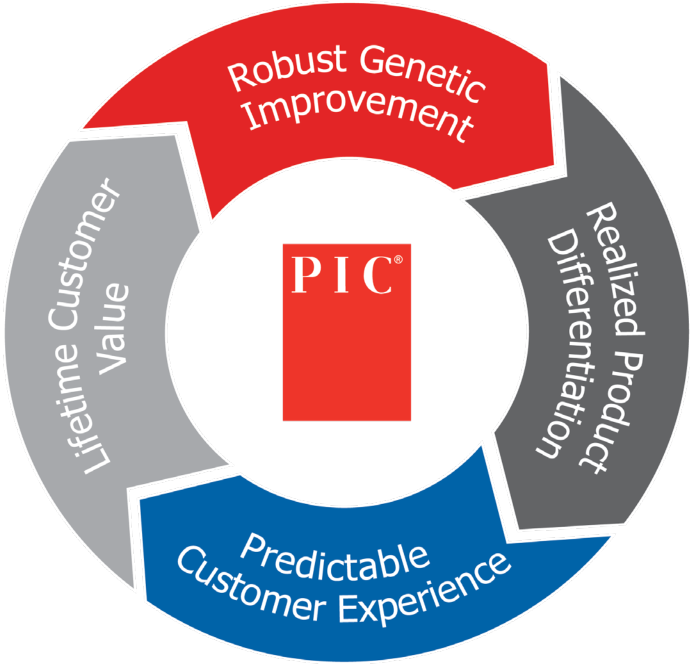


Updated Recommendations for Feeding Developing Gilts and Gestating/Lactating Sows

Carine Vier, D.V.M., Ph.D.
Nutrition Specialist, PIC

dsm-firmenich

Key Takeaways

1. There might be advantages to control growth of developing gilts.
2. Heavier gilts will be heavier throughout their lifetime.
3. Focus on thin body condition to improve longevity.
4. Simplify gestation feeding and track progress.
5. There is tremendous amount of variation in lactation feed intake.

Develop Females for Maximum Lifetime Production

Key components of gilt eligibility

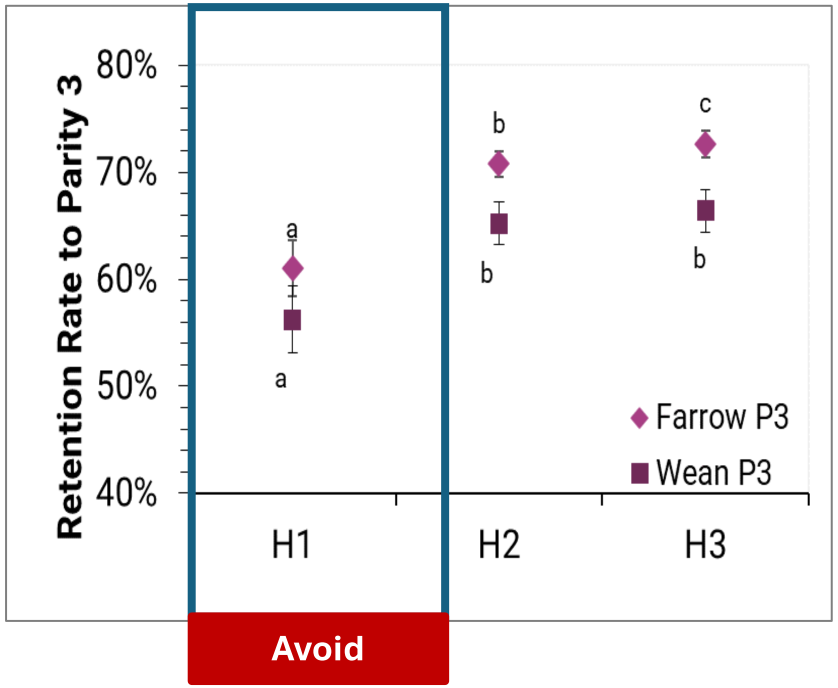
- Number of estrus at breeding
- Age at puberty
- Age at 1st breeding
- Weight at 1st breeding

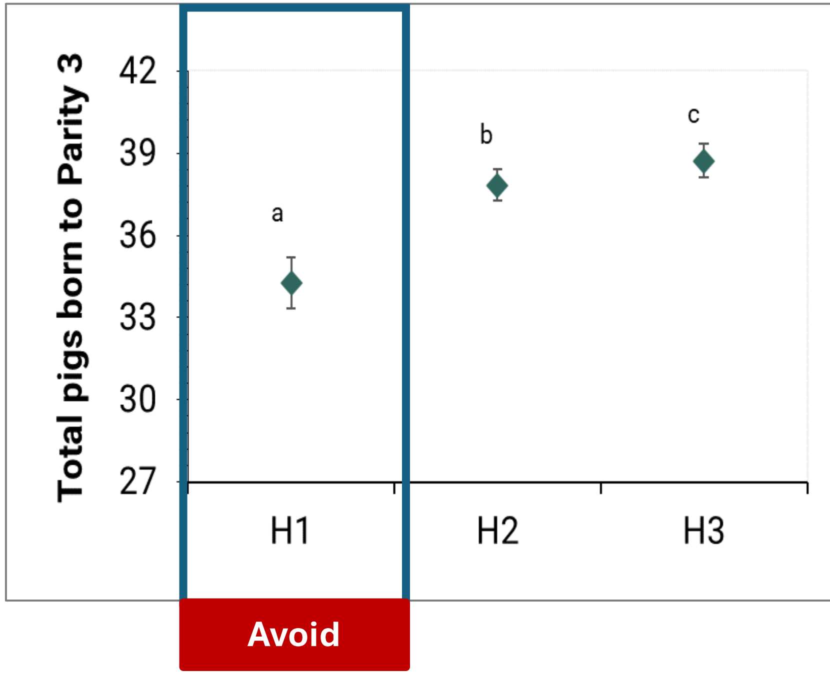
Develop Females for Maximum Lifetime Production

Key components of gilt eligibility

Number of estrus at breeding

- Physiological age is more important than chronological age
- Foxcroft & Patterson, 2010.
- Delaying to the second estrus can improve litter size
- Aherne et al., 1991; Levis, 2000.





Gilts bred at second estrus detected have a greater retention and pig born to third parity

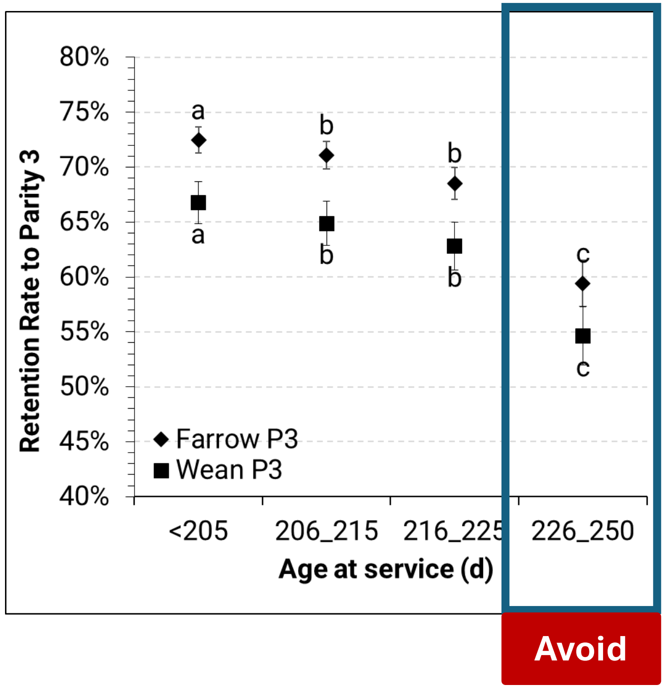
Patterson et al., 2020

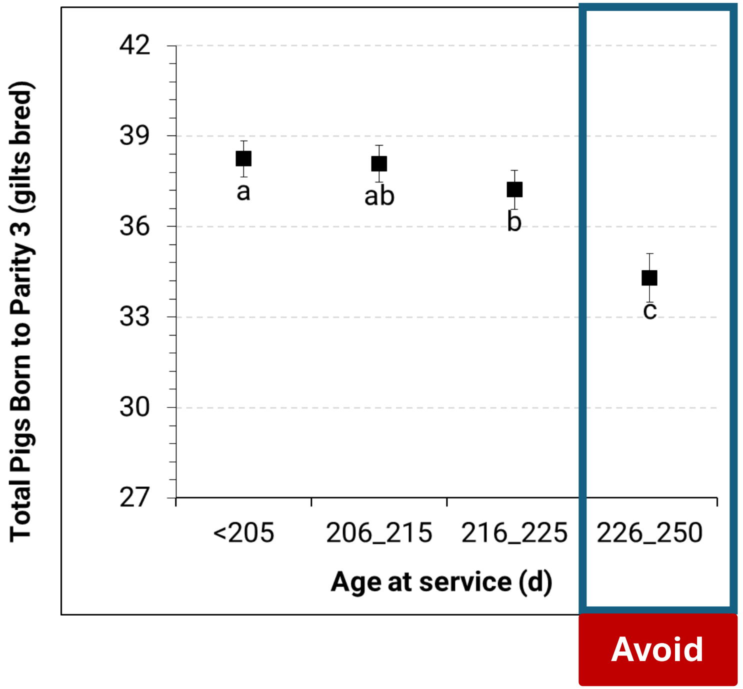
Develop Females for Maximum Lifetime Production

Key components of gilt eligibility

Age at Puberty and Age at First Breeding

- Early puberty is linked to age at breeding, impacting longevity, non-productive days, and lifetime productivity
- Tart et al., 2013; Koketsu et al., 2017; 2020, Li et al., 2018, Patterson et al., 2019





Gilts with puberty <195d and bred at <225 days have a greater retention and pigs born to third parity

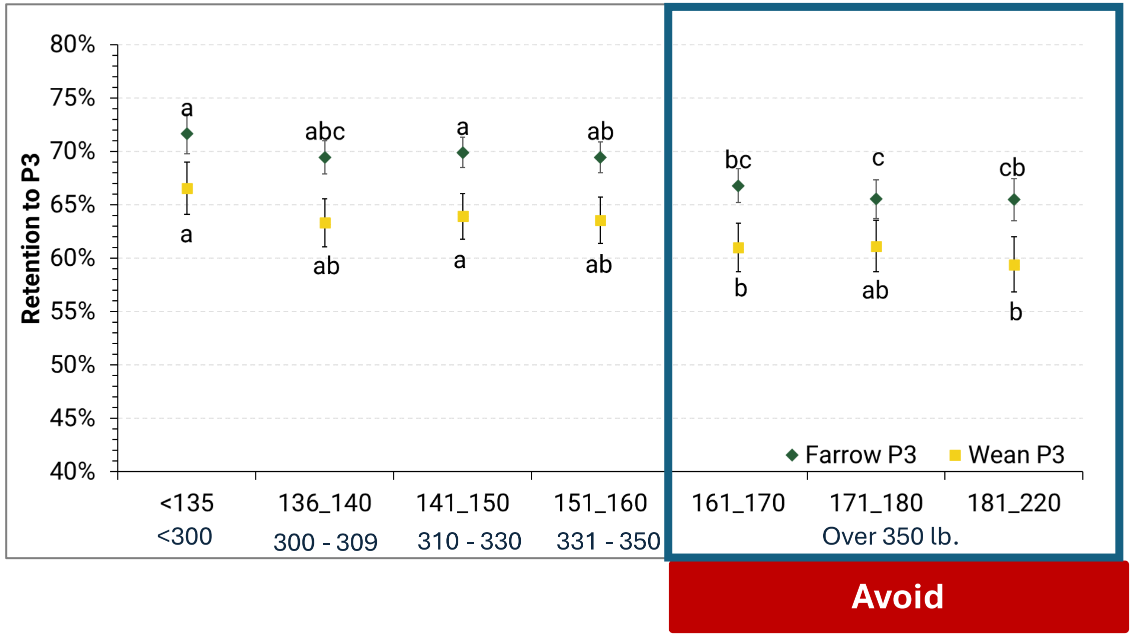
Patterson et al., 2020

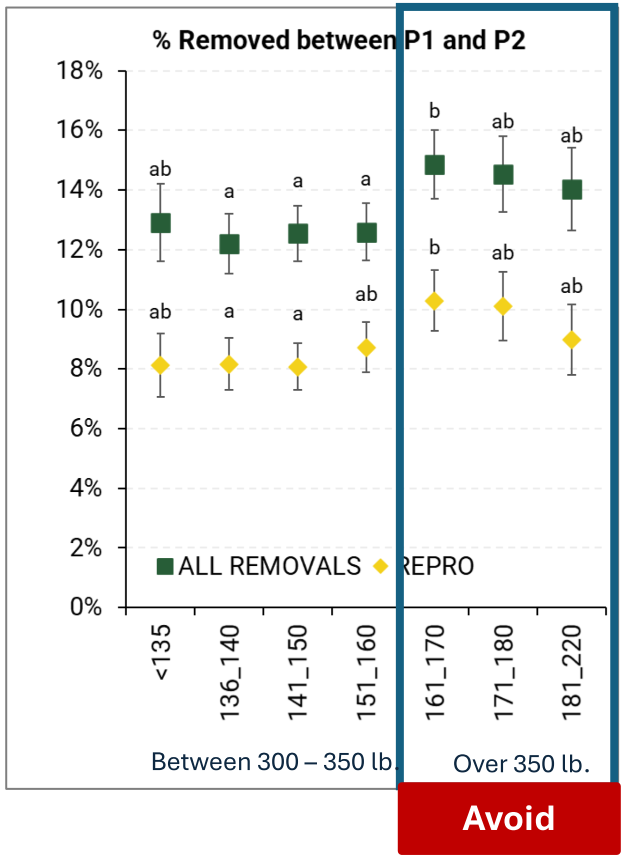
Develop Females for Maximum Lifetime Production

Key components of gilt eligibility

Weight at breeding

- Recommended weight between 135-160 kg (300-350 lbs)
- Williams et al., 2015; Bortolozzo et al., 2016; Patterson et al, 2020.



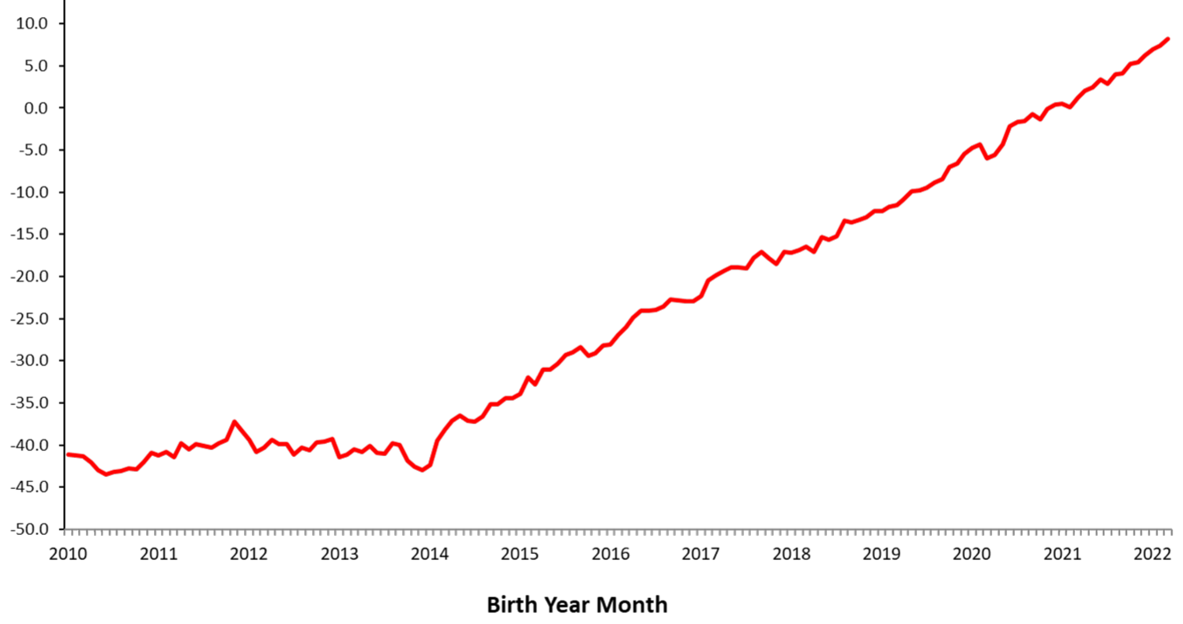


Gilts bred at >350 lb. (160 kg.) have a lower retention specifically between P1 and P2.

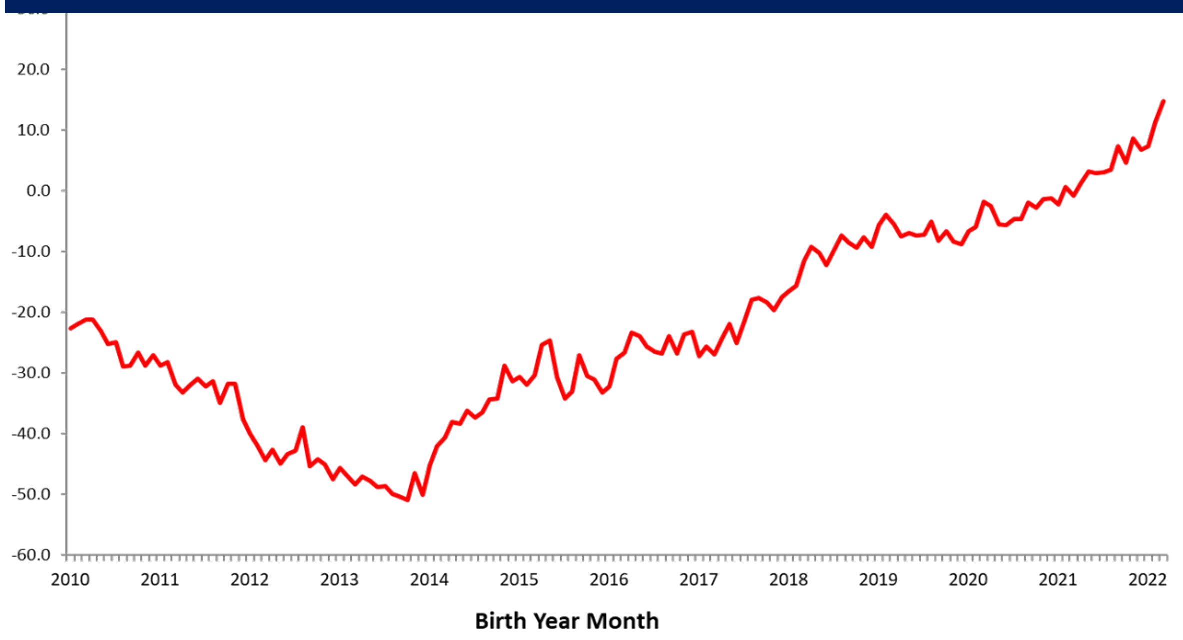
Patterson et al., 2020

Genetic Improvement for Growth Over the Years

Terminal lines



Maternal lines



Terminal lifetime daily gain from 2014 to 2022 : **+ 68 g/d (0.150 lb/d**

Maternal lifetime daily gain from 2014 to 2022: **+ 63 g/d (0.139 lb/d)**

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* Data from PIC Global Genetic Development
* Terminal lines: average of line 15, 27 and 65; maternal lines: average of lines 2 and 3
* WDA = weight per d of age; vertical axis is normalized to zero average for last 2 years

