Nutrition to Reach Marketing Goals & Optimize Profitability

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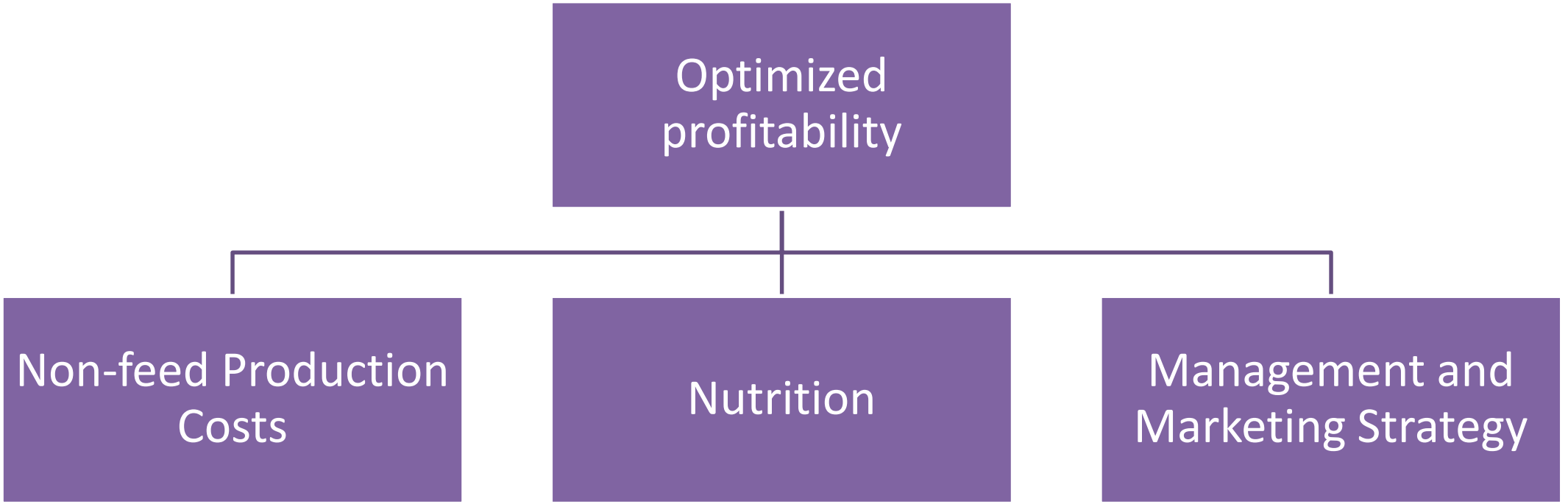
2025 Banff Pork Seminar

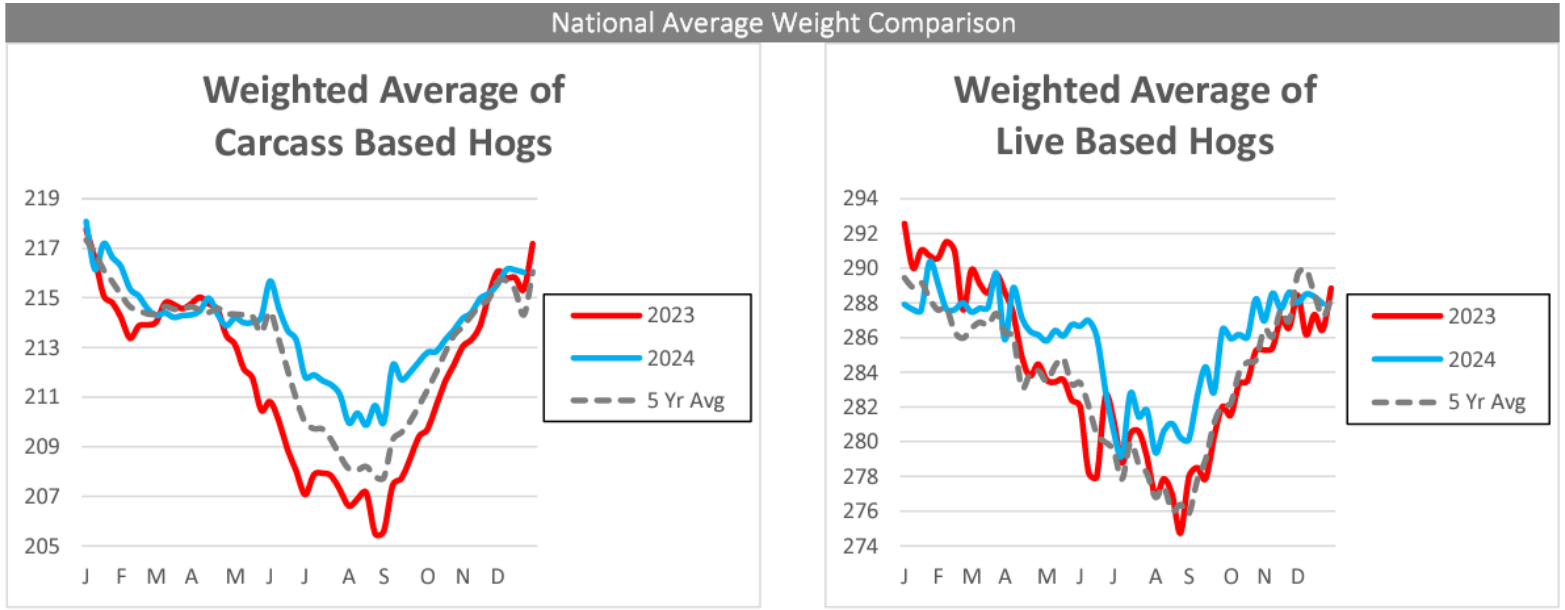
Presentation outline

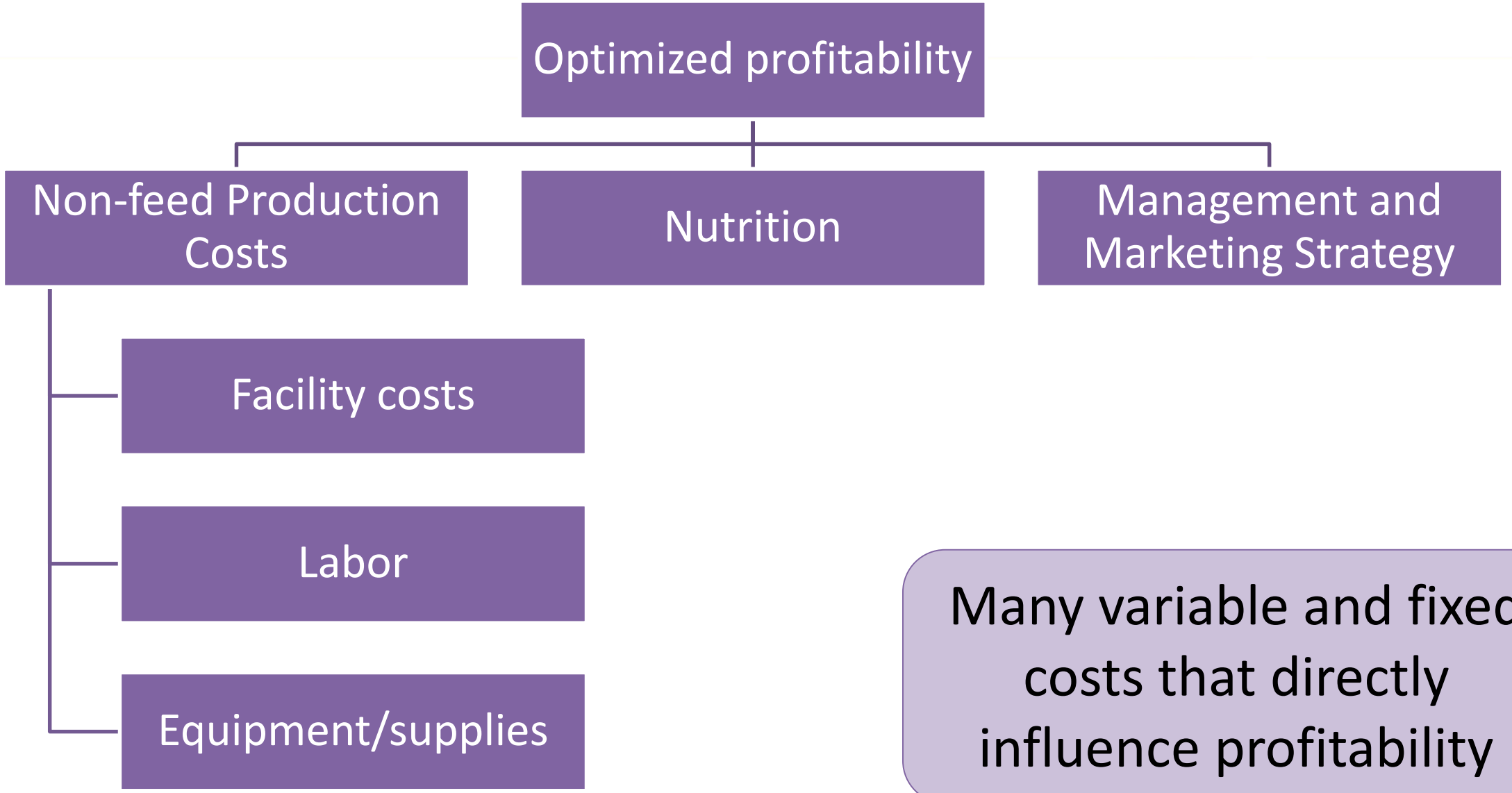
$$Profitability = Revenue - Expenses$$



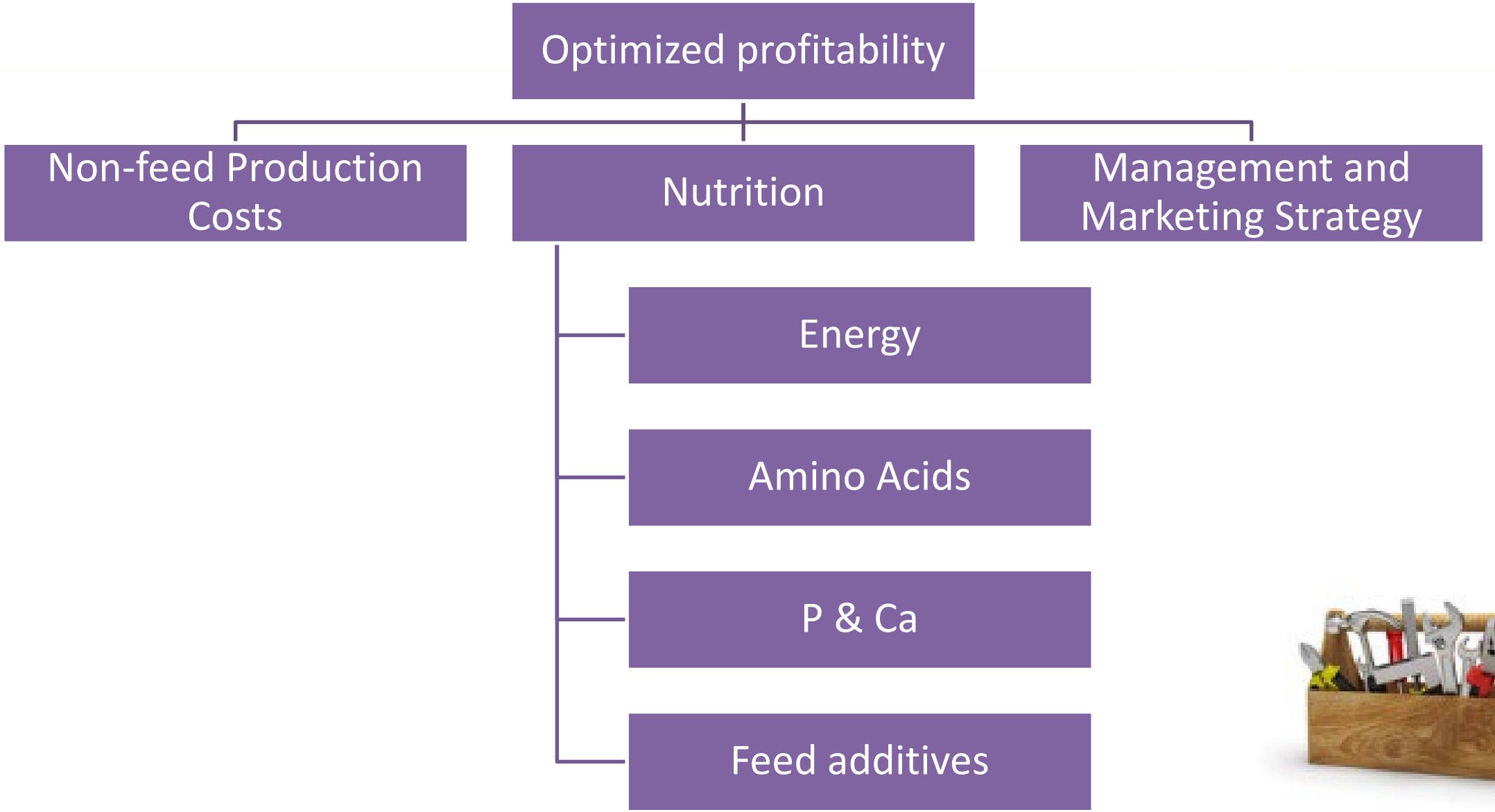
Determining goals

- What is our target?
  - Market weight
  - How will pigs be sold?
- How much “space” is in system?
  - Seasonal influence?





