KSU Swine Day 2011

Research and Extension

Research and Extension

Knowledge for Life

KSU Swine Day 2011

Morning – Finisher pigs

Afternoon – Nursery and sows

- Vitamin D research
- New KSU premix recommendations
- Nursery diet ingredients
- Feed processing

Grow-finish pigs

- Alternative ingredients
  - Wheat
  - Bakery meal
  - DDGS
  - Withdrawal from high fiber diets
- Feeder design
- Paylean
- Correct market weight
- Improvest

Feeding Wheat to Swine

- **Nutrient differences wheat vs. corn:**
  - Lysine: 35% more SID lysine; (CP: 13.5. vs 8.5%)
  - ME: 6% less energy; (1,456 vs. 1,551 kcal/lb)
  - Available Phosphorus: ~4 x higher (0.19 vs. 0.04%)

- **Ingredient changes:**
  - Less soybean meal and supplemental phosphorus
  - Higher synthetic lysine use is possible
  - Can add fat to balance dietary energy

- **Grinding:**
  - Still target 600-700 microns
  - More "flouring" occurs as wheat is more finely ground

Feeding Wheat to Swine

- **Anticipated performance and breakeven changes:**
  - No added fat to balance energy:
    - Higher F/G (~+0.12 F/G from 50 - 250 lb)
    - Slightly lower ADG
    - Current breakeven is 102% of corn price (bu/bu)
  - Added fat to balance energy ($0.48/lb CWG):
    - Similar ADG and F/G
    - Current breakeven is 95% of corn price (bu/bu)

Bakery meal (importance of source)

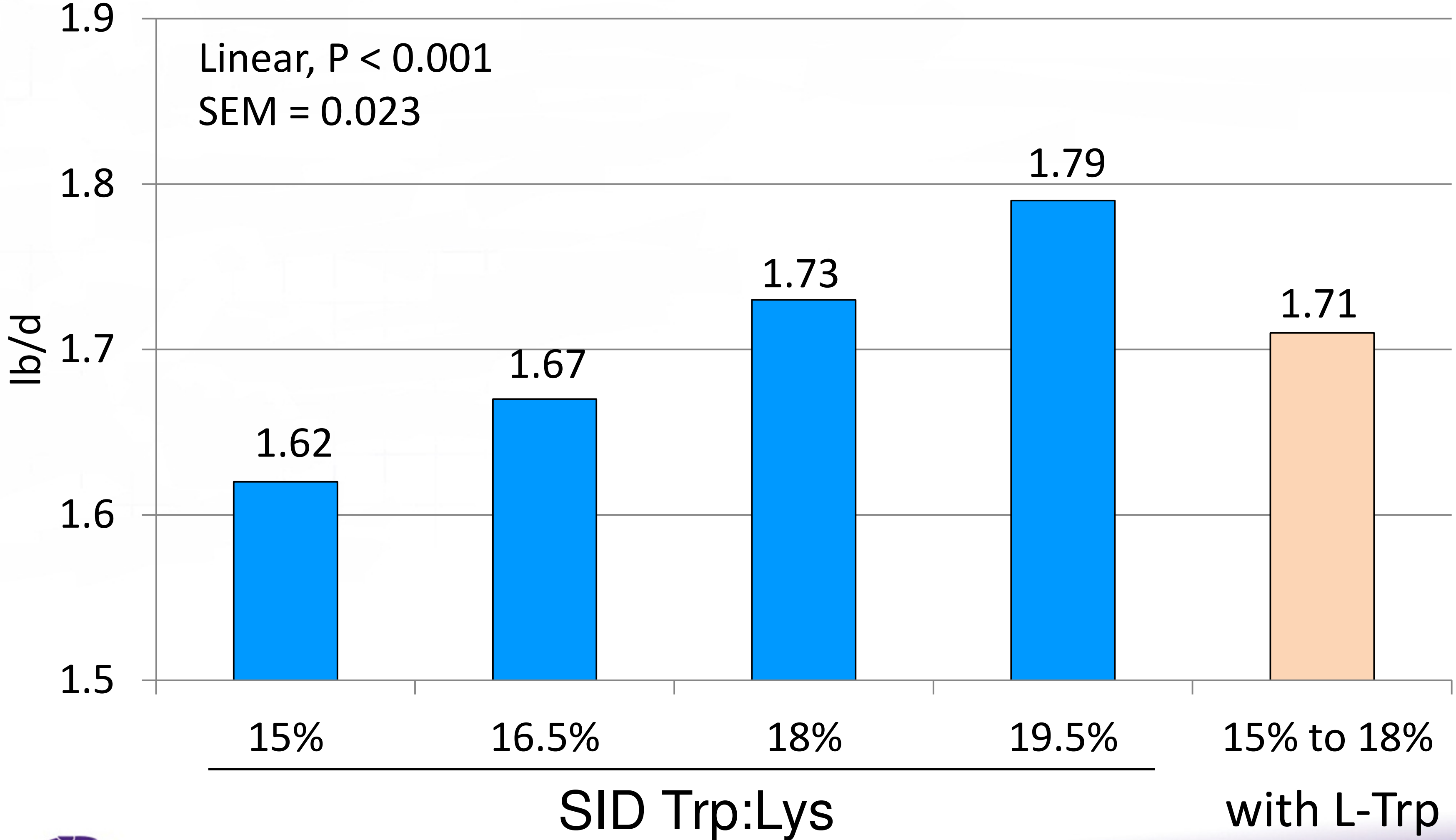
	Source				
	1	2	3	4	5
Moisture, %	10.0	10.0	10.0	10.0	11.0
Protein, %	12.0	10.0	12.0	9.7	9.3
Fat, %	8.5	9.0	9.1	3.4	9.2
Fat, % of NRC	75%	80%	81%	30%	81%
Crude fiber, %	5.0	5.0	3.1	2.7	1.7
Ash, %	5.5	5.5	4.0	2.8	2.3
Salt, %	1.3	1.3	2.0	1.2	1.5
Sugar, %	12	16	13.4	19.2	22.8
Starch, %	20	22	37.2	28.0	19.2
ME, Mcal/lb	1.53	1.55	1.59	1.49	1.63
ME, % of NRC	91%	92%	95%	89%	97%

Endres Processing, LLC, 2011

Feeding high DDGS levels

- Economics in 2011 greatly increased DDGS inclusion rates
  - Savings were as high as $7 to 8/pig with 40% inclusion
  - Still $1.50 to 5/pig potential savings depending on corn, DDGS, and soybean meal prices
  - Iodine value and carcass yield are the limiting factors
  - Economics will change as more fat is removed from DDGS
    - Potentially less iodine value issues, but more impact on growth and yield

Effect of TID Try:Lys in 30% DDGS diets on finishing ADG (Exp. 2; d 0 to 73; BW 150 to 275 lb)

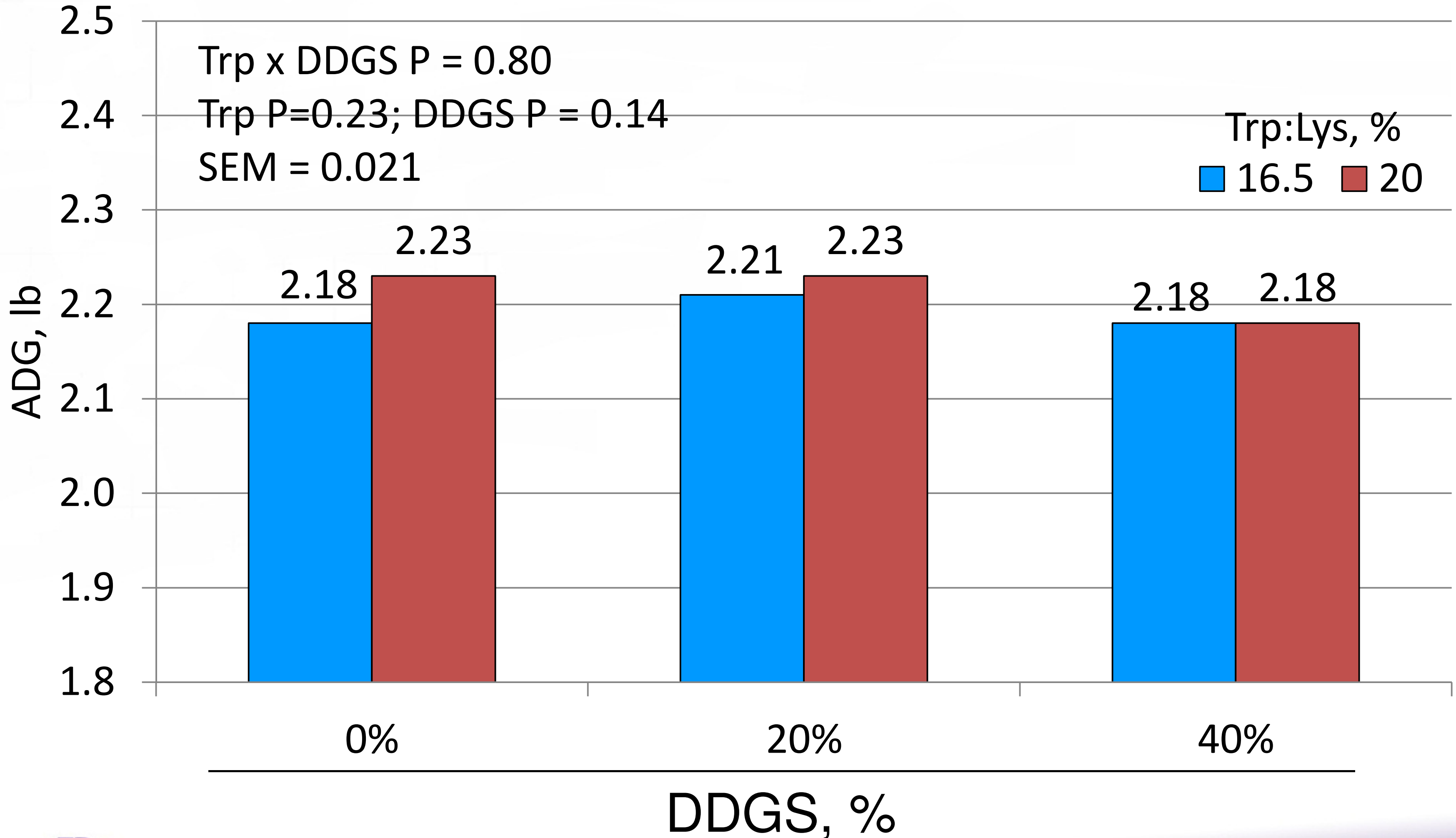


K·STATE Research and Extension

Barnes et al., 2010

Knowledge for Life

DDGS x SID Trp:Lys ratio for finishing pigs (Exp. 4; d 0 to 71; BW 150 to 300 lb)

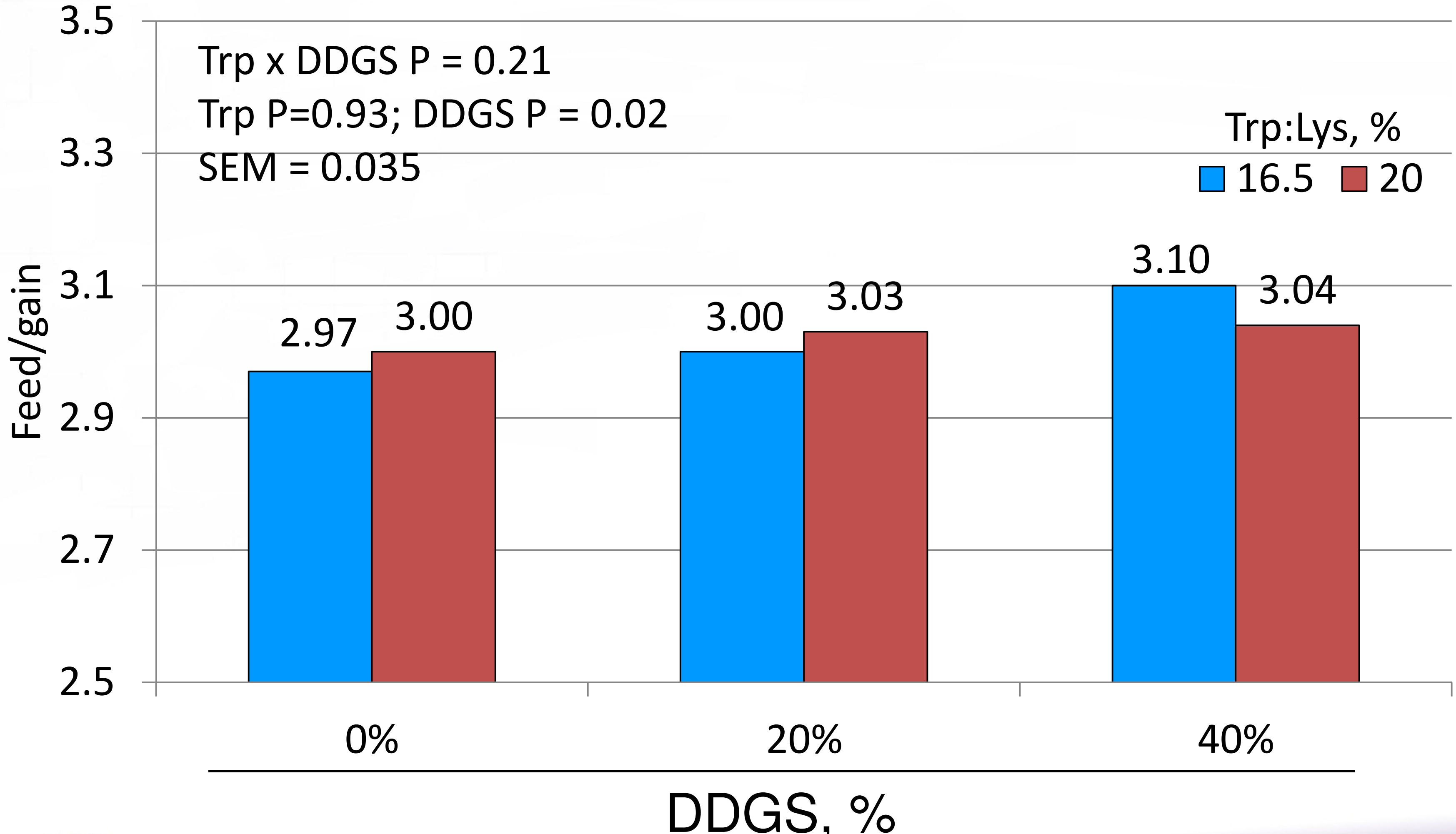


K·STATE Research and Extension

Nitikanchana et al., 2011

Knowledge for Life

DDGS x SID Trp:Lys ratio for finishing pigs (Exp. 4; d 0 to 71; BW 150 to 300 lb)

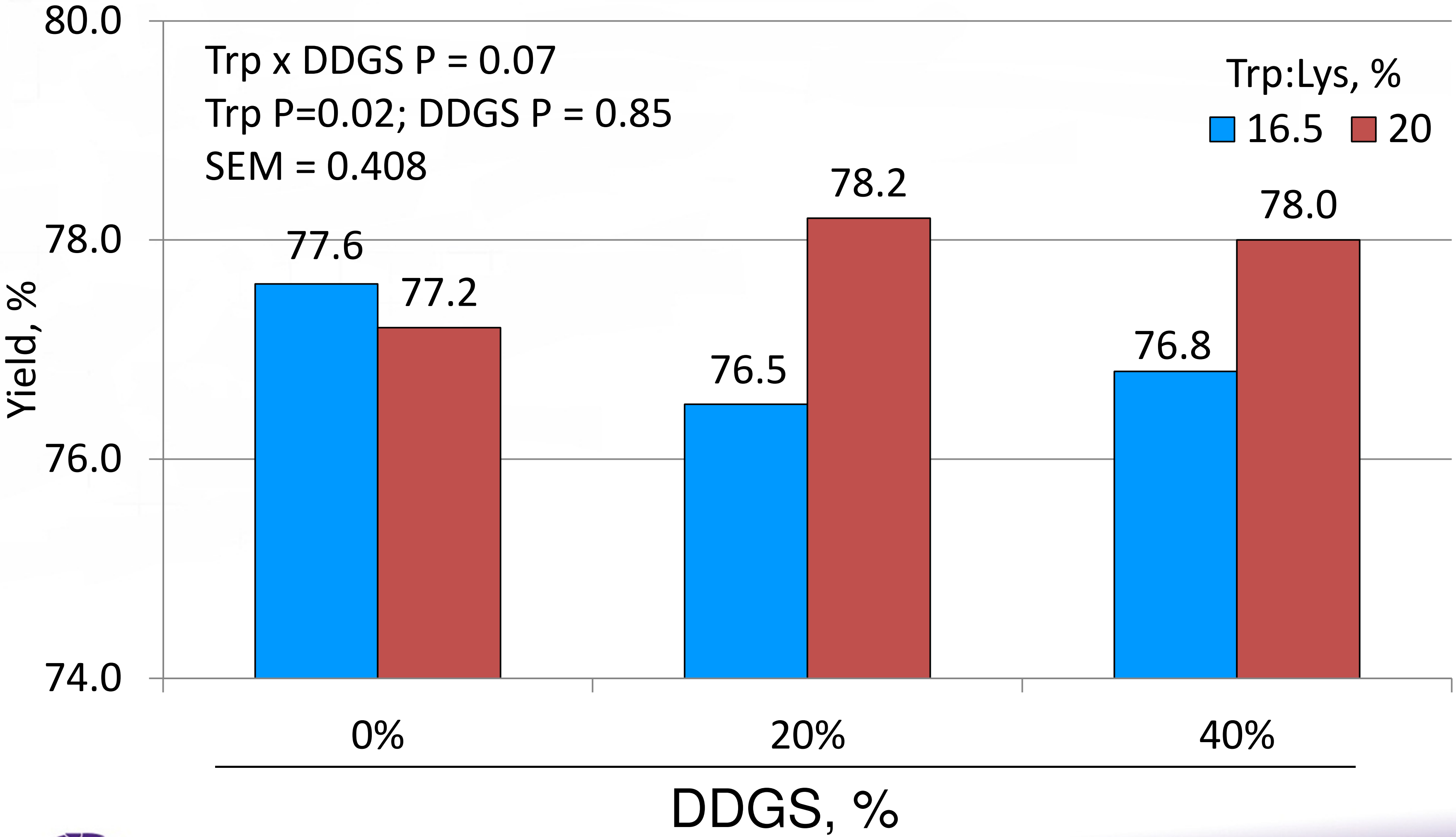


K·STATE Research and Extension

Nitikanchana et al., 2011

Knowledge for Life

DDGS x SID Trp:Lys ratio for finishing pigs (Exp. 4; d 0 to 71; BW 150 to 300 lb)

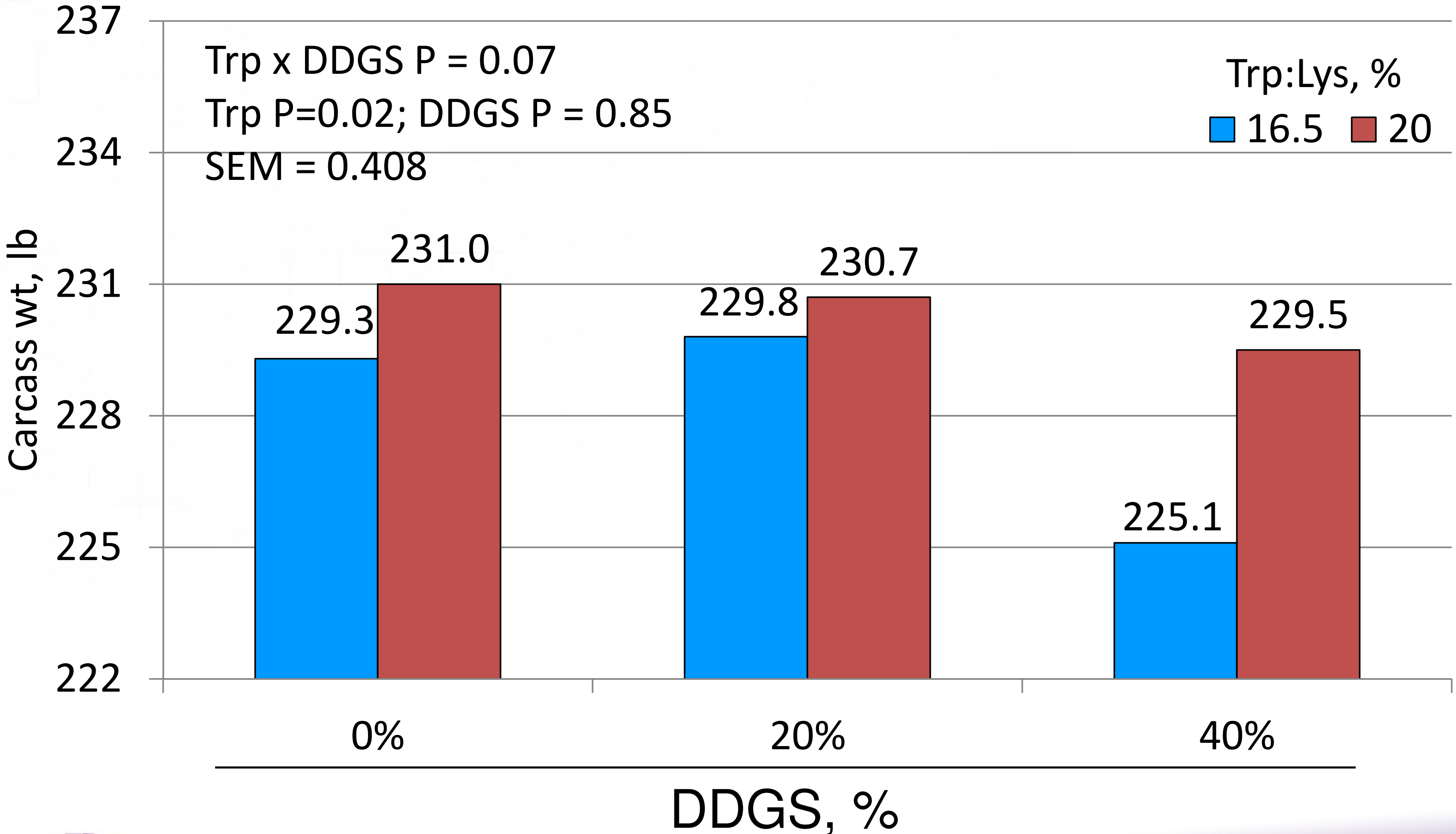


K·STATE Research and Extension

Nitikanchana et al., 2011

Knowledge for Life

DDGS x SID Trp:Lys ratio for finishing pigs (Exp. 4; d 0 to 71; BW 150 to 300 lb)

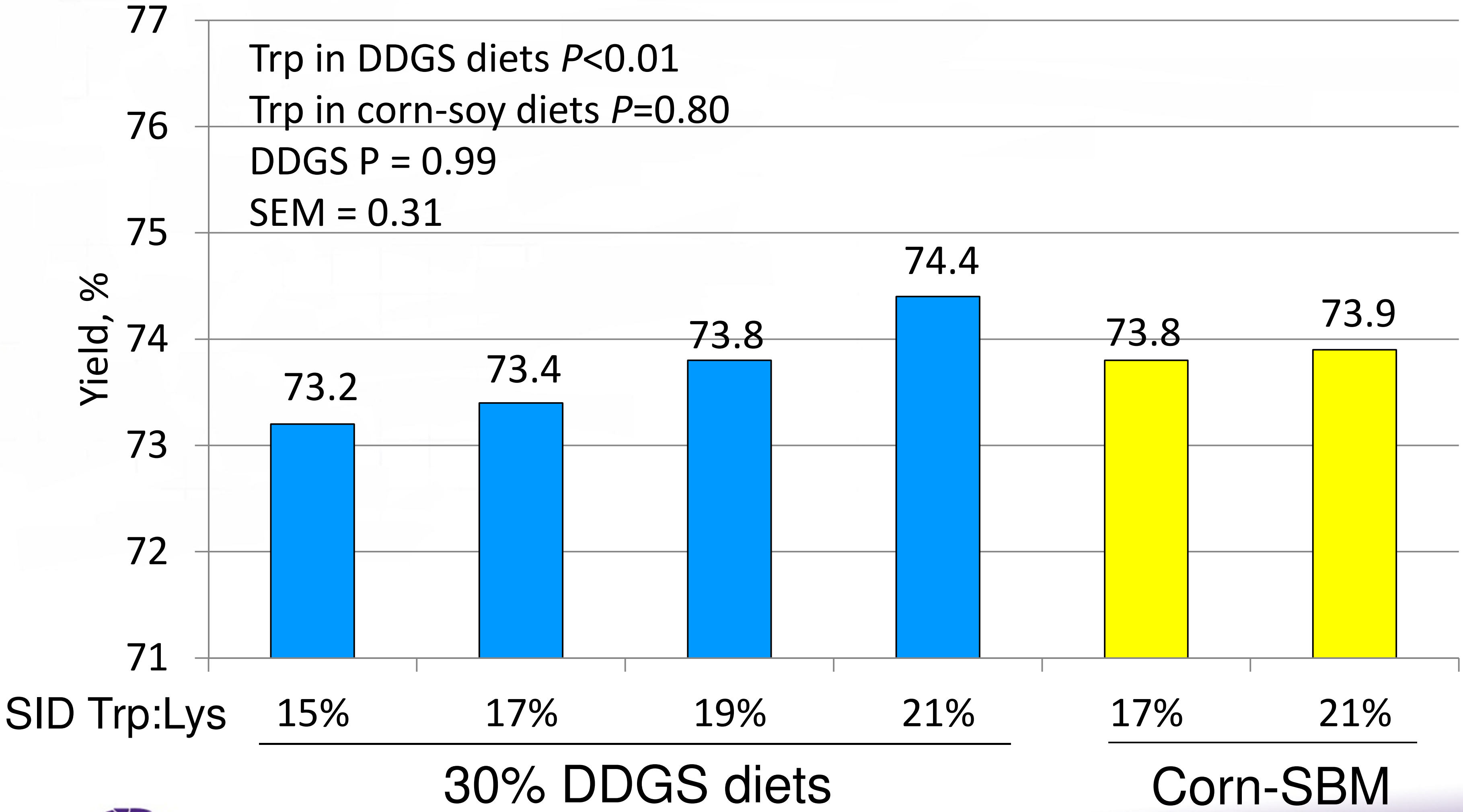


Nitikanchana et al., 2011

K·STATE Research and Extension

Knowledge for Life

SID Trp:Lys ratio for finishing pigs (Exp. 5; d 0 to 71; BW 157 to 280 lb)



Nitikanchana et al., 2011 at Hanor

K·STATE Research and Extension

Knowledge for Life

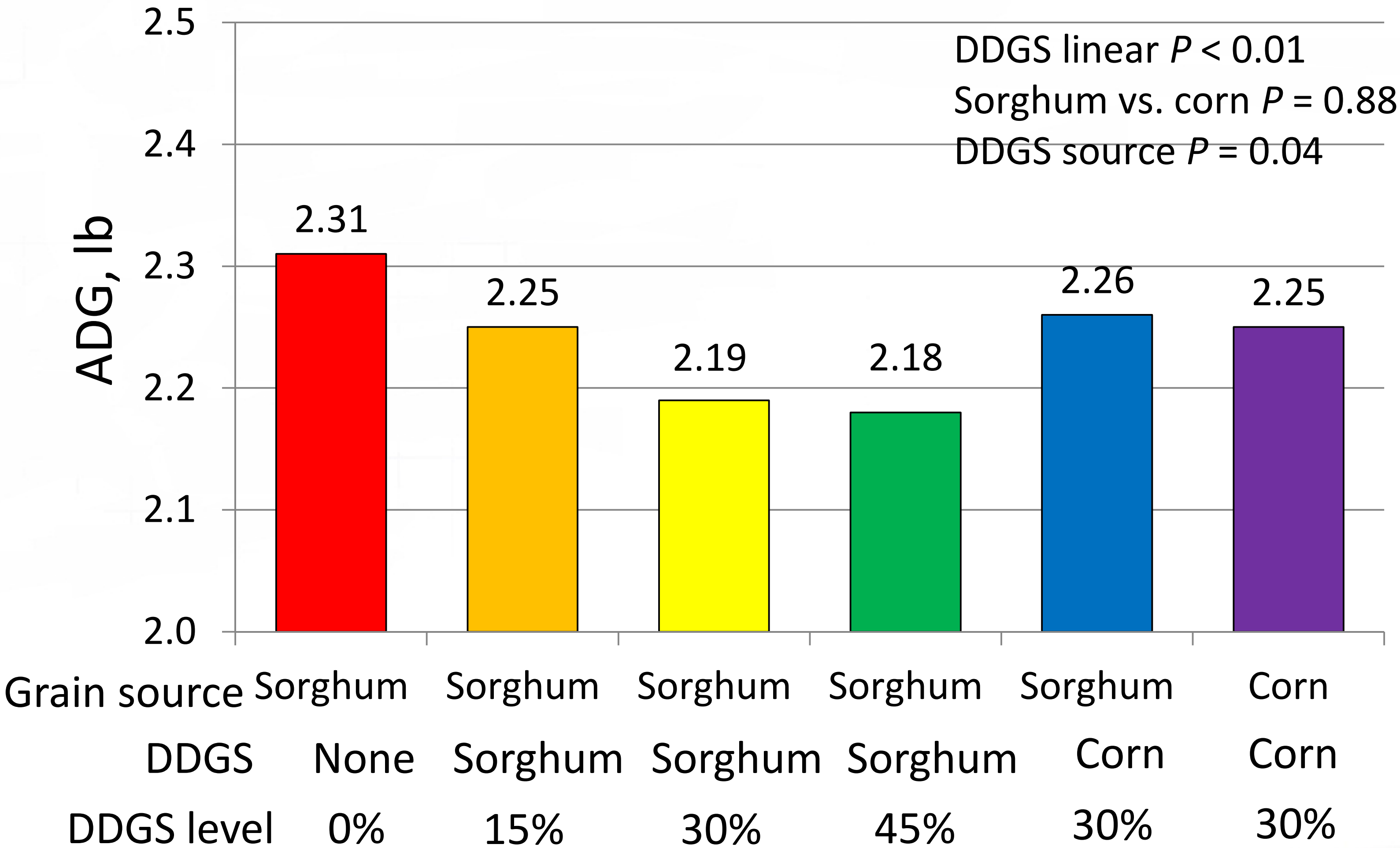
Corn DDGS quality control

- Variability in DDGS quality
  - Main issue is fat level

	Fat, %	ME, %
Low = < 9% fat	8.4	95.0%
Medium = 9 to 10.5% fat	10.2	97.5%
High = > 10.5% fat	11.9	100%

  - Need to monitor DDGS quality or work with company that monitors DDGS quality

Effects of Sorghum or Corn DDGS on ADG

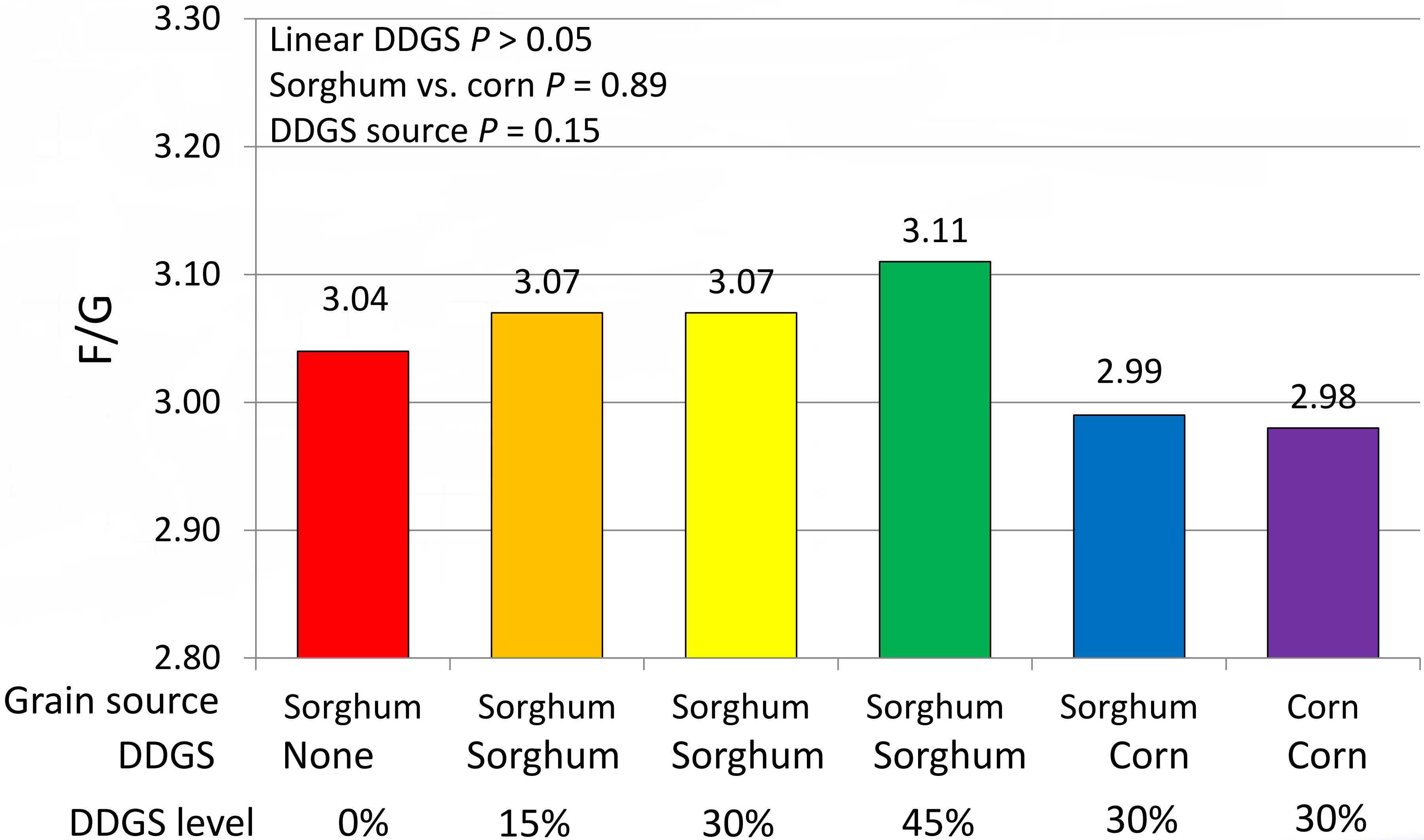


K·STATE
Research and Extension

Sotak, et al., 2011

Knowledge for Life

Effects of Sorghum or Corn DDGS on F/G

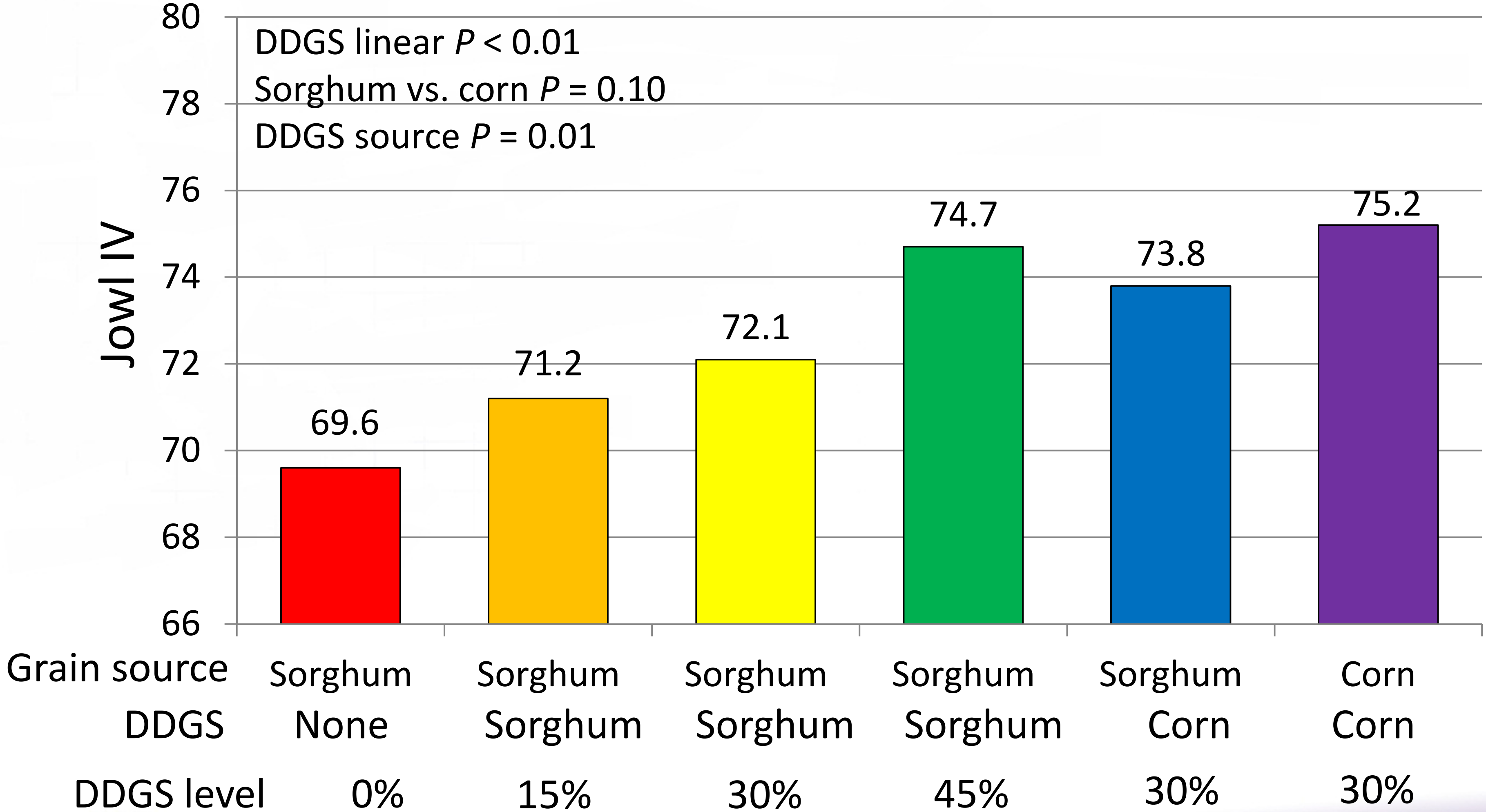


Sotak, et al., 2011

K·STATE Research and Extension

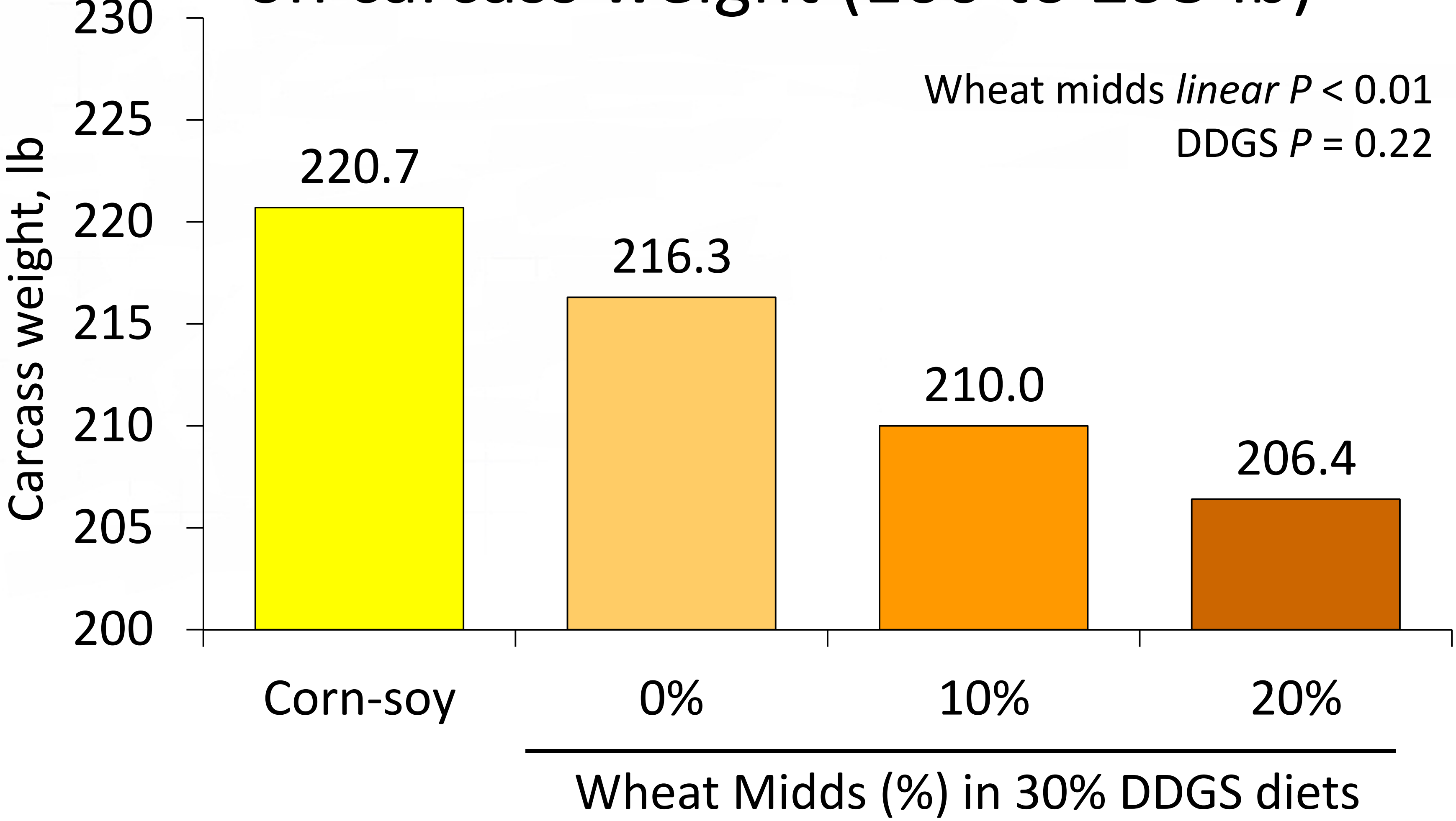
Knowledge for Life

Effects of Sorghum or Corn DDGS on Jowl IV



Sotak, et al., 2011

Effect of DDGS and wheat midds on carcass weight (100 to 295 lb)