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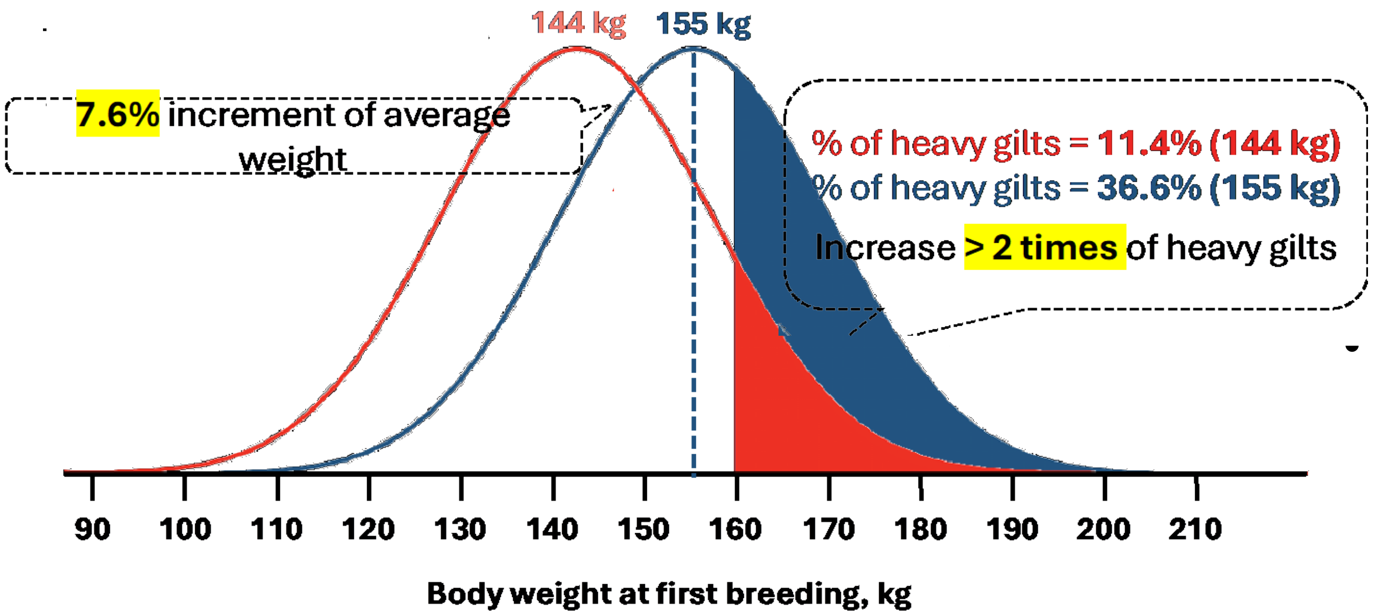
Impact of Increasing Growth Potential

Increasing average weight at first breeding (d210 of age) significantly increased the % of heavy gilts (> 160 kg or 350 lbs)



Heavy gilts at breeding:

- Have increased risk of:
  - Lower retention to P3 (Patterson et al., 2020).
  - Locomotion problems (Amaral Filha, et al,. 2008).
  - Development of osteochondrosis (de Koning et al., 2013).
  - Stillborns (Amaral Filha et al., 2008; Bortolozzo et al., 2009; Faccin et al., 2017).
- Are heavier throughout their whole life (Orlando et al., 2023).
  - Have more demands for maintenance (Bortolozzo et al., 2009).

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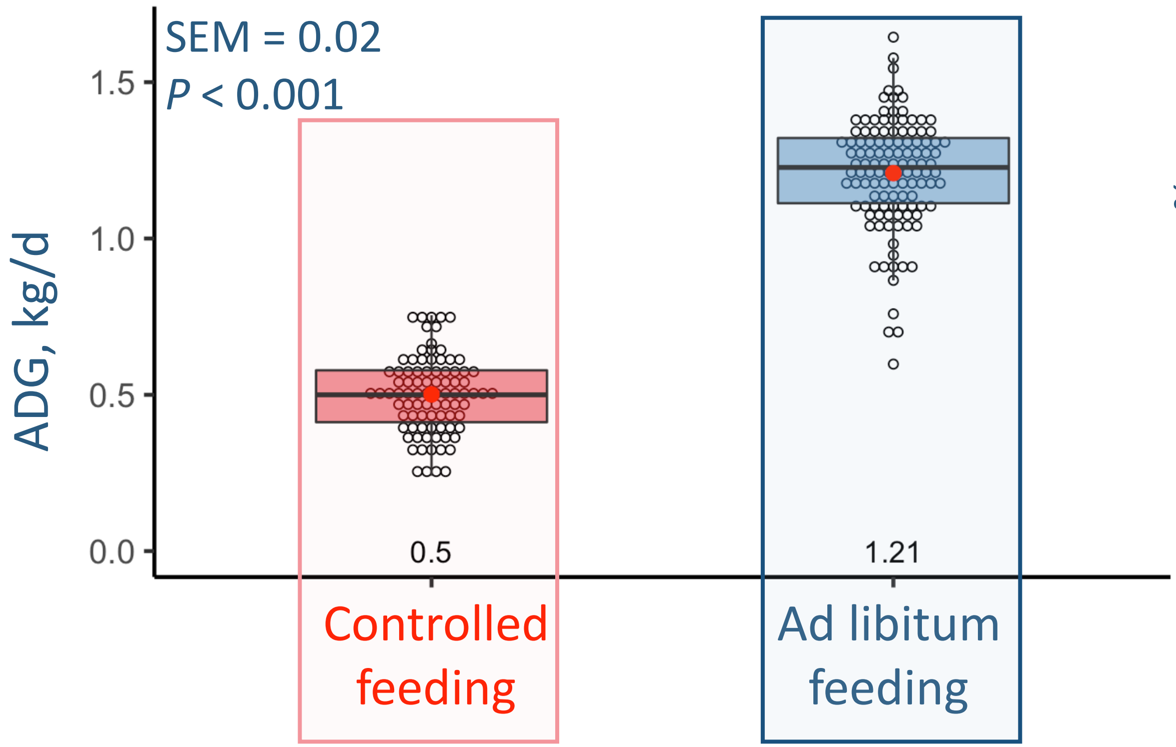
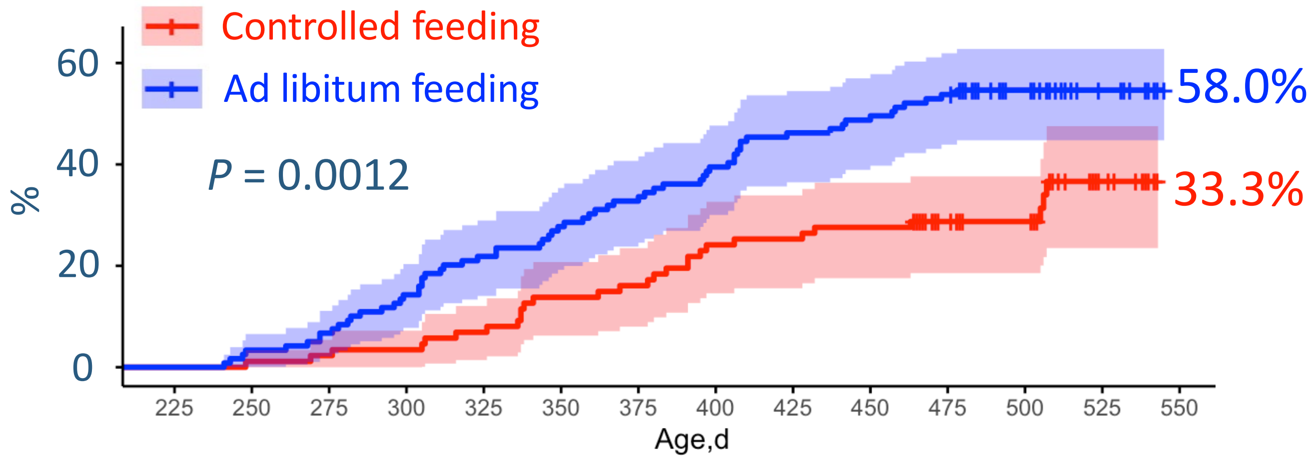
Impact of Controlling Growth Rate

Controlling growth rate of boars from 140 to 200 d of age improved longevity with no adverse impact on semen production

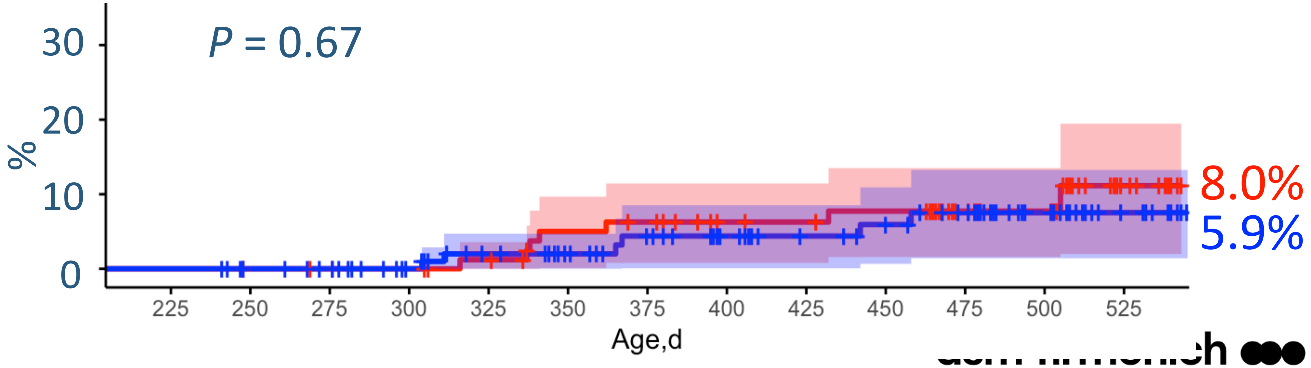
Average daily gain



Removal % for ALL reasons by 525 d of age



Removal % for SEMEN QUALITY reasons by 525 d of age



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* Lu et al. 2022

* Data from 206 boar L15

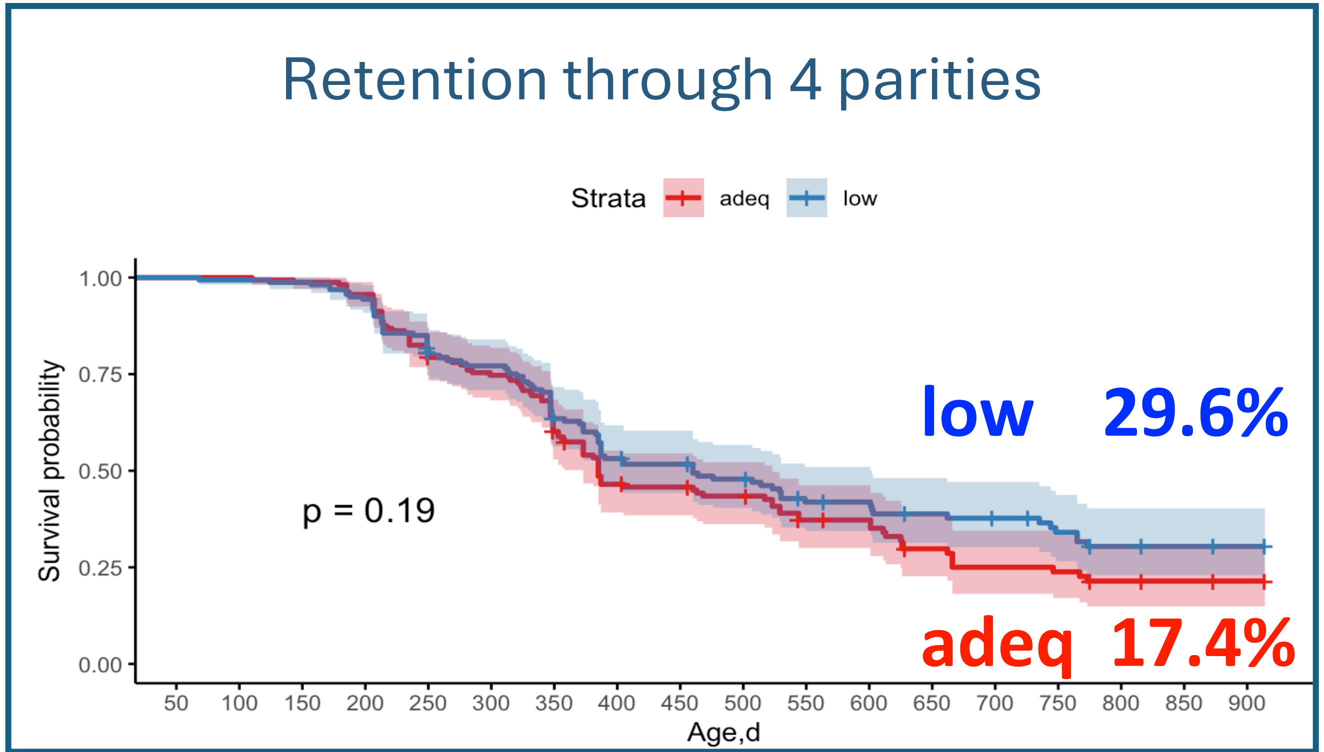
Impact of Controlling Growth Rate

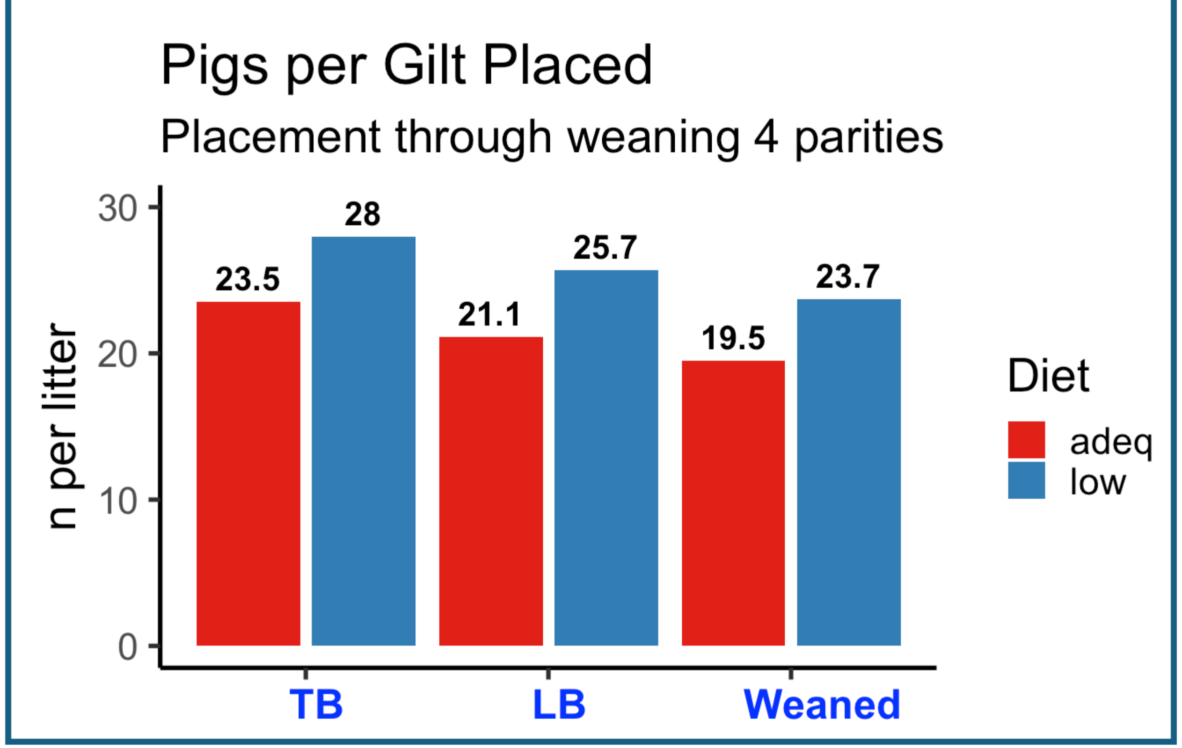
- **Objective:** To evaluate effects of reduced growth in developing gilts by dietary manipulation on longevity and reproductive performance.
- **Project 1: Tsai et al., MW ASAS 2023 Meeting**
  - 3 groups x 64 gilts per group
  - Period Nutritional Tx Applied: 14 weeks (55 kg BW) to 26 weeks of age
  - **Nutritional Tx:**
    - **Adequate** = Corn/SBM based diet to meet PIC recommendations
    - **Low** = SID lys and ME levels were reduced by ~0.15% and ~150 kcal/kg

Impact of Controlling Growth Rate

Item	adeq	low	*P*-value
ADG, lb (g)	2.16 (980)	2.02 (916)	<0.05
F/G	2.73	3.02	<0.05
BW, lb (kg)	317 (144)	303 (137)	<0.05

Tsai et al., 2023





Impact of Controlling Growth Rate

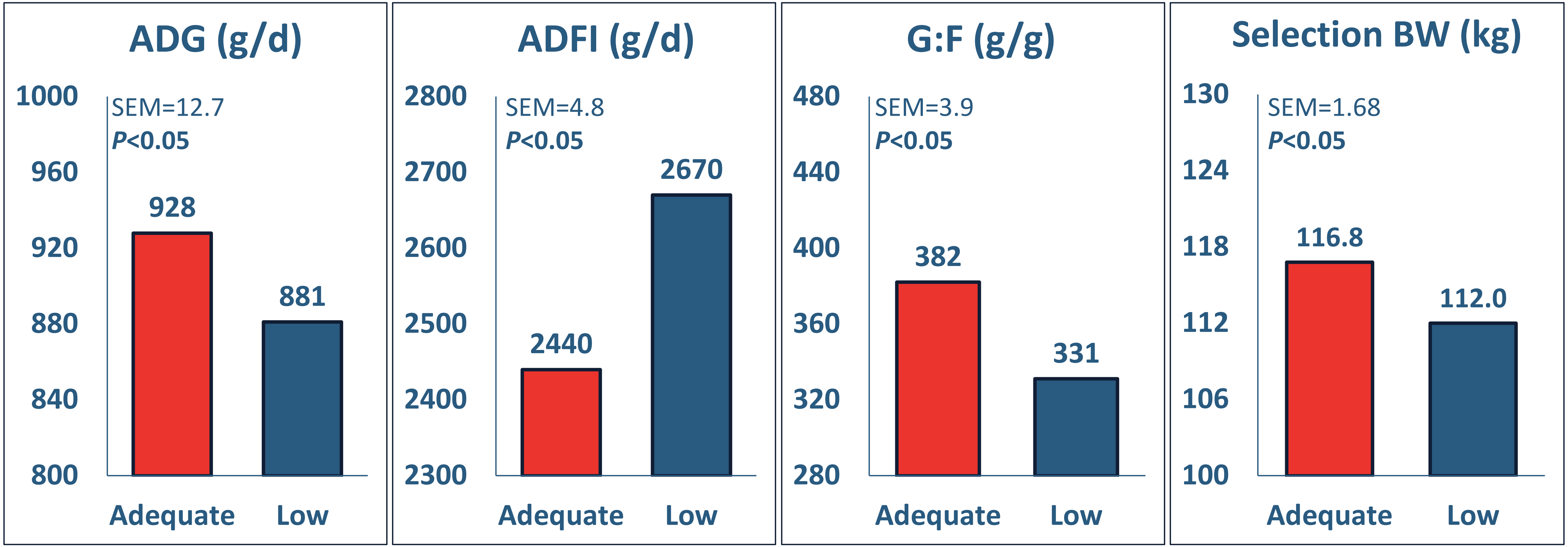
- **Objective:** To evaluate effects of reduced growth in developing gilts by dietary manipulation on longevity and reproductive performance.

