Never Stop Improving

Dam parity is associated with reproductive performance in primiparous sows

Calderon Diaz, Casiro, Huerta, and **Lewis**

EAAP, Florence, September 2024

PIC

Demand for Sustainability & Welfare

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Corporations, shareholders, regulators, and consumers are demanding progress towards societal demands

Farm Journal's PORK

U.S. Pork Seeks To Reduce GHGs 40% By 2030, Announces On-Farm Sustainability Report For Producers

THE WALL STREET JOURNAL.

EU, China Unveil Sweeping Plans to Cut Greenhouse-Gas Emissions

Moves reflect a new urgency to limit emissions in two of the world's biggest economies

FINANCIAL TIMES

EU farmers should pay for their carbon emissions, says Denmark

Climate minister steps up calls to bring agriculture under bloc's CO_2 trading system

THE WALL STREET JOURNAL.

Brazilian Lawmakers Advance Country's Regulated Carbon Market

Local exporters hope that regulation will open doors in developed export markets

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BBC

More cattle kept in UK 'megafarms', BBC finds

The Guardian

From cage-free chicks to puppy mills and Avian flu: Republicans are trying to roll back animal protections

European Commission

EU Animal Welfare Platform priorities:

1. Better application of EU rules on animal welfare
2. Development and use of voluntary commitments by businesses
3. Promotion of EU animal welfare standards at the global level

FOUR PAWS

HELP #ENDTHECAGEAGE FOR ALL FARMED ANIMALS

We select for relevant economic and social outcomes

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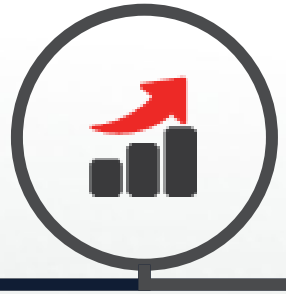

PIC overall breeding goal:
Maximize value potential across the pork chain

	Sow herd productivity	Fast and efficient growth	Robustness	Total carcass value
Drivers of economic success	High number of piglets High quality of piglets Sow herd efficiency	Efficient sire Heavy weight performance High weaning weight	Sow longevity High quality piglets Low mortality	Maximized primal value High processing value Eating satisfaction
Social outcomes	Low pre-wean mortality Reduced labor Success in group housing	Smaller footprint Naturally fast growing Improved nutrition	Reduced antibiotics Improved welfare Reduced labor needs	Reduced waste Nutritious Affordability

Nutritious, good tasting, affordable pork for consumers from ethically raised pigs

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Many traits influence customer success

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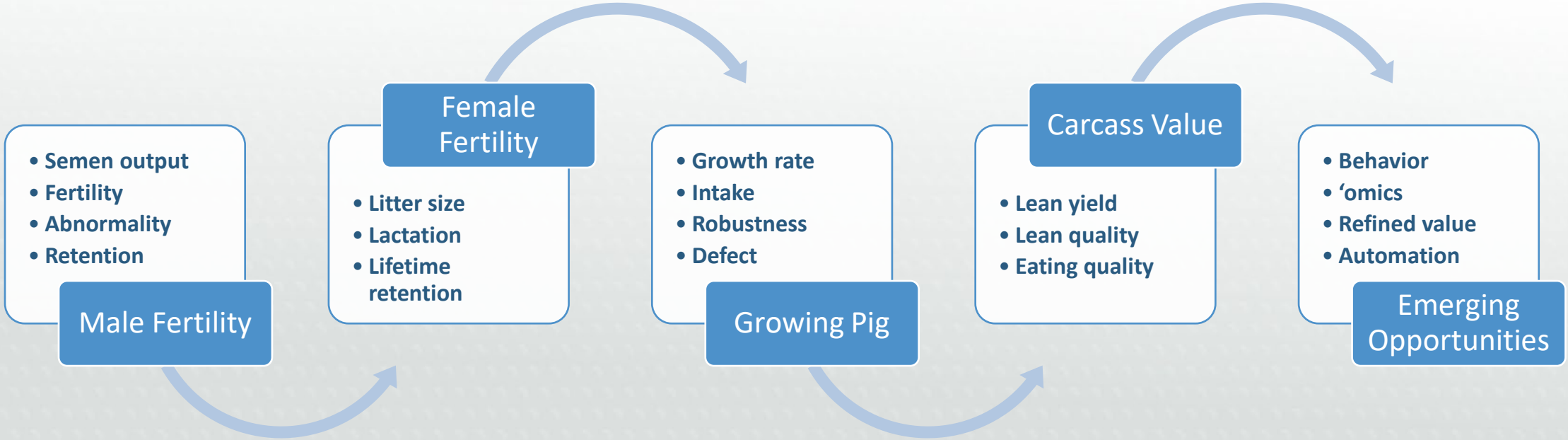
Real world performance from conception to consumption



