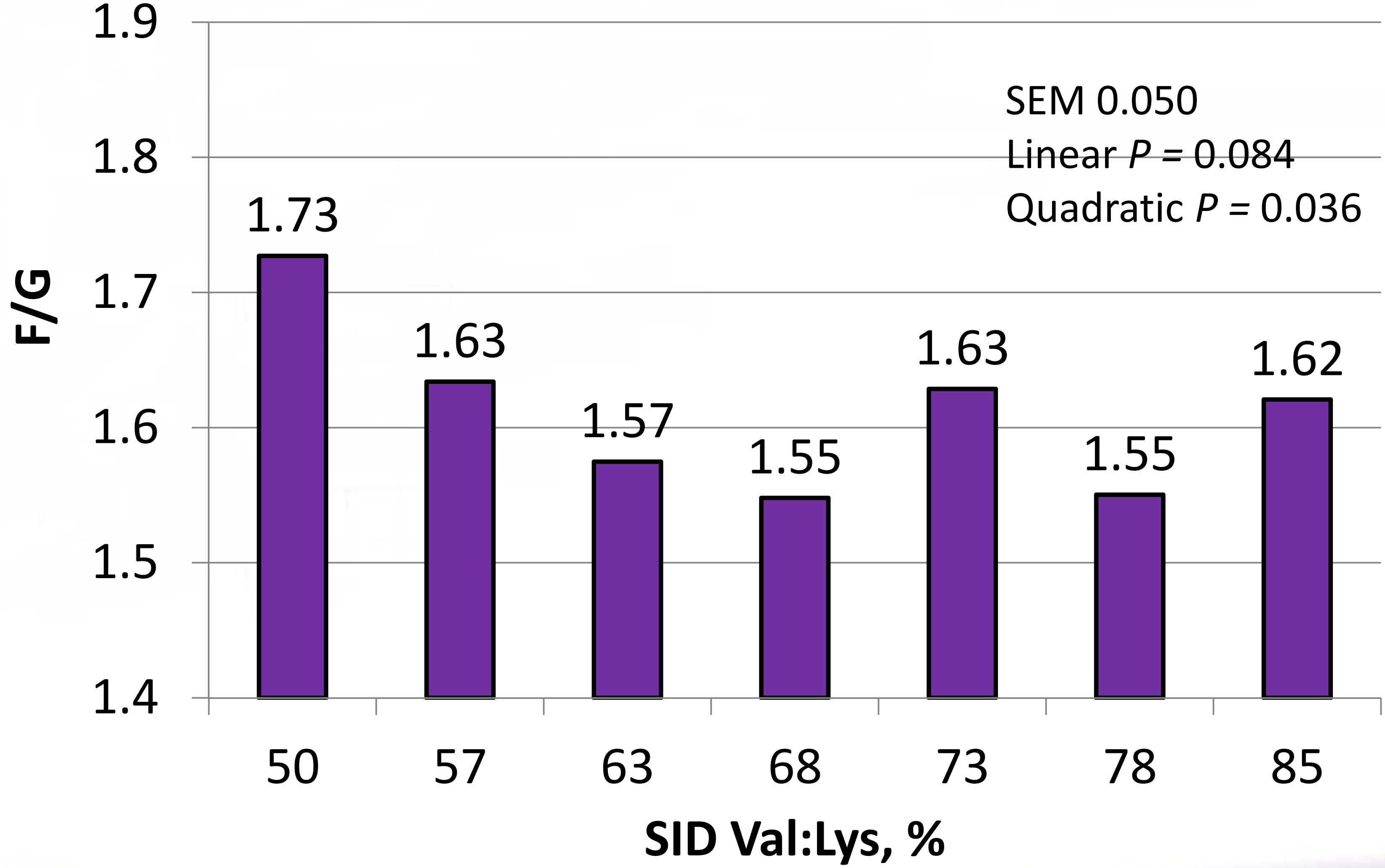
Clark et al. 2016

SID Val:Lys in diets for nursery pigs from 15 to 25 lb



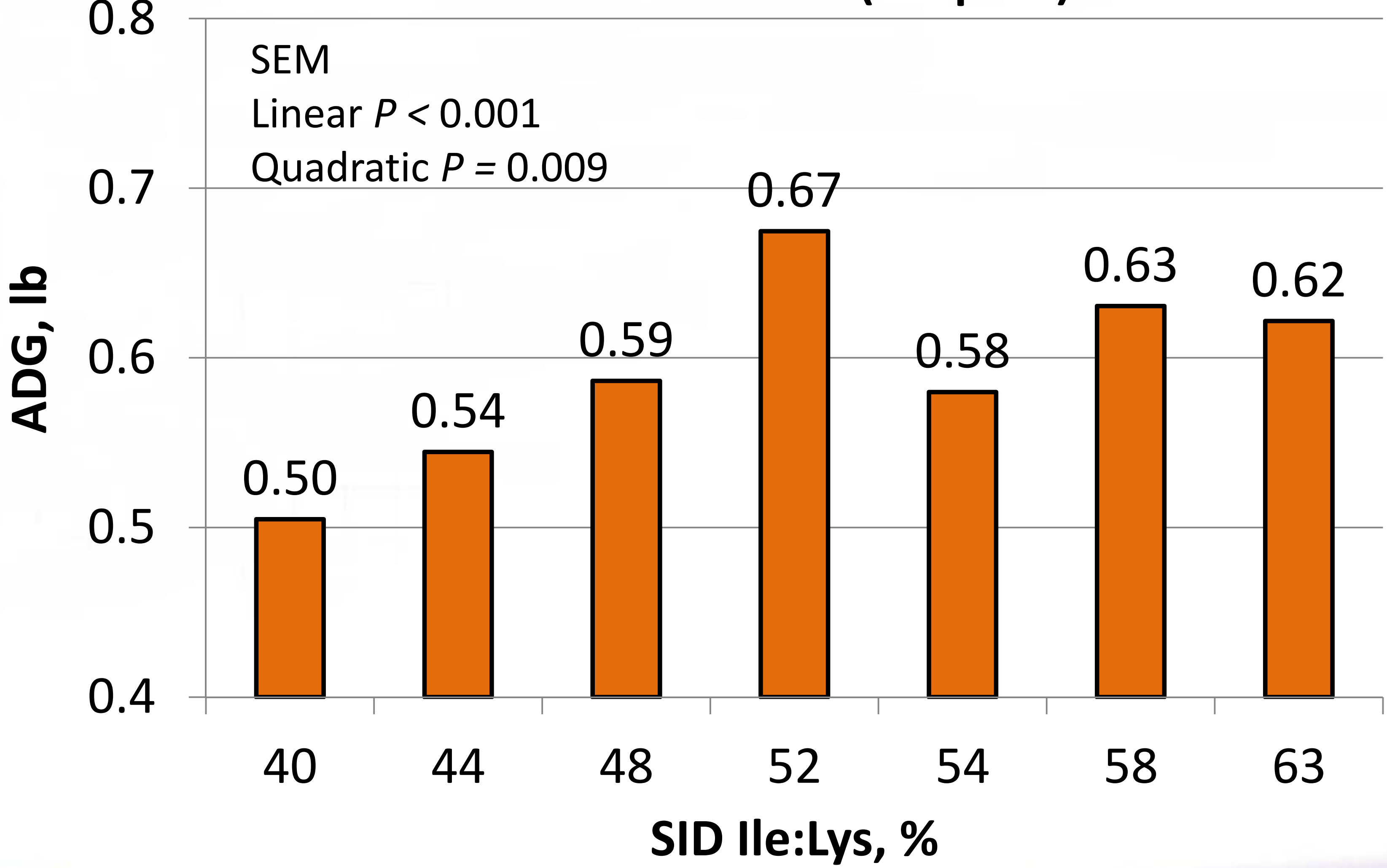
Clark et al. 2016

SID Val:Lys in diets for nursery pigs from 15 to 25 lb



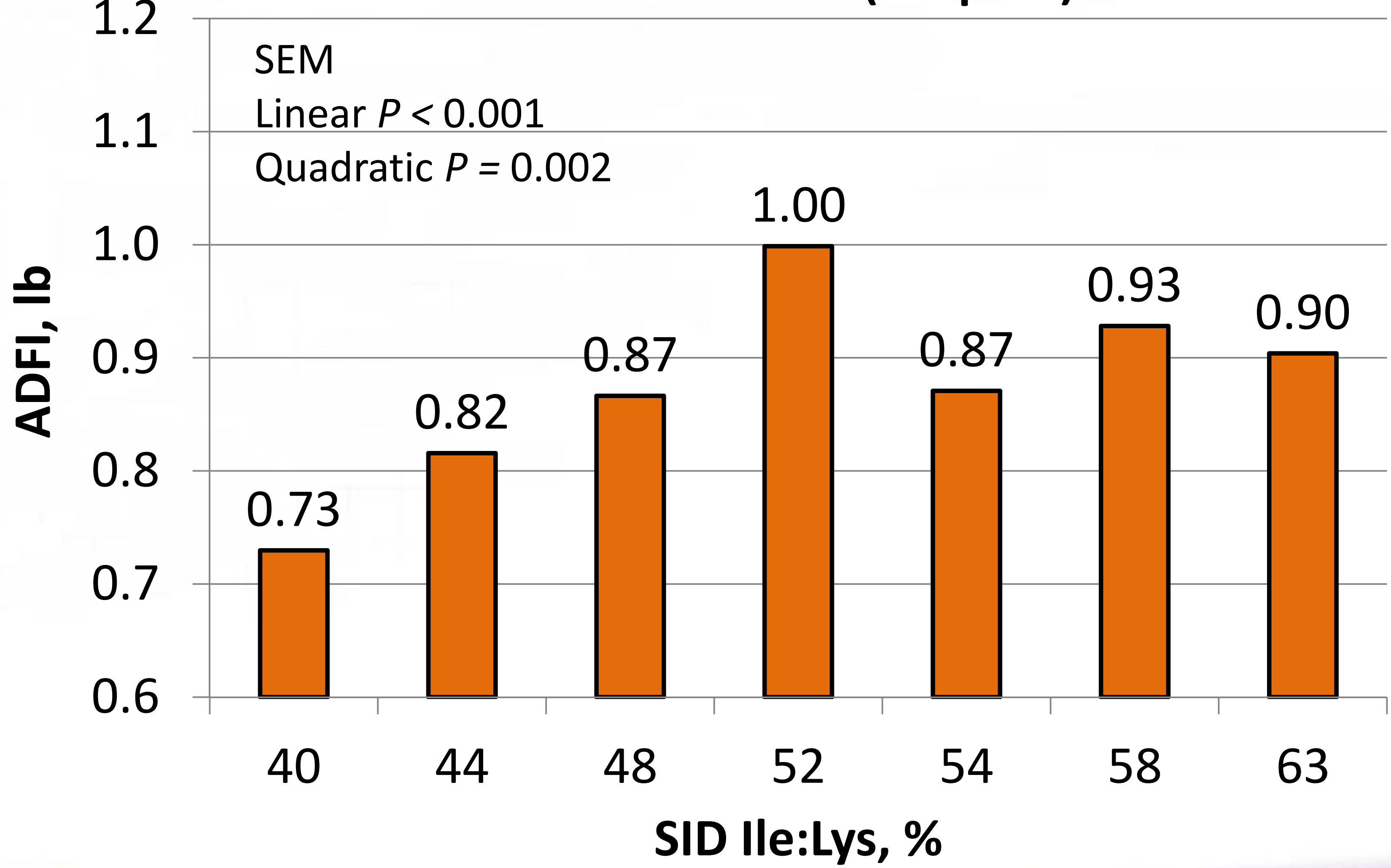
Clark et al. 2016

SID Ile:Lys in diets for nursery pigs from 15 to 25 lb (Exp 2)



Clark et al. 2016

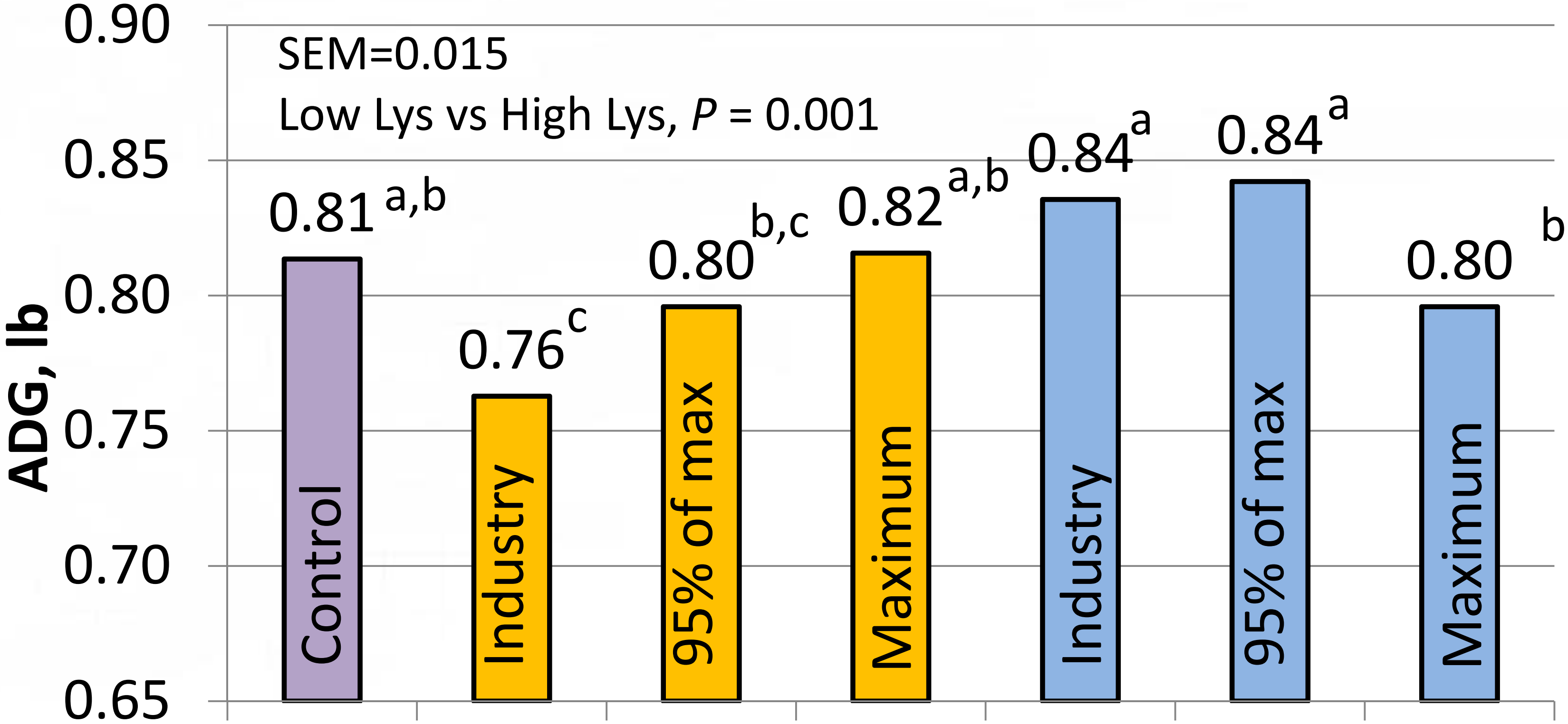
SID Ile:Lys in diets for nursery pigs from 15 to 25 lb (Exp 2)



Clark et al. 2016

Validation of AA ratios for nursery pigs from 15 to 25 lb

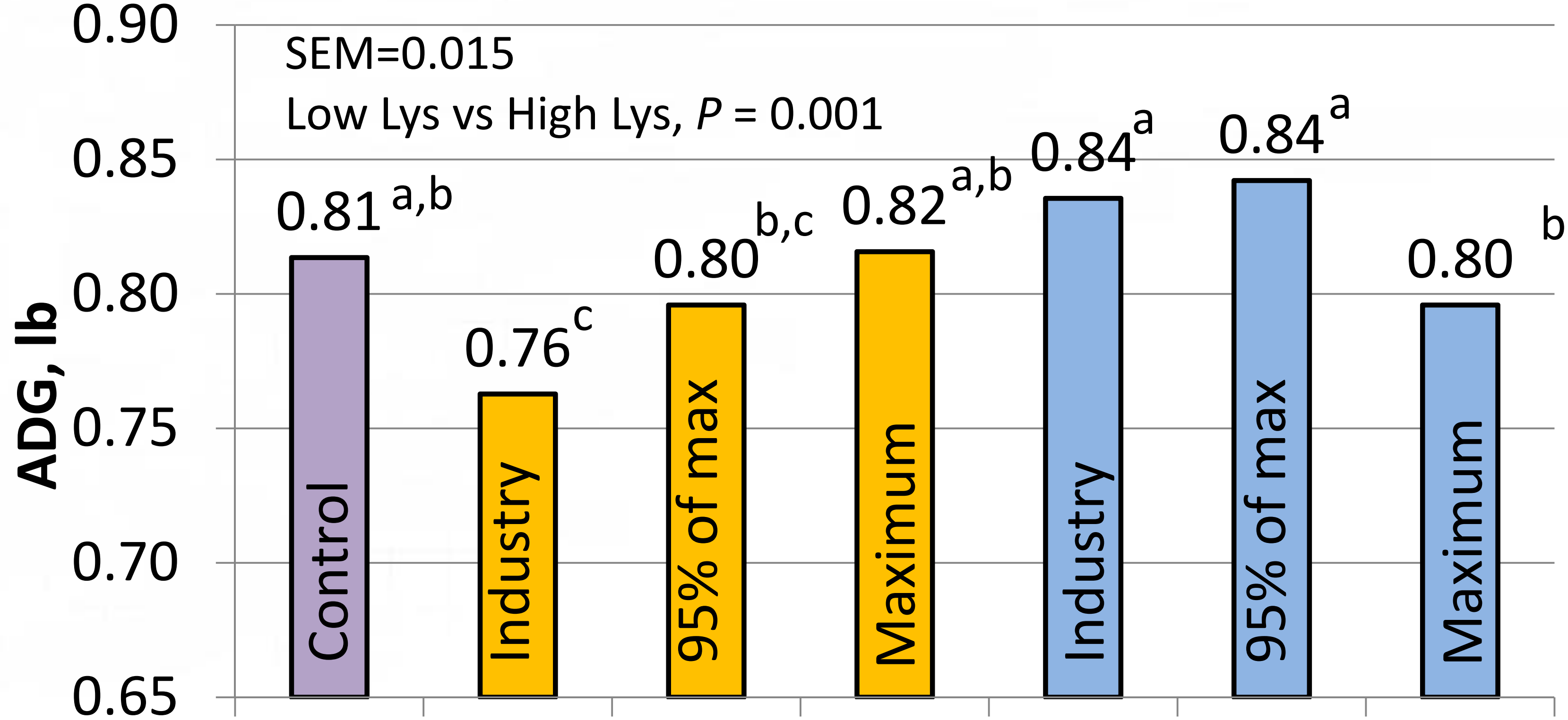
Clark et al. 2016



Lys, %	1.35	1.25	1.25	1.25	1.35	1.35	1.35
M & C:Lys	58	55	56	60	55	56	60
Thr:Lys	65	62	62	65	62	62	65
Trp:Lys	19	18	19	21	18	19	21
Val:Lys	70	65	67	72	65	67	72
Ile:Lys	60	53	53	53	52	52	52

Validation of AA ratios for nursery pigs from 15 to 25 lb

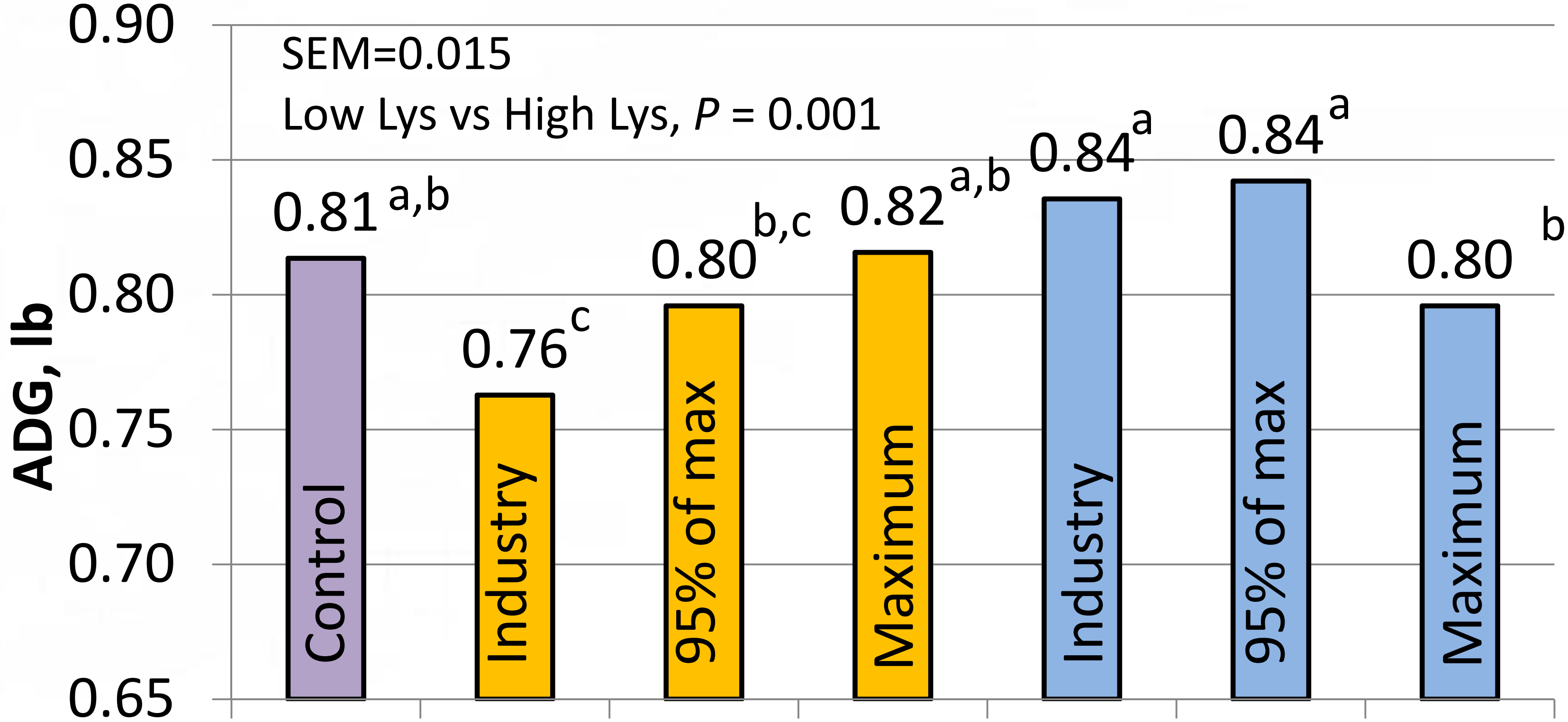
Clark et al. 2016



Lys, %	1.35	1.25	1.25	1.25	1.35	1.35	1.35
M & C:Lys	58	55	56	60	55	56	60
Thr:Lys	65	62	62	65	62	62	65
Trp:Lys	19	18	19	21	18	19	21
Val:Lys	70	65	67	72	65	67	72
Ile:Lys	60	53	53	53	52	52	52