- **Project 2: Leiva et al., MW ASAS 2023 Meeting**
  - 810 gilts from 3 different birth week lots
  - Period Nutritional Tx Applied: at 10 weeks (26 kg BW) to HNS
  - **Adequate** = Corn/SBM/Wheat midds based diet to meet PIC recommendations with a total dietary fiber (TDF) content of 10, 10, and 11%;
  - **Low** = corn/SBM/wheat midds/corn germ where SID Lys was reduced by 6, 11, and 11%, energy level was reduced by 2.7, 4.6, and 4.7%, and TDF content was increased to 15, 18, and 20%

Impact of Controlling Growth Rate

Gilt **Growing Period** Performance

First group with 810 Camborough gilts



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Leiva et al., 2023

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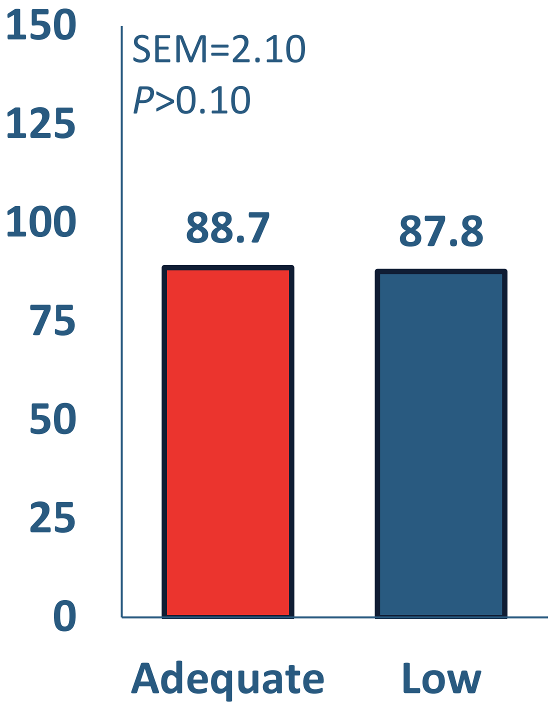
Impact of Controlling Growth Rate

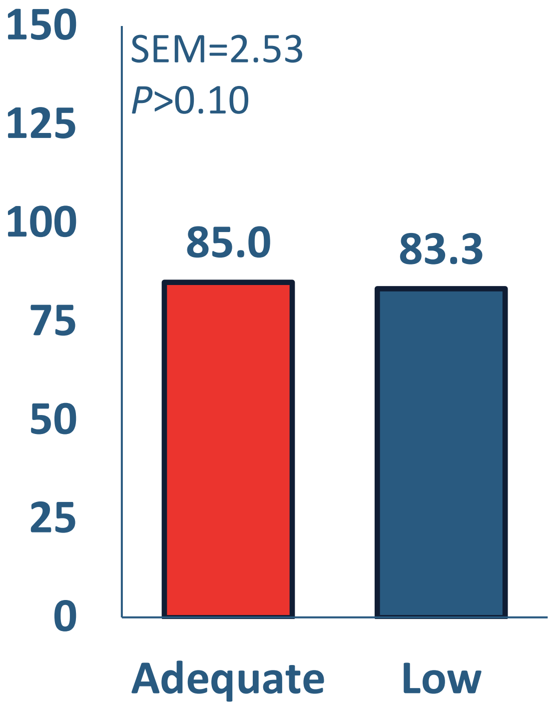
Gilt **Reproductive** Performance

First group with 810 Camborough gilts

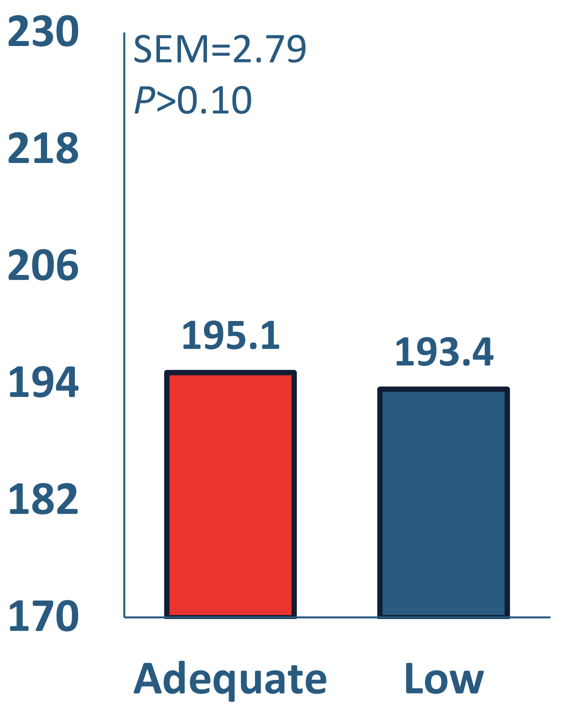
Selection Rate (%)



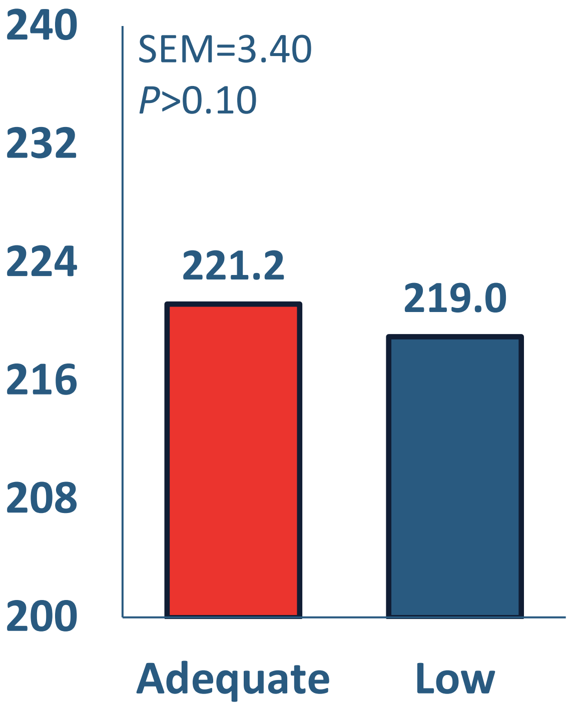
Breeding Rate (%)



Age at HNS (d)



Age at Breeding (d)

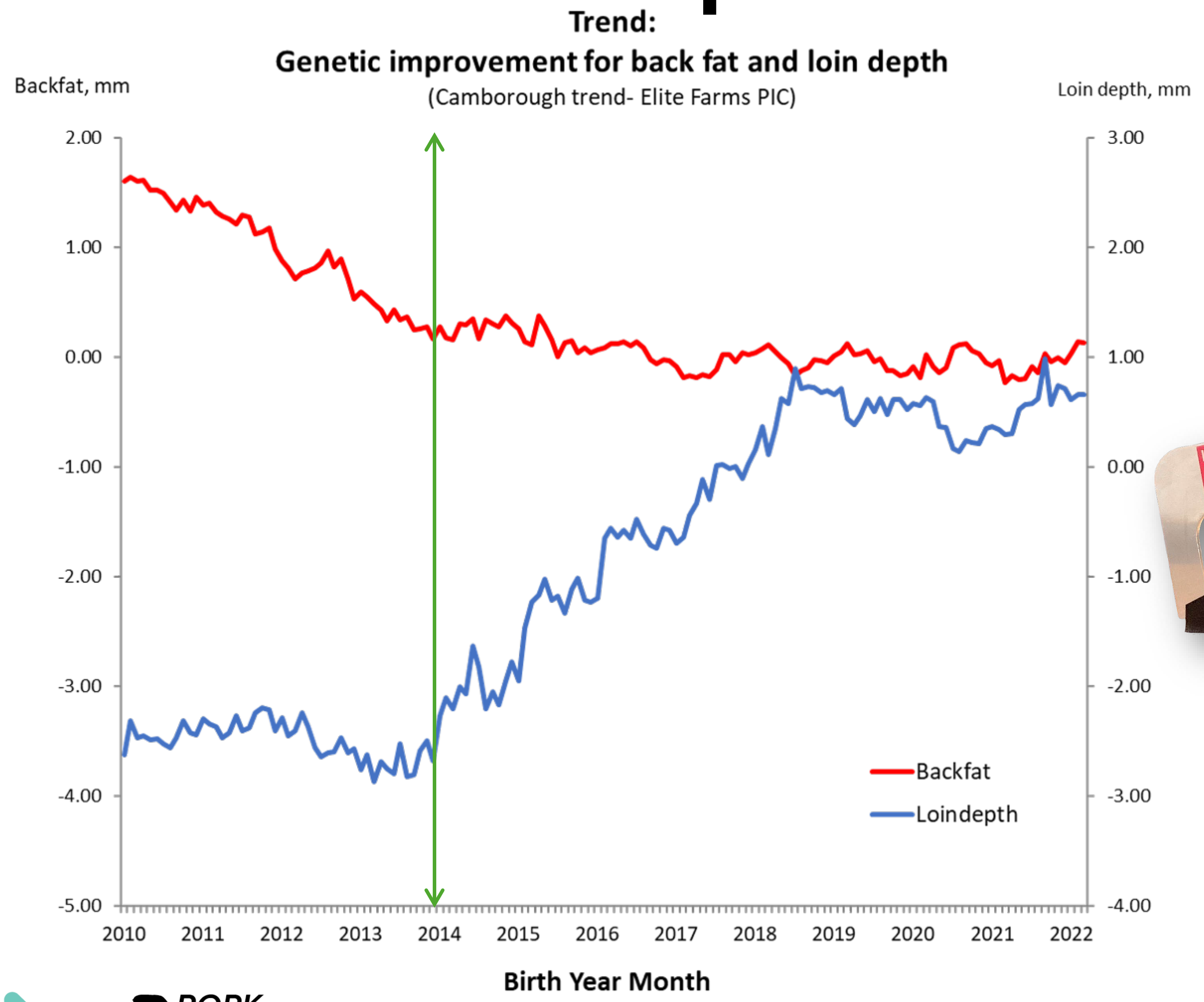


Leiva et al., 2023

Impact of Controlling Growth Rate

- What is the appropriate age to start applying strategies to slow down growth?
- What is the balance between reducing growth without resulting in abnormal behaviors?
- Compensatory growth?
- Are there practical ways to quantitatively control growth in GDUs?
- What is the minimum age to breed gilts (because younger means lighter) without negatively impacting reproduction and longevity?

Genetic Improvement Over the Years



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Categories:

1. Risk: Skinny condition
2. Recovery: Under condition
3. Target: Ideal condition
4. Risk: Over condition

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* Data from PIC Global Genetic Development
* Maternal lines: average of lines 2 and 3

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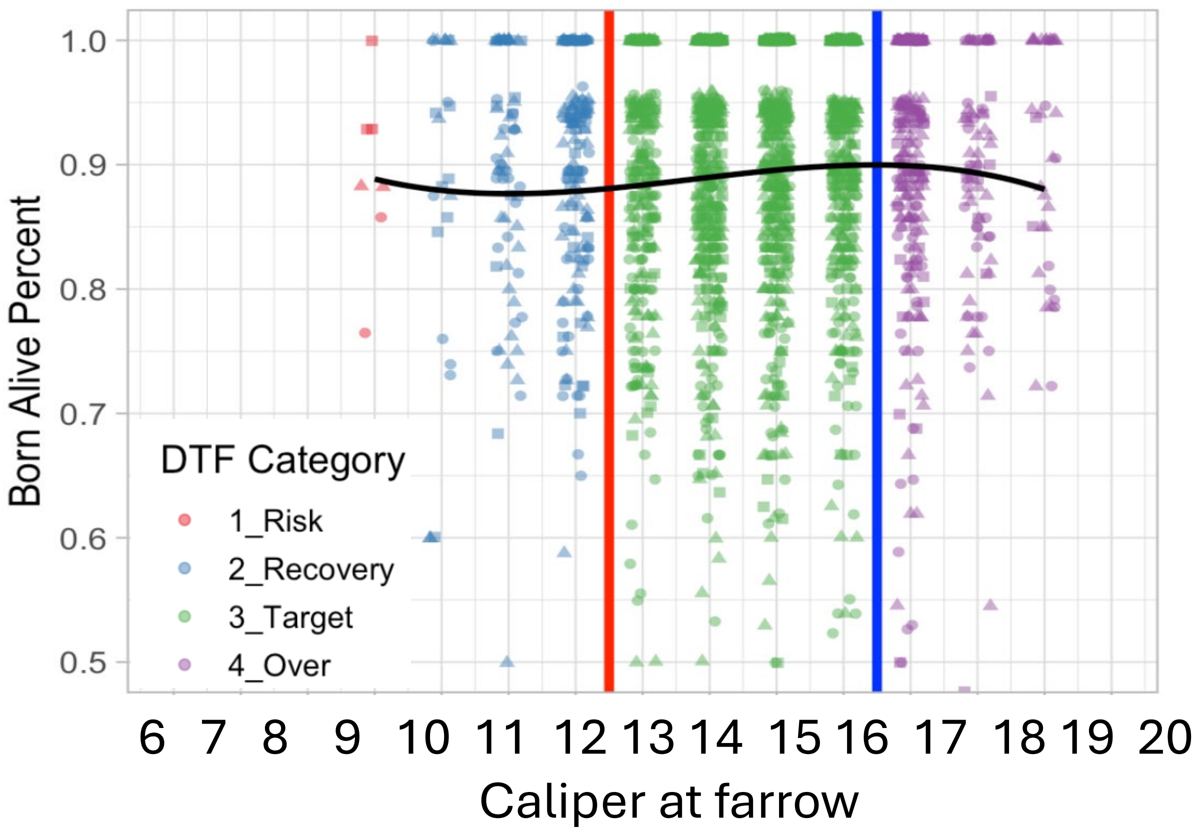
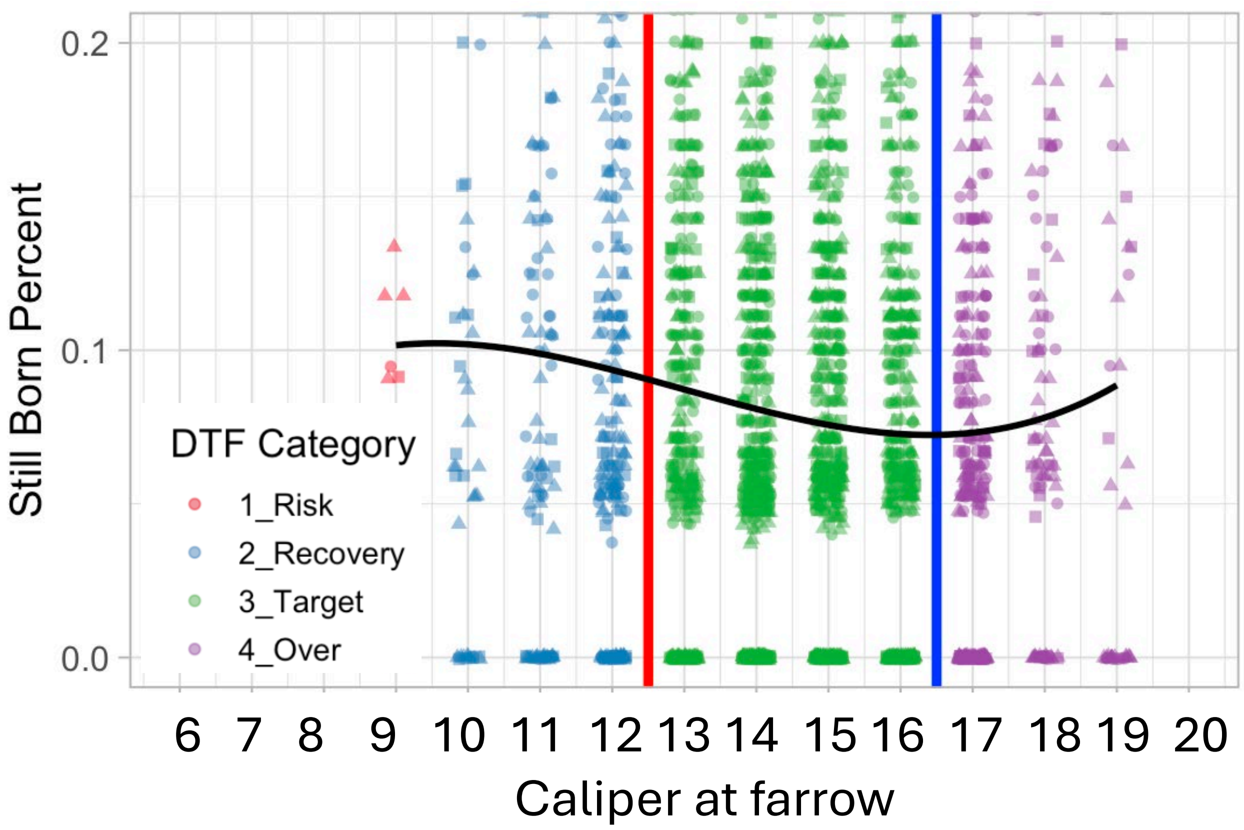
Body Condition Management

Born Alive and Stillborn Piglets

The old rules still apply: Under and over condition is negative on productivity.





