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FEED CONSULTING

Improving Performance and Profitability of Growing-Finishing Pigs – Benchmarks and Solutions

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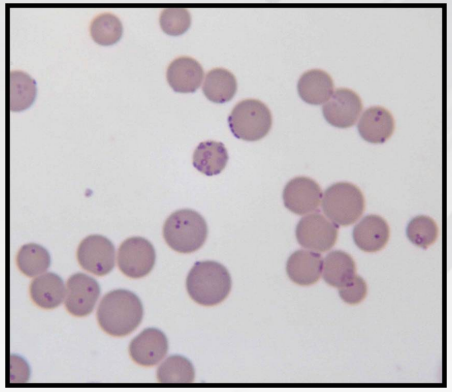
dsm-firmenich

Heath & Stability

- Sow herd health & gilt acclimation.
- Vaccine use in sow herd and weaned pigs for stability.
- Colostrum intake & management.

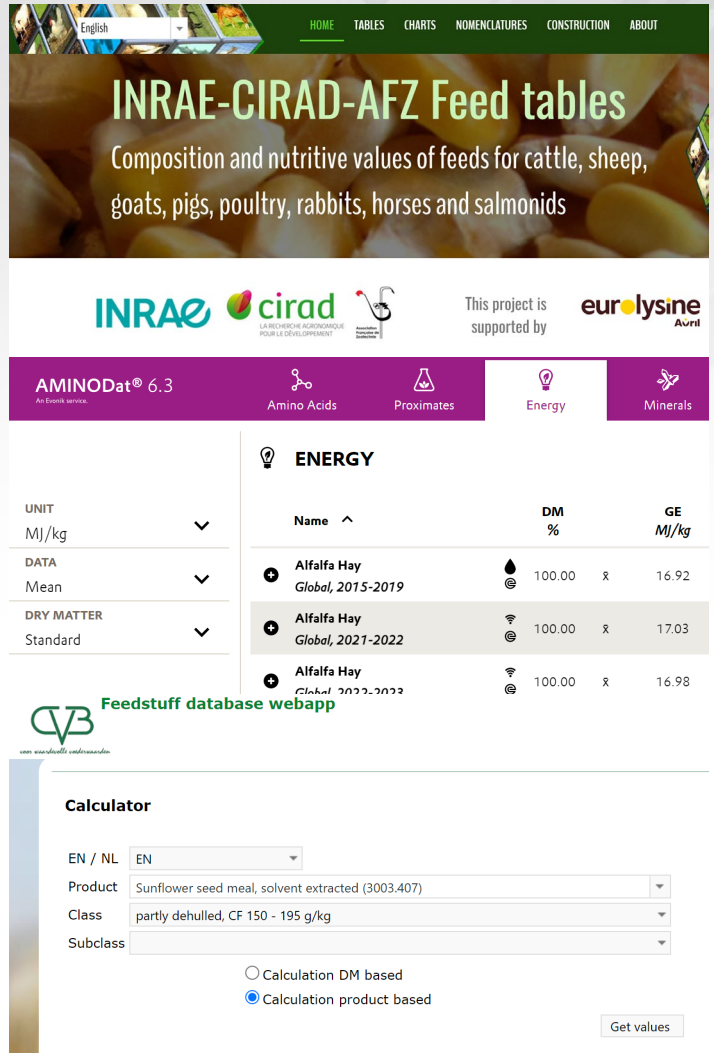
Heath & Stability

- Internal biosecurity.
- Mycoplasma Hysonovia.
- Health monitoring sow, nursery and GF.



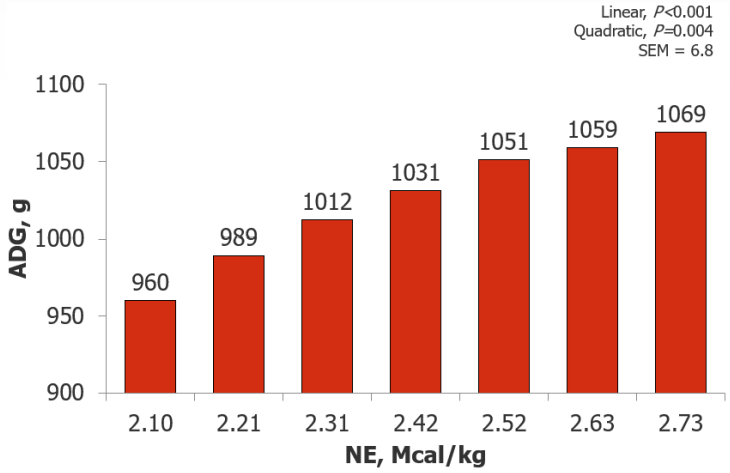
Diet Formulation

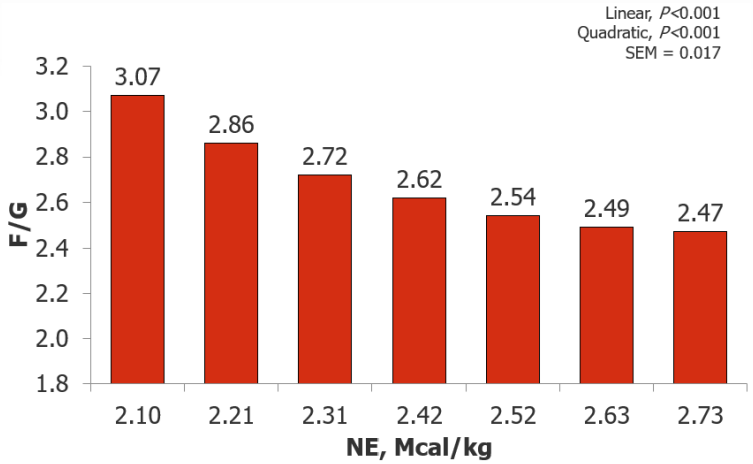
- Difference between Formulators vs. Nutritionists.
- Formulate for nutrients, not ingredients
  - Energy, amino acids, minerals, vitamins.
  - Acid binding capacity (ABC), dietary electrolyte balance (DEB), fermentable fiber, polyunsaturated fatty acids (PUFAs)…
- Accurate nutrient loading values – crucial for predictable performance.
  - INRA, Evonik, CVB…

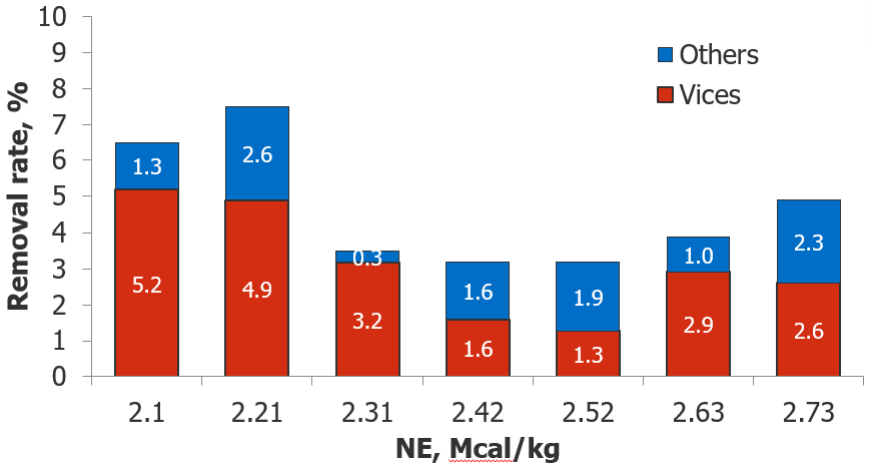


Diet Formulation

- Dietary net energy (NE).
  - Impact on cost.
  - Genotype response to NE changes.
  - Behavior and vices.
  - Space & marketing weight constraints.



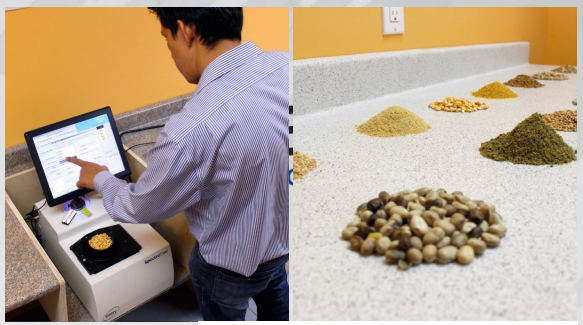


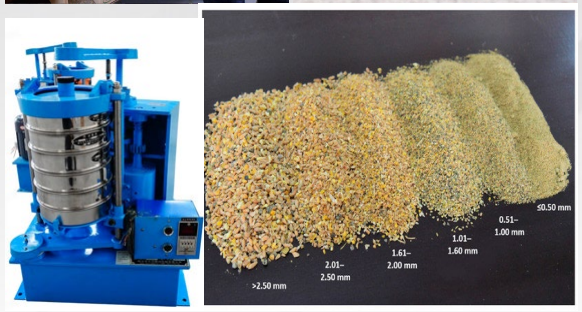


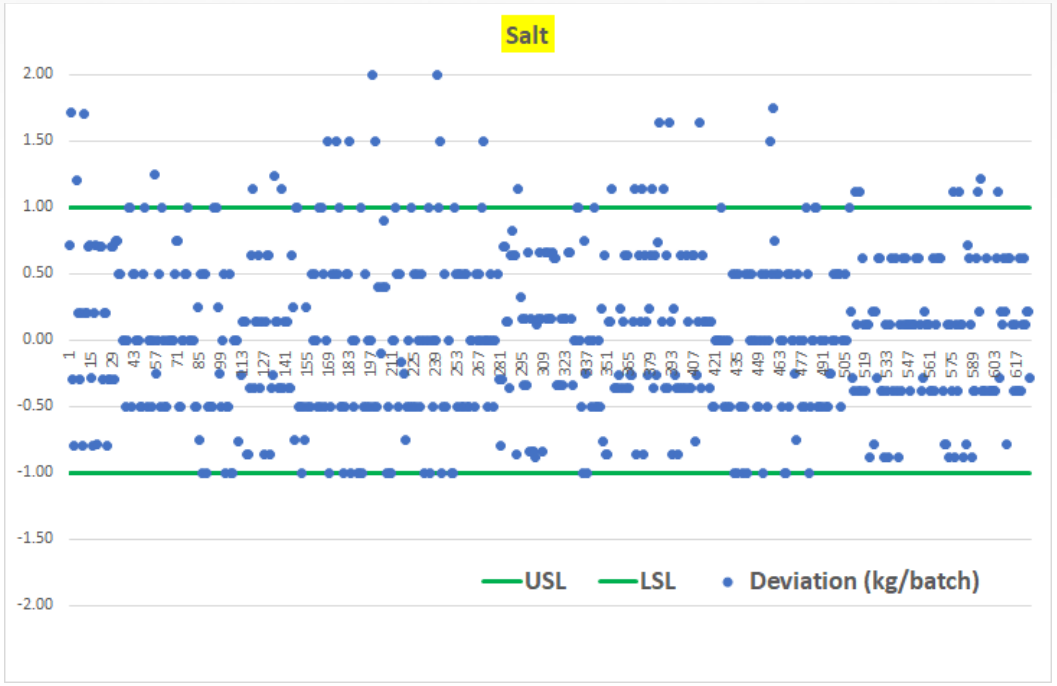
Lu et al., 2020 (n = 2,058)