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Objective

Never Stop Improving *Your Success.*

- Association between early life reproductive performance and dam parity

Contents lists available at ScienceDirect

Animal

The international journal of animal biosciences

Animal board invited review: Factors affecting the early growth and development of gilt progeny compared to sow progeny

U.A. Wijesiriwardana [a,1,*], J.R. Craig [b,1], J.J. Cottrell [c], F.R. Dunshea [a,c], J.R. Pluske [c,d]

[a] Faculty of Biological Sciences, University of Leeds, Leeds LS2 9JT, United Kingdom
[b] Research and Innovation, Rivalea (Australia) Pty. Ltd, Redlands Road, Corowa, New South Wales 2646, Australia
[c] Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Royal Parade, Parkville, Victoria 3010, Australia
[d] Australasian Pork Research Institute Ltd, PO Box 466, Willaston, South Australia 5118, Australia

Progeny born to primiparous sows farrowing their first litter, often called gilt progeny (**GP**), are typically characterised by their poorer overall production performance than progeny from multiparous sows (sow progeny; **SP**). Gilt progeny consistently grow slower, are born and weaned lighter, and have higher post-weaning illness and mortality rates than SP. Collectively, their poorer performance culminates in a long time to reach market weight and, ultimately, reduced revenue. Due to the high replacement rates of sows, the primiparous sow and her progeny represent a large proportion of the herd resulting in a significant loss for the pig industry. While the reasons for poorer performance are complex and multifaceted, they

Need more understanding on the impact on reproductive outcomes and longevity…

Data

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- 2019 – 2023
- 11 L03 multiplication herds within Europe
- 45k Lifetime records
- Females born from:
  - P1 = 30144
  - P2 = 10227
  - P3 = 3320
  - P4+ = 1218
- Traits: LDG, age 1st mating, age at successful mating, age at 1st farrowing, P1TB, P1BA, P1WSI, and NPDs

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Descriptive stats for early in life indicators

Performance Parameter	#Total				
	N	Mean	SD.	Min	Max
Litter of origen total born piglets, n / litter	44,608	15.6	3.14	6.0	25.0
Litter of origen born alive piglets, n / litter	44,574	14.7	2.94	6.0	23.0
Age at first mating, d	38,096	237.9	22.70	170.0	318.0
Age at first successful mating, d	31,050	242.5	26.35	173.0	341.0
Lifetime Average Daily Gain, g	25,500	610.4	69.94	396.9	824.8
Age at first farrowing, d	29,276	356.4	24.45	274.0	445.0
First litter total born piglets, n / litter	29,444	14.7	3.45	4.0	25.0
First litter born alive piglets, n / litter	29,406	13.7	3.39	3.0	24.0
First parity lactation length, d	27,368	23.2	4.90	0.0	34.0
First parity wean to service interval, d	26,466	9.5	10.61	0.0	67.0
First parity non-productive days	24,144	12.0	14.30	0.0	88.0
Females selected per liter, %	44,909	66.8	23.44	6.7	100.0