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Vier et al., 2024

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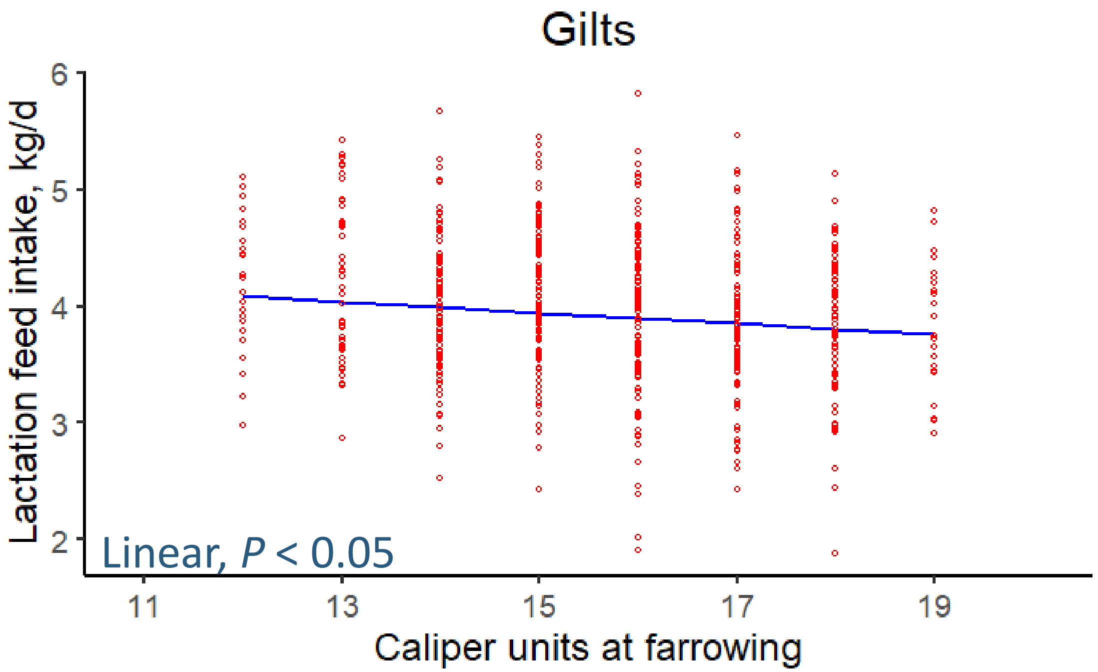
Body Condition Management

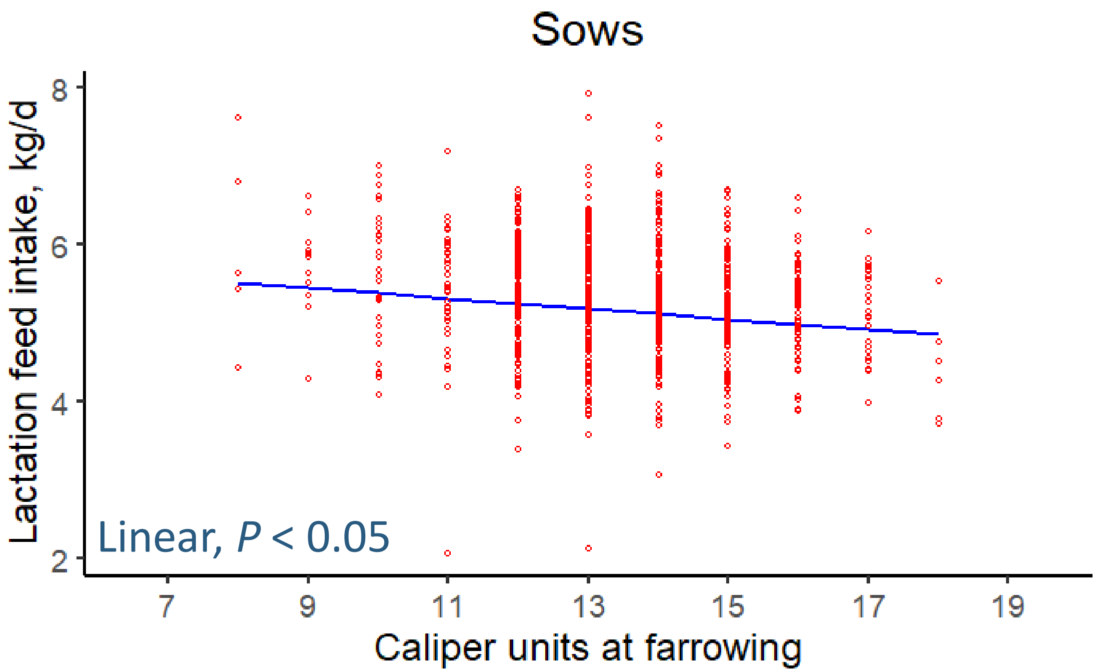
Lactation Feed Intake

The old rules still apply: over condition is negative on lactation intake/

ADFI Gilts, kg/d= 2.33756 + (**-0.04692** × caliper farrow) + (0.05475 × Lactation length) + (0.09676 × Number weaned)

ADFI Sows, kg/d= 3.17474 + (**-0.06631** × caliper farrow) + (0.09073 × Lactation length) + (0.06950 × Number weaned)





Predicted line assumes a fixed lactation length of 21 days and fixed number of weaned pigs of 12 pigs.

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Huerta et al., 2021

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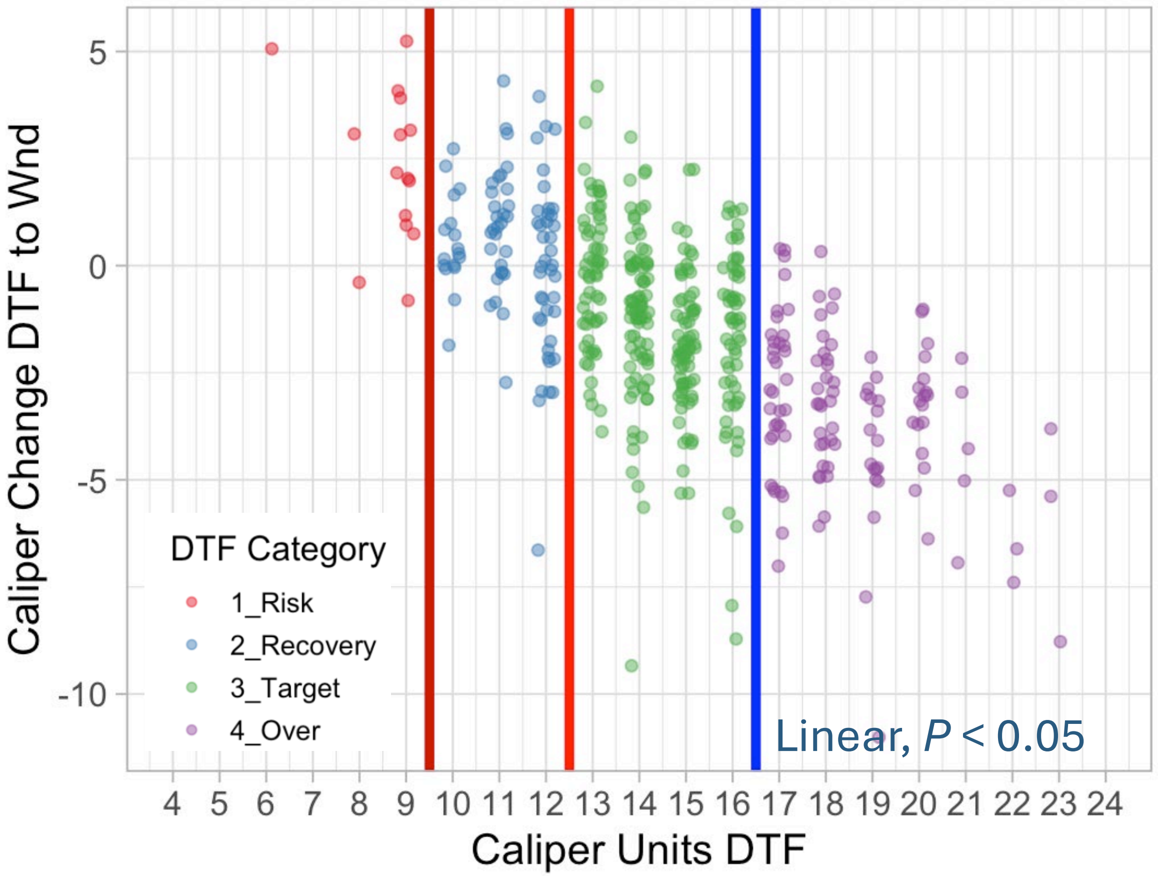
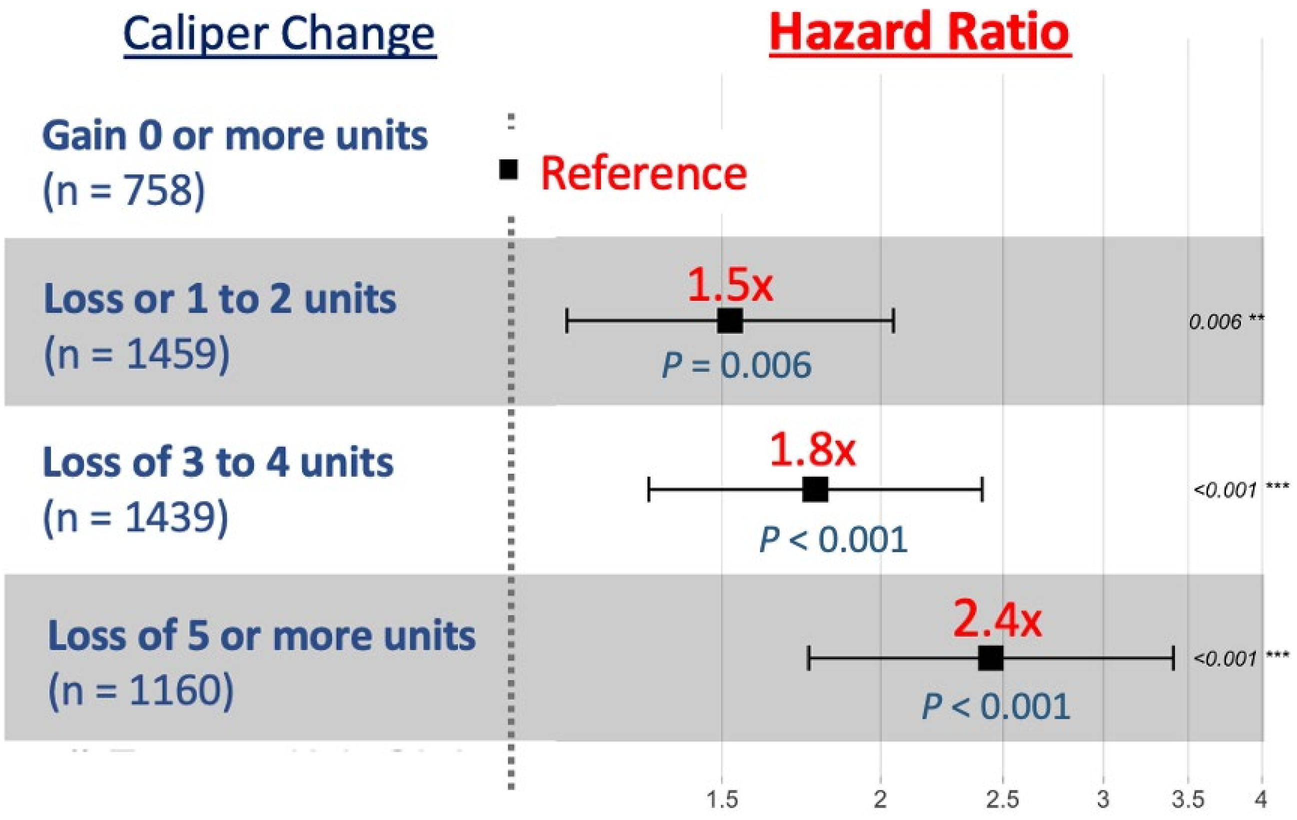
Body Condition Management

Lactation Body Condition Losses & Risk of Removal for Repro Reasons

The old rules still apply: body condition loss is negative on longevity.



Between Red and Blue line is considered Target Range



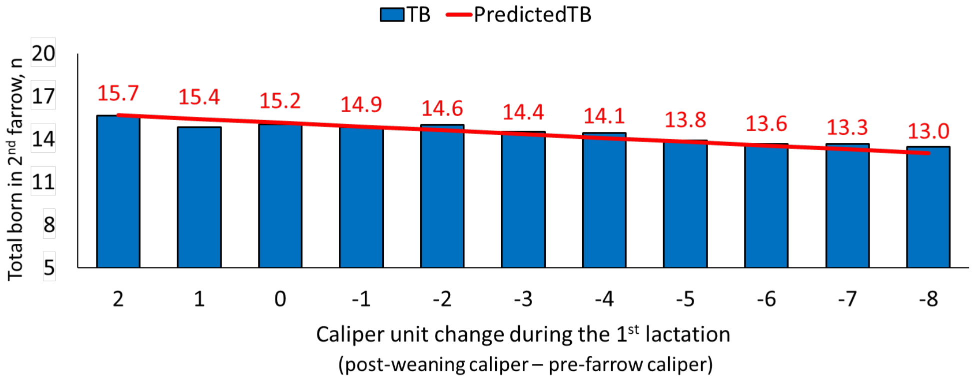
Vier et al., 2024

Body Condition Management

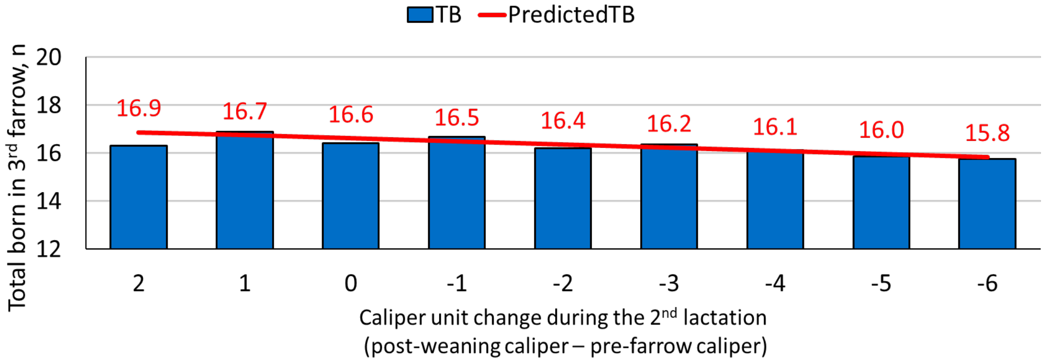
Subsequent Total Born

The old rules still apply: body condition loss is negative on subsequent TB.

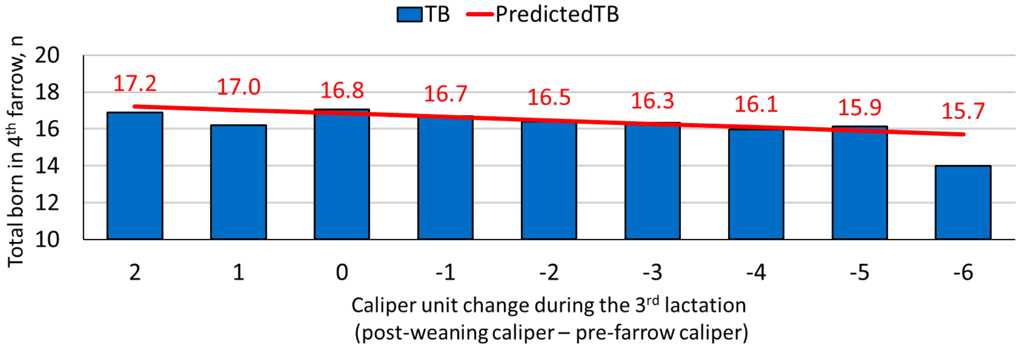
For every unit of caliper lost during 1st lactation, subsequent TB was reduced by 0.27



For every unit of caliper lost during 2nd lactation, subsequent TB was reduced by 0.12



For every unit of caliper lost during 3rd lactation, subsequent TB was reduced by 0.19



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Huerta et al., 2021

** Data from 4500 sows measured from parity 1 to 6

*** In collaboration with Technical Services of UVESA Spain

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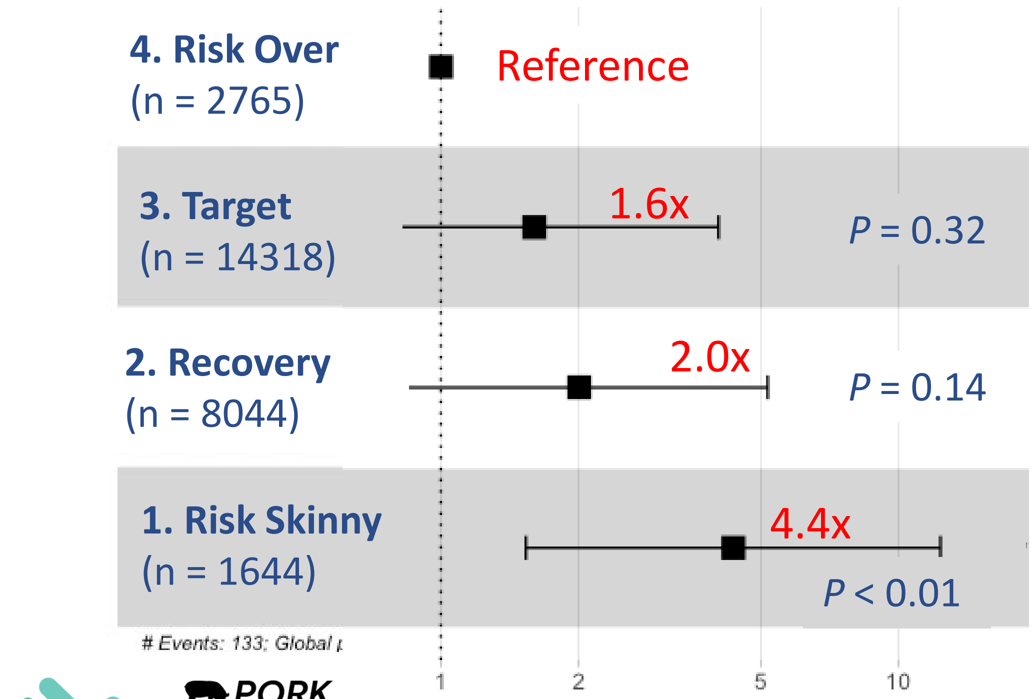
Body Condition Management

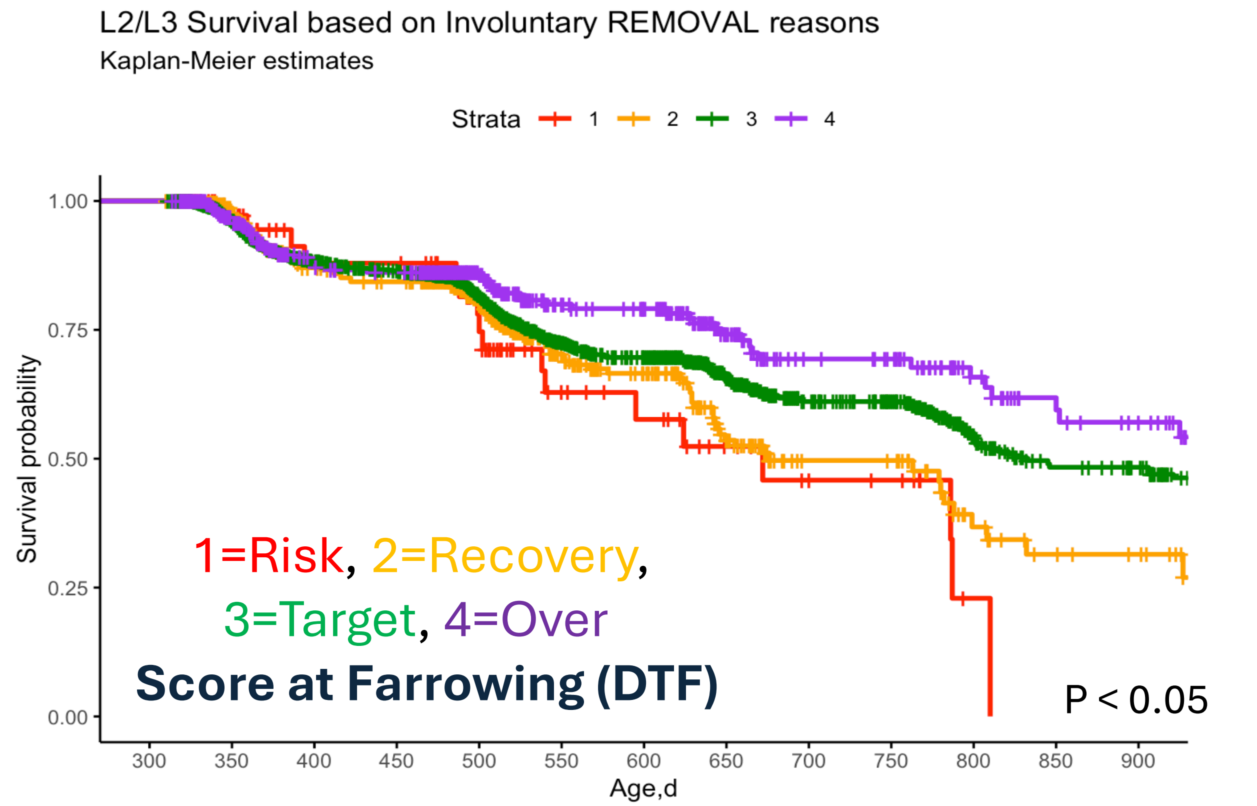
Mortality Risk of Thin Sows at Due to Farrow

The new rules: feeding for robustness!