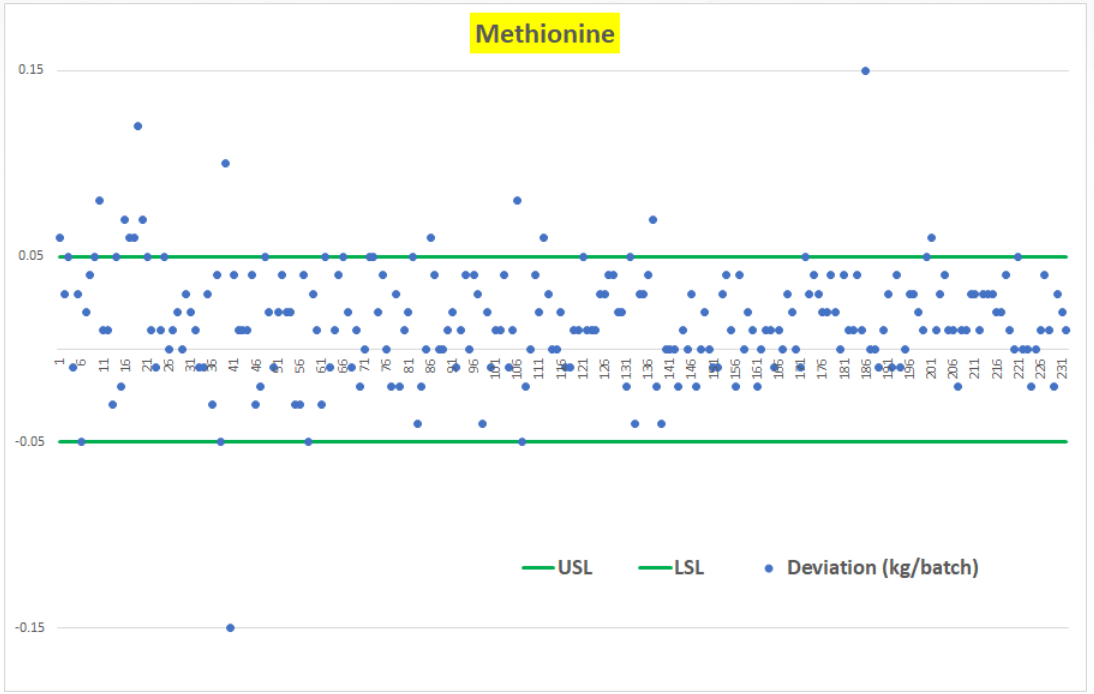
Diet Formulation

- Feedmill scale resolution:
  - Main, intermediate, micro…
- Robust QA program – ingredients & feed
  - Appearance, density, nutrients, particle size, mycotoxins…









Diet Formulation

- Alternative ingredients:
  - Barley, wheat, rice, rye.
  - Peas, faba beans, lentils.
  - Sunflower meal, canola meal, etc.
  - Food & by-products: bread, chips, cookies, candy, whey permeate, buttermilk etc.

Diet Formulation

- Impact of higher-fiber diets:
  - Dressing and carcass yield.
  - Vices in pigs.
  - Feed processing – grinding, hammer and screen wear.
  - Mixing – batch size, mixing uniformity, feed density and trucking.
  - Manure volume, cost, manure pit cleaning/emptying.

K-STATE Research and Extension

SWINE DAY 2017

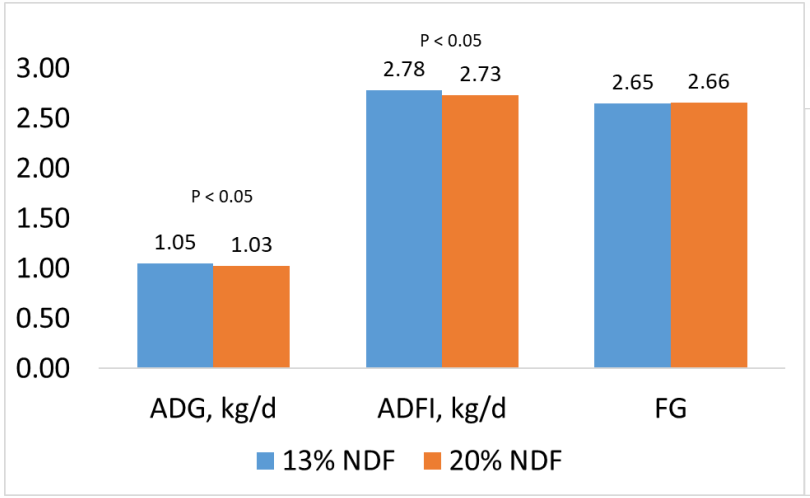
Regression Analysis to Predict the Impact of High Neutral Detergent Fiber Ingredients on Carcass Yield[1]

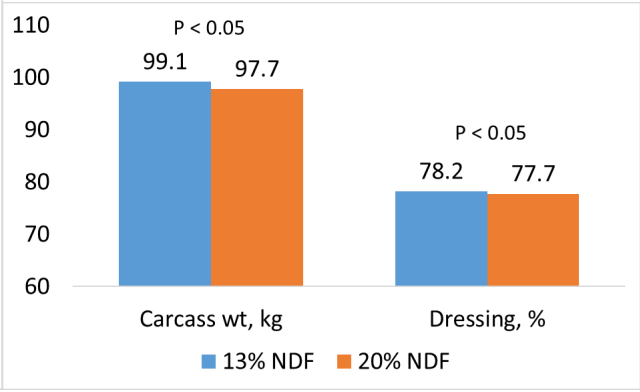
J.A. Soto, M.D. Tokach, S.S. Dritz,[2] M.A.D. Goncalves,[3] J.C. Woodworth, J.M. DeRouchey, and R.D. Goodband

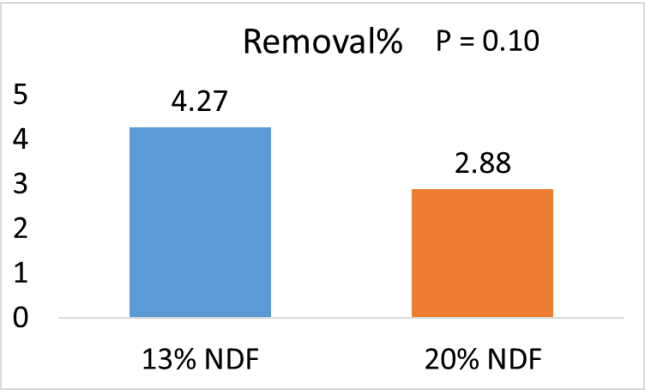
Table 2. Regression equation to predict carcass yield from dietary NDF and withdrawal strategies[1]

Yield, %	= 0.03492 × WP (d) – 0.05092 × NDF1 (%) – 0.06897 × NDF2 (%) – 0.00289 × (NDF2 (%) × WP (d)) + 76.0769

[1] Data from 8 trials were used as a database for the statistical analysis to develop the model.
NDF1 (%) = NDF concentration in dietary phase before final dietary phase.
NDF2 (%) = NDF concentration in final dietary phase before marketing.
WP (d) = withdrawal period.







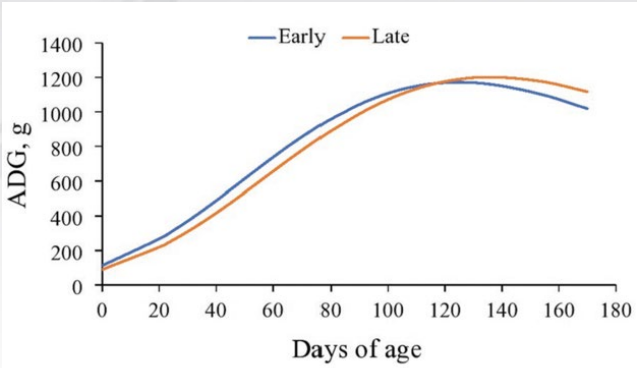
Orlando et al., 2020 (n = 2,016)

Factors Impacting Growth & Feed Conversion:

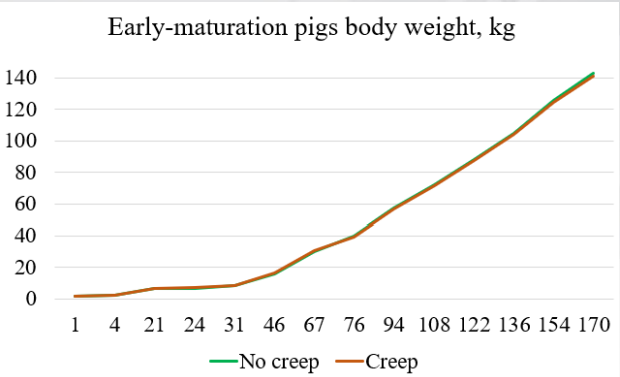
- Value of growth and FG improvement.
- Dietary NE and change in ADG & FG.
  - 2% increase in NE:
    → 1% increase in ADG.
    → 2% reduction in FG.
- Not all genotypes respond the same.