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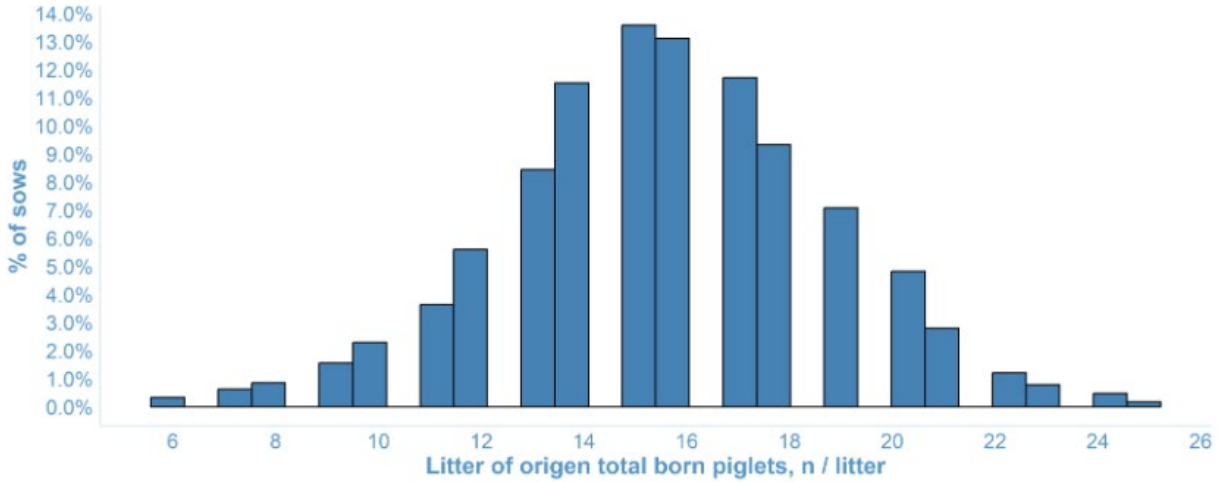
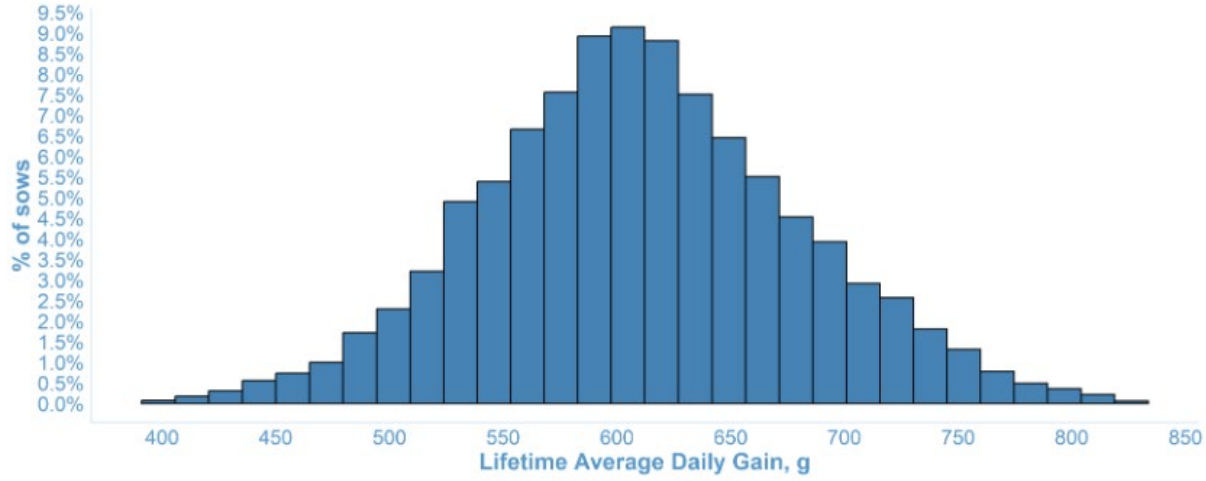
Distribution for Litter of origen total born piglets, n / litter



Distribution for Lifetime Average Daily Gain, g



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Model

- Univariable GLMs
- Dam parity (1 vs 2+) as a fixed effect
- Farm / year month as a random effect
- Gamma distribution to wean to service interval / non productive days (skewed traits)
- Simple models because traits are moderately to strongly correlated

Trait
Age at first mating, d[1]
Age at first successful mating, d[2]
Lifetime Average Daily Gain, g[3]
Age at first farrowing, d[4]
First litter total born piglets, n / litter[5]
First litter born alive piglets, n / litter[6]
First parity lactation length, d[7]
First parity wean to service interval, d[8]
First parity non-productive days[9]

Results

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ASSOCIATION OF DAM PARITY AND EARLY IN LIFE INDICATORS

Dam parity group

Trait	Primiparous	Multiparous	SE	Type III p-value
Age at first mating, d[1]	239.8[b]	237.2[a]	0.718	<0.001
Age at first successful mating, d[2]	244.4[b]	241.5[a]	0.749	<0.001
Lifetime Average Daily Gain, g[3]	606.3[a]	618.2[b]	2.323	<0.001
Age at first farrowing, d[4]	357.7[b]	354.9[a]	0.756	<0.001
First litter total born piglets, n / litter[5]	14.4[a]	14.7[b]	0.054	<0.001
First litter born alive piglets, n / litter[6]	13.5[a]	13.7[b]	0.052	<0.001
First parity lactation length, d[7]	23.5	23.5	0.104	0.751
First parity wean to service interval, d[8]	9.3[b]	8.7[a]	0.117	<0.001
First parity non-productive days[9]	11.1[b]	10.7[a]	0.175	<0.001