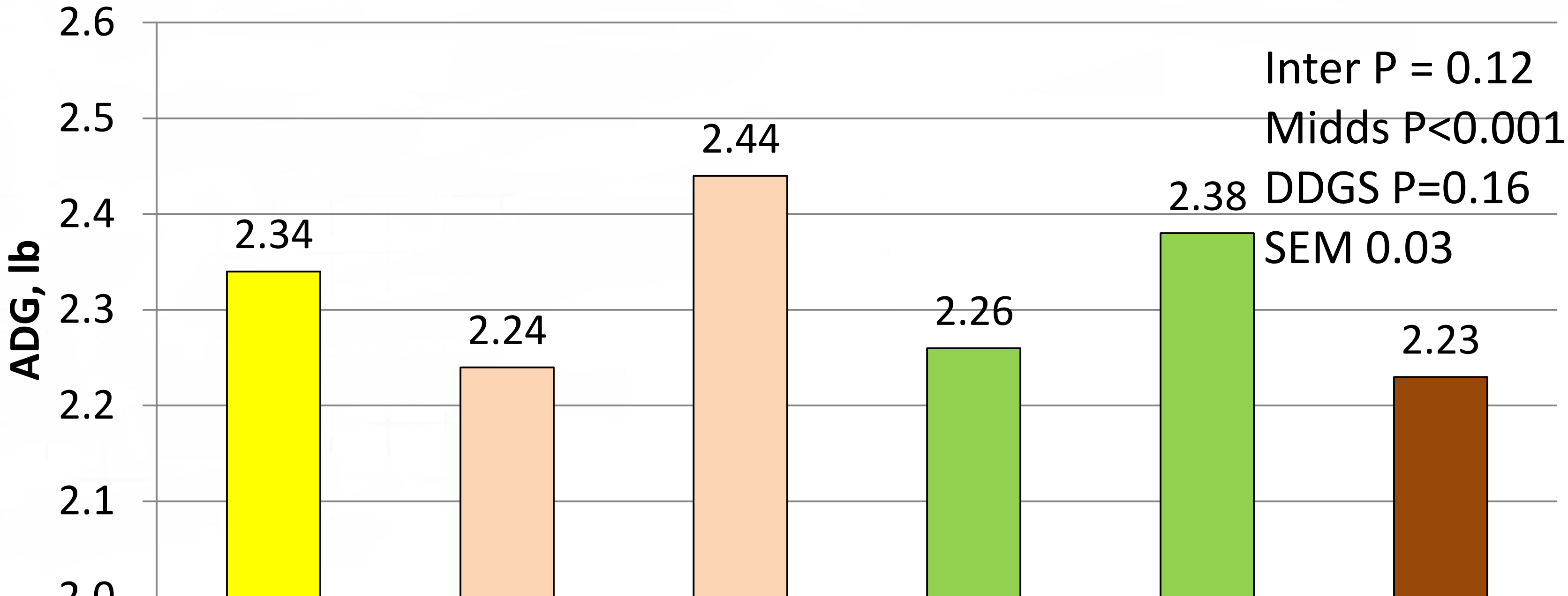


Barnes et al., 2010

K·STATE Research and Extension

Knowledge *for* Life

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



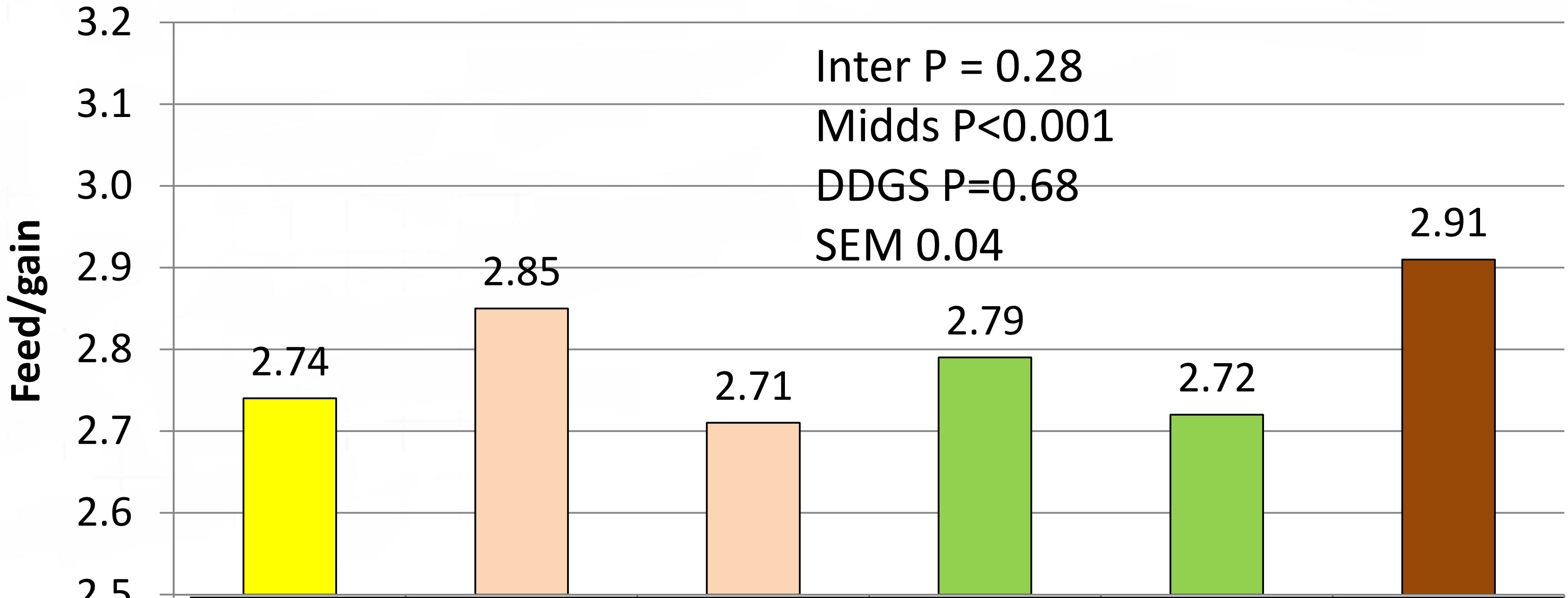
NDF, %	9.2	14.0	14.0	16.4	16.4	18.8
Midds, %	- - -	9.5	- -	19	9.5	19
DDGS, %	- - -	- - -	30	15	30	30

K·STATE Research and Extension

Asmus et al., 2011

Knowledge for Life

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



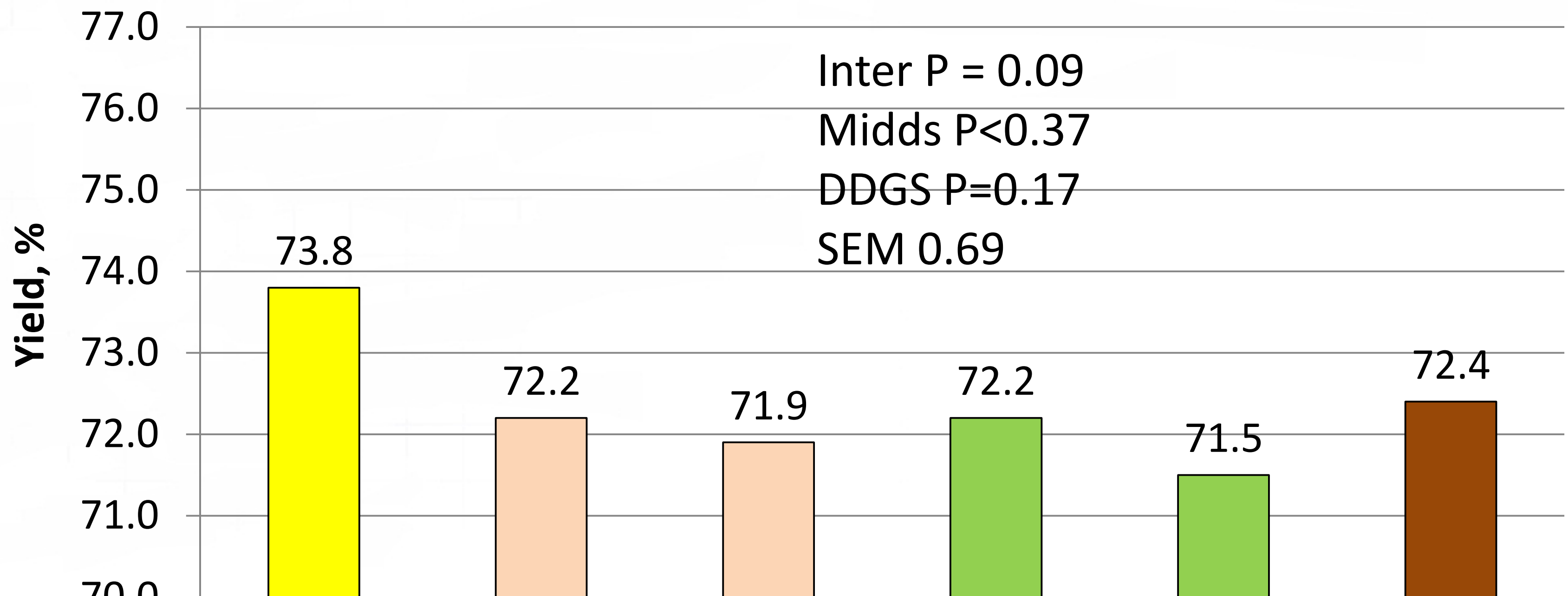
NDF, %	9.2	14.0	14.0	16.4	16.4	18.8
Midds, %	- - -	9.5	- -	19	9.5	19
DDGS, %	- - -	- - -	30	15	30	30

K-STATE Research and Extension

Asmus et al., 2011

Knowledge for Life

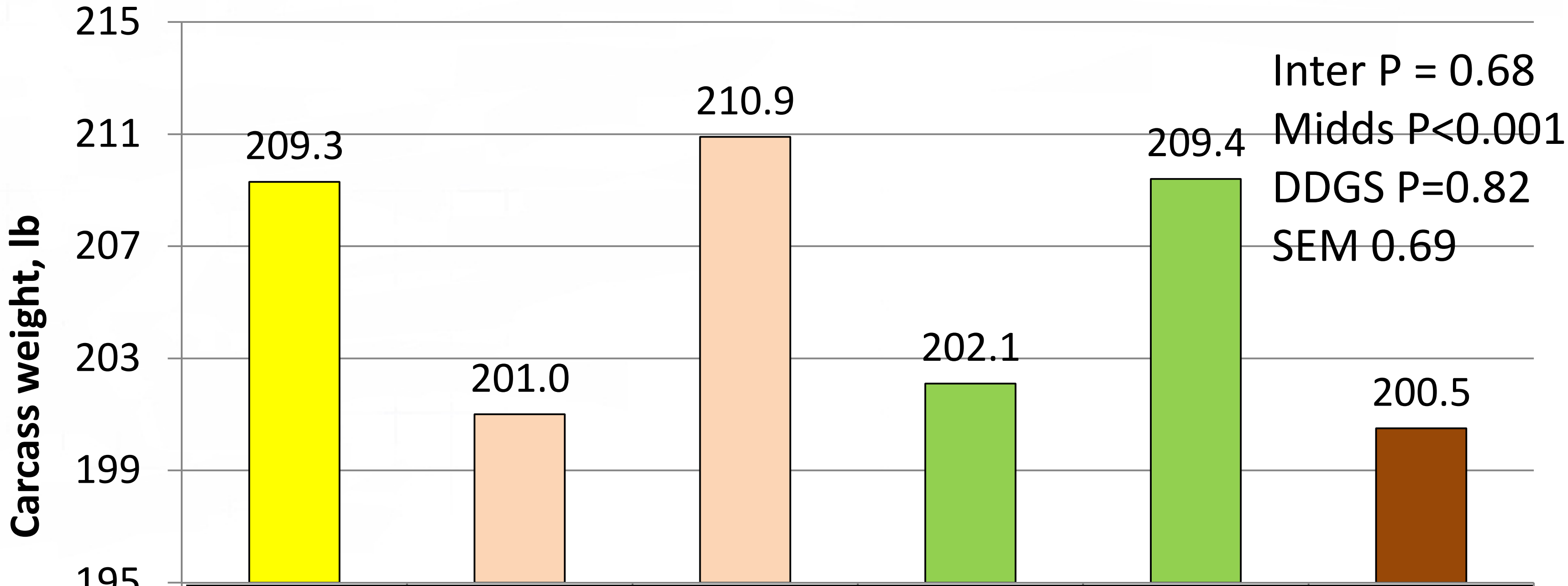
Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



NDF, %	9.2	14.0	14.0	16.4	16.4	18.8
Midds, %	- - -	9.5	- -	19	9.5	19
DDGS, %	- - -	- - -	30	15	30	30

Asmus et al., 2011

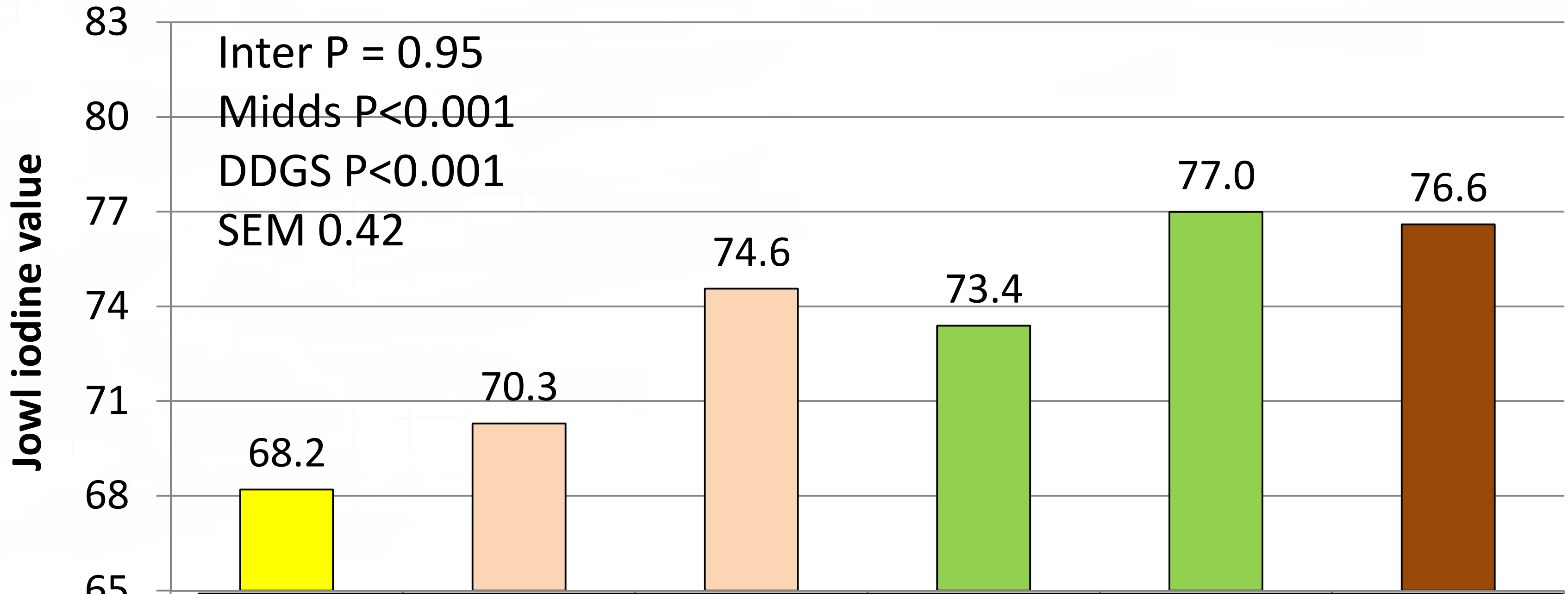
Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



NDF, %	9.2	14.0	14.0	16.4	16.4	18.8
Midds, %	- - -	9.5	- -	19	9.5	19
DDGS, %	- - -	- - -	30	15	30	30

Asmus et al., 2011

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



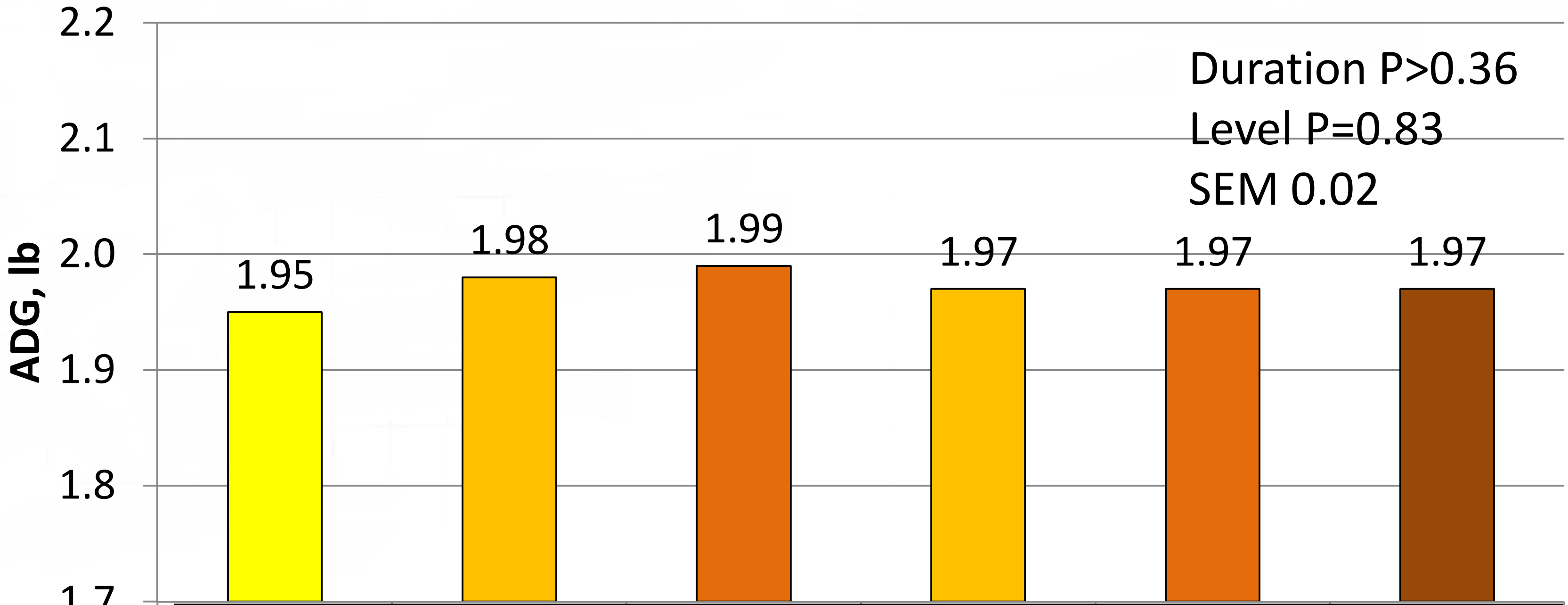
NDF, %	9.2	14.0	14.0	16.4	16.4	18.8
Midds, %	- - -	9.5	- -	19	9.5	19
DDGS, %	- - -	- - -	30	15	30	30

K·STATE Research and Extension

Asmus et al., 2011

Knowledge *for* Life

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



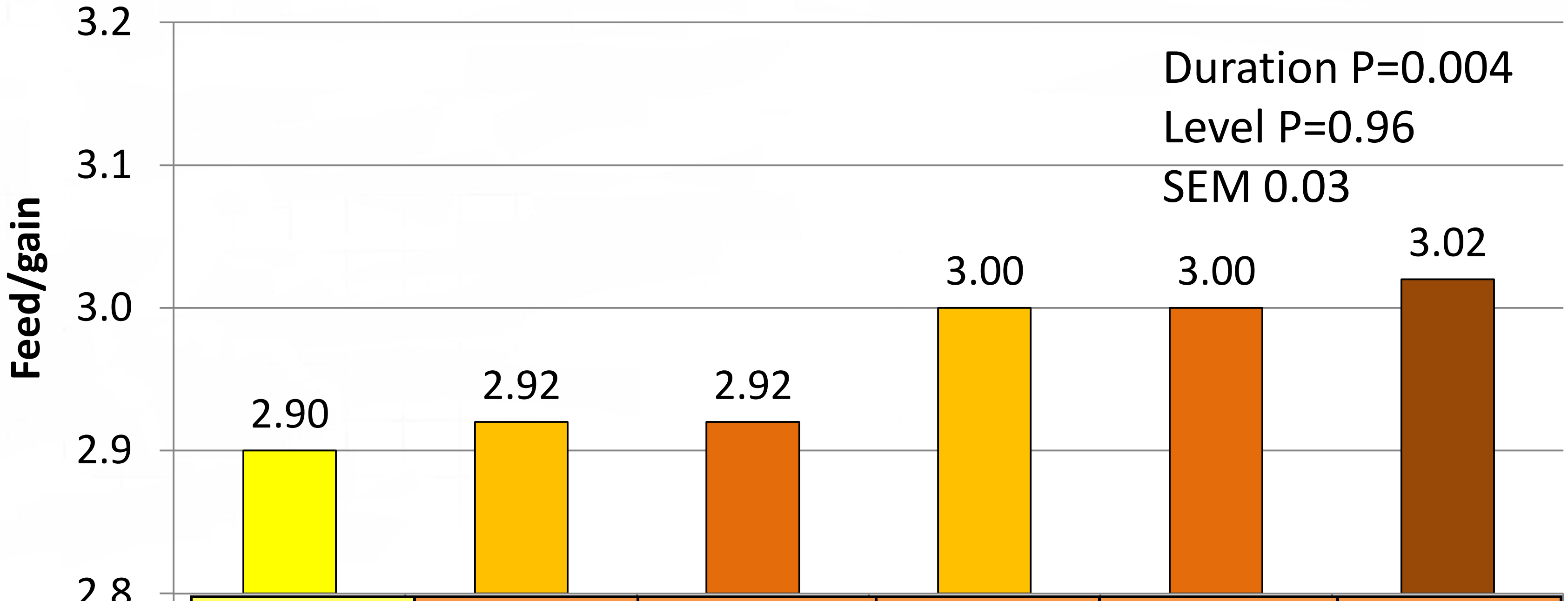
d 0 to 43:	Low	High	High	High	High	High
d 43 to 67:	Low	Low	Med	High	High	High
d 67 to 90:	Low	Low	Med	Low	Med	High

K·STATE Research and Extension

Asmus et al., 2011

Knowledge for Life

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



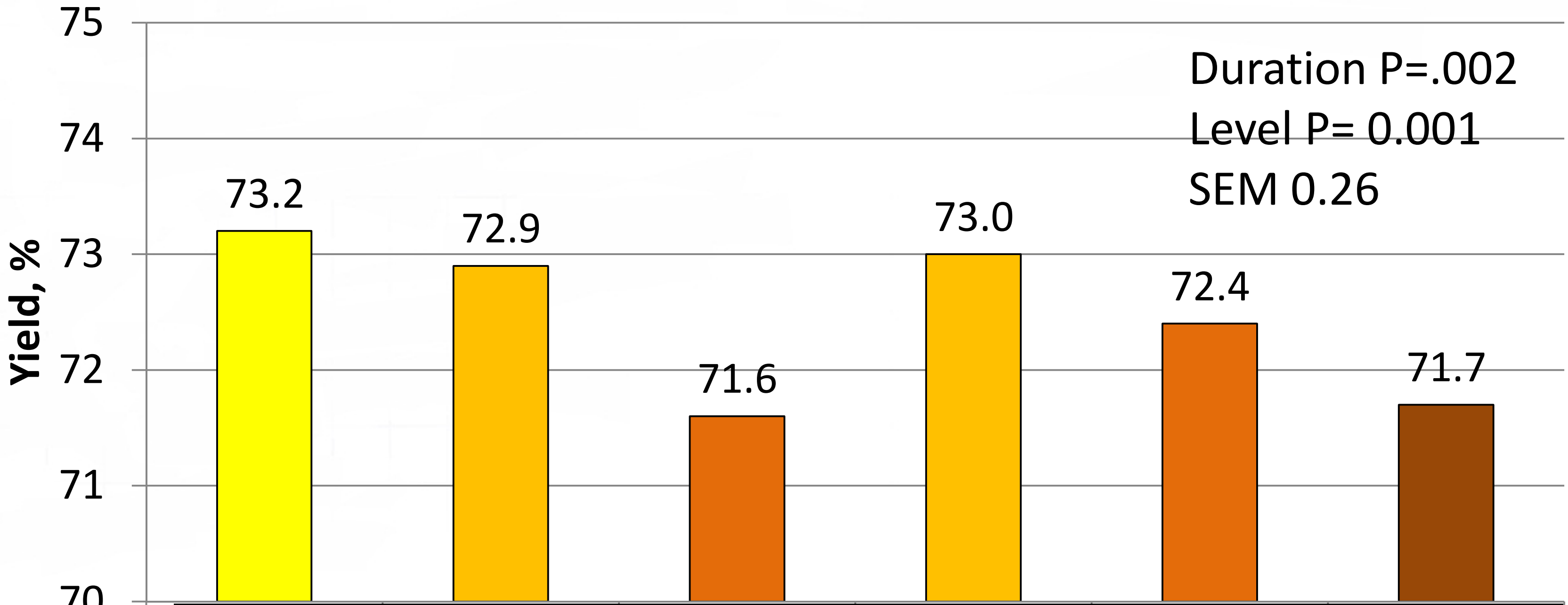
d 0 to 43:	Low	High	High	High	High	High
d 43 to 67:	Low	Low	Med	High	High	High
d 67 to 90:	Low	Low	Med	Low	Med	High

K·STATE Research and Extension

Asmus et al., 2011

Knowledge for Life

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



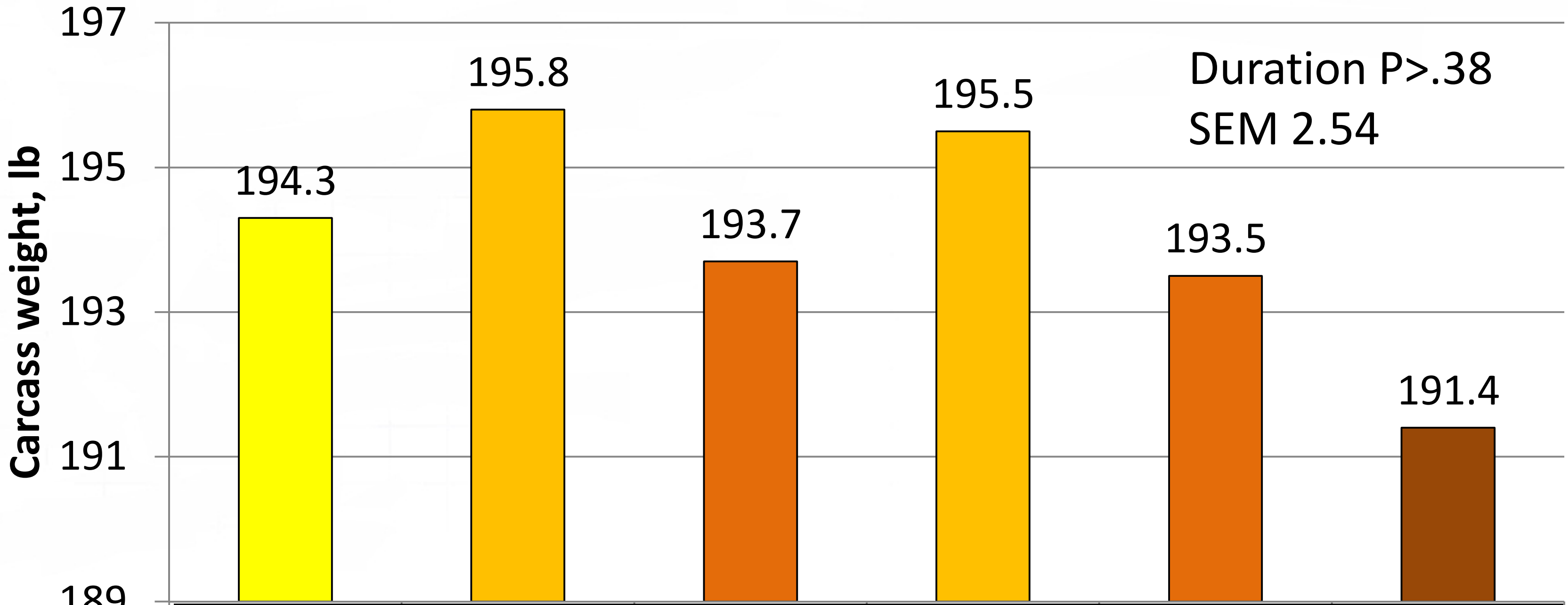
d 0 to 43:	Low	High	High	High	High	High
d 43 to 67:	Low	Low	Med	High	High	High
d 67 to 90:	Low	Low	Med	Low	Med	High

K·STATE Research and Extension

Asmus et al., 2011

Knowledge for Life

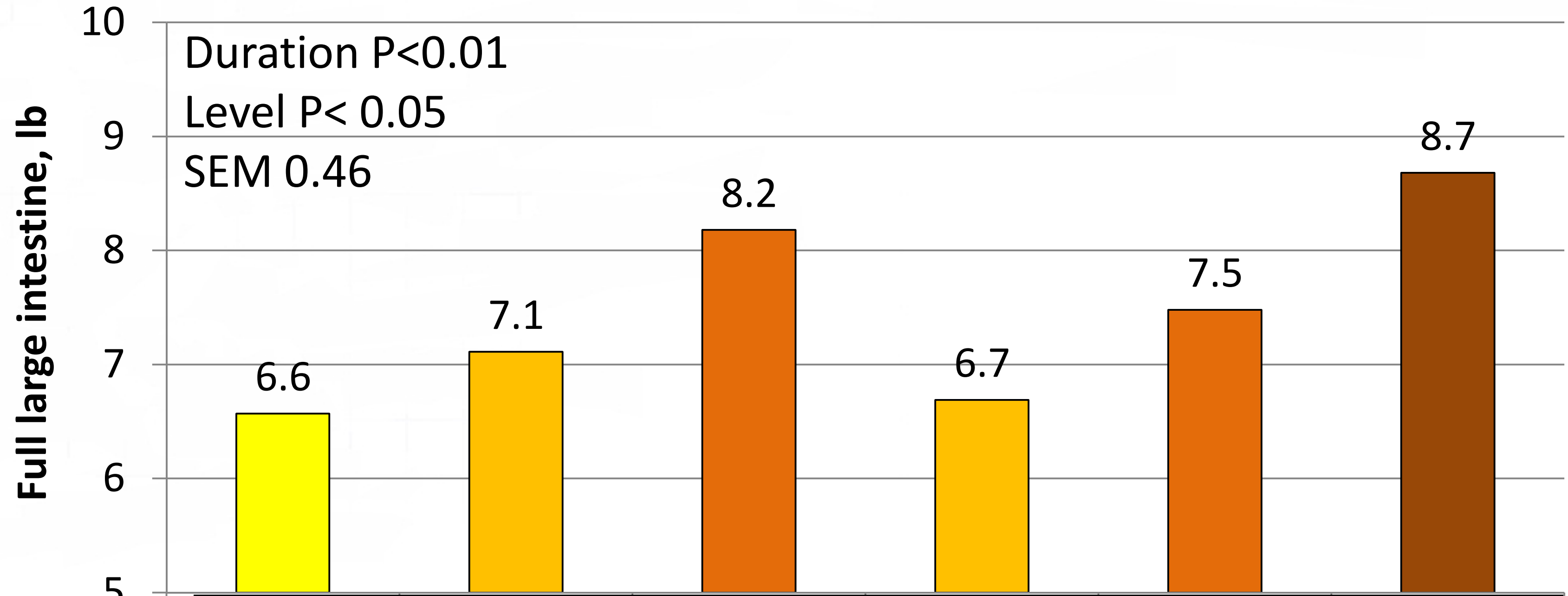
Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



d 0 to 43:	Low	High	High	High	High	High
d 43 to 67:	Low	Low	Med	High	High	High
d 67 to 90:	Low	Low	Med	Low	Med	High

Asmus et al., 2011

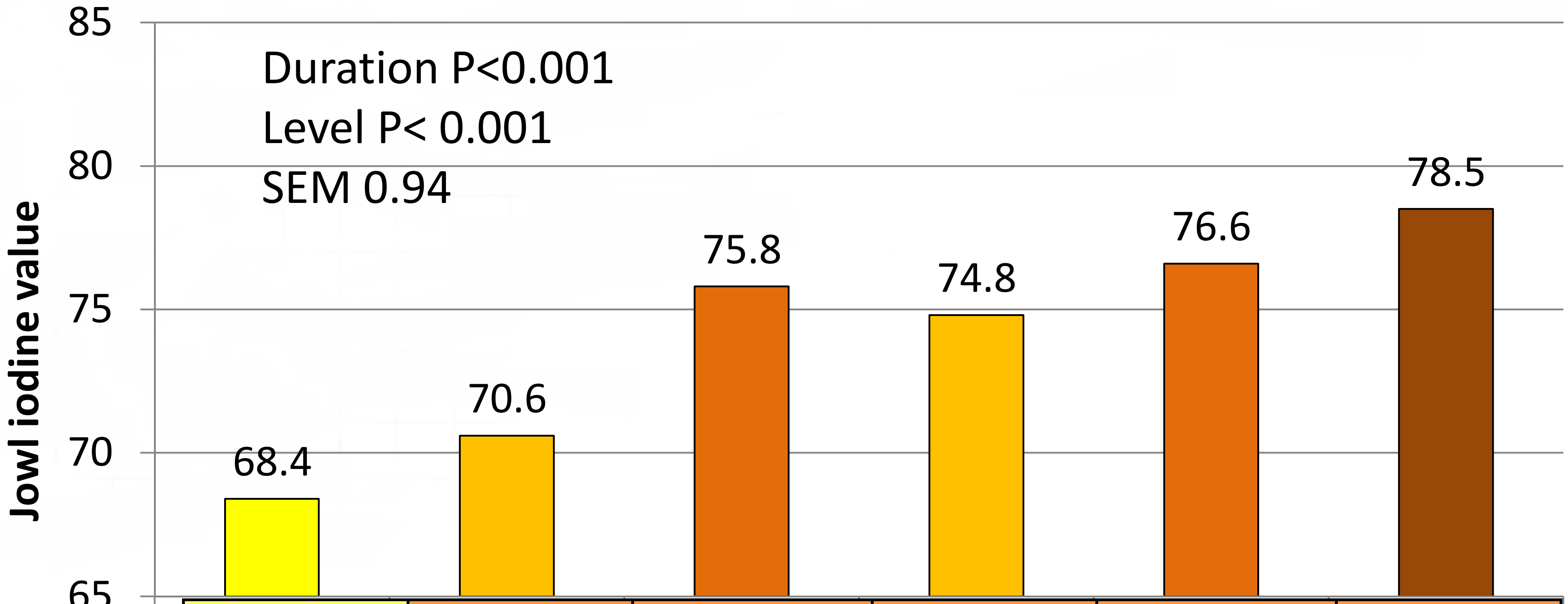
Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



d 0 to 43:	Low	High	High	High	High	High
d 43 to 67:	Low	Low	Med	High	High	High
d 67 to 90:	Low	Low	Med	Low	Med	High

Asmus et al., 2011

Effect of DDGS (0, 15, 30%) and Midds (0, 9.5, 19%) on pig performance (90 to 270 lb)



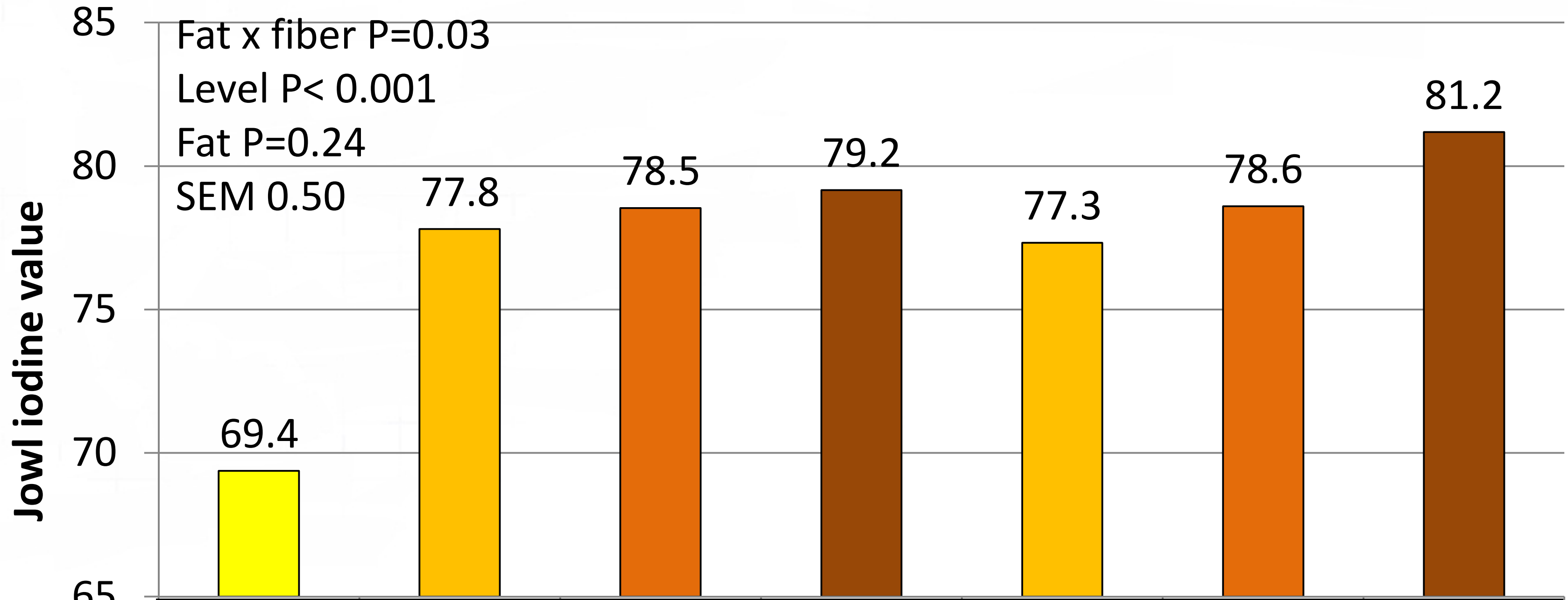
d 0 to 43:	Low	High	High	High	High	High
d 43 to 67:	Low	Low	Med	High	High	High
d 67 to 90:	Low	Low	Med	Low	Med	High

Asmus et al., 2011

K·STATE Research and Extension

Knowledge for Life

Effect of fiber level and fat addition during withdrawal on pig performance (100 to 275 lb)



d 0 to 73:	Low	High	High	High	High	High	High
d 73 to 92:	Low	Low	Med	High	Low	Med	High
Fat, %:	---	---	---	---	3%	3%	3%