Validation of AA ratios for nursery pigs from 15 to 25 lb

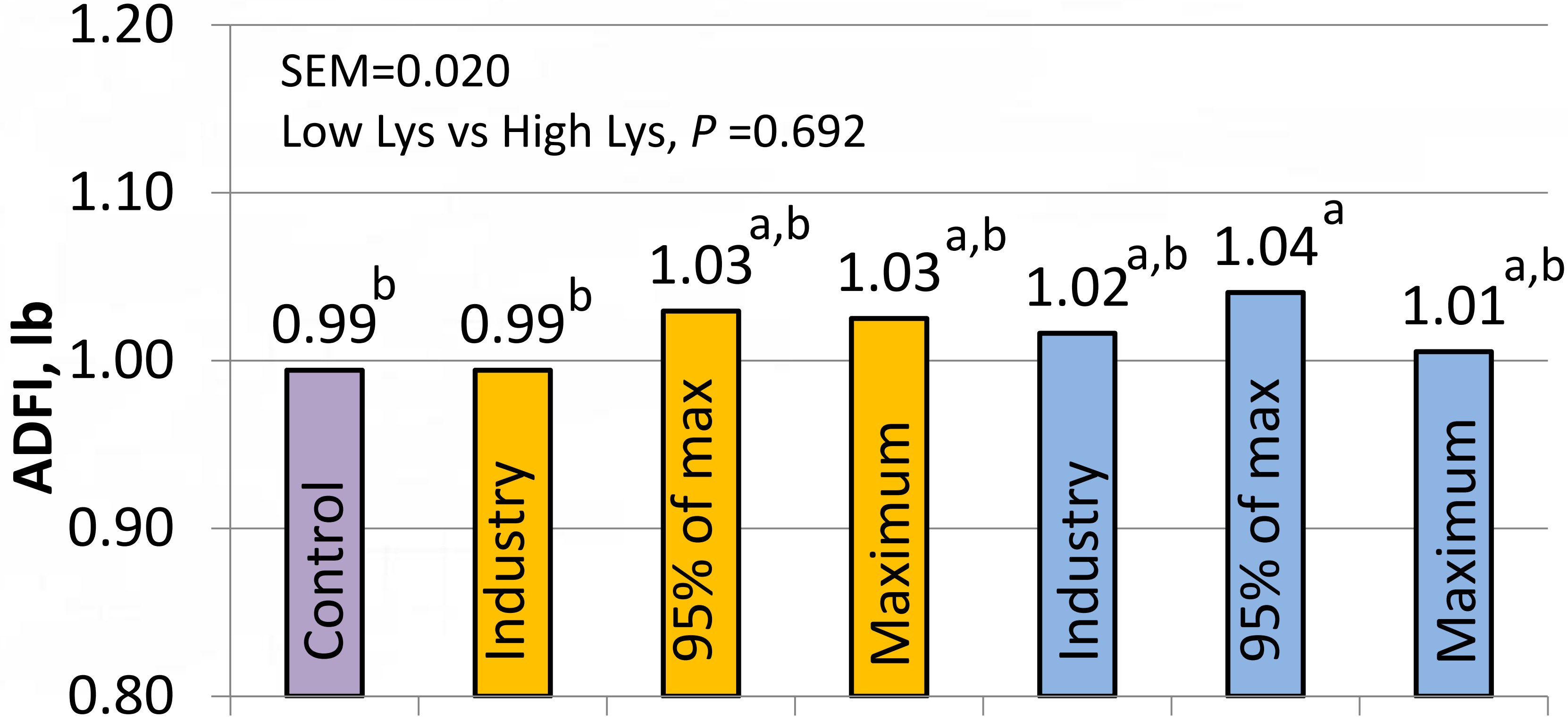
Clark et al. 2016



Lys, %	1.35	1.25	1.25	1.25	1.35	1.35	1.35
M & C:Lys	58	55	56	60	55	56	60
Thr:Lys	65	62	62	65	62	62	65
Trp:Lys	19	18	19	21	18	19	21
Val:Lys	70	65	67	72	65	67	72
Ile:Lys	60	53	53	53	52	52	52

Validation of AA ratios for nursery pigs from 15 to 25 lb

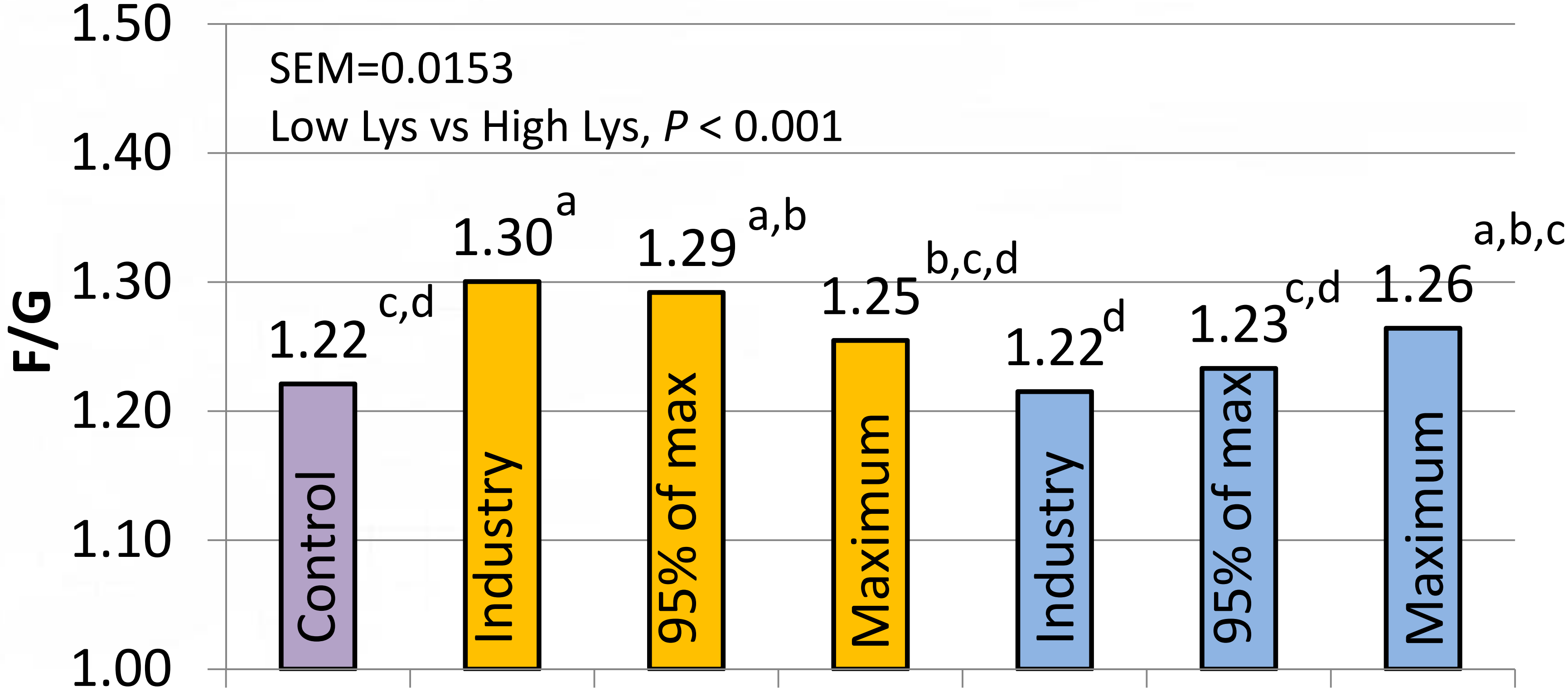
Clark et al. 2016



Lys, %	1.35	1.25	1.25	1.25	1.35	1.35	1.35
M & C:Lys	58	55	56	60	55	56	60
Thr:Lys	65	62	62	65	62	62	65
Trp:Lys	19	18	19	21	18	19	21
Val:Lys	70	65	67	72	65	67	72
Ile:Lys	60	53	53	53	52	52	52

Validation of AA ratios for nursery pigs from 15 to 25 lb

Clark et al. 2016

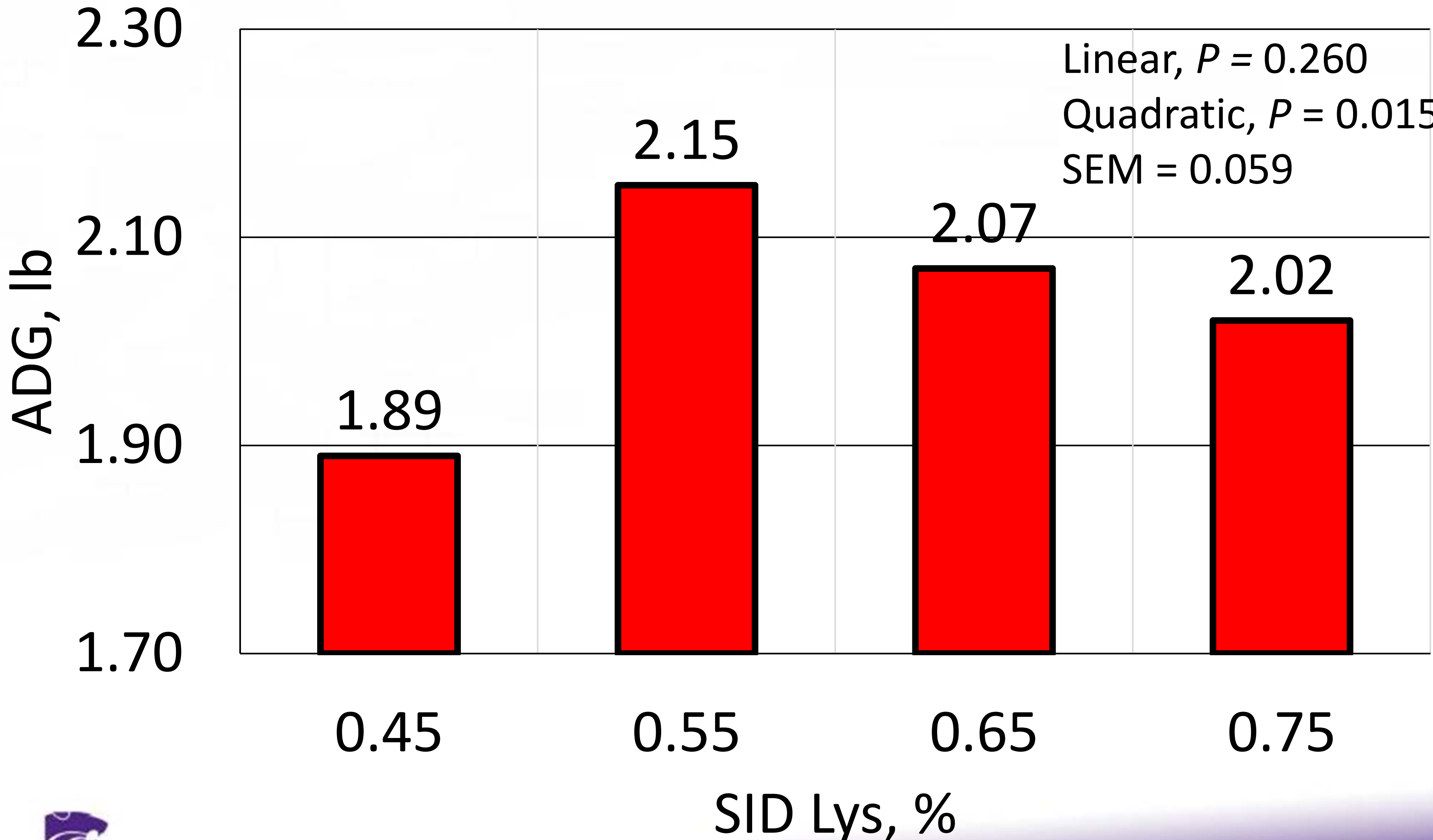


Lys, %	1.35	1.25	1.25	1.25	1.35	1.35	1.35
M & C:Lys	58	55	56	60	55	56	60
Thr:Lys	65	62	62	65	62	62	65
Trp:Lys	19	18	19	21	18	19	21
Val:Lys	70	65	67	72	65	67	72
Ile:Lys	60	53	53	53	52	52	52

Summary 15 to 25 lb pigs

- ✓ SID Lys – 1.45 to 1.60%
- ✓ SID Val:Lys – 63 to 72%
- ✓ SID Ile:Lys – 52%
- ✓ Results dependent on the model and criteria
- ✓ Higher ratios are required when lower lysine diets are fed.
- ✓ Generating response surfaces allows producers and nutritionists to make decisions based on ingredient nutrient composition, availability, and economics