Many variable and fixed costs that directly influence profitability


Optimized profitability
Non-feed Production Costs
Nutrition
Management and Marketing Strategy
Energy
Amino Acids
P & Ca
Feed additives

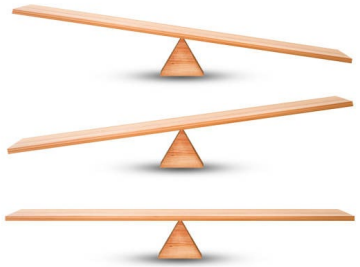
Dietary energy

- Most expensive component of diet
- Increasing energy
  - Improves F/G
  - ADG response variable
  - Dietary fiber (reducing energy) reduces carcass yield
  - Iodine value considerations – depending on lipid source and level
- When considering changing energy, must consider:
  - Feed cost
  - Impact on growth performance – ADG and F/G
  - Implications on carcass yield, lean percentage, iodine value

Dietary energy

- How to value changes in performance
  - F/G: relatively easy to calculate economic implications
  - Market weight
    - Incremental change in carcass weight (carcass weight if days to market limited, cost of space if days to market not limiting)
    - Full value pigs – packer premiums/discounts

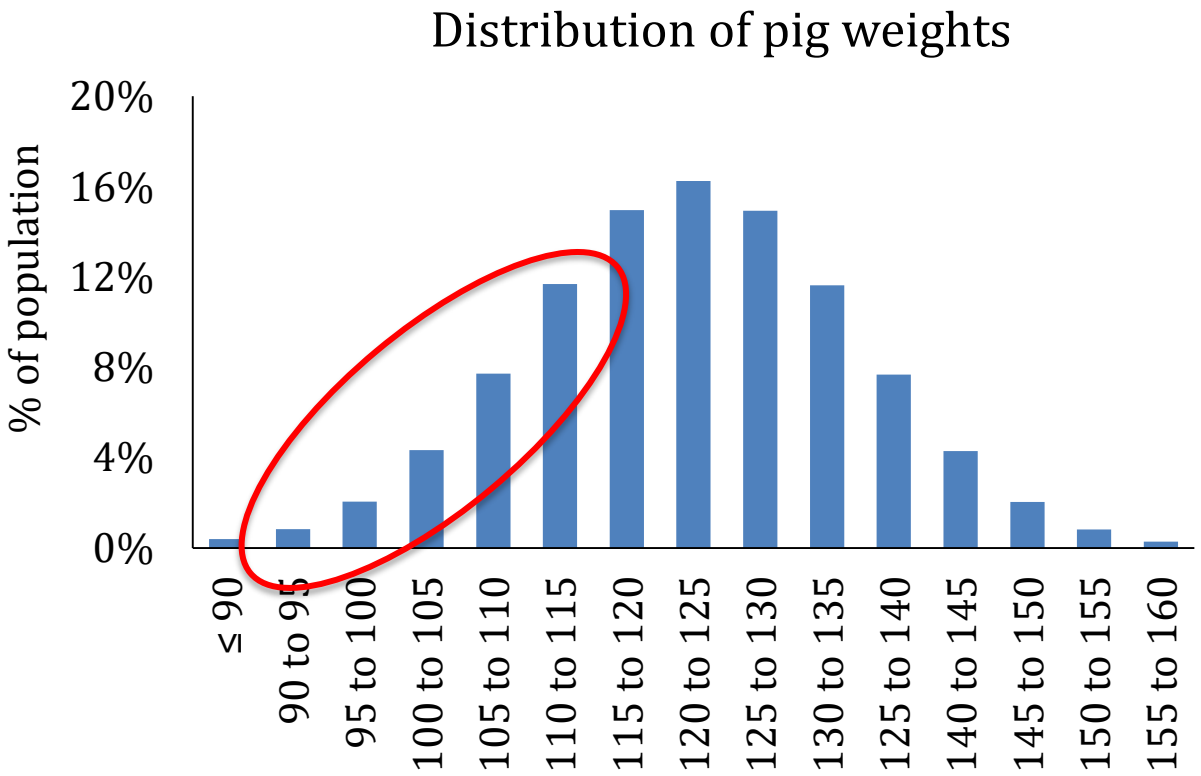
Short on space



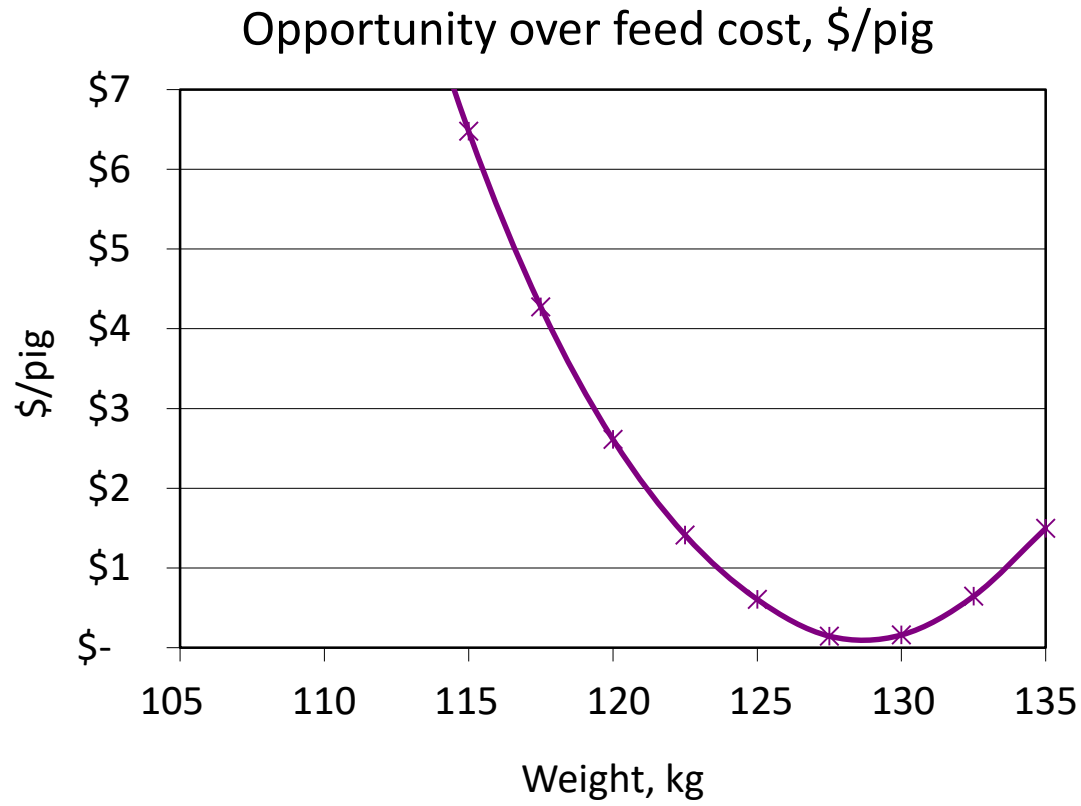
Long on space

Determining the value of dietary energy for ADG

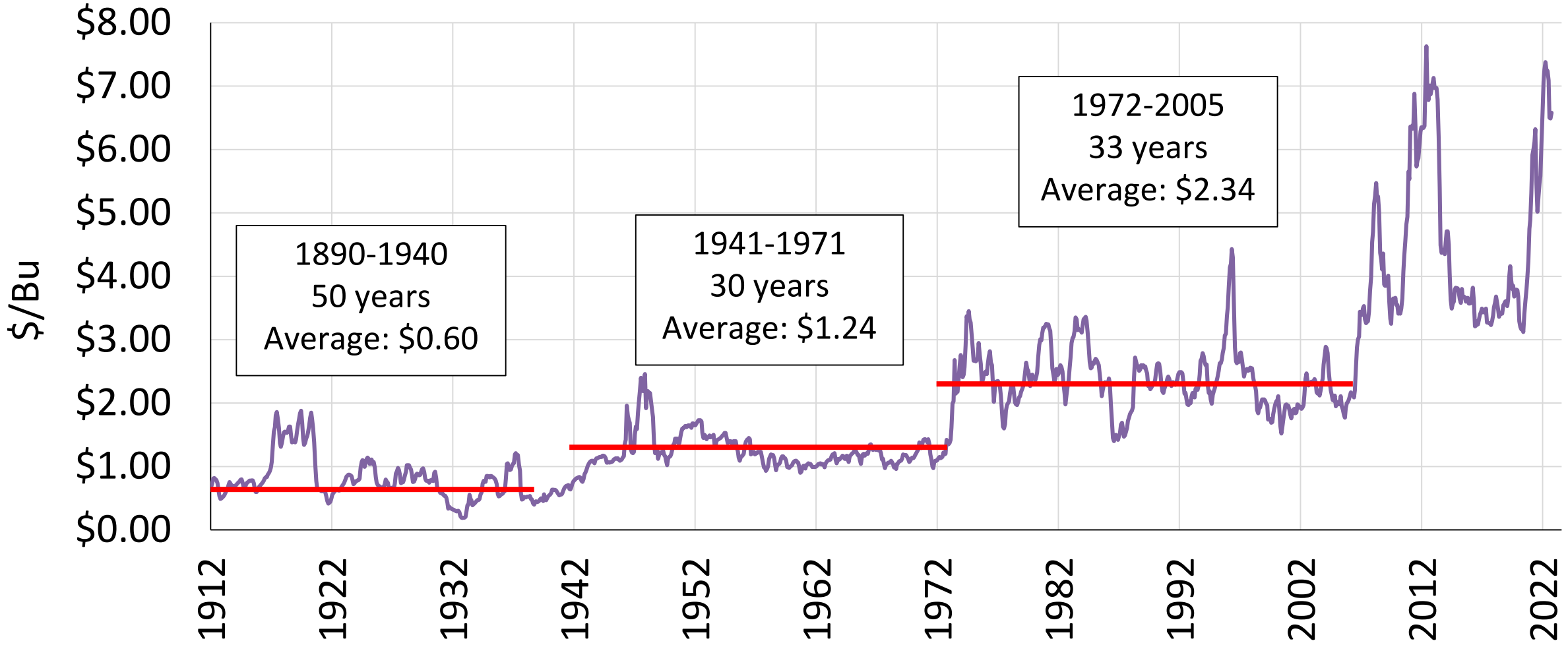
- Space limited – Margin of feed and facility cost
- Moving pigs into packer matrix and increasing premiums



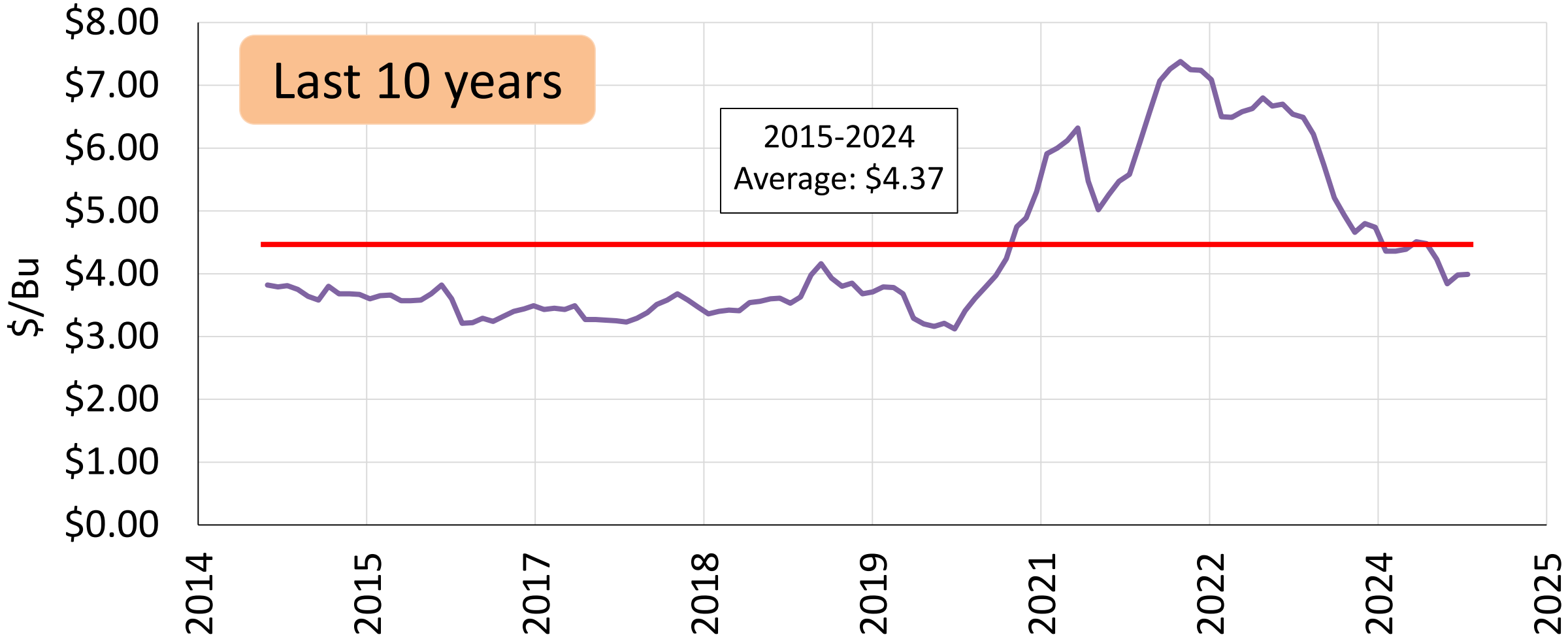
Average weight of 123 kg, 1,000 pigs



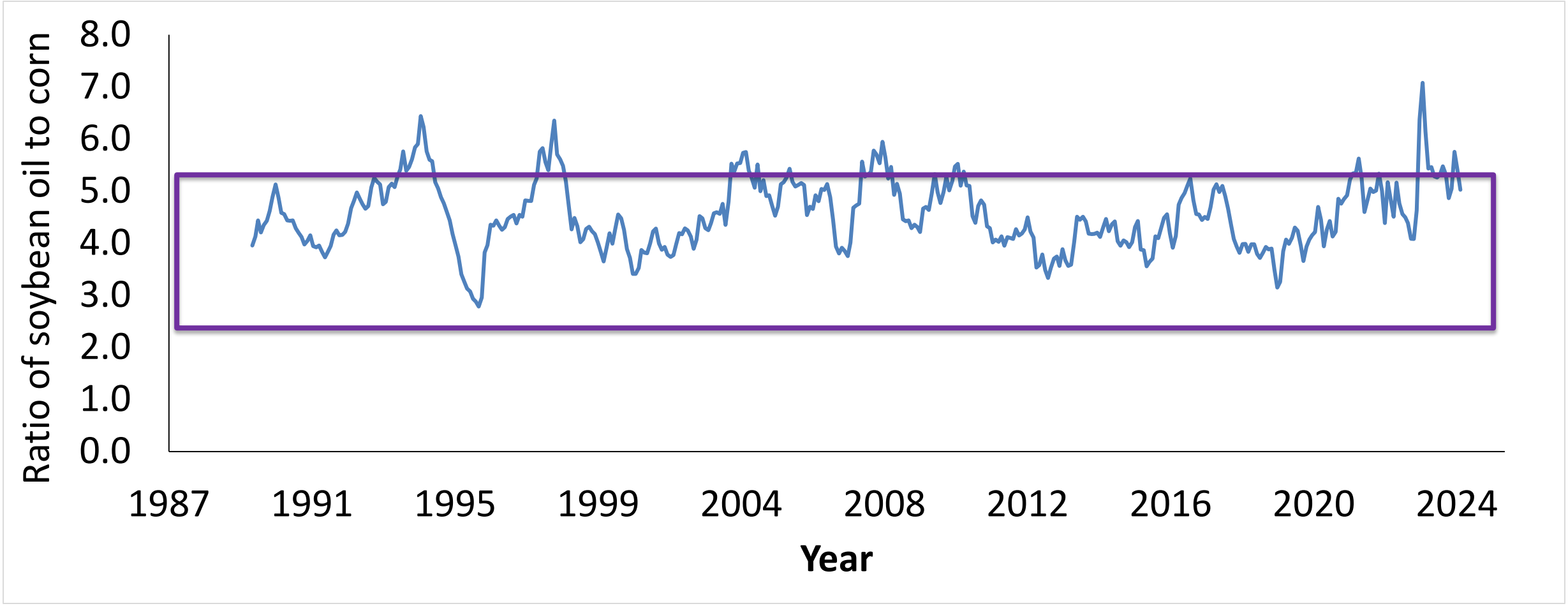
Average corn price received by U.S. Farmers