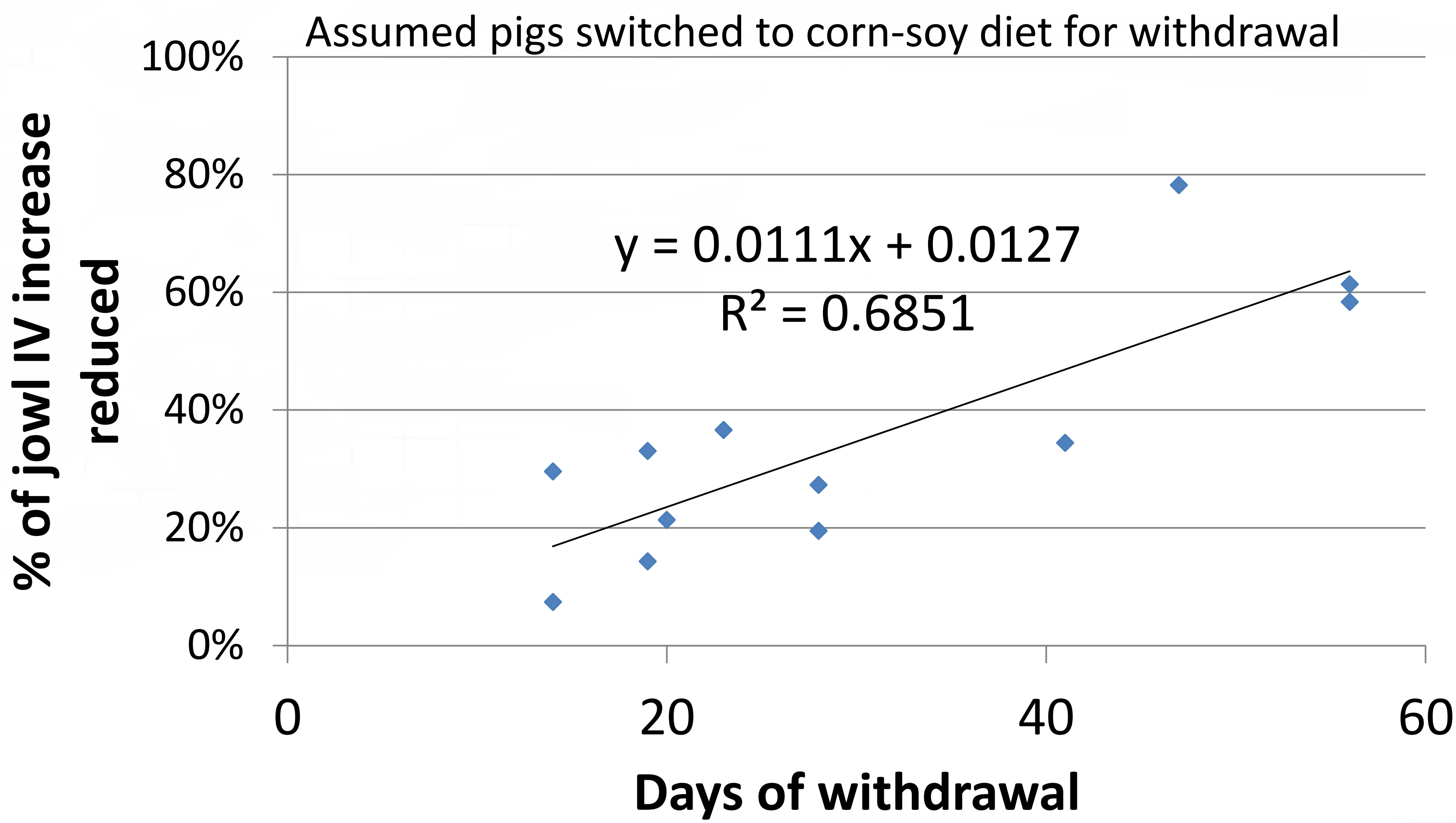
Fiber = DDGS (0, 15, 30%) and Midds (0, 9.5, 19%)

Asmus et al., 2012

K·STATE Research and Extension

Knowledge for Life

Influence of days of withdrawal of high IV diet on jowl fat iodine value



K-STATE Research and Extension

Knowledge for Life

Influence of days of withdrawal of high IV diet on jowl fat iodine value

Days	21	42	21	42
IV increased from normal	6	6	12	12
IV reduced, %	25%	48%	25%	48%
IV reduced, mg/g	1.5	2.9	2.9	5.7

IV reduction % = 0.0111x + 0.0127

Assumed pigs switched to corn-soy diet for withdrawal

K·STATE Research and Extension

Knowledge for Life

Feeder type – Dry vs. Wet/Dry

Dry feeder

Single-sided, 62.7 in long, 5-hole feeder (Staco, Inc., Schaefferstown, PA) and a stainless steel cup waterer

Wet/Dry feeder

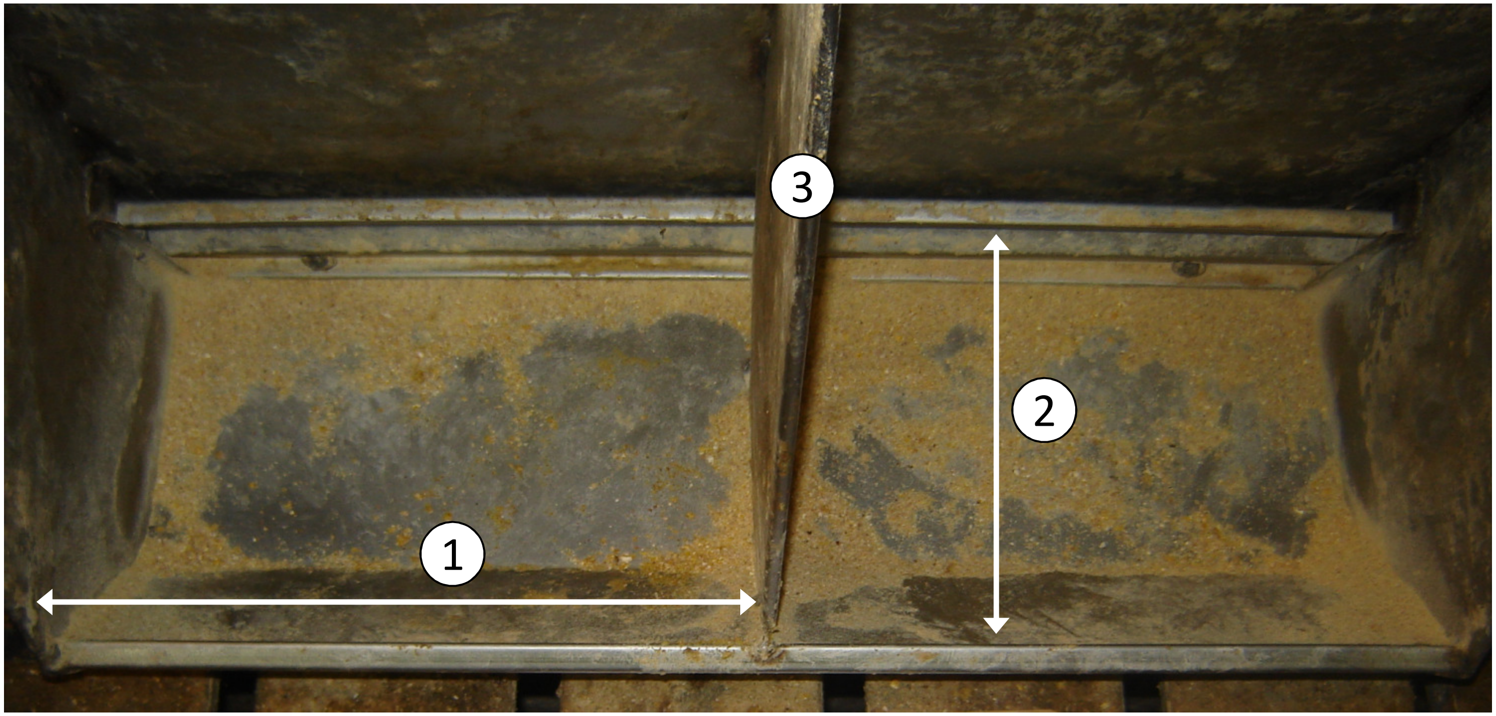
Double-sided with 15 in wide opening on both sides of the trough and single nipple waterer (Crystal Springs, GroMaster, Inc., Omaha, NE)

Bergstrom et al. 2011

Wet Dry vs Dry Feeders

Trial	ADG	FG	Lean	IOFC*
1 Meal	Pos	No Diff	--	--
2 Meal	Pos	Neg	Neg	Neg
3 Meal	Pos	Neg	Neg	Neg
4 Meal	Pos	Pos	--	--
5 Meal	Pos	No Diff	Neg	Neg
6 Meal	Pos	No Diff	Neg	Pos
7 Meal	Pos	No Diff	No Diff	No Diff
8 Meal	Pos	Neg	Neg	Neg
9 Pellets	Pos	Pos	Neg	Pos
9 Meal	Pos	Neg	Neg	No Diff
10 Pellets	Pos	Neg	Neg	Neg
10 Meal	Pos	Neg	Neg	Neg
11 Meal	Pos	Pos	--	--

Feeder design characteristics



1. Width of a single feeding space – minimum 14 inches
   – Shoulder width (cm) + 10% = 6.1 x $BW^{0.33}$ kg + 10%
2. Depth of feeding space – Approximately 10 inches
3. Divider to provide some degree of pig protection
   – Forces pig to stand perpendicular to feeder to eat
   – Decreased rooting and pig/pig interaction

K·STATE Research and Extension

Knowledge for Life

Summary of feeder adjustment trials

Authors	Stage	Feeder type	Coverage, % Min	Coverage, % Max	Significant response	Change in F/G
Smith	Nursery	Dry	6	93	**ADG**, ADFI	2.1%
Duttlinger1	Finisher	Dry	26	79	---	3.1%
Duttlinger2	Finisher	Dry	24	78	**ADG**	2.6%
Bergstrom1	Grower	Dry	9	79	ADFI	2.2%
Bergstrom1	Grower	Wet/dry	35	65	**ADG**, ADFI	-1.6%
Bergstrom2	Finisher	Dry	25	83	---	0.0%
Bergstrom2	Finisher	Wet/dry	53	82	**ADG**, ADFI	5.7%
Bergstrom3	Finisher	Wet/dry	63	83	**ADG**, ADFI	0.4%
Myers	Finisher	Dry	28	75	ADFI, **F/G**	3.9%
Myers2	Finisher	Dry	43	87	ADFI, **F/G**	4.9%

Finisher F/G improvement by decreasing pan coverage 2.9%

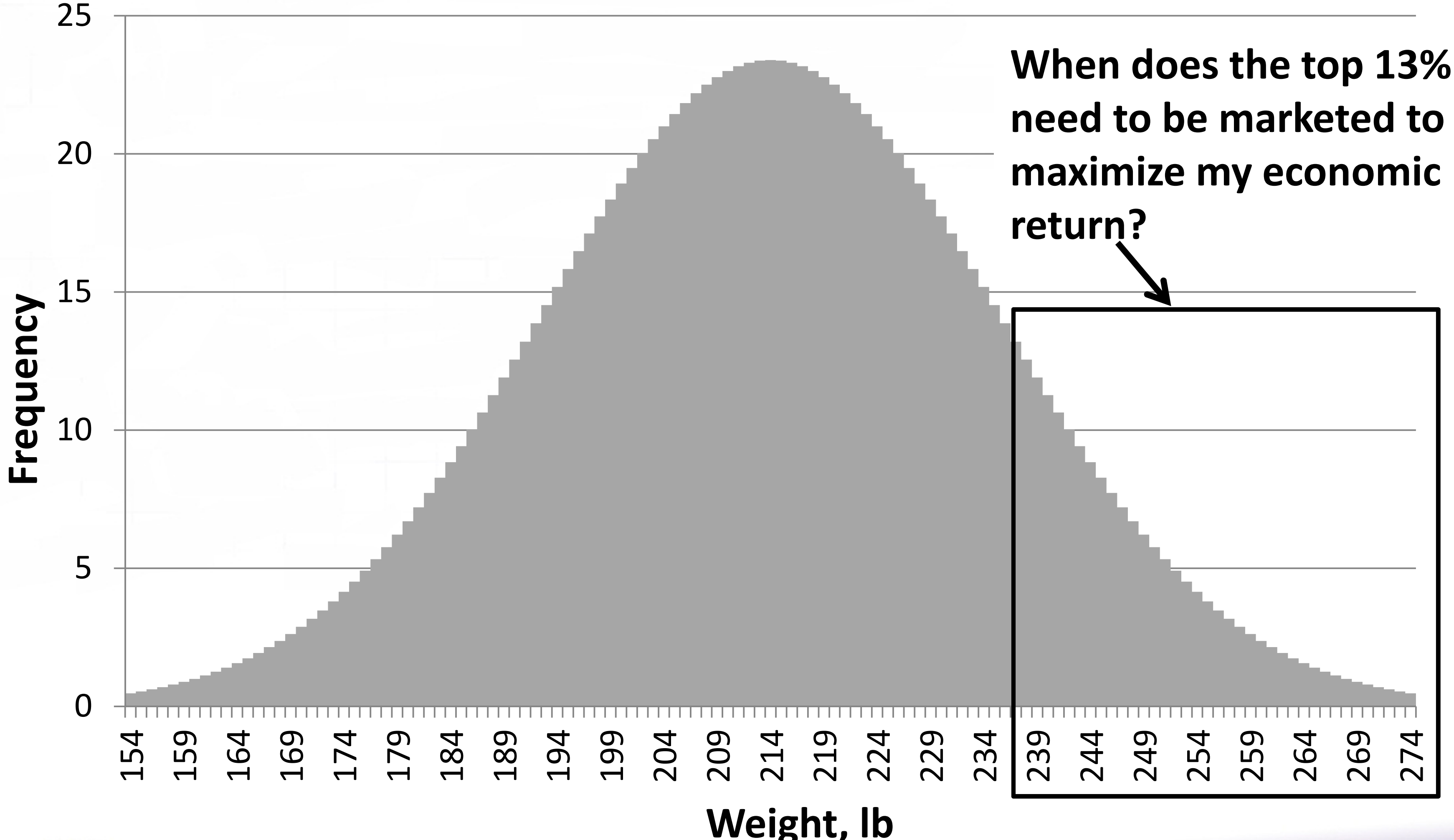
Paylean economic return

- During high feed and market prices
  - Greater economic return per pig
  - Greater return for higher doses
    - 9 > 6.75 > 4.5 g/ton
  - Optimal duration increases slightly
    - Feed for 21 to 28 days before market

Determining optimal marketing strategy for barns

- To accurately market barns, we need information:
  - Average weight of pigs in barn
  - Variation in pig weight
- Then, we must be able to find the heaviest pigs and get them on the truck?

Normal distribution of pig weights in a barn
Mean = 213.5 lb, Standard Deviation = 21.5 lb

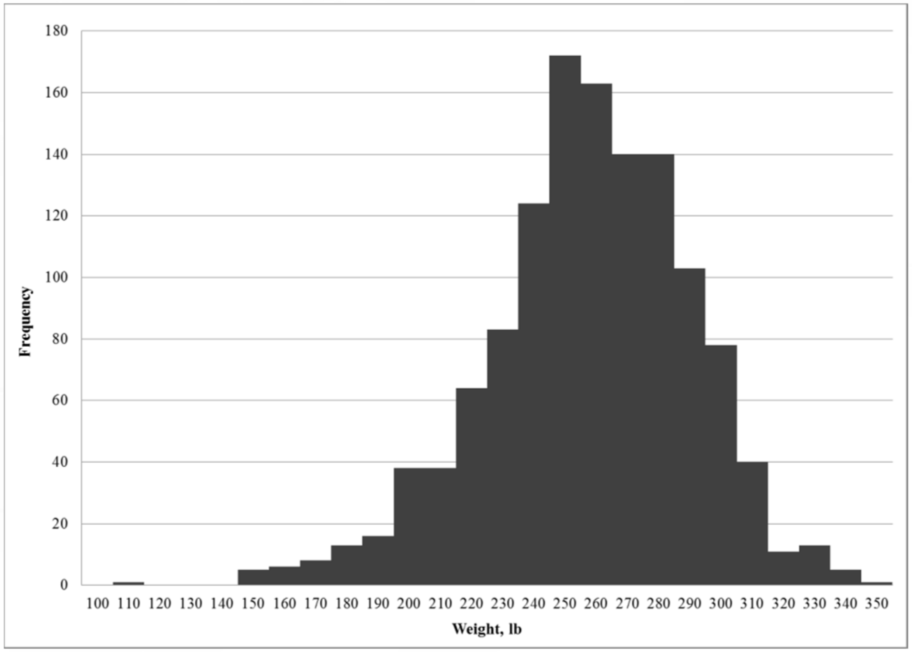


K·STATE Research and Extension

Knowledge for Life

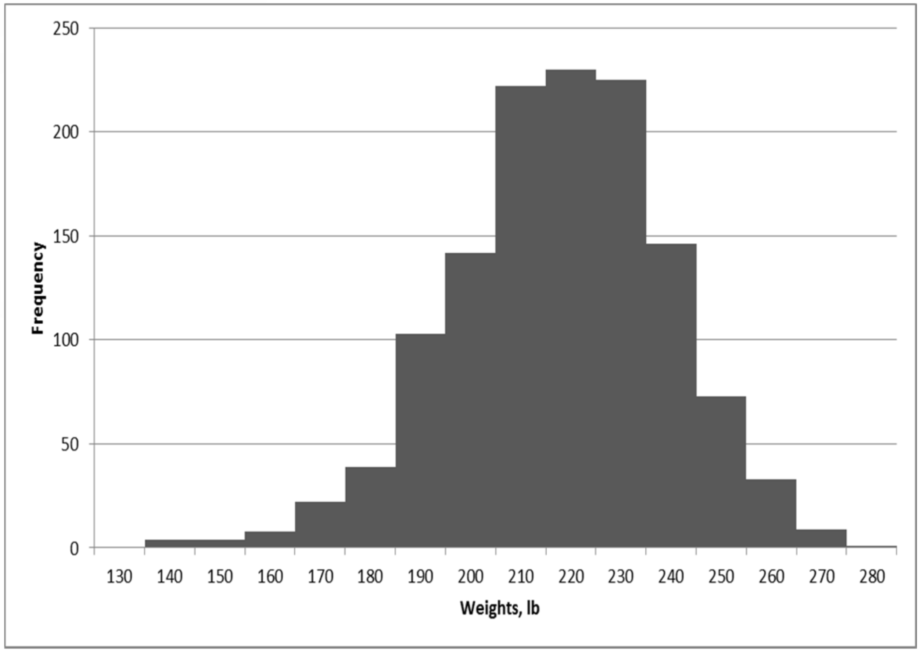
Histogram of Pig Weights

Groesbeck



Mean = 253.0 lb
Median = 254 lb
Standard Deviation = 38.2 lb
CV = 13.0 %

Portland



Mean = 213.5 lb
Median = 214 lb
Standard Deviation = 21.5 lb
CV = 10.1 %

K·STATE
Research and Extension

Paulk et al., 2011

Knowledge for Life

Methods of sampling a barn to determine average pig weight (30 pig sample)

		95% confidence interval		
Pigs/pen	Pens	Upper, lb	Lower, lb	Range, lb
15	2	223.9	197.6	26.3
10	3	223.3	201.3	22.0
6	5	222.5	203.9	18.6
5	6	222.0	204.6	17.4
3	10	221.3	205.6	15.7
2	15	220.9	206.1	14.8

Mean of 10,000 random samples of pigs from 1260 head barn with 19 pens with 56 to 81 pigs/pen (weight 213.5)

Paulk et al., 2011

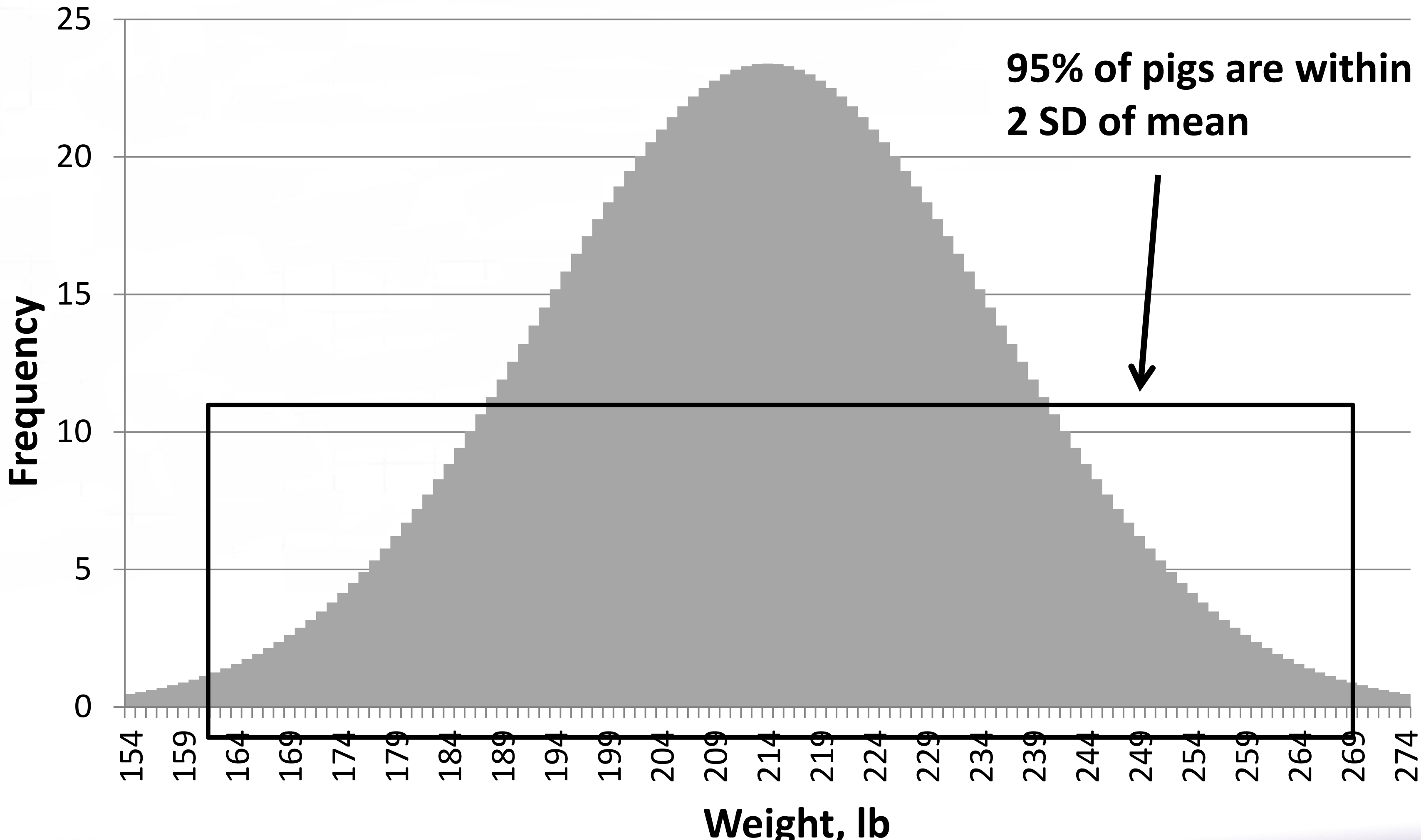
Methods of sampling a barn to determine standard deviation (30 pig sample)

		95% confidence interval		
Pigs/pen	Pens	Upper, lb	Lower, lb	Range, lb
15	2	27.5	14.6	12.9
10	3	27.9	15.0	12.9
6	5	27.6	15.3	12.3
5	6	27.6	15.3	12.3
3	10	27.5	15.8	11.6
2	15	27.3	15.9	11.4

Mean of 10,000 random samples of pigs from 1260 head barn with 19 pens with 56 to 81 pigs/pen (SD = 21.5)

Paulk et al., 2011

Normal distribution of pig weights in a barn
Mean = 213.5 lb, Standard Deviation = 21.5 lb

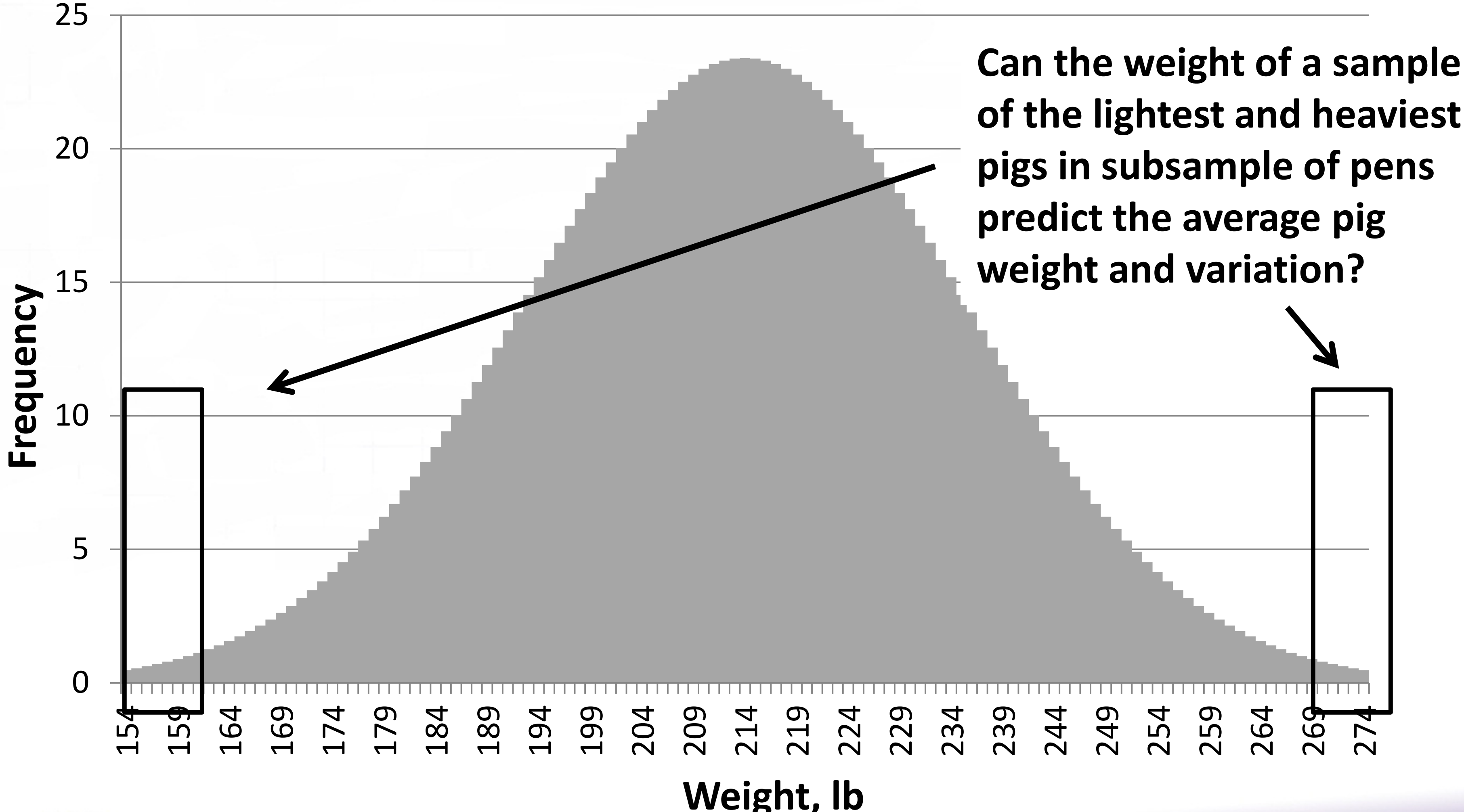


K·STATE
Research and Extension

Paulk et al., 2012

Knowledge *for* Life

Normal distribution of pig weights in a barn
Mean = 213.5 lb, Standard Deviation = 21.5 lb



Paulk et al., 2012

K·STATE Research and Extension

Knowledge for Life

What is immunological castration?

- Temporary immunological suppression of testicular function (late in life) as an alternative to surgical castration (early in life) to control 'boar taint'
- Mode of action is induction of antibodies to endogenous GnRF which temporarily blocks pituitary-gonadal endocrine axis
- Or stated another way "blocks communication between the brain and the testicles"

What is the advantage of immunological castration late in life?

- Boars are more feed efficient and have a higher lean meat yield compared to barrows
- Immunological castrated male pigs spend a large proportion of their life as boars
- Immunological castration temporarily blocks production of sexual hormones that are the cause of “boar taint”

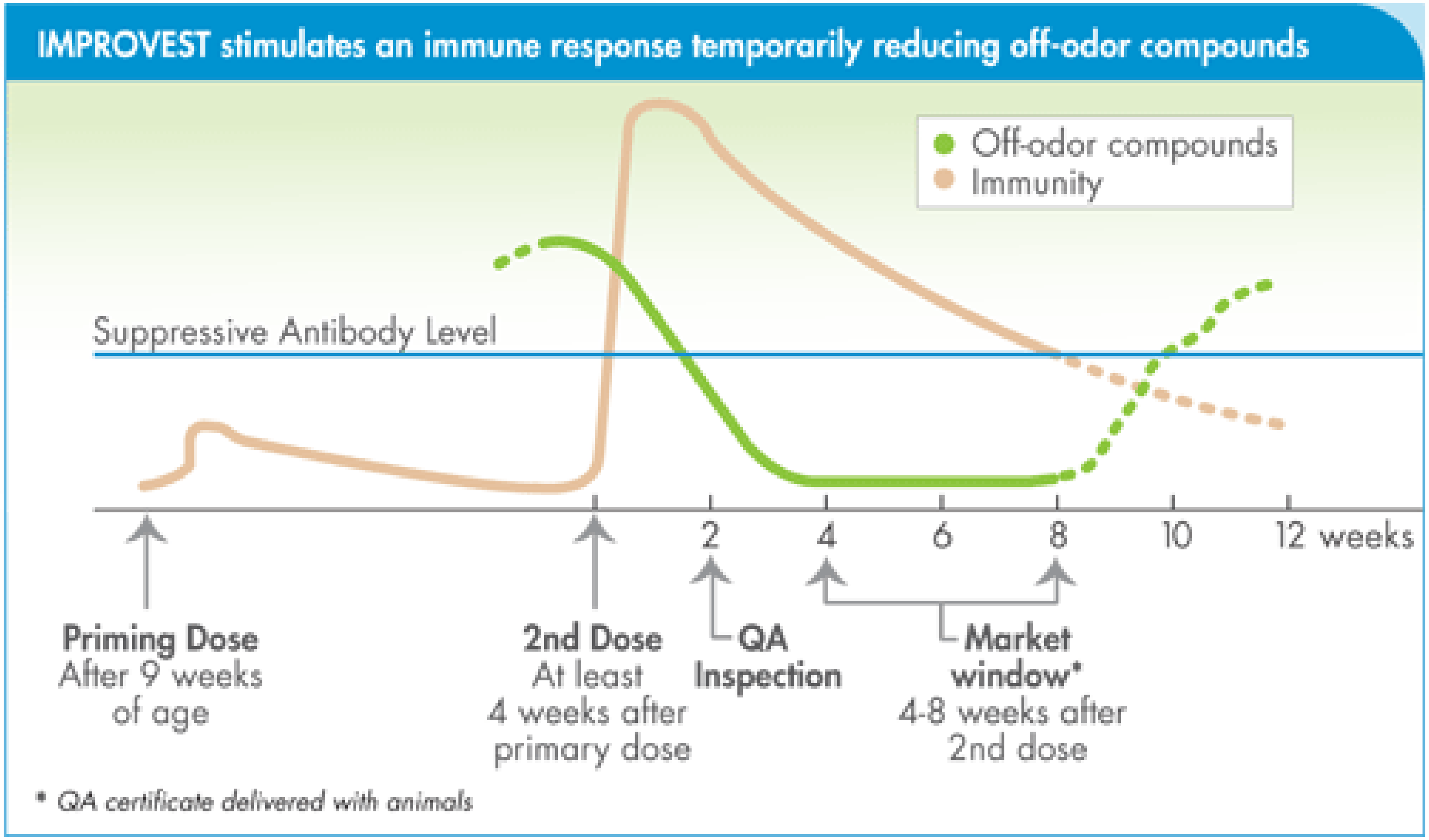
What products are available for immunological castration in the US?

- Improvest – Pfizer Animal Health
- FDA Approved/Not widely available commercially
- First product available in it's class in the US
  - 5 year exclusivity

How is immunological castration late in life performed?

- Requires two injections
- First injection primes the immune system but full testicular and reproductive function is retained
- Second injection induces a strong immune response that causes temporary suppression of testicular function

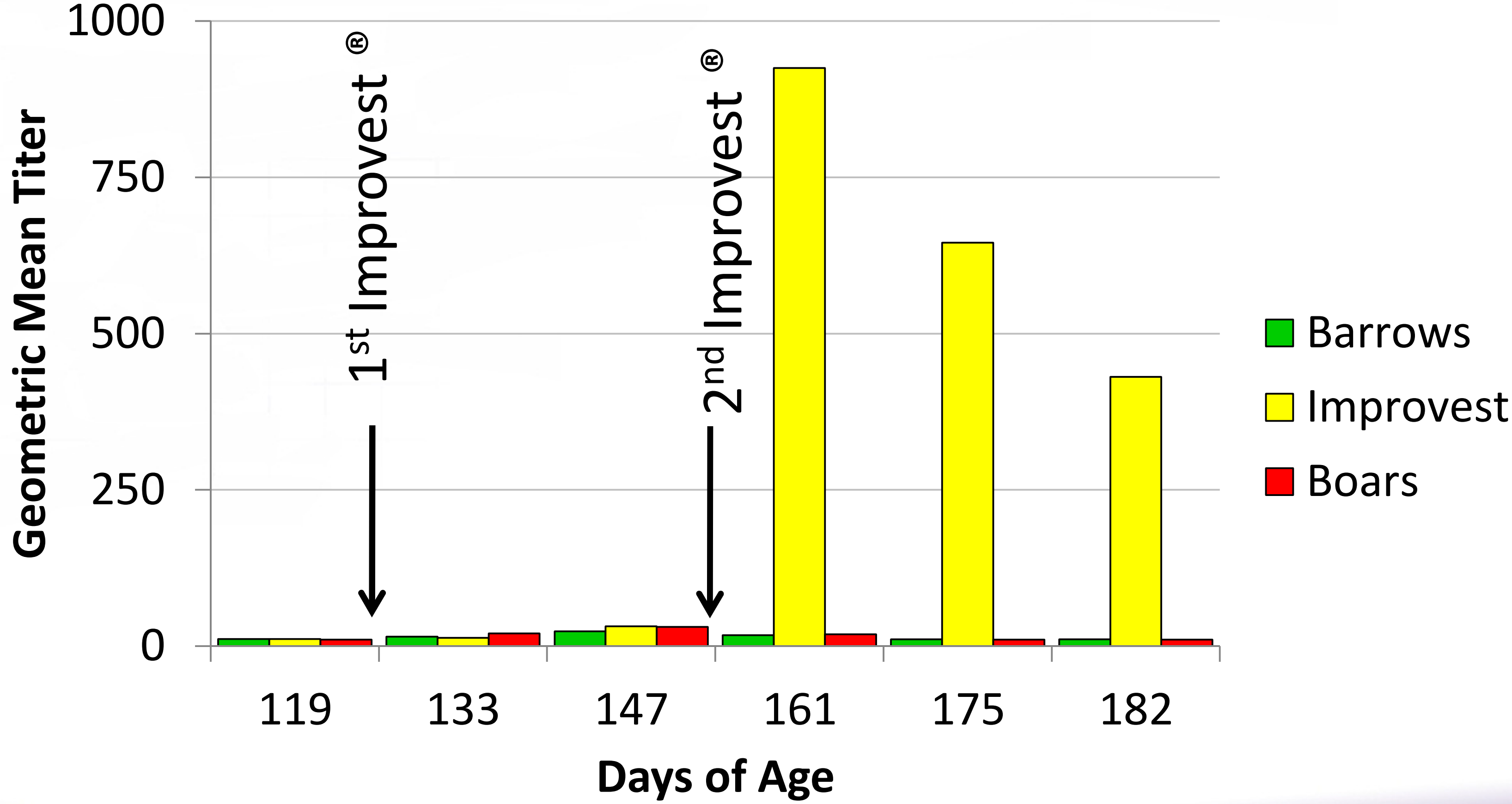
Biology of Immunological castration



K·STATE Research and Extension

Knowledge for Life

Aniti-GnRF antibodies in immunocastrates (Improvest) compared to barrows and boars

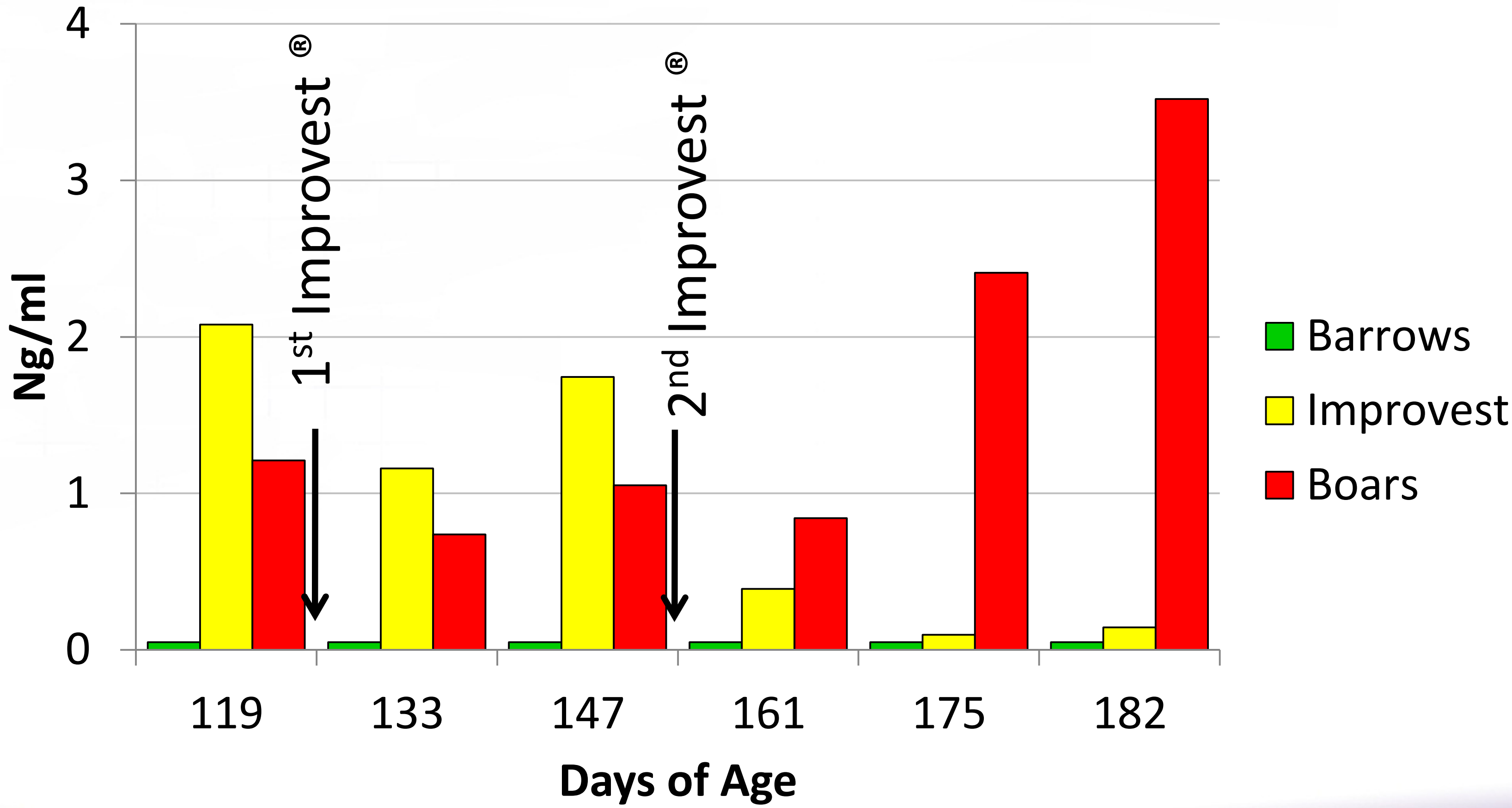


Source: FDA NADA 141-322

How effective is immunological castration?

