Gilt management for improved sow lifetime productivity

Banff Pork Seminar

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January 9th and 10th, 2019

BANFF PORK SEMINAR

UNIVERSITY OF ALBERTA

Outline

1. **Introduction and background**
2. **A good gilt management program will monitor and manage the following key components:**
    1. “Litter of origin” is a key factor determining the efficiency of replacement gilt production and sow lifetime productivity.
    2. Effective gilt selection programs resolve many SLP issues.
3. **Conclusions**

Sow Lifetime Productivity

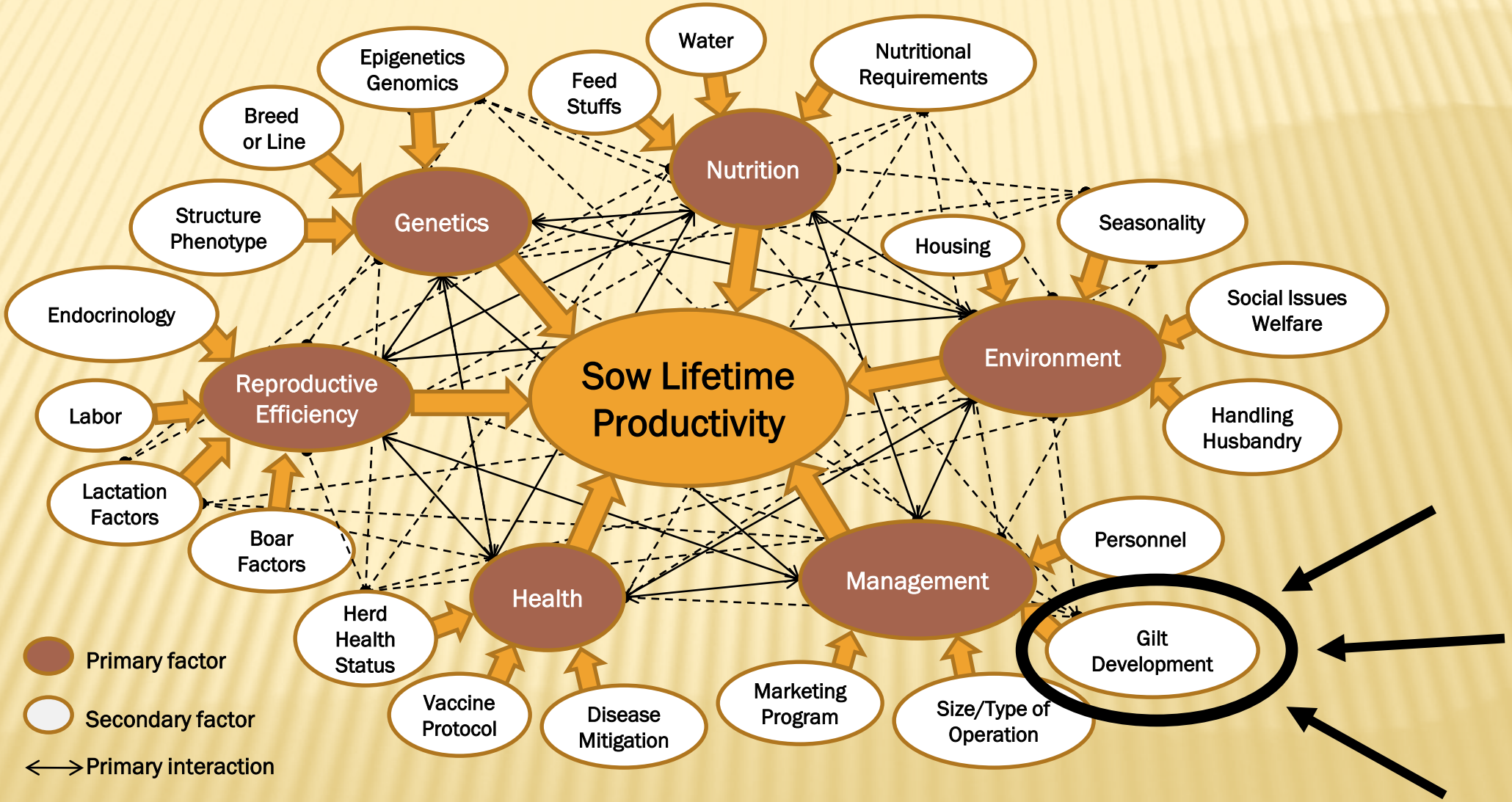
*"The total number of quality pigs weaned during the productive lifetime of a female; from the time she **becomes breeding eligible** until she leaves the herd"*

National Pork Board, 2010

How long the sow stays in the herd

How many pigs she weans during that time

Complexity: sow lifetime productivity



Mark Boggess 2009

Gilt development sets up sow lifetime productivity

Clay Lents 2018

In the industry today….