Effect of SID Lys levels in DNA finishing pigs from 225 to 280 lb

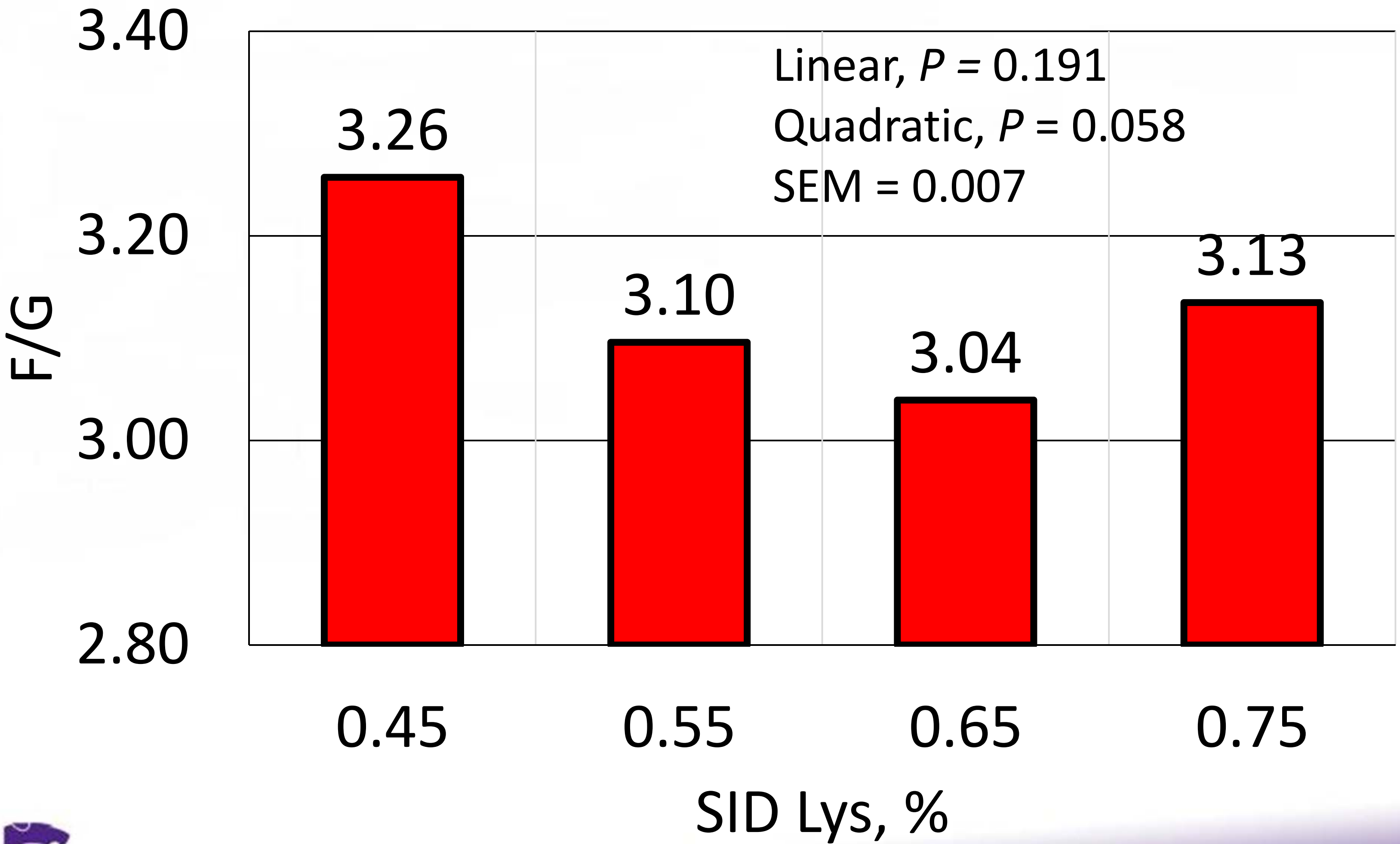


Soto et al. 2016

K·STATE Research and Extension

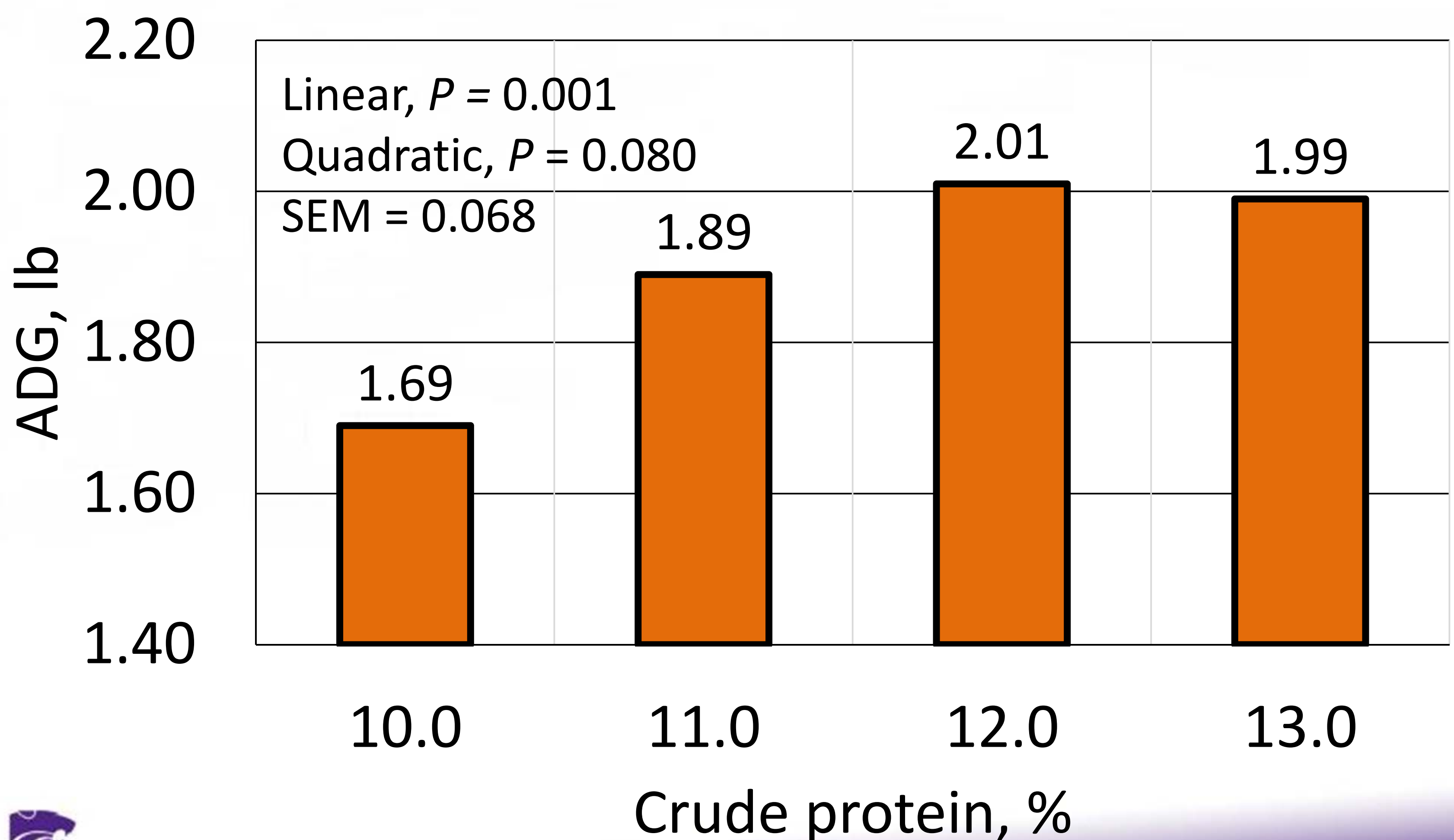
Knowledge for Life

Effect of SID Lys levels in DNA finishing pigs from 225 to 280 lb



Soto et al. 2016

Minimum dietary crude protein for finishing pigs from 240 to 280 lb

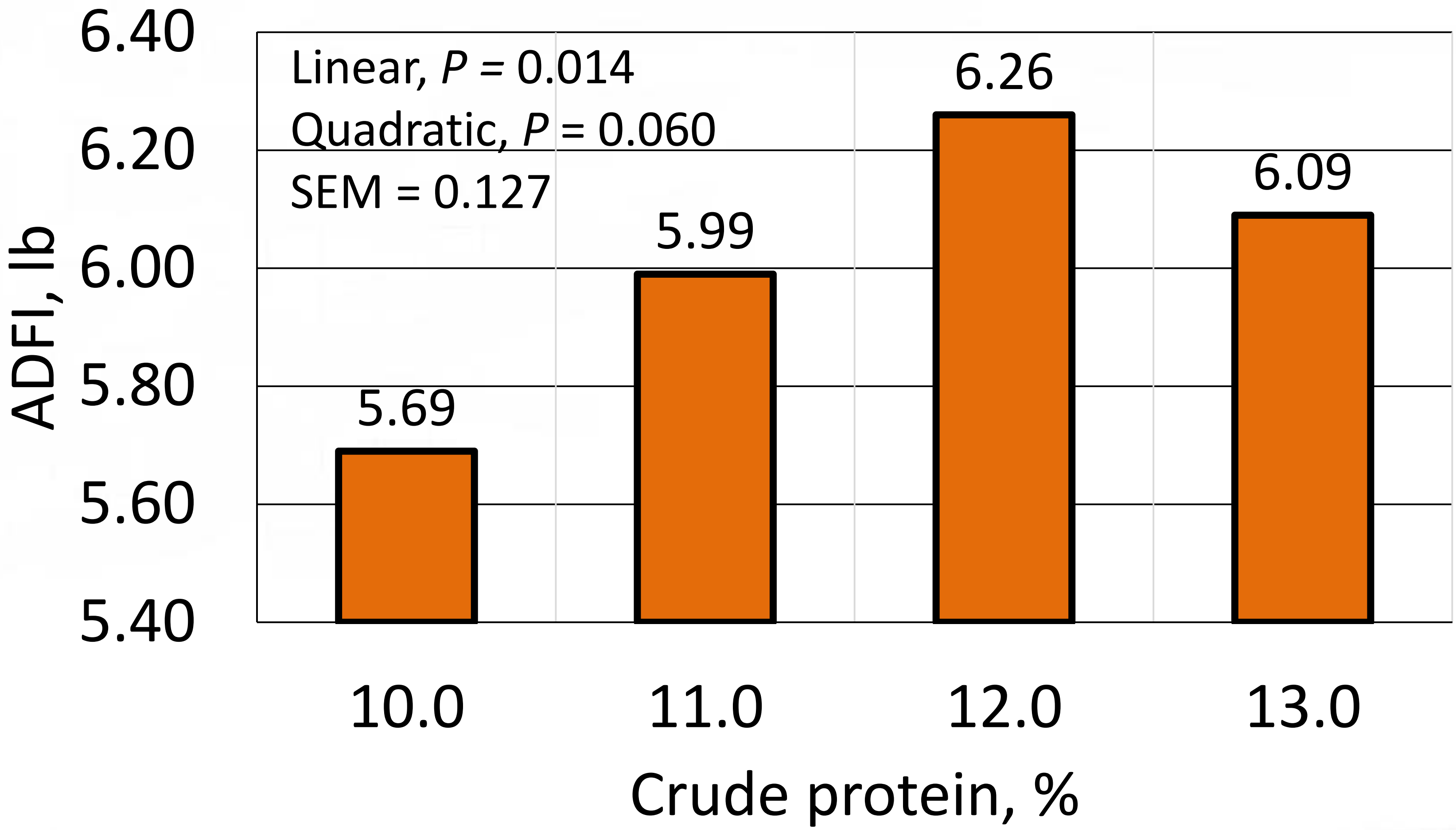


Soto et al. 2016

K·STATE Research and Extension

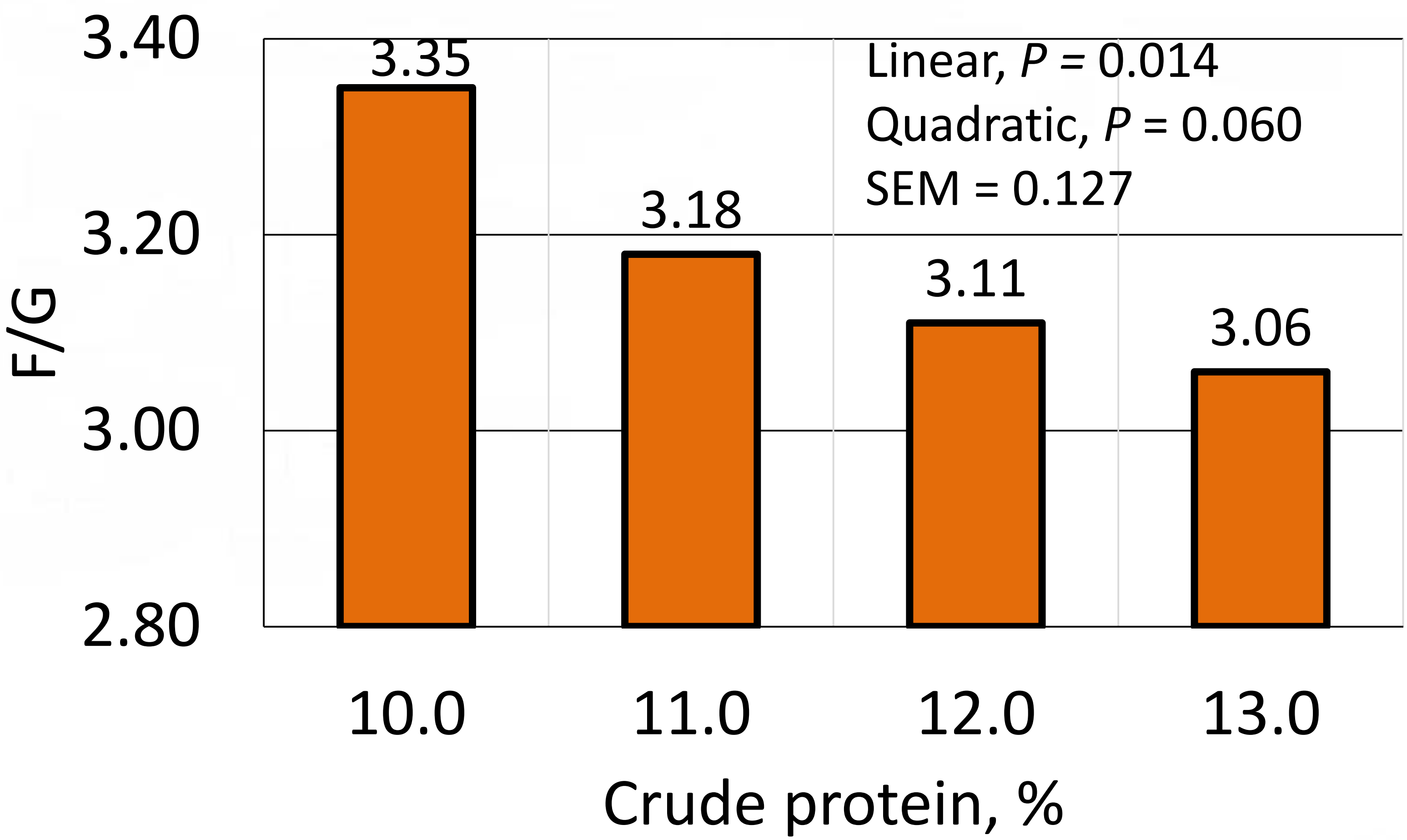
Knowledge for Life

Minimum dietary crude protein for finishing pigs from 240 to 280 lb



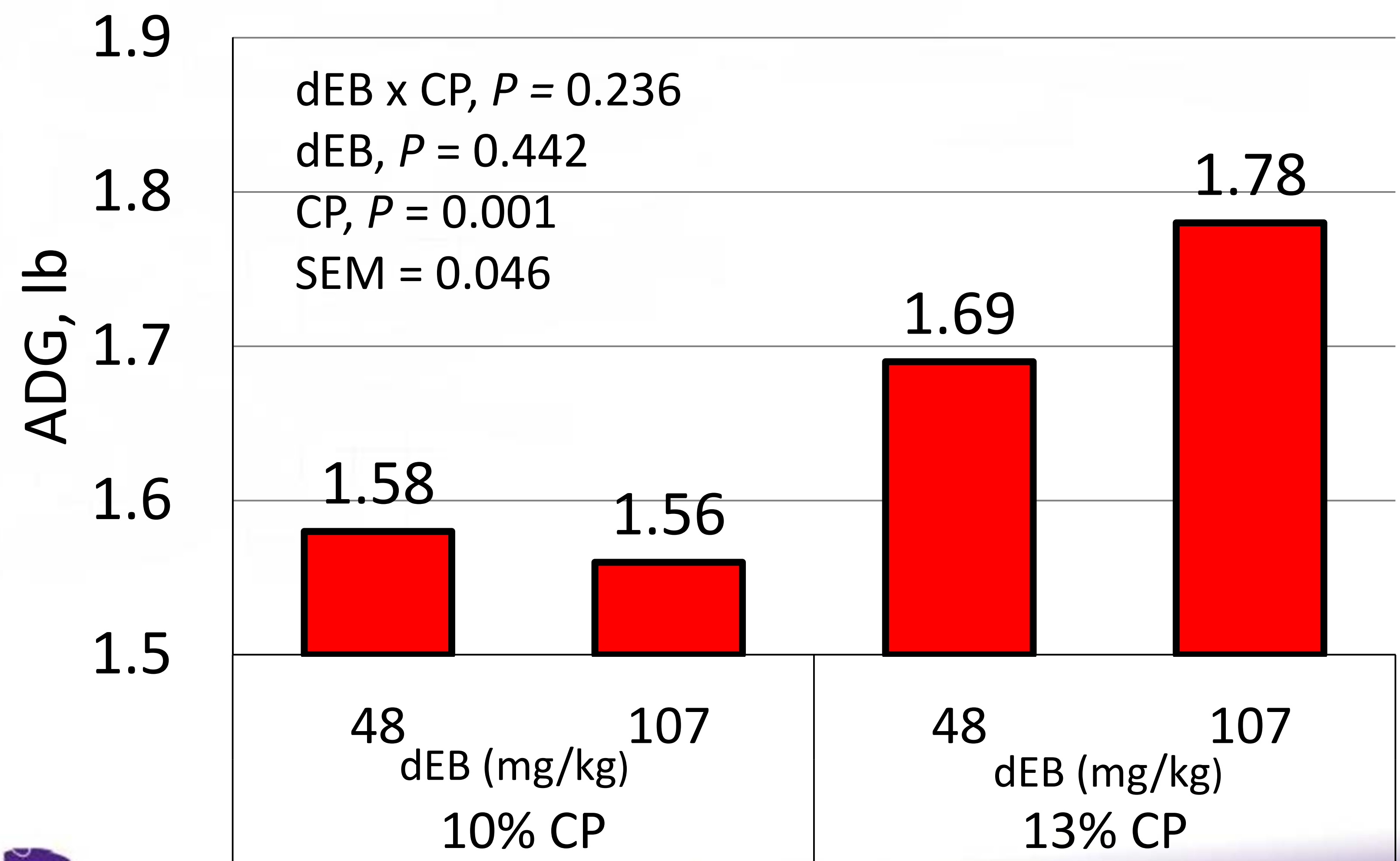
Soto et al. 2016

Minimum dietary crude protein for finishing pigs from 240 to 280 lb



Soto et al. 2016

Effect of electrolyte balance and crude protein in finishing pigs from 240 to 280 lb

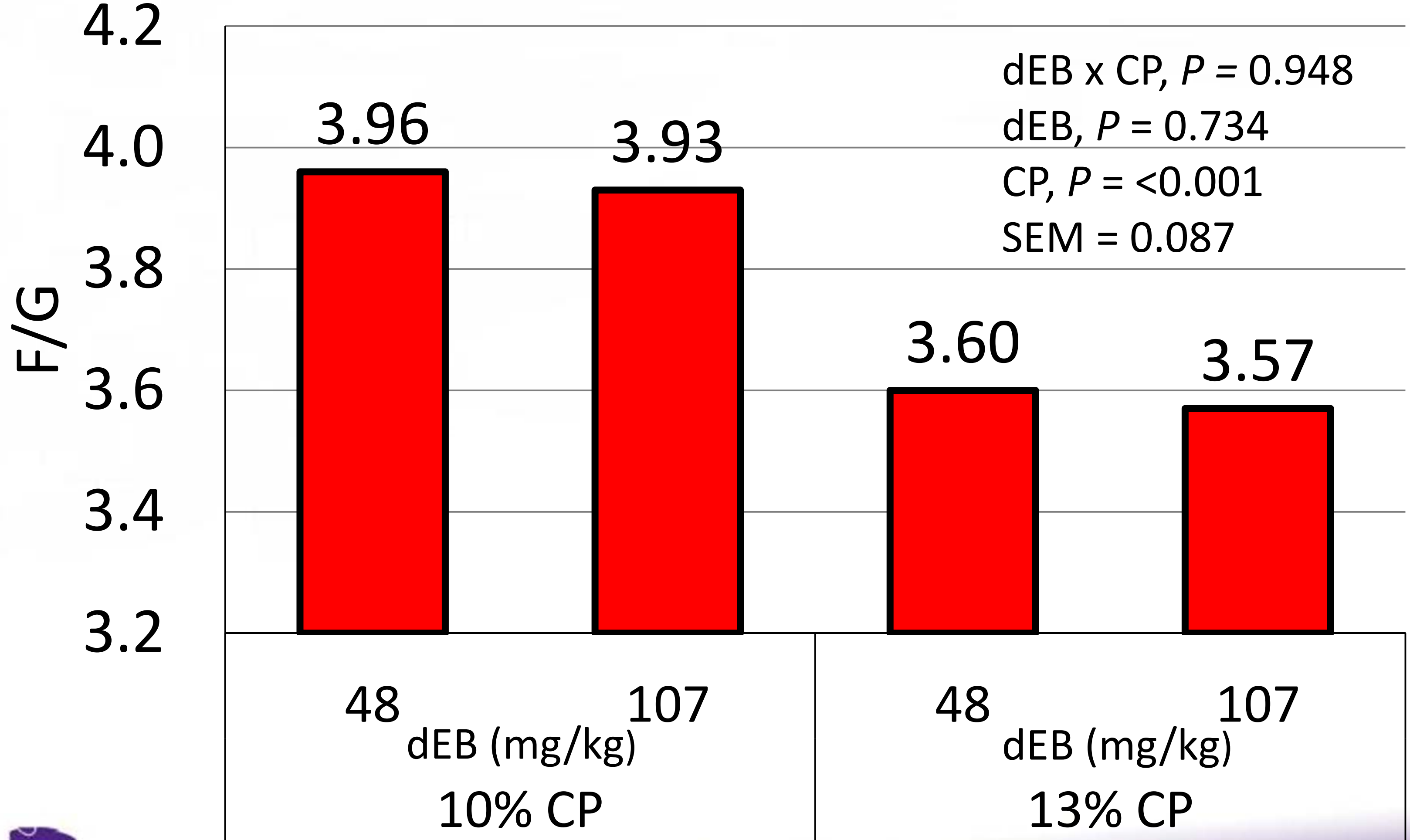


Soto et al. 2016

K·STATE Research and Extension

Knowledge for Life

Effect of electrolyte balance and crude protein in finishing pigs from 240 to 280 lb



Soto et al. 2016

K·STATE Research and Extension

Knowledge for Life

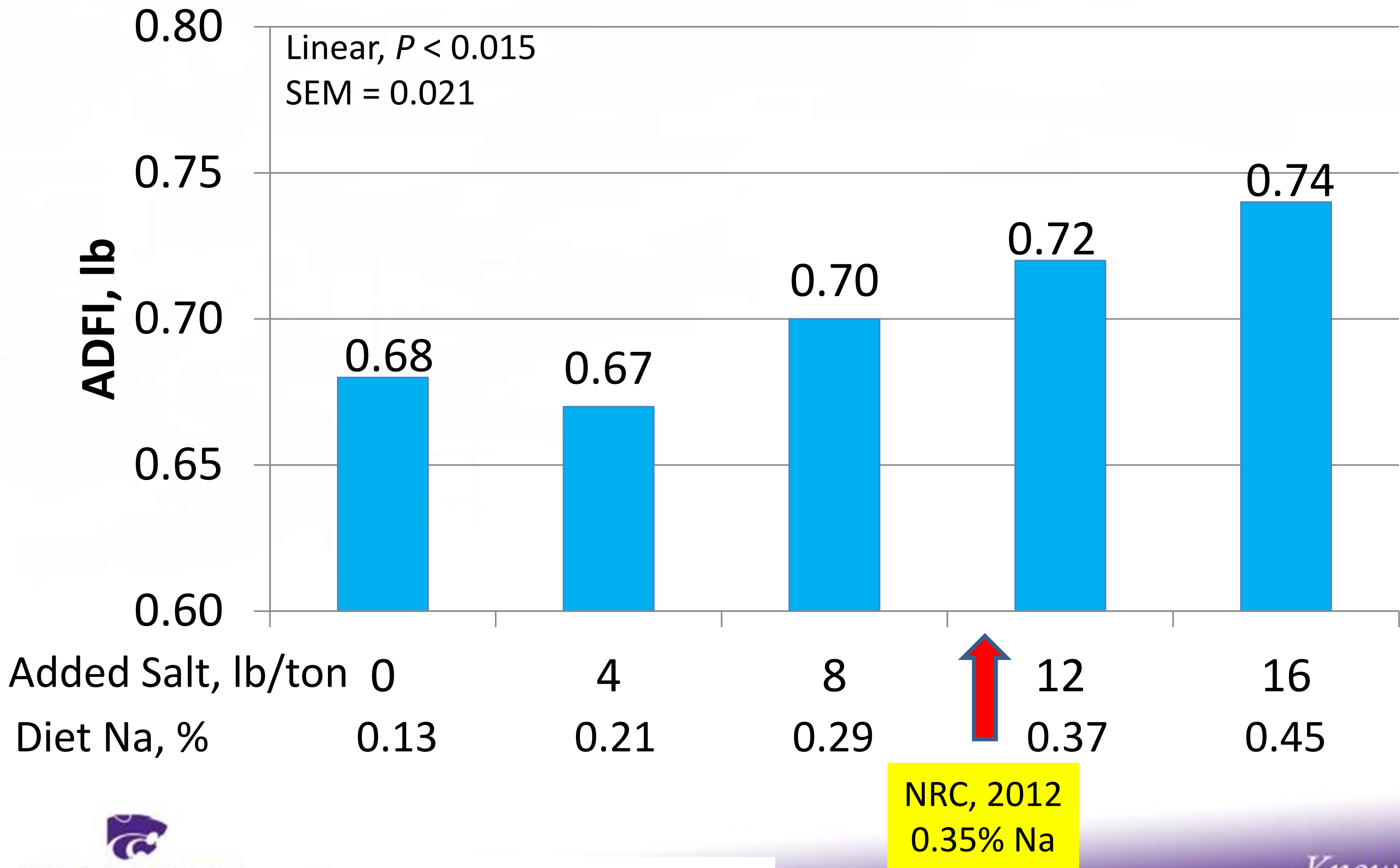
Late finishing amino acid summary

- ✓ 0.55 to 0.65% SID Lys required from 240 to 280 lb
- ✓ Minimum dietary crude protein of 12%
  - ✓ Electrolyte balance is not reason for poor performance of pigs fed lower CP diets in late finishing.

Mineral research

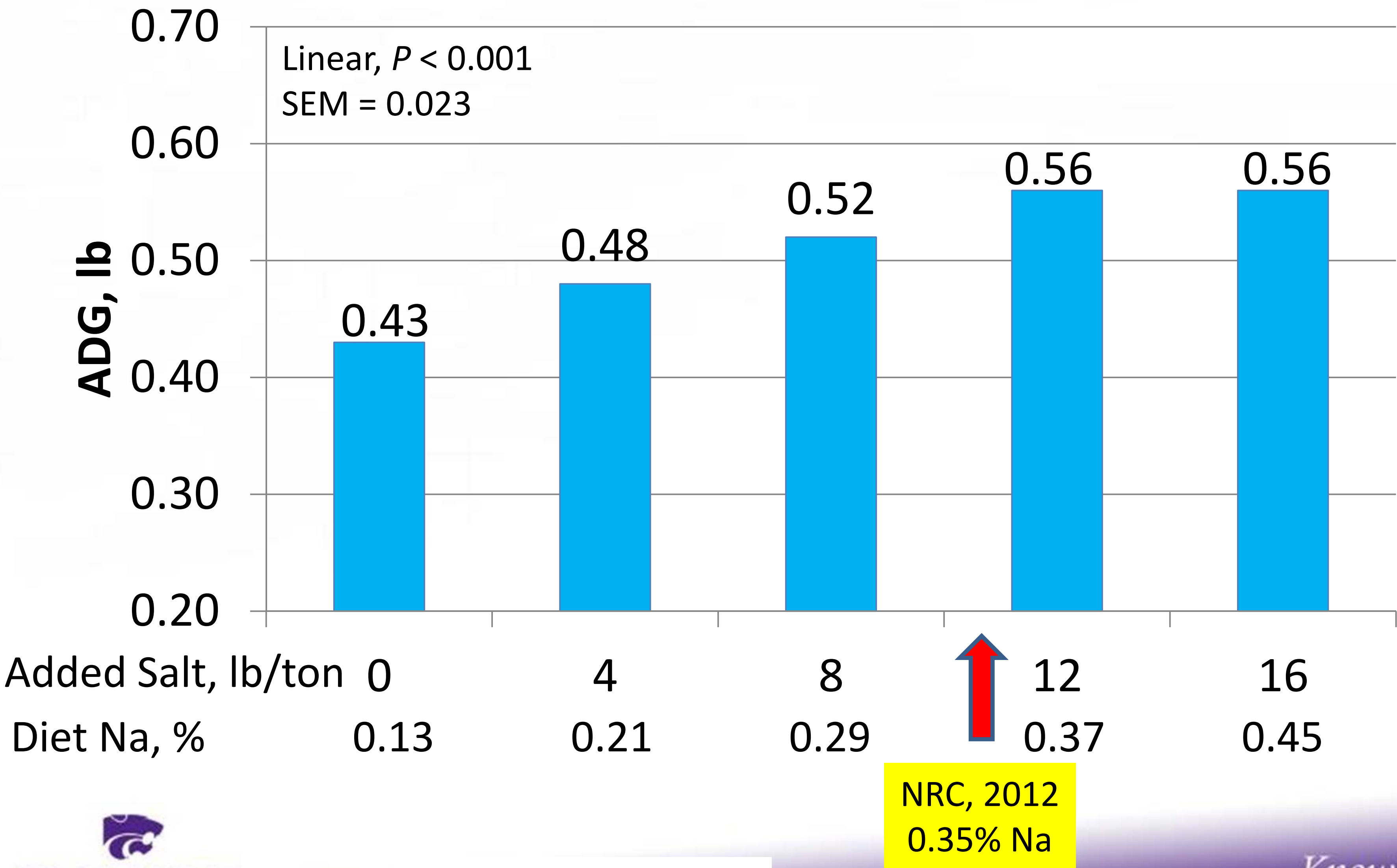
Kansas State University | applied swine nutrition

Added salt for 15–22 lb nursery pigs on ADFI (d 0 to 14)



Shawk et al., 2016

Added salt for 15–22 lb nursery pigs on ADG (d 0 to 14)

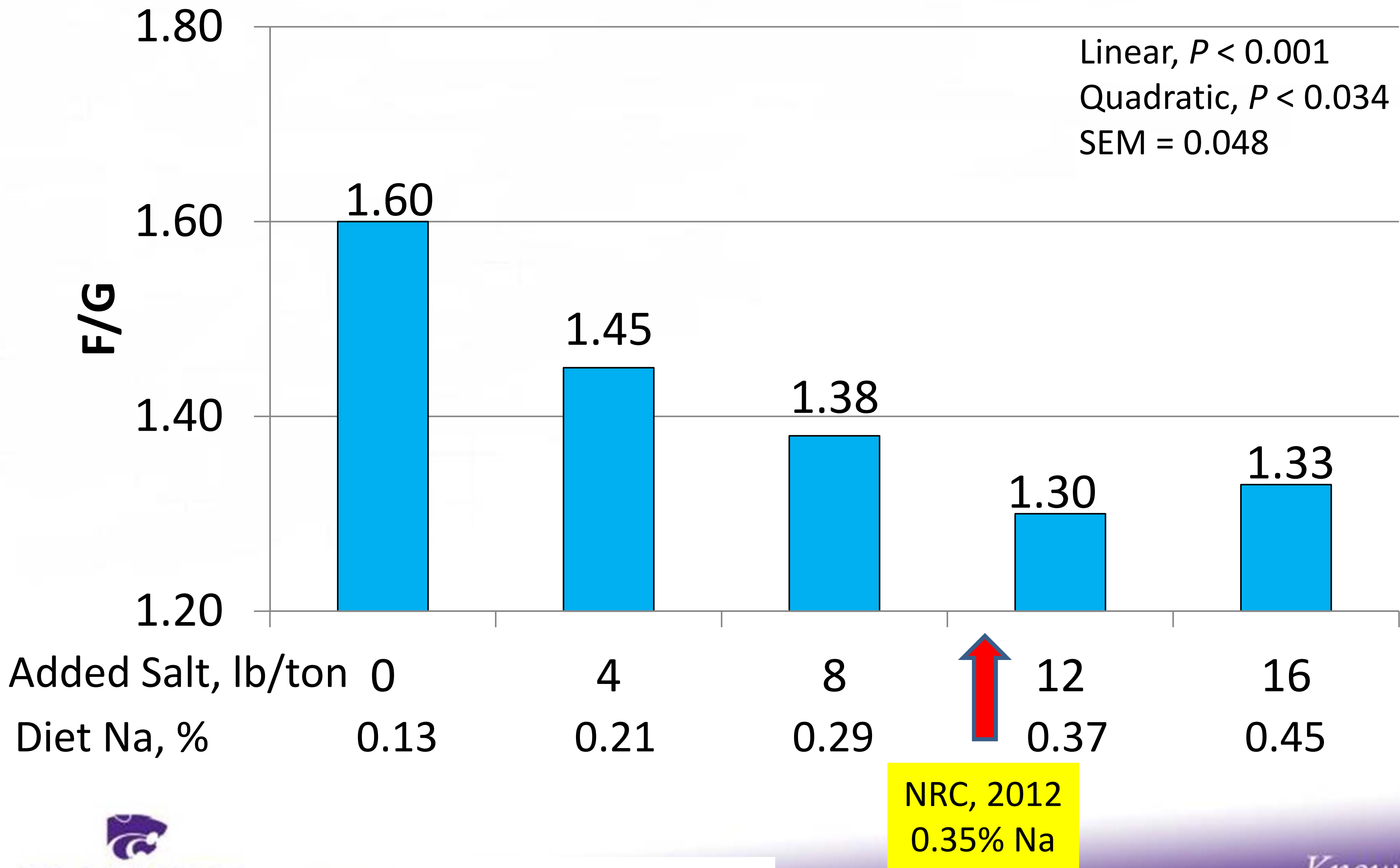


Shawk et al., 2016

K·STATE Research and Extension

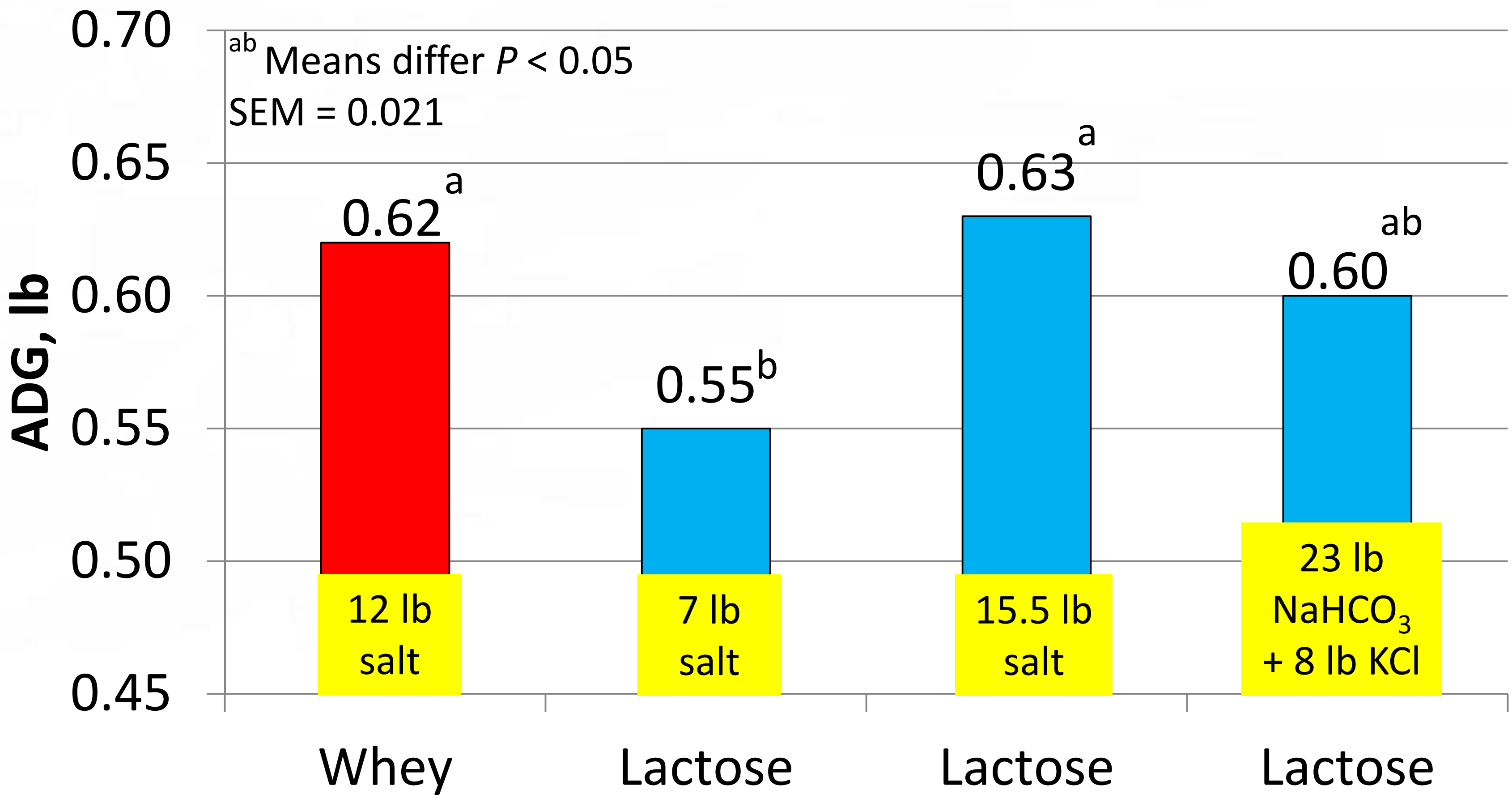
Knowledge for Life

Added salt for 15–22 lb nursery pigs on F/G (d 0 to 14)