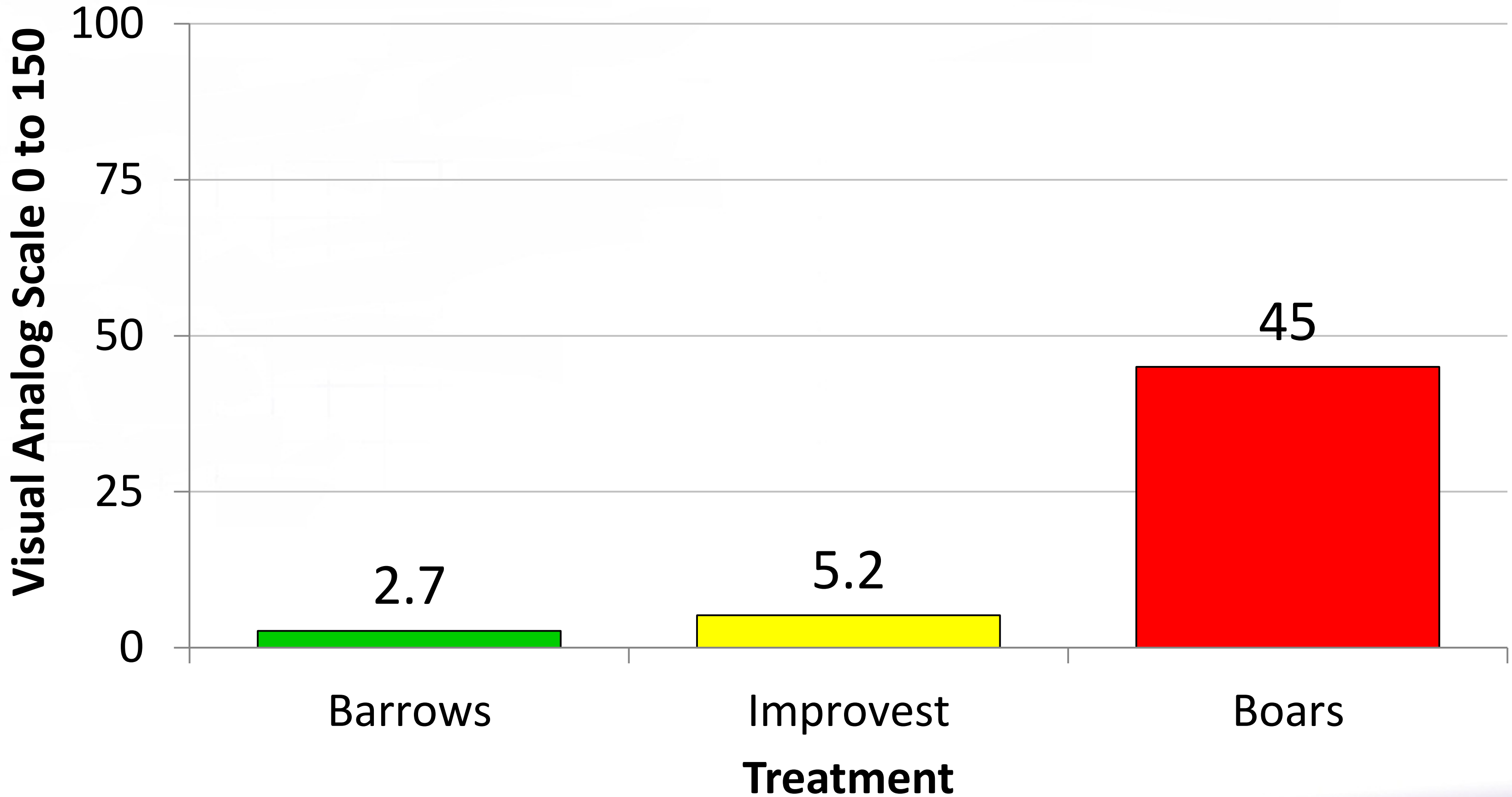
- Reduces circulating testosterone
- Reduces chemical responsible for "boar taint"

Serum testosterone in immunocastrates (Improvest) compared to barrows and boars



Source: FDA NADA 141-322

Olfactory scores from cooked meat from immunocastrates (Improvest) compared to barrows and boars



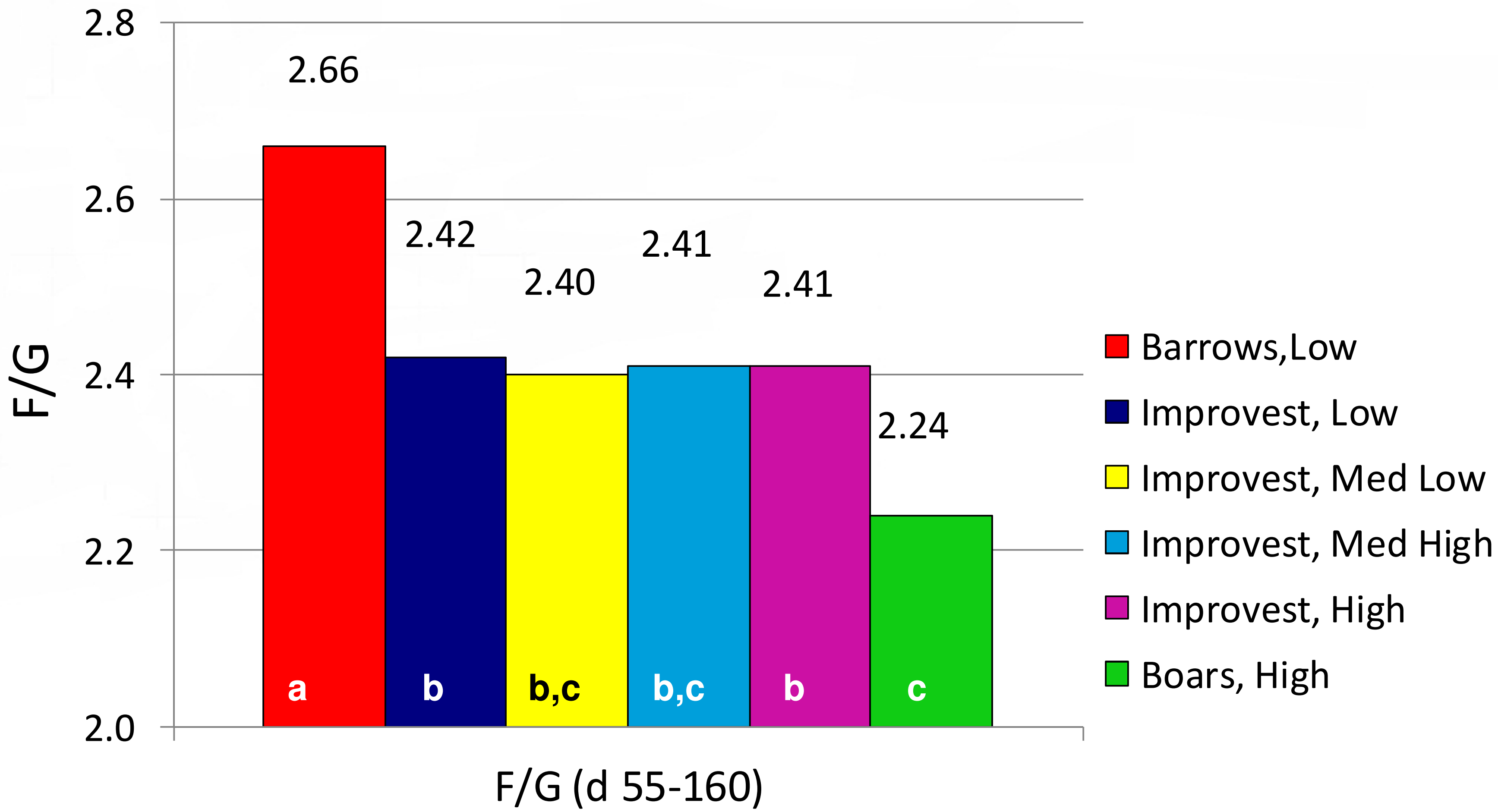
Source: FDA NADA 141-322

K·STATE Research and Extension

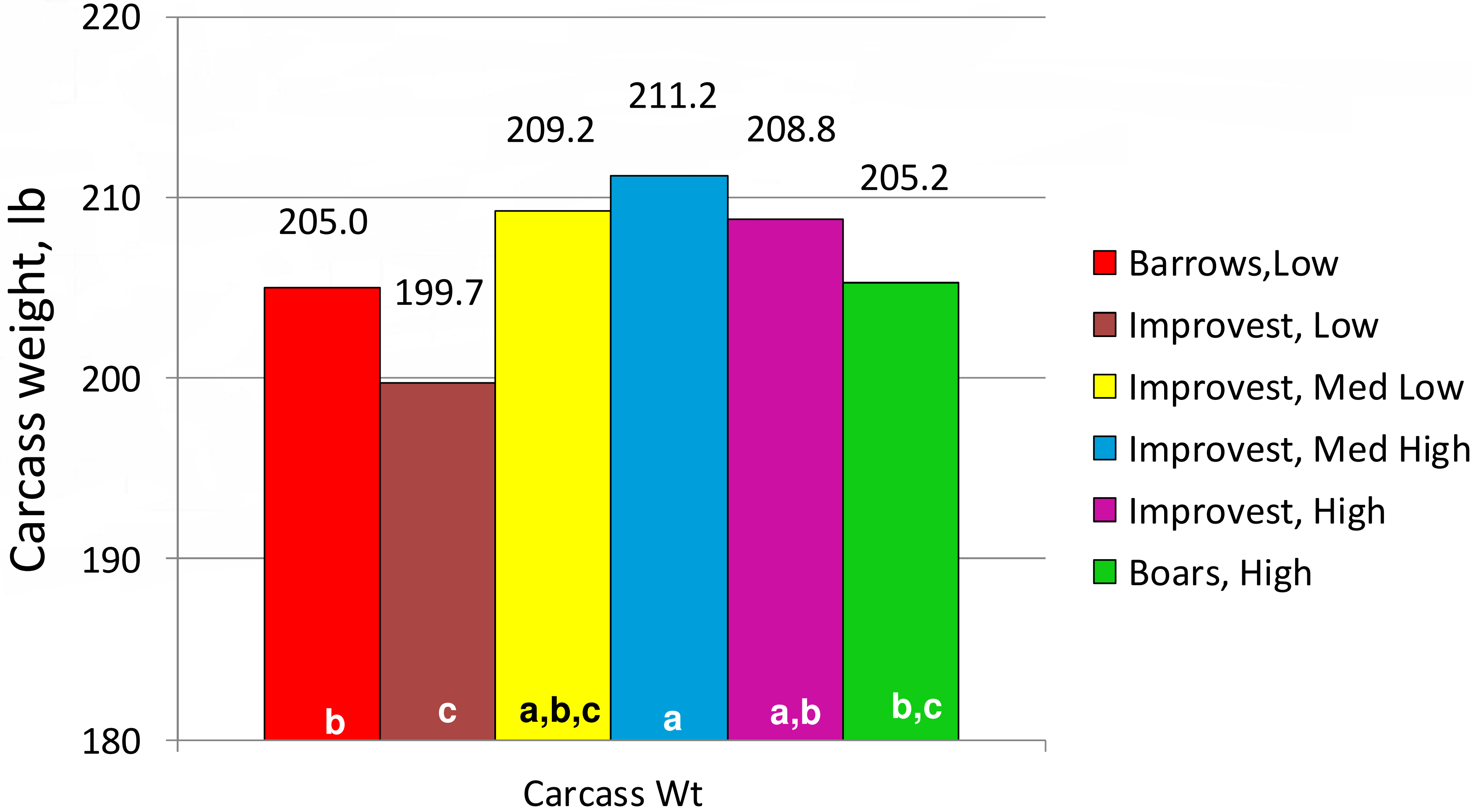
Knowledge for Life

Influence of Improvest and lysine level on F/G

d 55 to 160



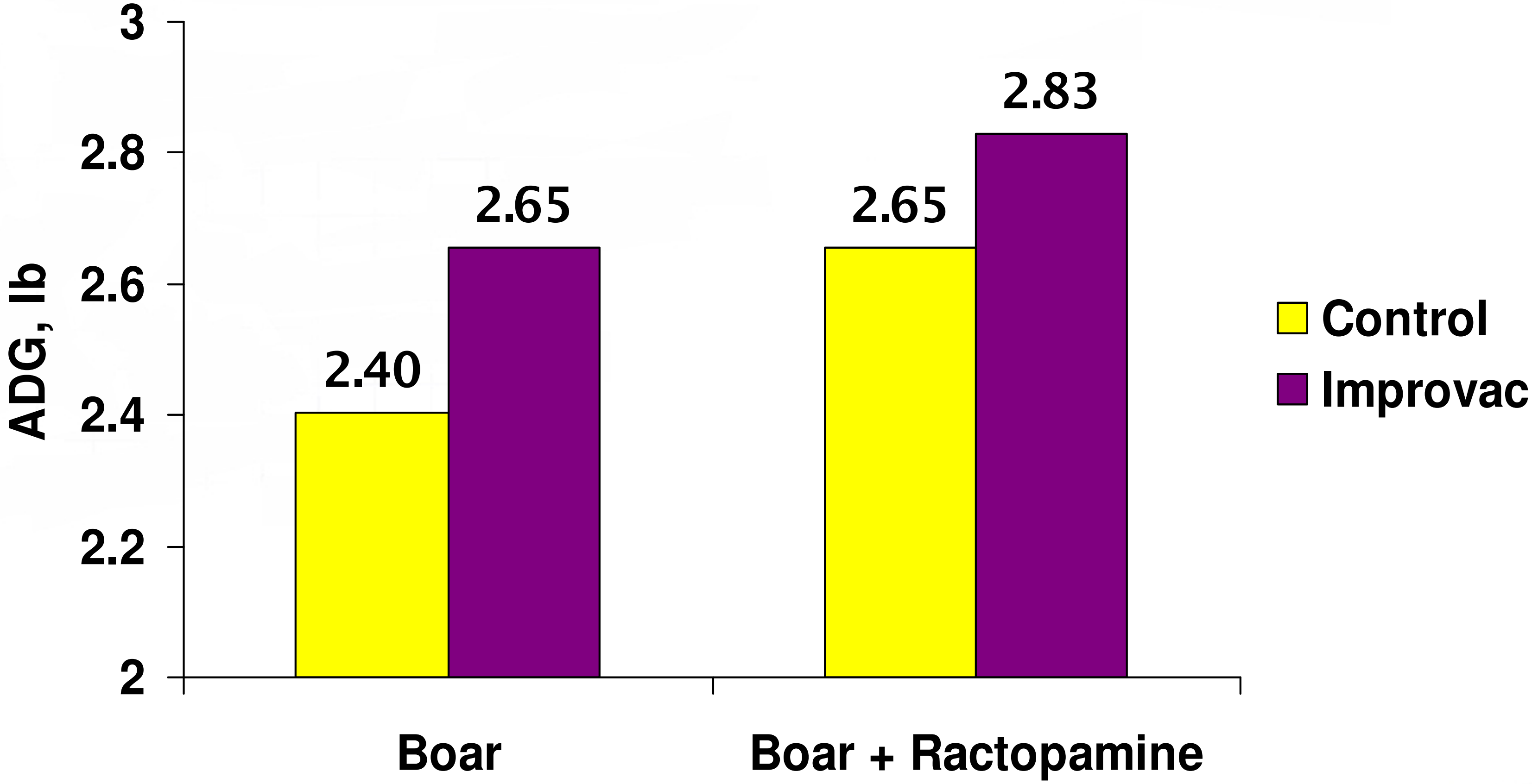
Influence of Improvest and lysine level on carcass weight, lb



K·STATE Research and Extension

Knowledge for Life

Influence of Ractopamine and Improvest on average daily gain



Moore et al., 2008

General information about Improvest?

- How applied:
  - Injection, subcutaneous – under the skin
  - Two doses at least 4 weeks apart
  - First dose can be more than 4 weeks prior to the second injection
- Slaughter window is a minimum of 4 weeks and up to 8 weeks after the 2nd injection

Source: FDA NADA 141-322

General information about Improvest

- Availability – Only by veterinary prescription due to precautions for human user safety
  - Use a safety injector
  - Accidental self injection can interfere with reproductive function of men and women
  - Proper training for administration critical
- Withdrawal – none when used according to label, no evidence of tissue residues

Source: FDA NADA 141-322

Key Take Home Points

- Requires effective injection administration
- Requires dietary adjustments
  - Feed like boars up to second injection
  - Feed like barrows after second injection
- ADG and feed efficiency for immunocastrates after second injection is better than barrows
- Carcass yield is decreased
- Packer contracts are containing clauses to require notification of use

Source: FDA NADA 141-322

Thank You!

K·STATE
Research and Extension

KSU Swine Day 2011

Morning – Finisher pigs

Afternoon – Nursery and sows

- Vitamin D research
- New KSU premix recommendations
- Nursery diet ingredients
- Feed processing

Vitamin D – The Nutritionist Perspective

K·STATE Research and Extension

Knowledge for Life

History

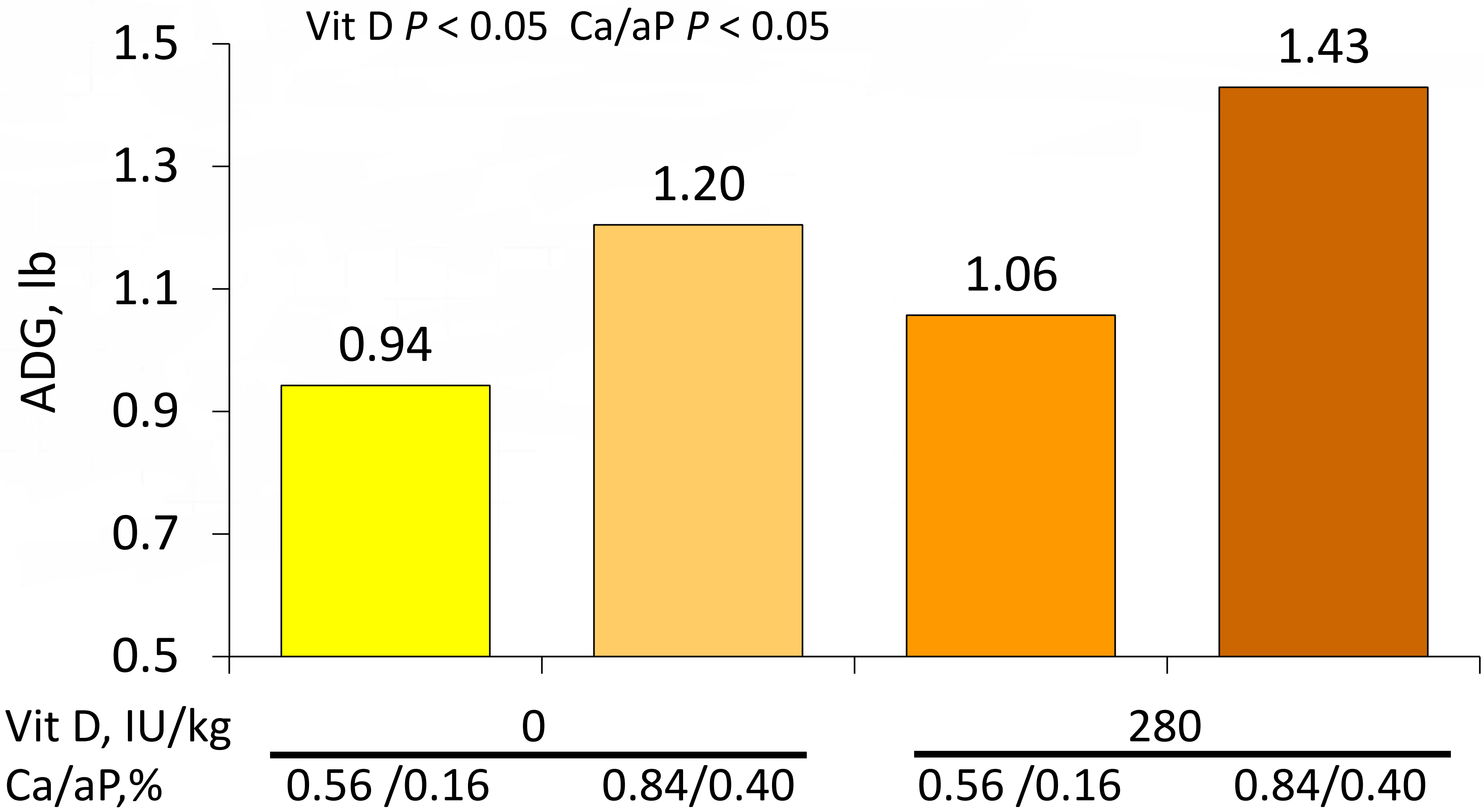
- University Research Herd
- Omission of all supplemental Vitamin D from premix
- Kyphosis “Humpback” out break
- Signs first observed in growing pigs fed research diets marginal with Ca/P

K·STATE Research and Extension

Rortvedt et al., 2010

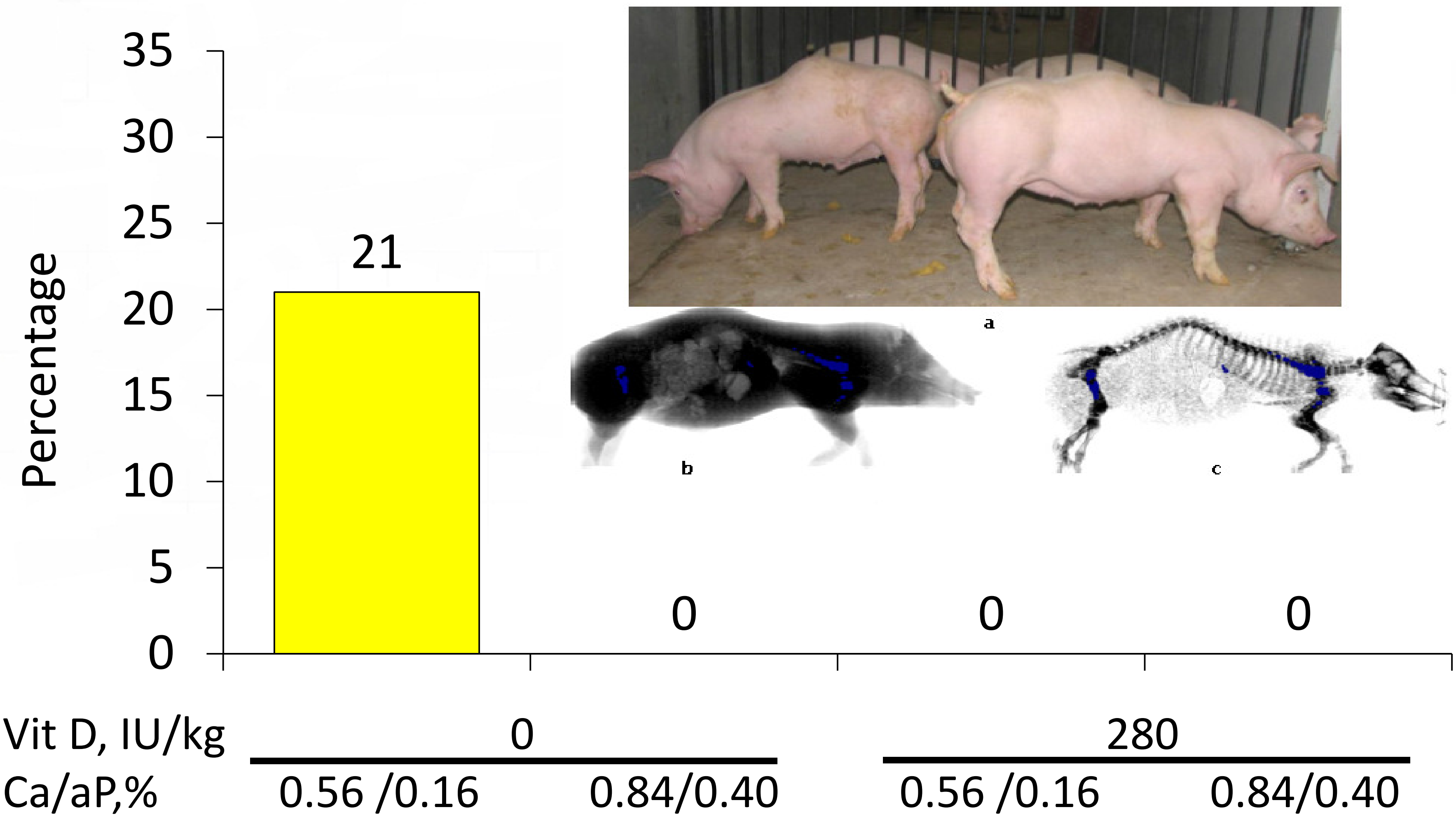
Knowledge for Life

Nursery growth rate from weaning at 4 weeks of age until 9 weeks



Rortvedt et al., 2010

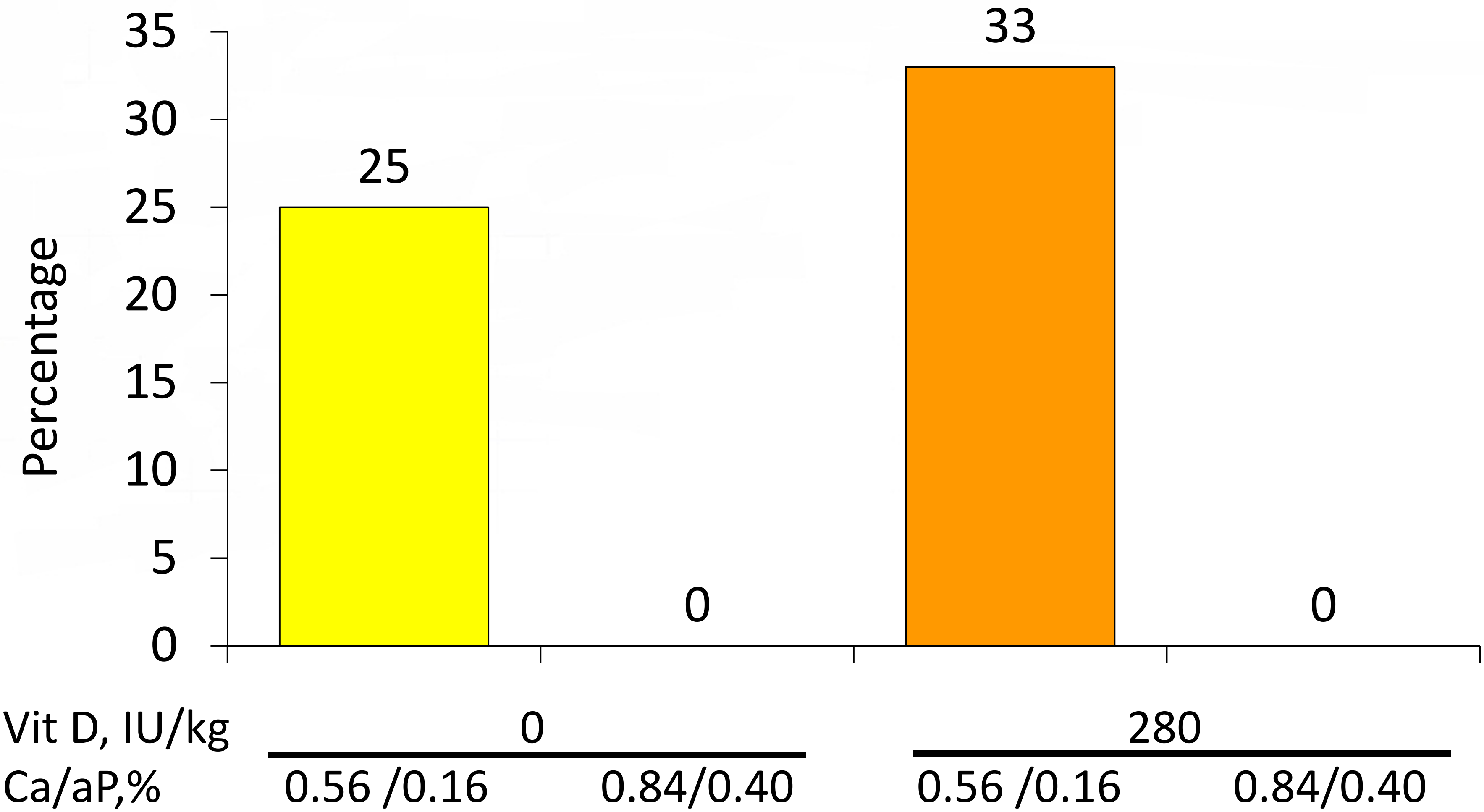
Kyphosis – 9 wk of age



Rortvedt et al., 2010

Kyphosis – 13 wk of age

All pigs fed 0.40 aP diets from wk 9 to 13



Rortvedt et al., 2010

K·STATE
Research and Extension

Knowledge for Life

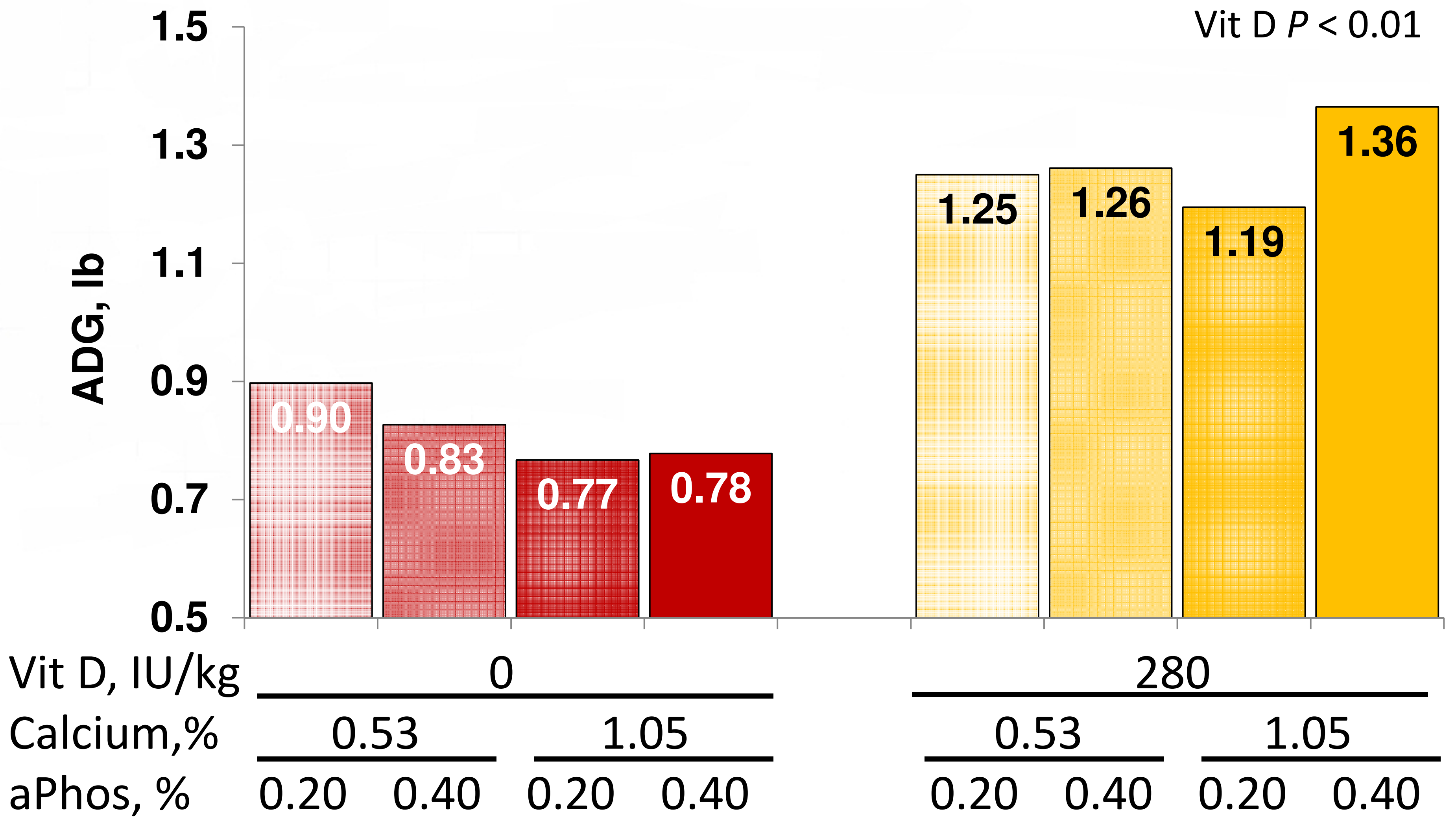
Exp. 2. Vitamin D at 0 or 280 IU/kg with four calcium/phosphorus regimens

Diet	Calcium: / Phosphorus:	Low / Low	High / Low	Low / High	High / High
Ca, %		0.53	1.05	0.53	1.05
P, %		0.57	0.57	0.72	0.72
Available P, %		0.25	0.25	0.40	0.40
Ca:P		0.93	1.86	0.74	1.47
Ca:aP		2.2	4.3	1.3	2.7

Low Ca = 75% NRC High Ca = 150% NRC
Low P = 95% NRC High P = 120% NRC

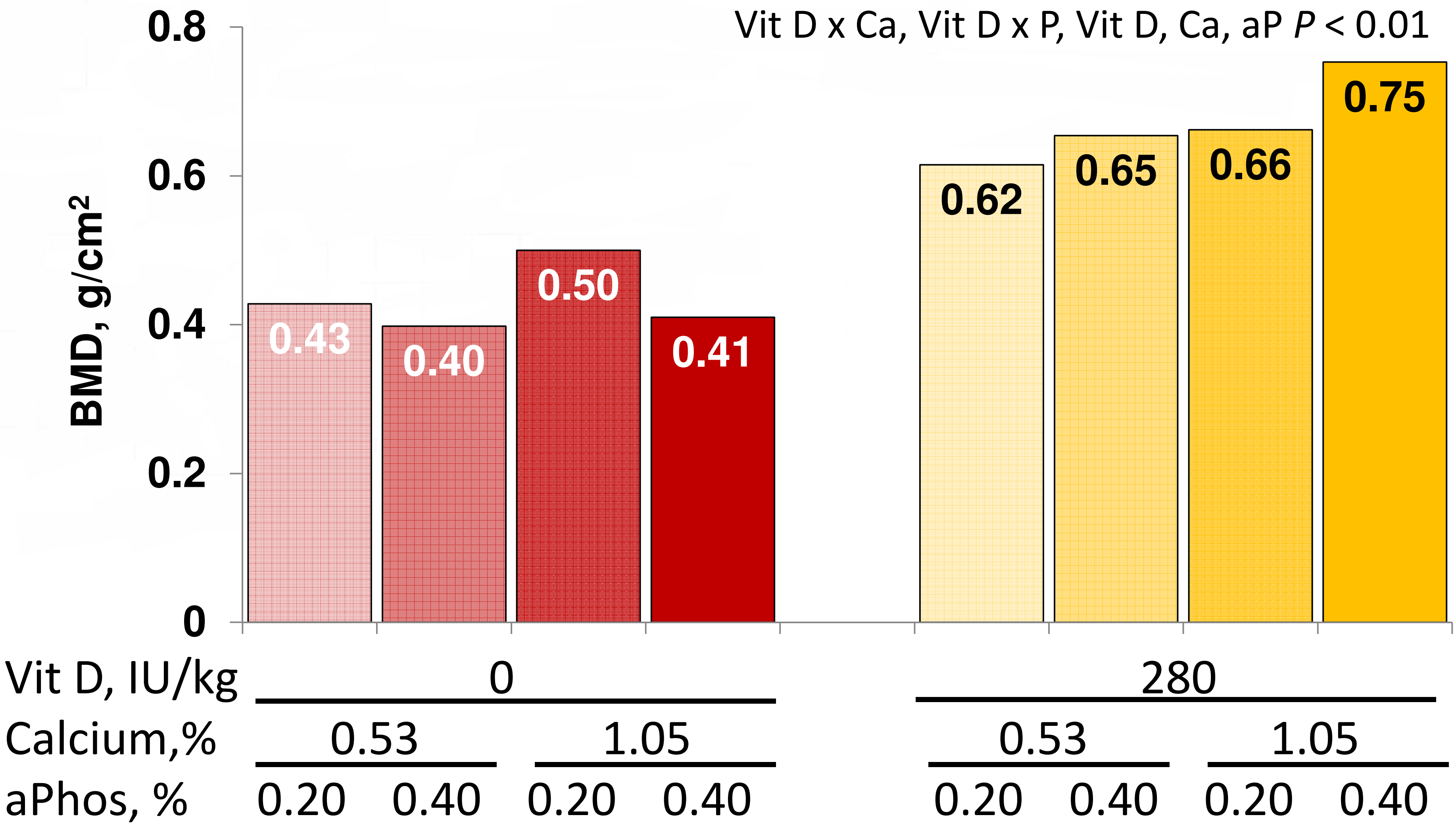
Rortvedt et al., 2011

Vitamin D/Ca/aP on nursery pig growth



Rortvedt et al., 2011

Vitamin D/Ca/aP on bone mineral density



Rortvedt et al., 2011

K·STATE Research and Extension

Knowledge for Life

What does this mean?

- Dietary vitamin D supplementation is clearly necessary
- Increases growth rate and bone mineralization
- As expected, marginal dietary Ca and P affect growth rate and bone mineralization
- Supplementing additional Ca and P is not as effective without vitamin D supplementation
  - Confirms vitamin D is necessary for Ca and P absorption

Comparison of vitamin D recommendations

Source, IU/kg	NRC, 1998	NSNG, 2010	KSU
Gestation	200	660	1378
Lactation	200	660	1378
Early nursery	220	660	1378
Late nursery	200	660	1378
Grower	150	550	827
Finisher	150	440	551
Paylean phase	150	550	413

Effects of Oral Vitamin D3 Supplementation

Flohr et al., 2011

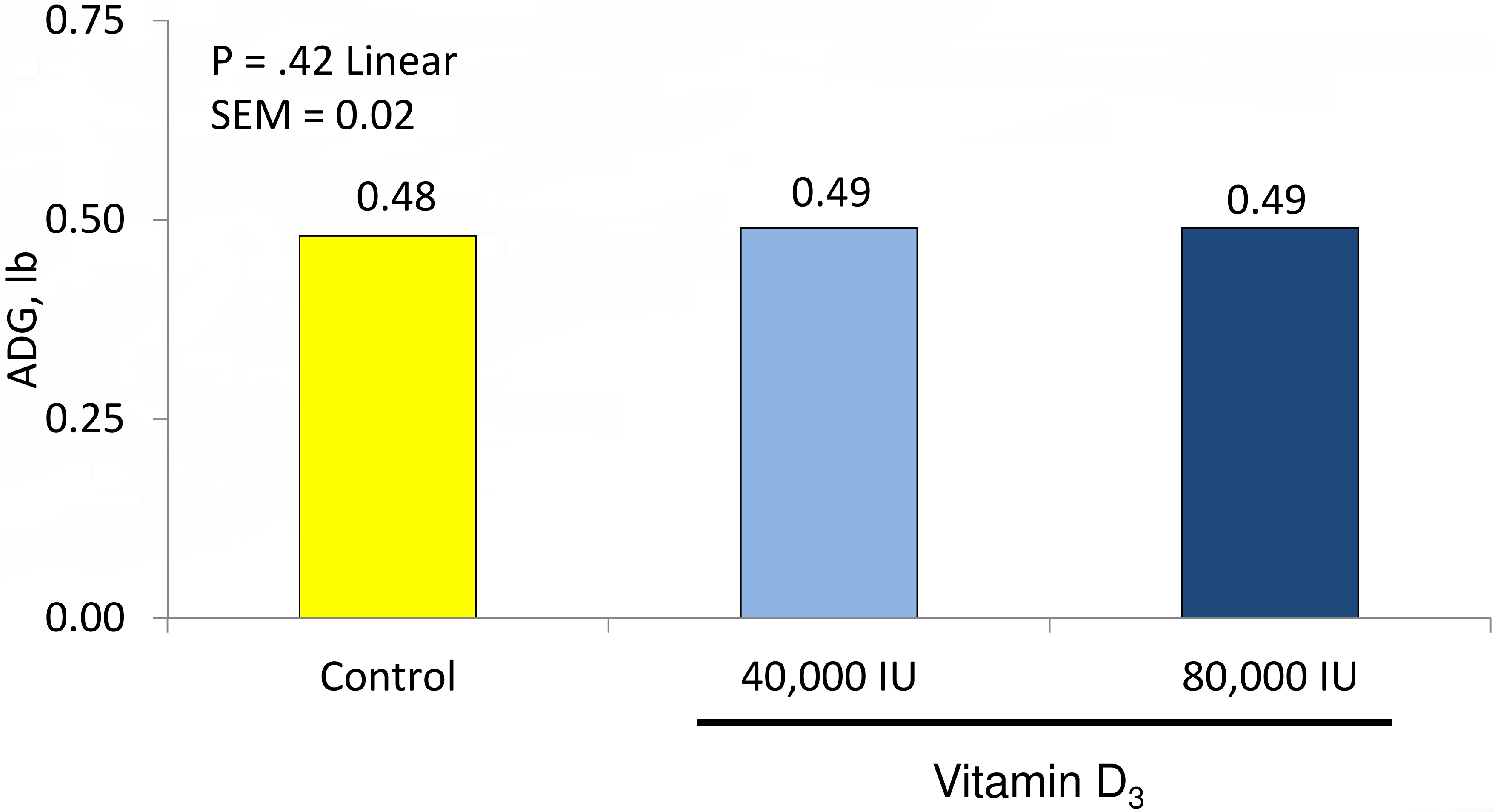
Abilene Animal Hospital, P.A.