[1]Number of observations: Multiparous = 12,695, Primiparous = 25,401
[2]Number of observations: Multiparous = 10,108, Primiparous = 20,942
[3]Number of observations: Multiparous = 8,324, Primiparous = 17,176
[4]Number of observations: Multiparous = 9,524, Primiparous = 19,752
[5]Number of observations: Multiparous = 9,545, Primiparous = 19,899
[6]Number of observations: Multiparous = 9,543, Primiparous = 19,863
[7]Number of observations: Multiparous = 8,840, Primiparous = 18,528
[8]Number of observations: Multiparous = 8,719, Primiparous = 17,747
[9]Number of observations: Multiparous = 7,875, Primiparous = 16,269
[abc]Different letters indicate a statistical difference at $P < 0.05$.

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Results – Age

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ASSOCIATION OF DAM PARITY AND EARLY IN LIFE INDICATORS

Dam parity group

Trait	Primiparous	Multiparous	SE	Type III p-value
Age at first mating, d[1]	239.8[b]	237.2[a]	0.718	<0.001
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Lifetime Average Daily Gain, g[3]	606.3[a]	618.2[b]	2.323	<0.001
Age at first farrowing, d[4]	357.7[b]	354.9[a]	0.756	<0.001
First litter total born piglets, n / litter[5]	14.4[a]	14.7[b]	0.054	<0.001
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[9]Number of observations: Multiparous = 7,875, Primiparous = 16,269
[abc]Different letters indicate a statistical difference at $P < 0.05$.

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Results – Growth

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ASSOCIATION OF DAM PARITY AND EARLY IN LIFE INDICATORS

Dam parity group

Trait	Primiparous	Multiparous	SE	Type III p-value
Age at first mating, d[1]	239.8[b]	237.2[a]	0.718	<0.001
Age at first successful mating, d[2]	244.4[b]	241.5[a]	0.749	<0.001
Lifetime Average Daily Gain, g[3]	606.3[a]	618.2[b]	2.323	<0.001
Age at first farrowing, d[4]	[illegible]	[illegible]	0.756	<0.001
First litter total born piglets, n / litter[5]	14.4[a]	14.7[b]	0.054	<0.001
First litter born alive piglets, n / litter[6]	13.5[a]	13.7[b]	0.052	<0.001
First parity lactation length, d[7]	23.5	23.5	0.104	0.751
First parity wean to service interval, d[8]	9.3[b]	8.7[a]	0.117	<0.001
First parity non-productive days[9]	11.1[b]	10.7[a]	0.175	<0.001

[1]Number of observations: Multiparous = 12,695, Primiparous = 25,401
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[9]Number of observations: Multiparous = 7,875, Primiparous = 16,269
[abc]Different letters indicate a statistical difference at $P < 0.05$.

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Results – Repro

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ASSOCIATION OF DAM PARITY AND EARLY IN LIFE INDICATORS

Dam parity group

Trait	Primiparous	Multiparous	SE	Type III p-value
Age at first mating, d[1]	239.8[b]	237.2[a]	0.718	<0.001
Age at first successful mating, d[2]	244.4[b]	241.5[a]	0.749	<0.001
Lifetime Average Daily Gain, g[3]	606.3[a]	618.2[b]	2.323	<0.001
Age at first farrowing, d[4]	257.7[b]	254.9[a]	0.756	<0.001
First litter total born piglets, n / litter[5]	14.4[a]	14.7[b]	0.054	<0.001
First litter born alive piglets, n / litter[6]	13.5[a]	13.7[b]	0.052	<0.001
First parity lactation length, d[7]	23.5	23.5	0.104	0.751
First parity wean to service interval, d[8]	9.3[b]	8.7[a]	0.117	<0.001
First parity non-productive days[9]	11.1[b]	10.7[a]	0.175	<0.001

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[9]Number of observations: Multiparous = 7,875, Primiparous = 16,269
[abc]Different letters indicate a statistical difference at $P < 0.05$.

Farm math… 1000 sow herd = 80 pigs a year?