Factors Impacting Growth & Feed Conversion:

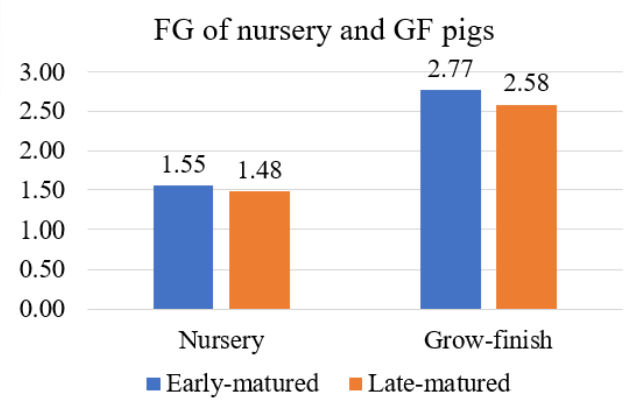
- Genotype:
  - Early vs. late maturation.
  - Synthetic vs. Duroc.
  - Maternal line.



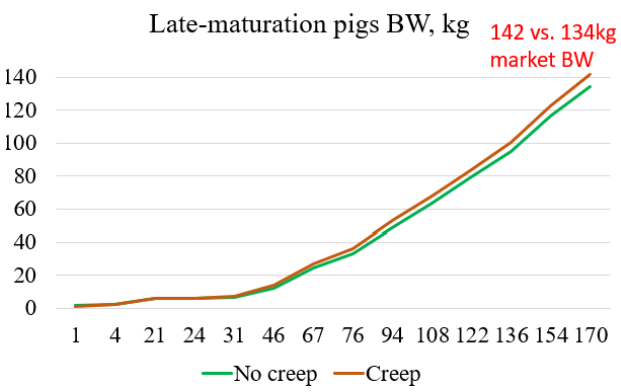
Late matured pigs had slower growth until 136 days of age (100kg BW).



Creep feed did not help early-maturation pigs to grow better.



Late matured pigs had better FG in nursery and GF

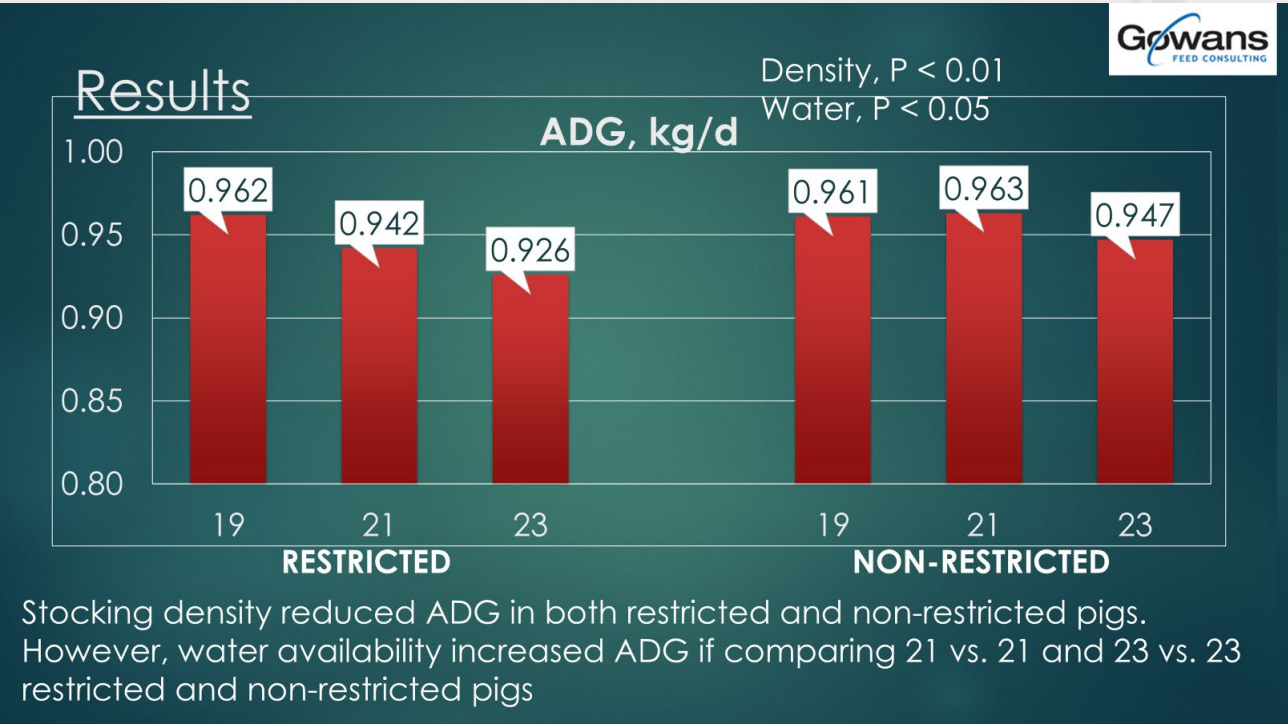


Creep feed helped late-maturation pigs to grow better.

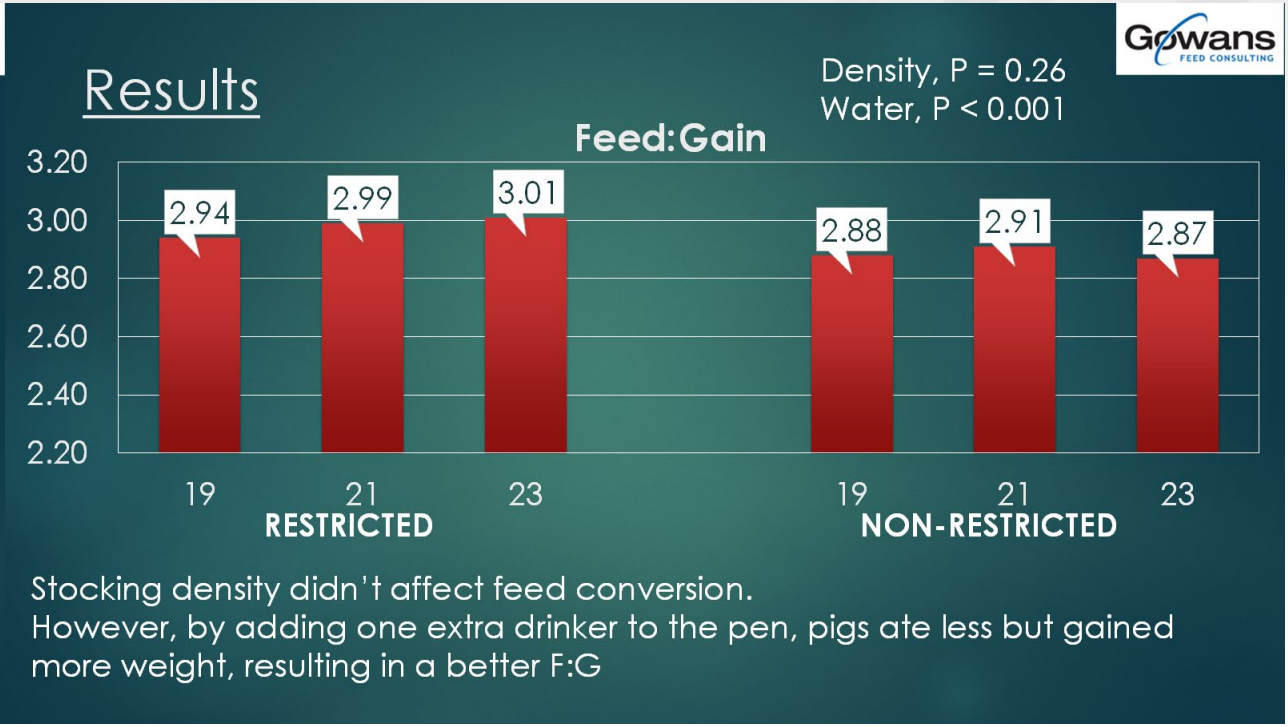
Wensley et al., 2023 (n = 21 litters)

Factors Impacting Growth & Feed Conversion:

- Stocking density & water source.



Stocking density reduced ADG in both restricted and non-restricted pigs. However, water availability increased ADG if comparing 21 vs. 21 and 23 vs. 23 restricted and non-restricted pigs