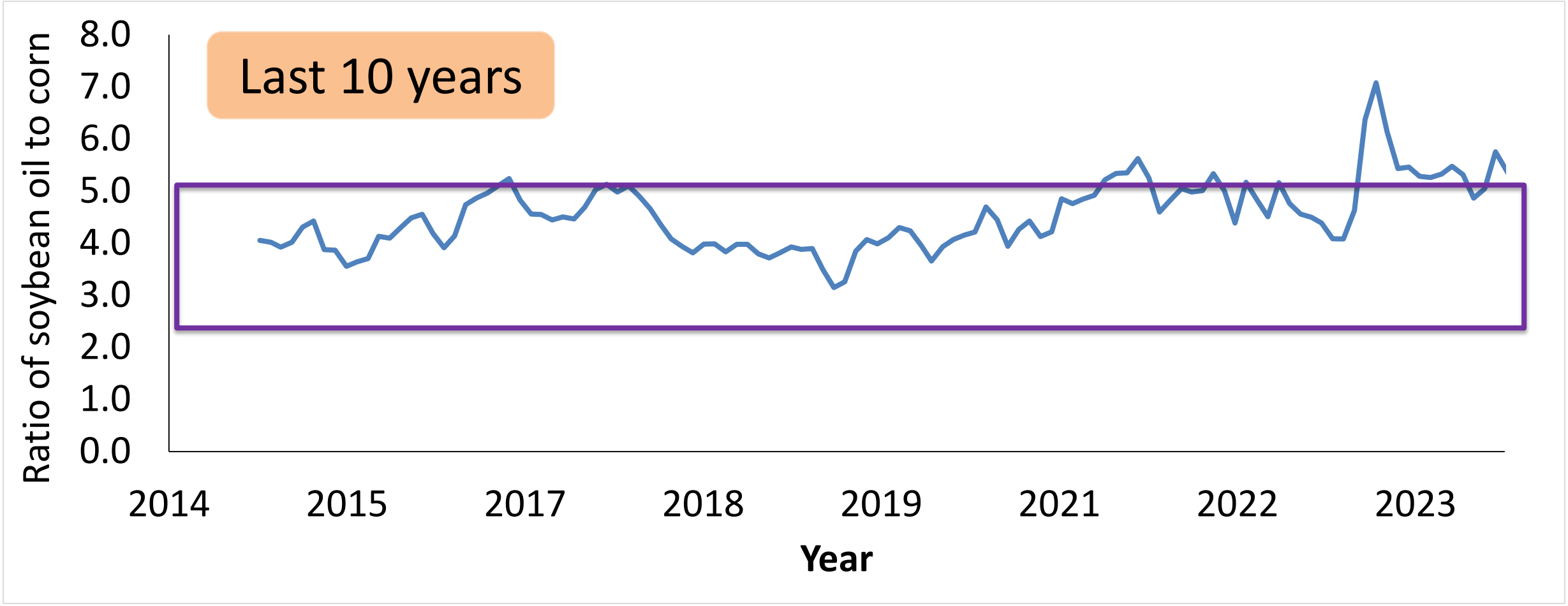
Average corn price received by U.S. Farmers



Ratio of soybean oil:corn



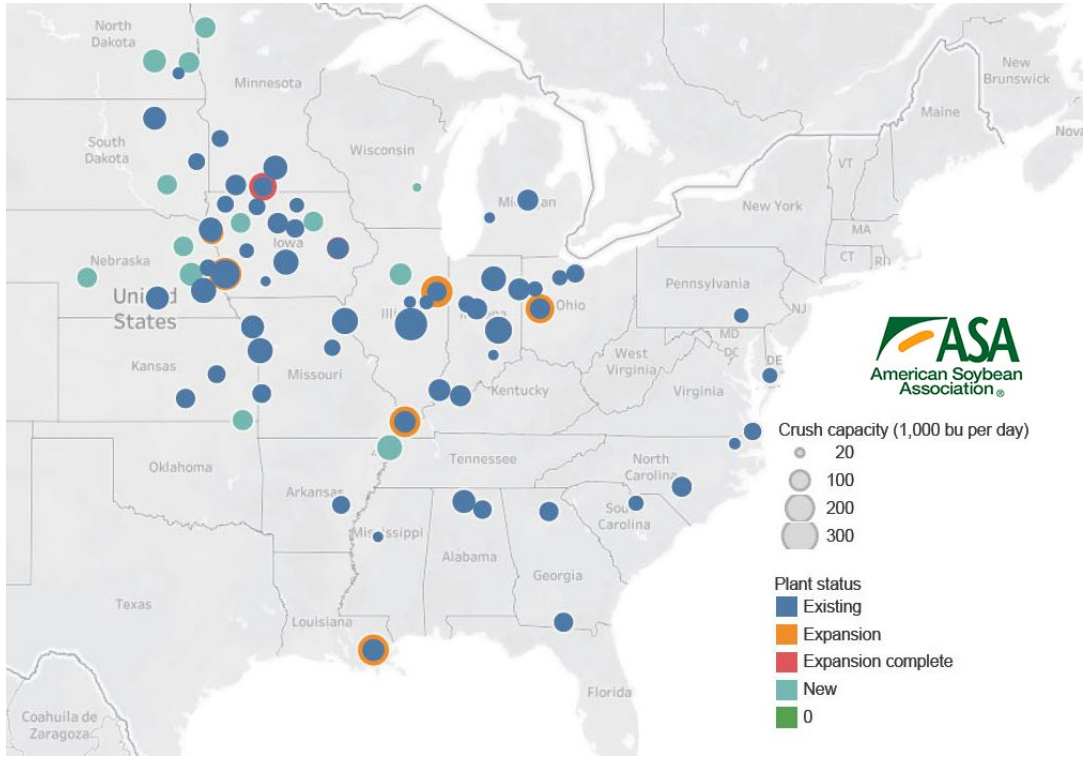
Ratio of soybean oil:corn



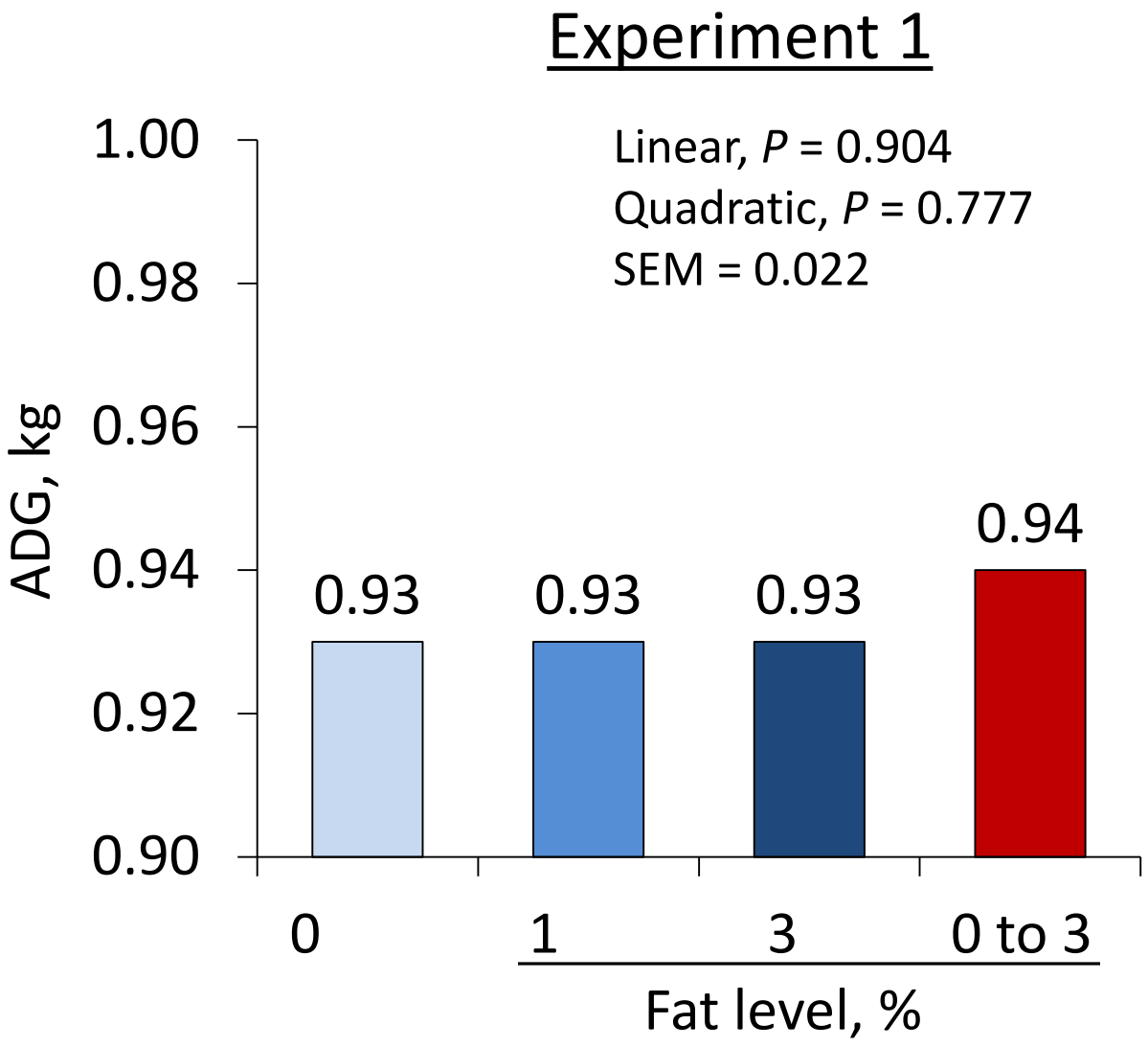
Data source: Federal Reserve Economic Data

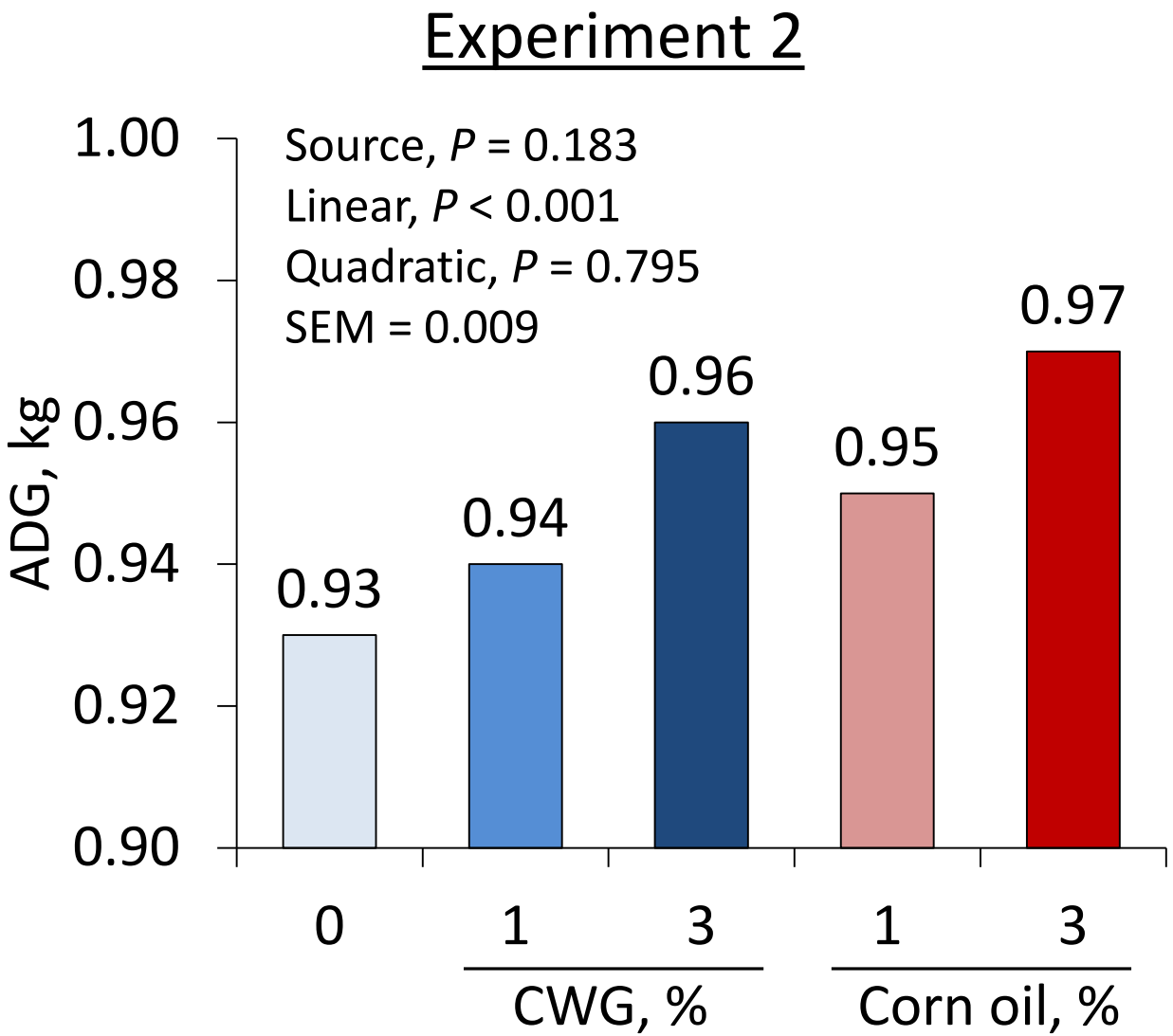
Soybean Crush capacity

- Significant growth in soybean crush capacity
- Growth driven by renewable diesel production from soybean oil
- Discussion of 13 new plants, 10 plant expansions
- Cost of energy in swine diets continues to be high