Mortality Risk for All Causes



Survival based on Involuntary Removal Reasons



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Vier et al., 2024

Data from one production system in Brazil (26,773 observations): sows in pen gestation ESF

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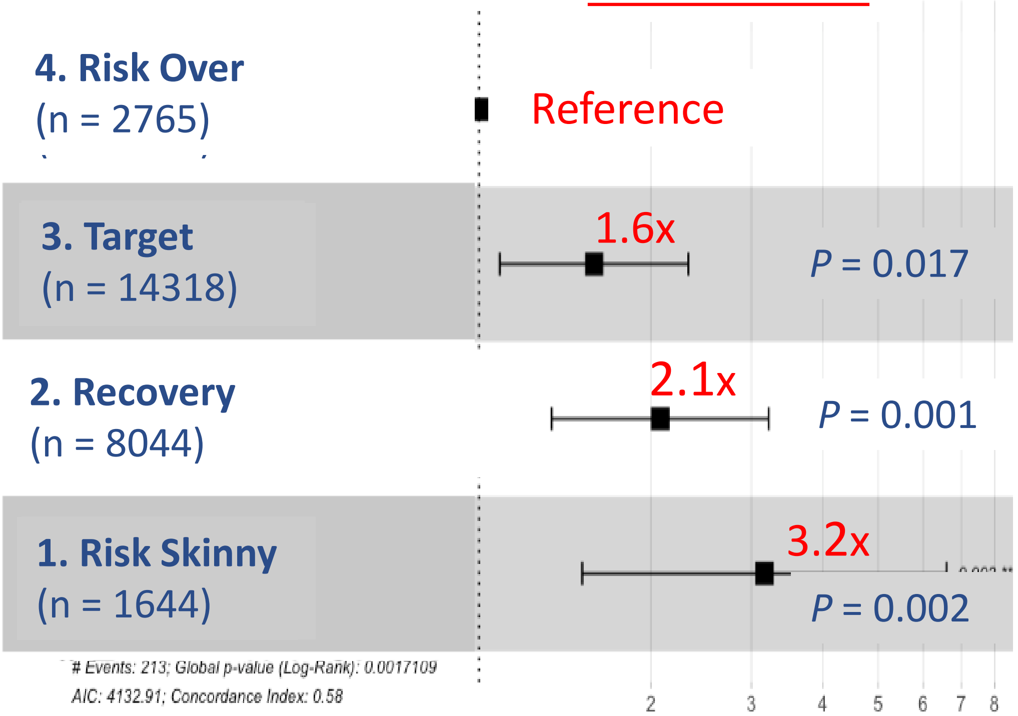
Body Condition Management

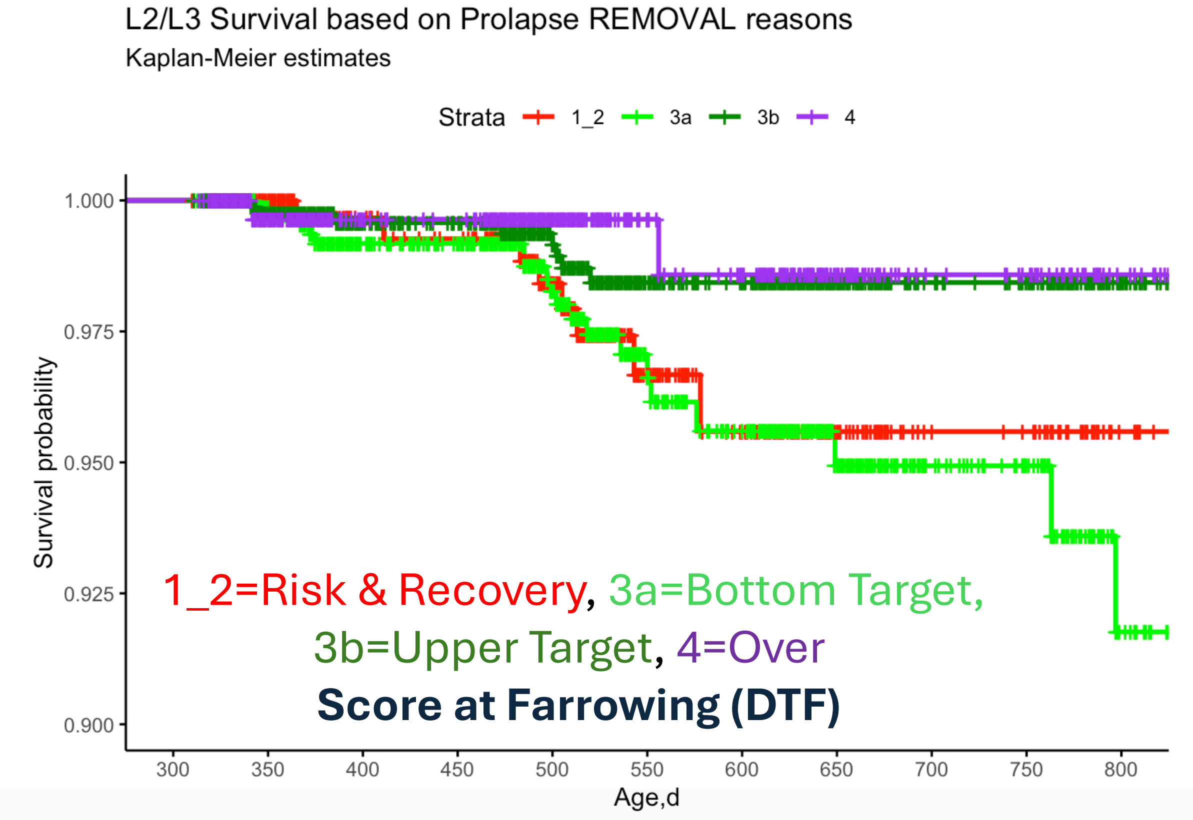
Prolapse Risk of Thin Sows at Due to Farrow

The new rules: feeding for robustness!

Mortality Risk for Prolapse



Survival based on Prolapse Removal Reasons



Vier et al., 2024

Data from one production system in Brazil (26,773 observations): sows in pen gestation ESF

Feeding Program Focusing on Ease of Implementation

It assumes a minimum daily intake of 6.8 g of STTD Phosphorus and 11.0 g of SID Lysine

RECOVERY SOWS

- 8.6 Mcal ME/d or 6.5 Mcal NE/d (*6.0 to **6.5 lb/d or *2.7 to **2.9 kg/d)
- Feeding this level throughout gestation will result in an estimated overall gain of 3 caliper units.

GILTS, IDEAL AND FAT SOWS

- 5.9 Mcal ME/d or 4.4 Mcal NE/d (*4.0 to **4.5 lb/d or *1.8 to **2.0 kg/d)
- Feeding this level throughout gestation will result in an estimation of no overall caliper change.

0 30 60 90 112

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* If Gestation diet is formulated using high energy (corn and SBM).
** If Gestation diet is formulated using low energy (fiber ingredient included).

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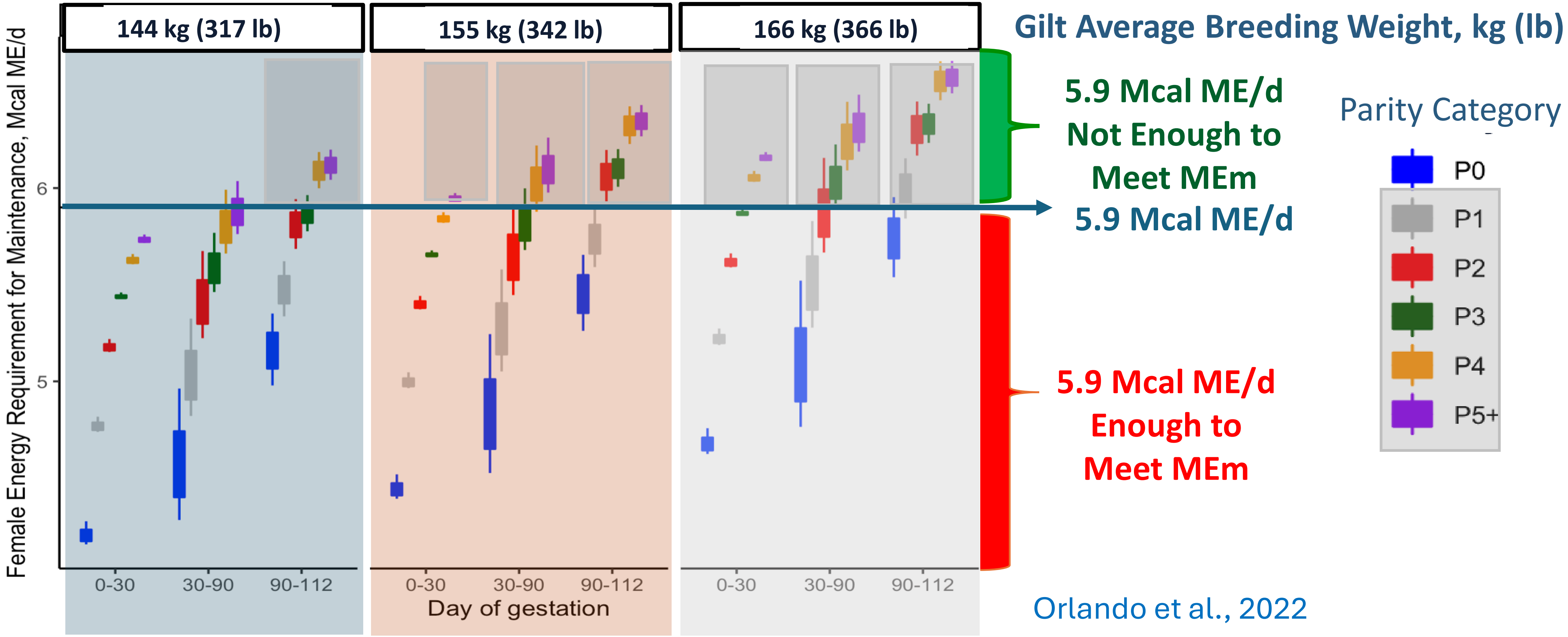
Heavier Gilts Become Heavier Sows



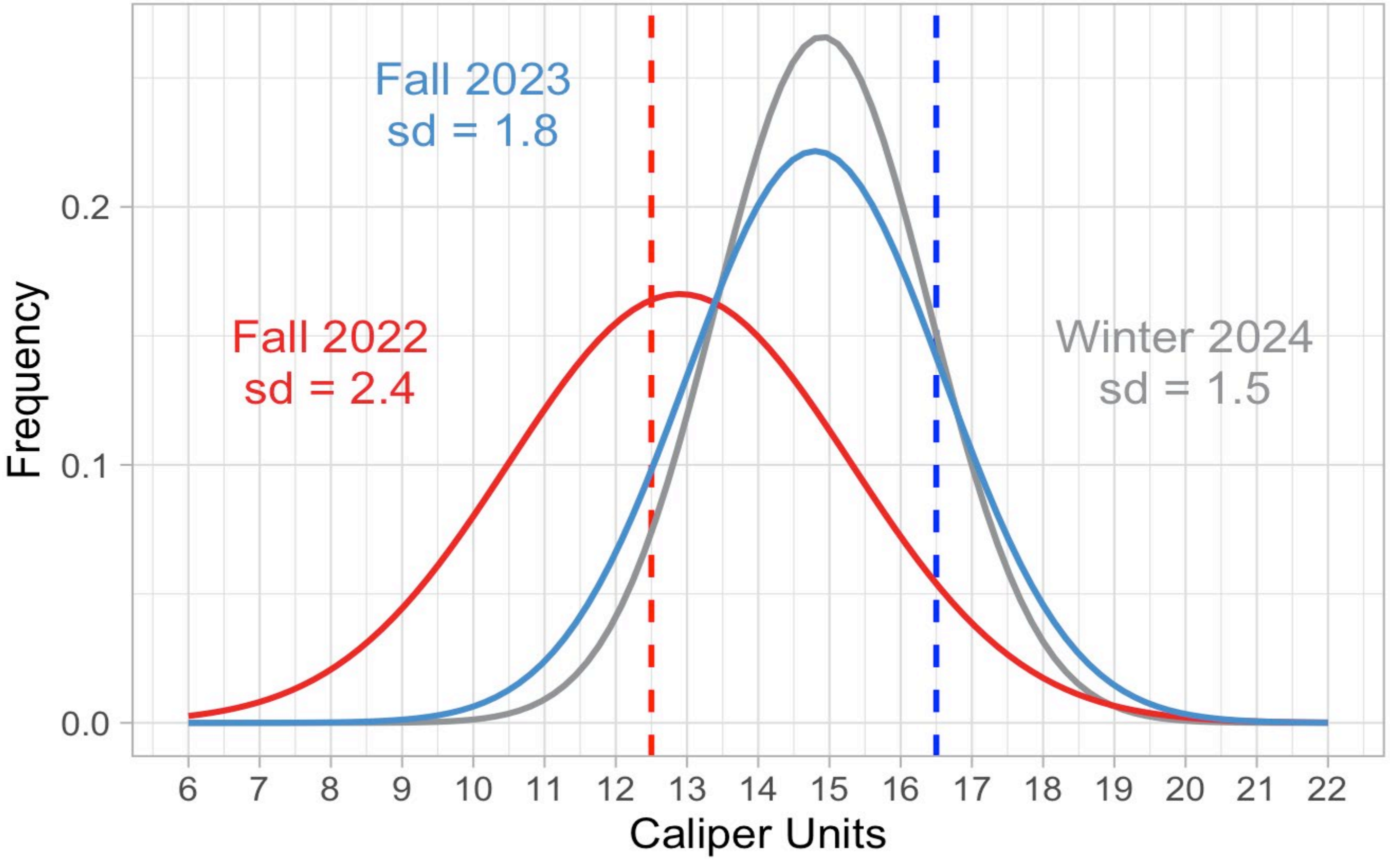
Orlando et al., 2022

Gilt Breeding BW > 160 kg (350 lb), increase the base level for P1+ females to 6.65 Mcal ME/d or 4.95 Mcal NE/d (*4.5 to**5.0 lb/d or *2.0 to**2.25 kg/d)

Focus on Recovering Thin Sows in Gestation

Measure and Track Due to Farrow Sows!

30% Reduction in BC Variation

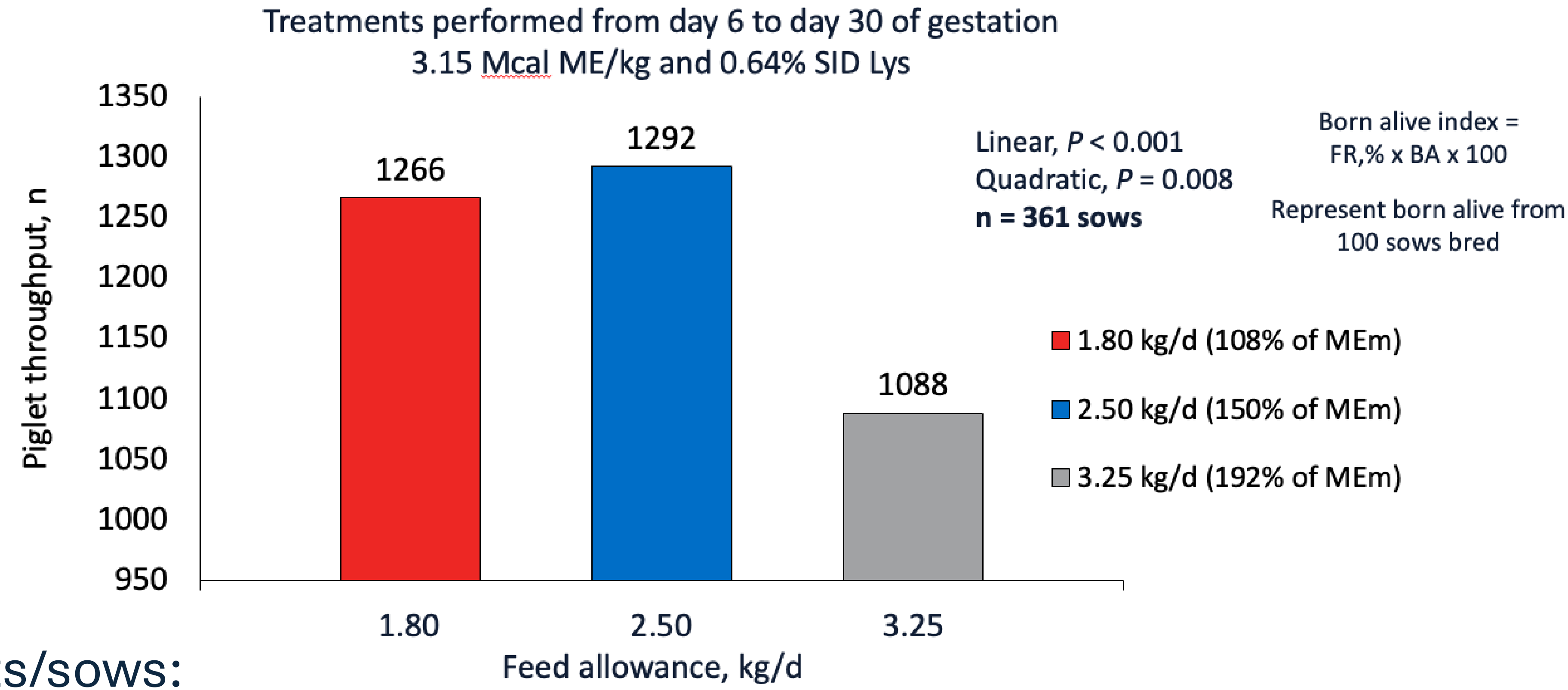


Between Red and Blue line is considered Target Range at DTF

- Target < 10% thin at farrow
- 70-80% ideal condition is doable

Nutrition Strategies During Early Gestation

- Excessive feed intake (>10 Mcal of ME/day) has negative impact in total born and piglet throughput over all parities.
  (Mallmann et al., 2020)



- For group gestating gilts/sows:
  - If aggressive behavior is observed right after grouping, consider providing an extra feed up to 3 kg/d for no longer than five days.