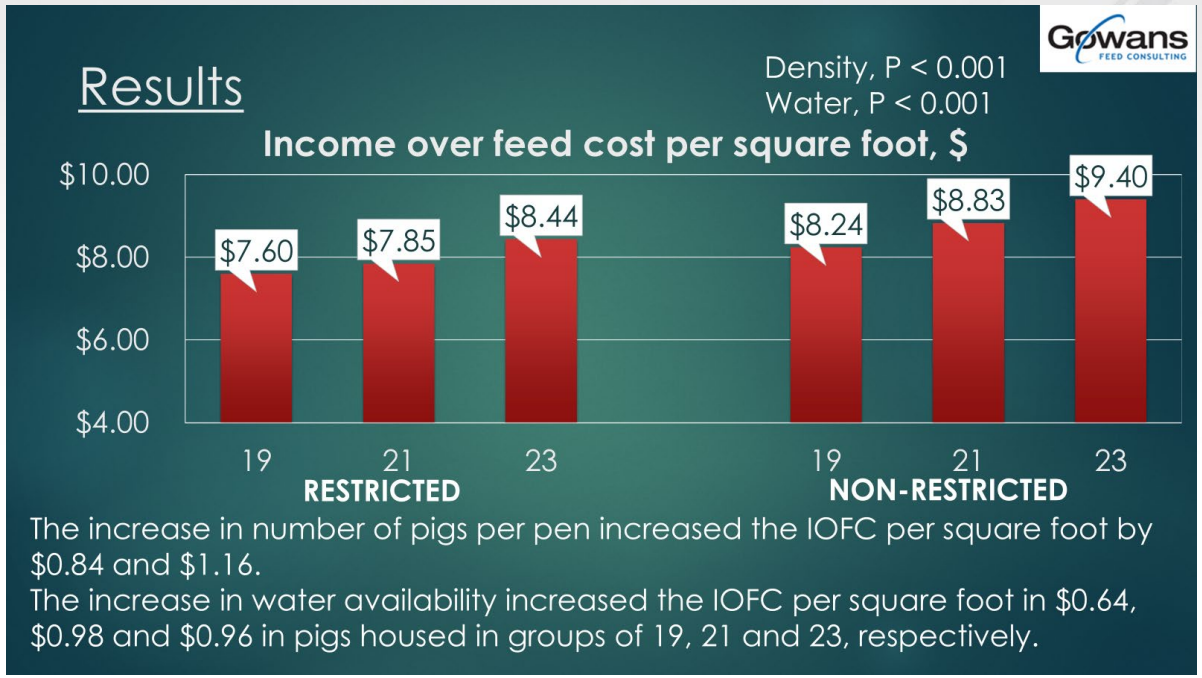


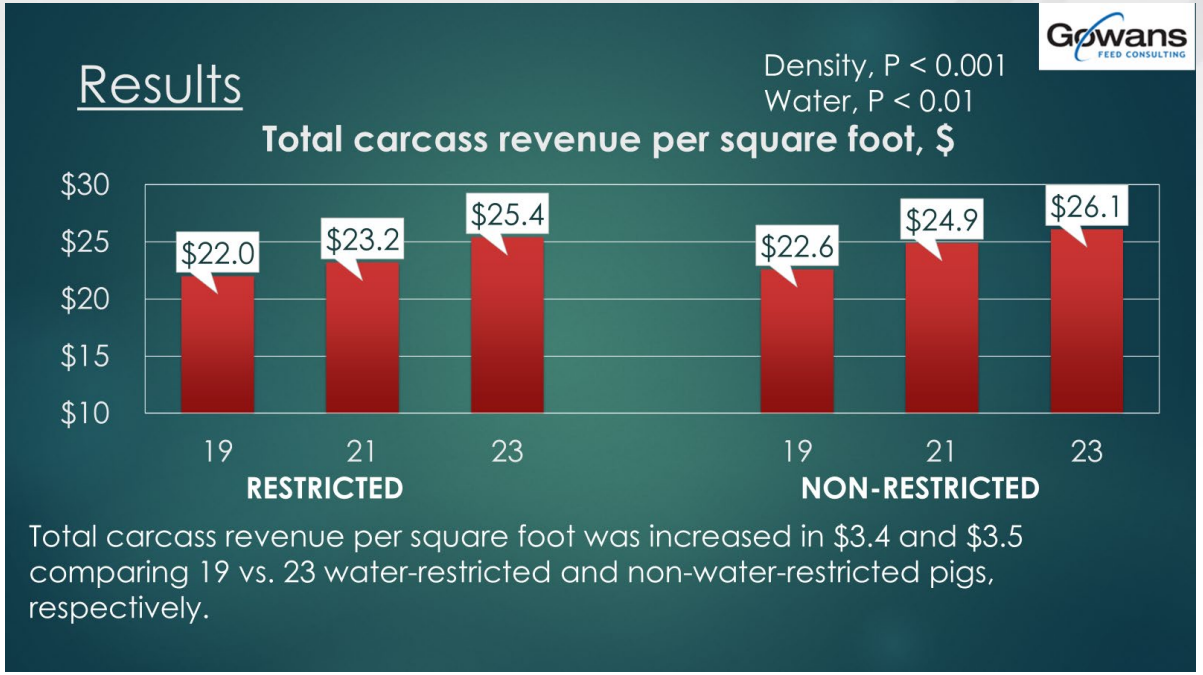
Stocking density didn't affect feed conversion. However, by adding one extra drinker to the pen, pigs ate less but gained more weight, resulting in a better F:G

Gowans Feed Consulting & Prairie Swine Centre, 2013 (n = 1008)

Factors Impacting Growth & Feed Conversion:

- Stocking density & water source.





Gowans Feed Consulting & Prairie Swine Centre, 2013 (n = 1008)

Factors Impacting Growth & Feed Conversion:

- Feeder space

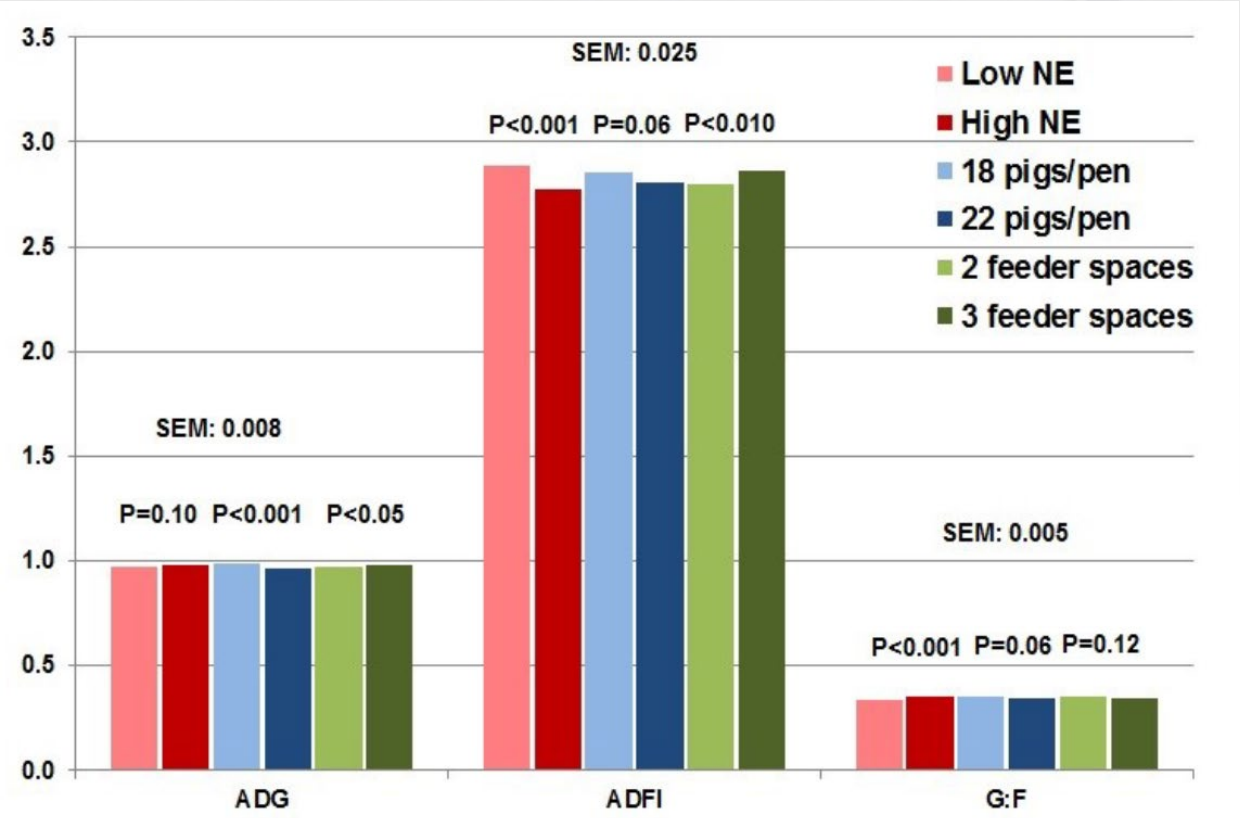
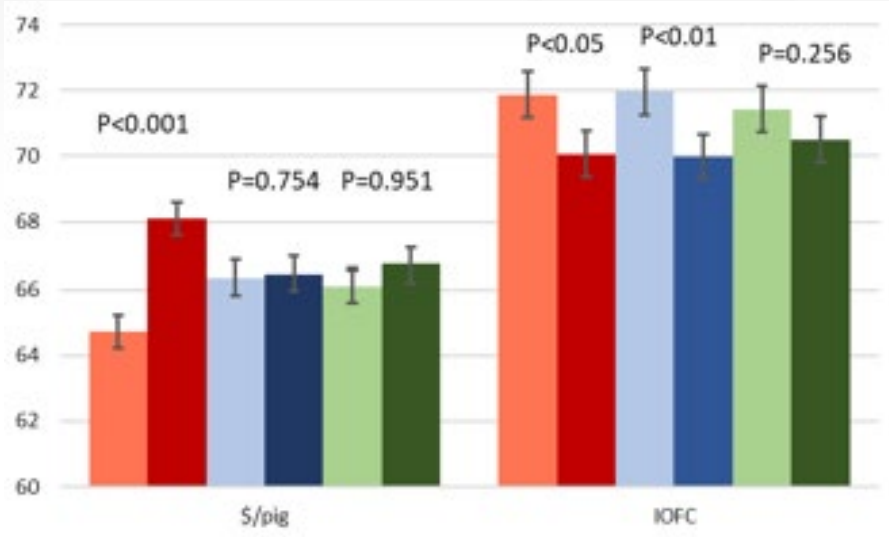


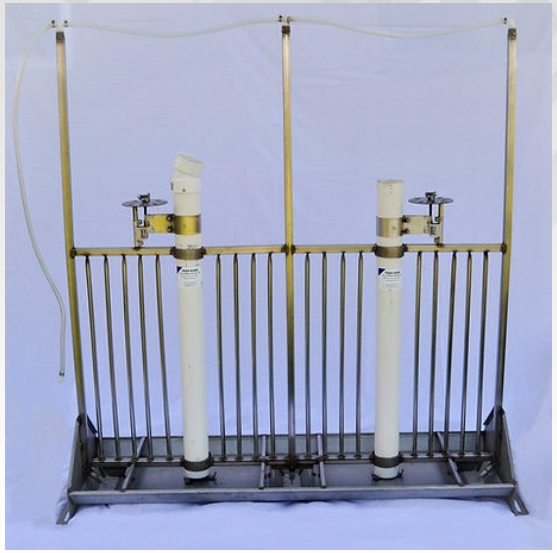
Figure 1. Effect of dietary NE level, feeder space and stocking density on growth performance



Smit et al., 2021 (n = 1920)

Factors Impacting Growth & Feed Conversion:

- Feeders:
  - Wet-dry vs. dry feeders.
  - Tube vs. shelf feeders.
  - Water away from feeders.
- Feeder management.
  - Maximize intake.
  - Minimize feed wastage.