Heartland Assays

K·STATE Research and Extension

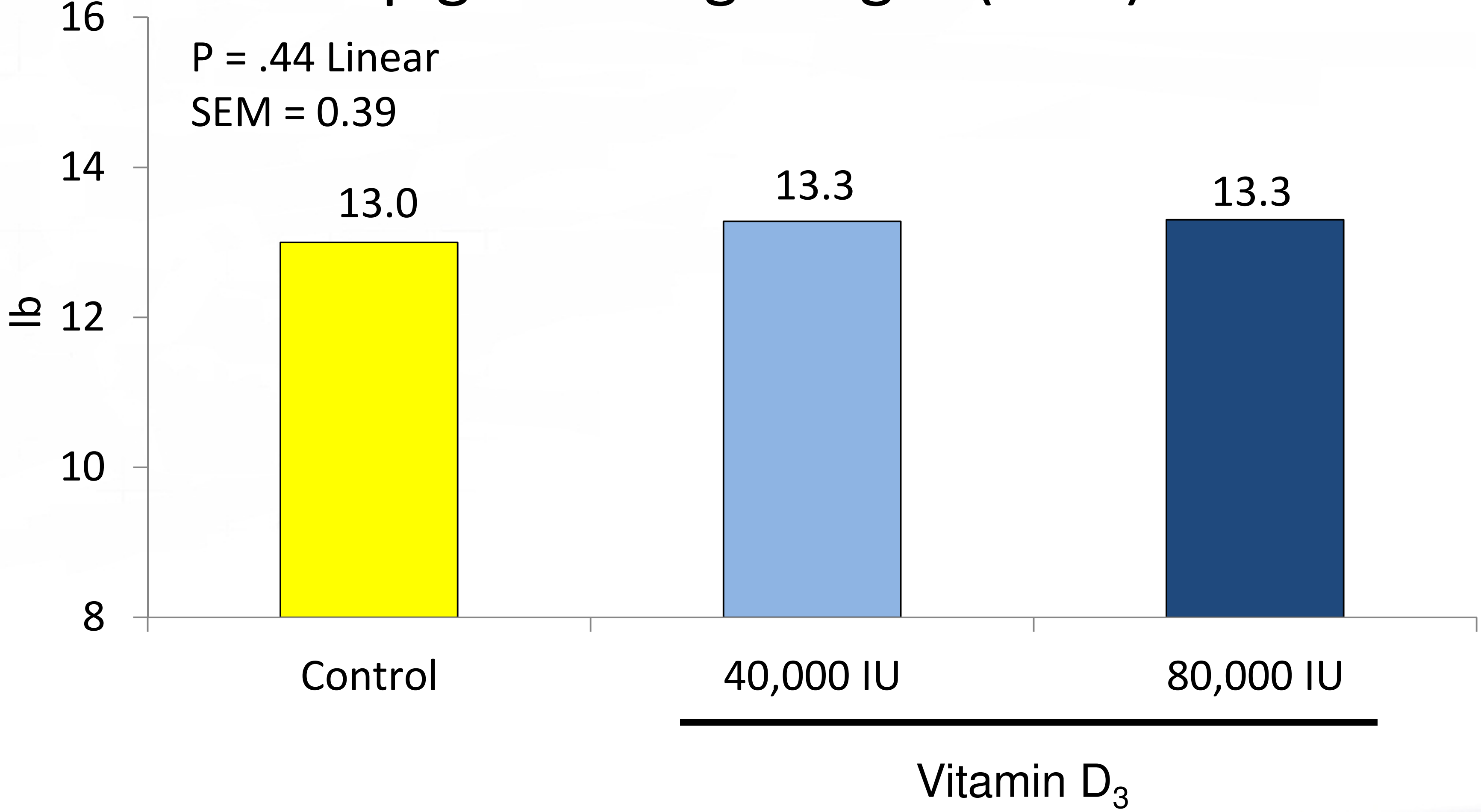
Knowledge for Life

Effect of oral vitamin D_3 on lactation phase piglet growth rate (d 2 to 20)



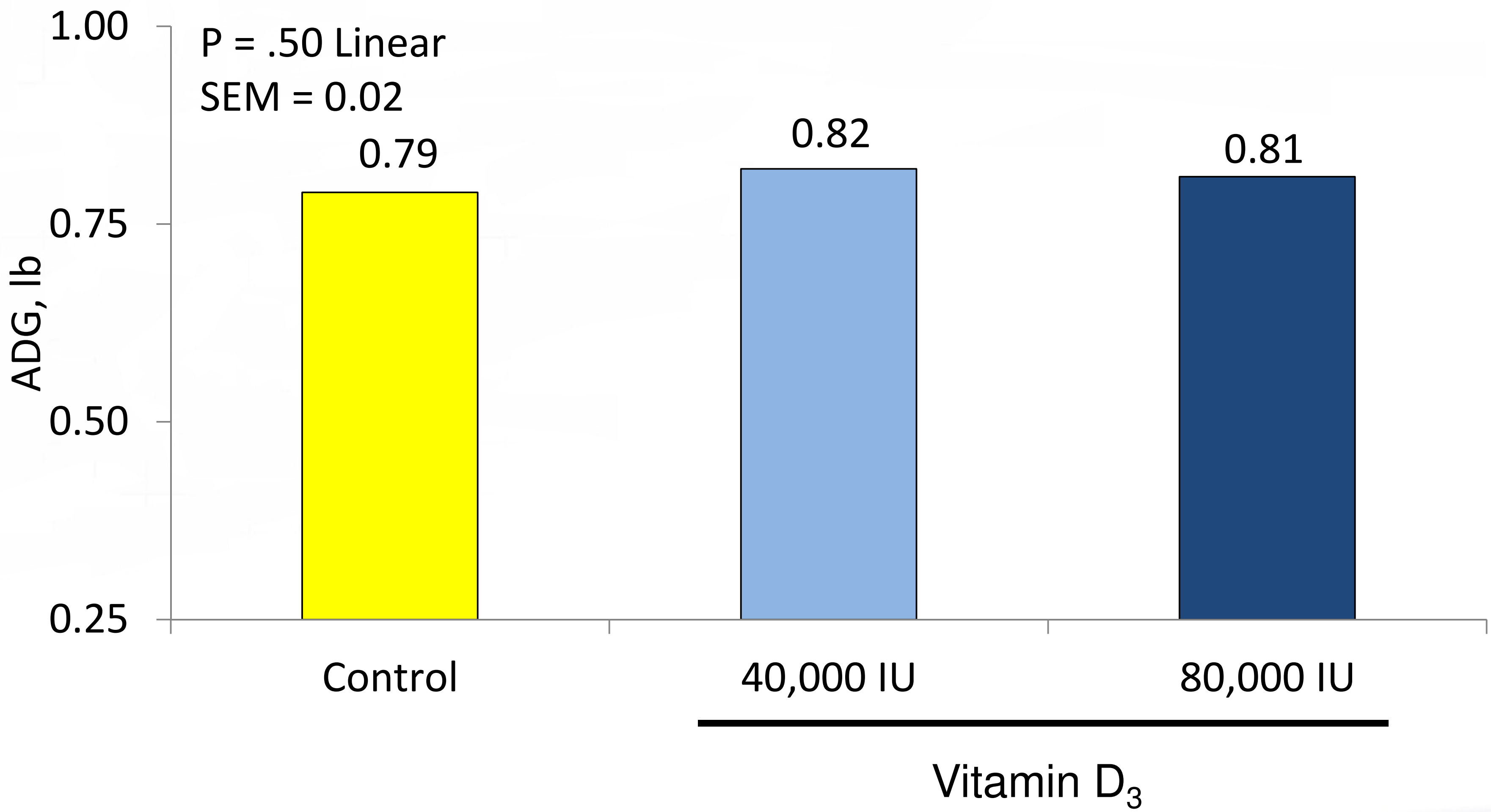
Flohr et al., 2011

Effect of oral vitamin D_3 on pig weaning weight (d 20)



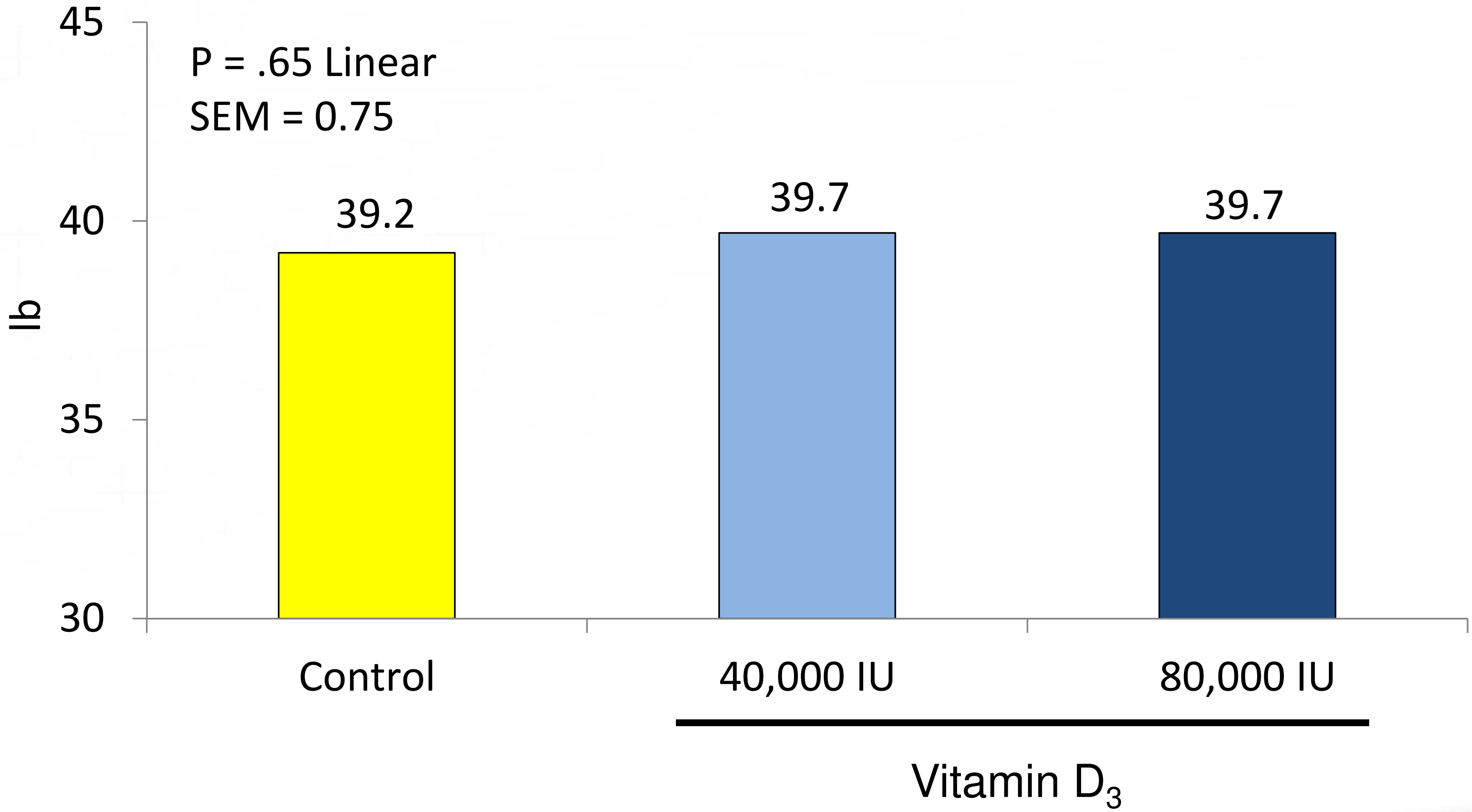
Flohr et al., 2011

Effect of oral vitamin D_3 on nursery phase piglet growth rate (d 20 to 52)



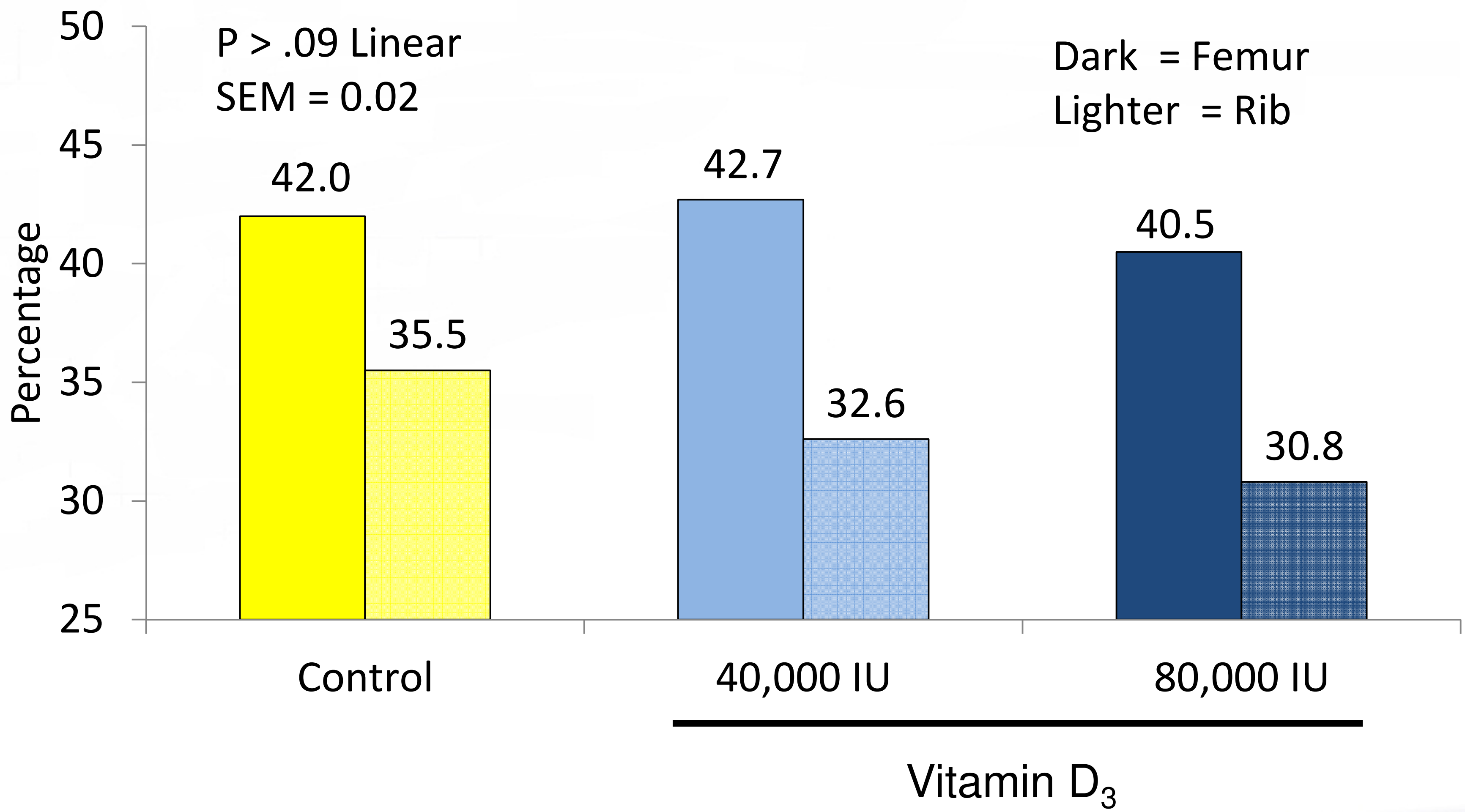
Flohr et al., 2011

Effect of oral vitamin D_3 on pig weight (d 52)



Flohr et al., 2011

Effect of oral vitamin D_3 on bone ash (d 19)

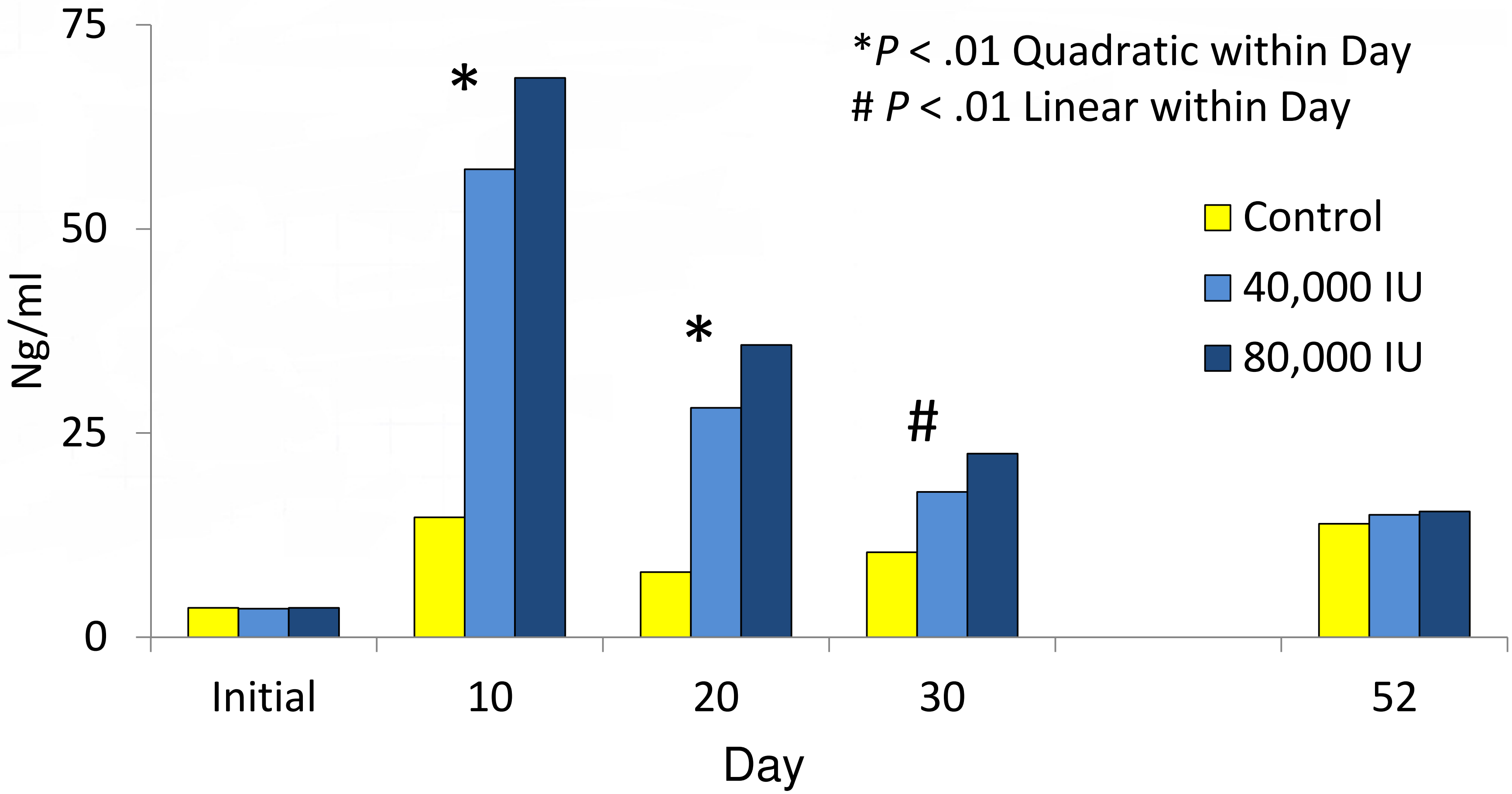


K·STATE Research and Extension

Flohr et al., 2011

Knowledge for Life

Effect of oral vitamin D_3 on serum 25(OH)D3



Flohr et al., 2011

Steps to ensure vitamin D is supplemented correctly (and other vitamins and trace minerals):

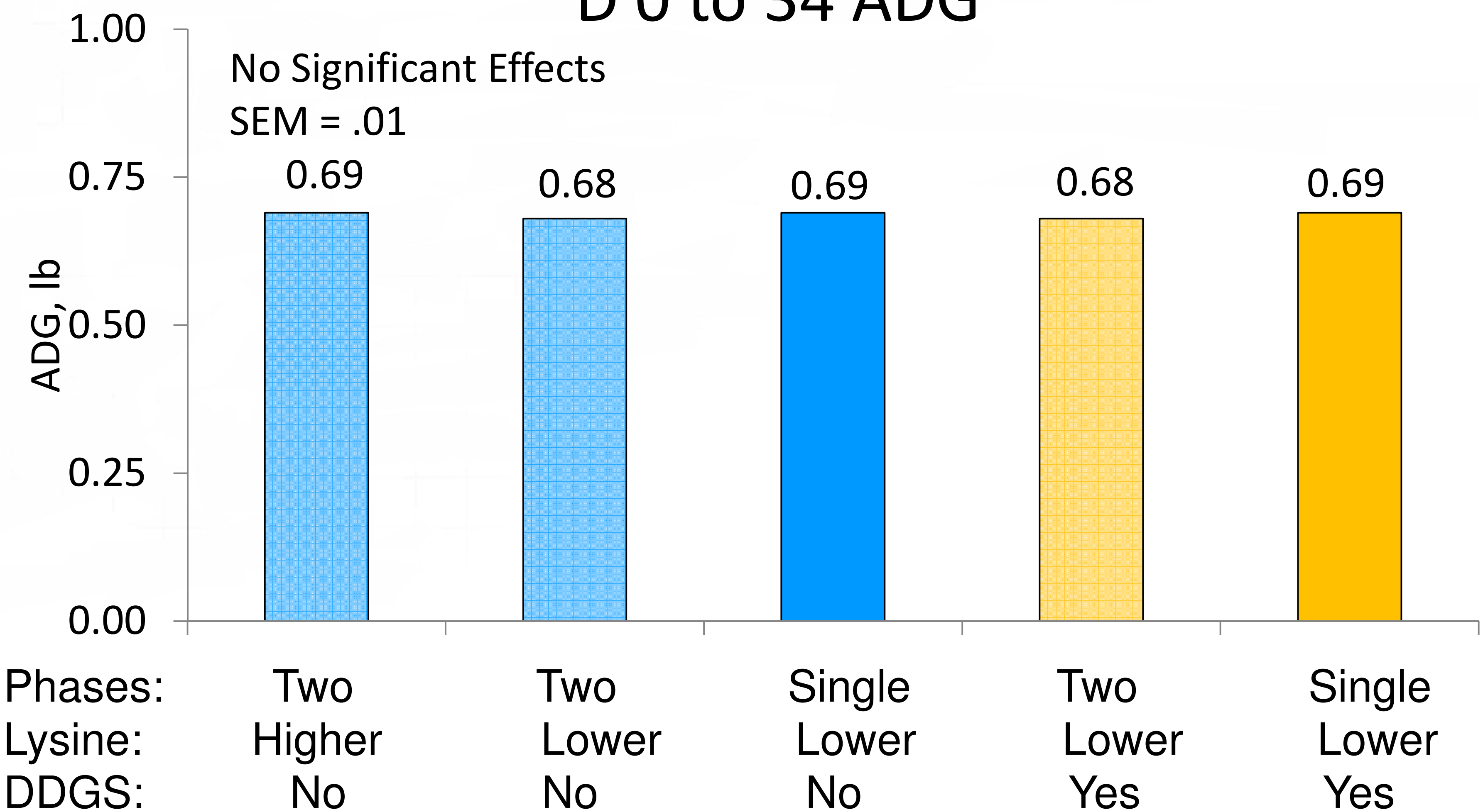
- Develop clear premix specifications
- Use reputable premix suppliers
- Verify premix production batch sheets
- Ensure product rotation
- Separate vitamin and trace mineral premix
- Verify premix additions
  - Inventory control
  - Eliminate hand adds
- Evaluate mixer efficiency
- Consider premix testing

Changes made to diets for pigs <15 lb

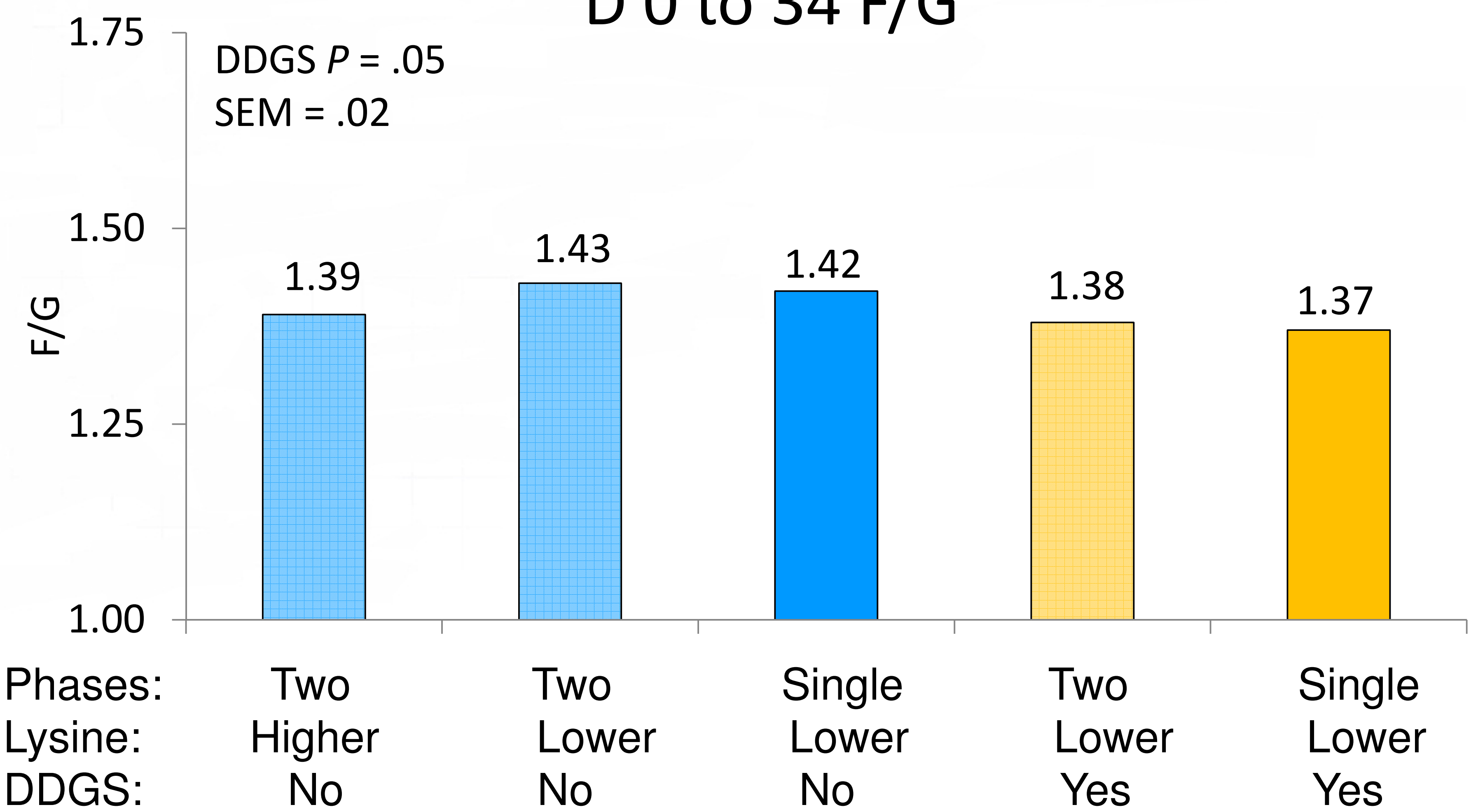
- Lower lysine levels
- Eliminate fishmeal / Add DDGS
- Single "Phase 1" Diet

- Available at www.KSUswine.org

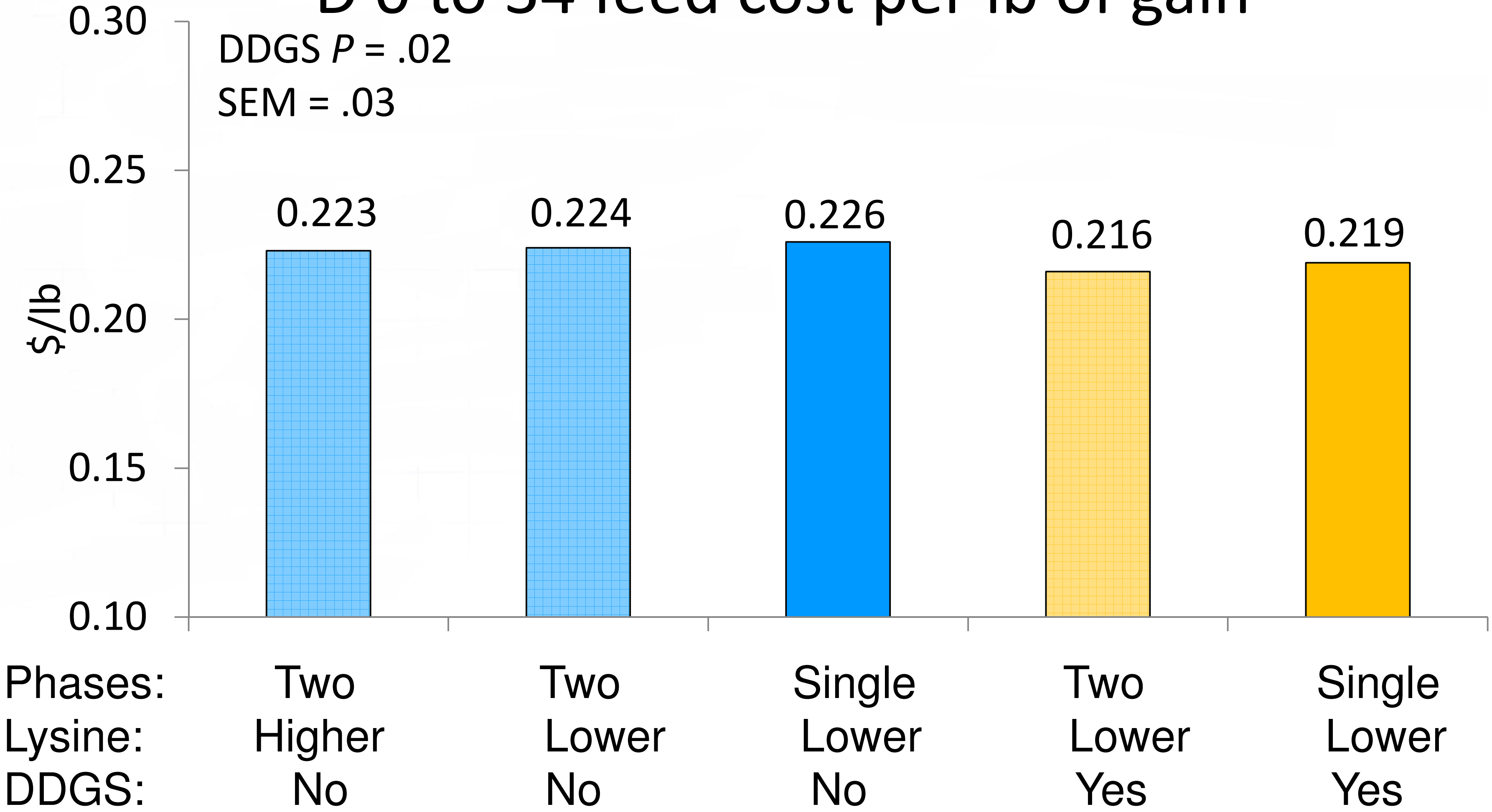
Field validation of diets for < 15 lb pigs
D 0 to 34 ADG



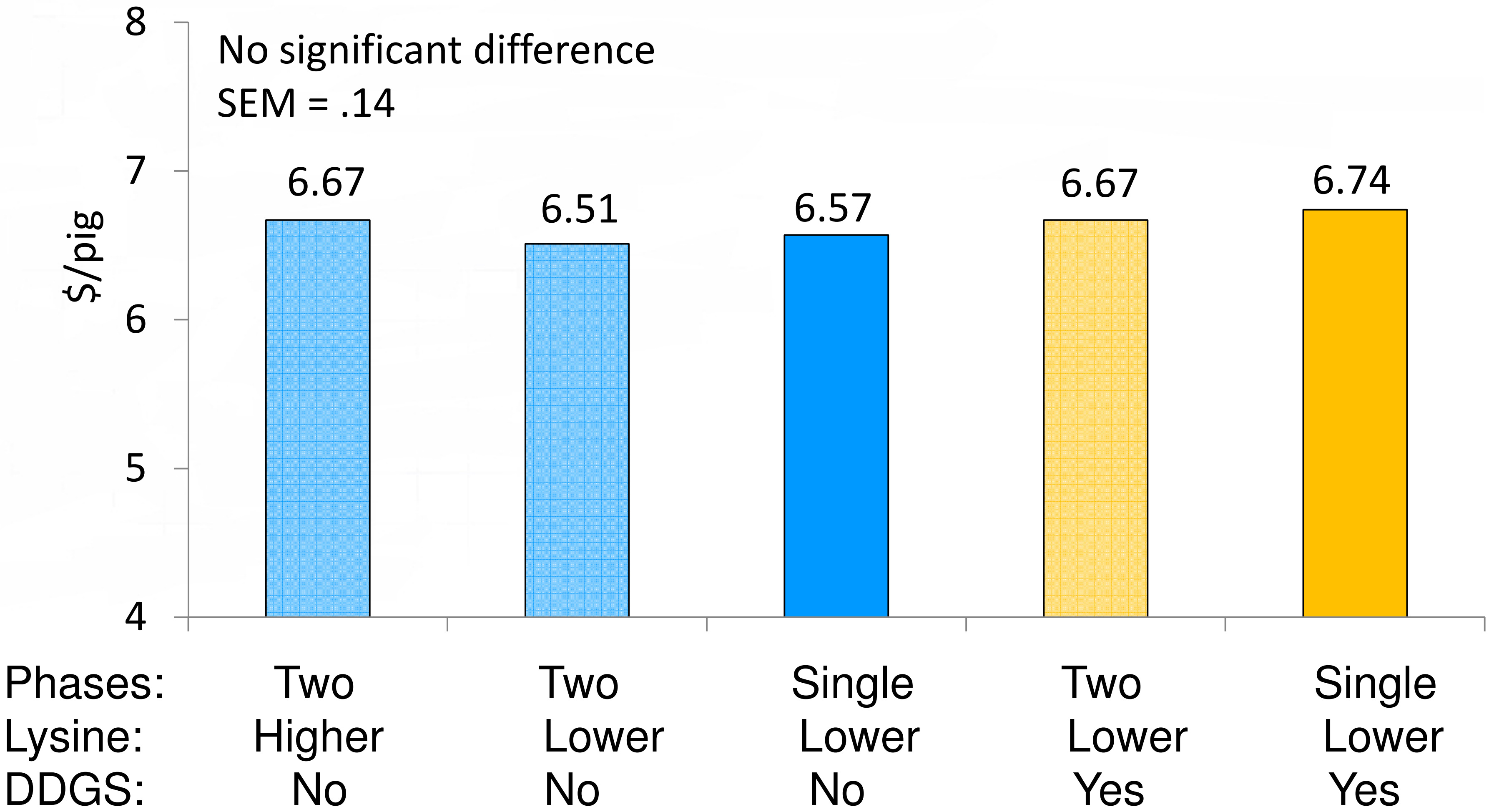
Field validation of diets for < 15 lb pigs
D 0 to 34 F/G



Field validation of diets for < 15 lb pigs
D 0 to 34 feed cost per lb of gain



Field validation of diets for < 15 lb pigs
D 0 to 34 income over feed cost

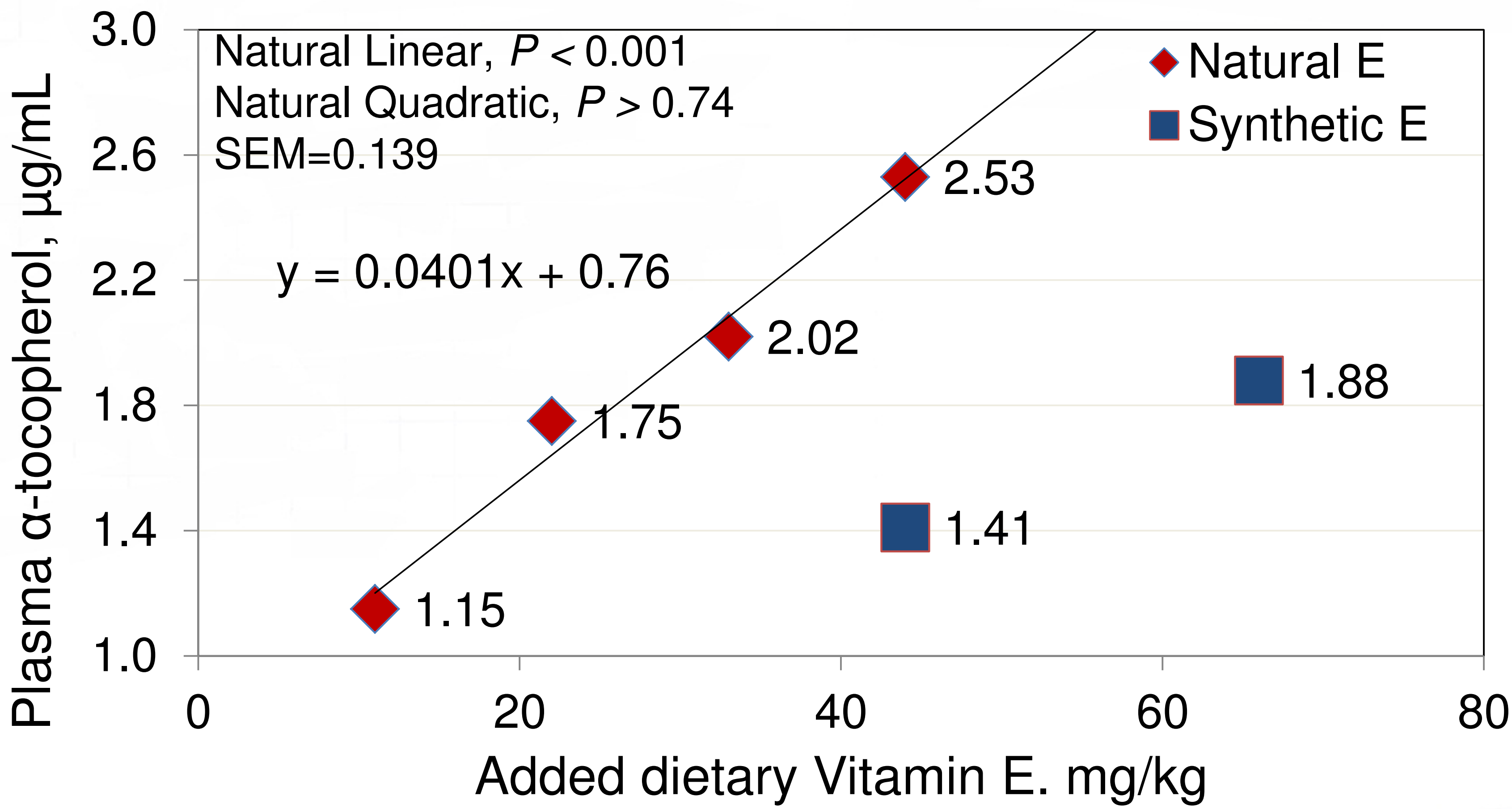


2012 KSU premix and base mix recommendations

- Changes:
  - Phytase specified in coated forms
  - At least 50% of vitamin D as A/D cross-linked beadlet
  - Natural vitamin E offered at 2:1 bioequivalency
  - Decreased iron levels
  - Decreased zinc levels
  - Decreased manganese levels