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Results – System losses

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ASSOCIATION OF DAM PARITY AND EARLY IN LIFE INDICATORS

Dam parity group

Trait	Primiparous	Multiparous	SE	Type III p-value
Age at first mating, d[1]	239.8[b]	237.2[a]	0.718	<0.001
Age at first successful mating, d[2]	244.4[b]	241.5[a]	0.749	<0.001
Lifetime Average Daily Gain, g[3]	606.3[a]	618.2[b]	2.323	<0.001
Age at first farrowing, d[4]	357.7[b]	354.9[a]	0.756	<0.001
First litter total born piglets, n / litter[5]	14.4[a]	14.7[b]	0.054	<0.001
First litter born alive piglets, n / litter[6]	13.5[a]	13.7[b]	0.052	<0.001
First parity lactation length, d[7]	23.5	23.5	0.104	0.751
First parity wean to service interval, d[8]	9.3[b]	8.7[a]	0.117	<0.001
First parity non-productive days[9]	11.1[b]	10.7[a]	0.175	<0.001

[1]Number of observations: Multiparous = 12[illegible]
[2]Number of observations: Multiparous = 10,108, Primiparous = 20,942
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[9]Number of observations: Multiparous = 7,875, Primiparous = 16,269
[abc]Different letters indicate a statistical difference at $P < 0.05$.

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Are gilts alone in being different?

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Dam parity number

Trait	1	2	3	4	SE	Type III p-value
Age at first mating, d[1]	239.8[b]	237.2[a]	237.3[a]	237.0[a]	0.769	<0.001
Age at first successful mating, d[2]	244.4[b]	241.5[a]	241.2[a]	241.9[a]	0.853	<0.001
Lifetime Average Daily Gain, g[3]	606.3[a]	618.0[b]	618.6[b]	618.4[b]	2.643	<0.001
Age at first farrowing, d[4]	357.7[b]	354.9[a]	354.3[a]	355.6[a]	0.838	<0.001
First litter total born piglets, n / litter[5]	14.4[a]	14.7[b]	14.6[ab]	14.7[ab]	0.083	<0.001
First litter born alive piglets, n / litter[6]	13.5[a,z]	13.7[b,y]	13.7[ab,y]	13.7[ab,zy]	0.081	<0.001
First parity lactation length, d[7]	23.5	23.6	23.4	23.6	0.137	0.515
First parity wean to service interval, d[8]	9.3[b]	8.8[a]	8.5[a]	8.4[a]	0.168	<0.001
First parity non-productive days[9]	11.1[b]	10.8[b]	10.2[a]	10.5[ab]	0.238	<0.001

[1]Number of observations: 1 = 25,401, 2 = 8,966, 3 = 2,767, 4 = 962
[2]Number of observations: 1 = 20,942, 2 = 7,176, 3 = 2,127, 4 = 805
[3]Number of observations: 1 = 17,176, 2 = 5,806, 3 = 1,872, 4 = 646
[4]Number of observations: 1 = 19,752, 2 = 6,763, 3 = 2,007, 4 = 754
[5]Number of observations: 1 = 19,899, 2 = 6,775, 3 = 2,013, 4 = 757
[6]Number of observations: 1 = 19,863, 2 = 6,773, 3 = 2,012, 4 = 758
[7]Number of observations: 1 = 18,528, 2 = 6,279, 3 = 1,866, 4 = 695
[8]Number of observations: 1 = 17,747, 2 = 6,220, 3 = 1,823, 4 = 676
[9]Number of observations: 1 = 16,269, 2 = 5,602, 3 = 1,663, 4 = 610
[abc]Different letters indicate a statistical difference at $P < 0.05$.
[zyx]Different letters indicate a statistical difference at $P < 0.10$.