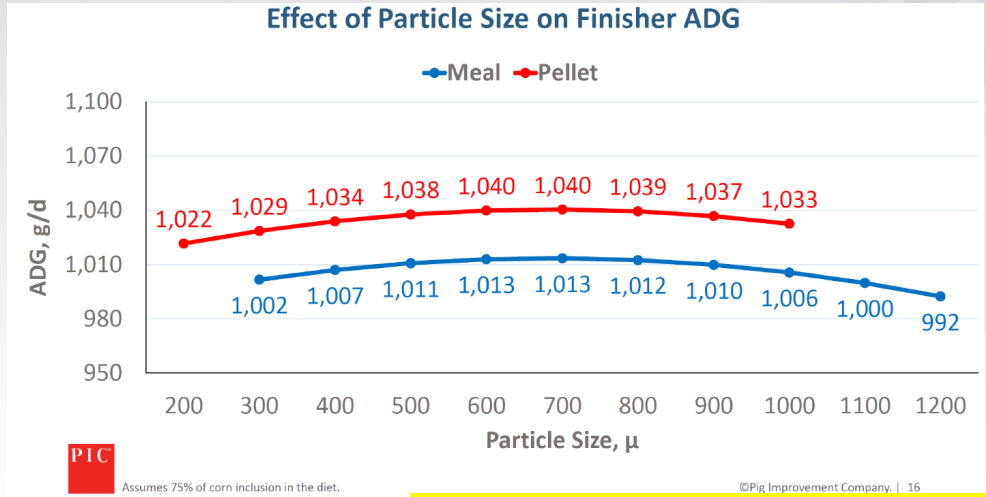
Factors Impacting Growth & Feed Conversion:

- Growth promotors

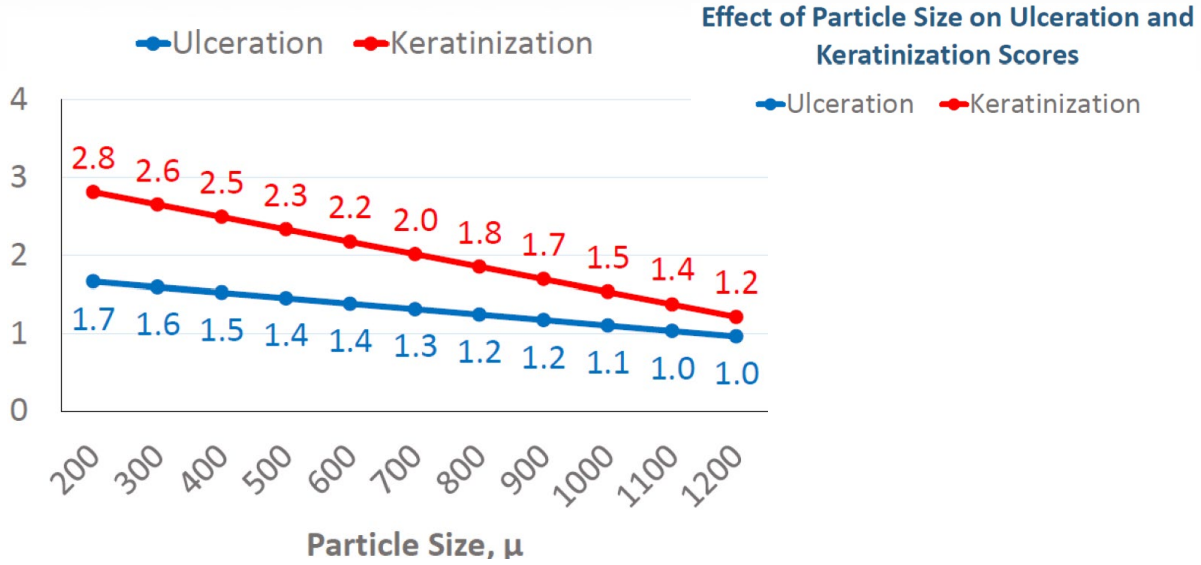
Group	No meds	Salino/Narasin	Difference
End wt, kg	127.05	127.7	0.65
ADG, g/day	961	969	0.83%
F:G	2.88	2.80	-2.78%
Mortality	No difference		

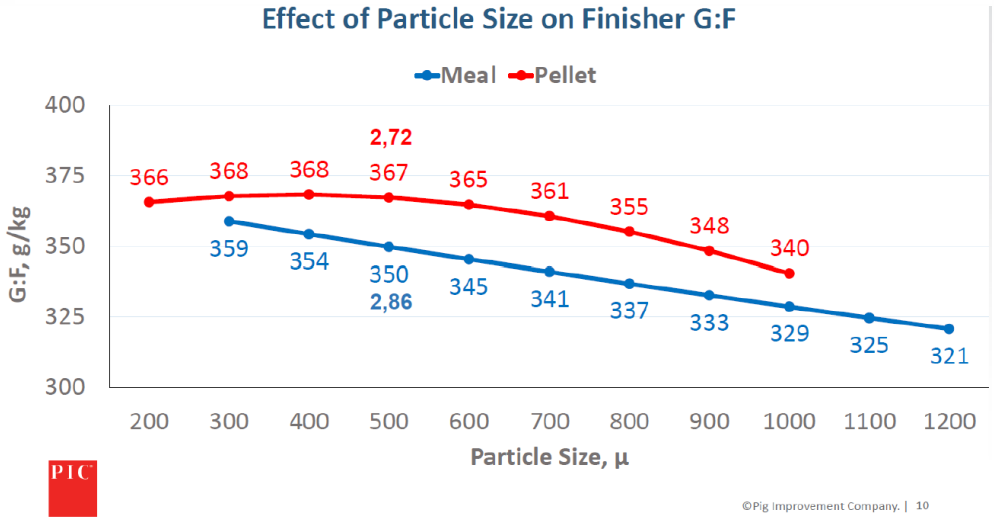
Factors Impacting Growth & Feed Conversion:

- Particle size:
  - Every 100-micron reduction:
    - F:G improves 1.2%.
    - Feed cost reduced $2.45.
  - Particle size lower than 400 microns – high risk of ulcers.



Summarizing 29 trials from 1986 – 2016





Factors Impacting Growth & Feed Conversion:

- Particle size
  - ➢ Fine diet + 5% coarse particles maintained FG & reduced ulcers.

Particle size and oesophagus lesions

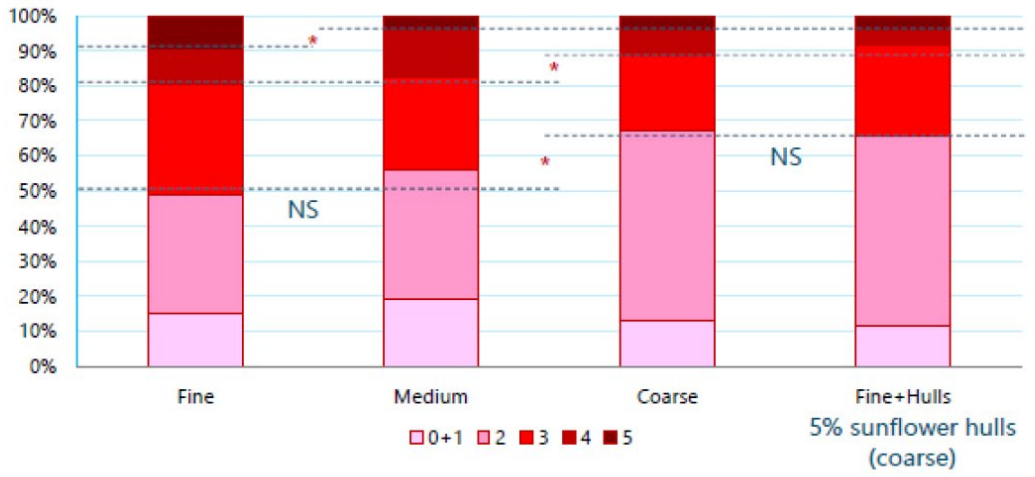
- Growing-fattening
- Pelleted feed
- Grinding:
  1= Fine
  2= Medium
  3 =Coarse
  4 = Fine
  + 5% sunfl. hulls

Particle % pellet	Fine	Medium	Coarse	Fine +hull
< 0,1 mm	62	58	55	58
0,1 – 1,4 mm	35	32	27	36
> 1,4 mm	3	10	18	6

- Coarse
  - Higher ADFI (spillage?)
  - Higher FCR
- Fine + hulls
  - Lower ADFI
  - Better FCR

Performance 25-110	Fine	Medium	Coarse	Fine +hull	P val.
ADFI	2.19 b	2.24 ab	2.26 a	2.17 c	0.02
ADG	887	884	884	897	NS
FCR	2.49 b	2.52 ab	2.6 a	2.45 c	0.001

Influence of diet on ulcers frequency in fattening pigs



- Fine diets increased stomach ulcer problems.
- Coarse diets and fine diets + addition of 5% sunflower hulls reduce the incidence of stomach ulcers.
- Potential to grind fine all the diet and only add fibre ingredients coarse> better production results?

SFR, 1998

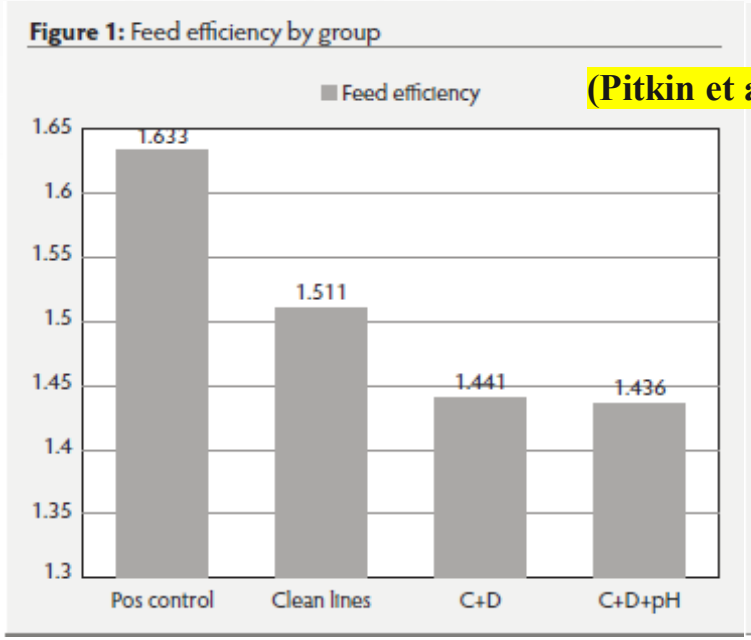
Dirkzwager et al., 1998 (n = 1,288)

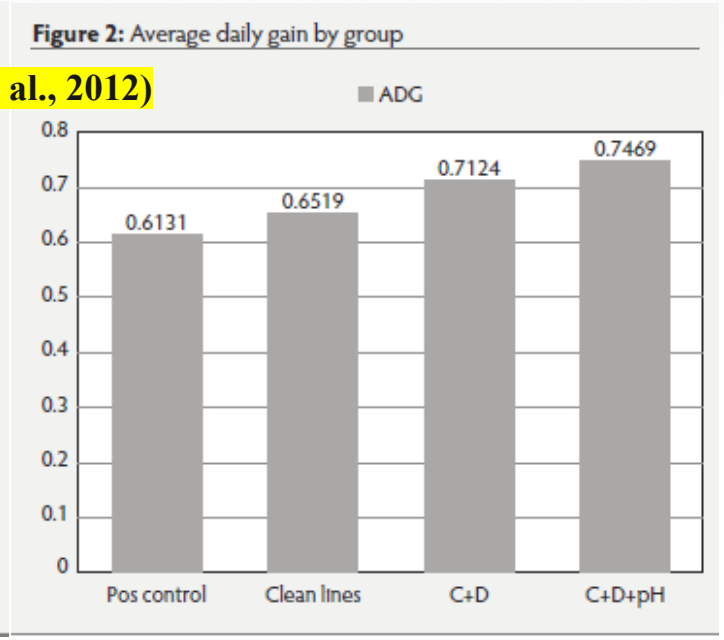
Factors Impacting Growth & Feed Conversion:

- Water quality
  - pH, minerals, microorganisms.
  - Impact on performance.