Shawk et al., 2016

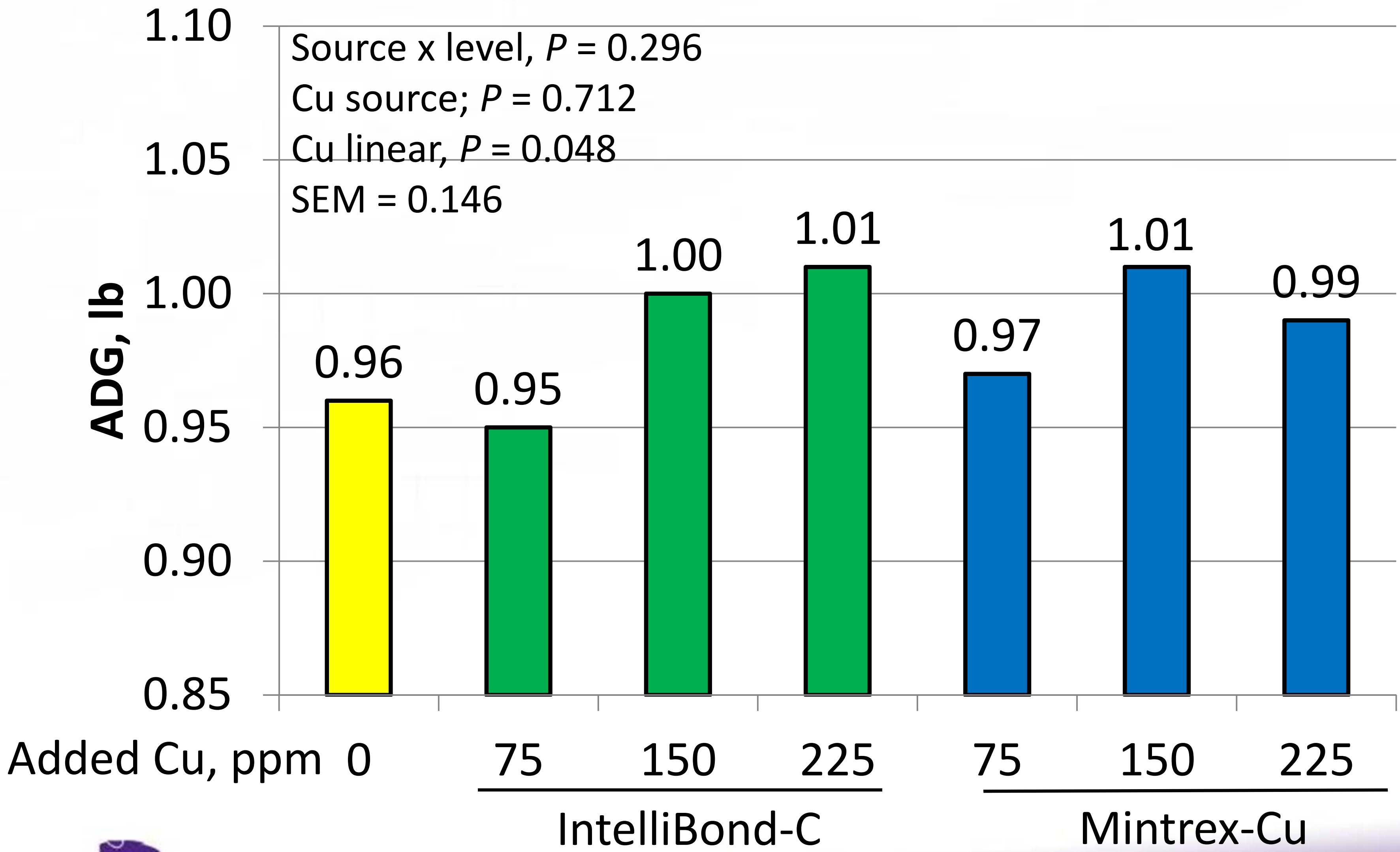
Added Na and Cl for 15–24 lb nursery pigs (d 0 to 14)



Diet Na, %	0.37	0.18	0.35	0.35
Diet Cl, %	0.75	0.47	0.72	0.45

Shawk et al., 2016

Cu source on nursery pig ADG (13-48 lb)

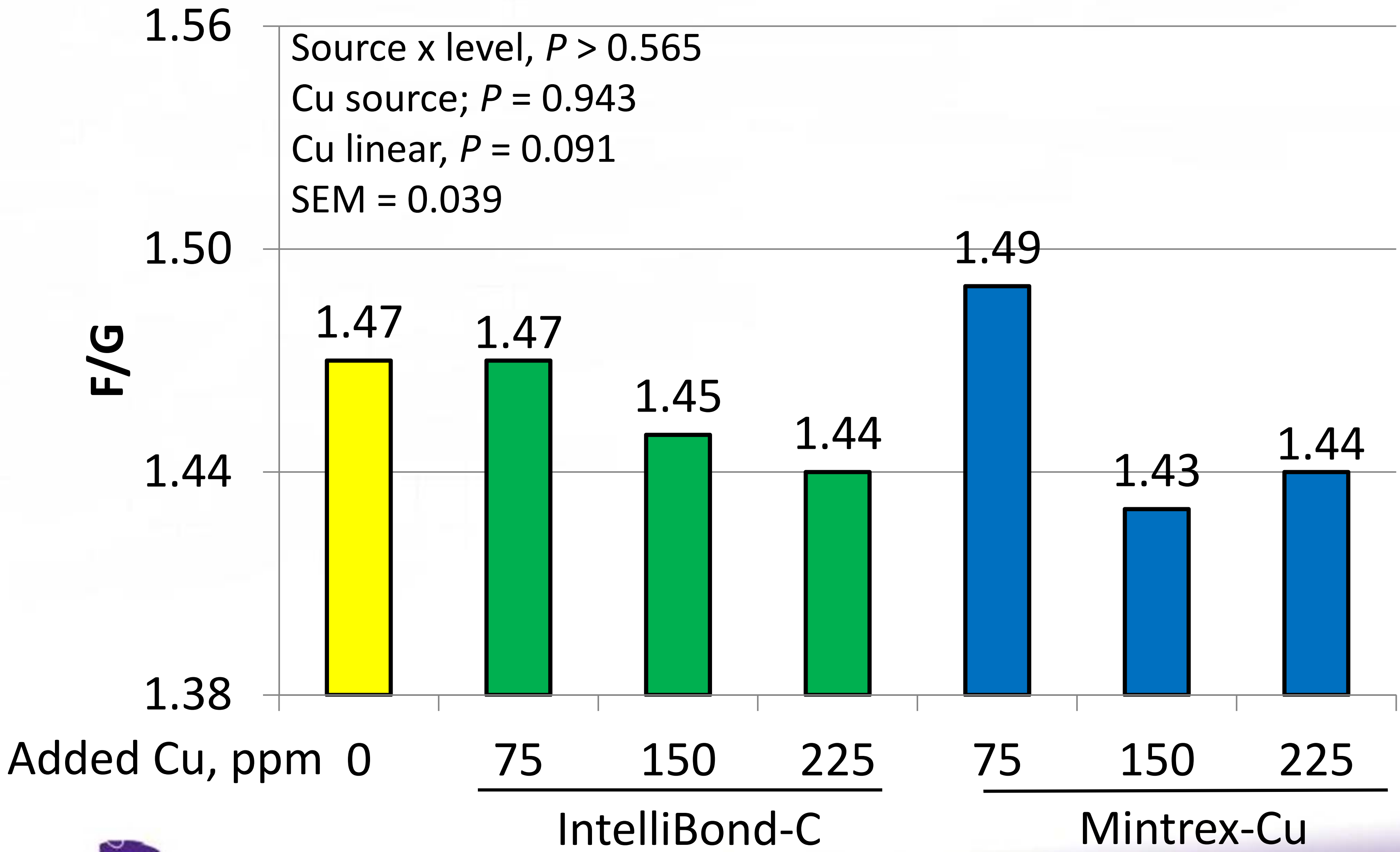


Carpenter et al., 2016

K·STATE Research and Extension

Knowledge for Life

Cu source on nursery pig F/G (13-48 lb)

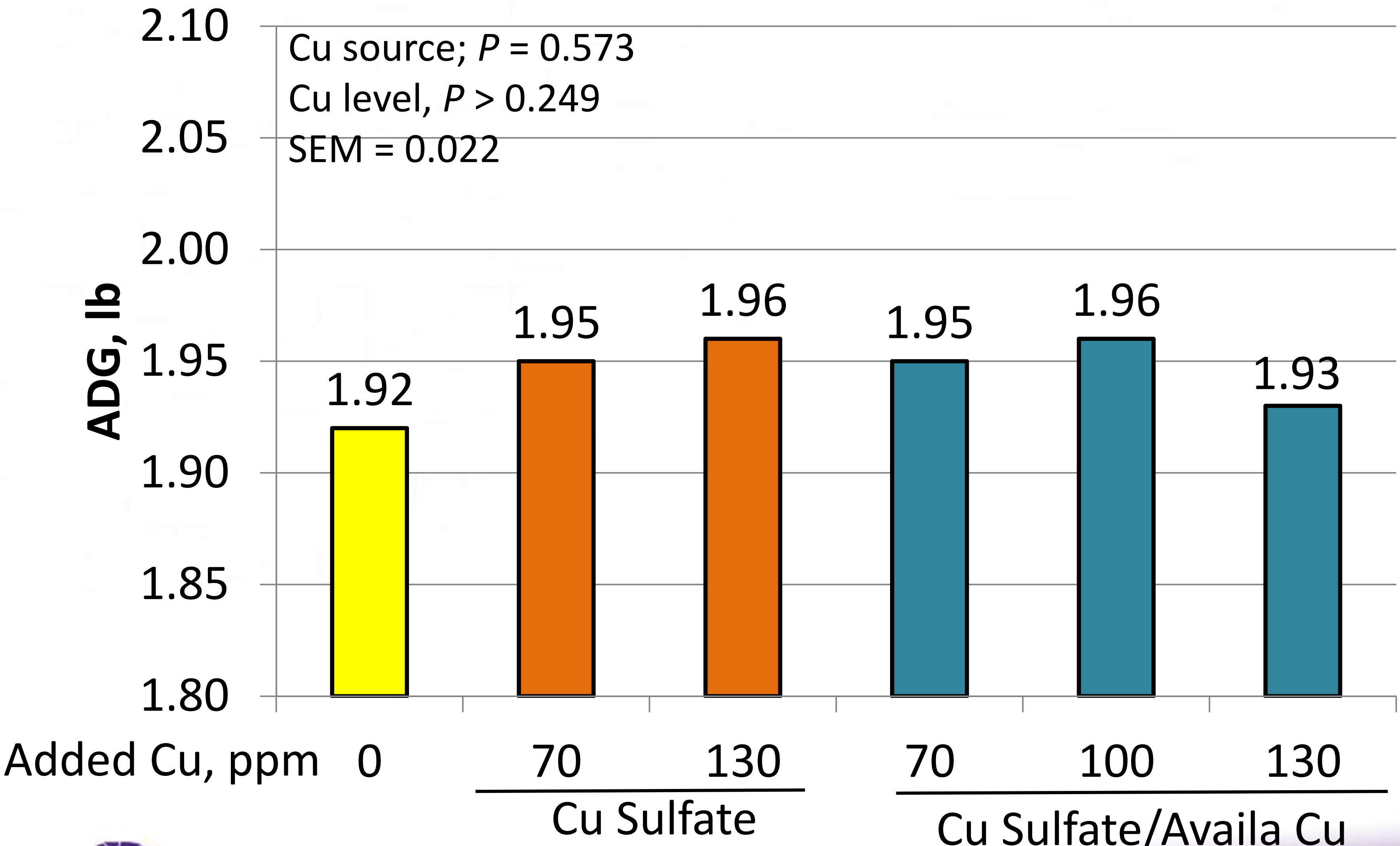


K·STATE Research and Extension

Carpenter et al., 2016

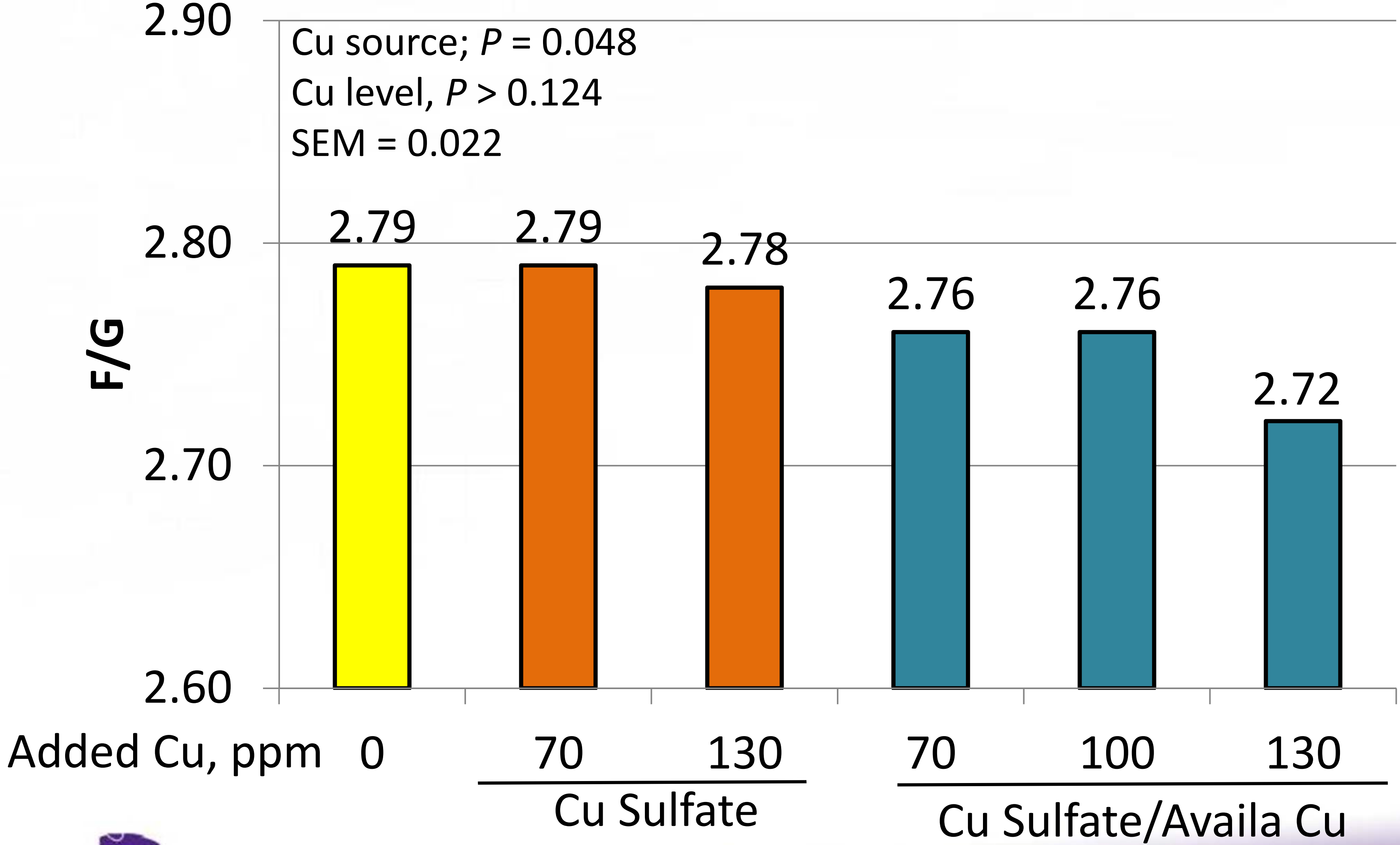
Knowledge for Life

Cu source on finishing pig ADG (82-285 lb)



Carpenter et al., 2016

Cu source on finishing pig F/G (82-285 lb)

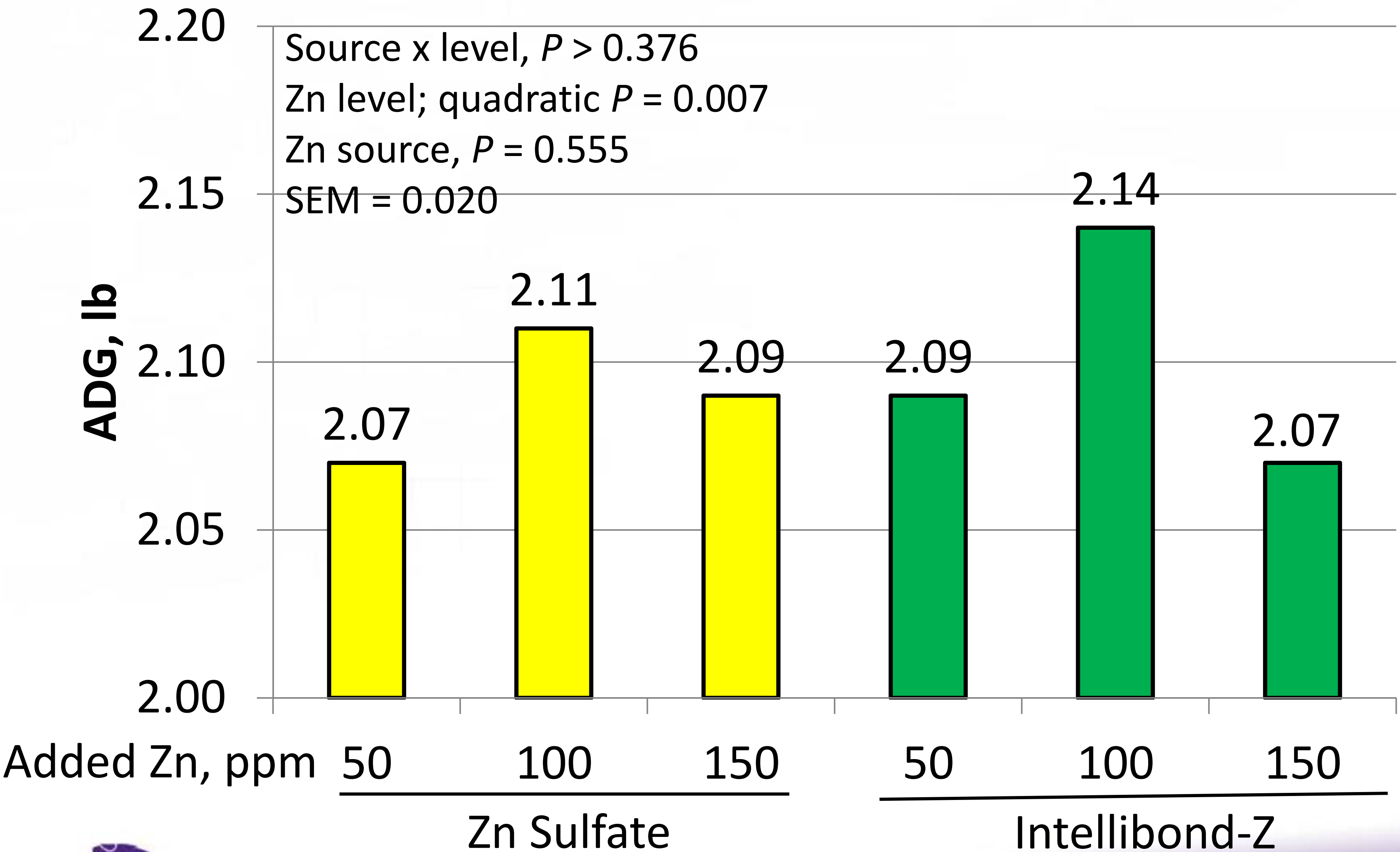


Carpenter et al., 2016

K·STATE Research and Extension

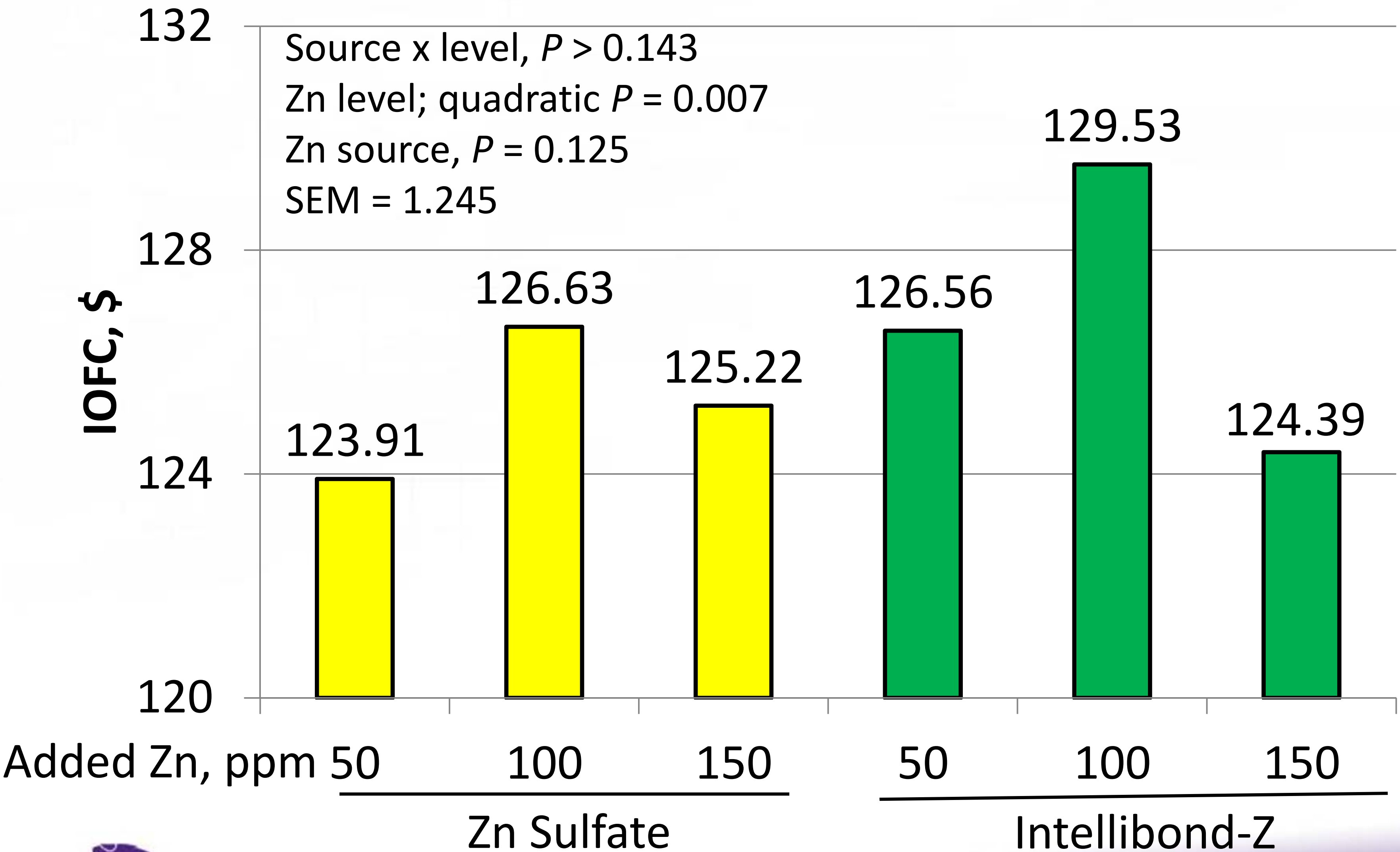
Knowledge for Life

Zn source on finishing pig ADG (70-280 lb)