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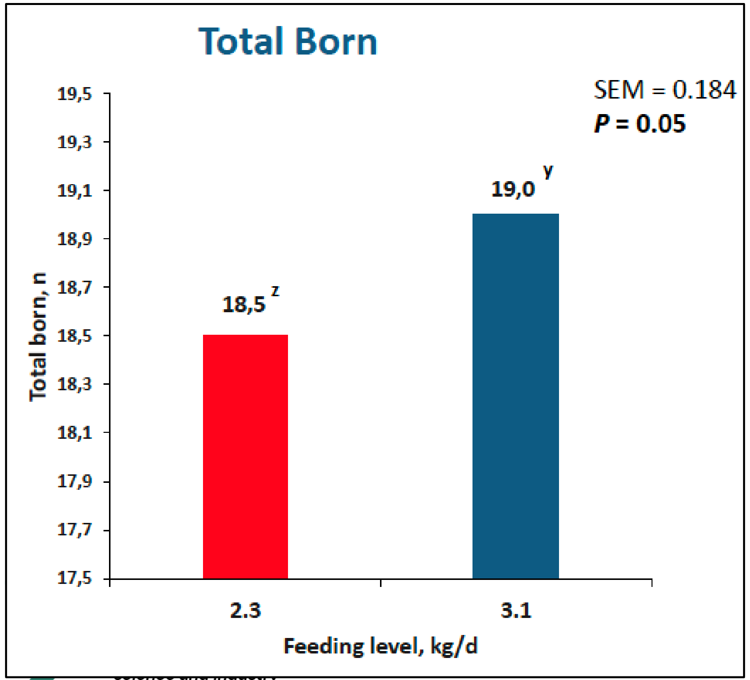
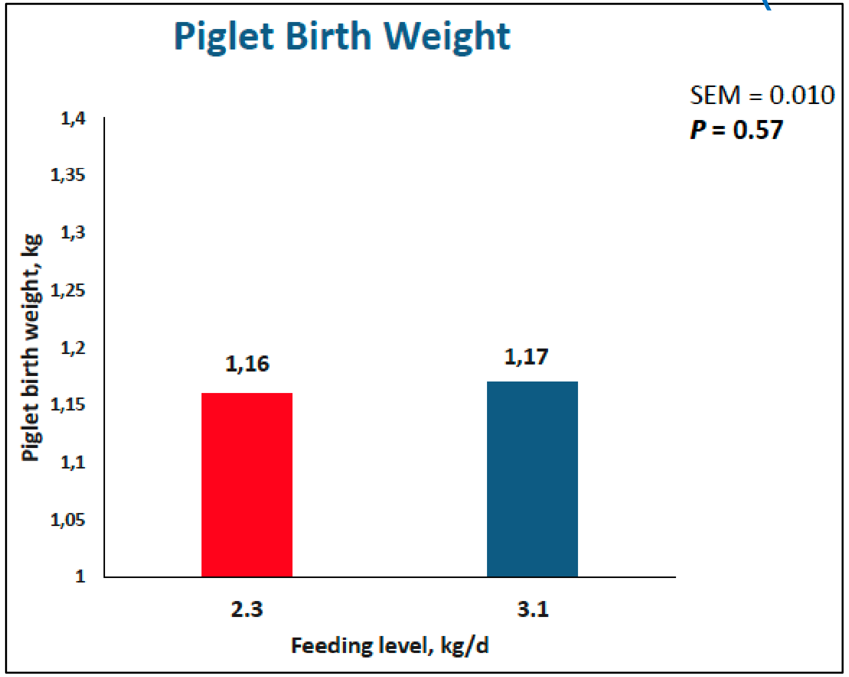
Nutrition Strategies During Late Gestation

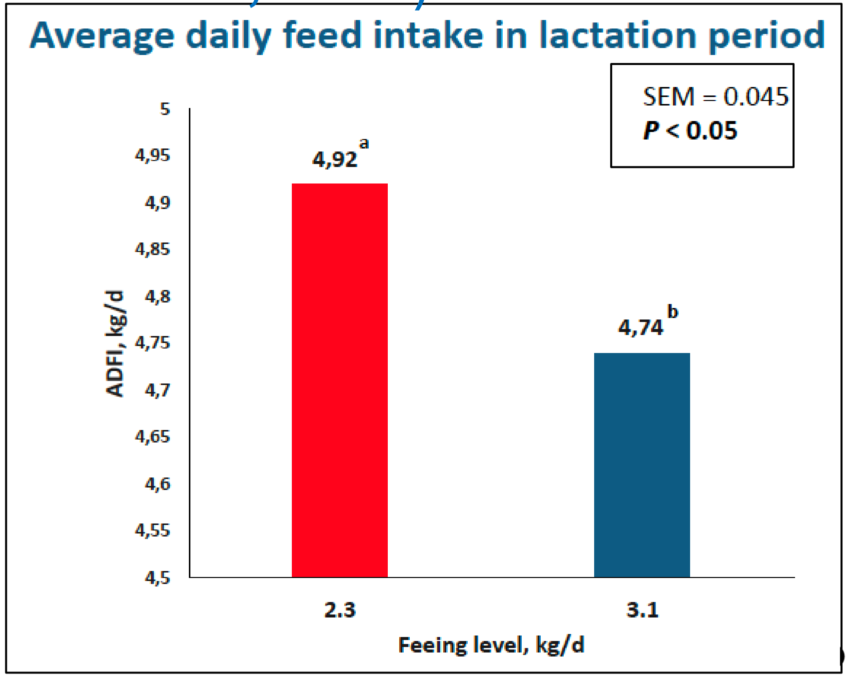
- Bump feeding (Shelton et al., 2009; Sot et al., 2011; Goncalves et al., 2015; Greiner et al., 2016; Ampaire et al., 2017; Mallmann et al., 2018; Mallmann et al., 2019) as a routine practice results in:
  - Little to no improvement of birth weight
  - Higher percentage of stillborn in gilts and sows
  - Decreased lactation feed intake
  - Tendency to fewer days in the herd

...Even in hyper prolific females

(Blanco et al., 2023)

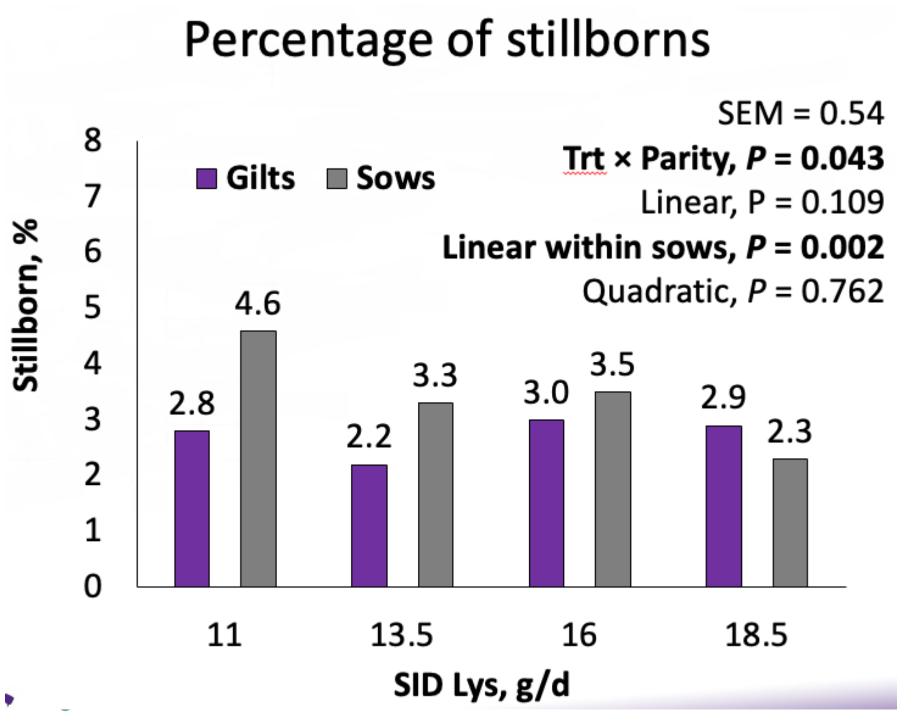


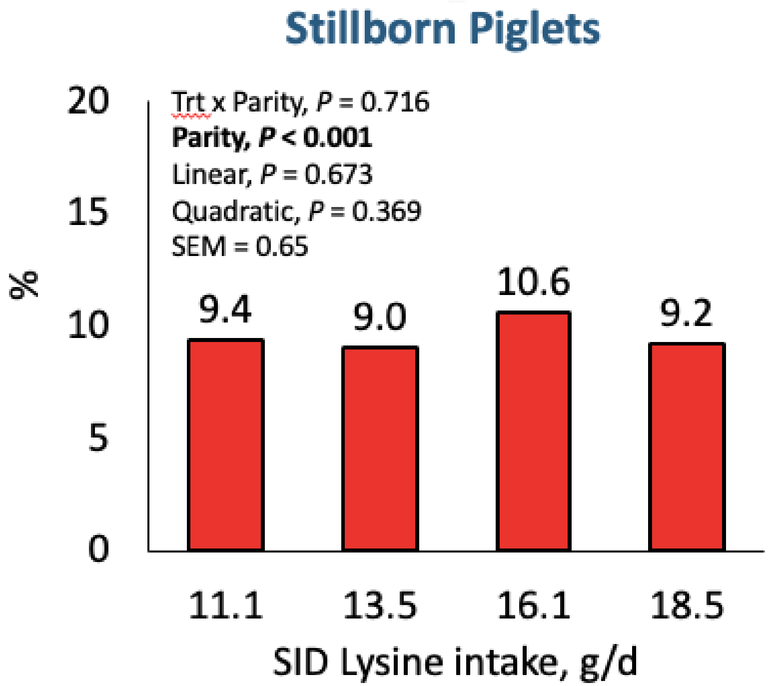


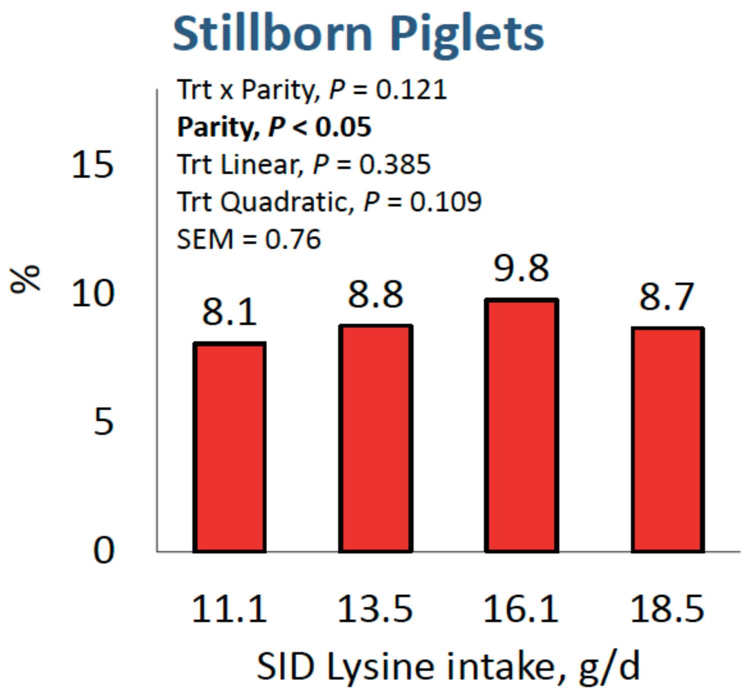


SID Lysine Intake During Gestation

- Thomas et al., 2021 evaluated the effects of increasing SID Lys intake from 11 g to 18.5 g during gestation and observed a 2.3% reduction in stillbirth rate in sows provided with 18.5 g SID Lys per day.
- Two follow-up studies (Lu et al., 2022; Vier et al., 2024) evaluated similar SID Lys levels and found no evidence of lysine intake effects on piglet or sow reproductive performance.

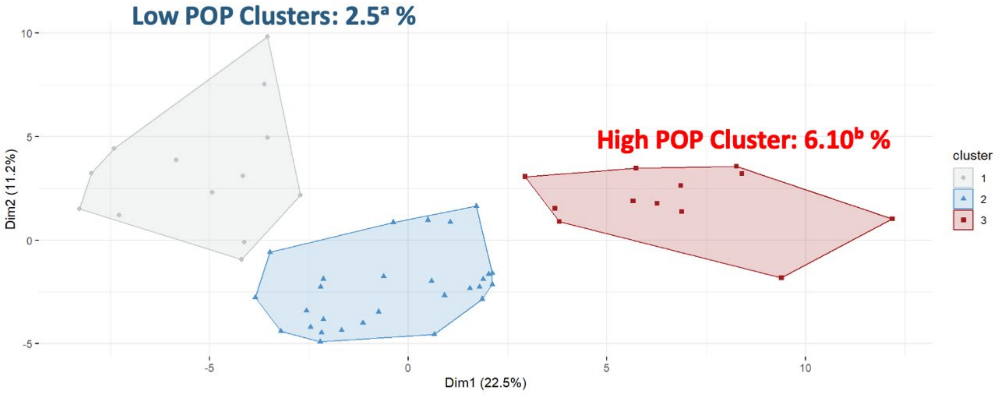




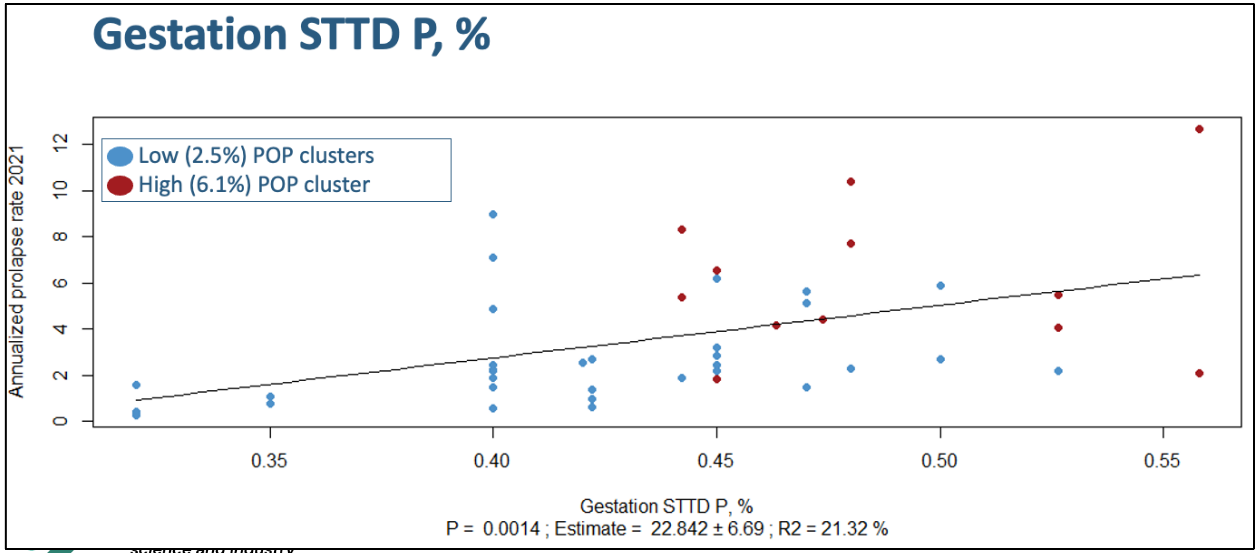


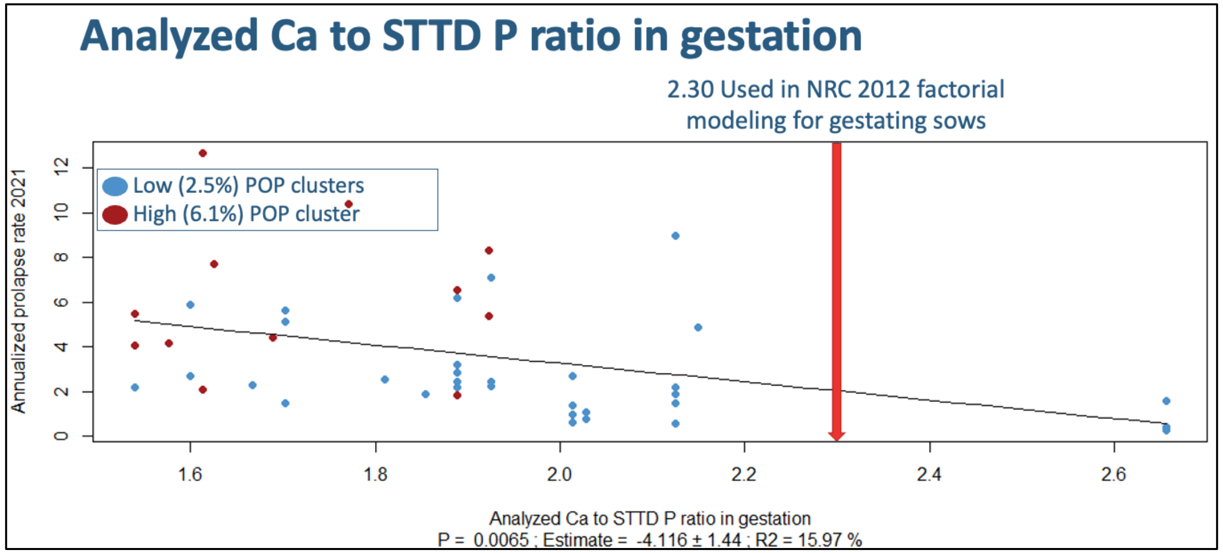
PIC Pelvic Organ Prolapse (POP) Survey

- Survey consisted of **800+ questions** about:
  - General farm information and management
  - Performance traits
  - Boar & Replacement gilt management
  - Gestation and Farrowing practices
  - Labor
  - Health management
  - Nutrition
- Surveys from **53 PIC customer farms across Canada, United States, and Mexico**
- Kociemba et al., 2024



*SE = 0.585 P = 0.0017
Variability explained by the final model = 33.7%
Low POP vs High POP – P <0.05
Each dot represents 1 farm

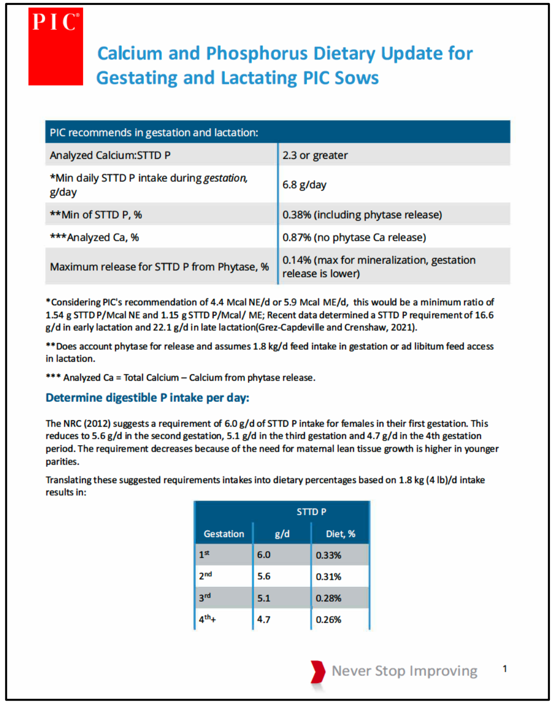




Calcium and Phosphorus for Gestating and Lactating Sows

Recommendations Gestation and Lactation	
Analyzed Calcium:STTD P	2.3 or greater
*Min daily STTD P intake during <u>gestation</u>, g/day	6.8 g/day (Gestation only)
** Min of STTD P, %	0.38%
*** Analyzed Ca, %	0.87% (**minimum with no phytase Ca release**)
Max. release for STTD P from Phytase, %	0.14% (**gestation release is lower, max for mineralization**)

*Recent data determined a STTD P requirement of 16.6 g/d in early lactation and 22.1 g/d in late lactation.
**Does account phytase release and assumes 1.8 kg/d feed intake gestation and ad libitum feed access in lactation.
*** Analyzed Ca = Total Calcium – Calcium of phytase release



PIC®

Calcium and Phosphorus Dietary Update for Gestating and Lactating PIC Sows

PIC recommends in gestation and lactation:	
Analyzed Calcium:STTD P	2.3 or greater
*Min daily STTD P intake during *gestation*, g/day	6.8 g/day
**Min of STTD P, %	0.38% (including phytase release)
***Analyzed Ca, %	0.87% (no phytase Ca release)
Maximum release for STTD P from Phytase, %	0.14% (max for mineralization, gestation release is lower)

*Considering PIC's recommendation of 4.4 Mcal NE/d or 5.9 Mcal ME/d, this would be a minimum ratio of 1.54 g STTD P/Mcal NE and 1.15 g STTD P/Mcal/ ME; Recent data determined a STTD P requirement of 16.6 g/d in early lactation and 22.1 g/d in late lactation(Grez-Capdeville and Crenshaw, 2021).