Influence of added fat on grow-finish average daily gain



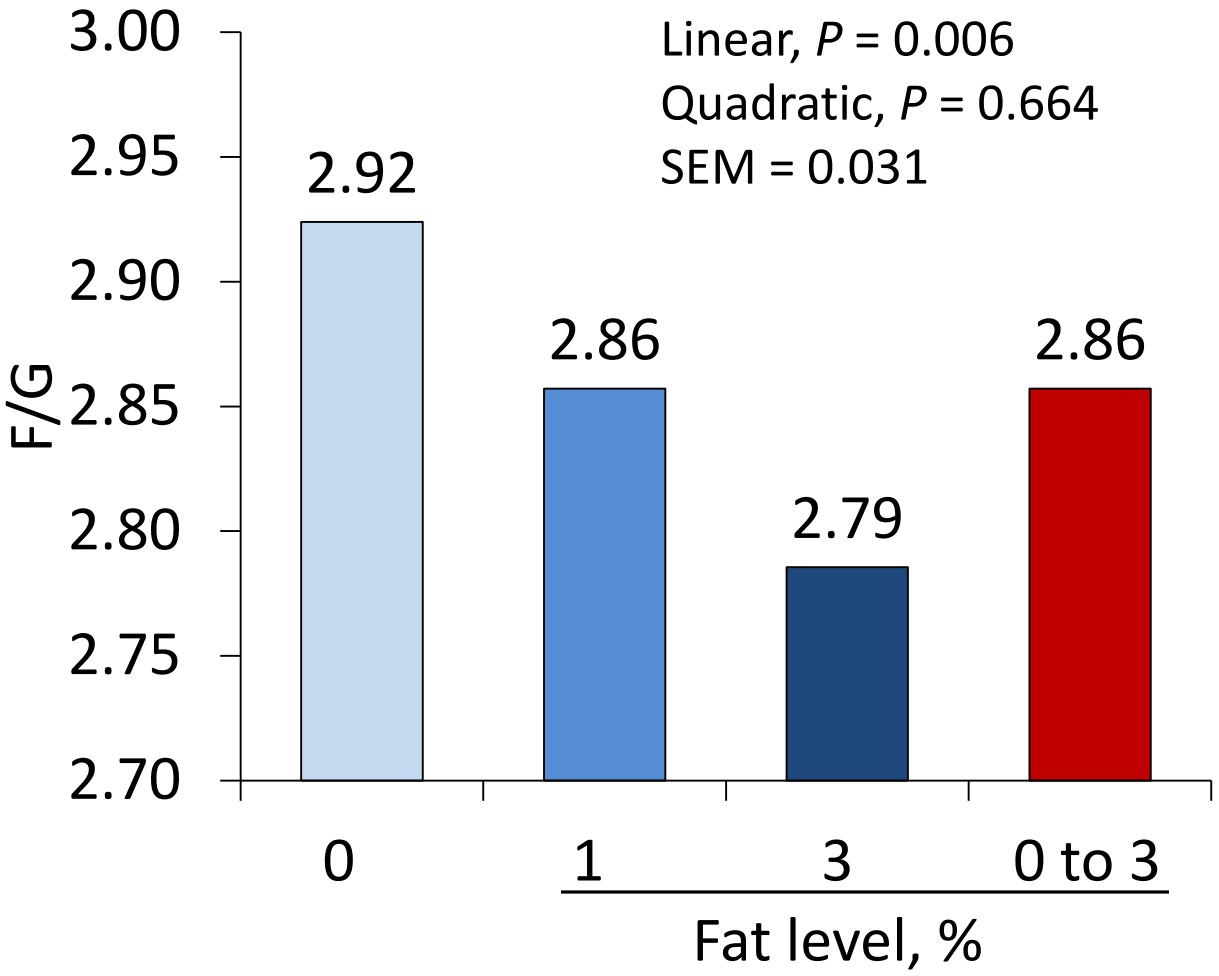


Response to energy on gain variable

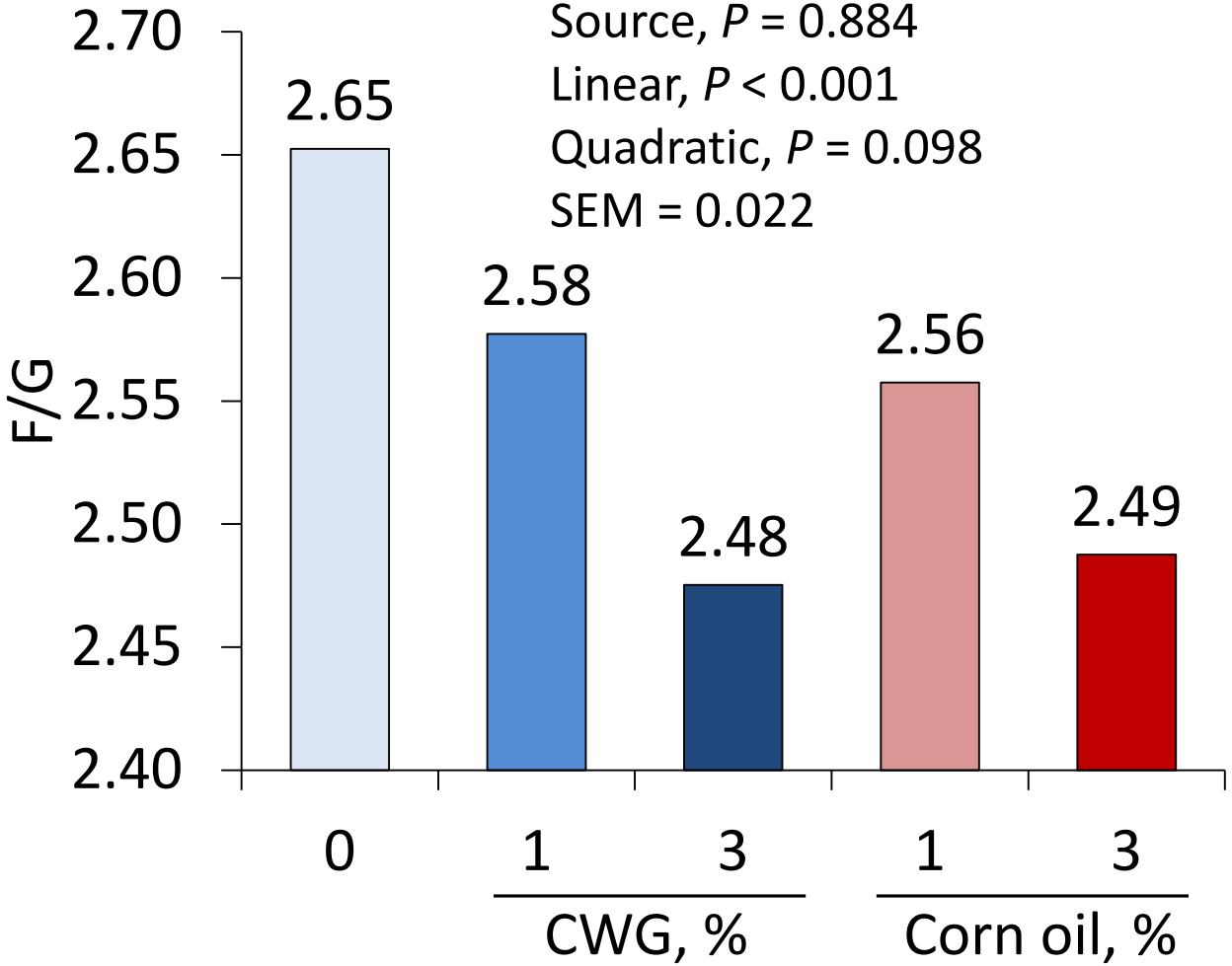
Bromm et al., 2023

Influence of added fat on grow-finish feed efficiency

Experiment 1



Experiment 2



Consistent improvement in F/G

Bromm et al., 2023

Phase 1 Diet Composition (as-fed basis)

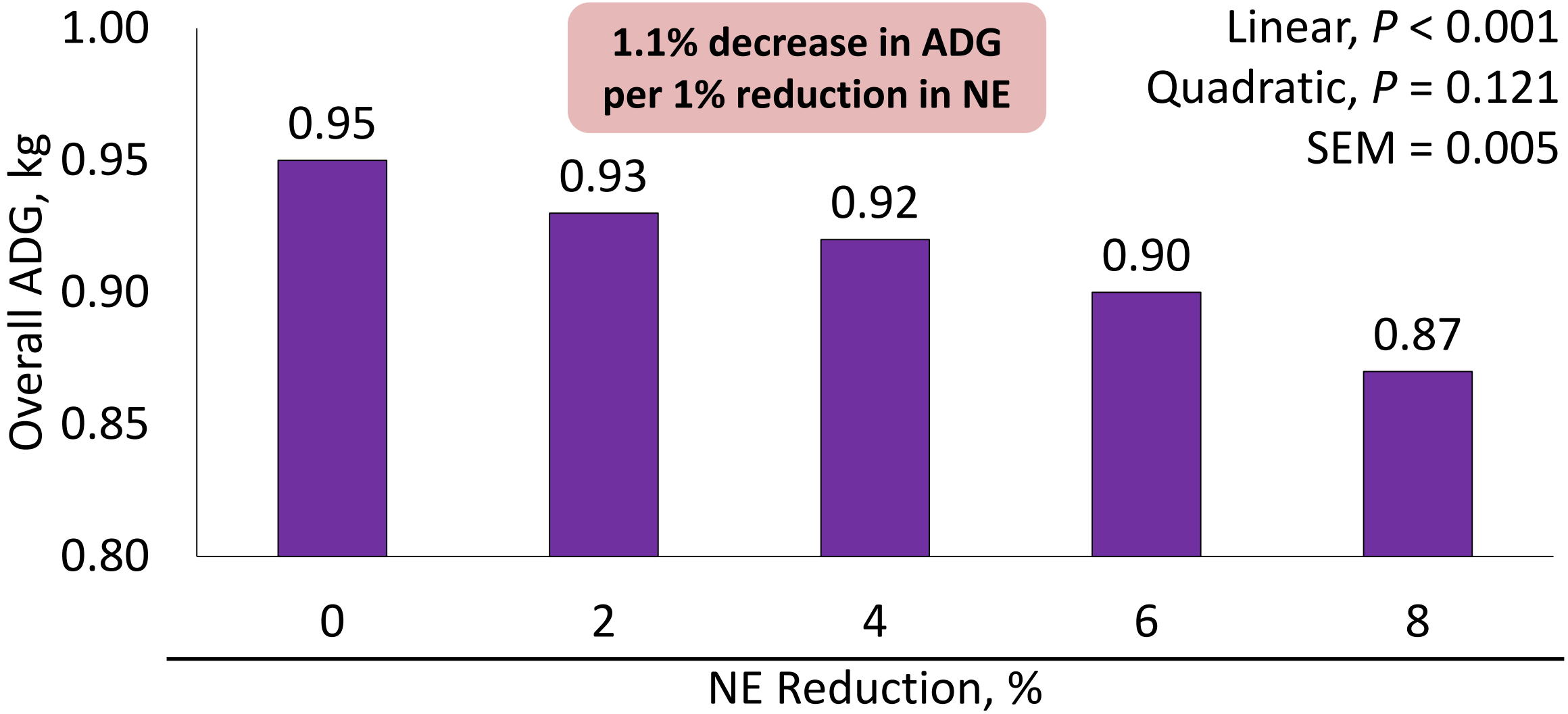
	NE Reduction, %	
Ingredient, %	**0**	**8**
Corn	64.32	31.77
Soybean meal	32.04	25.34
Wheat middlings	---	25.00
Corn DDGS	---	15.00
L-Lys HCl	0.45	0.34
Other AA	0.67	0.29
Vitamins and Minerals	2.53	2.35
Total	100.00	100.00

- NE based on Eq. 1-8 NRC with proximate analysis of major ingredients

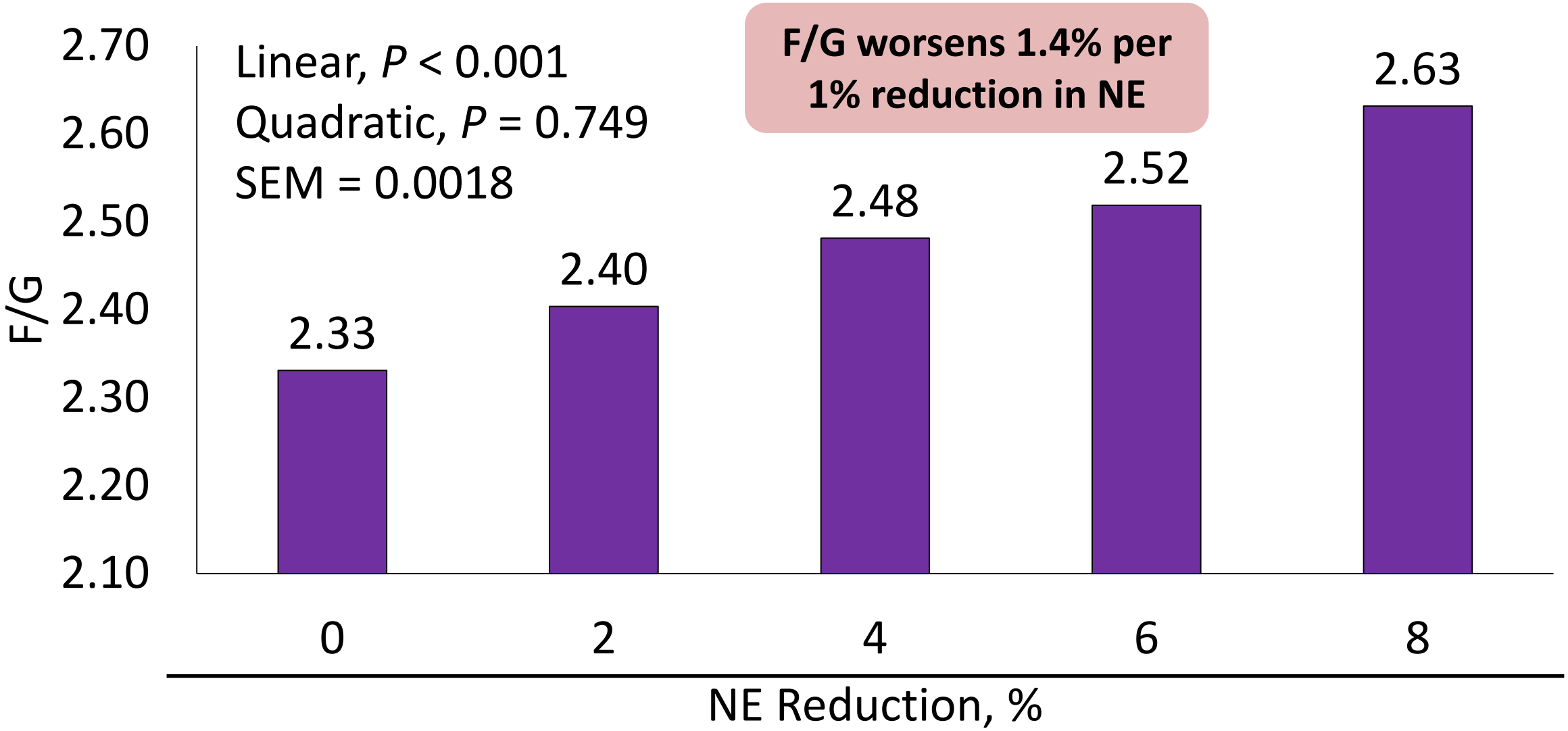
Calculated Analysis

	NE Reduction, %	
SID AA, %	**0**	**8**
Lys, %	1.27	1.17
Ile:Lys	58	66
Leu:Lys	113	142
Met and Cys:Lys	59	59
Thr:Lys	66	66
Trp:Lys	20.0	20.1
Val:Lys	70	75
NE, kcal/kg	2,432	2,237
SID Lys:NE, g/Mcal	5.22	5.23
CP, %	20.5	23.1
Ca, %	0.70	0.79
STTD P, %	0.40	0.43