C+D: Clean lines + chlorine dioxide
C+D+pH: Clean lines + chlorine dioxide + acidifier

(Pitkin et al., 2012)





Typical water quality report

ACFT
Alberta Centre For Toxicology

UNIVERSITY OF CALGARY
HM-B19, 3330 HOSPITAL DRIVE NW
CALGARY, ALBERTA T2N 4N1

REPORT TO:
CENTRAL ZONE (3)
WAINWRIGHT COMMUNITY HEALTH
#22, 810 -14 AVENUE
WAINWRIGHT AB
T9W 1R2

PRIVATE DRINKING WATER FROM:

Req. ID No: T199394
Lab Code: 2016070835

CERTIFICATE OF CHEMICAL ANALYSIS

			Comments:	CDW GUIDELINES
pH	8.22			6.5-8.5 units AO
Conductivity	990	uS/cm		
Sodium	103.16	mg/L		≤ 200 mg/L AO
Potassium	3.99	mg/L		
Calcium	73.66	mg/L		
Magnesium	29.87	mg/L		
Total Hardness (CaCO3)(Calc)	306.93	mg/L		
Iron	1.13	mg/L		≤ 0.3 mg/L AO
Total Alkalinity (CaCO3)	403.1	mg/L		
Carbonate	0	mg/L		
Bicarbonate	491.8	mg/L		
Hydroxide	0	mg/L		
Chloride	7.5	mg/L		≤ 250 mg/L AO
Fluoride	0.3	mg/L		1.5 mg/L MAC
Nitrite (N)	0.83	mg/L		1.0 mg/L MAC
Nitrate (N)	0	mg/L		10 mg/L MAC
Sulfate	119.9	mg/L		≤ 500 mg/L AO
Total Dissolved Solids (Calc)	581.25	mg/L		≤ 500 mg/L AO
Cation Sum	10.76	mEq/L		
Anion Sum	10.86	mEq/L		
Ion Balance(Cation/Anion)	99.07	%		
Ion Balance (% Difference)	-0.47	%		

Comments: Results relate only to the sample tested. Values less than LOQ are reported as zero.

Received: 7/6/2016
Reported: 7/14/2016
Certified By:

CDW = Canadian Drinking Water
AO = Aesthetic Objectives
MAC = Maximum Acceptable Concentration
LOQ = Limit of Quantitation

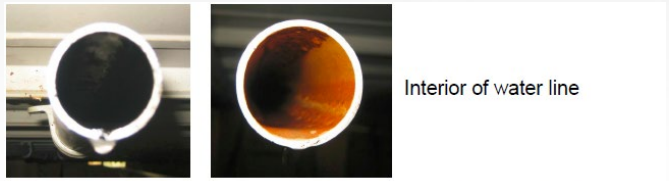
For: David W. Kinniburgh, PhD, FCACB
Director
Alberta Centre for Toxicology

NOTE: Sample was analyzed more than 2 days after collection; Nitrite-N value could be higher than reported value. Discuss with PHI for recollection if required. PHI should call ACFT for recollection instructions.

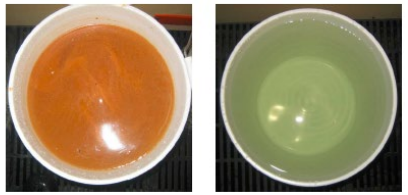
RECEIVED
JUL 21 2016

Factors Impacting Growth & Feed Conversion:

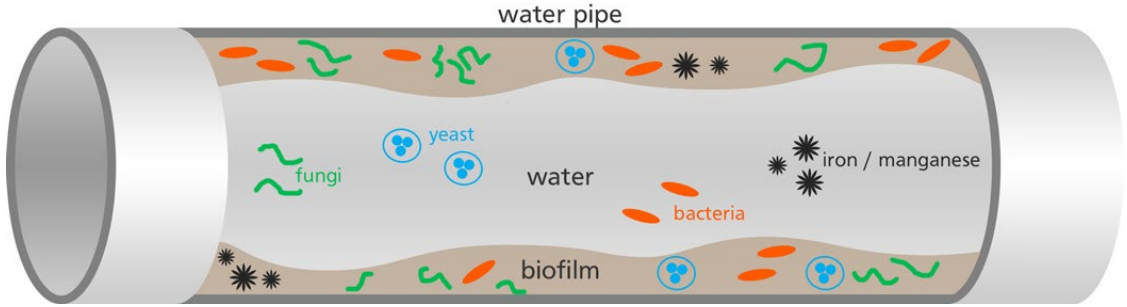
- Water quality
  - Hard water minerals.
  - Water line cleaning protocol.
  - Reducing mortality & medication cost.



Interior of water line



First 5 gallons and last five gallons



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www.gowansfeedconsulting.ca

Water line cleaning with hydrogen peroxide (no animals present)

When using hydrogen peroxide to clean the lines it is very important that there is some air release in the lines because the hydrogen peroxide creates bubbles and the air pressure might break the lines. See below a picture of the valve that can be installed at the end of the line. The valve can be opened a little bit to release some air and water. To make sure that there is air release and lines will not break, it is better to check the valves at the end of the lines every 2 hours or so to allow some air release.

EQUIPMENT/MATERIAL REQUIRED

a. Dosing system (Dosatron, Selko-InLine, Stenner, Digi-Doser, etc.)
b. Hydrogen peroxide 50%

PROTOCOL:

1. Before cleaning the water lines make sure there are no animals in the room. If animals are present, there are other options using a lower dose of hydrogen-peroxide but for longer period of time.
2. Completely empty the lines and all nipples in each pen.
3. Set the dosing system at 3:100 hydrogen-peroxide:water
4. Fill the lines with the solution at 3:100 hydrogen-peroxide:water and once it's filled, turn off the dosing system. The cleaning solution will remain in the line for 10-12 hours, making sure that there is adequate air release out of the system. Can start first thing in the morning and finish in the afternoon.
5. After ~10-12h, the water lines and all the nipples in each pen need to be totally emptied.
6. Then fill the lines again with fresh water (no hydrogen-peroxide added). The idea is to well flush the lines and nipples so there is no residue of biofilm or hydrogen peroxide in the line or nipples. After the flushing, empty again all nipples and water lines.
7. Water lines are now cleaned and there is no residue of hydrogen peroxide in the line or nipples.

Finisher mortality

- Parity segregation
  - Segregation between the offspring of the P1 sows and the offspring of all the other parity sows.
  - Allowed us to stabilize PRRS in the progeny.
  - Improved control of mycoplasma.
  - Design a system specifically for P1 progeny.

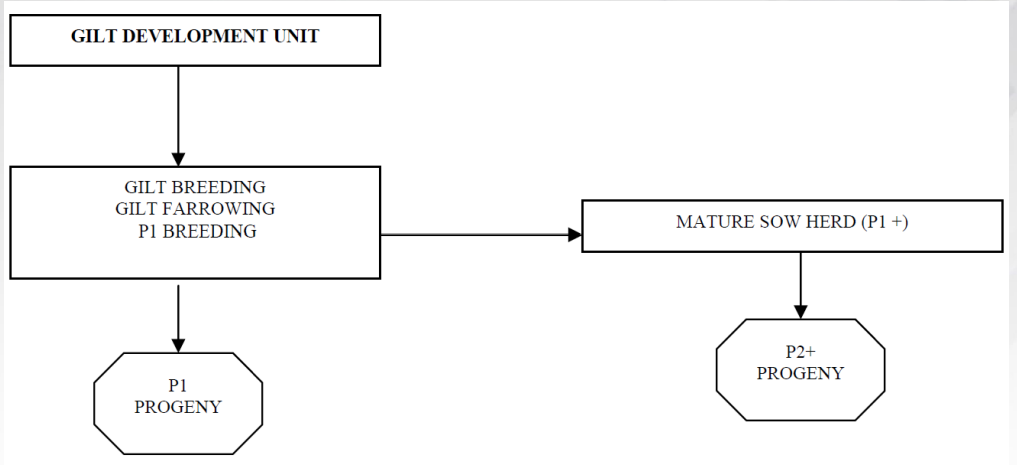


Table 1. Production results for P1 and P2 + progeny.

	P1 Offspring	P2+ Offspring
Nursery Mortality (%)	2.96	1.52
Nursery ADG (g/day)	430	465
Nursery Drug Cost (US $)	1.37	0.53
Finisher Mortality (%)	3.8	3.25
Finisher ADG (g/day)	795	820
Finisher Drug Cost (US $)	1.07	0.77

Moore, 2005

Finisher mortality

- Feed grind size.
- Feed additives.
  - Hy-D & high-level vitamin E?
  - Enzymes and substrates.
    - Xylanase.
    - Health status.
- Fiber and gut health.
  - Fermentable fiber ideal for finishing pigs.