**Does account phytase for release and assumes 1.8 kg/d feed intake in gestation or ad libitum feed access in lactation.

*** Analyzed Ca = Total Calcium – Calcium from phytase release.

Determine digestible P intake per day:

The NRC (2012) suggests a requirement of 6.0 g/d of STTD P intake for females in their first gestation. This reduces to 5.6 g/d in the second gestation, 5.1 g/d in the third gestation and 4.7 g/d in the 4th gestation period. The requirement decreases because of the need for maternal lean tissue growth is higher in younger parities.

Translating these suggested requirements intakes into dietary percentages based on 1.8 kg (4 lb)/d intake results in:

	STTD P	
Gestation	g/d	Diet, %
1st	6.0	0.33%
2nd	5.6	0.31%
3rd	5.1	0.28%
4th+	4.7	0.26%

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Non Ruminant Nutrition

OXFORD

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A review of calcium and phosphorus requirement estimates for gestating and lactating sows

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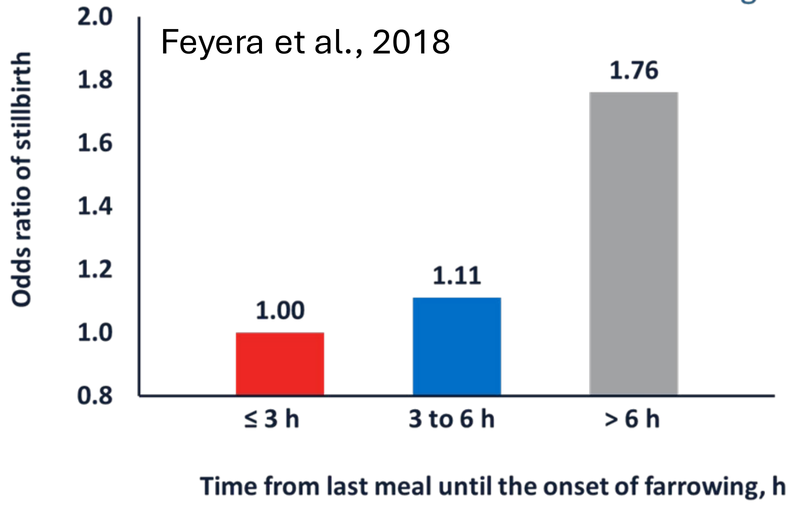
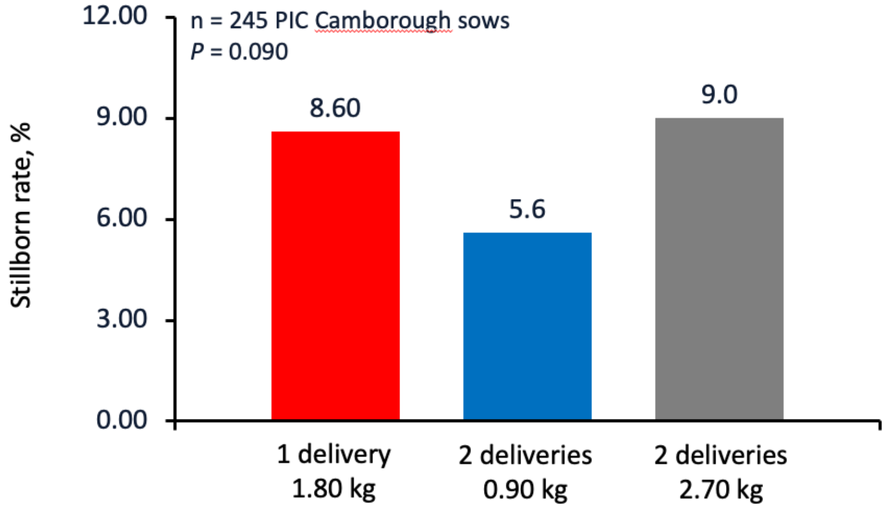
Pre–Farrow Feeding Management

Feed amount and frequency

- Feed the same amount as gilts and sows were fed in gestation.
- Increase the frequency of feeding after sows are loaded in the farrowing crates
  - Some evidence suggests reduced stillbirth rate when farrowing assistance is limited (Miller and Kellner, 2020).
  - One study has shown improved pre-weaning livability (Gourley et al., 2020).
  - Example: giving the sow half her feed first thing in the morning and half her feed before you leave.
  - Target is to have sows starting to farrow within 3 hours of last meal (Feyera et al., 2018).

Odds ratio of stillbirth is reduced if sows have access to feed within 6 h before farrowing





Miller and Kellner, 2020

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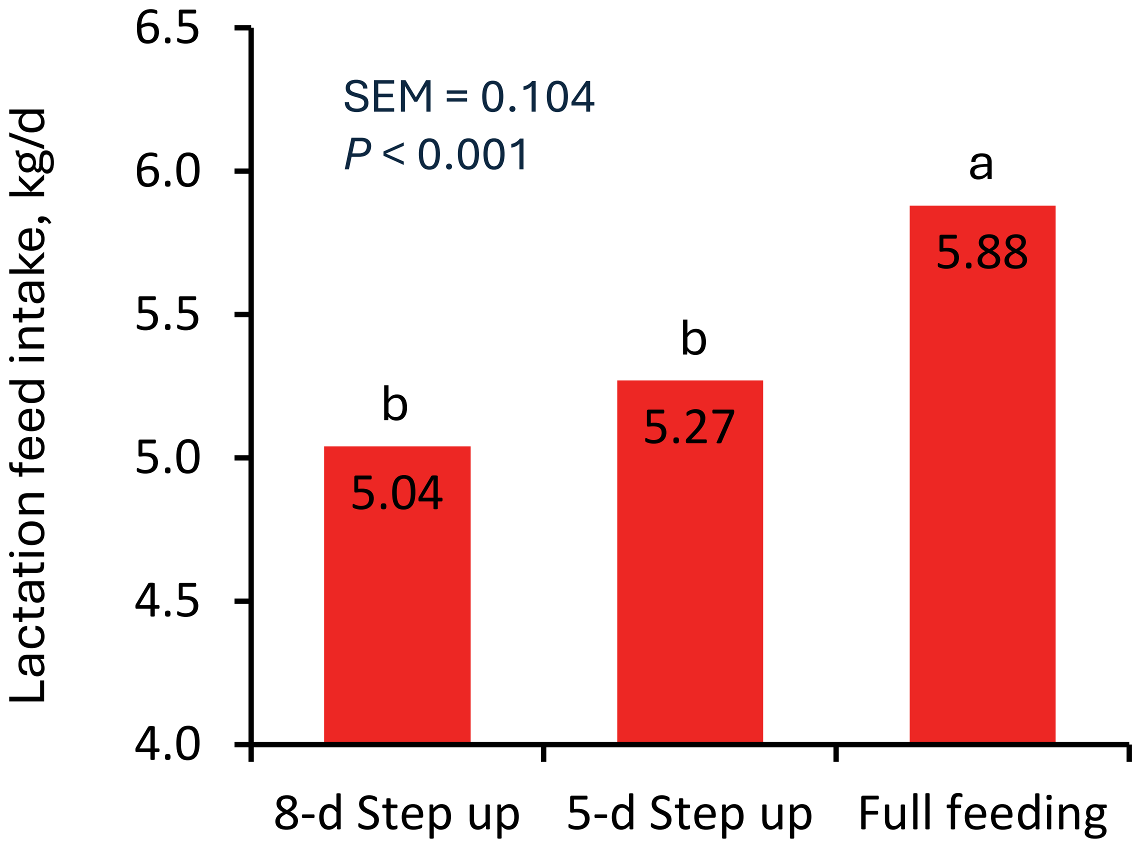
Post–Farrow Feeding Management

Lactation feeding regime influenced lactation feed intake of parity 1 sows

Day of lactation	Lactation feeding regime, kg/d		
	8-d Step up	5-d Step up	Full feeding
0	1.8	1.8	Full
1	1.8	2.7	Full
2	2.7	3.6	Full
3	2.7	4.6	Full
4	3.6	5.5	Full
5	3.6	Full	Full
6	4.6	Full	Full
7	4.6	Full	Full
8 to 19	Full	Full	Full



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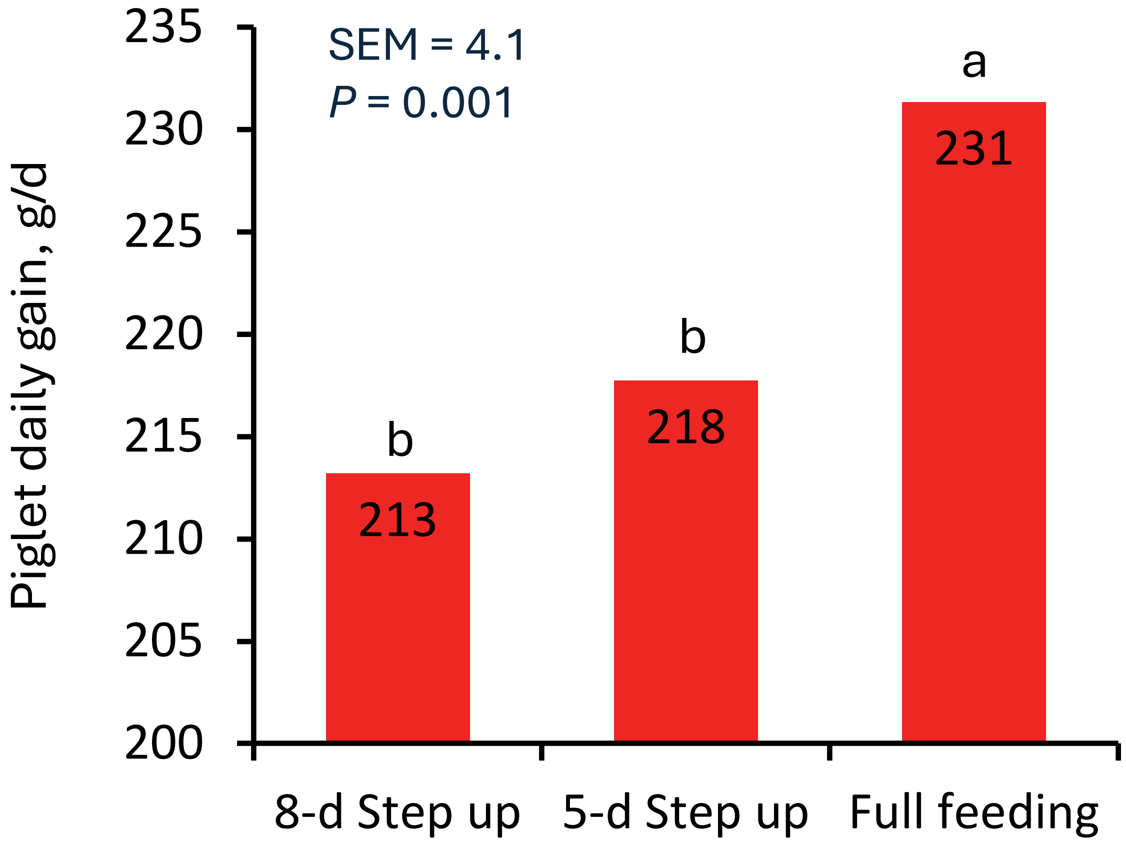
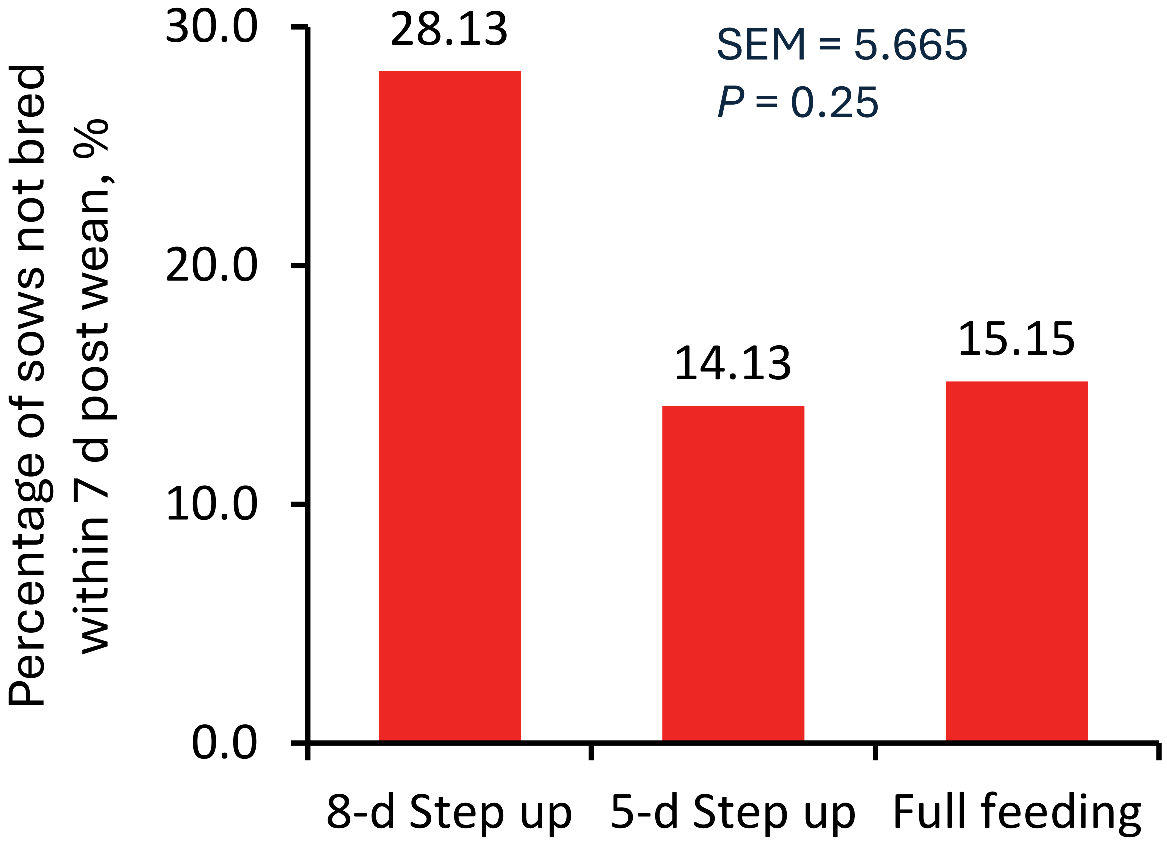
Post–Farrow Feeding Management

Lactation feeding regime influenced piglet daily gain and parity 1 sows bred





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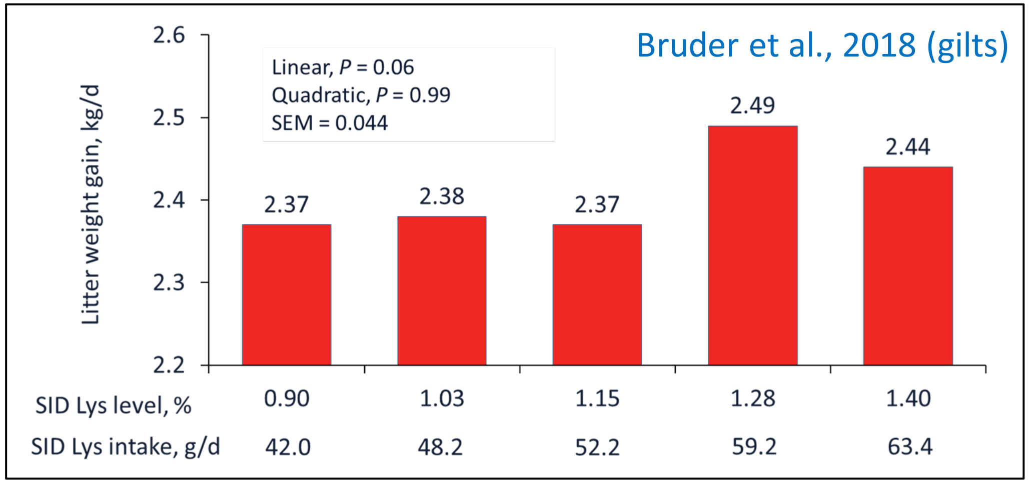
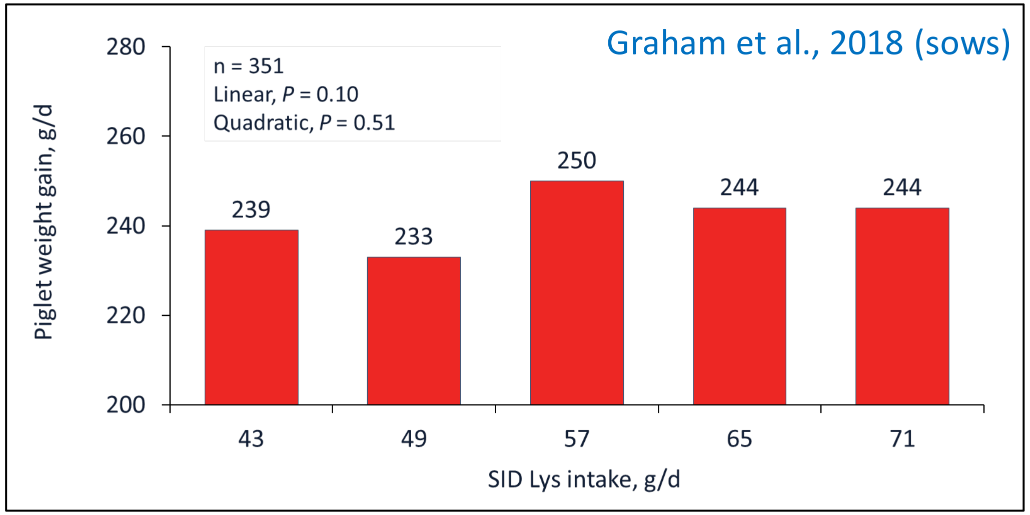
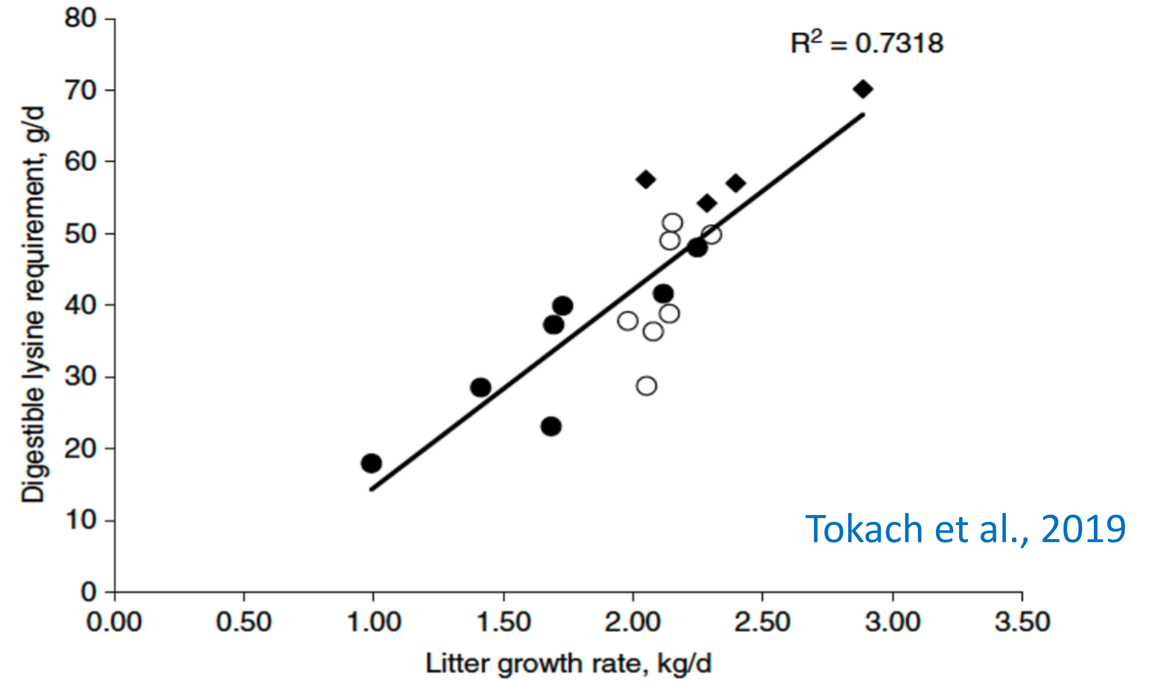
Optimal Nutrient Intake During Lactation