Carpenter et al., 2016

Zn source on finishing pig IOFC (constant day)



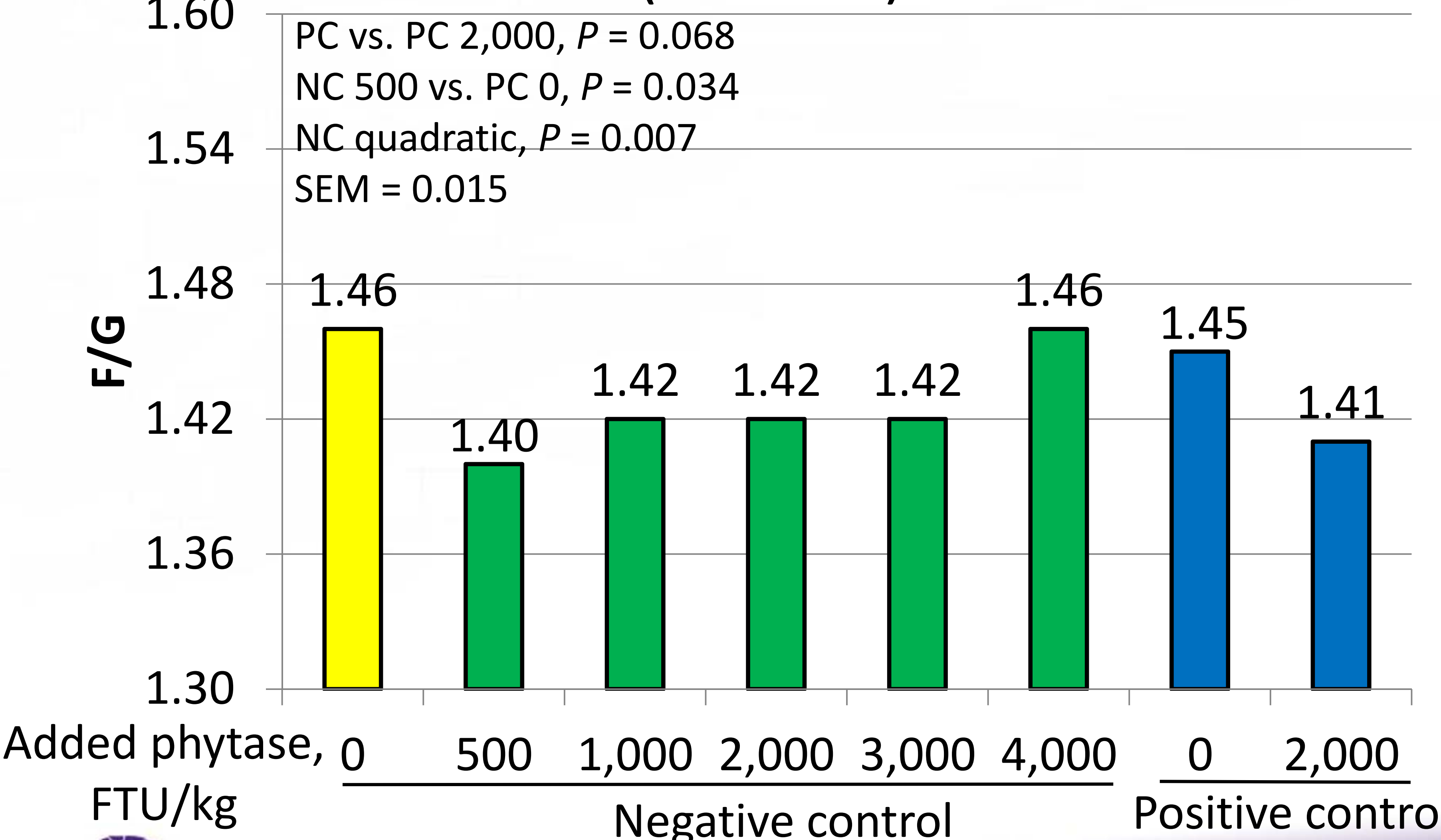
K-STATE Research and Extension

NFP NEW FASHION PORK

Carpenter et al., 2016

Knowledge for Life

Superdose Natuphos E 5,000 G on nursery pig F/G (13-49 lb)

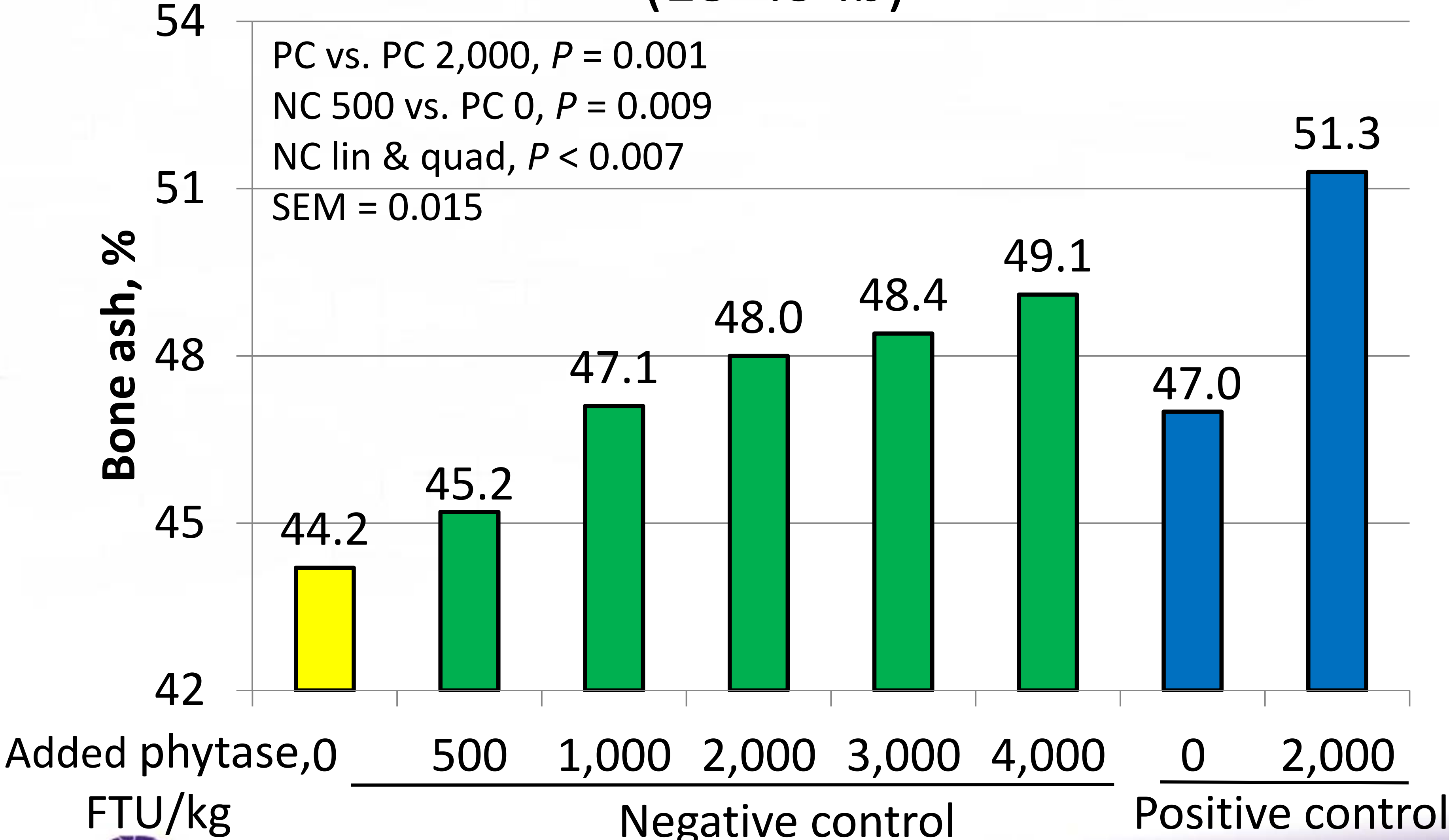


K·STATE Research and Extension

Gourley et al., 2016

Knowledge for Life

Superdose Natuphos E 5,000 G on bone ash % (13-49 lb)

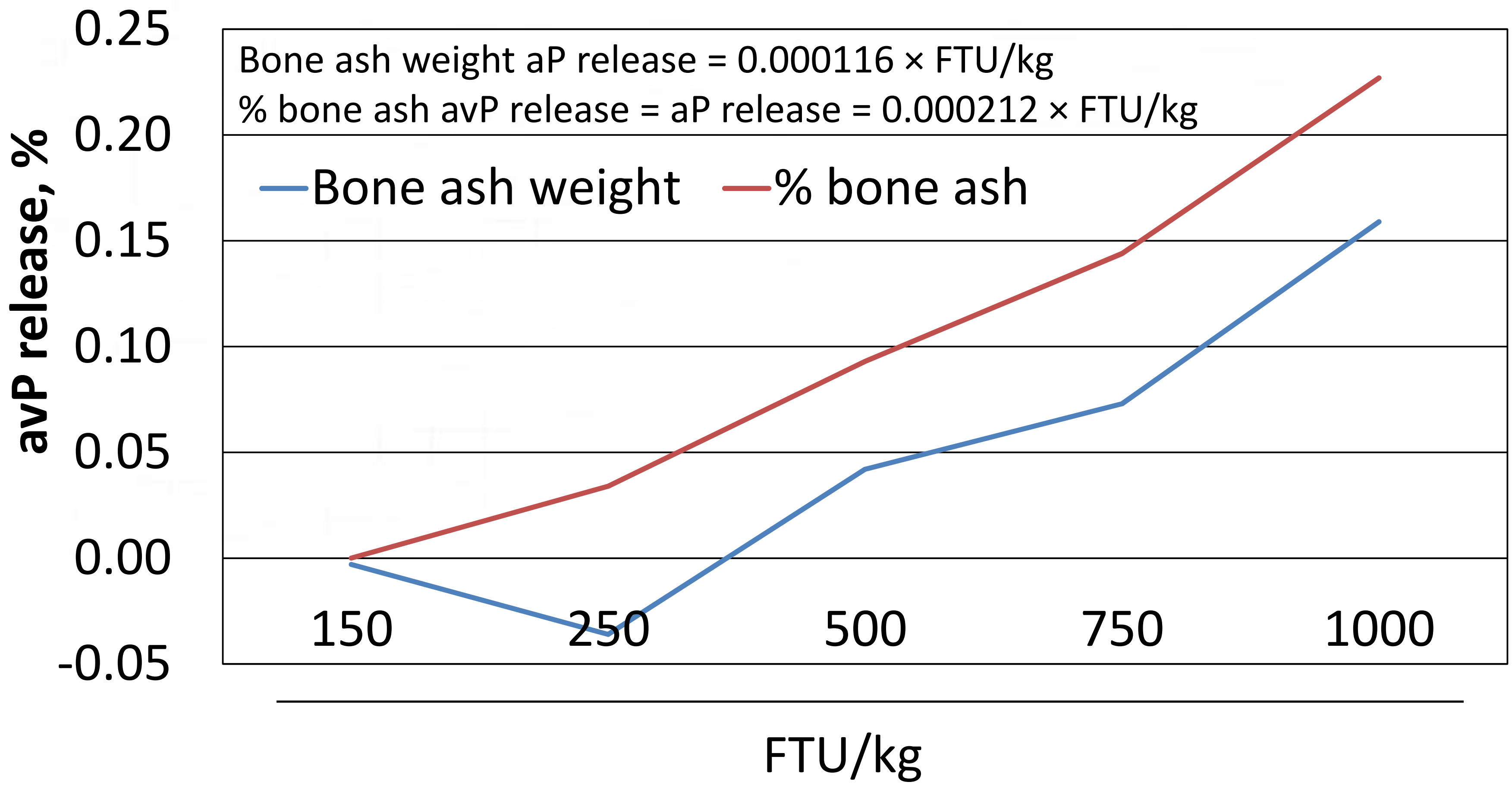


K·STATE Research and Extension

Gourley et al., 2016

Knowledge for Life

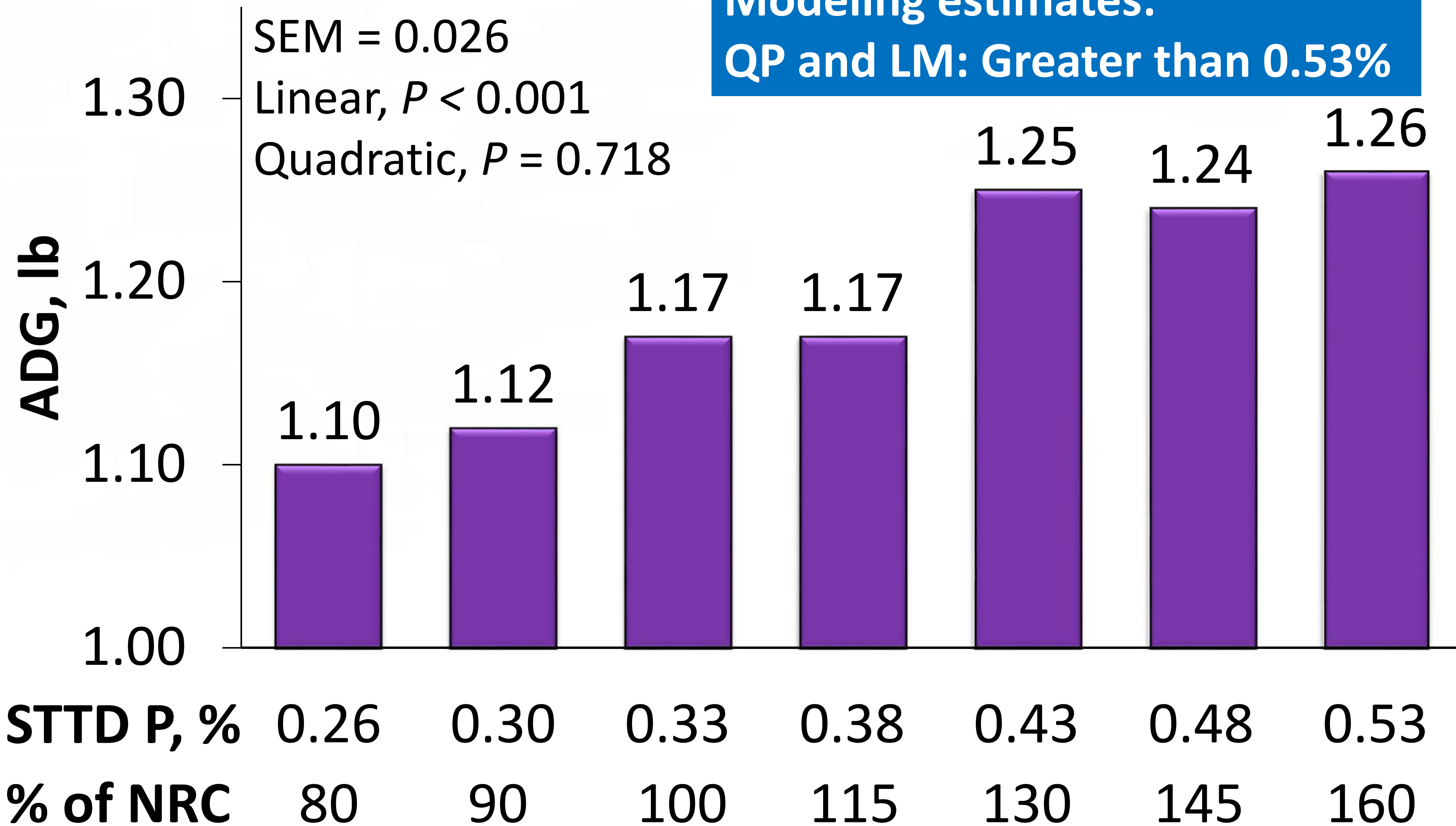
Calculated avP release from Natuphos E 5,000 G