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Results – Longevity

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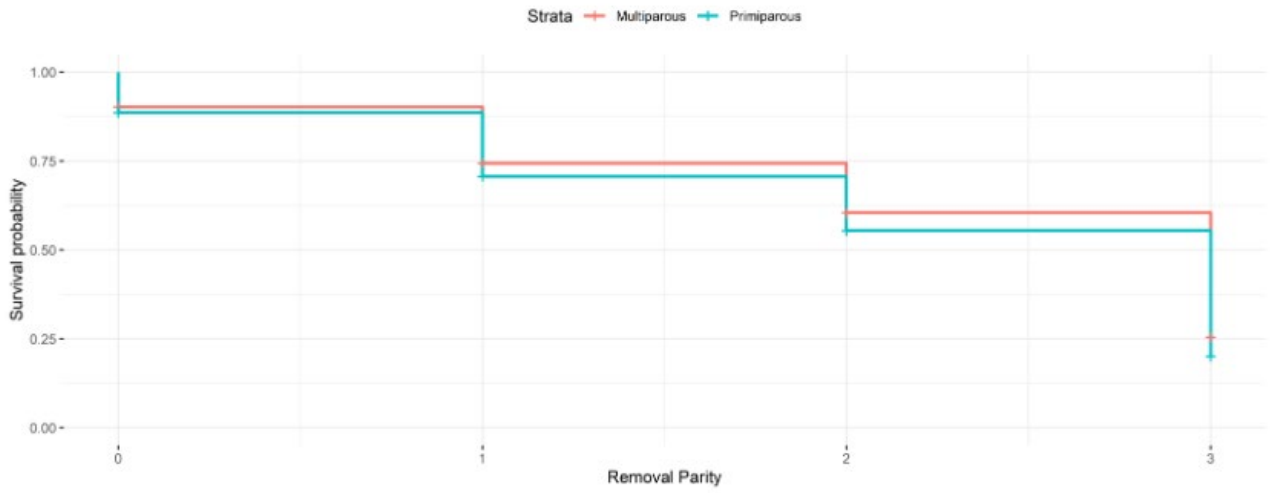
SURVIVAL UP TO PARITY 3

REMOVAL STATUS

Dam parity group

Characteristic	HR[1]	95% CI[1]	p-value
as.factor(dam_parity)			
Multiparous	—	—	
Primiparous	1.17	1.10, 1.25	<0.001

[1] HR = Hazard Ratio, CI = Confidence Interval



Gilts from sows 46% more likely to get to P3…

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Results – Soap box…

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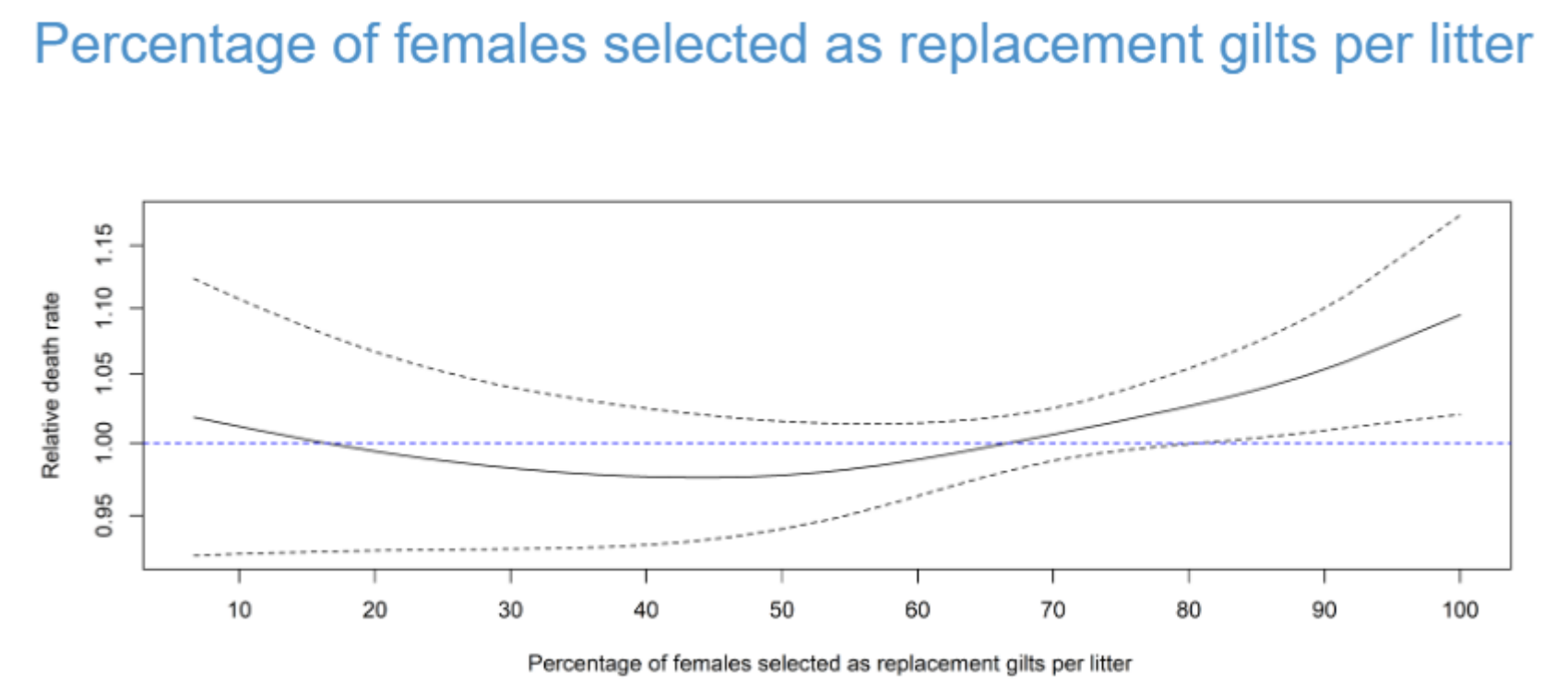