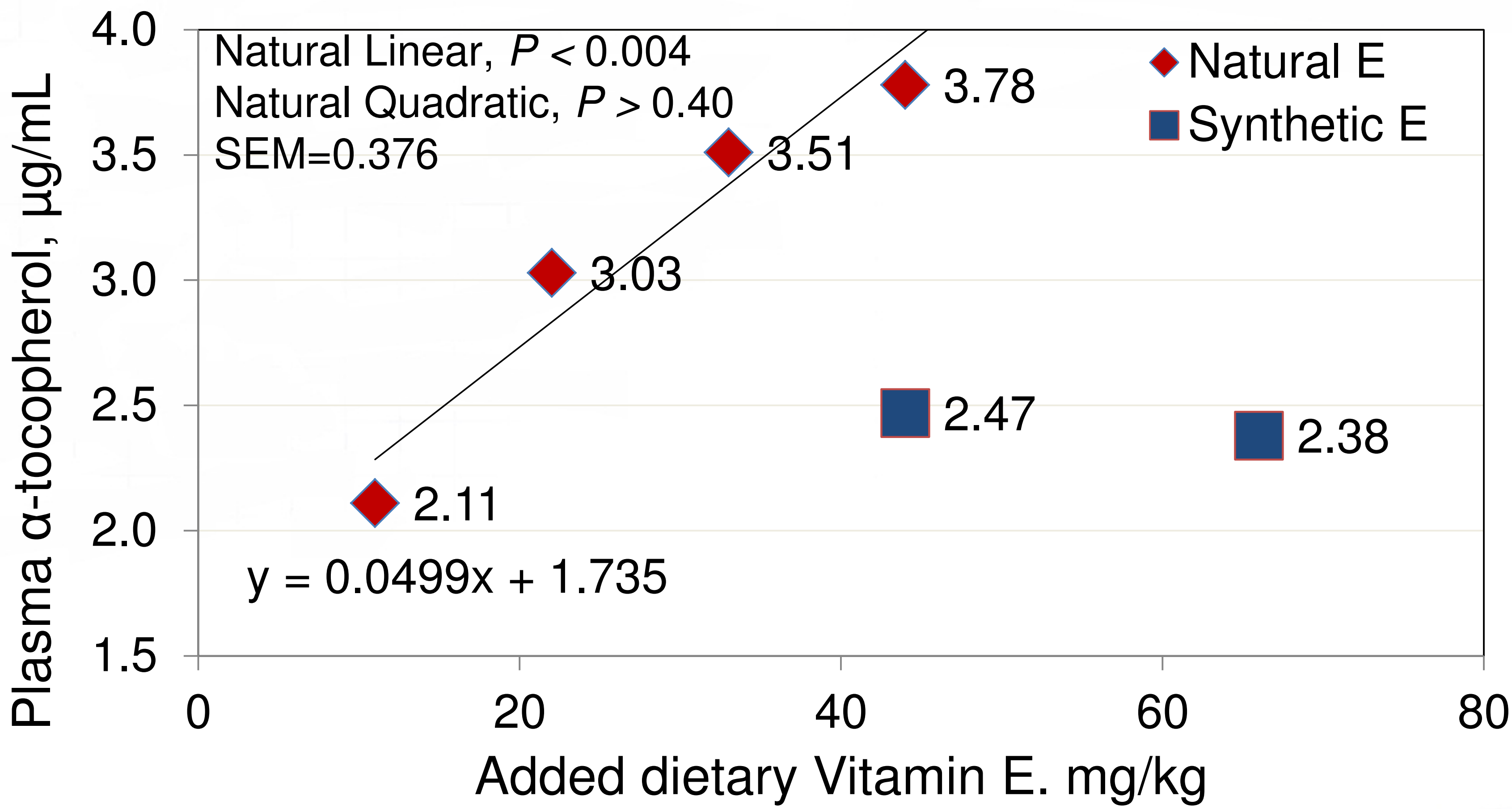
- Official change date of January 1, 2012

Influence of natural vitamin E on sow plasma α-tocopherol at weaning



Shelton et al., 2012

Influence of natural vitamin E on piglet plasma α-tocopherol at weaning



Shelton et al., 2012

K·STATE
Research and Extension

Knowledge for Life

Estimated relative bioavailability of natural vs synthetic vitamin E

Based on synthetic level:	44 mg/kg	66 mg/kg
Sow Plasma		
D 100	2.1	2.4
Farrowing	4.2	3.0
Weaning	2.7	2.4
Weaned Piglet		
Plasma	3.0	5.1
Heart	1.8	5.3
Liver	2.0	7.5
Sow Colostrum	3.0	2.9
Sow milk	1.6	7.3

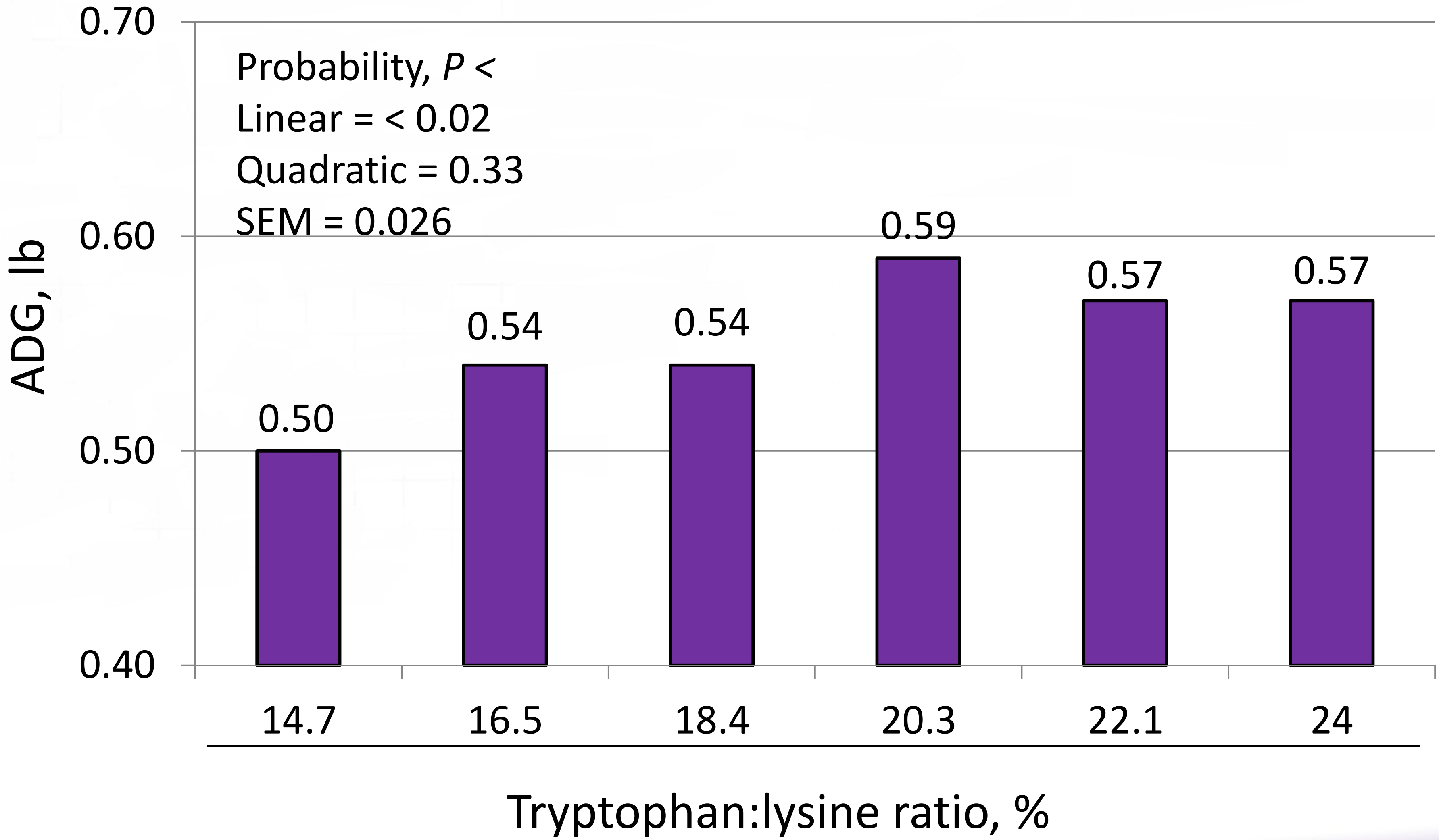
Varies depending on the response criteria but is greater than the standard value of 1.36 in sows.

Shelton et al., 2012

Amino acid requirement of nursery pigs

- Recent years:
  - Lysine levels
  - Ratios of other amino acids to lysine
    - Thr, Met&Cys, Iso, Val, CP:Lys
- 2011
  - Lysine source
  - Trp:Lys ratios (5 studies)

Effect of Trp:Lys ratio on ADG from 13 to 22 lb



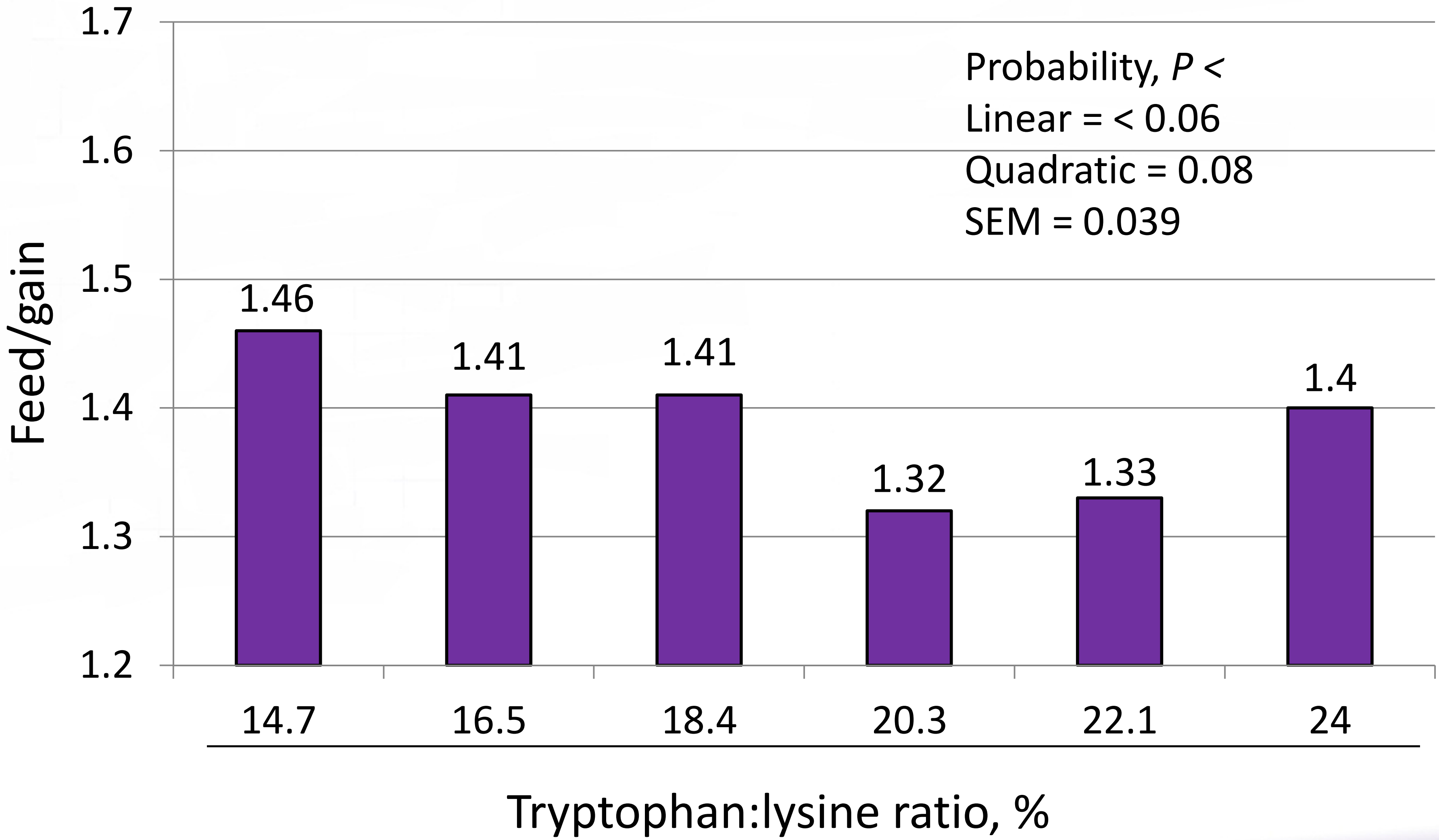
K·STATE Research and Extension

AJINOMOTO
AJINOMOTO HEARTLAND LLC
AJINOMOTO ANIMAL NUTRITION

Nitikanchana et al., 2011

Knowledge for Life

Effect of Trp:Lys ratio on F/G from 13 to 22 lb



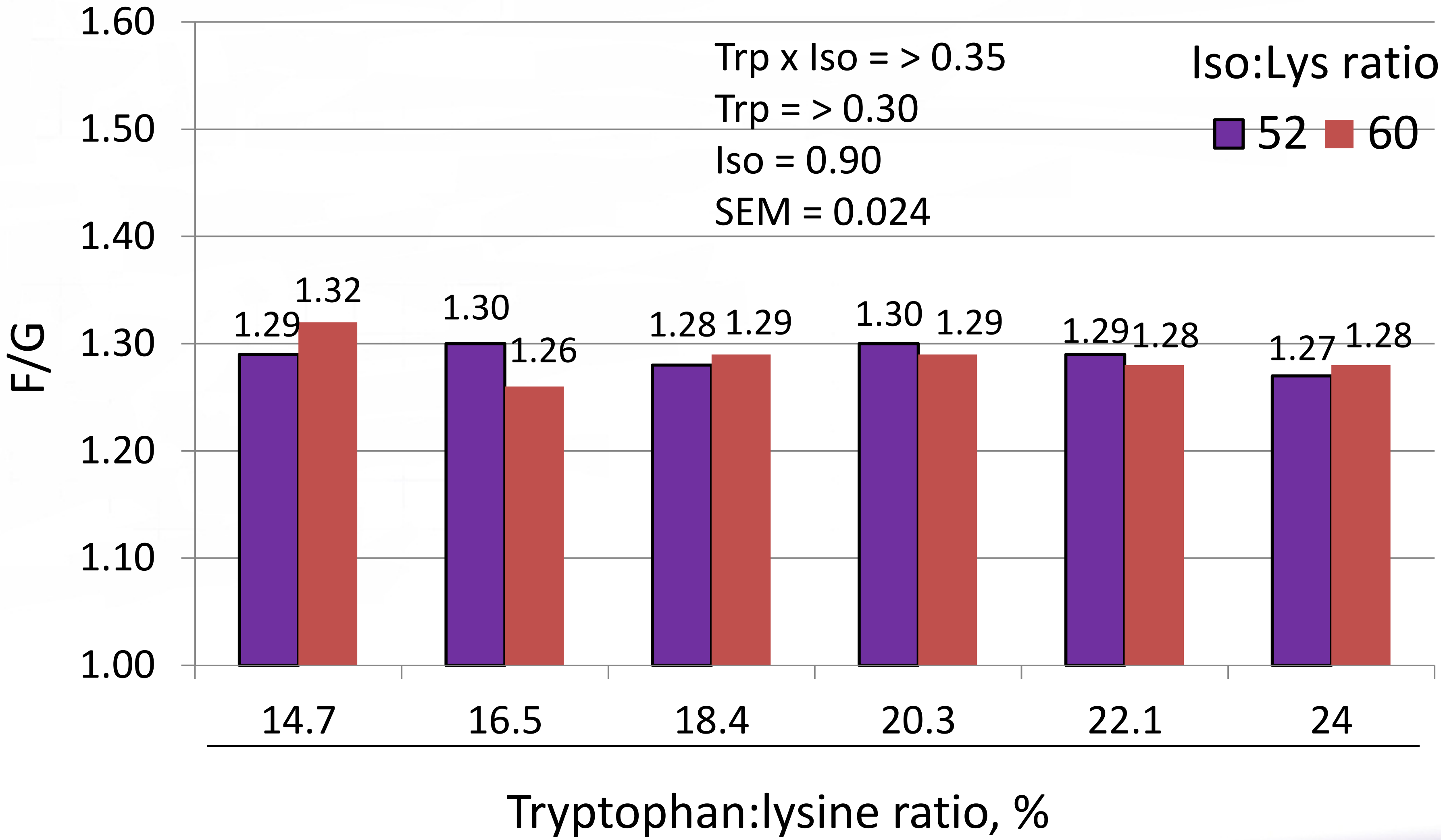
K·STATE Research and Extension

AJINOMOTO. AJINOMOTO HEARTLAND LLC AJINOMOTO ANIMAL NUTRITION

Nitikanchana et al., 2011

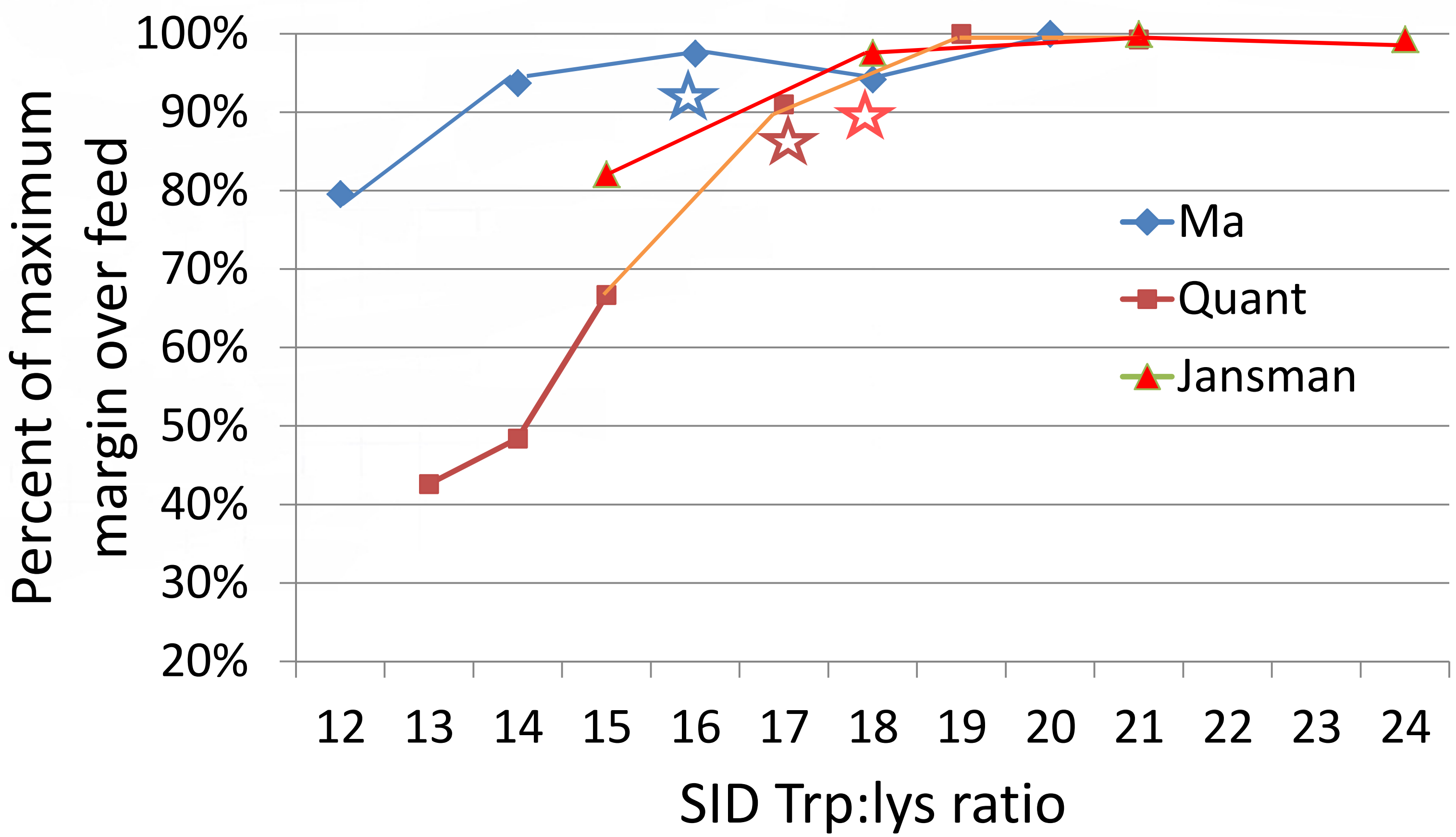
Knowledge for Life

Effect of Trp:Lys ratio on F/G from 13 to 24 lb

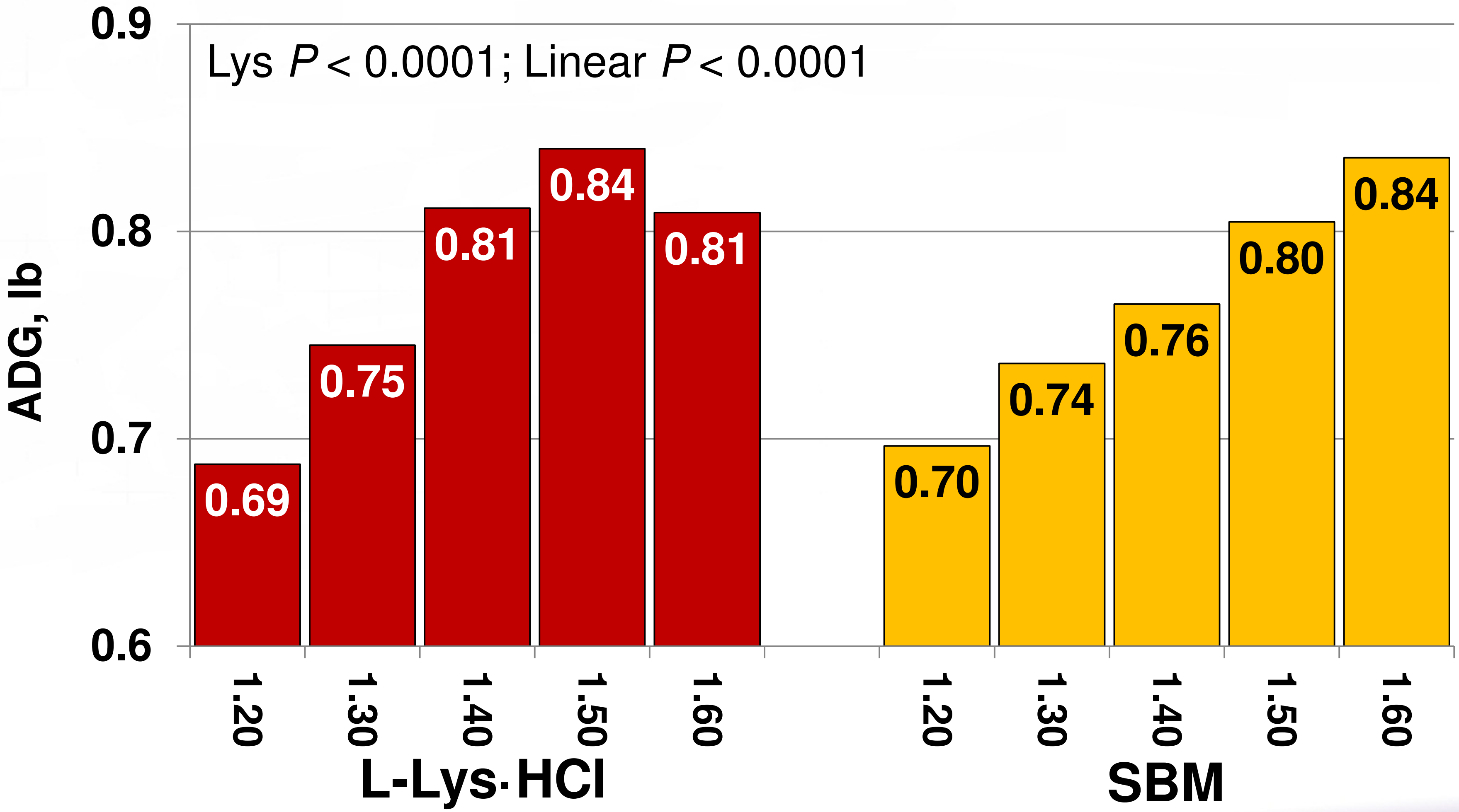


Nitikanchana et al., 2011

Influence of SID Trp:Lys ratio on margin over feed



Influence of amino acid source on lysine requirement



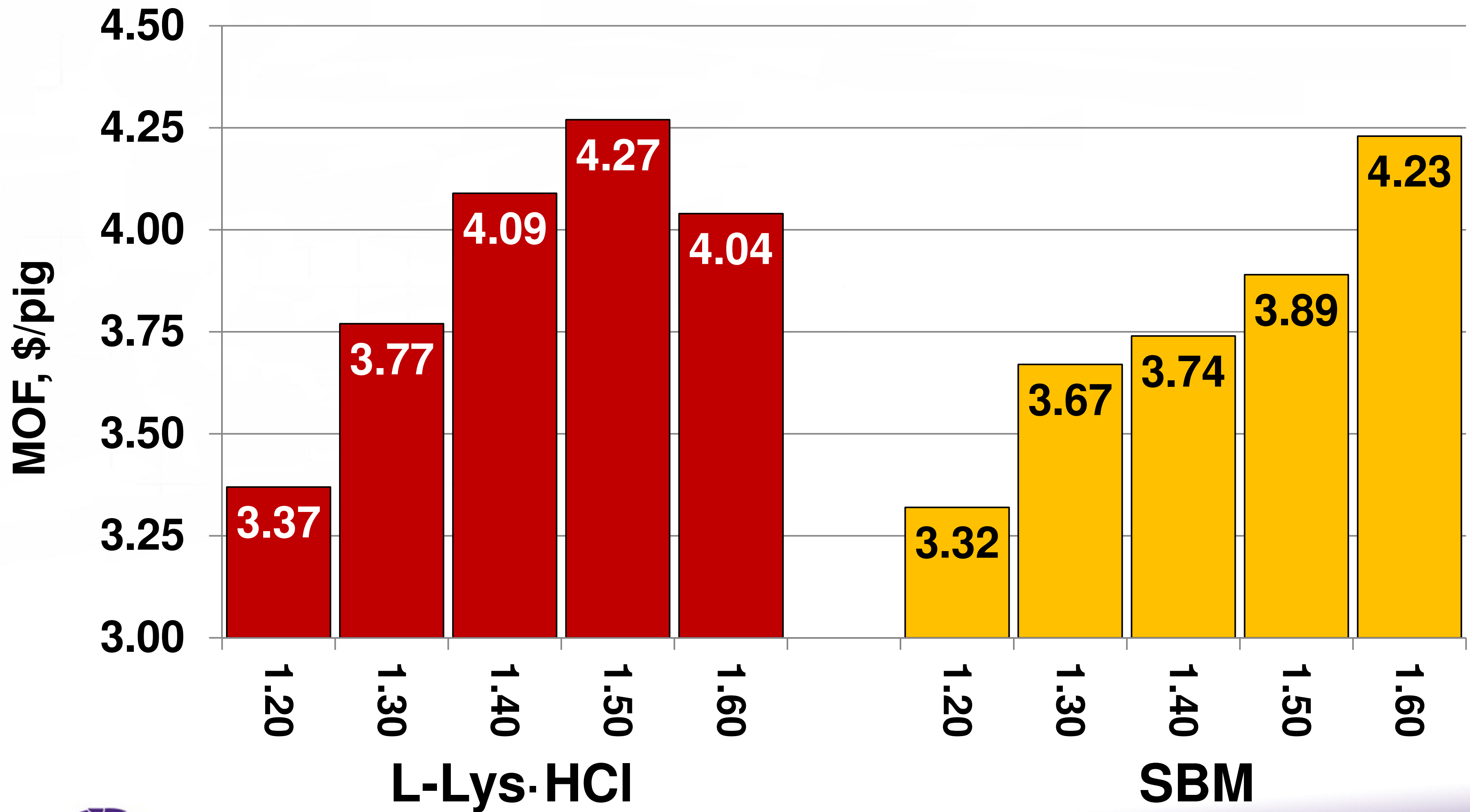
K·STATE Research and Extension

AJINOMOTO AJINOMOTO HEARTLAND LLC AJINOMOTO ANIMAL NUTRITION

Jones et al., 2011

Knowledge for Life

Influence of amino acid source on margin over feed

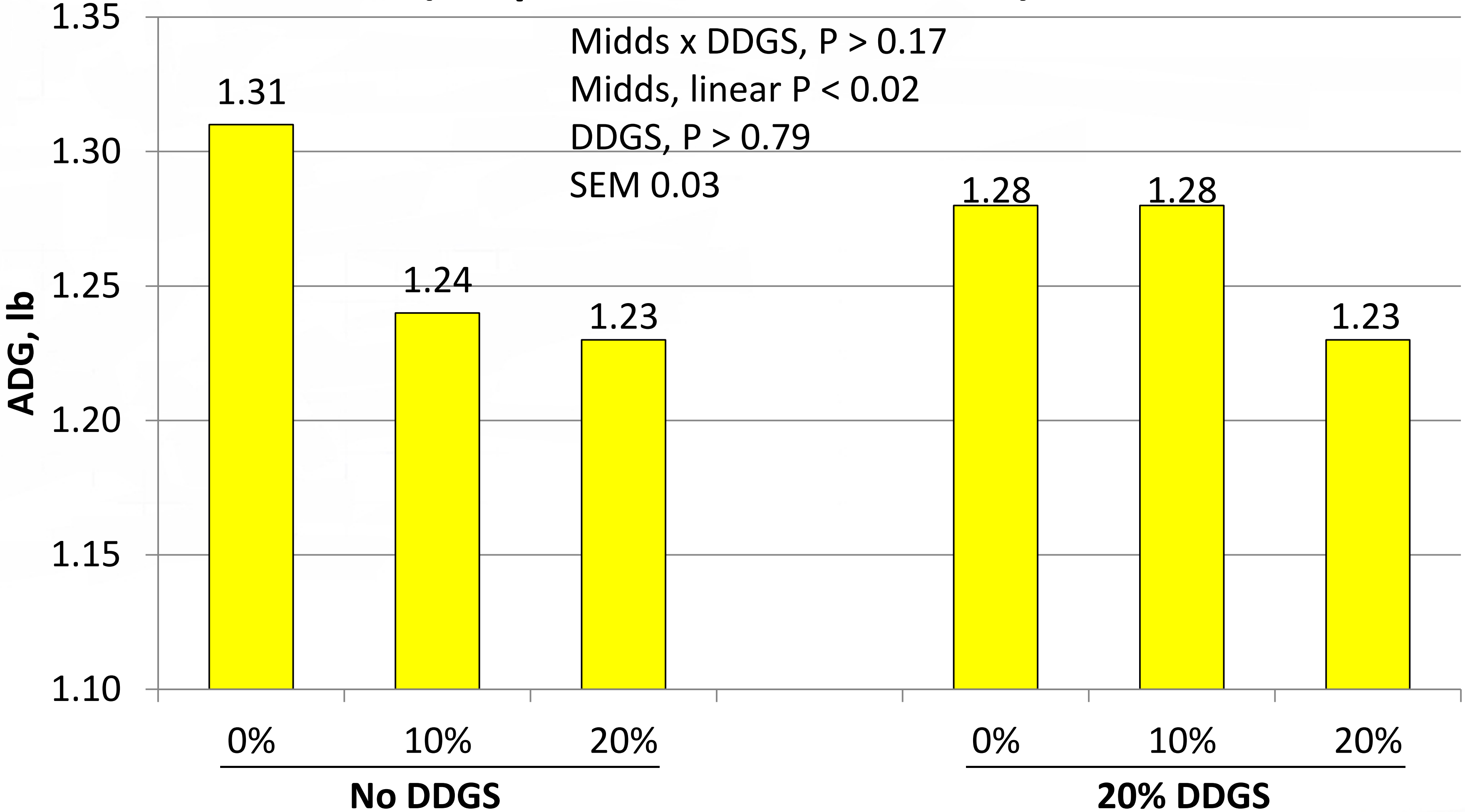


Jones et al., 2011

Wheat Middlings

- During the wheat milling process, about 70 to 75% of the grain becomes flour, leaving 25 to 30% as wheat byproducts, one of these byproducts is wheat middlings.
- Wheat midds can be valuable to swine diets because of their protein, phosphorus and moderate energy content.
  - 16% CP; 89% the ME value of corn;
- Typically, 100 lb of wheat midds will replace 86.5 lb of corn, 12 lb of high protein soybean meal, and 1.5 lb of monocalcium phosphate.
- This will decrease the energy content of the diet marginally by approximately 15 Kcal ME/ton (equivalent to 0.50% added fat).

Effect of wheat midds on nursery ADG (Exp. 2; 26 to 54 lb)

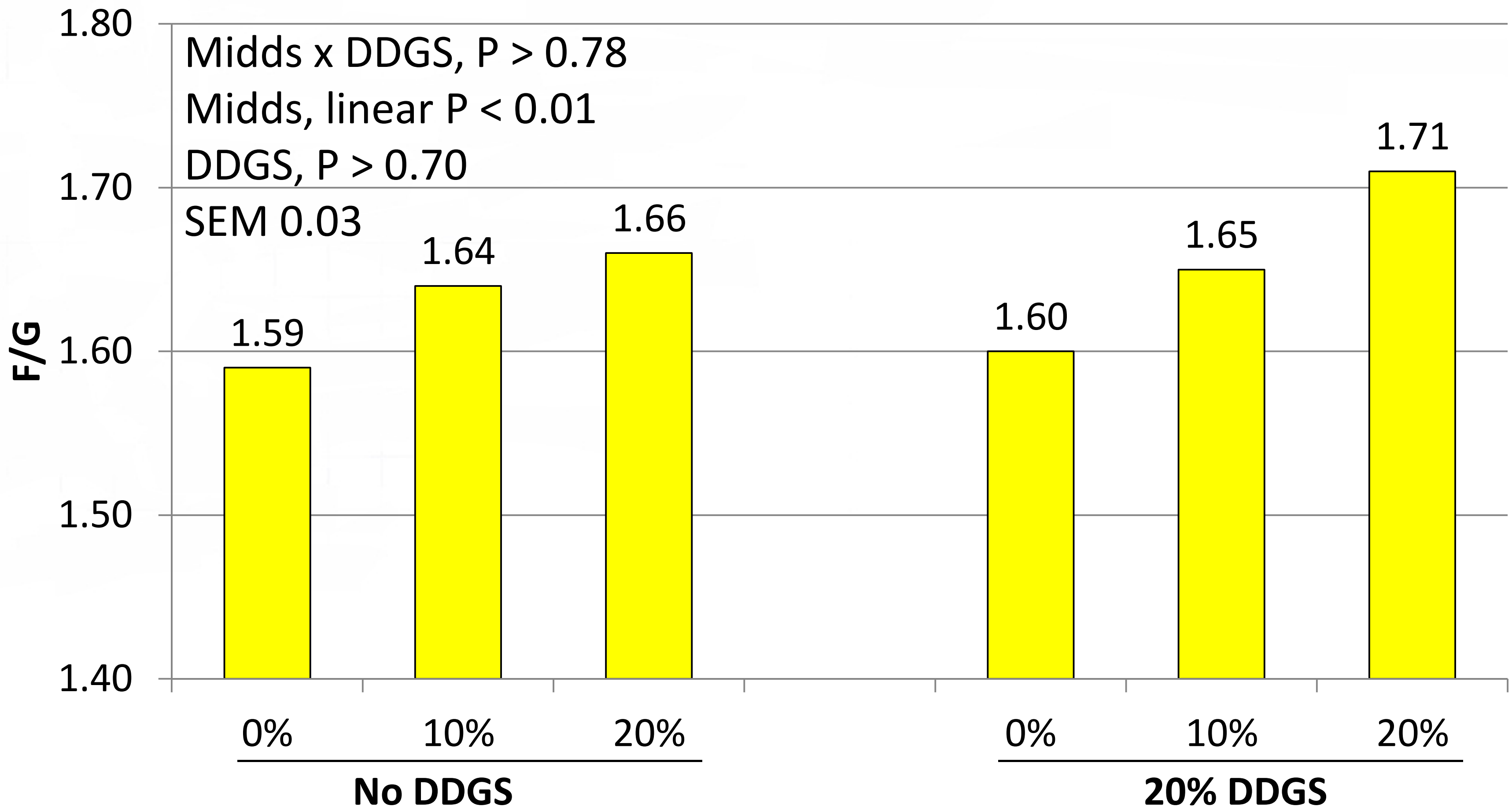


K·STATE Research and Extension

De Jong et al., 2011

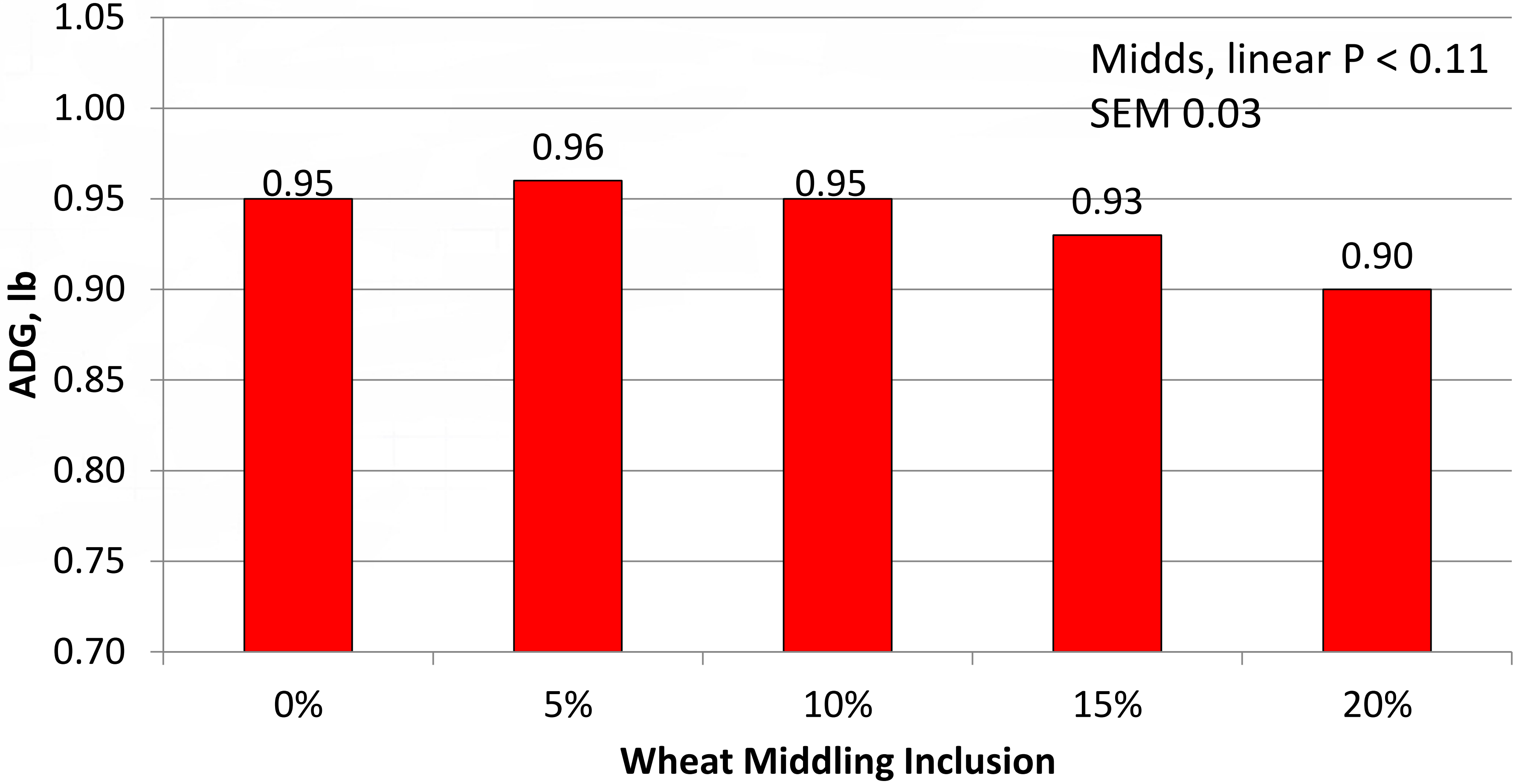
Knowledge for Life

Effect Wheat Midds on nursery F/G (Exp. 2; 26 to 54 lb)