Item	Meal, μm			
	1,000	800	600	400
Stomach ulceration				
No. of observations	20	20	20	20
Normal	19	17	15	10
Erosions	0	3	2	4
Ulcers	1	0	2	6

Wondra et al., 1995

Fibre rich feedstuffs and fermentability based on growing pigs

Feedstuff	Fiber	NSP	Fermt	FCHO	iCHO
Sunflower sd meal	25.3	46.1	34	17.7	31.3
Rice bran	5.3	19.7	46	9.0	11.5
Wheat bran	8.5	37.6	47	19.3	20.6
Palmkernel meal	16.7	60.9	47	42.2	19.3
Rapeseed meal	12.4	33.9	55	20.9	16.4
Maize DDGS	6.8	42.9	71	30.9	12.5
Soy hulls	35.0	68.0	75	51.8	17.3
Citrus pulp	12.4	55.5	83	48.0	9.7
Beet pulp	17.3	66.8	84	56.1	11.0

NSP= Non-Starch Polysaccharides (D.M. – ash – protein – fat – starch- sugars), Fermt. = fermentability, FCHO = fermentable carbohydrates, iCHO = inert carbohydrates

SFR Feedstuff table

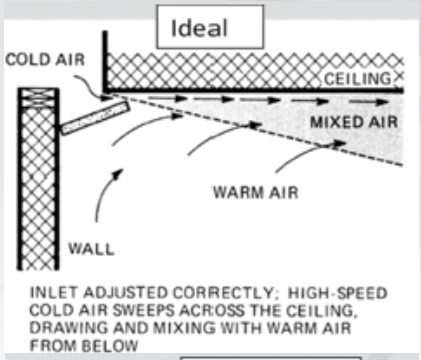
Knowhow to feed

29

Schothorst Feed Research., 2023

Finisher mortality

- Ventilation management.
  - Big impact on pig comfort.
    - Pigs defecate & urinate in drafty areas in pens.
    - Fighting for comfort zone → injury.
    - Slippery floor → injury.
    - Stress → illness & vices.
  - Key points:
    - Ensure sufficient air volume (CO2).
    - No direct drafts hitting pigs (inlet management).
    - Observe pig behavior.



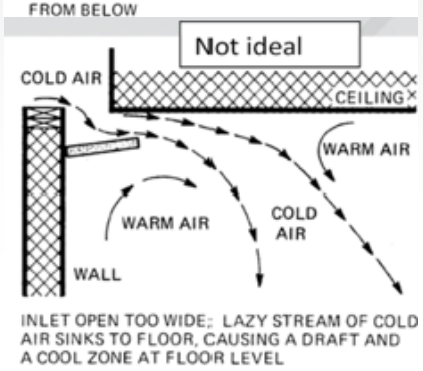
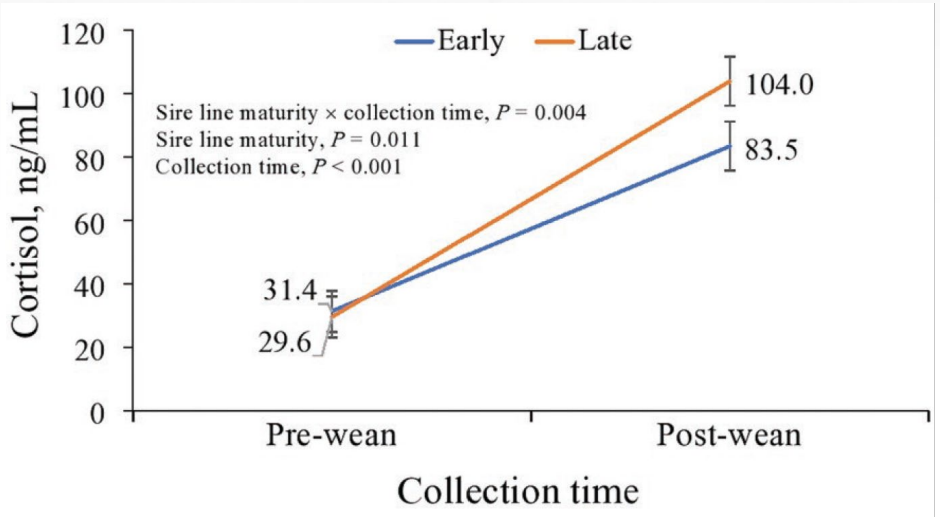


Table 1. Rules of thumb for swine ventilation (adapted from Midwest Plan Service).

		Ventilation Rate (cfm/head)	
Production Phase	Weight (lbs)	Winter Minimum	Hot Weather
Sow and Litter	450	20	500
Nursery	12-30	1.5 to 2	25
Nursery	30-75	3	35
Finishing	75-150	7	75
Finishing	150 to Market	10	120
Gestating sow	400	14	250

Finisher mortality

- Belly rupture – piglet processing.
- Vices:
  - Ventilation, water quality, pen space, feeder space.
  - Fiber.
  - Net energy & lysine.
  - Salt.
  - Out of feed event.
- Big vs. small pen groups.
- Genotype – synthetic vs. late maturation



Late matured pigs are more stressed after weaning

Wensley et al., 2023 (n = 21 litters)

Improvest

- What is Improvest?

IMPROVEST

- **Acts like a vaccine**
- **2 doses will create antibodies that temporarily block production of sex hormones**

INDICATIONS

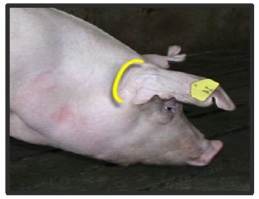
- For the **temporary suppression** of testicular function and reduction of boar taint in intact male pigs intended for slaughter **(2011)**
- For the **temporary suppression** of ovarian function and suppression of estrus in intact female pigs intended for slaughter **(2016)**

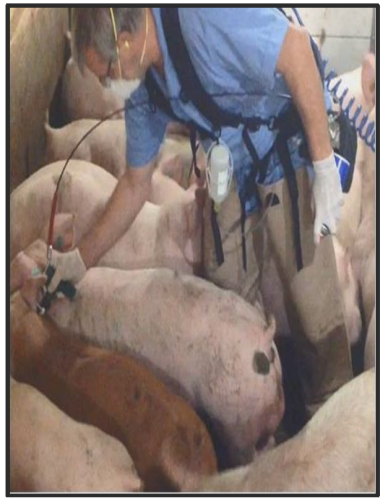
Veterinary prescription

zoetis

Injection Site

2cc/dose
SQ



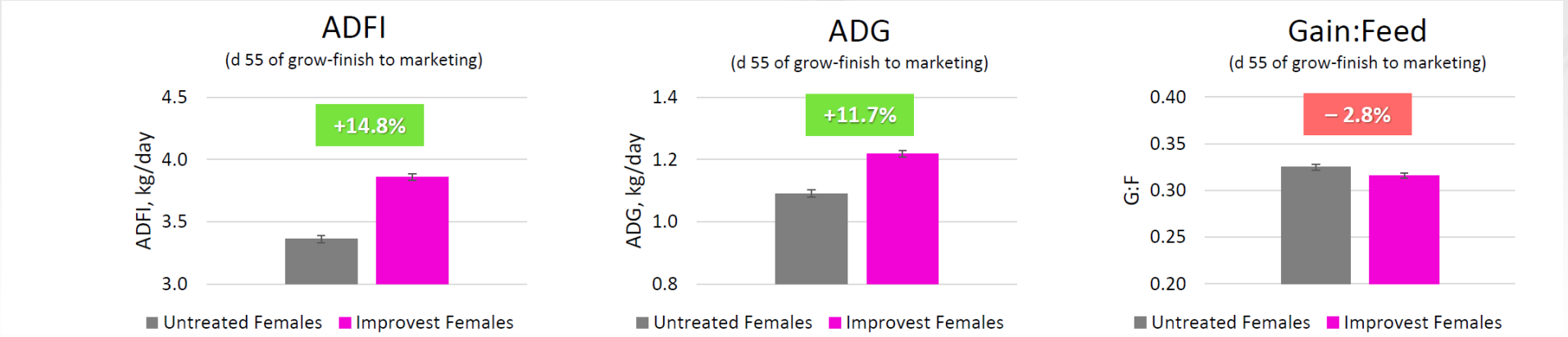


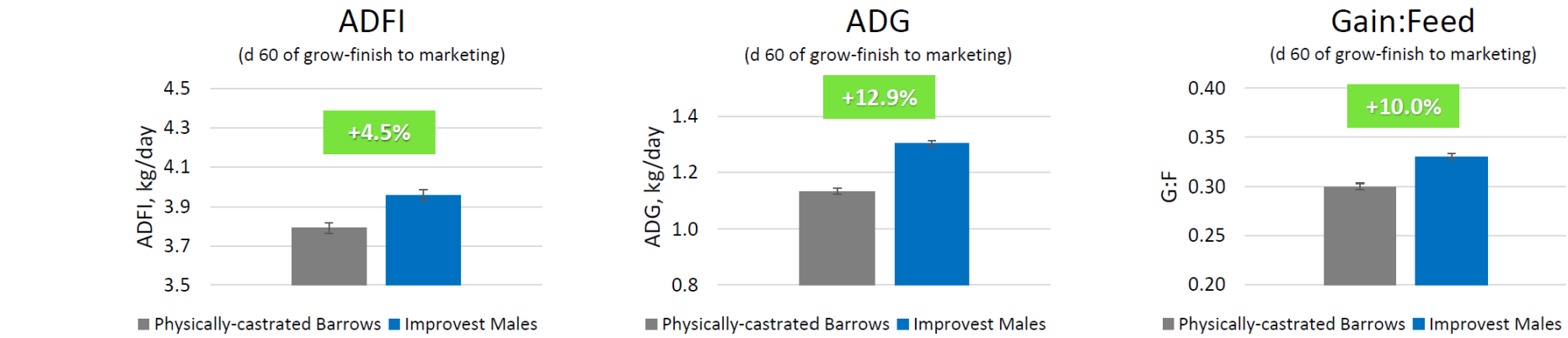
Improvest can be administered by Syringe + Needle (Sekurus) or Needle-free equipment (Pulse)

zoetis

Improvest

- Impact on live performance



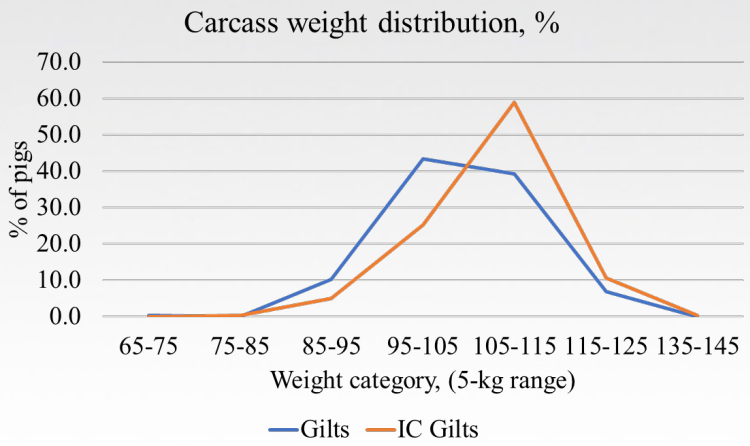


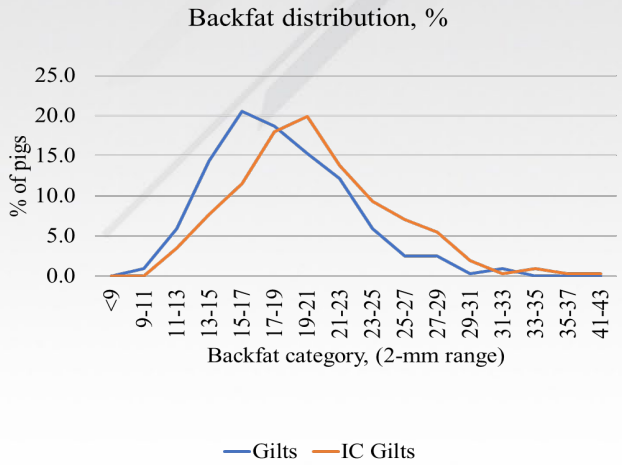
[6] Bohrer et al. (2024a) - https://doi.org/10.1093/tas/txae027