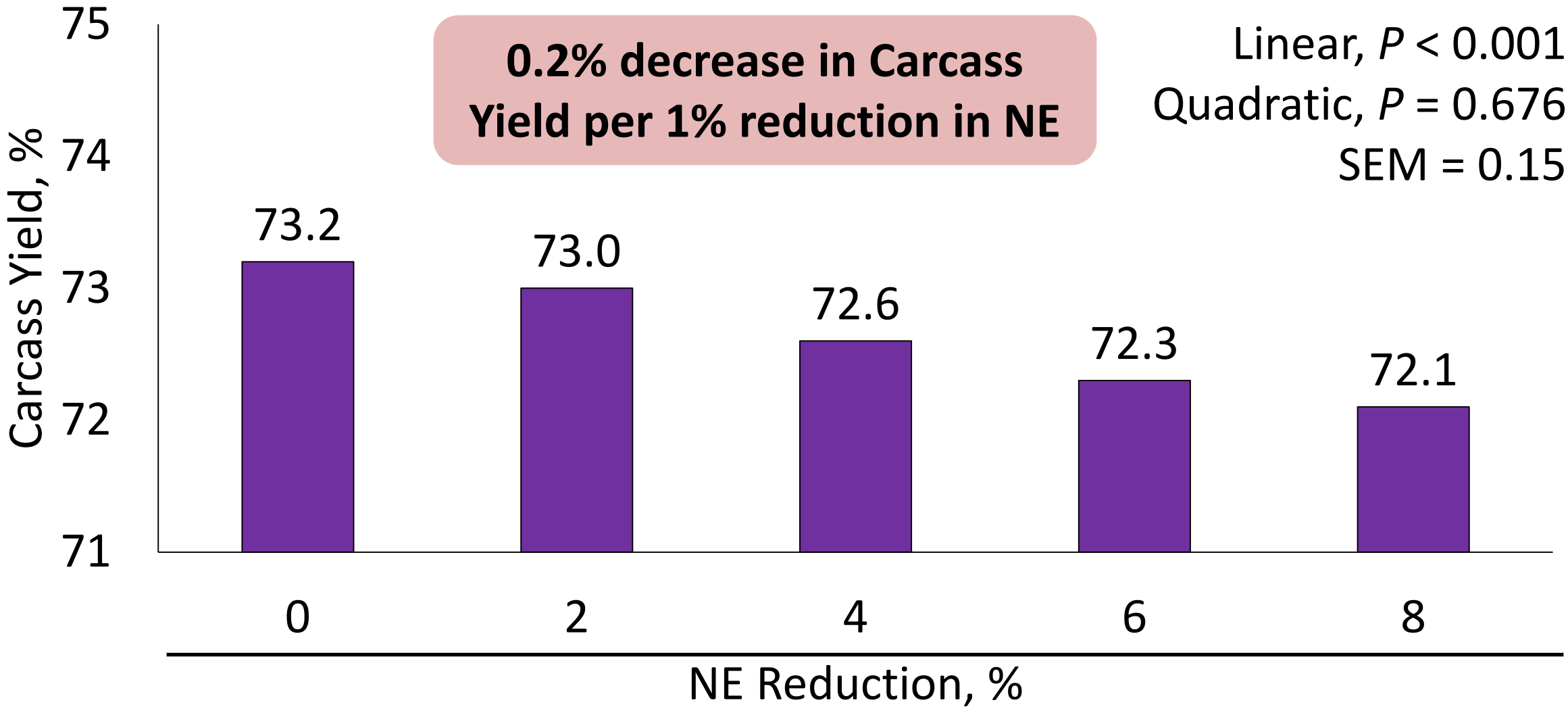
Effects of Reducing NE on ADG



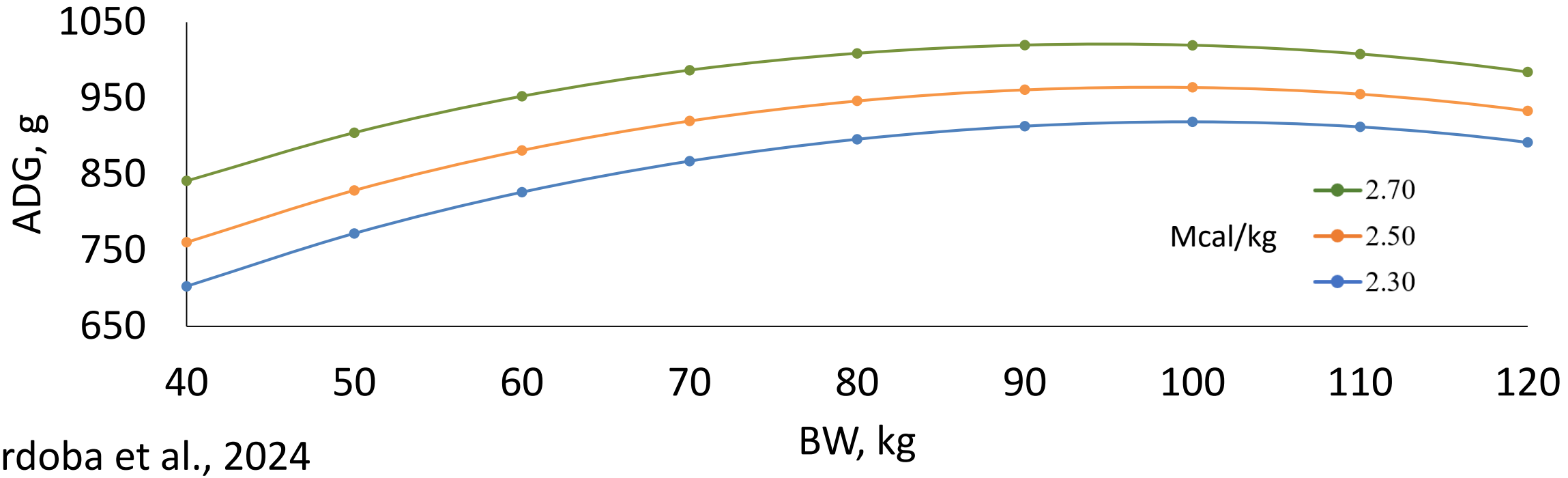
Effects of Reducing NE on F/G



Effects of Reducing NE on Carcass Yield



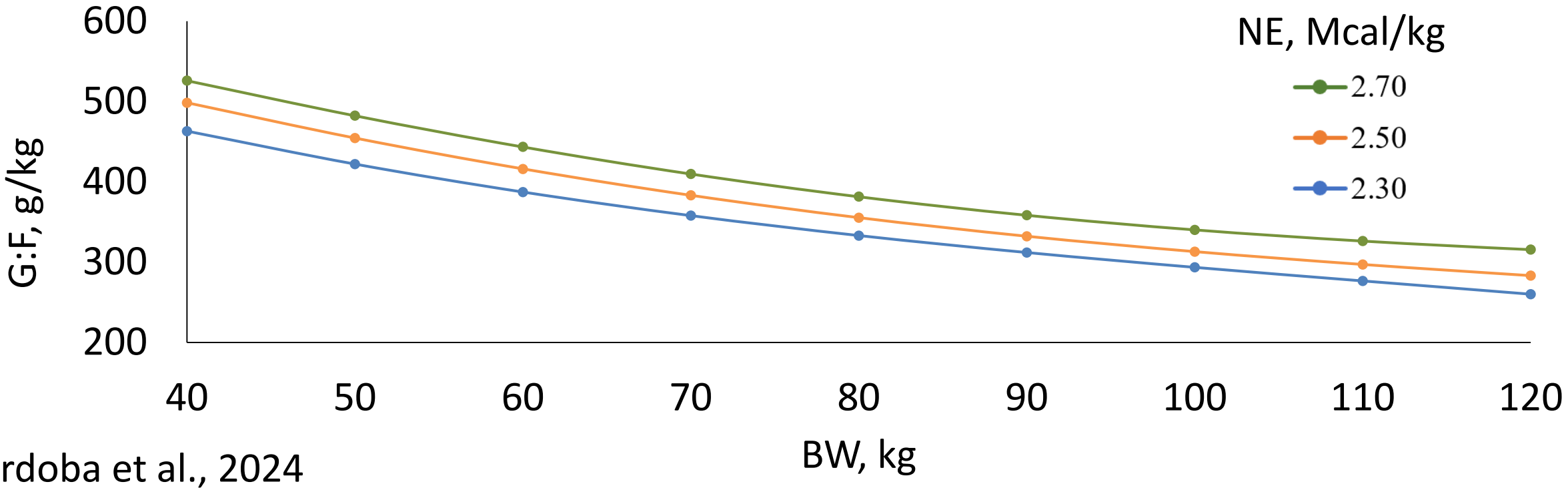
Updated Growth Performance modelling



Cordoba et al., 2024

ADG (kg) response = -1619.2980797296 + 25.9248064834 × NE (Mcal/kg) + -2657.6209162609 × SID Lys (%) + 123.0469725298 × CP (%) + -9.2854579989 × NDF (%) + 872.0182830582 × LysNE + 26.664395965 × BW (kg) + 2599.7646012325 × SID Lys (%) × SID Lys (%) + -0.1016237102 × BW (kg) × BW (kg) + -71.8618465276 × SID Lys (%) × CP (%) + -607.1294449572 × SID Lys (%) × LysNE + 25.6463076451 × SID Lys (%) × BW (kg) + -0.8399854508 × CP (%) × BW (kg) + 0.0967347393 × NDF (%) × BW (kg) + -5.2553838048 × LysNE × BW (kg)

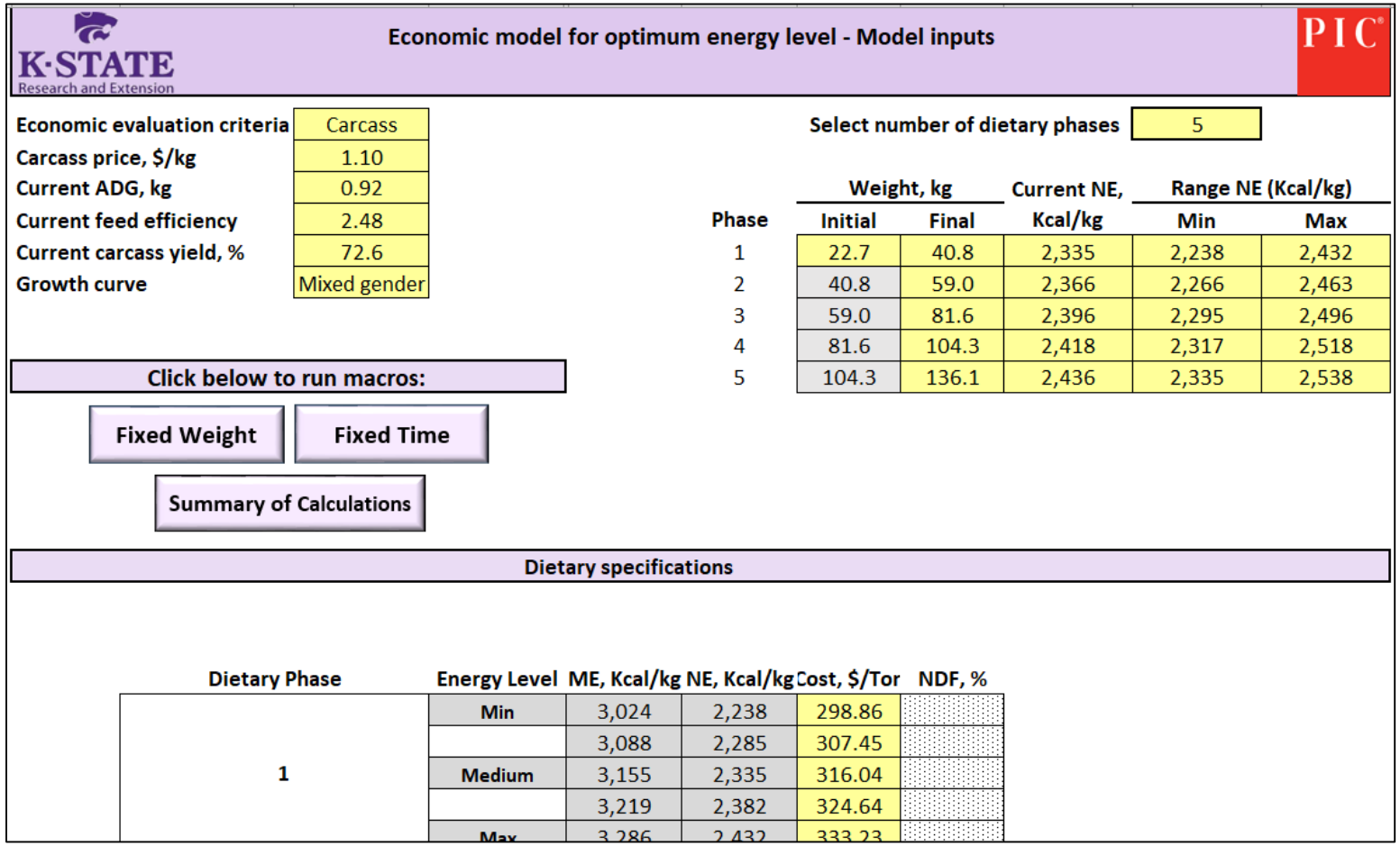
Updated Growth Performance modelling



Cordoba et al., 2024

G:F (g/kg) response = -232.8670000513 - 102.0339177026 × NE + 1386.8135453223 × SID Lys - 3.1583174866 × CP + 80.3303777865 × NDF - 115.1570451563 × Lys:NE + 4.1836503117 × BW + 2553.6417073224 × SID Lys × SID Lys + 228.757399518 × Lys:NE × Lys:NE + 12.736240264 × NE × CP - 24.4502664605 × NE × NDF - 23.0415882284 × SID Lys × CP + 101.5847297779 × SID Lys × NDF - 1559.9331198689 × SID Lys × Lys:NE - 3.9239483753 × SID Lys × BW - 0.1078600966 × CP × BW - 28.1879330488 × NDF × Lys:NE - 0.1153929924 × NDF × BW

Energy Economic Decision Tool



K-STATE Research and Extension

Economic model for optimum energy level - Model inputs

PIC

Economic evaluation criteria	Carcass
Carcass price, $/kg	1.10
Current ADG, kg	0.92
Current feed efficiency	2.48
Current carcass yield, %	72.6
Growth curve	Mixed gender

Select number of dietary phases: 5

Phase	Weight, kg Initial	Weight, kg Final	Current NE, Kcal/kg	Range NE (Kcal/kg) Min	Range NE (Kcal/kg) Max
1	22.7	40.8	2,335	2,238	2,432
2	40.8	59.0	2,366	2,266	2,463
3	59.0	81.6	2,396	2,295	2,496
4	81.6	104.3	2,418	2,317	2,518
5	104.3	136.1	2,436	2,335	2,538

Click below to run macros:

Fixed Weight | Fixed Time

Summary of Calculations

Dietary specifications

Dietary Phase	Energy Level	ME, Kcal/kg	NE, Kcal/kg	Cost, $/Tor	NDF, %
1	Min	3,024	2,238	298.86	
		3,088	2,285	307.45	
	Medium	3,155	2,335	316.04	
		3,219	2,382	324.64	
	Max	3,286	2,432	333.23	

Energy Economic Decision Tool

Current and recommended energy levels

Dietary Phase	Net energy, Kcal/kg			Metabolizable energy, Kcal/kg		
	Current	Recommended[1]	Difference, Kcal/kg	Current	Recommended[1]	Difference, Kcal/kg
Ph 1	2,335	2,238	-97	3155	3,024	-131
Ph 2	2,366	2,266	-99	3197	3,063	-134
Ph 3	2,396	2,295	-101	3238	3,101	-137
Ph 4	2,418	2,518	99	3268	3,402	134
Ph 5	2,436	2,538	101	3292	3,429	137

The current energy levels used in the diets can be adjusted to increase IOTC for the current scenario