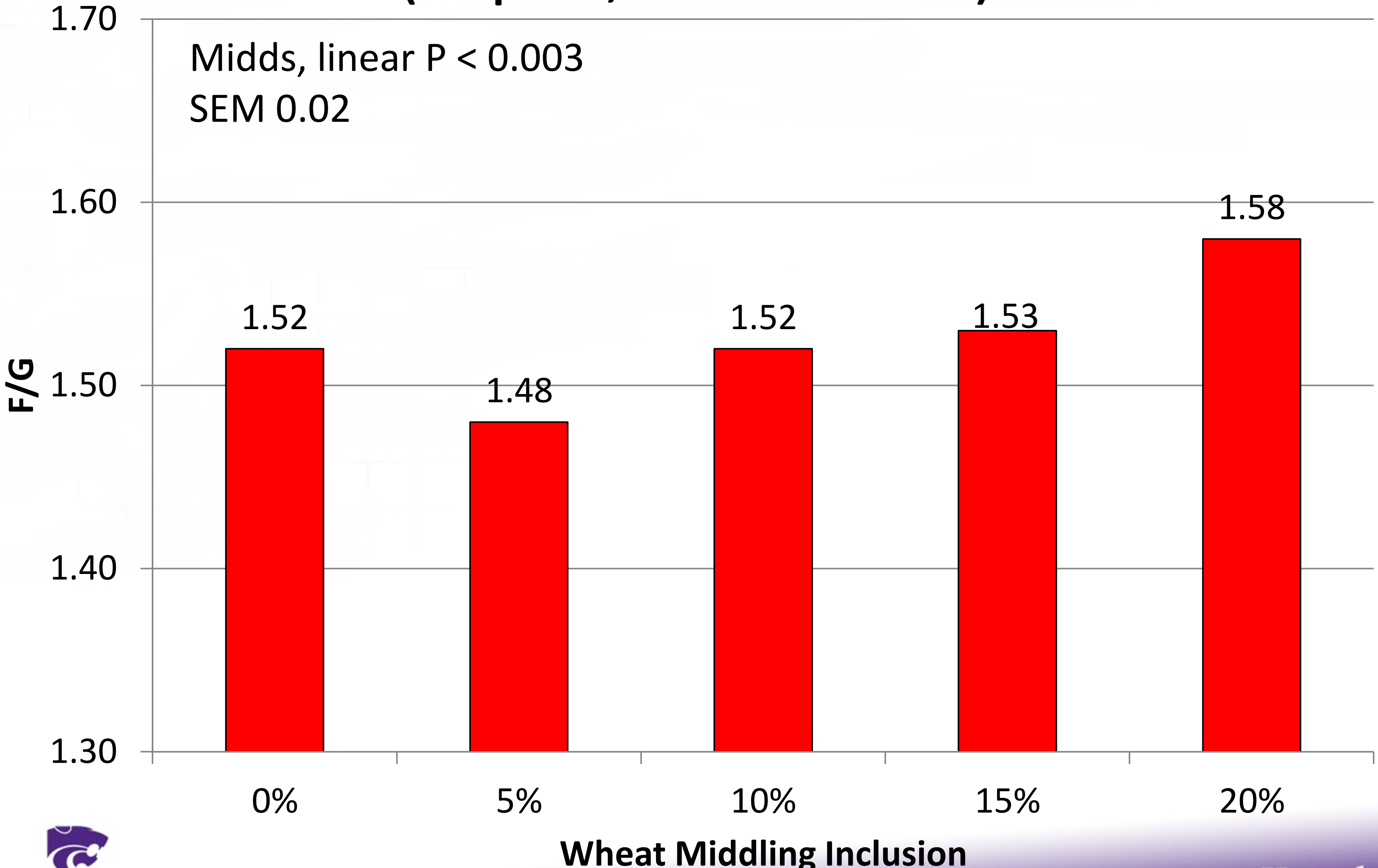
De Jong et al., 2011

Effect of wheat midds on nursery ADG (Exp. 3; 15 to 48 lb)



De Jong et al., 2011

Effect of wheat midds on nursery F/G (Exp. 3; 15 to 48 lb)



De Jong et al., 2011

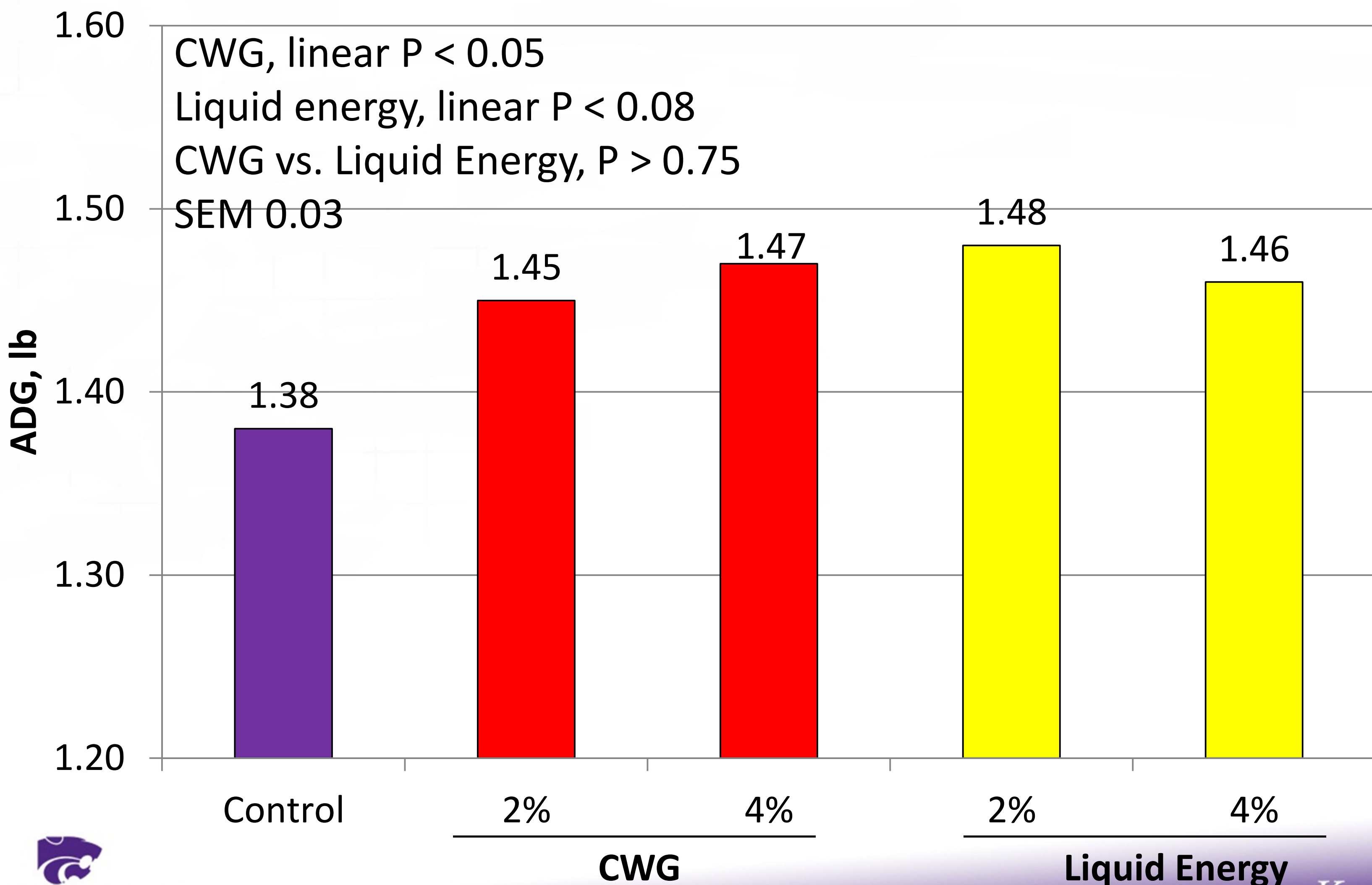
K·STATE Research and Extension

Knowledge for Life

Wheat Midds and Nursery Diet Summary

- Feeding increasing midds to 12-50 lb pigs consistently lowered ADG which was driven by either reduced ADFI and higher F/G
- Effects were minimal until over 10% midds were added to the diet.
- Evaluating wheat middlings economics on an IOFC basis is important when valuing in rations for nursery and finishing pigs

Effect Of XFE Liquid Energy and Choice White Grease on Nursery ADG (Exp. 1; 27 to 57 lb)

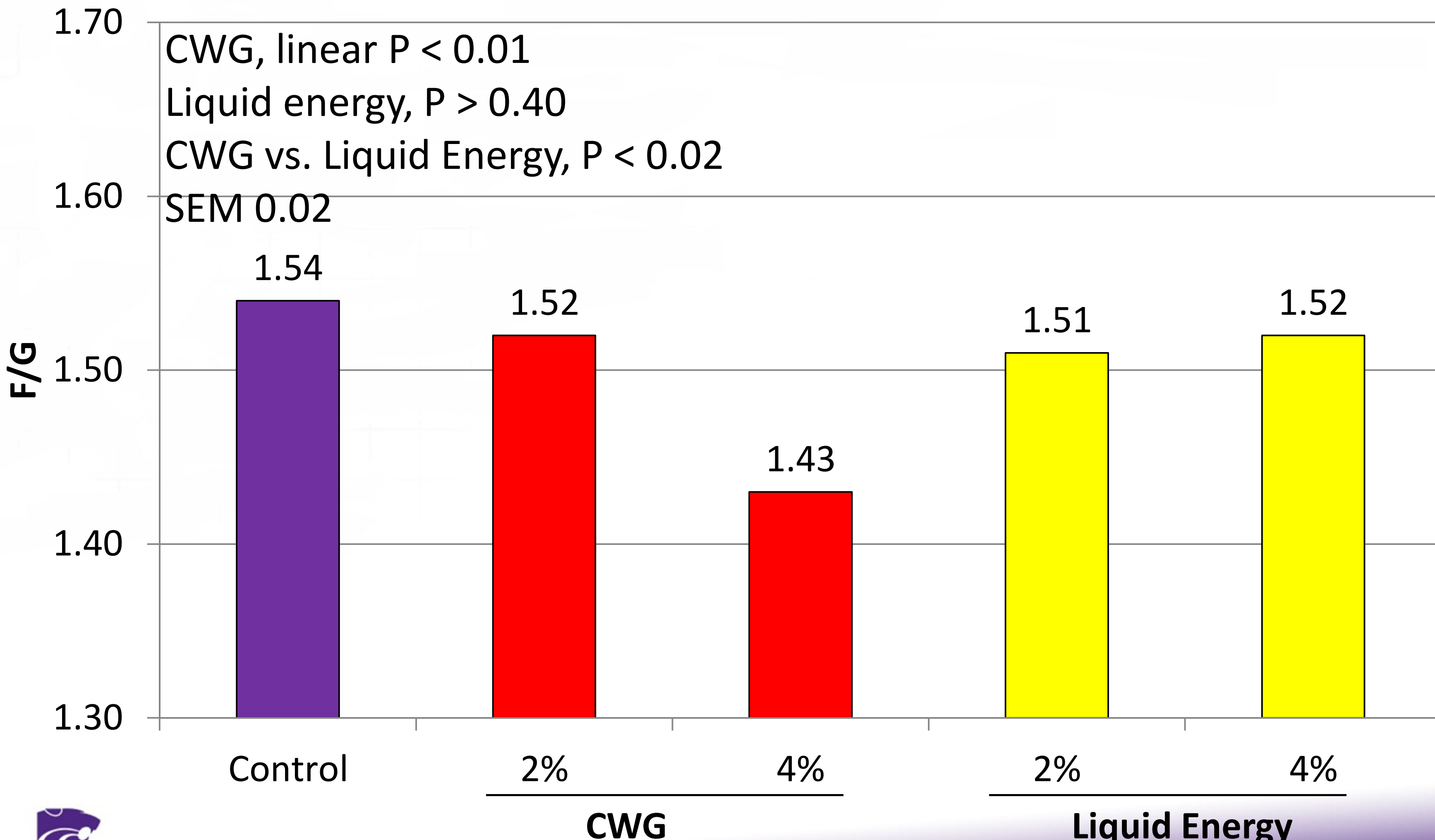


Ying et al., 2011

K·STATE Research and Extension

Knowledge for Life

Effect of XFE Liquid Energy and Choice White Grease on Nursery F/G (Exp. 1; 27 to 57 lb)

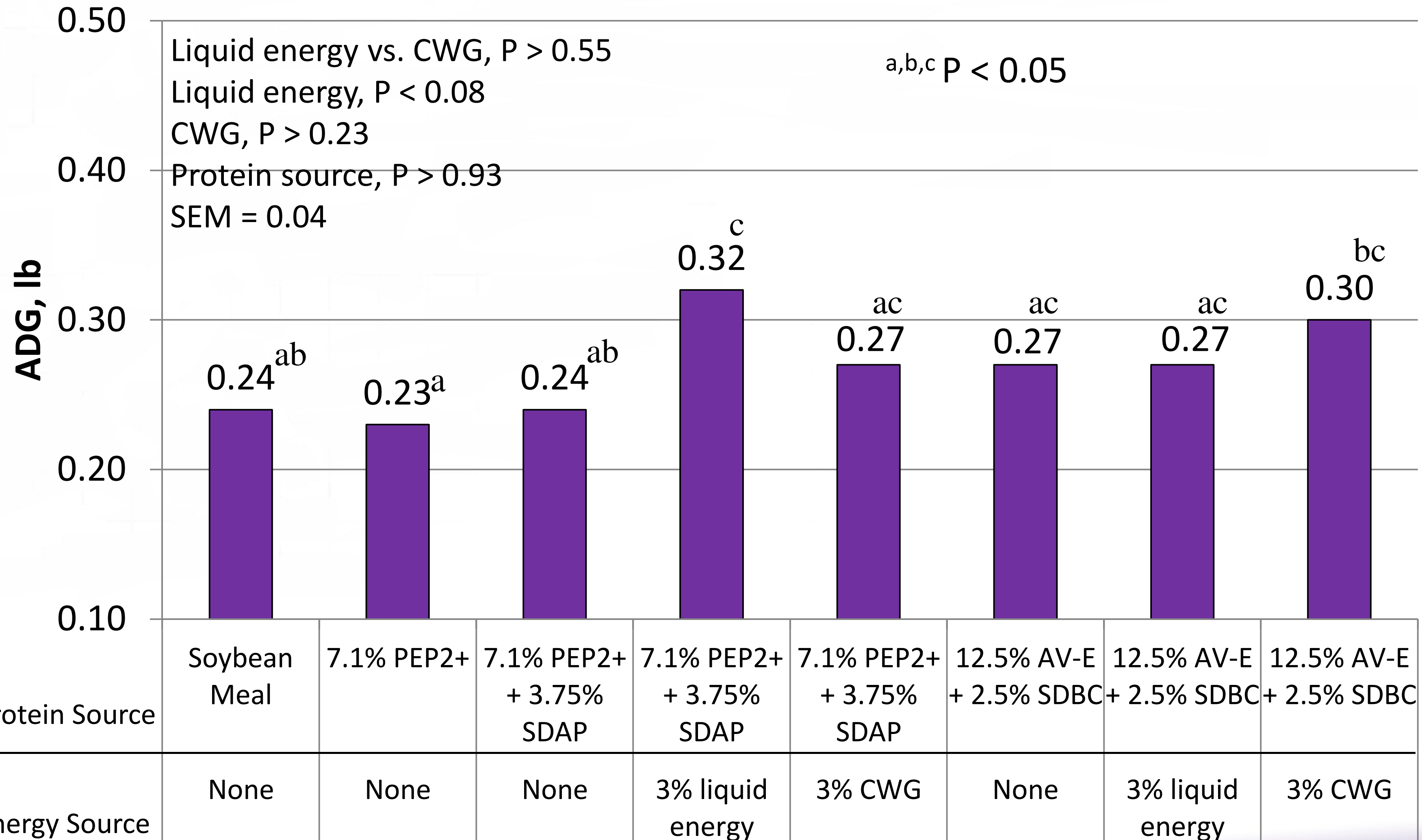


Ying et al., 2011

K·STATE Research and Extension

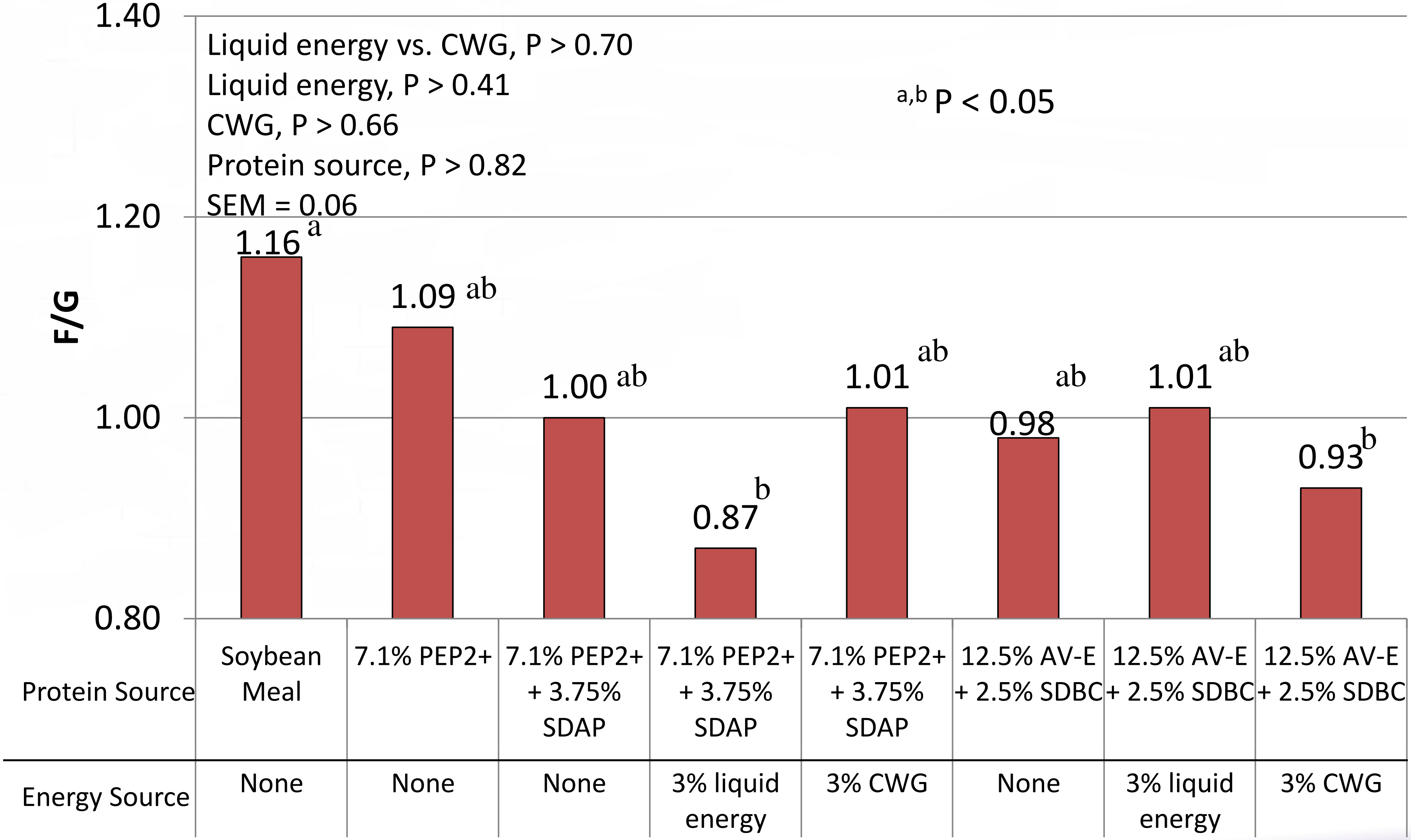
Knowledge for Life

Effect of AV-E Digest and XFE Liquid Energy on Nursery ADG
(Exp. 3; Day 0 to 9)



Ying et al., 2012

Effect of AV-E Digest and XFE Liquid Energy on Nursery F/G
(Exp. 3; Day 0 to 9)

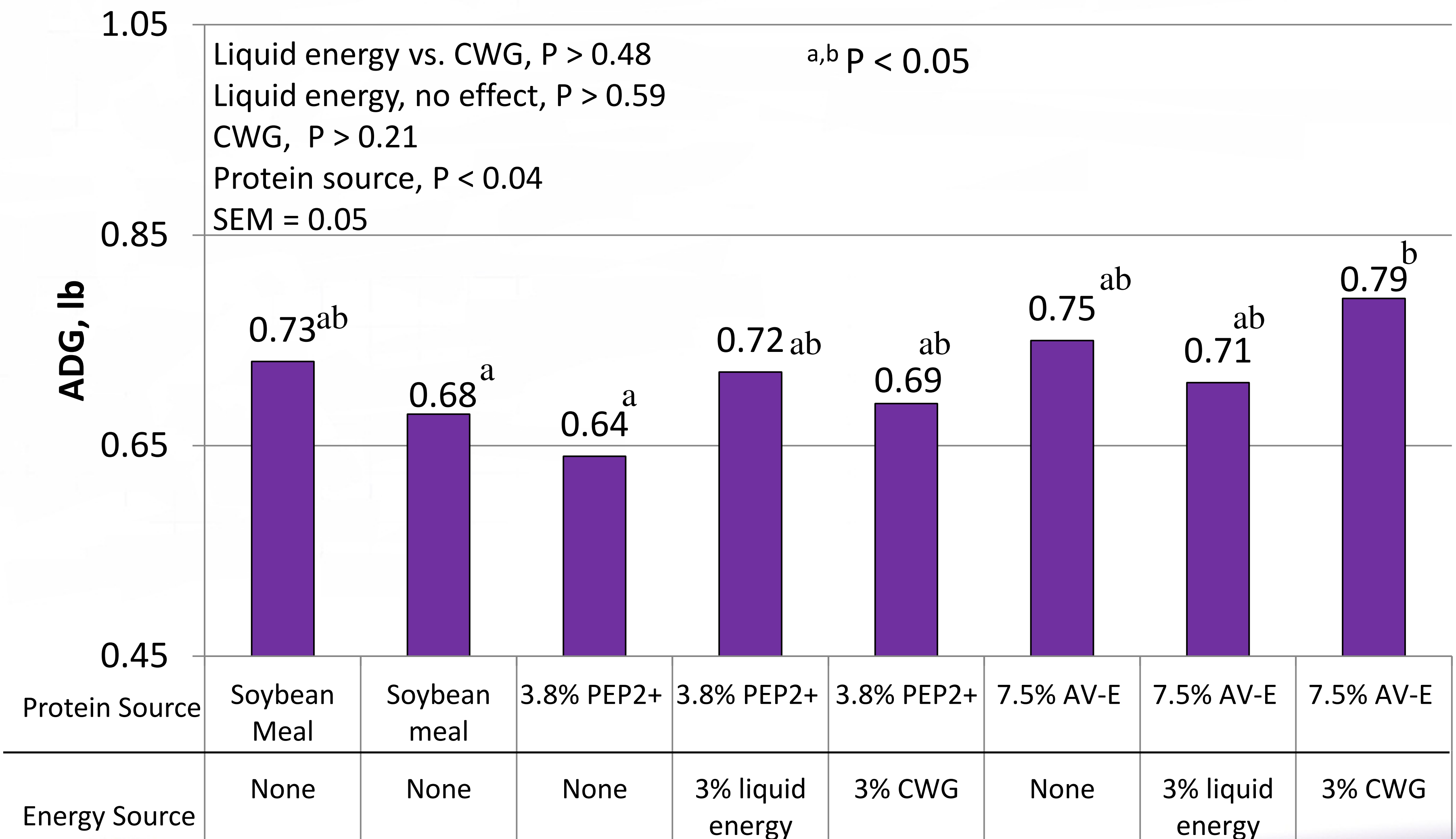


K·STATE Research and Extension

Ying et al., 2012

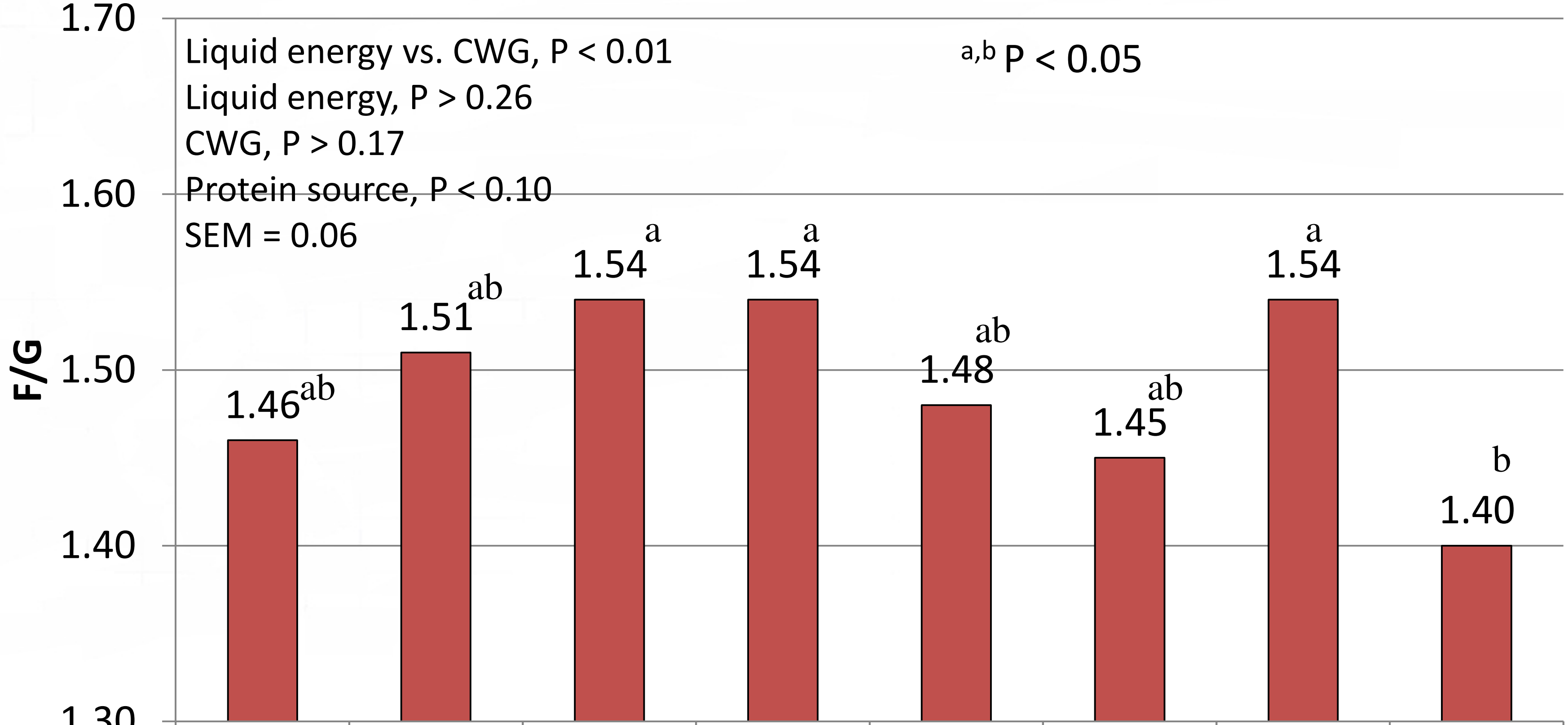
Knowledge for Life

Effect of AV-E Digest and XFE Liquid Energy on Nursery ADG
(Exp. 3; Day 9 to 23)



Ying et al., 2012

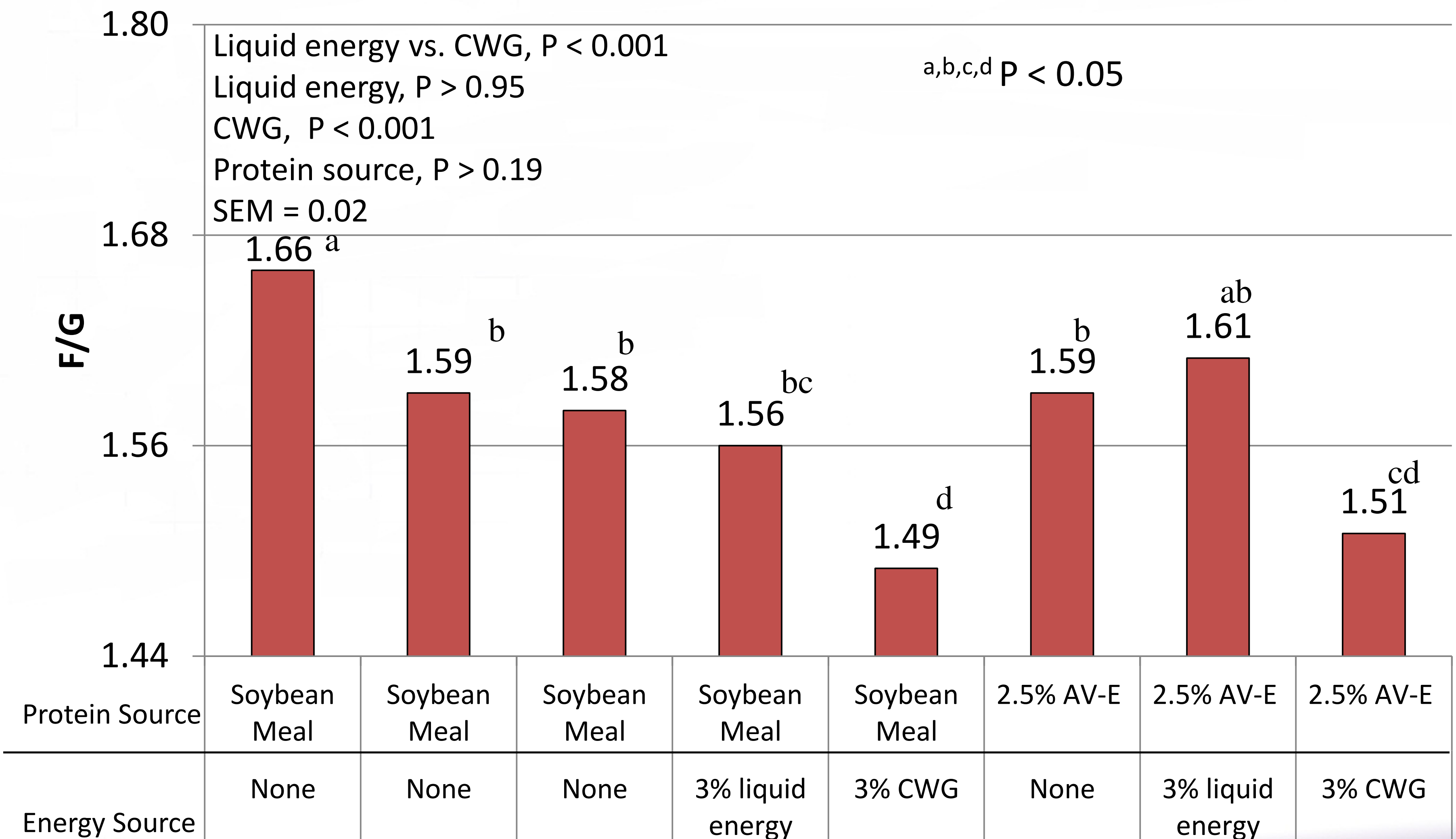
Effect of AV-E Digest and XFE Liquid Energy on Nursery G/F
(Exp. 3; Day 9 to 23)



Protein Source	Soybean Meal	Soybean meal	3.8% PEP2+	3.8% PEP2+	3.8% PEP2+	7.5% AV-E	7.5% AV-E	7.5% AV-E
Energy Source	None	None	None	3% liquid energy	3% CWG	None	3% liquid energy	3% CWG

Ying et al., 2012

Effect of AV-E Digest and XFE Liquid Energy on Nursery Pig Performance (Exp. 3; Day 23 to 44)

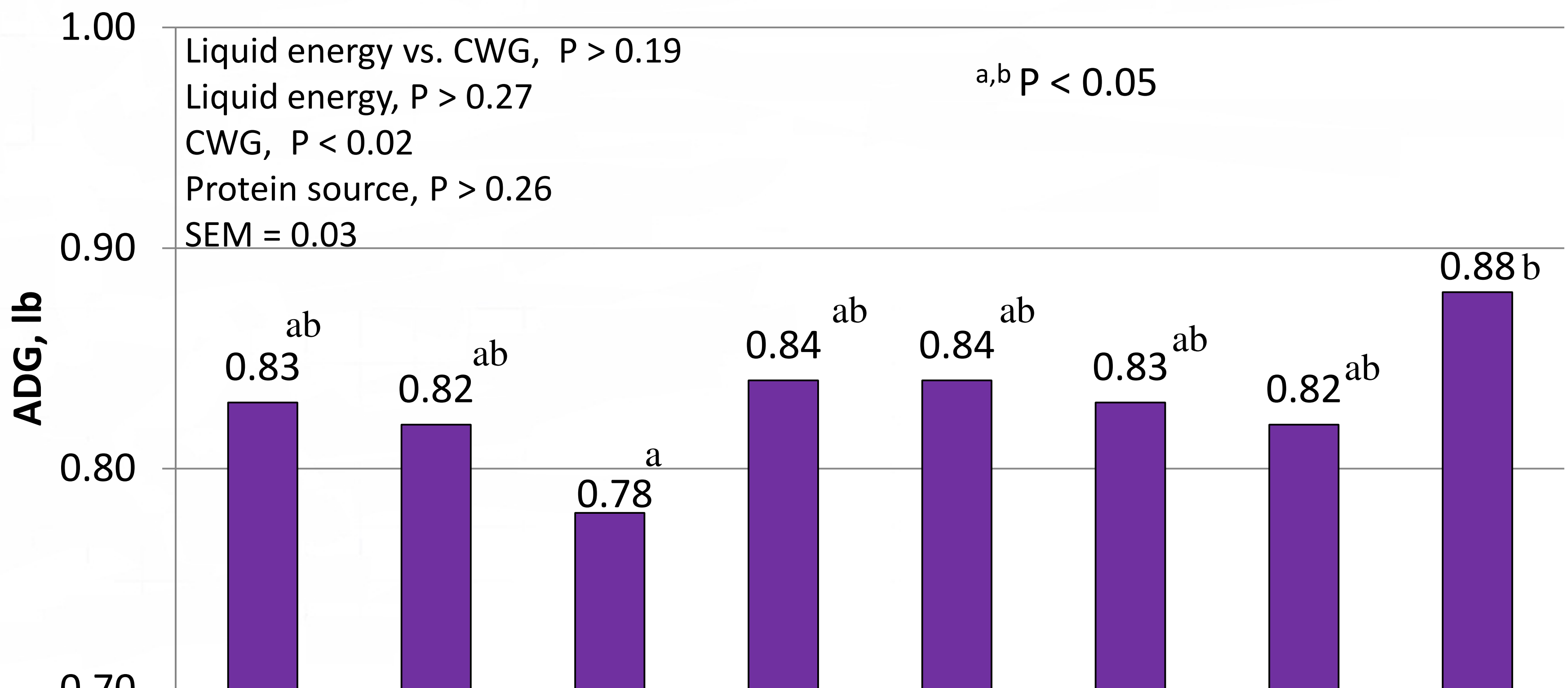


Ying et al., 2012

K·STATE Research and Extension

Knowledge for Life

Effect of AV-E Digest and XFE Liquid Energy on Nursery Pig Performance (Exp. 3; Day 0 to 44)



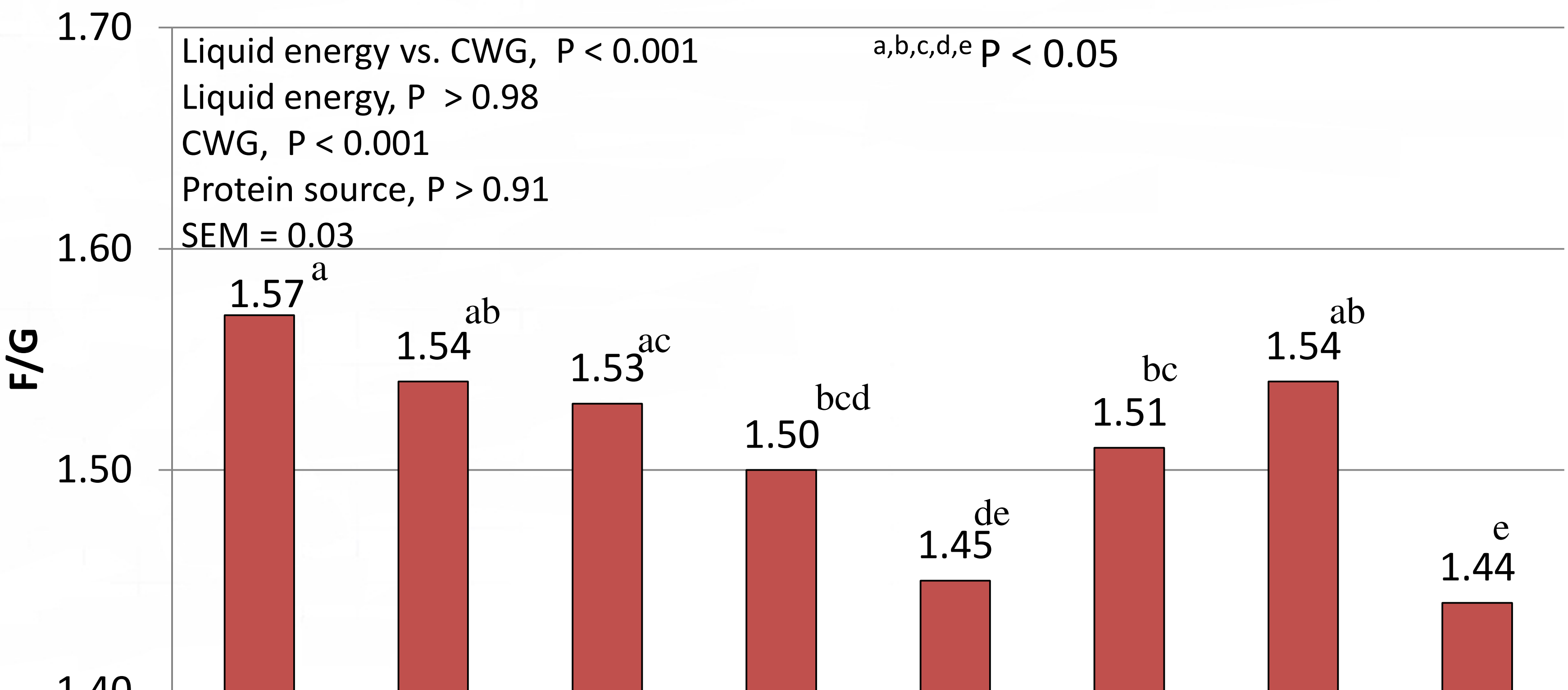
Protein Source	SBM SBM SBM	PEP2+ SBM SBM	PEP2+ SDAP PEP2+ SBM	PEP2+ SDAP PEP2+ SBM	PEP2+ SDAP PEP2+ SBM	AV-E + SDBC AV-E AV-E	AV-E + SDBC AV-E AV-E	AV-E + SDBC AV-E AV-E
Energy Source	None	None	None	3% liquid energy	3% CWG	None	3% liquid energy	3% CWG

K·STATE Research and Extension

Ying et al., 2012

Knowledge for Life

Effect of AV-E Digest and XFE Liquid Energy on Nursery Pig Performance (Exp. 3; Day 0 to 44)



Protein Source	SBM SBM SBM	PEP2+ SBM SBM	PEP2+ SDAP PEP2+ SBM	PEP2+ SDAP PEP2+ SBM	PEP2+ SDAP PEP2+ SBM	AV-E + SDBC AV-E AV-E	AV-E + SDBC AV-E AV-E	AV-E + SDBC AV-E AV-E
Energy Source	None	None	None	3% liquid energy	3% CWG	None	3% liquid energy	3% CWG

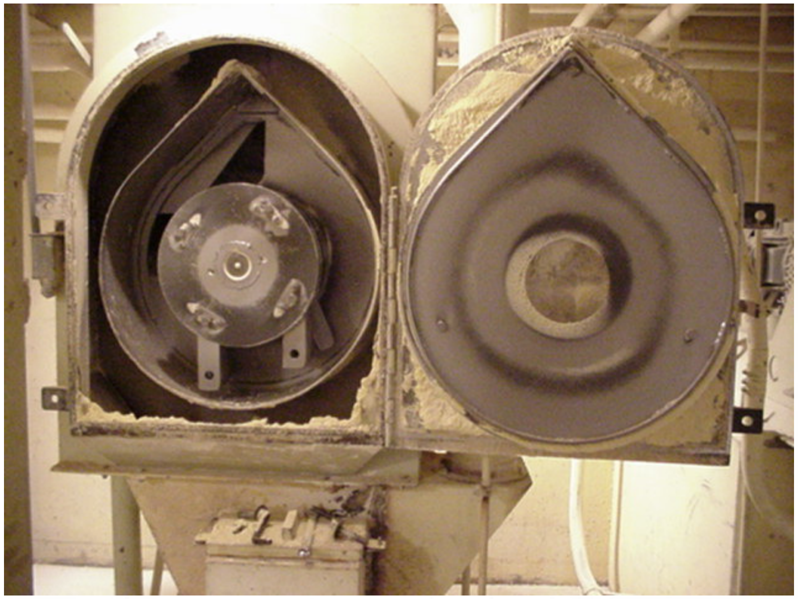
K·STATE Research and Extension

Ying et al., 2012

Knowledge for Life

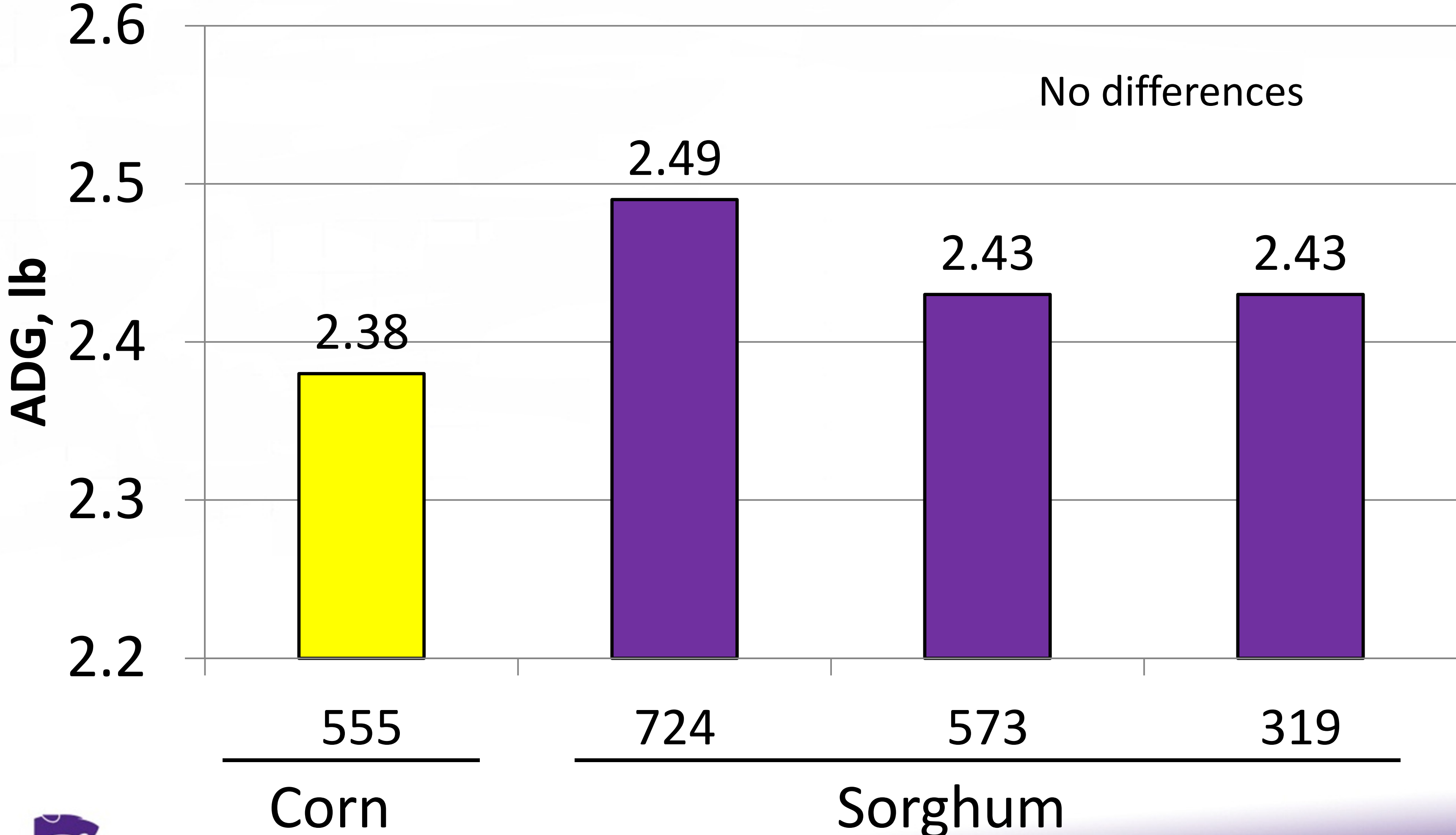
Liquid Energy and AV-E Digest Summary

- Liquid Energy:
  - No F/G response
  - Mixed ADG response
  - While the actual energy value is unknown, it cannot directly substitute added fat and maintain similar performance.
- AV-E Digest:
  - Can be used as a replacement for other animal specialty proteins sources in Phase 2 (15-25 lb) nursery diets.
  - More research is needed validating AV-E as a SDAP replacement in Phase 1 diets due to the lack of growth response for pigs fed diets with plasma over the negative control.