Less selection intensity higher risk of losses???

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We invest to accelerate genetic gain

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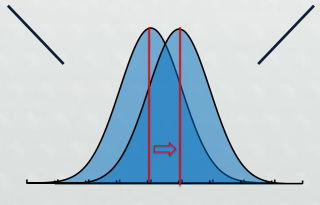
PIC invests in large, diverse populations and best selection tools…

Selection intensity

Our elite populations doubled and we select fewer boars / sow

Index deviation

We add differentiated germplasm, e.g. Møllevang



$$\Delta G = \frac{\text{Selection Intensity} \times \text{Index Std} \times \text{Accuracy}}{\text{Generation Interval}}$$

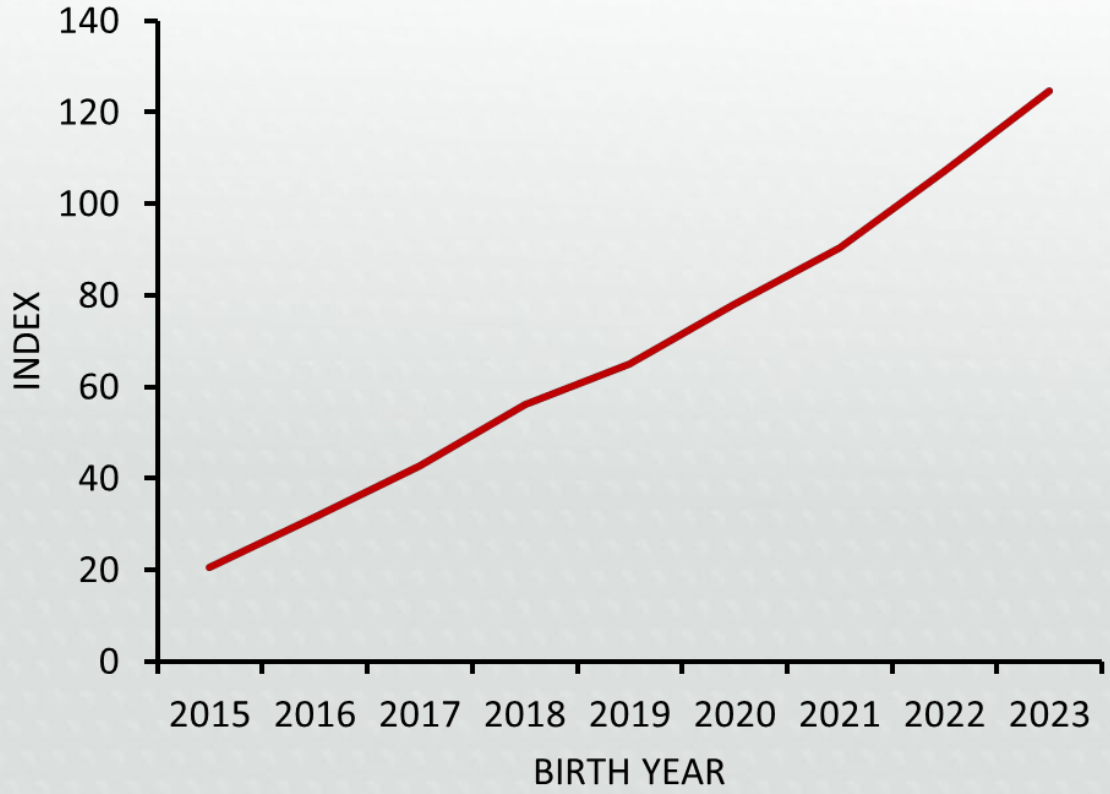
Generation interval:

We use higher replacement rates in sow farms and studs

Selection accuracy:

We combine extensive data capture with the latest genomics

…which results in accelerated genetic gain



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Four pillars of sow robustness

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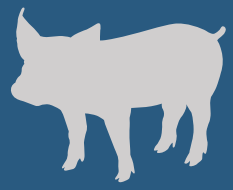
Innovations lead to long term success

Genetics

- Maternal GNX
- Digital Phenotyping
- Robustness & sow reproductive success EBVs

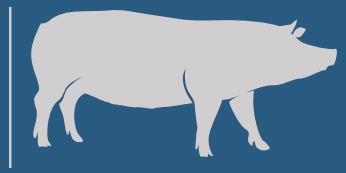
Body Condition

- Updated recommendations target maximum lifetime productivity
- Updated caliper ranges
- New feeding recommendations



P1 Development

- Gilt development and 1st parity management build a strong foundation for success
- Four strategic areas to prevent removal and promote longevity



Sow Care

- Breeding decisions and daily observations yield results
- Focus on four sow care principles to increase longevity

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Thoughts…

- Industry sees trends on mortality
- Clearly replacements from gilts are different
- *Do we need to think about handling gilts from gilts differently?*
- *Does gilt from gilt performance need to be a different trait?*

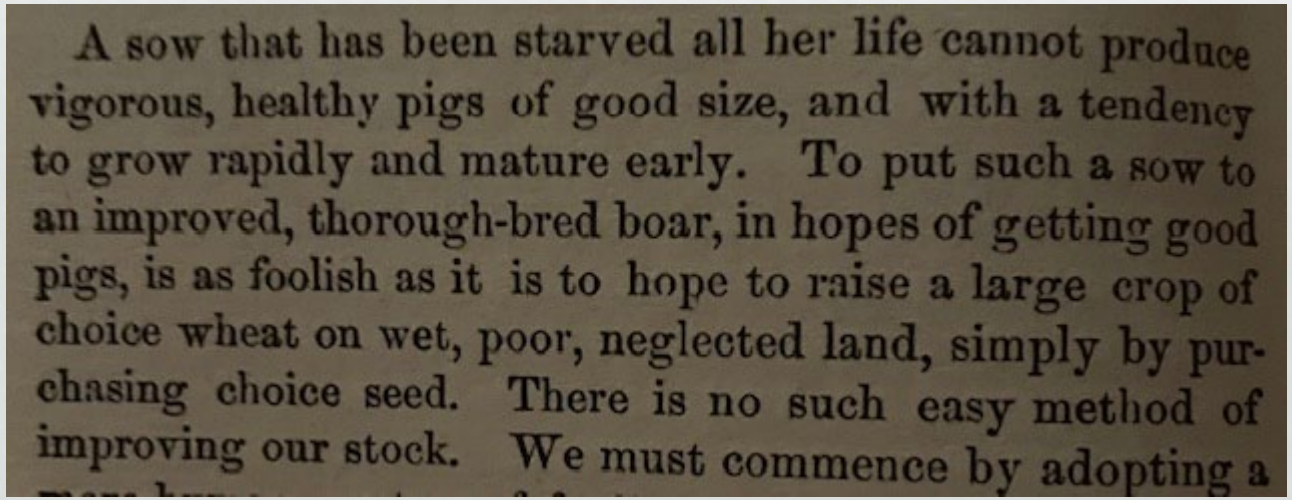
- Easy to say don't use gilts from gilts… Nothing for Free!!!

Quick math…

- PIC value per maternal index point is 0.045 Euro
- Approx 18 points per year
- Skipping gilts is an extra 153 days
- **0.34 Euro per slaughter pig additional genetic lag**
- Not including reduced production efficiency and larger multiplication requirement

Acknowledgements

- PIC Team – Commercial / Technical / Genetic
  - Danielle Wells – Data support (I owe her wine)
- Customers & Partners
- Pigs



A sow that has been starved all her life cannot produce vigorous, healthy pigs of good size, and with a tendency to grow rapidly and mature early. To put such a sow to an improved, thorough-bred boar, in hopes of getting good pigs, is as foolish as it is to hope to raise a large crop of choice wheat on wet, poor, neglected land, simply by purchasing choice seed. There is no such easy method of improving our stock. We must commence by adopting a