Gourley et al., 2016

Standardized total tract digestible phosphorus
ADG, 25 to 50 lb pigs

Modeling estimates:
QP and LM: Greater than 0.53%



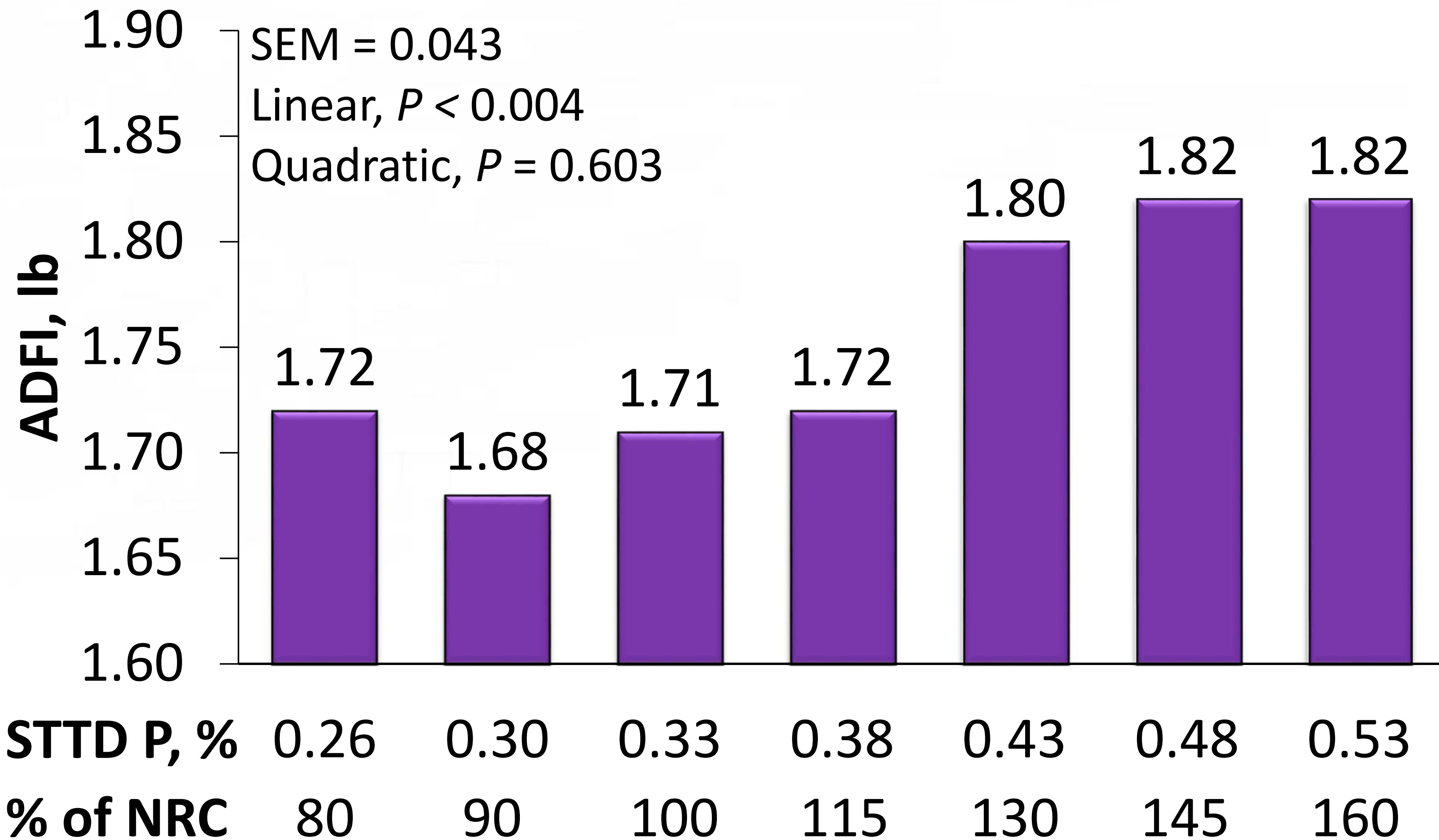
K·STATE Research and Extension

PIC

Vier et al. 2017

Knowledge for Life

Standardized total tract digestible phosphorus
ADFI, 25 to 50 lb pigs



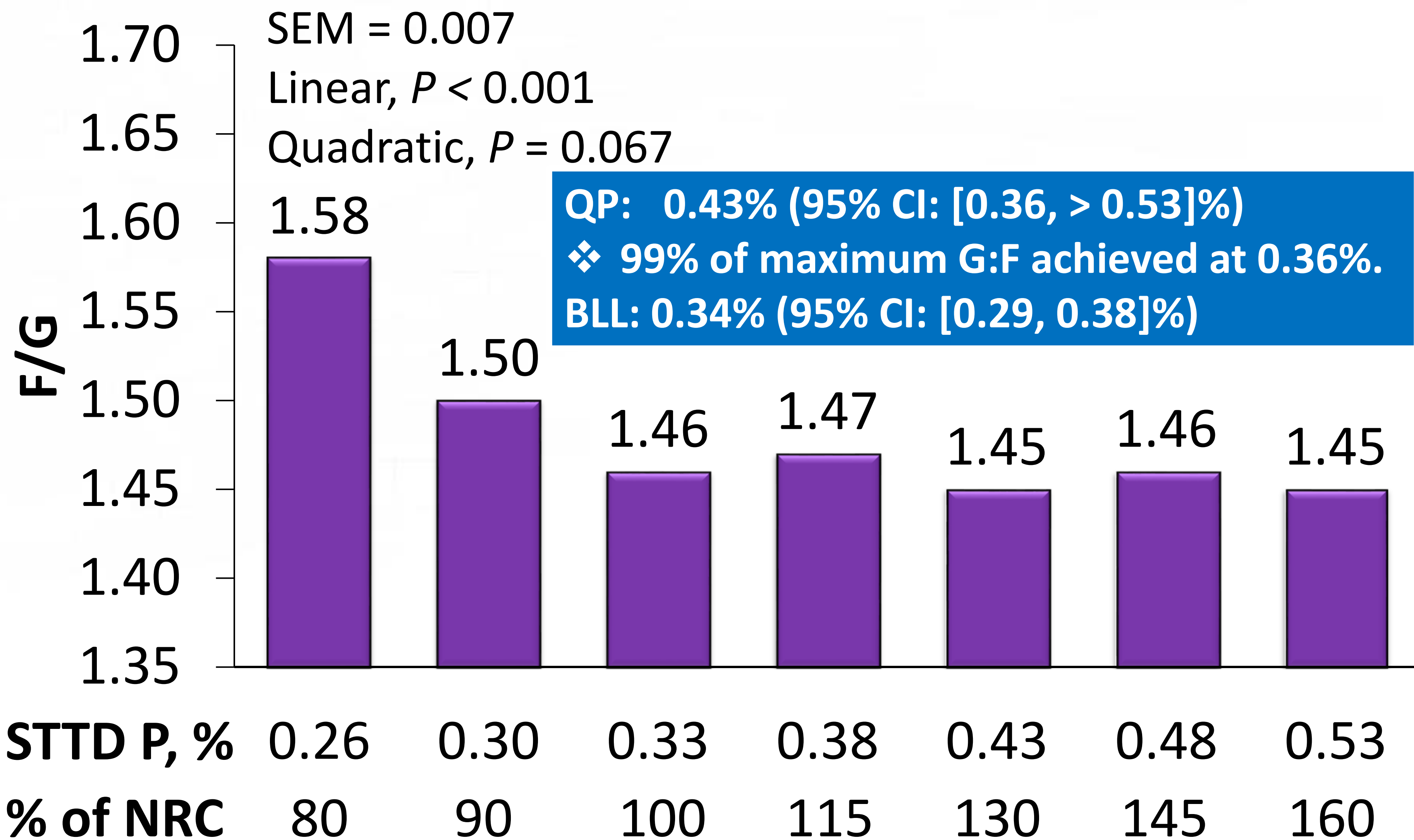
K·STATE Research and Extension

PIC

Vier et al. 2017

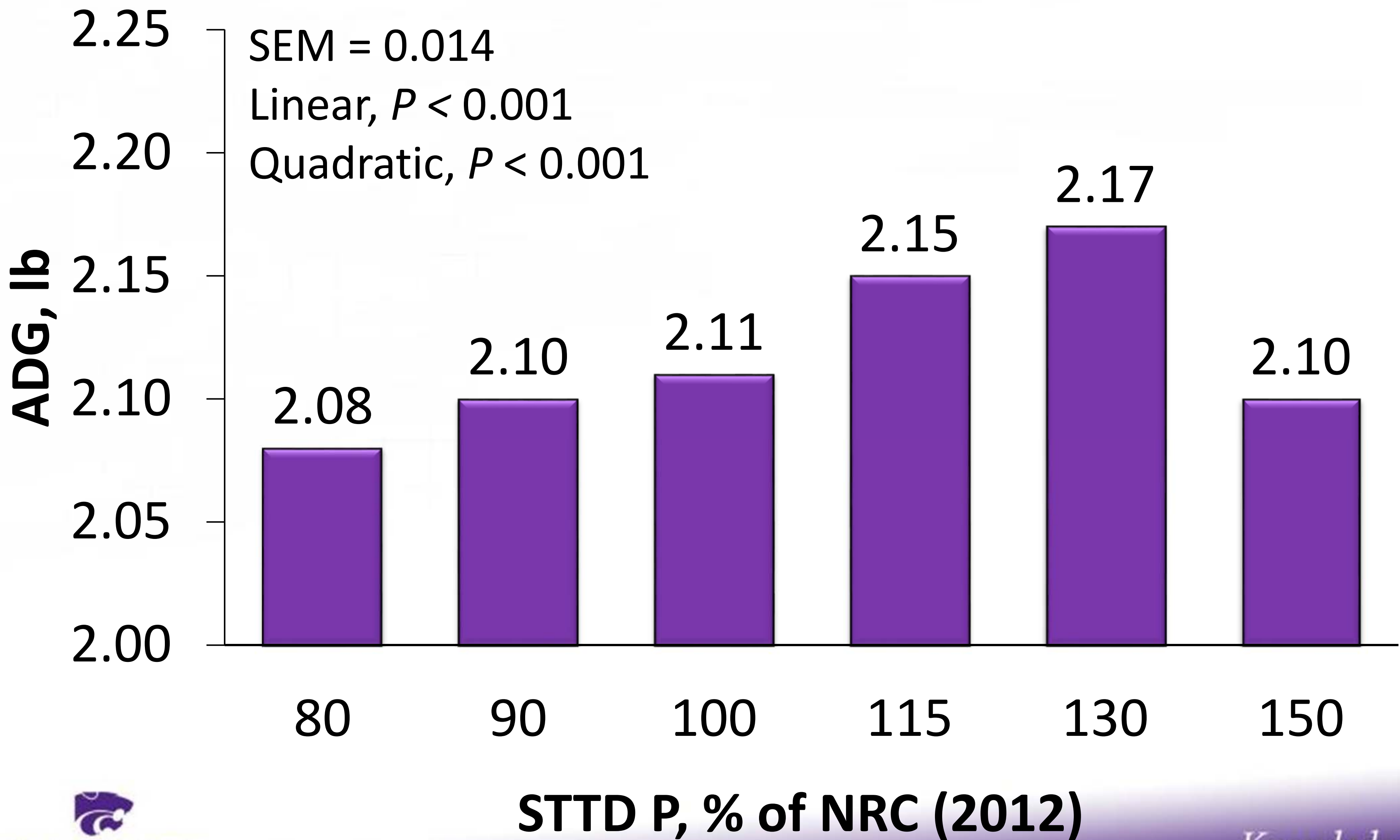
Knowledge for Life

Standardized total tract digestible phosphorus
F/G, 25 to 50 lb pigs



Vier et al. 2017

Standardized total tract digestible phosphorus ADG, d 0 to 111



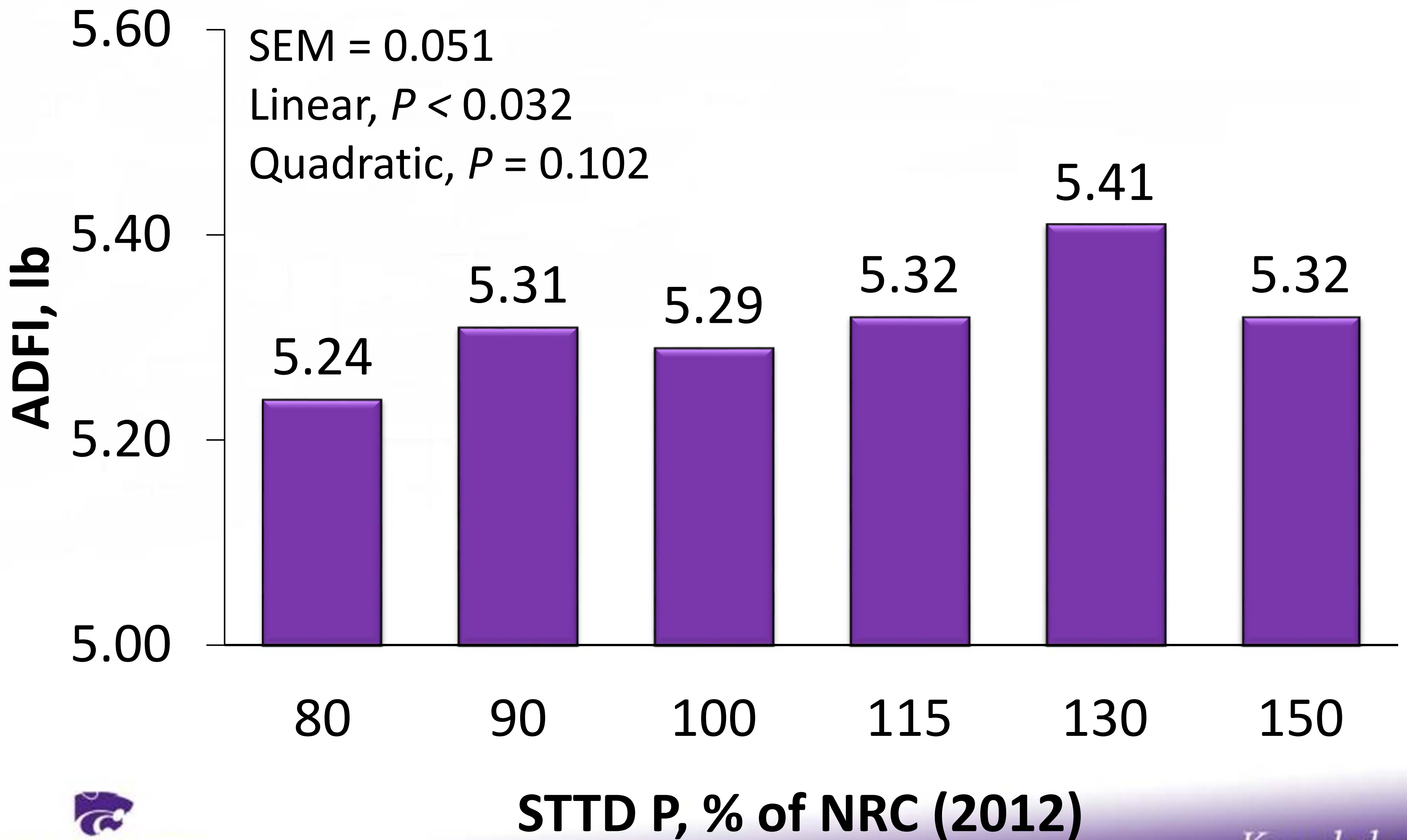
K·STATE Research and Extension

PIC

Vier et al. 2017

Knowledge for Life

Standardized total tract digestible phosphorus ADFI, d 0 to 111



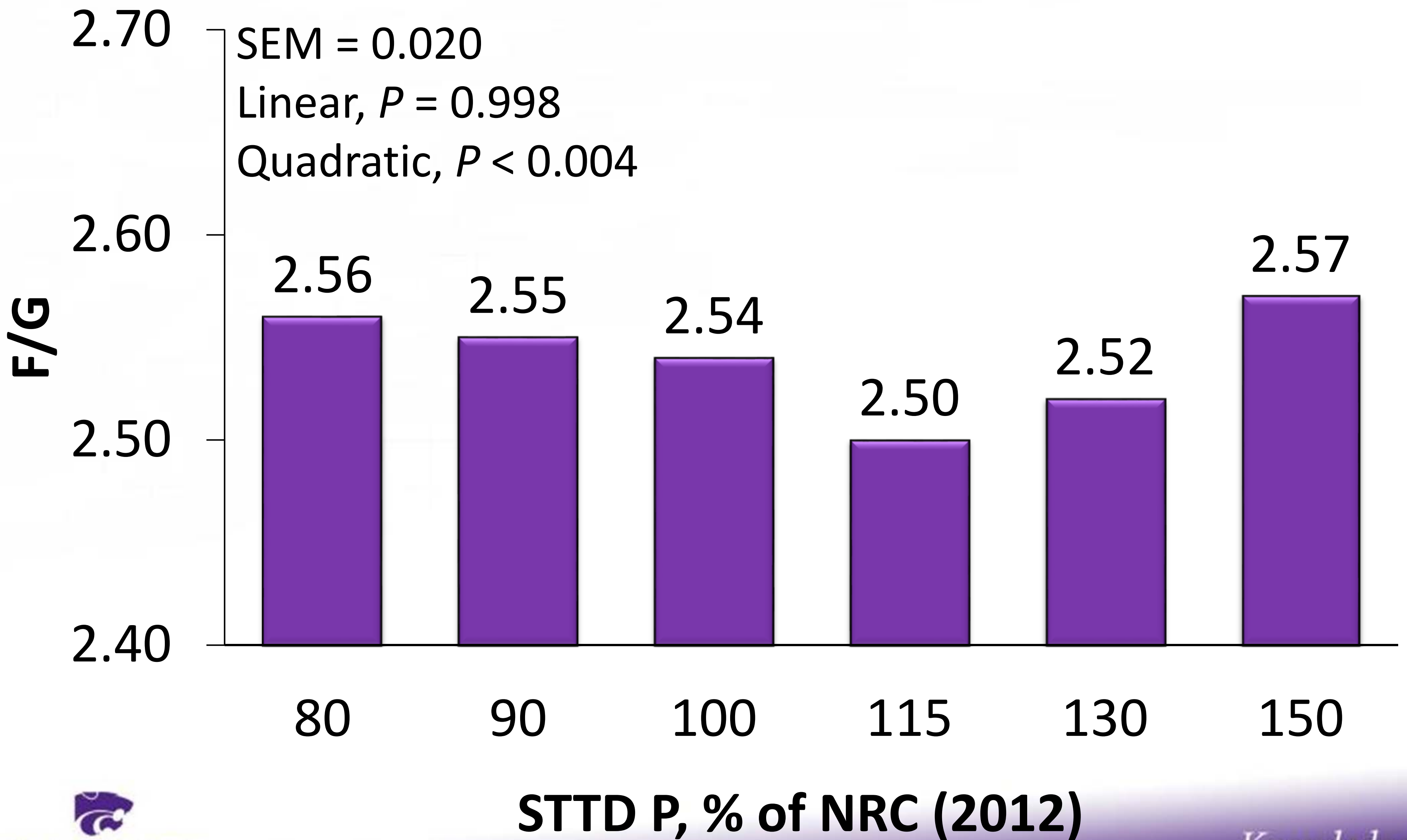
K·STATE Research and Extension

PIC

Vier et al. 2017

Knowledge for Life

Standardized total tract digestible phosphorus F/G, d 0 to 111



K·STATE Research and Extension

PIC

Vier et al. 2017

Knowledge for Life

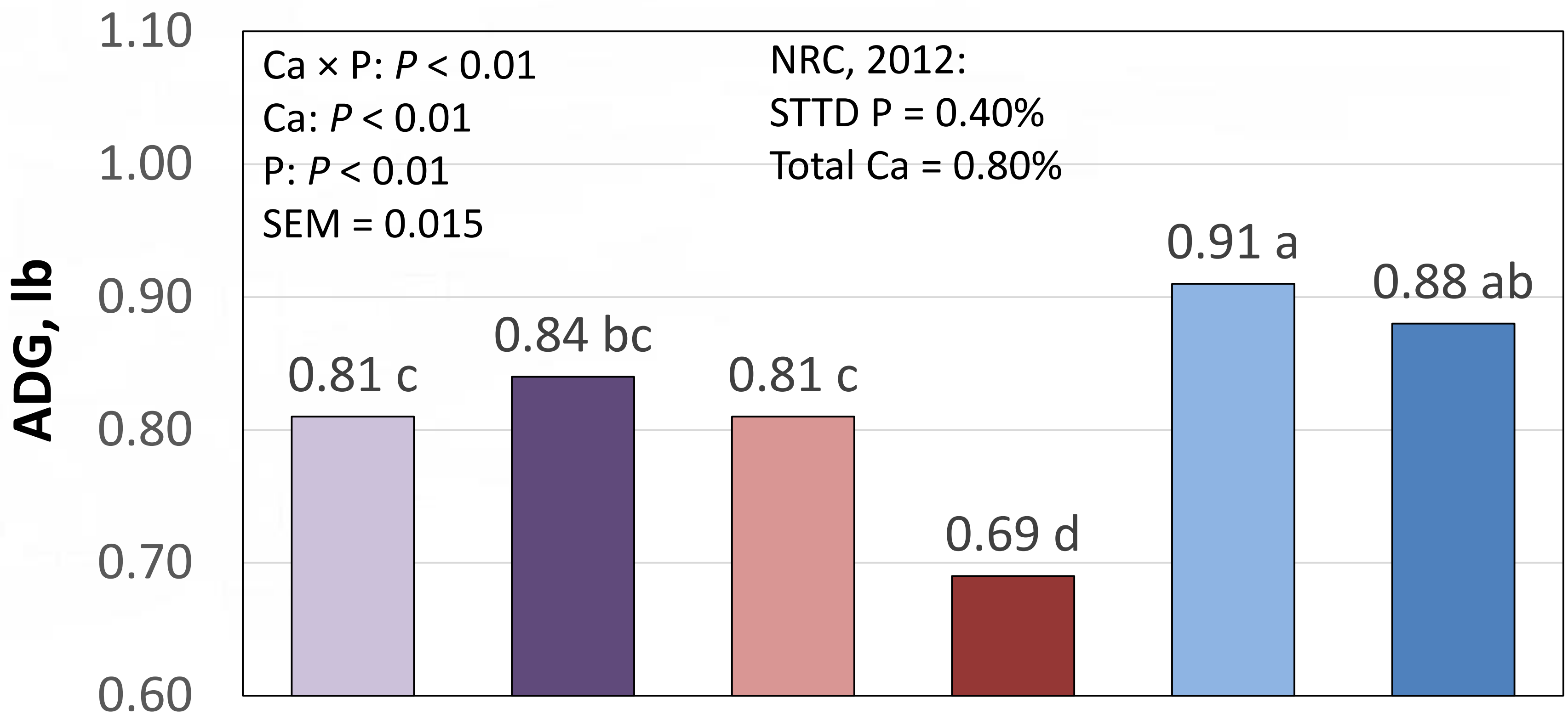
Effects of dietary Ca:P ratio on growth performance of nursery pigs

- Objective:

  To determine the growth performance of nursery pigs fed 2 levels of Ca in combination with 3 standardized total tract digestible (STTD) P treatments.

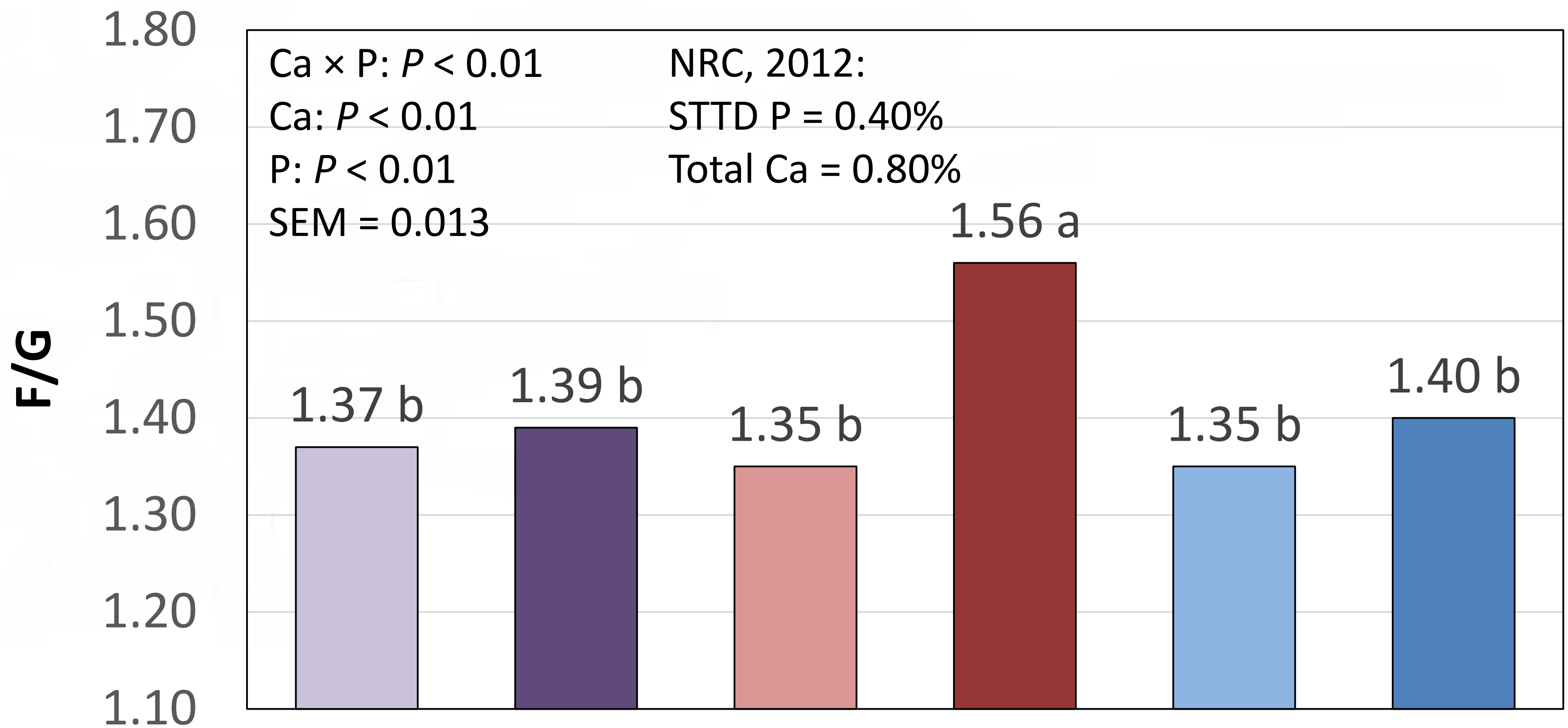
Wu et al., 2017

Effects of dietary Ca:STTD P ratio on growth performance of nursery pigs (d 0 to 28)



Analyzed Ca	0.58	1.03	0.58	1.03	0.46	0.91
Ca with phytase	-	-	-	-	0.58	1.03
STTD P no phytase	0.45	0.45	0.33	0.33	0.33	0.33
STTD P w/phytase	-	-	-	-	0.45	0.45
Total Ca:STTD P	1.29	2.29	1.76	3.12	1.29	2.29

Effects of dietary Ca:STTD P ratio on growth performance of nursery pigs (d 0 to 28)



Analyzed Ca	0.58	1.03	0.58	1.03	0.46	0.91
Ca with phytase	-	-	-	-	0.58	1.03
STTD P no phytase	0.45	0.45	0.33	0.33	0.33	0.33
STTD P w/phytase	-	-	-	-	0.45	0.45
Total Ca:STTD P	1.29	2.29	1.76	3.12	1.29	2.29

Mycotoxins reported in 2016 corn

Fumonisin

- Kansas, North Carolina, Missouri, Texas, Illinois, Oklahoma

Deoxynivalenol (Vomitoxin or DON)

- Ohio, Michigan, Illinois, Indiana, Iowa, Ontario, Canada

Aflatoxin

- Kansas, Oklahoma, Louisiana, Alabama, South Carolina, North Carolina, Georgia, Texas

Zearalenone

- Iowa

Management

Kansas State University | applied swine nutrition

TEAM!!!


12
11
10

Blending Left Over Finishing Feed

- Left-over finishing feed in wean-to-finish production creates challenge in feed management
  - Due to imperfect feed budgeting
  - Issues with storage capacity, tandem contamination
- Reclaim vs. blend in nursery diets in the next turn
  - When to blend?
  - Effects on growth performance and economics?