Current and expected performance

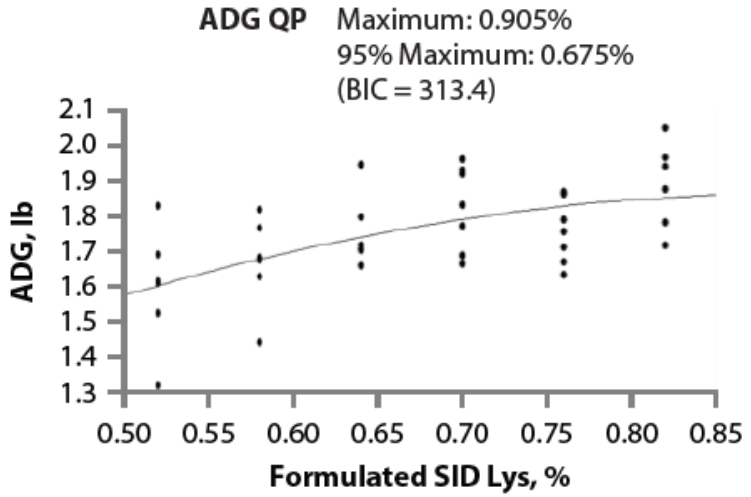
Metrics	Current	Recommended	Difference
ADG, kg	0.920	0.919	-0.1%
F/G	2.48	2.47	-0.2%
ADFI, kg	2.28	2.28	-0.3%
Carcass yield, %	72.6	73.8	1.6%
IOTC Carcass, $/pig			$1.86

Go to inputs

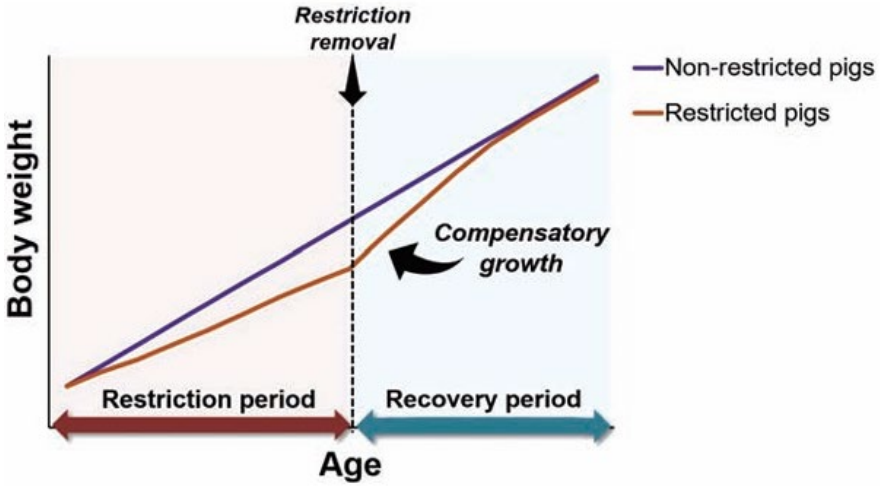
Go to metrics

Amino Acids: Lysine

- Ratio to dietary energy, SID Lys:Energy (NE or variation of ME)
- Diminishing returns when approaching requirement
- Genetic supplier recommendations & available tools



- Compensatory gain
  - During recovery period:
    - Improved feed efficiency
    - Increased protein deposition rate
- Some systems exploring:
  - Feed lower than SID Lys requirement early GF
  - At/near requirement late GF

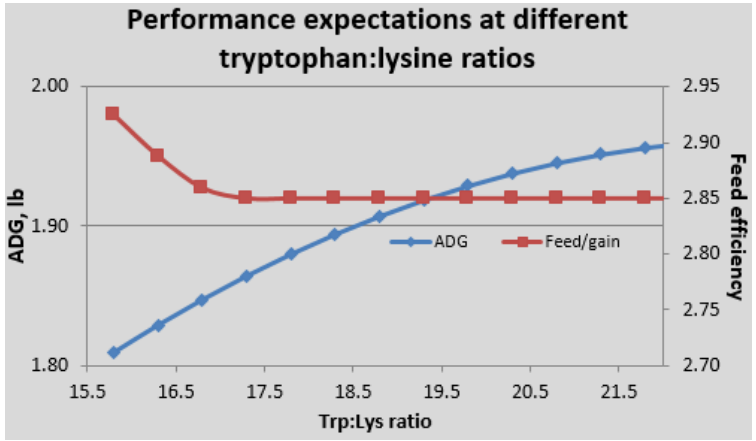


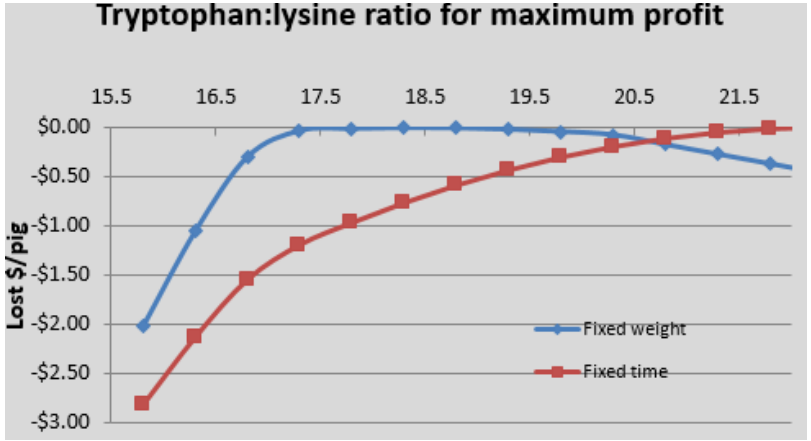
Amino Acid ratios

- SID Trp:Lys
  - Ratio depends on economics
  - Feed efficiency optimized at relatively low ratios
  - Growth rate continues to increase to higher ratios
  - What is the value of gain?

Table 1. Standardized ileal digestible tryptophan:lysine ratio at different target performance levels of finishing pigs (adapted from Goncalves et al., 2015).

	Percent of maximum performance, %					
Item	95%	96%	97%	98%	99%	100%
ADG	17.6%	18.3%	18.9%	19.8%	20.8%	23.5%
F/G	14.9%	15.3%	15.7%	16.1%	16.5%	16.9%



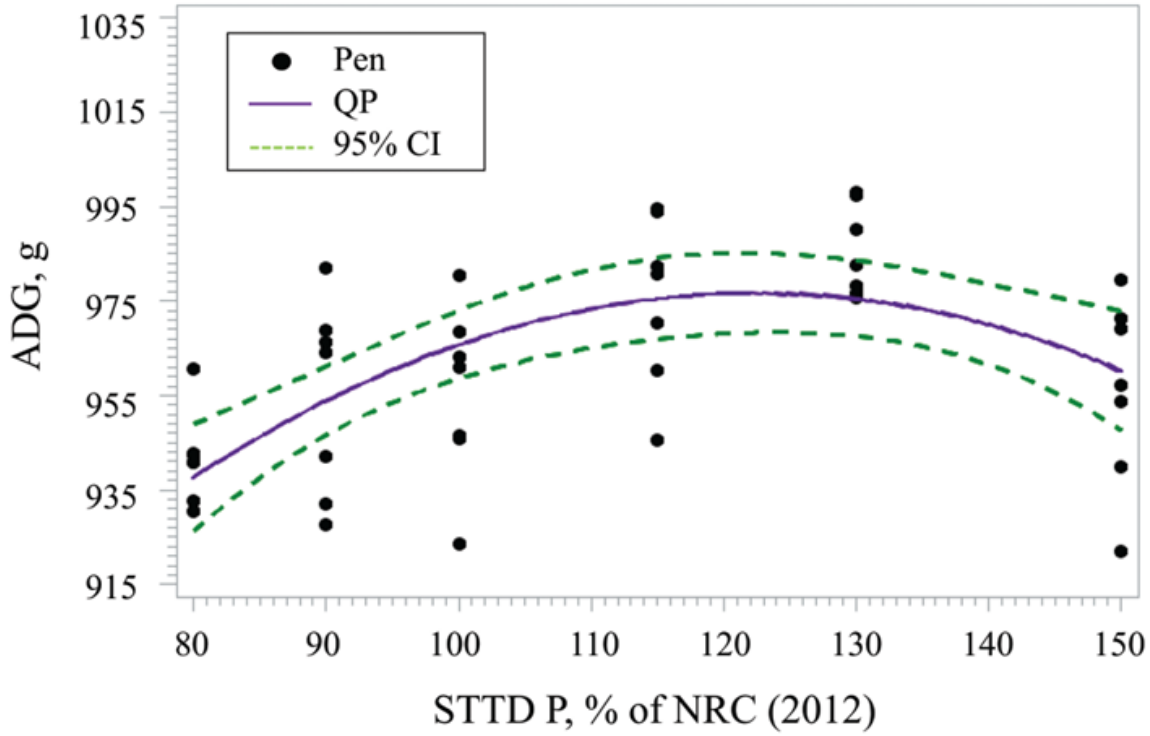


Takeaway: Amino acids

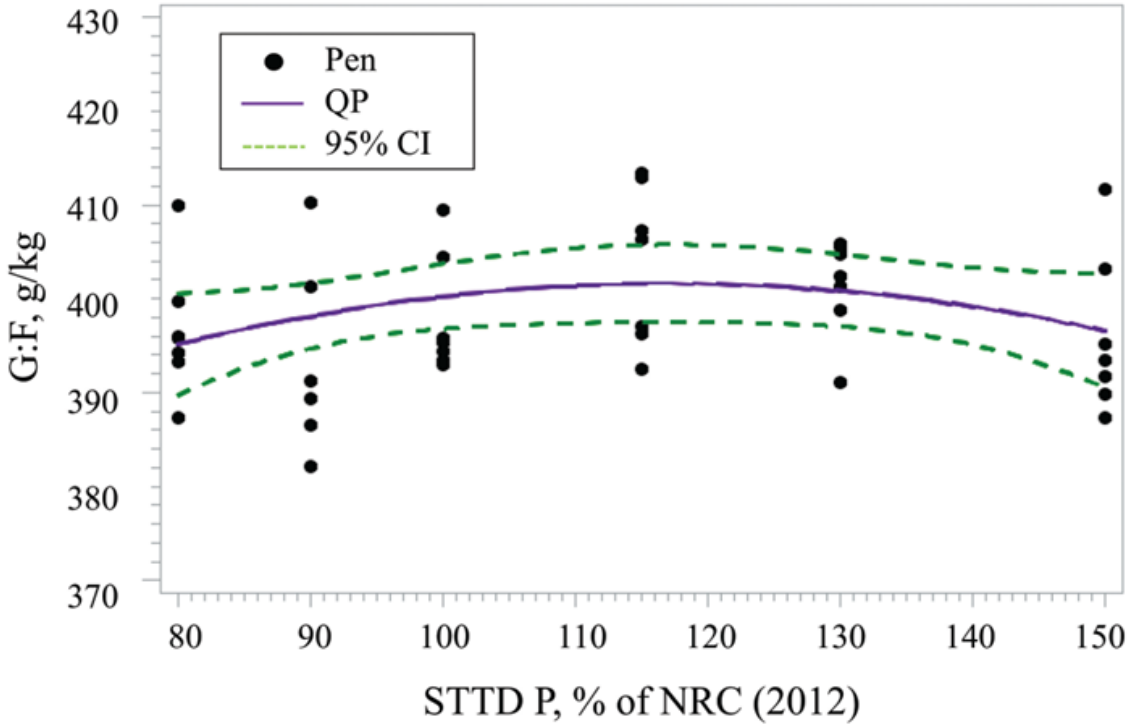
- Set lysine considering dietary energy level
  - Generally not profitable to feed below lysine requirement
  - Exception: Some room for compensatory gain/phase feeding
- Other amino acid ratios to lysine should be at requirement
  - AA deficiency worsens F/G, does not efficiently use other nutrients
- SID Trp:Lys ratio depending on value of gain

Phosphorous

Maximum ADG: 122% of NRC (2012)



Maximum GF: 116% of NRC (2012)

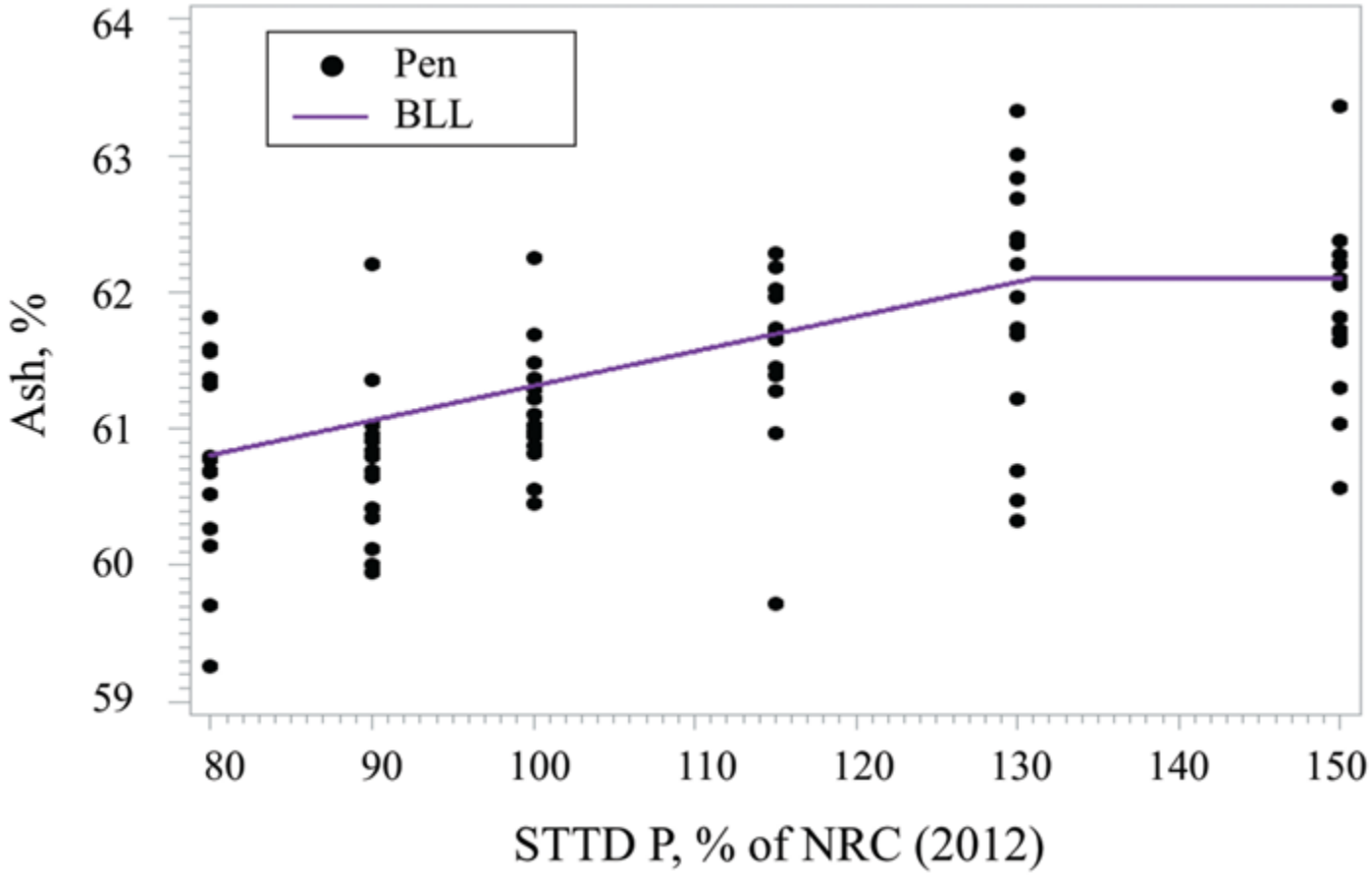


Vier et al., 2019

Phosphorous

- STTD P required to maximize bone ash is greater than required for growth

Bone Ash Breakpoint: 131% of NRC (2012)



Vier et al., 2019

Phosphorous

- Economic calculator available at:

www.ksuswine.org

Kansas State University | applied swine nutrition

Economic model for optimum phosphorus levels v2.0$^{\alpha}$

PIC

Input ***(please fill yellow cells)***

Economic evaluation criteria	Live
Live pig price, $/kg	$1.00
Facility cost, $/pig/day	$0.12

			Current diets			Biological requirement	
Phase	BW, kg		Energy, kcal NE/kg	STTD P, %	$/tonne	STTD P, %	$/tonne
1	23	34	2,457	0.39	$254.82	**0.41**	$255.66
2	34	57	2,503	0.35	$216.44	**0.37**	$217.05
3	57	79	2,542	0.31	$206.56	**0.32**	$206.78
4	79	100	2,553	0.28	$203.01	**0.29**	$203.17
5	100	116	2,553	0.26	$197.88	**0.26**	$197.88
6	116	132	2,551	0.26	$195.49	**0.25**	$195.49

Performance and economics output - Fixed Weight (space long)

Using PIC biological requirement levels will increase the current growth rate by 0.05% and worsen feed efficiency by 0.01%; however, resulting in losses of $0.07 per pig in IOFFC given the current ingredients and pig prices.