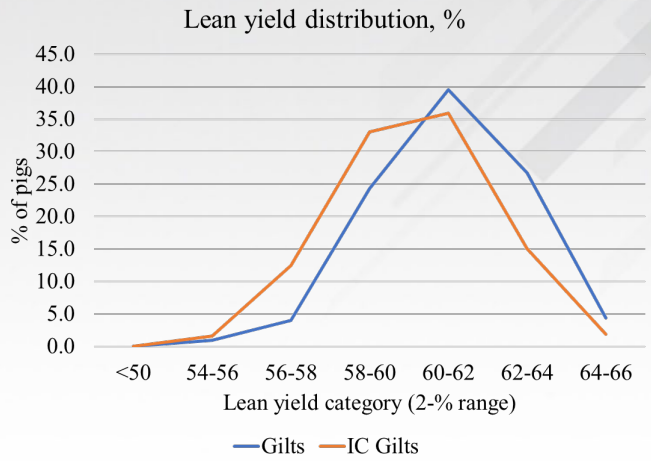
Improvest

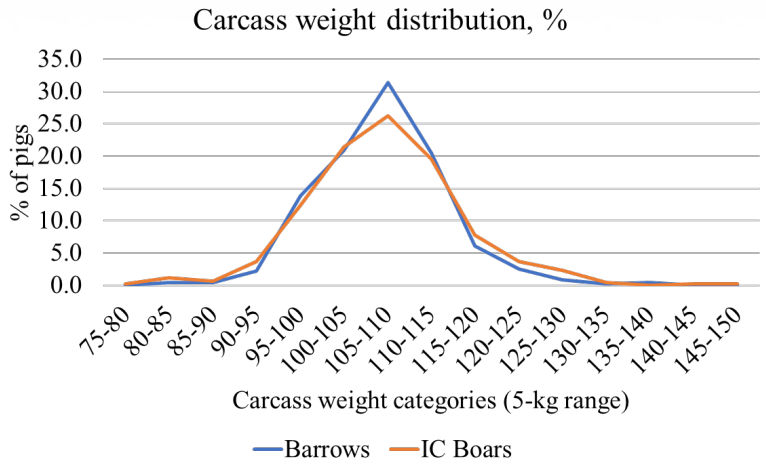
- Impact on carcass performance

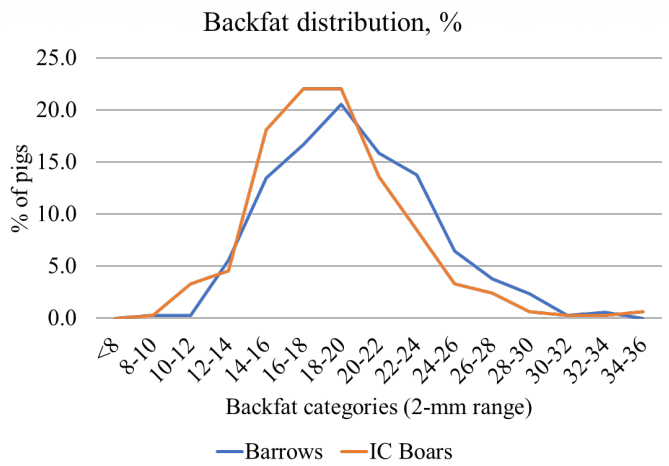
Bohrer et al., 2021, 2022 (n = 1008)

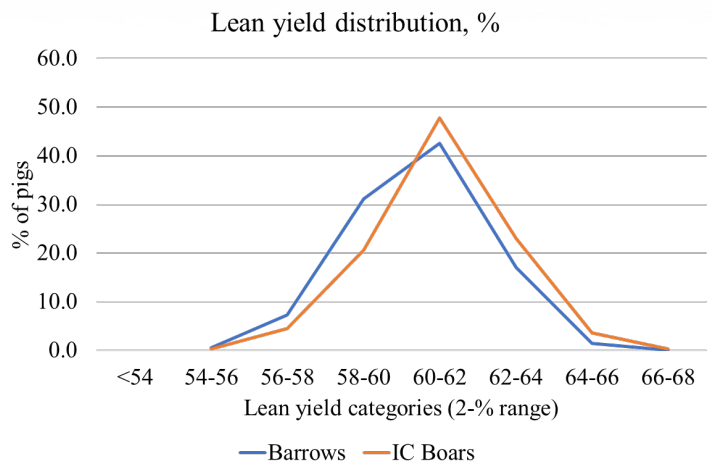






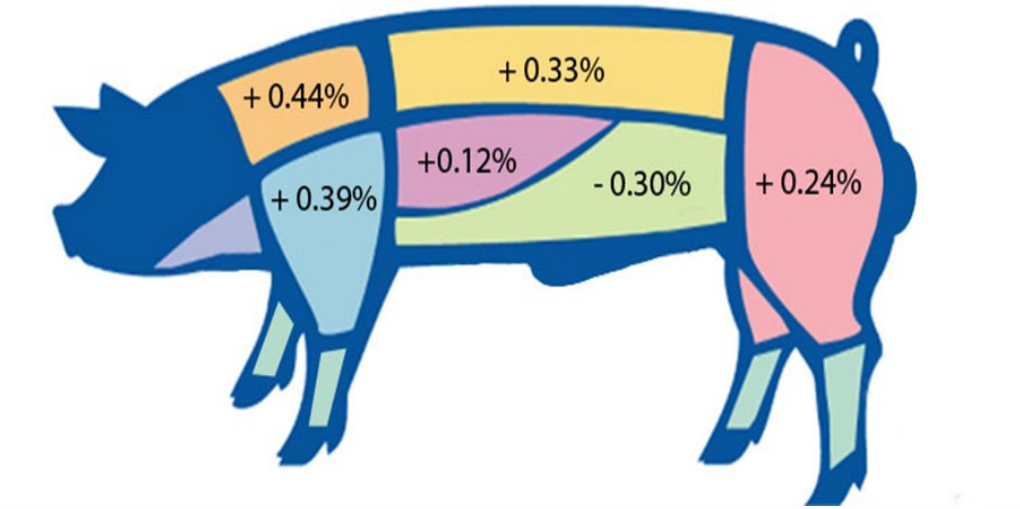






Improvest Males – Carcass Cutting Yields[2]

	Effect IC - PC	SED	*P*-value
Boston butt, % chilled side wt.	0.44	0.12	< 0.001
Picnic, % chilled side wt.	0.39	0.12	< 0.01
Trimmed loin, % chilled side wt.	0.33	0.22	0.13
Spareribs, % chilled side wt.	0.12	0.06	0.06
Natural fall belly, % chilled side wt.	-0.30	0.15	0.05
Whole ham, % chilled side wt.	0.24	0.23	0.30



Carcass Value Impact from cutting yield differences at common HCW:

- Average **$2.44 USD** per head using 5-year primal pricing avg. (2011-2015)
- Range of **$2.08 to 3.13 USD** per head (worst and best year primal pricing)

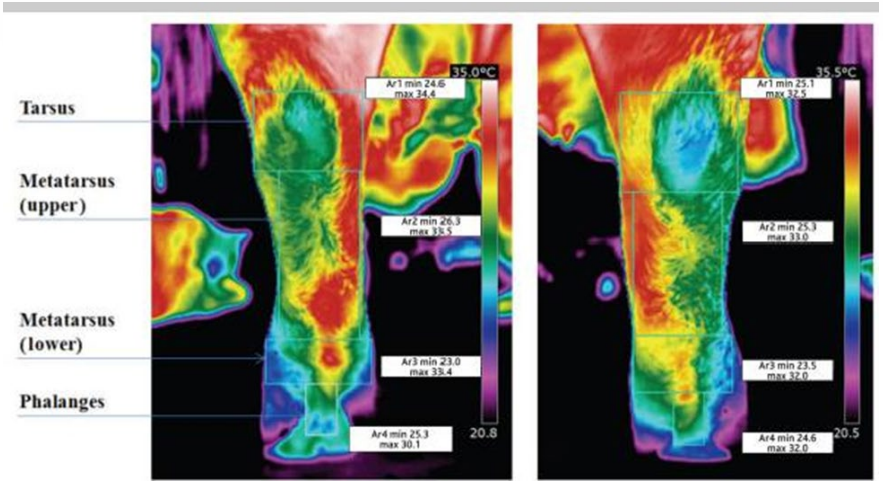
[2] Harsh et al. 2017 - https://doi.org/10.2527/tas2016.0009

Improvest

BENEFITS	
Males	Females
Greater growth rate (4 to 8%)	Greater growth rate (3 to 6%)
Improved feed efficiency (8 to 12%)	No (or minor) differences in feed efficiency
Greater carcass weights (1.5 to 5.0 kg)	Greater carcass weights (3.0 to 6.0 kg)
Greater carcass cutting yields (1.24% units)	Greater group uniformity for weight and fat thickness
	Improved fat quality (–2.75 iodine value units)
Net ROI Estimation - $3 production / $2 processing	**Net ROI Estimation - $? production / $3 processing**

Closing comments

- Health & stability – working with the health team.
- Nutritionist:
  - Feed QA from mill to farm.
  - Important to get on the ground.
  - Listen to people on ground.
- Keep open network – open to new information.
- New genotypes – performance, robustness, livability.
- New technologies.



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Thank you! Questions?

Gowans
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