K·STATE Research and Extension

Wu et al., 2016

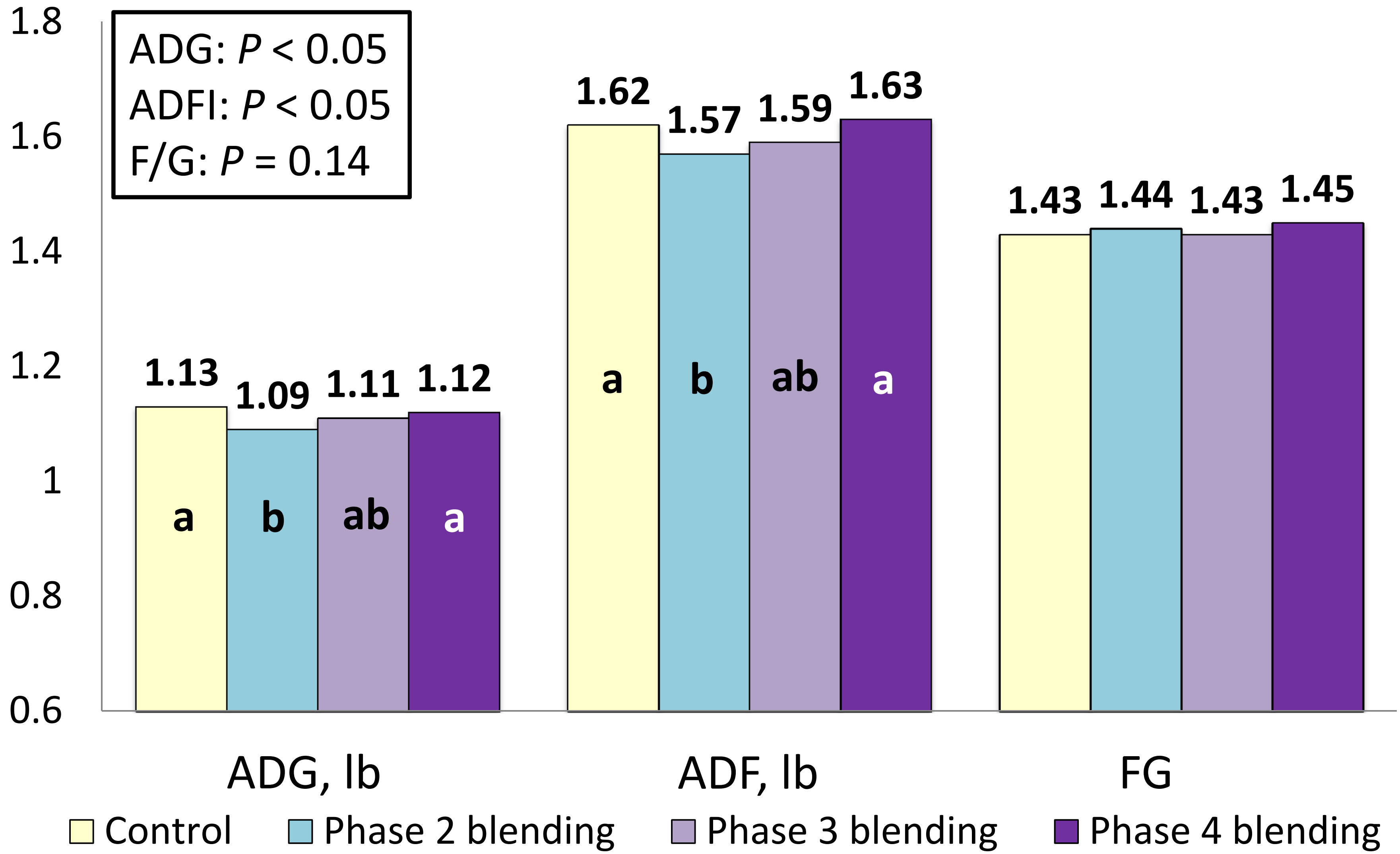
NFP NEW FASHION PORK

Feed budget

Phase	Control	Blended diets: Phase 2	Blended diets: Phase 3	Blended diets: Phase 4
Phase 1	5.47 lb	5.47 lb	5.47 lb	5.47 lb
Phase 2	8.07 lb	2.75 lb finishing feed, 5.5 lb 50:50% blend, 5.5 lb standard Phase 2	8.07 lb	8.07 lb
Phase 3	8.07 lb	8.07 lb	2.75 lb finishing feed, 5.5 lb 50:50% blend, 5.5 lb standard Phase 3	8.07 lb
Phase 4	21 lb	21 lb	21 lb	2.75 lb finishing feed, 5.5 lb 50:50% blend, 5.5 lb standard Phase 4
Phase 5	21 lb	15.5 lb	15.5 lb	15.5 lb

Wu et al., 2016

Overall growth performance



Wu et al., 2016

[a,b] Least squares means differ ($P \leq 0.05$)

Economics

		Blended diets				
Item	Control	Phase 2	Phase 3	Phase 4	SEM	*P*-value
Economics, $/pig						
Feed cost	12.37[a]	11.74[b]	12.01[b]	12.39[a]	0.134	<0.001
Gain value	31.95[a]	30.64[b]	31.18[ab]	31.64[a]	0.334	0.031
Feed cost/lb gain	0.232	0.231	0.230	0.234	0.0020	0.410
IOFC	19.58	18.89	19.16	19.26	0.261	0.317
Breakeven cost for reclaiming feed, $	-	**1,518**	**924**	**704**	-	-

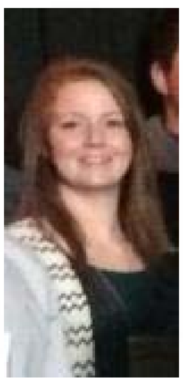
Reclaiming feed ($290 per group @ $0.23/head) is more cost effective than feeding in any phase of the nursery!

K·STATE Research and Extension

Wu et al., 2016

NEW FASHION PORK

Effects of Pig Space Allowance on Finishing Pig Growth Performance



C.J. Holder

Undergraduate Research Symposium

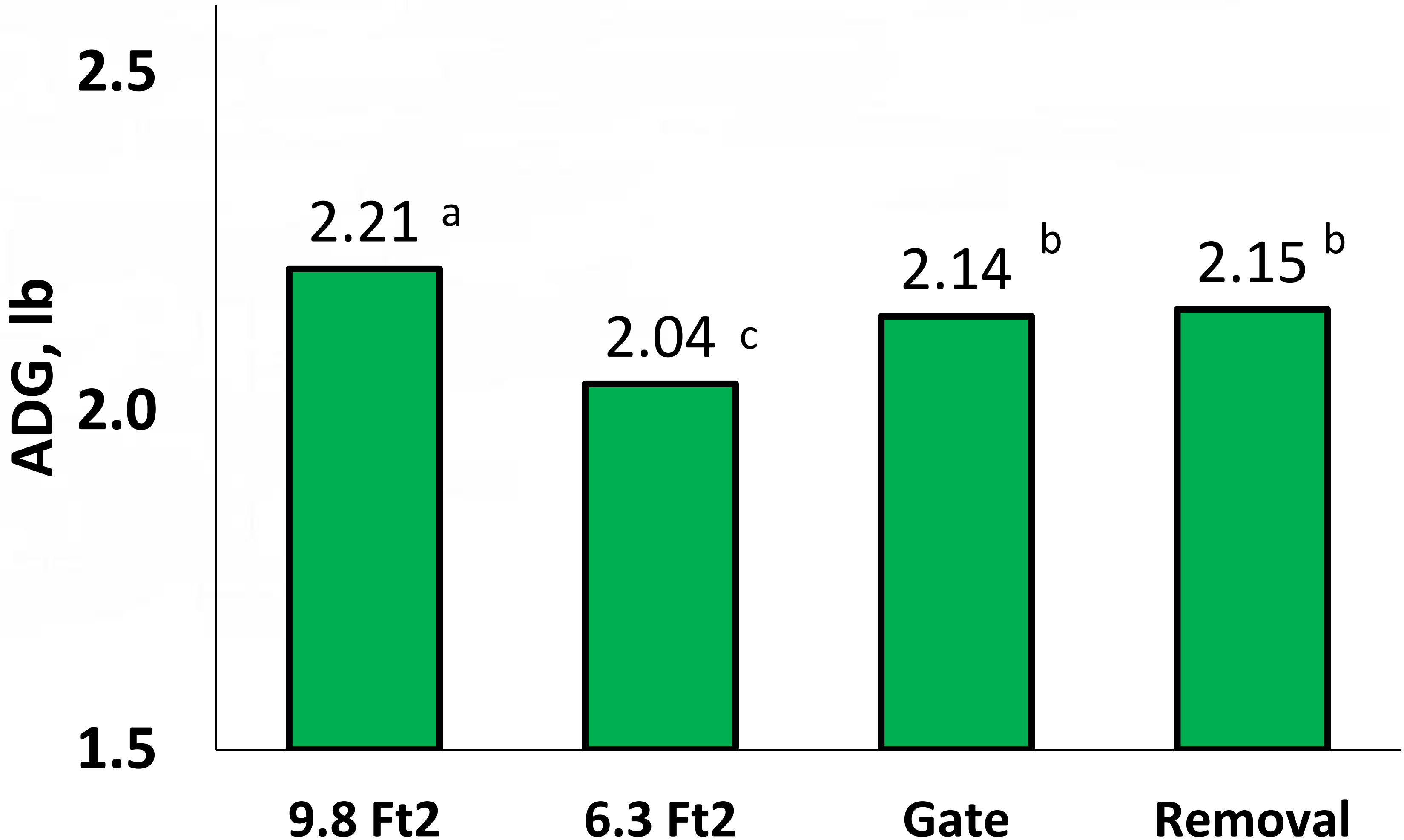
May 6th, 2106

Volume 2, Issue 8 (2016) Swine Day

Holder, C.; Carpenter, C.; Tokach, M. D.; DeRouchey, J. M.; Woodworth, J. C.; Goodband, R. D.; and Dritz, S. S. (2016) "Effects of Increasing Space Allowance by Removing a Pig or Gate Adjustment on Finishing Pig Growth Performance," *Kansas Agricultural Experiment Station Research Reports*: Vol. 2: Iss. 8.
http://dx.doi.org/10.4148/2378-5977.1315

K·STATE
Research and Extension

ADG, d 0 to 71



Holder et al. 2016

Discussion

- Space restriction began to influence growth rate between 153 and 182 lb.

- Confirms research by Thomas et al., 2015 and Flohr et al. (2015) which suggests reductions in growth due to occur prior to when the pigs reach the **critical *k* value**

KANSAS STATE UNIVERSITY

Search web, people, directories

Browse A-Z

Sign

K-State home » College of Agriculture » ASI » Species » Swine » Research and Extension » Calculators

Animal Sciences and Industry

- ASI Home
- People
- About Us
- Students & Programs
- Species
  - Beef
  - Dairy
  - Equine
  - Poultry
  - Sheep & Goats
  - Swine
    - Research & Extension
      - Feeder Adjustment Cards
      - Calculators
      - Gestation Feeding Tools
      - Particle Size Information
      - Premix & Diet

Calculators

Feed Efficiency Evaluation Tool (v3 - November, 2015)

Floor Space Impact on Pig Performance (v7 - November, 2015)

Iodine Value Prediction Spreadsheet

KSU Fat Analysis calculator

DDGS Calculator (November, 2013)

AA Pricing Spreadsheet

Meat and Bone Meal Calculator

KSU Feed Budget Calculator

KSU Phytase Calculator

Floor space Tool

K-STATE Research and Extension

Josh Flohr Meta analysis 2015

Knowledge for Life

Floor space calculator

	Adjustment observation	Input information required (Can do five estimates) 1	2	3	4	5
Initial BW, lbs	50	230	230	230	230	230
Final BW, lbs	280	280	280	280	280	280
Stocking density, pigs/pen	26	26	26	24	22	20
Floor space/pig, ft^2	6.9	6.9	6.9	7.5	8.2	9.0
Observed ADG, lb	1.87					
Observed ADFI, lb	5.7					
Pen width, ft	10	Pen, sq ft	180			
Pen length, ft	18					
k value	0.0250	0.0250	0.0250	0.0271	0.0296	0.0326
Growth measurement estimates						
ADG, lb/d		1.63	1.63	1.68	1.74	1.80
ADFI, lb/d		6.01	6.01	6.12	6.24	6.37
G:F		0.272	0.272	0.275	0.279	0.283
Feed/gain		3.68	3.68	3.63	3.58	3.54

Intro | Floor space calcuator | **Stocking density calculator**

K·STATE Research and Extension

Josh Flohr Meta analysis 2015

Knowledge for Life

A review of heavy weight market pigs: status of knowledge and future needs assessment

F. Wu, K. R. Vierck, T. G. O'Quinn, M. D. Tokach, R. D. Goodband, S. S. Dritz, J. C. Woodworth, and J. M. DeRouchey

Acknowledgement:

Funding for this review was provided by:
National Pork Board

K·STATE
Research and Extension

Knowledge for Life

Summary

- Marketing weight will continue increase
  - 0.5 kg/yr (1.2 lb/yr; NASS, 2014)
- Genetic selection of lean genotype is the driving force for increasing marketing weight
- Limited information is available concerning nutritional requirements of pigs > 140 kg (310 lb)
- Facility design and packing plant equipment need to be adjusted for biological and physical requirements of heavy pig

K·STATE Research and Extension

Wu et al., 2017 Translational Animal Science

Knowledge for Life

Swine production around the world is differentiating based on health and productivity.

T.L.C.
THOMAS LIVESTOCK CO.
Creating Community Opportunities

Parameter	3 FARM AVG/ TOTAL
FARROWING RATE	96.1%
AVG TOTAL BORN	15.8
AVERAGE LIVEBORN	14.9
NET GAIN (WEAN AVG) TARGET 13.5	14.0
POPULATION	
MATED GILTS/SOWS	15767
SOW DEATHS %	3.7%
# PIGSWEANED/ MATED FEMALE/YR	36.1

SUNWOLD		MORTALITY
		Running Total
Week	Phase	%
17	Nursery	0.83%
17	Finisher	0.74%

SUNTERRA™


6
PULMOTIL
ELANCO
PULMOTIL
ELANCO

VFD Management

- Biosecurity
- Increase Wean Age
- Pathogen Elimination
  – Eradicate mycoplasma
  – Control pathogen spread in the growing pig

KANSAS STATE
UNIVERSITY

Search web, people, directories
Browse A-Z   Sign in

K-State home » College of Agriculture » ASI » Research and Extension » Antibiotic Resources

Animal Sciences and Industry

About | Undergraduate | Graduate | Research & Extension | Events

Antibiotic resistance

- KSU Factsheets
- Overview
- Mechanisms
- Livestock production
- USDA and FDA action plans
- News Feeds

Regulations and veterinary feed directives

Alternatives to antibiotics in livestock production

Management practices to reduce the need for antibiotics

Antibiotics in Livestock Production

Antibiotic resistance

- KSU Factsheets
- Overview
- Mechanisms
- Livestock production
- USDA and FDA action plans
- News Feeds

www.KSUantibiotics.org

Regulations and veterinary feed directives

Alternatives to antibiotics in livestock production

Management practices to reduce the need for antibiotics

This work is/was supported by the USDA National Institute of Food and Agriculture, AFRI Food Safety Challenge Grant project 2013-68003-21257. The contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA or NIFA.

Animal Sciences and Industry

Kansas State University
232 Weber Hall
Manhattan, KS 66506-8028

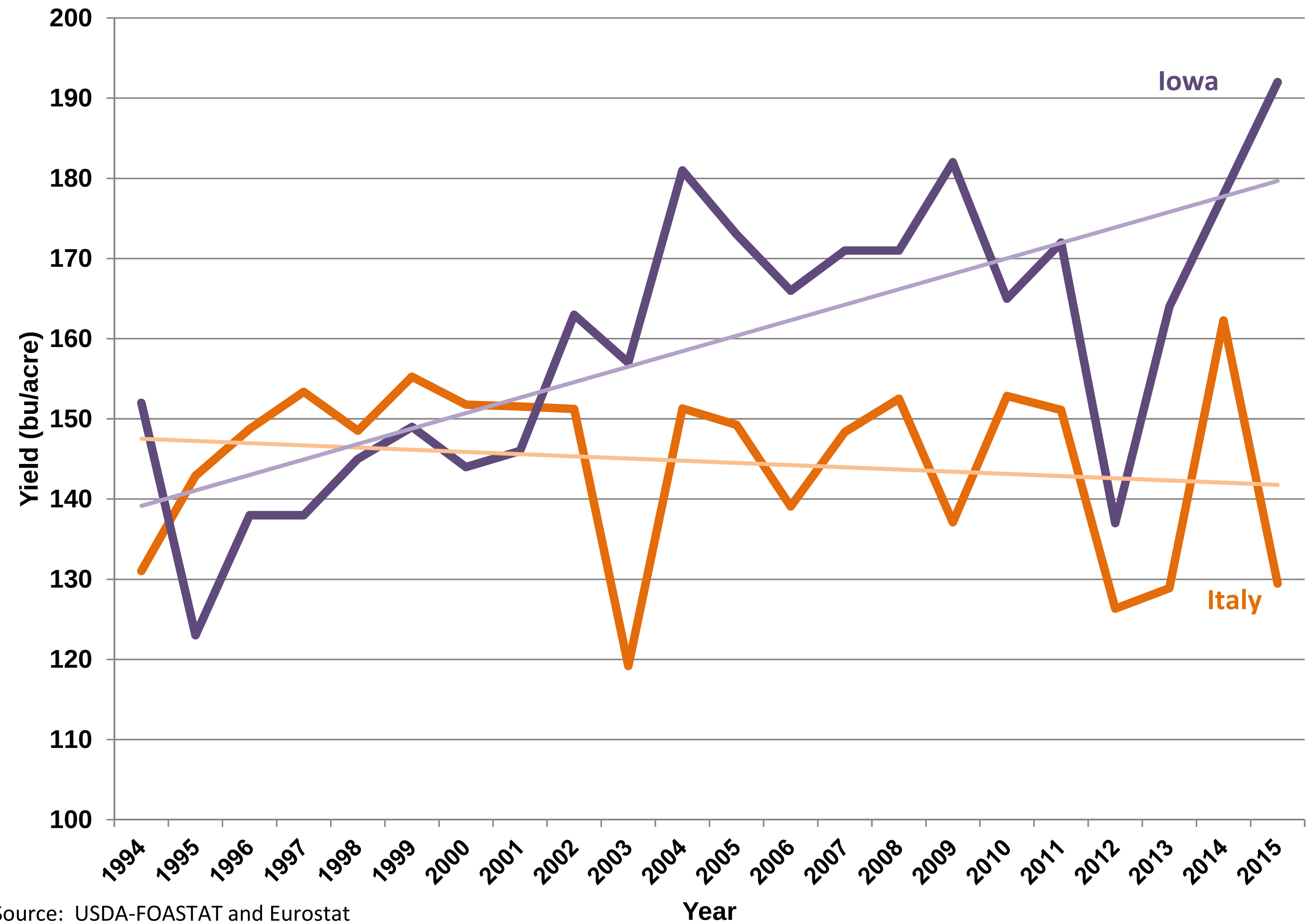
Evaluating the Effects of Replacing Feed Grade Antibiotics with Yeast, Essential Oils or Zinc Oxide and Copper Sulfate on Nursery Pig Performance

Jim L. Nelssen, Austin Langemeier, Spencer Scotten and Morgan Cox

K·STATE
Research and Extension

Knowledge for Life

Comparison of Corn Yield in Iowa vs. Italy, 1994-2015



Source: USDA-FOASTAT and Eurostat

K·STATE Research and Extension

Knowledge for Life

Introduction

- Since feed-grade antibiotics became available to the swine industry in the mid-1950s, research has shown that dietary inclusions of these antimicrobial agents improve growth rate and feed efficiency of nursery pigs.

- Veterinarian Feed Directive will eliminate the use of growth promoting antibiotics in swine feeds

Purpose

- Many swine producers have shared their concern with possible production losses caused by the elimination of antimicrobial agents use in swine diets, in particularly the nursery phase.

Two critical points

- Major retailers and meat producers are taking a clear stance – CONSUMER DRIVEN.
- Several classes of feed additives have been suggested as possible replacements

Objective

- The objective of this experiment was to compare the growth performance of nursery pigs fed diets containing carbadox and different dietary supplements that are commonly fed as antibiotic alternatives
    1. Pharmacological levels of Zn and Cu
    2. Essential oils (cinnamon)
    3. Yeast (cells and cell walls)

- Fed alone or in combination

Procedures

- 288 pigs (DNA 200 × 400); 11.8 lb BW
- 42-d study, with 4 pigs per pen and 8 replications per treatment
- Includes 9 dietary treatments
- Phase I -- d 0-7
- Phase II -- d 7-28
- Phase III d -- 28-42

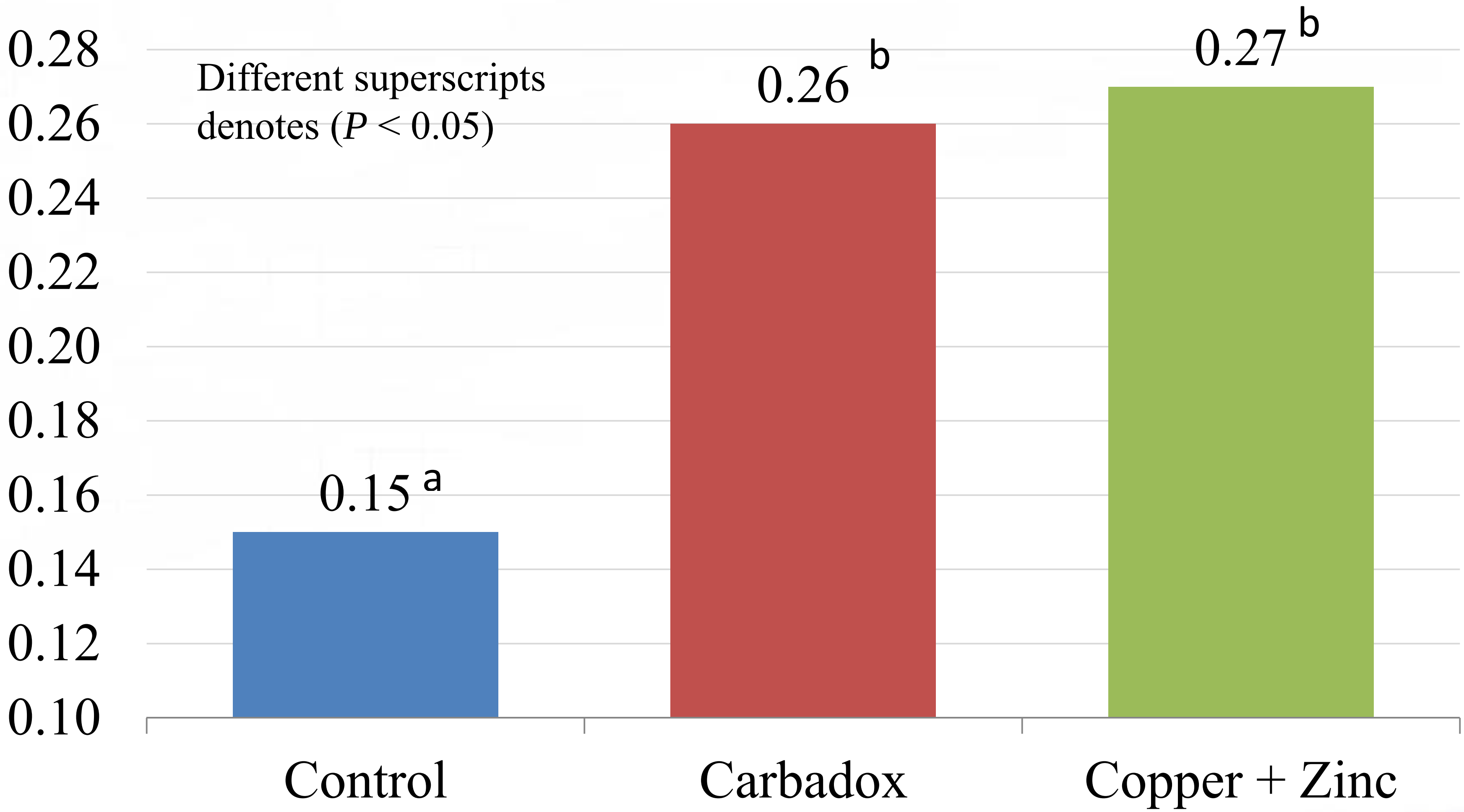
Diets Phase 1, d 0-7

Ingredient, %									
Corn	37.35	36.35	37.25	36.90	37.30	36.80	36.85	37.20	36.75
SBM	19.85	19.85	19.85	19.85	19.85	19.85	19.85	19.85	19.85
Blood meal	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Blood plasma	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Corn DDGS	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Fish meal	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Milk, whey powder	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Choice White Grease	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Vitamins, Min., and AA	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
Kemgest	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mecadox	---	1.00	---	---	---	---	---	---	---
Yeast	---	---	0.11	---	---	0.11	---	0.11	0.11
XTRACT 6930	---	---	---	---	0.05	---	0.05	0.05	0.05
Copper sulfate	---	---	---	0.05	---	0.05	0.05	---	0.05
Zinc Oxide	---	---	---	0.42	---	0.42	0.42	---	0.42

Diets Phase 2, d 7-28

Ingredient, %									
Corn	54.71	53.71	54.61	54.38	54.66	54.28	54.33	54.56	54.23
SBM	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55
Blood meal	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Fish meal	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Milk, whey powder	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Vitamins, Min., and AA	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
Mecadox	---	1.00	---	---	---	---	---	---	---
Yeast	---	---	0.11	---	---	0.11	---	0.11	0.11
XTRACT 6930	---	---	---	---	0.05	---	0.05	0.05	0.05
Copper sulfate	---	---	---	0.05	---	0.05	0.05	---	0.05
Zinc Oxide	---	---	---	0.28	---	0.28	0.28	---	0.28