In this scenario, it isn't economical to feed PIC STTD phosphorus biological levels.

Performance and economics output - Fixed Time (space short)

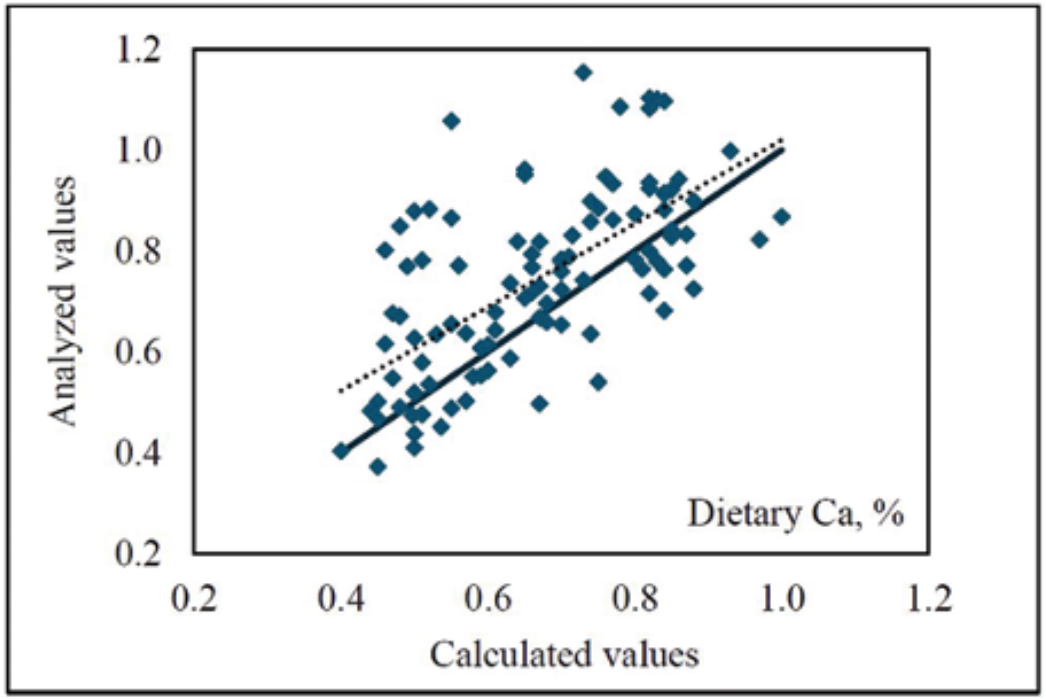
Using PIC biological requirement levels will increase the current growth rate by 0.05% and worsen feed efficiency by 0.01%; however, resulting in losses of $0.05 per pig in IOFC given the current ingredients and pig prices.

In this scenario, it isn't economical to feed PIC STTD phosphorus biological levels.

Calcium

- Fairly wide range in Ca:P can be fed.
- Ca:P ratio of 1.10-1.20 often appropriate
- Moving towards STTD Ca:STTD P as ingredient digestibility values continue to improve.
- Wider Ca:P ratio required to maximize bone mineralization compared to growth.
- Wide Ca:P ratio can reduce growth when STTD P below requirement.
  - Reduces digestibility of P

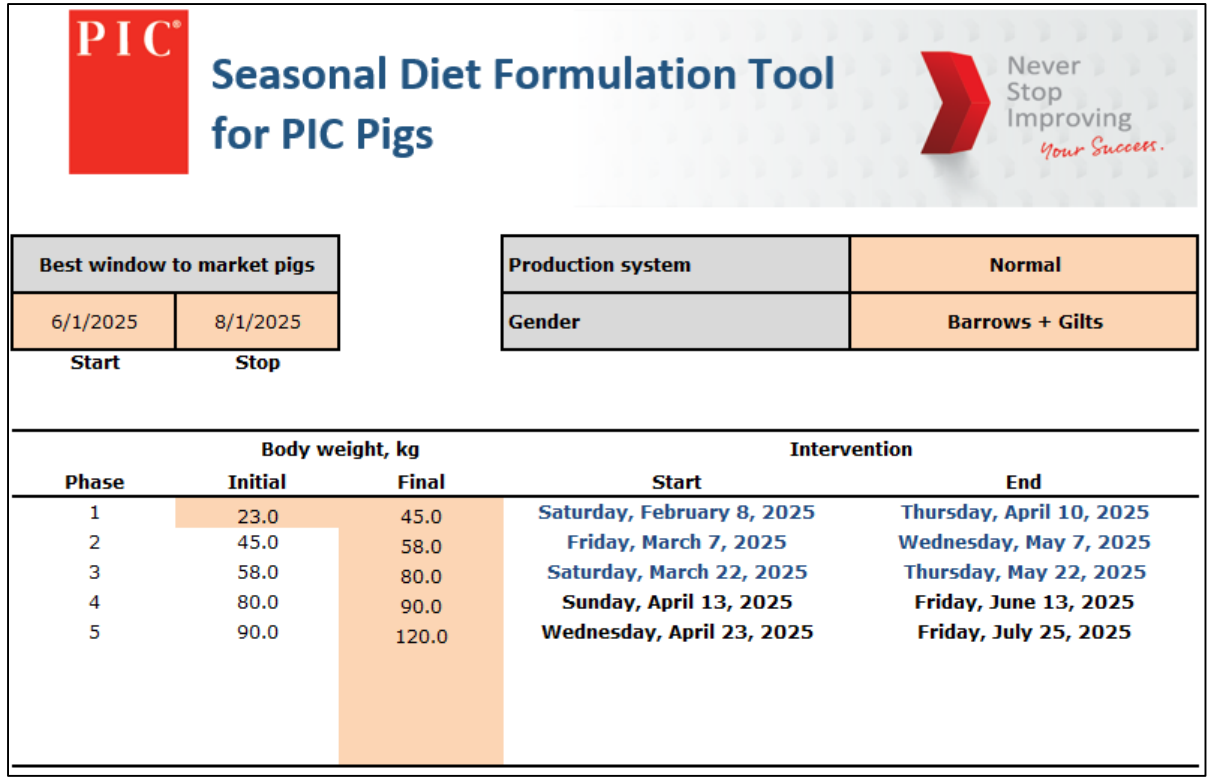
Lagos et al., 2023



Diets often have 0.10-0.20% analyzed Ca higher than formulated level.

Feed Additives

- Variety of feed additives have potential to improve producer profitability.
- Value often greatest for pigs marketed during highest revenue time of year.
- If using seasonally, generally start using these strategies in February.



PIC

Seasonal Diet Formulation Tool for PIC Pigs

Never Stop Improving *Your Success.*

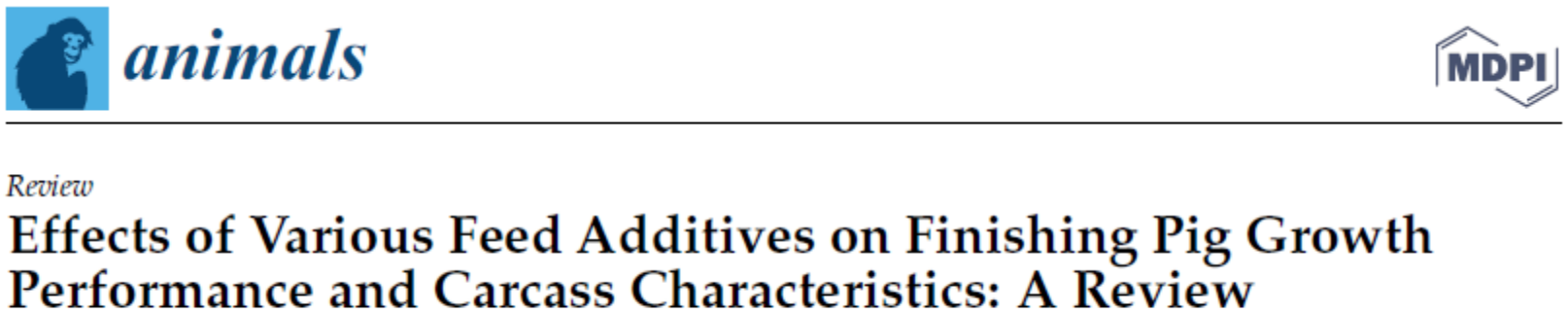
Best window to market pigs	
6/1/2025	8/1/2025
Start	Stop

Production system	Normal
Gender	Barrows + Gilts

	Body weight, kg		Intervention	
Phase	Initial	Final	Start	End
1	23.0	45.0	Saturday, February 8, 2025	Thursday, April 10, 2025
2	45.0	58.0	Friday, March 7, 2025	Wednesday, May 7, 2025
3	58.0	80.0	Saturday, March 22, 2025	Thursday, May 22, 2025
4	80.0	90.0	Sunday, April 13, 2025	Friday, June 13, 2025
5	90.0	120.0	Wednesday, April 23, 2025	Friday, July 25, 2025

Feed Additives

- Tons of information and data
- Best strategy is to evaluate in your production system.
  - Not always feasible
- Literature review summarizing 402 papers



animals

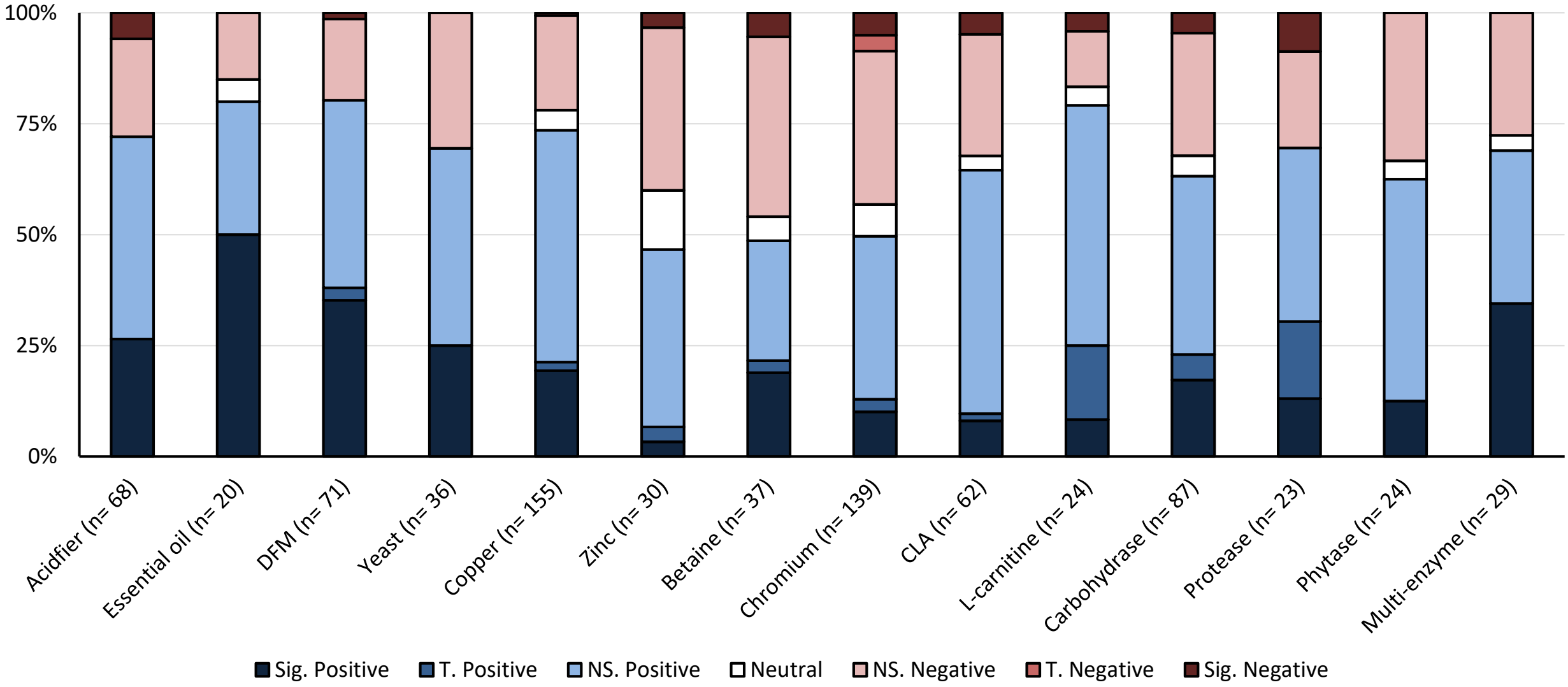
MDPI

Review

Effects of Various Feed Additives on Finishing Pig Growth Performance and Carcass Characteristics: A Review

Zhong-Xing Rao [1], Mike D. Tokach [1], Jason C. Woodworth [1], Joel M. DeRouchey [1], Robert D. Goodband [1,*] and Jordan T. Gebhardt [2]