Update on Feed Processing Research

Effects of sorghum particle size in finishing pig diets

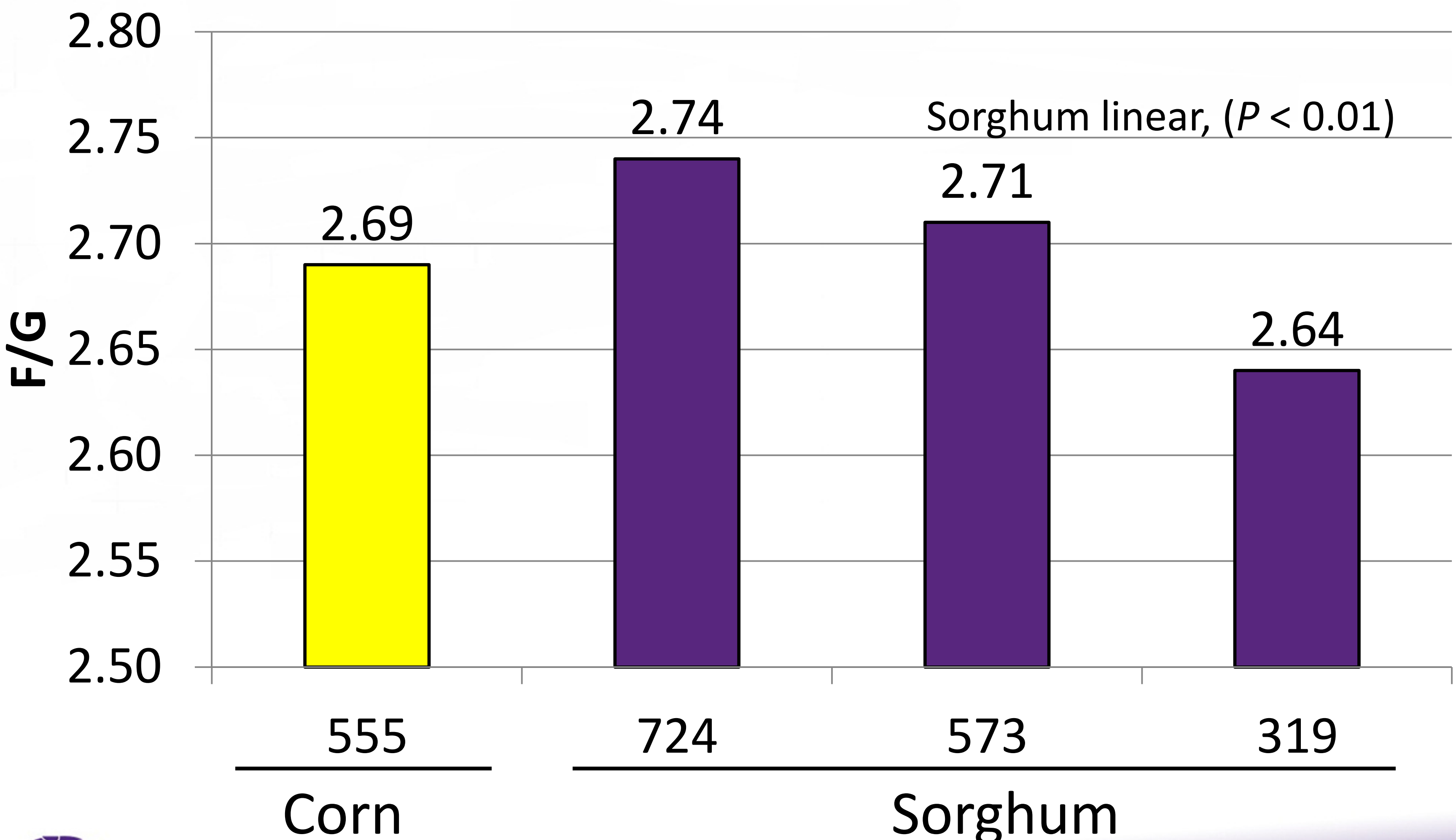


Paulk et al., 2011

K·STATE Research and Extension

Knowledge for Life

Effects of sorghum particle size in finishing pig diets

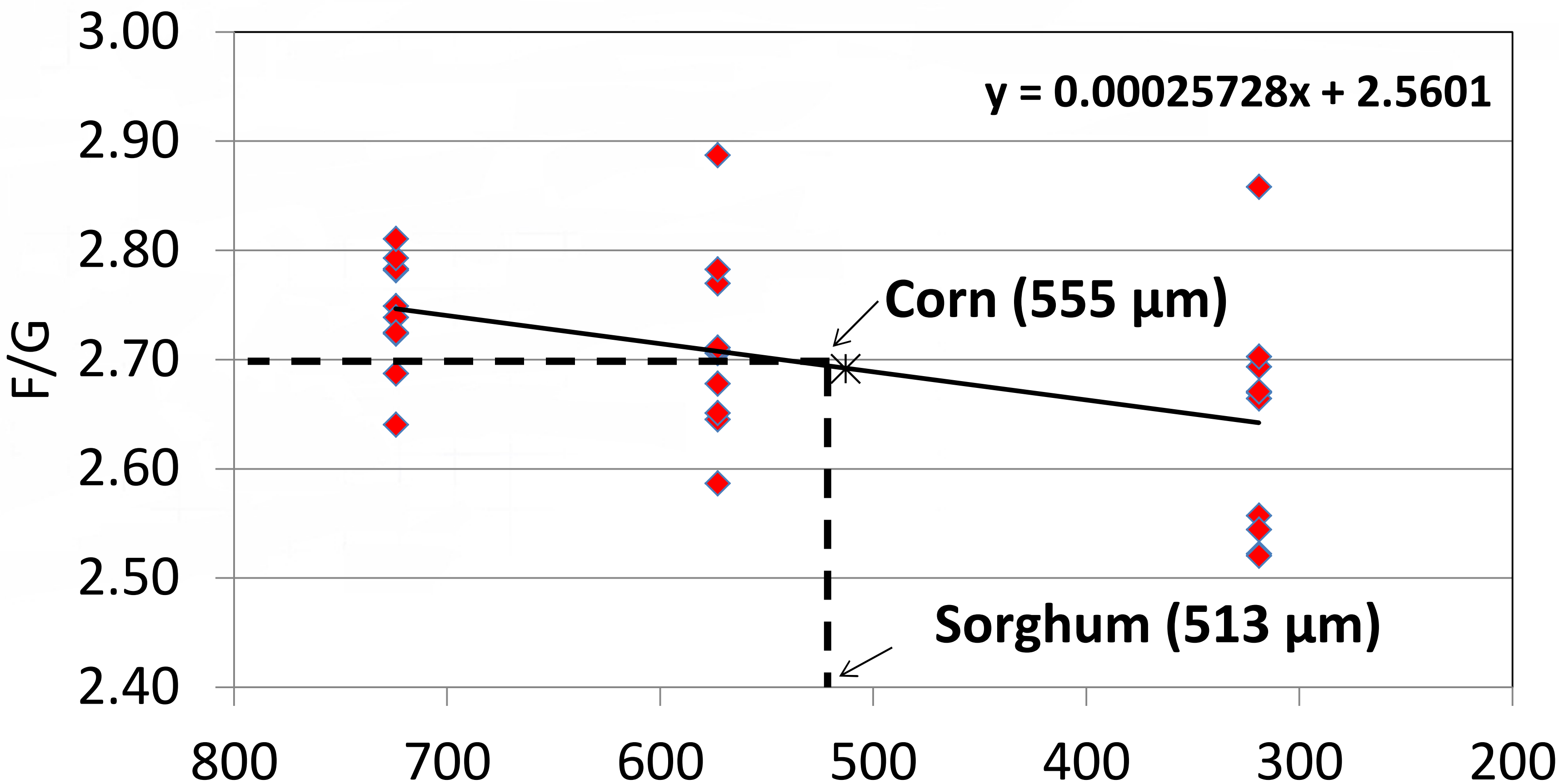


K·STATE Research and Extension

Paulk et al., 2011

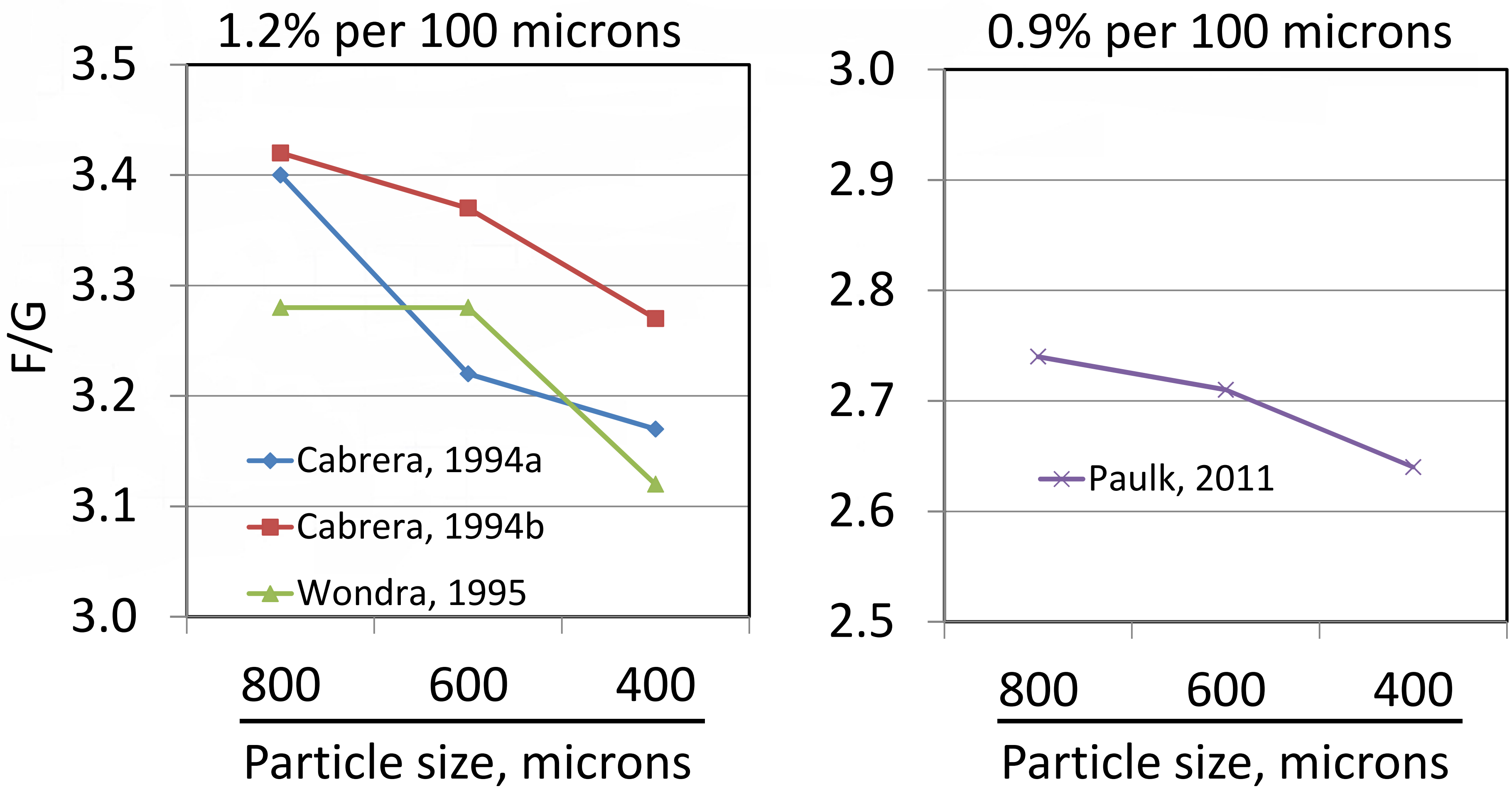
Knowledge for Life

Particle size of sorghum to have same F/G as corn



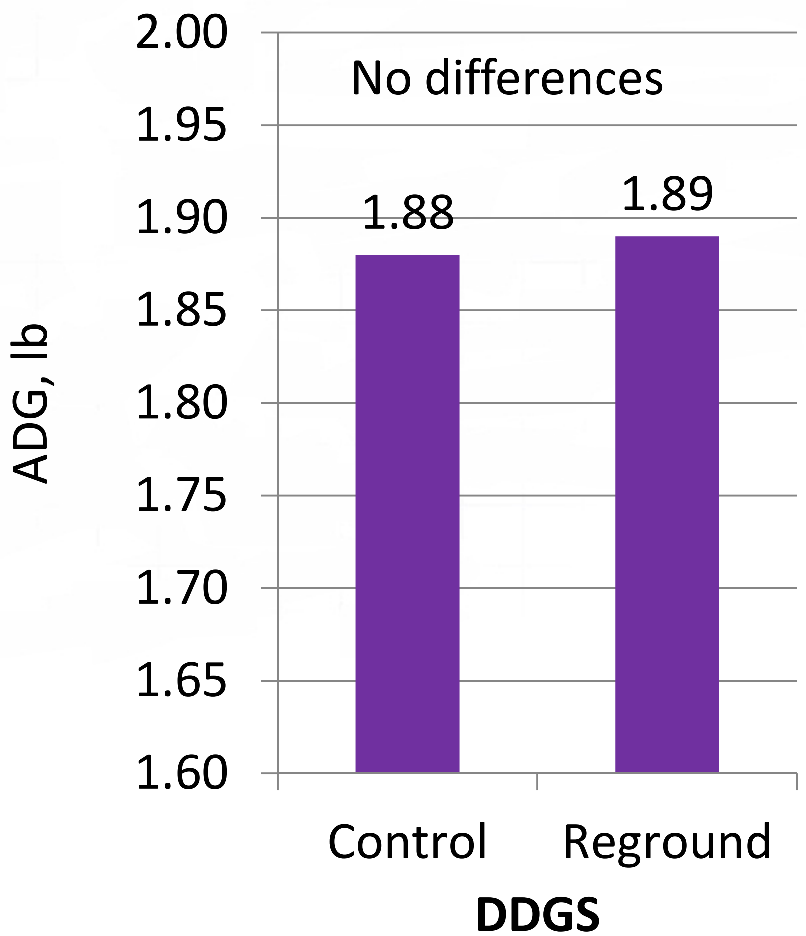
Paulk et al., 2011

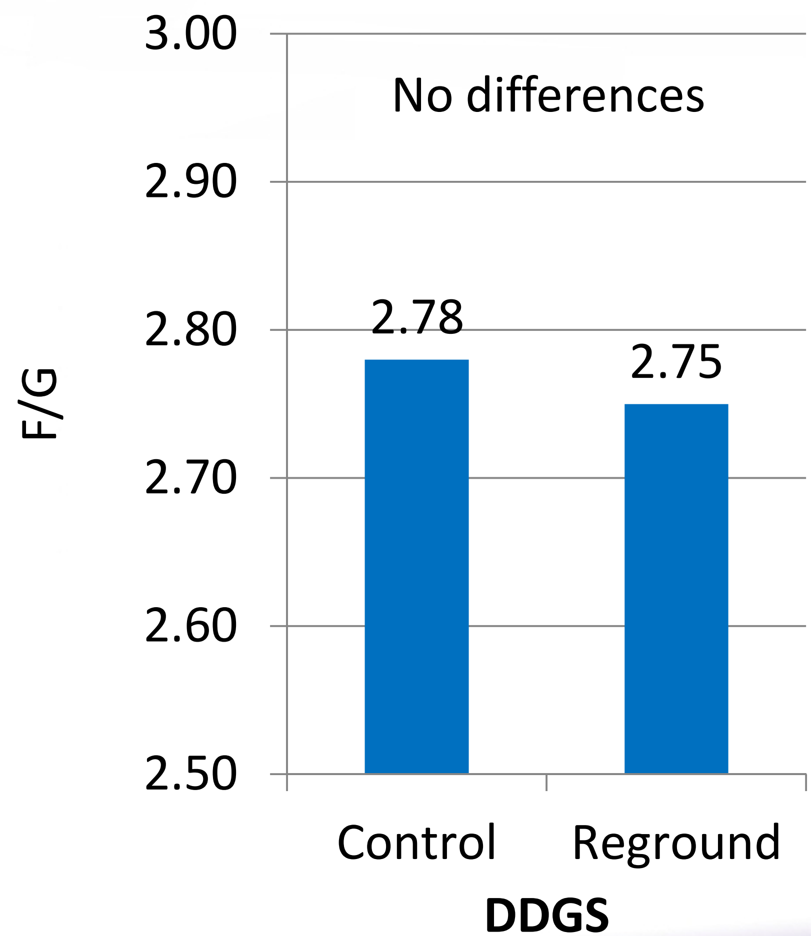
Effects of particle size on feed efficiency



Whether its from 1990's data or 2011, for every 100 microns decrease in particle size, F/G improves 1.2%

Effect of regrinding dried distillers grains with solubles on growth performance in finishing pigs





95 micron difference in DDGS particle size

De Jong et al, 2011

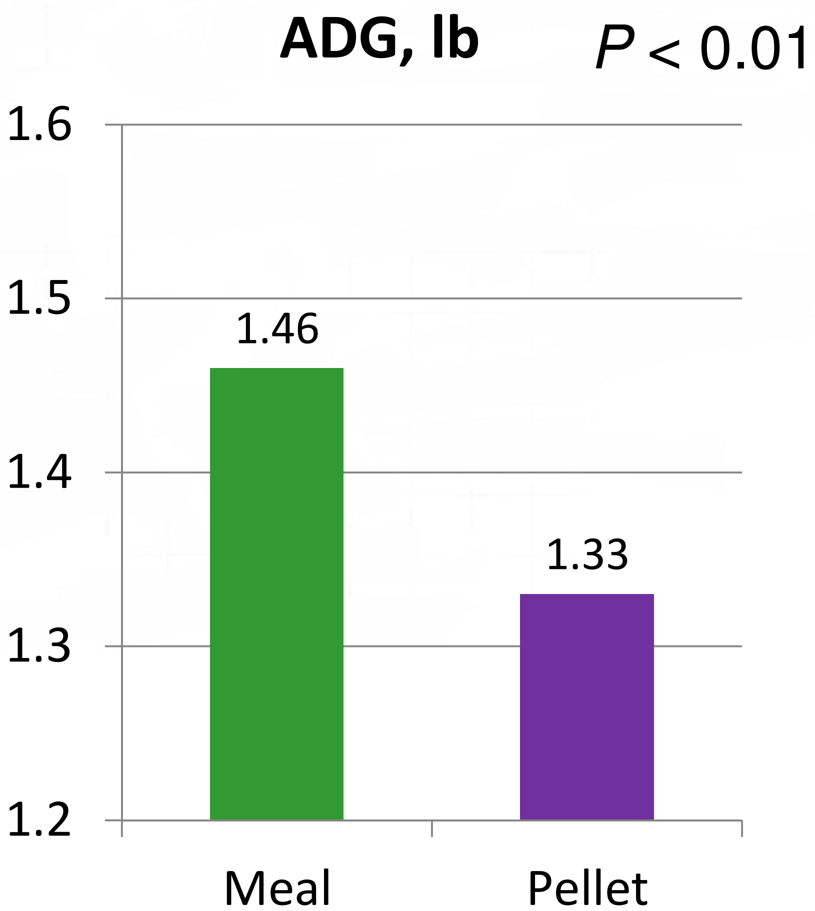
Effects of pelleting on growth performance of grow-finish pigs 1969 to 1999					
	Meal			Pellet	
Reference	ADG	F/G		ADG	F/G
NCR-42 (1969)	1.70	3.23		1.72	3.13
Hanke et al. (1972)	1.65	3.45		1.76	3.23
Baird (1973)	1.52	3.70		1.59	3.42
Tribble et al. (1975)	1.46	3.77		1.50	3.44
Harris et al. (1979)	1.34	3.83		1.46	3.55
Tribble et al. (1979)	1.37	4.10		1.54	3.66
Erickson et al. (1980)	1.54	3.03		1.74	2.70
Skoch et al. (1983)	1.70	3.10		1.85	2.91
Wondra et al. (1993a)	1.83	3.64		1.98	3.46
Van Heugten (1997)	1.59	2.14		1.64	2.02
Van Heugten (1997)	2.17	2.89		2.07	2.70
Brumm (1998)	1.76	3.13		1.81	2.94
Johnston et al. (1999)	2.01	3.03		2.18	2.86
Average	**1.66**	**3.31**		**1.76**	**3.08**

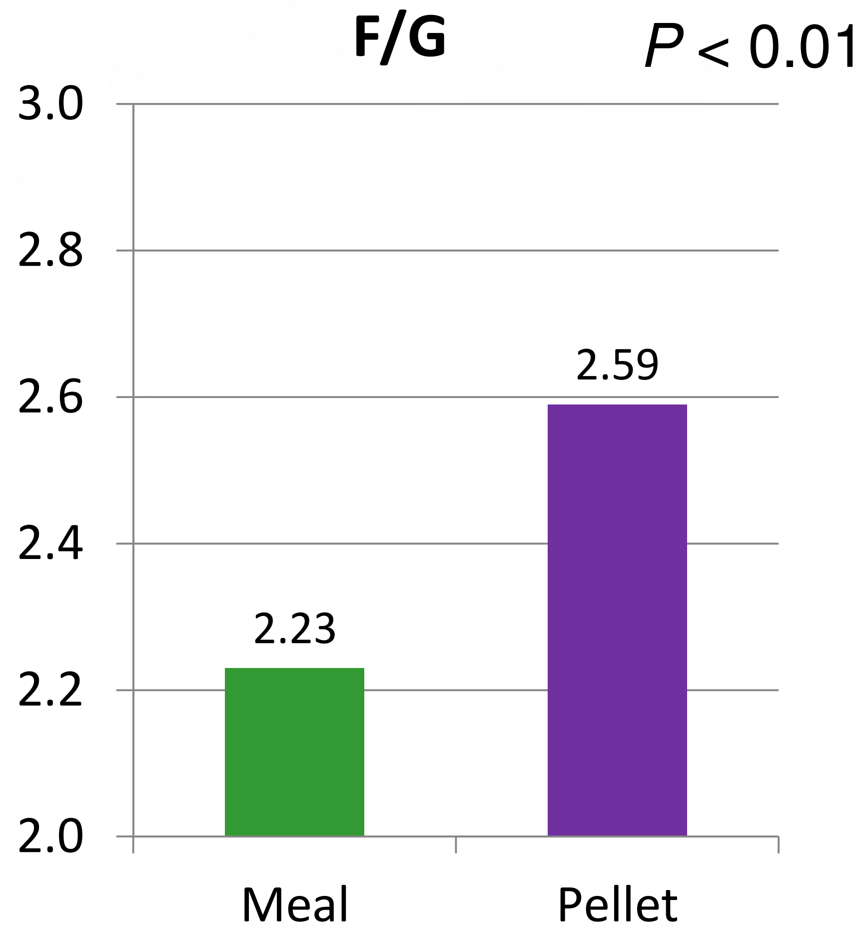
Average response = 5.6% for ADG and 7.0% for F/G

Effects of pelleting on growth performance of grow-finish pigs 2005 to 2011					
	Meal			Pellet	
Reference	ADG	F/G		ADG	F/G
Groesbeck et al. (2005)	0.83	1.25		0.90	1.22
Groesbeck et al. (2005)	0.62	1.43		0.65	1.37
Groesbeck et al.(2006)	0.80	1.25		0.78	1.17
Potter et al. (2009)	1.95	2.12		2.05	2.07
Potter et al. (2009)	1.92	2.83		2.04	2.68
Myers et al. (2010)	1.81	2.76		1.94	2.82
Potter et al. (2010)	1.92	2.86		2.03	2.70
Frobose et al. (2011)	1.46	1.72		1.43	1.63
Frobose et al. (2011)	1.29	1.51		1.38	1.40
Myers et al. (2011)	1.96	2.73		1.97	2.67
Paulk et al. (2011)	2.50	2.75		2.63	2.55
Paulk et al. (2011)	2.31	2.50		2.44	2.40
Average	**1.61**	**2.14**		**1.69**	**2.06**

Average response = 5.0% for ADG and 4.0% for F/G

Effect of diet form on overall ADG and F/G
40% fines



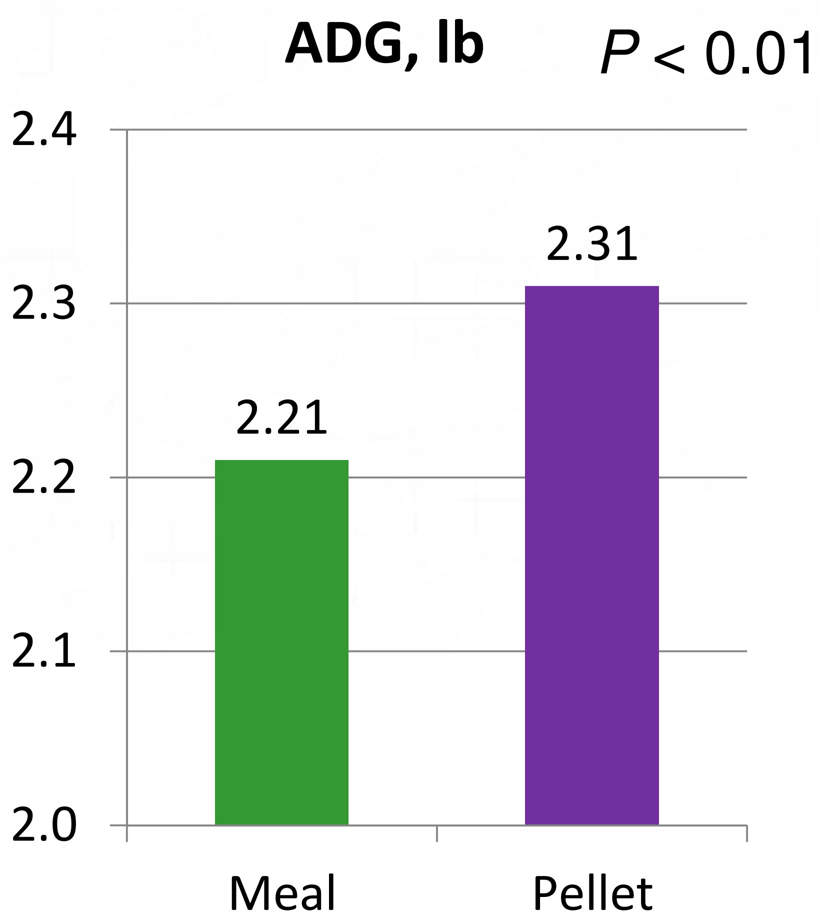


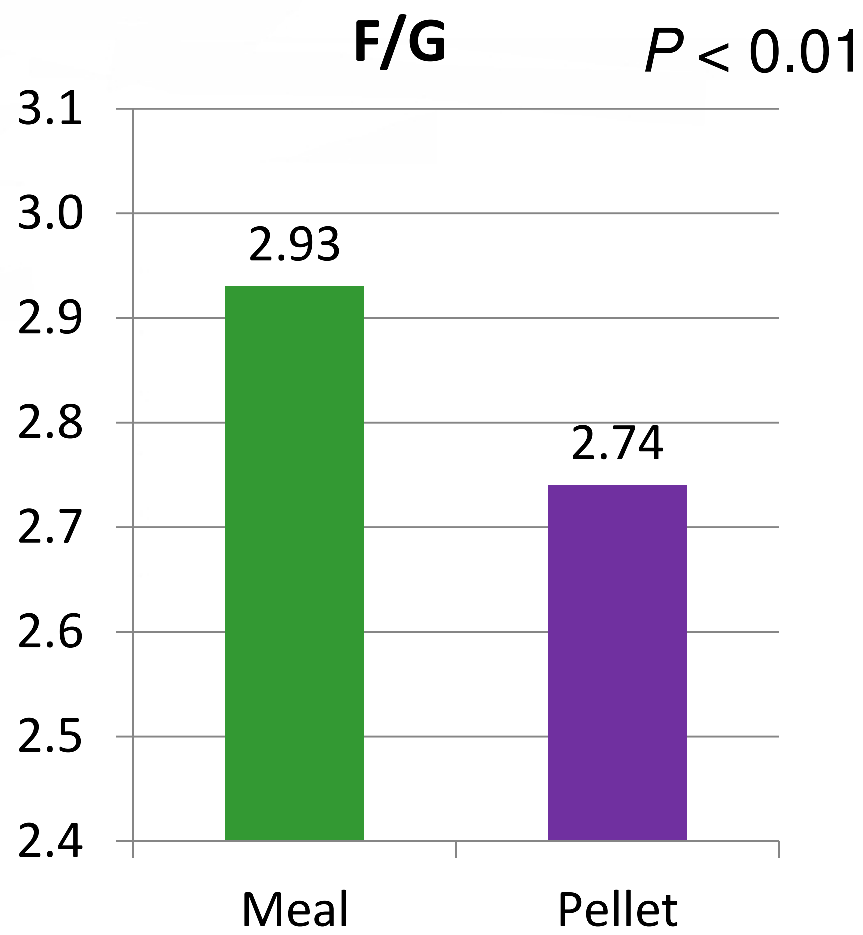
Myers et al., 2011

K·STATE Research and Extension

Knowledge for Life

Effect of diet form on overall ADG and F/G
4% fines



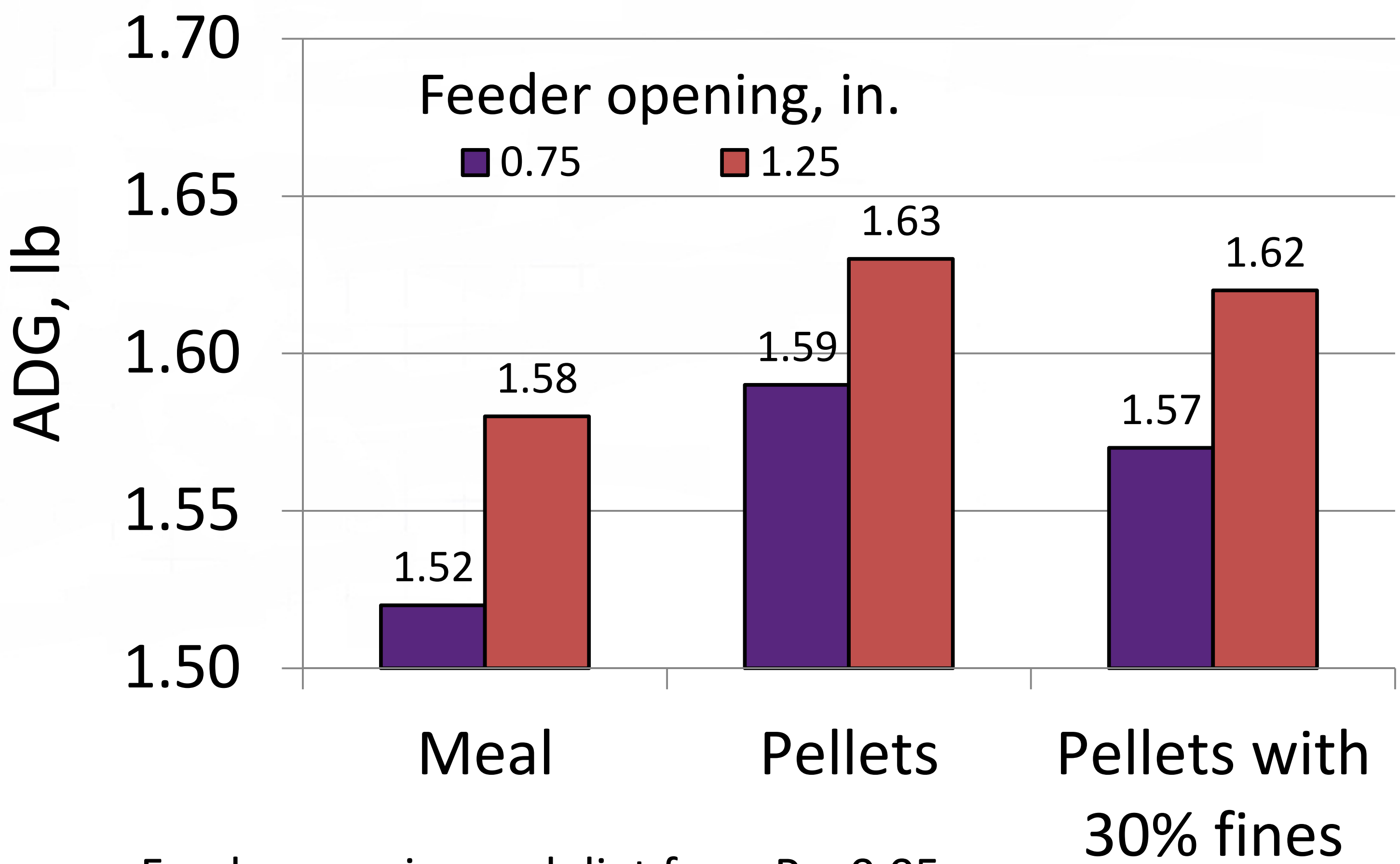


Myers et al., 2011

K·STATE Research and Extension

Knowledge for Life

Effects of feeder adjustment and pellet quality on ADG

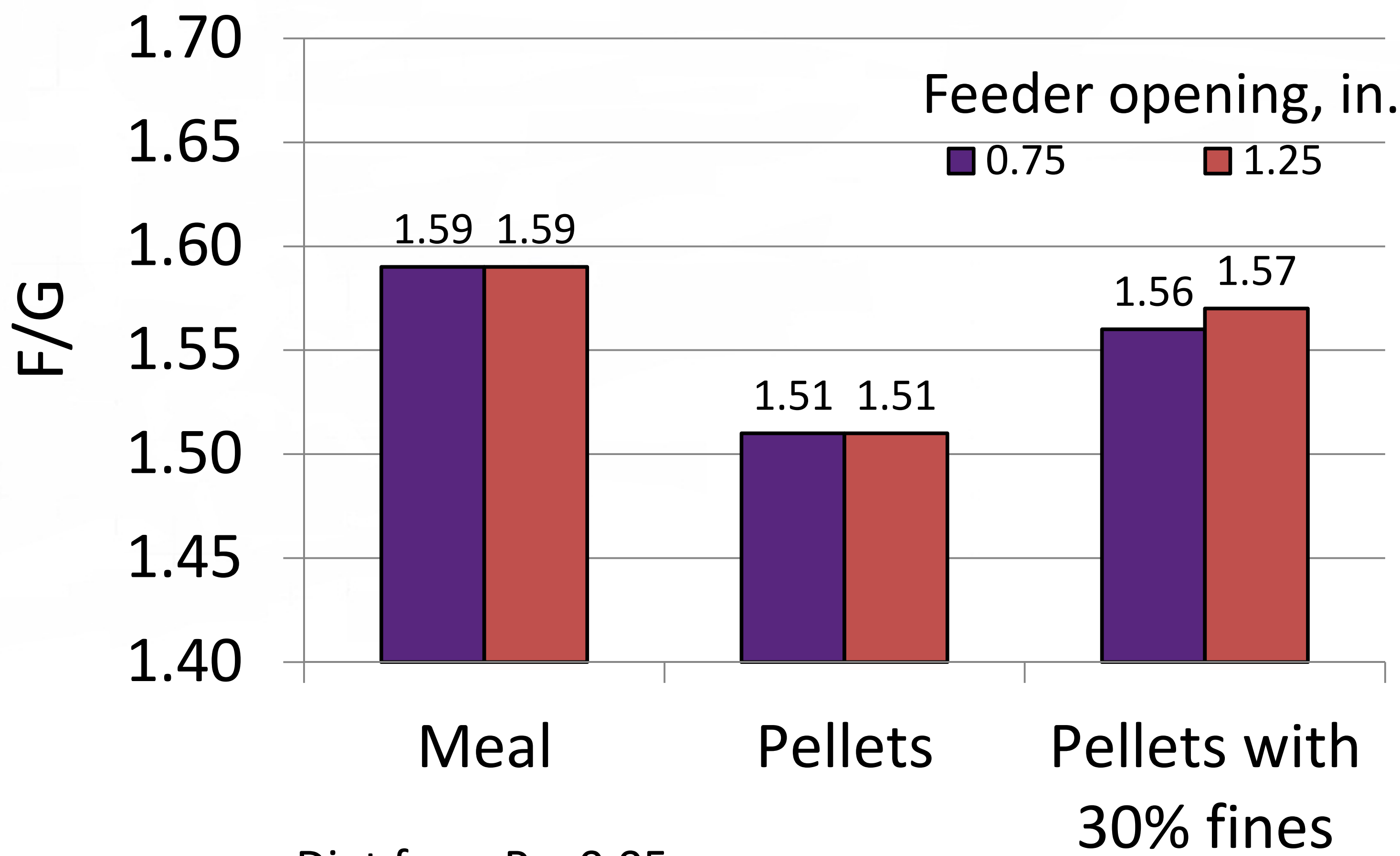


Feeder opening and diet form $P < 0.05$

Nemecheck et al. 2012

Knowledge for Life

Effects of feeder adjustment and pellet quality on F/G



Diet form $P < 0.05$

Nemecheck et al. 2012

Pellet quality

Pellets with fines

Good quality pellets

K·STATE Research and Extension

NFP NEW FASHION PORK

HUBBARD®

Nemecheck et al. 2012

Knowledge for Life

Future feed processing needs

- Particle size
  - Effects of fine particle sizes (< 500 microns)
  - Grinding of ingredients or complete diet
- Pelleting
  - Pellet quality standards
  - Expanding
- Feeder by pellet quality interaction

Thank You!

K·STATE
Research and Extension