Item	Unit	Gilts	Sows	Herd
Lysine using single diet	g/d	50.0	62.0	59.5
Lysine parity segregation or startups	g/d	59.0	56.5	

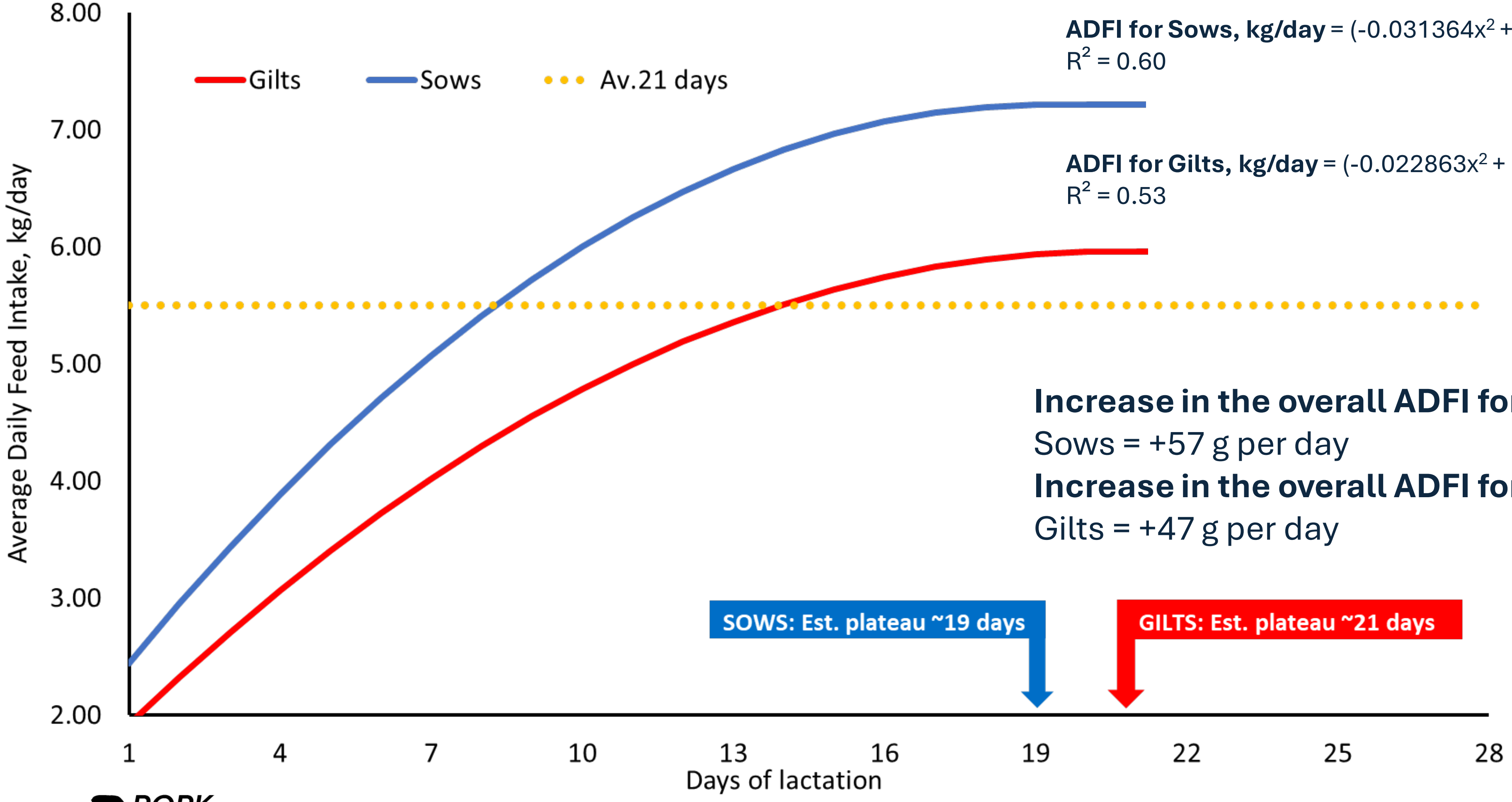
27 g of SID Lys is needed per kg of litter growth



- Boyd and Touchette 2000 model: ~ 60 to 65 g SID Lys/d assuming 2.5 to 2.7 kg/d litter growth
- Spinler et al., 2024: ~60 g SID Lys/d sufficient to maximize litter growth rate with 13.5 weaned pigs

Optimal Nutrient Intake During Lactation

Lactation feeding curves for gilts and sows



ADFI for Sows, kg/day = $(-0.031364x^2 + 1.201068x + 4.104837) \div 2.204622$
$R^2 = 0.60$

ADFI for Gilts, kg/day = $(-0.022863x^2 + 0.940148x + 3.234049) \div 2.204622$
$R^2 = 0.53$

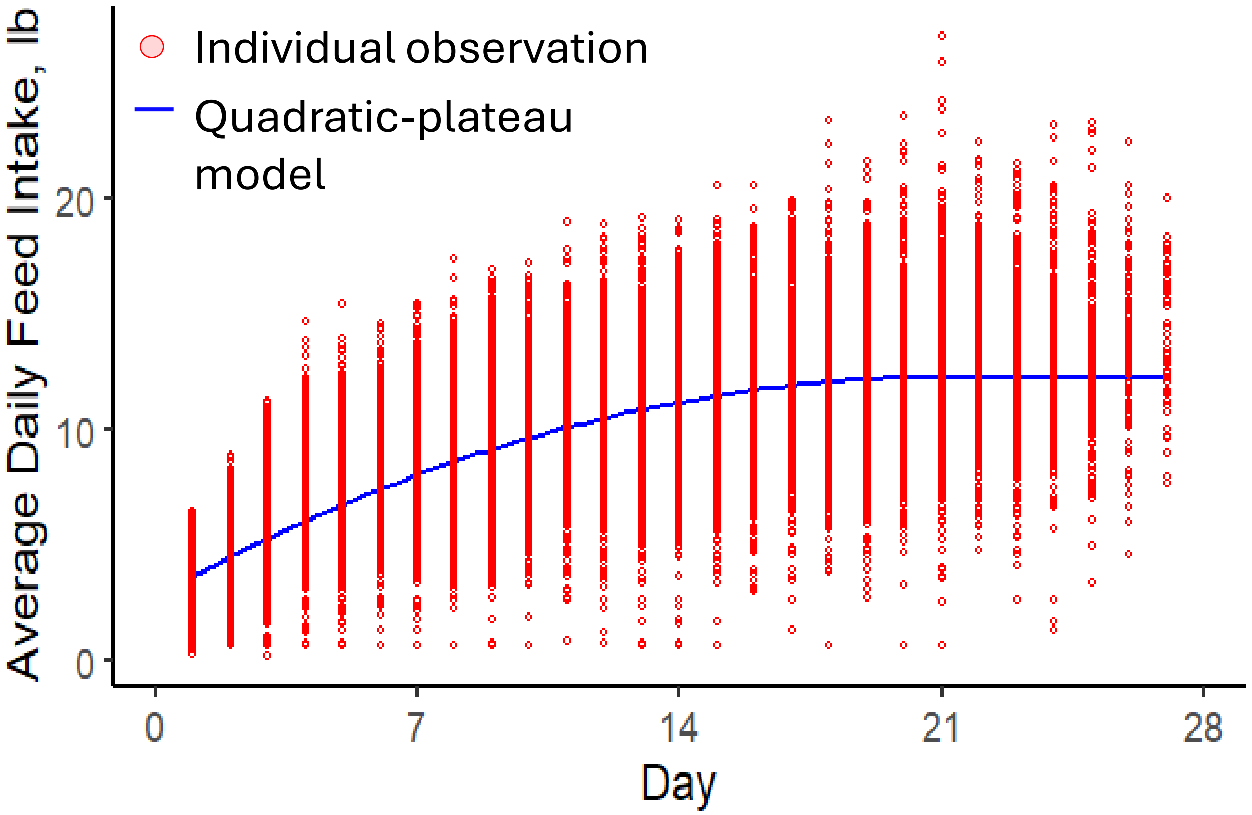
Increase in the overall ADFI for each day above 19 days for:
Sows = +57 g per day
Increase in the overall ADFI for each day above 21 days for:
Gilts = +47 g per day

* Jerez et al, 2021
** Data is based on daily lactation feed intake recorded from 405 Camborough sows over a 10 months period for a total of 9,002 observations and from 1665 L3 sows over a 3-year period for a total of 37,402 observations.

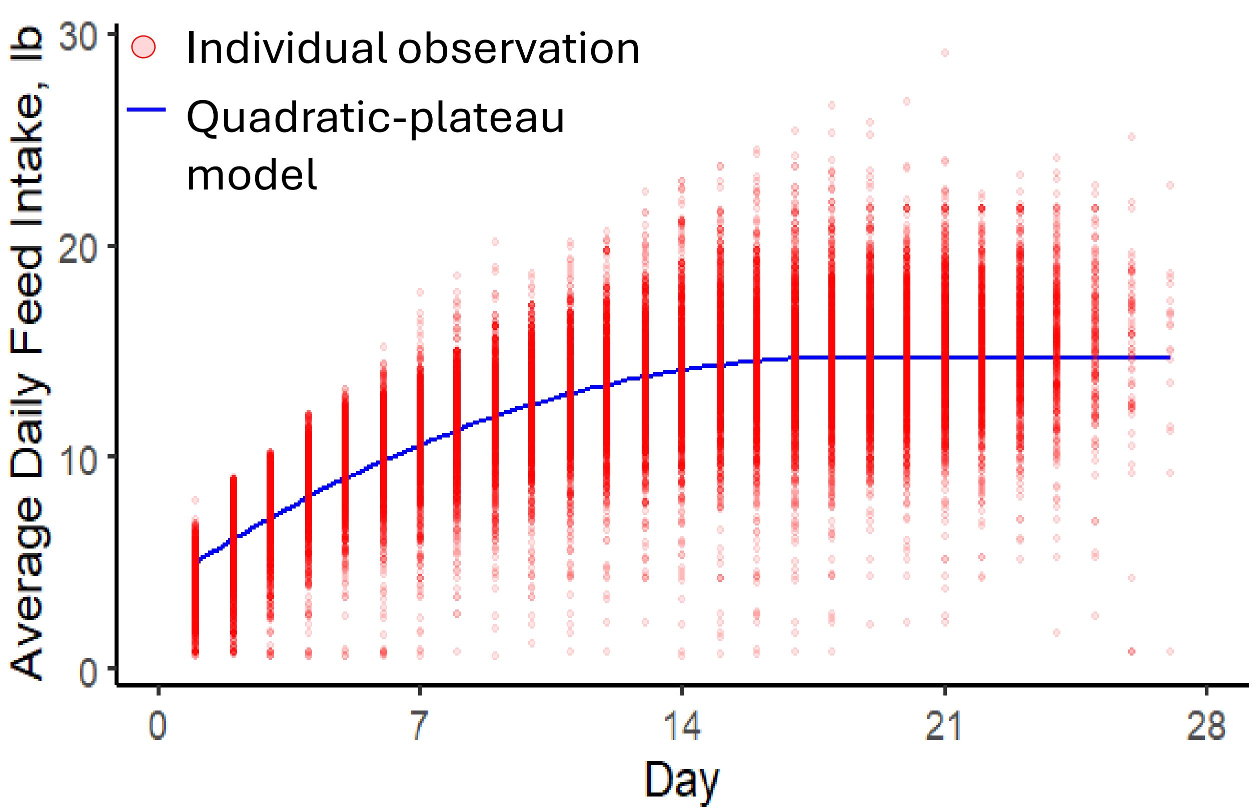
Optimal Nutrient Intake During Lactation

Tremendous Variability in Individual Lactation Feed Intake!

Gilts



Sows



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* Jerez et al, 2021

** Data is based on daily lactation feed intake recorded from 405 Camborough sows over a 10 months period for a total of 9,002 observations and from 1665 L3 sows over a 3-year period for a total of 37,402 observations.

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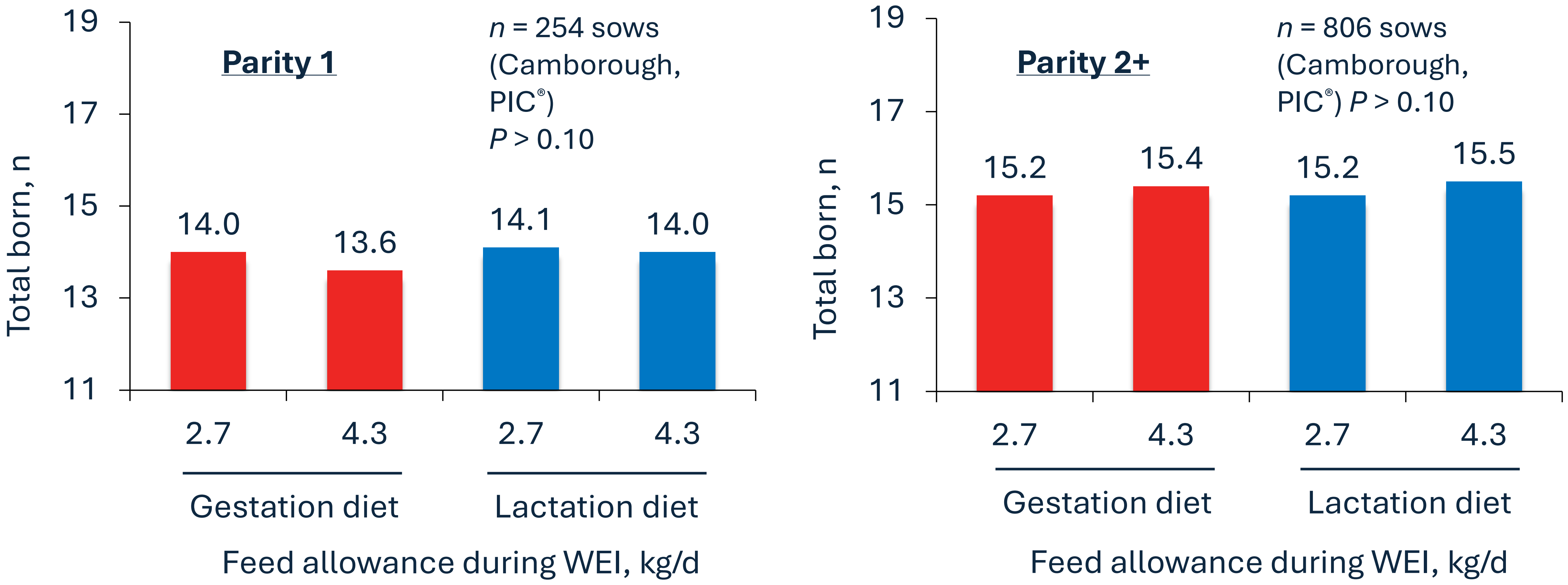
Nutrition Strategies During Wean to Estrus Interval

Sows in good body condition do not benefit from feeding lactation diet and increased feeding levels during WEI



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Gianluppi et al., 2019

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Nutrition Strategies During Wean to Estrus Interval

- Energy/feed requirement is not extreme
- Group sows by body condition
  - Ideal and over condition:
    - 8.7 Mcal of ME/d
    - 16.0 g of SID Lys/d
    - 2.7 kg/d (6 lb/d) of gestation diet
  - Risk and recovery:
    - Ad libitum
- Ensure feed is fresh
- Minimize wastage

Experiment	Feed Allowance, kg/day	Wean to Estrus Interval, days	Farrowing Rate, %	Total Born, n	Born Alive (BA), n	BA index[1], n
Graham et al., 2015	2.7	5.1	85.4	14.3	13.1	1,119
	3.6	5.0	87.0	13.9	12.9	1,122
	5.5	5.0	82.3	13.9	12.9	1,062
Almeida et al., 2017	2.7	NR	88.3[b]	14.6	13.4	1,144[b]
	3.7	NR	93.3[a]	15.0	13.7	1,262[a]
Almeida et al., 2018	2.6	4.2	88.1	15.1	13.8	1,535
	3.5	4.2	88.2	15.3	13.8	1,543
Gianluppi et al., 2019 – P1	2.7	5.0	92.0	14.0	13.3	1,227
	4.3	5.7	86.1	13.8	13.2	1,135
Gianluppi et al., 2019 – P2+	2.7	4.5	93.4	15.2	14.3	1,340
	4.3	4.6	92.6	15.5	14.5	1,340
Lu et al., 2021	3.0	4.7	97.4	15.3	14.0	1,372
	4.5	4.7	95.7	15.6	14.3	1,362

[a,b]Means with different superscripts within column and experiment differ, $P < 0.05$.
WEI: Wean-to-estrus interval; **FR:** Farrowing rate; **TB:** Total born; **BA:** Born alive;
BA index: Born alive index = FR × BA × 100

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Key Takeaways

1. There might be advantages to control growth of developing gilts.
2. Heavier gilts will be heavier throughout their lifetime.
3. Focus on thin body condition to improve longevity.
4. Simplify gestation feeding and track progress.
5. There is tremendous amount of variation in lactation feed intake.

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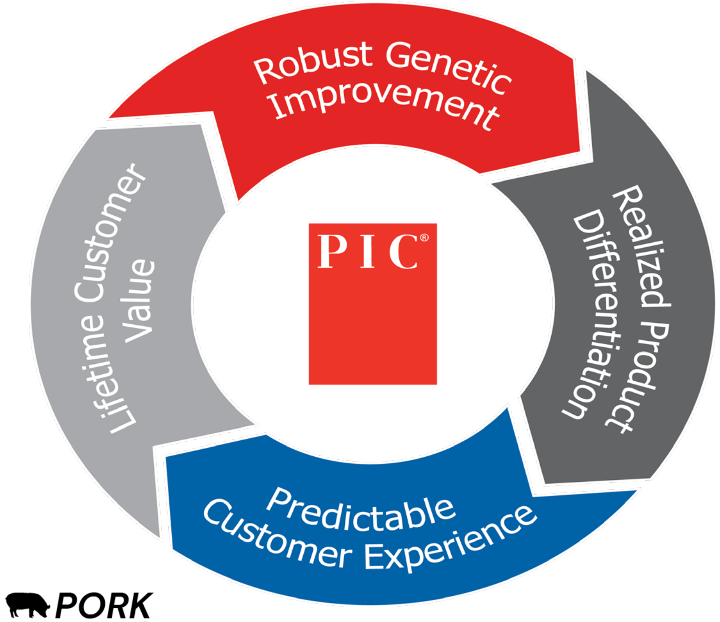

Thank You!

Carine Mirela Vier, DVM, PhD

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