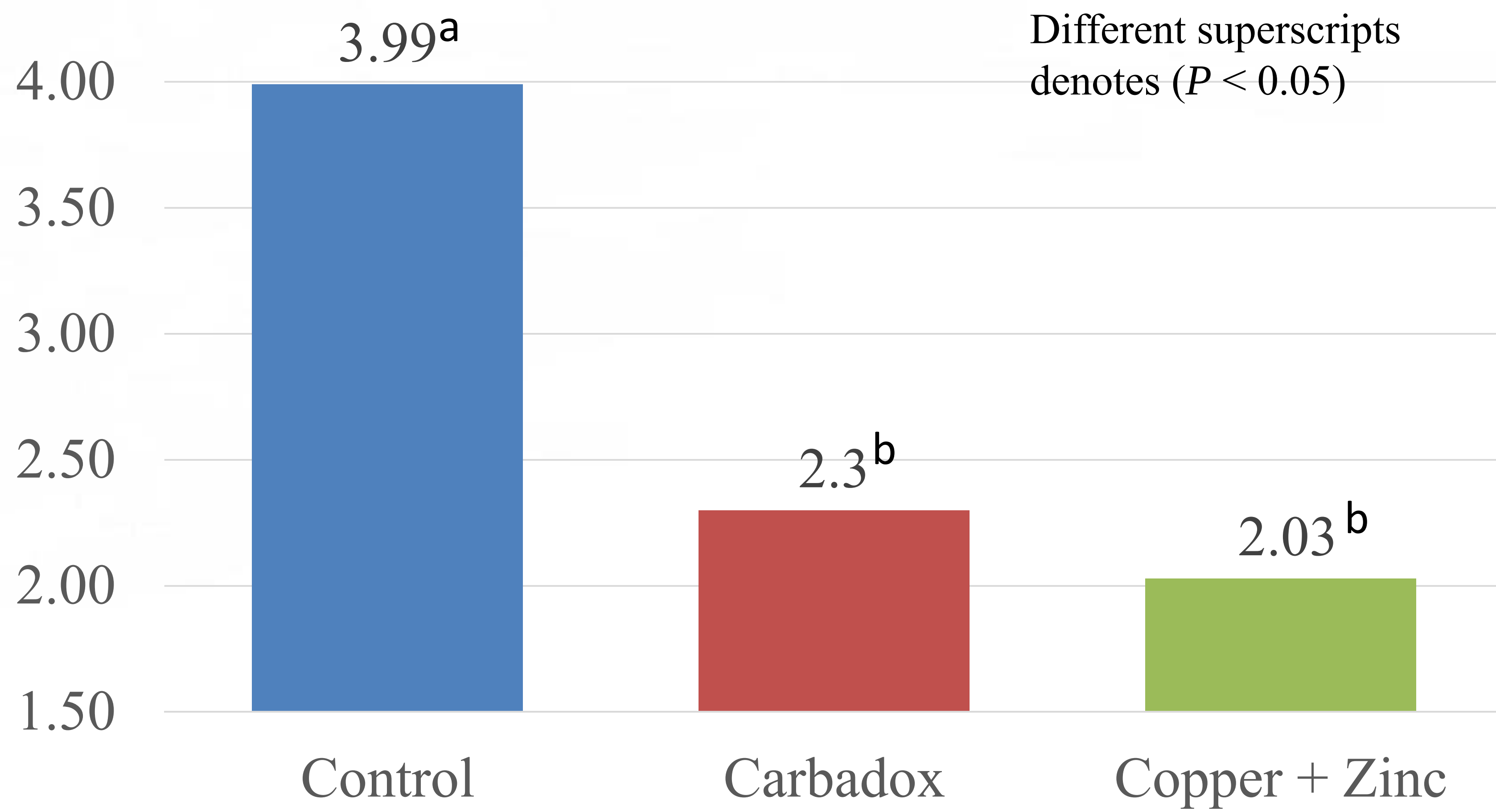
ADG d 0-7



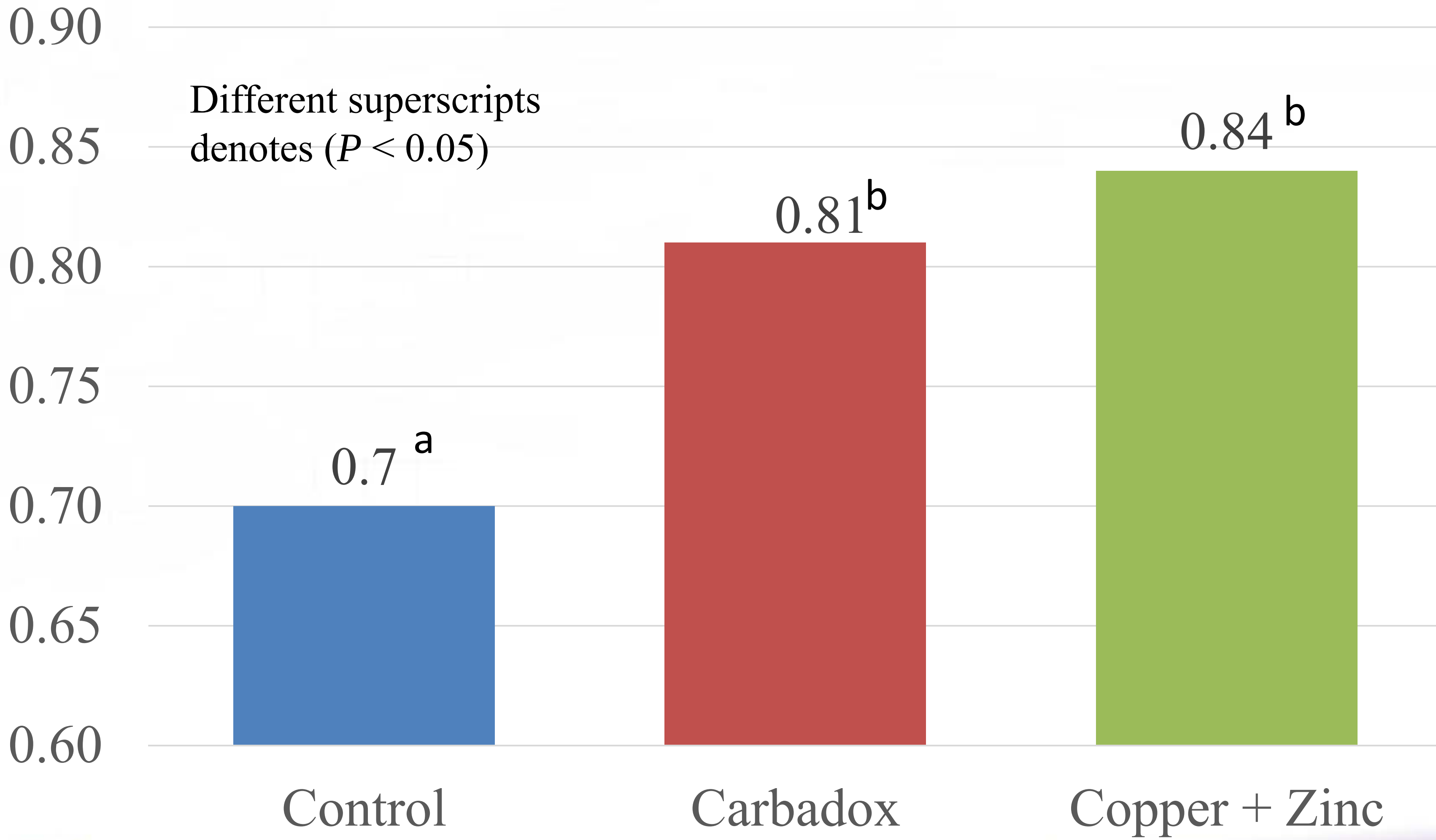
K·STATE Research and Extension

Knowledge for Life

F/G d 0-7


3.99a
2.3b
2.03 b
Different superscripts denotes (P < 0.05)
4.00
3.50
3.00
2.50
2.00
1.50
Control
Carbadox
Copper + Zinc

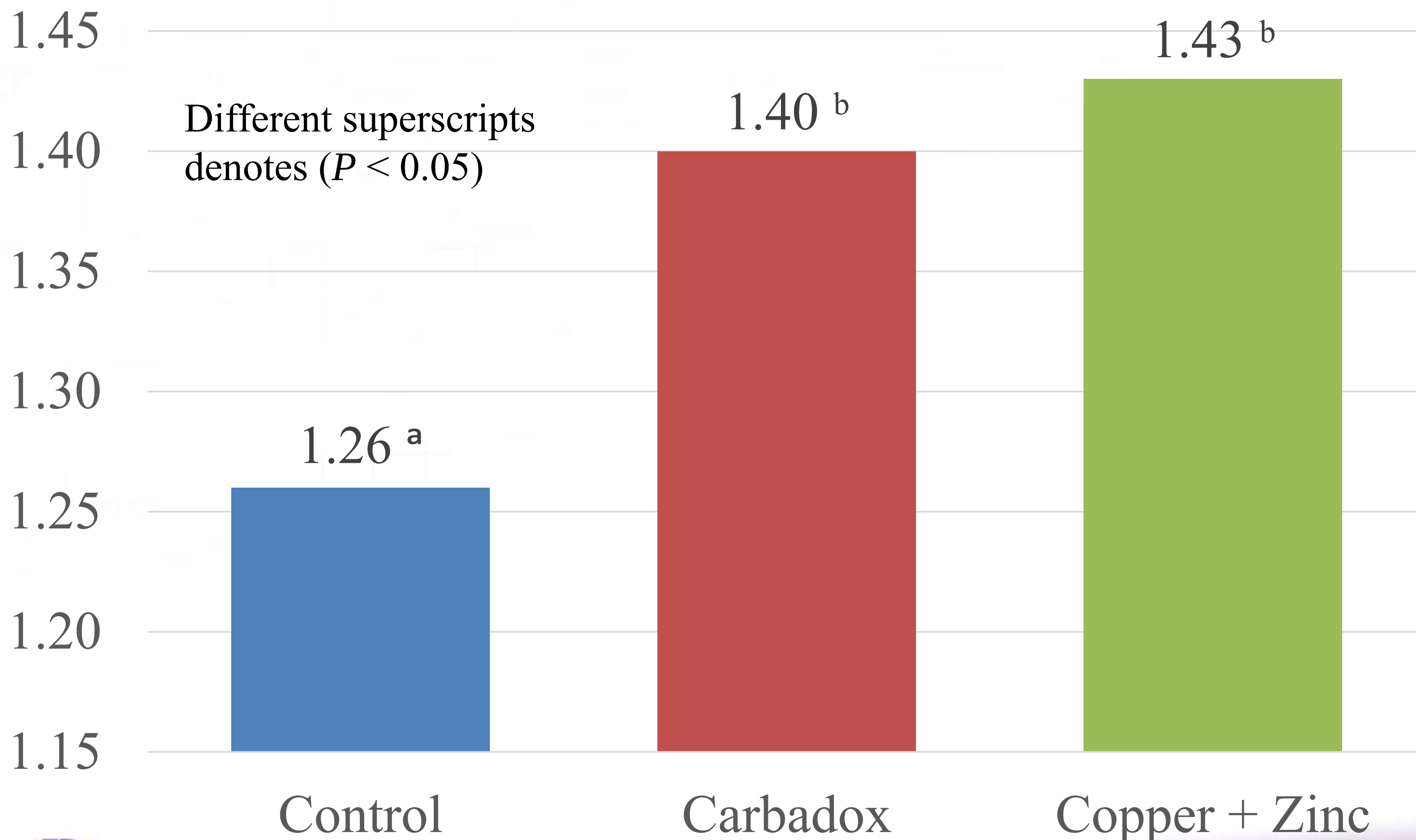
ADG d 7-28



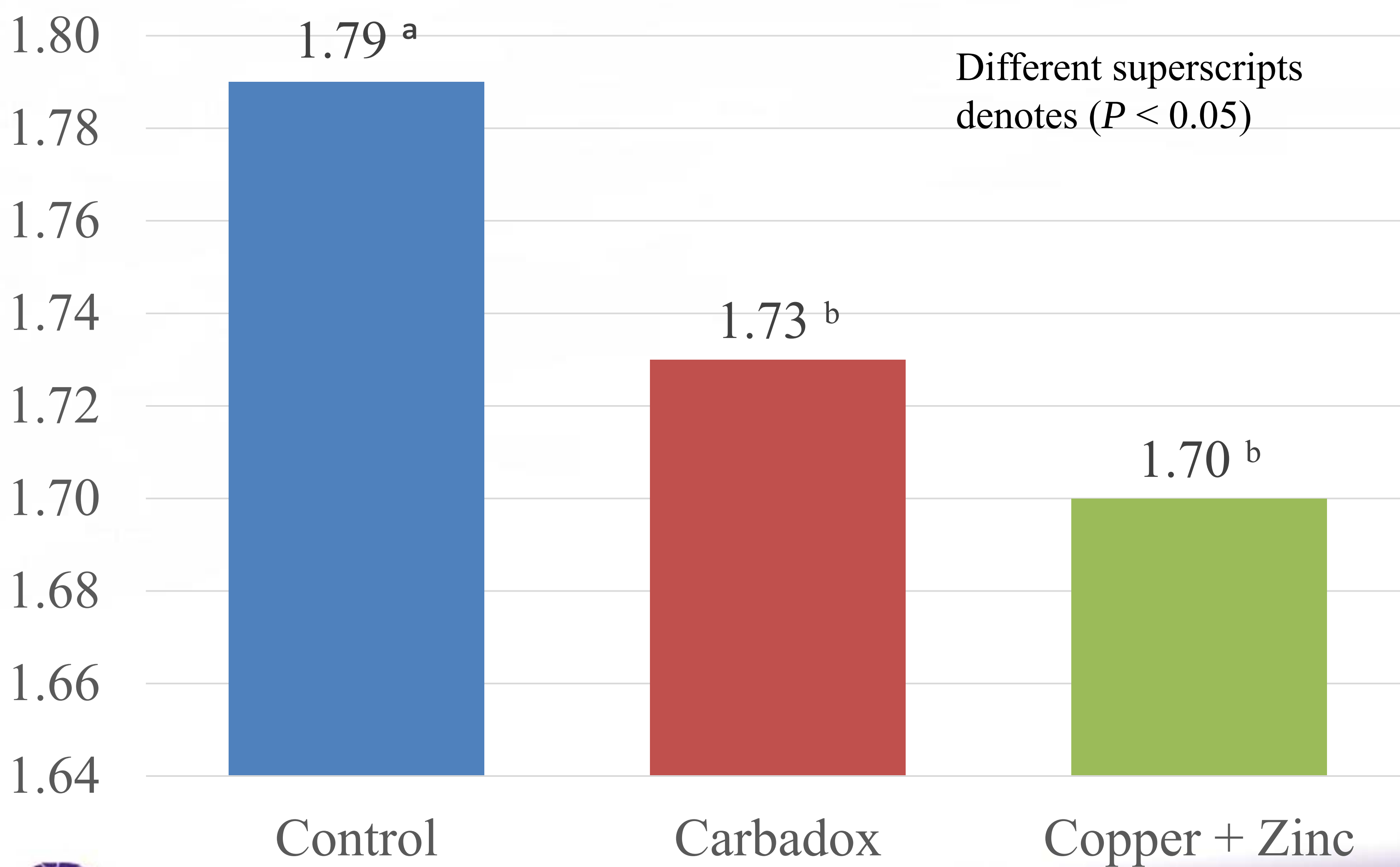
K·STATE Research and Extension

Knowledge for Life

Days 7-28 ADFI



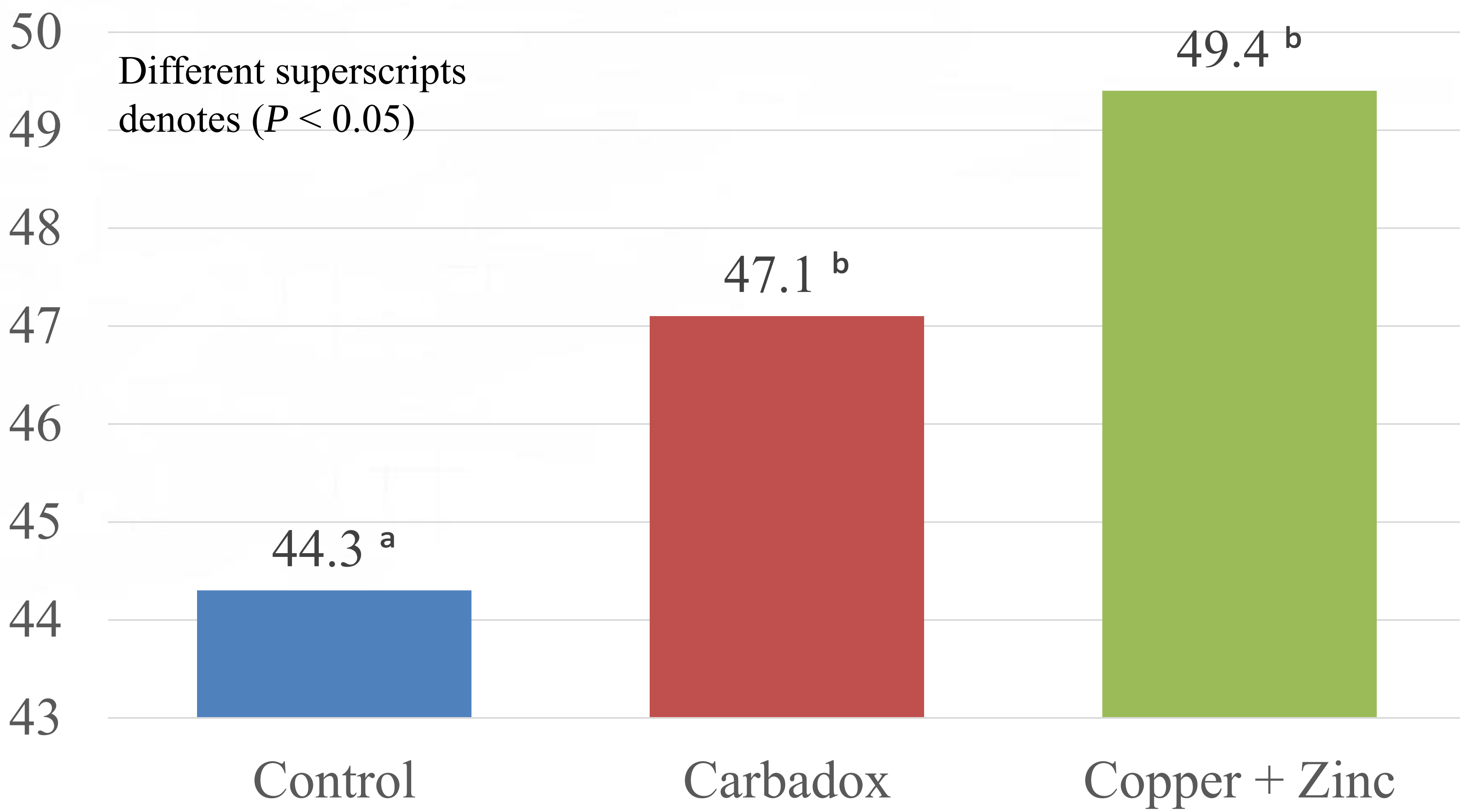
Days 7-28 F/G



K·STATE Research and Extension

Knowledge for Life

Day 42 Body Weight



Results

- During Phase 1 & 2 (d 0 to 28)
  - Pigs fed carbadox proved to have increased ADG ($P < 0.05$) compared to pigs fed a non-medicated control diet.
  - Pigs fed pharmacological trace minerals (Cu + Zn) had equal ($P > 0.05$) growth performance with those fed carbadox.
  - Pigs fed pharmacological levels of Zn and Cu outperformed control pigs during this period.

Discussion

- We fed carbadox to nursery pigs and found a consistent improvement in growth performance compared to pigs fed a non-medicated diet.

- In addition, pigs fed the zinc oxide and copper sulfate combination were over 5 pounds heavier ($P < 0.0081$) at the end of the nursery phase (d-42) compared to pigs fed an antibiotic free control diet.

Economics

- Ingredient cost per ton, Phase 1
  - Control: $662.28/ton
  - Carbadox: $687.89/ton
  - Copper + Zinc: $669.83/ton

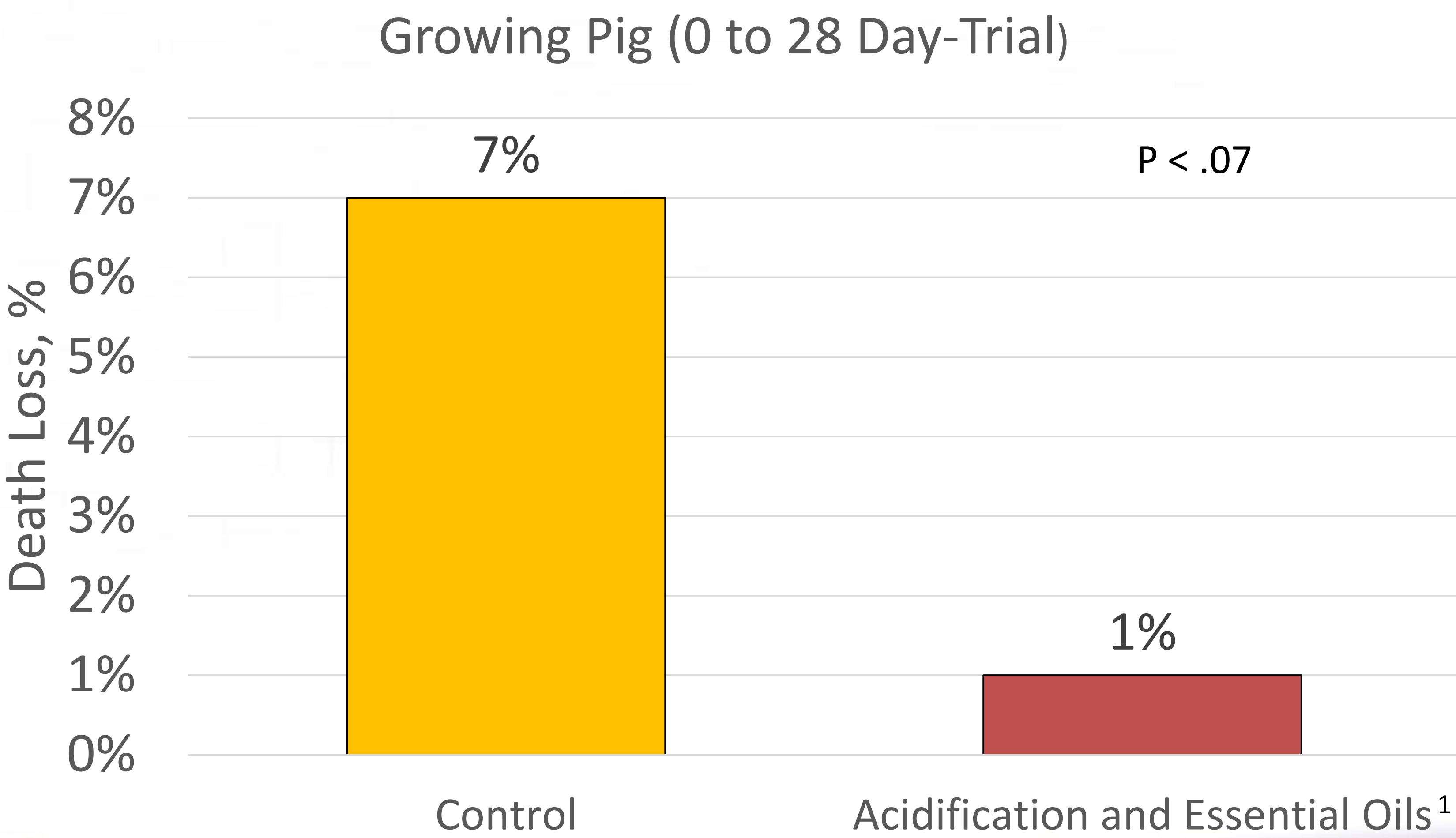
- Copper + Zinc Diet is $18.06 cheaper per ton when compared to carbadox

Economics

- Ingredient cost per ton, Phase 2
  - Control: $348.80/ton
  - Carbadox: $374.41/ton
  - Copper + Zinc: $354.06/ton

- Copper + Zinc Diet is $20.35 cheaper per ton when compared to carbadox

Dietary Essential Oils and Acidification Effects of Growing Pig Death Loss



[1] VevoWin provided by DSM

K·STATE Research and Extension

Knowledge for Life

THANKS to all our sponsors for their support of the 2016 KSU Swine Day

K·STATE Research and Extension

Knowledge for Life

KSU Swine Day 2016

K·STATE
Research and Extension

K·STATE
Research and Extension

Knowledge for Life