Summary - ADG

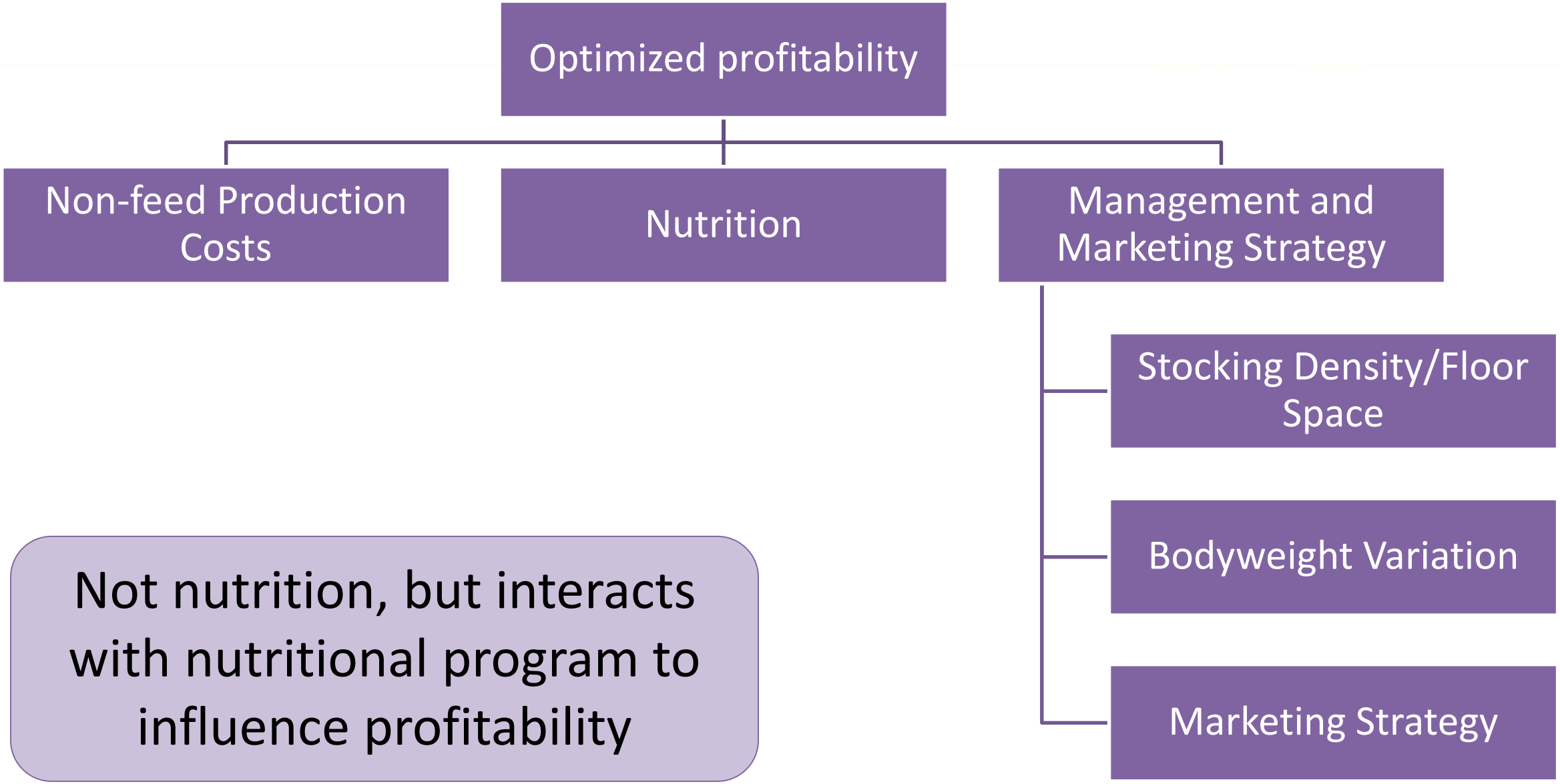

100%
75%
50%
25%
0%
Acidfier (n= 68)
Essential oil (n= 20)
DFM (n= 71)
Yeast (n= 36)
Copper (n= 155)
Zinc (n= 30)
Betaine (n= 37)
Chromium (n= 139)
CLA (n= 62)
L-carnitine (n= 24)
Carbohydrase (n= 87)
Protease (n= 23)
Phytase (n= 24)
Multi-enzyme (n= 29)
Sig. Positive
T. Positive
NS. Positive
Neutral
NS. Negative
T. Negative
Sig. Negative

Results of additives on grow-finish pigs

ADG		Number of comparisons	
		< 36	≥ 36
Improvement	< 1.5 %	Proteases, Phytases, Zn	Carbohydrases, Betaine, Cr, CLA
	≥ 1.5 %	Multi-enzymes, Essential oils, L-carnitine	Acidifiers, Cu, DFM, Yeasts

Copper

- Sources: $CuSO_4$, TBCC, organic chelates
- Requirement is 3-4 ppm in grow-finish
- Variety of levels fed, often 125-150 ppm in grow-finish
  - 2.0-2.5 kg improvement in market weight
- Depending on economics, feed when gain is most valuable

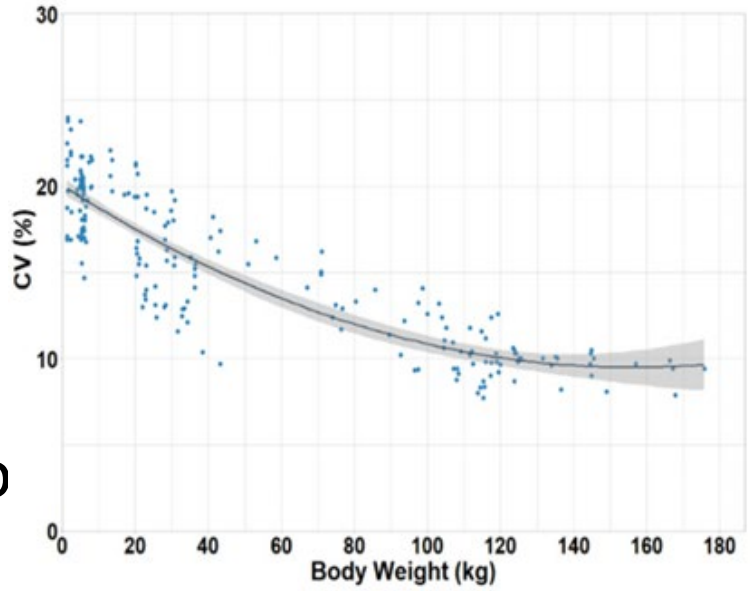


Not nutrition, but interacts with nutritional program to influence profitability

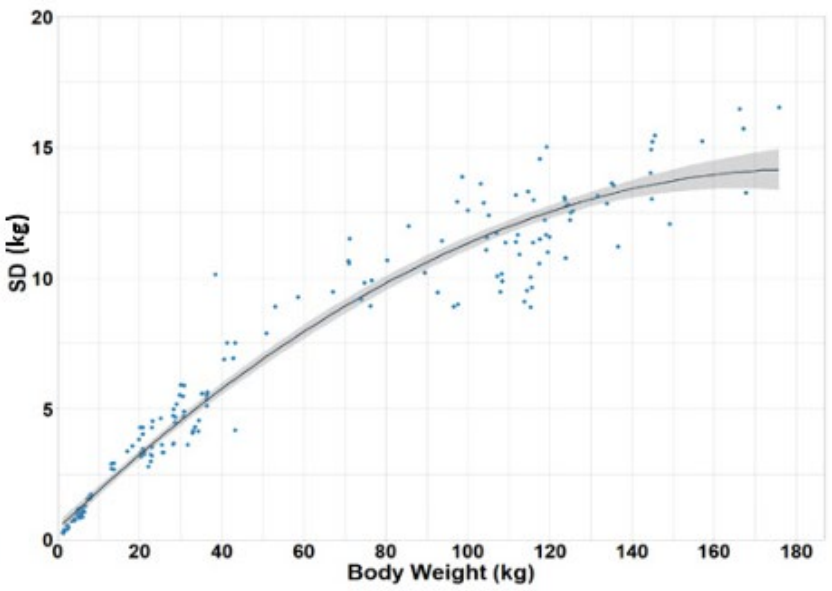
Bodyweight variation

- Weight variation is a part of biology
- CV decreases as pigs age (but SD increases)
- Health issues can greatly increase CV
- Nutritional & management strategies to reduce variation have been variable.

Coefficient of Variation



Standard Deviation



$$CV\ (\%) = 20.04 - 0.135 \times BW + 0.00043 \times BW^2$$

Tolosa et al., 2021

Stocking density/Floor Space

- Increasing floor space:
  - ↑ ADG, ADFI, feed efficiency
- Highly dependent upon amount of space available in system.
- Calculator available at:
  - www.ksuswine.org

	Adjustment observation	Input information required (Can do five estimates) 1	2	3	4	5	Values from equation develop. Mean	Min	Max
Initial BW, lbs	50	50	50	50	50	50	108	40	260
Final BW, lbs	280	280	280	280	280	280	231	99	311
Floor space/pig, ft^2	7.0	7.0	7.8	8.8	10.0	11.7	7.3	2.3	15.0
Observed ADG, lb	1.9								
Observed ADFI, lb	5.7								
k value	0.0255	0.0253	0.0282	0.0318	0.0362	0.0423	0.0301	0.0164	0.0520
Growth measurement estimates									
ADG, lb/d		1.90	1.93	1.96	1.98	1.97			
ADFI, lb/d		5.70	5.75	5.79	5.82	5.80			
G:F		0.333	0.336	0.339	0.341	0.340			
Feed/gain		3.00	2.98	2.95	2.94	2.94			
ADG % change from Estimate 1		---	1.8%	3.4%	4.4%	4.0%			
% change from previous estimate		---	1.8%	1.6%	1.0%	-0.4%			
ADFI % change from Estimate 1		---	0.9%	1.7%	2.1%	1.8%			
% change from previous estimate		---	0.9%	0.8%	0.4%	-0.3%			
G:F Percentage change from Estimate 1		---	0.9%	1.7%	2.2%	2.2%			
% change from previous estimate		---	0.9%	0.8%	0.5%	0.0%			
F/G Percentage change from Estimate 1		---	0.9%	1.7%	2.2%	2.1%			
% change from previous estimate		---	0.9%	0.8%	0.5%	0.0%			

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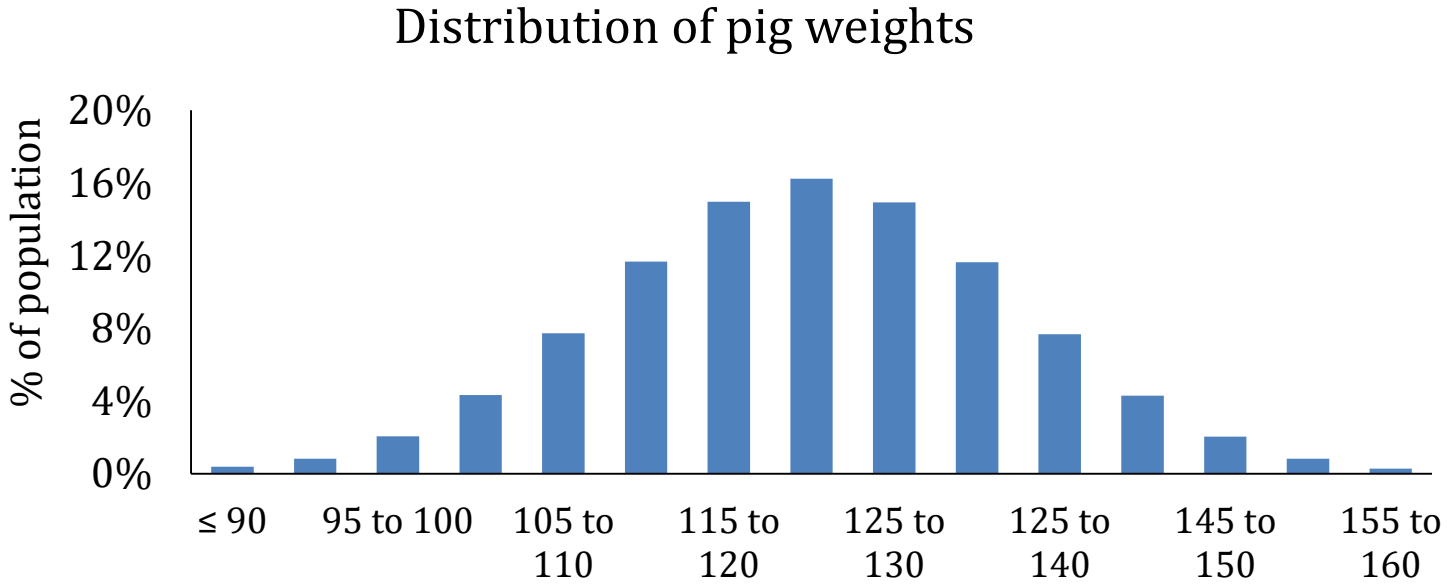
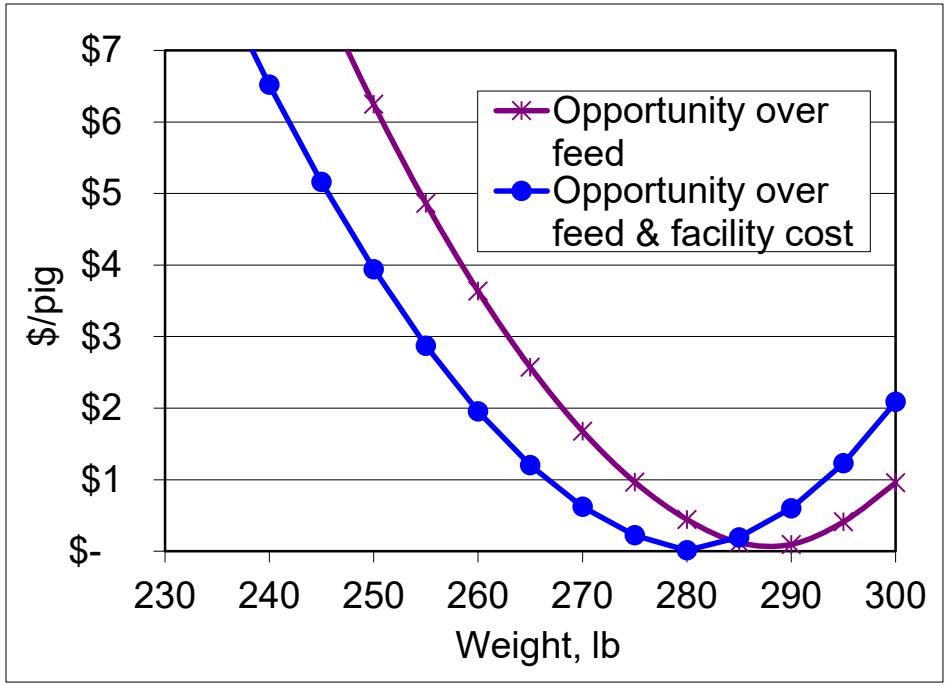
Marketing strategy

- <u>Goal:</u> Get the right pigs to market at the right weight to optimize profitability
- Huge opportunity cost if not done correctly
- Depends heavily on plant and grid used
- Skilled marketing personnel are highly valuable





Key takeaways

- Understand goals
- Nutritional considerations
  - Energy
  - Amino acids
  - P & Ca
  - Feed Additives

- Management and Marketing Strategy
- Lots of tools, calculators, and resources available (universities, genetic suppliers)

Kansas State University | applied swine nutrition

K-State home » College of Agriculture » ASI » Extension » Swine

KSU Swine
Events
Resources
Swine Facilities
Swine Nutrition Guide

Upcoming Events

KSU Swine Day
November 21, 2024

Swine Profitability Conference
February 4, 2025

Swine Extension

The Kansas State University Swine Extension program takes practical swine nutrition research and works with producers to facilitate rapid adoption of technology by the industry. The program also works with producers in the area of environmental management of swine facilities.

Upcoming Events
Quick Links

Swine Nutrition Resources

- Swine Nutrition Guide - 2019 Edition
- Feed Safety Resources
- Premix & Diet Recommendations
- Calculators & Tools

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