- **Good gilt management is often overlooked as a critical driver of sow lifetime productivity (SLP):**
  - Gilts are the foundation of good production (Tubbs, 2015)
  - Gilts drive farm success now and in the future (Ketchem and Rix, 2015).
- **Top producing farms recognize:**
  - Successful gilt management programs identify and deliver gilts to the sow farm with the greatest SLP.
  - Gilt management starts at birth.
  - Common reproductive issues in the sow can result from suboptimal gilt management.

Production Targets vs Reality

	Production Targets		PigChamp 2017 Canada	
	Genetics 1	Genetics 2	Upper 10th percentile	Mean
Farrowing rate	>92 %	>90%	89.9	82.5
Total born	>16.0	>16.0	15.7 ≠	14.9
Pigs weaned	>14.0	>13.0	12.1	11.3
Pre-weaning mortality	<10%	<13%	11.1	14.7

Goal ➔ to identify key management changes in the GDU needed in "average performing farms" to improve SLP

(Foxcroft, 2015).

STAGES OF A GILT REPLACEMENT PROGRAM

A gilt becomes a potential replacement female at birth!

Pre-Select 1	Pre-Select 2	Final Select	Breed Group Mmgt
Birth -Weaning	**~ 140 d**	**~ 170 - 200 d**	**100% breed targets met** **100% Select Gilts** **100% bred at target weight** **100% bred at 2nd–3rd estrus** **Feed mmgt before breeding**
✓Confirmation ✓ 14 + teats ✓ Health ✓ Structure ✓ Growth ✓ Litter of origin	✓Confirmation ✓ 14+ teats ✓ Health ✓ Structure ✓ 0.6 kg/day ✓ Litter of origin	-125% of req's enter -Direct boar contact **80% estrus in 28 d** **+5-10% Non-Selects**	

Genetics, health programs, nutrition, quality of floor and slats, air flow and temperature, stocking density, PEOPLE and biosecurity ~ Dr. Gonzalo Castro (2018)

1. “Litter of origin” is a key factor determining the efficiency of replacement gilt production and Sow Lifetime Productivity (SLP)

Pre-Select 1	Pre-Select 2	Final Select	Breed Group Mmgt
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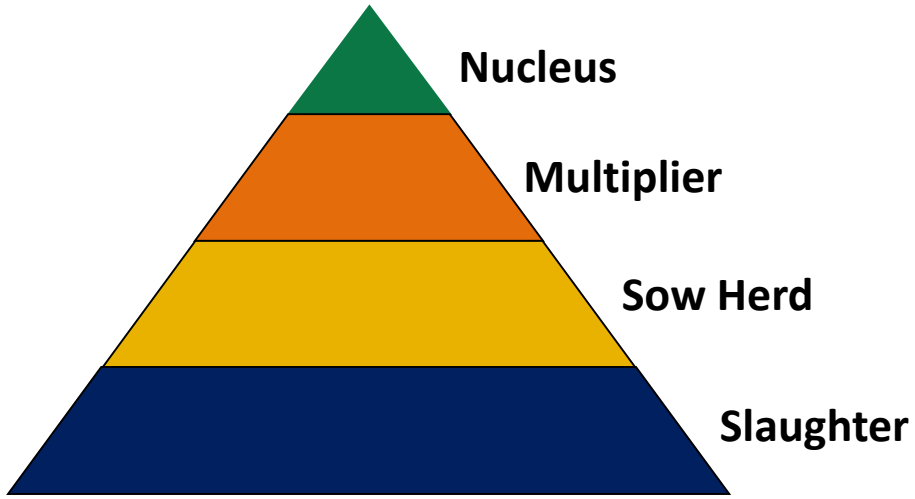
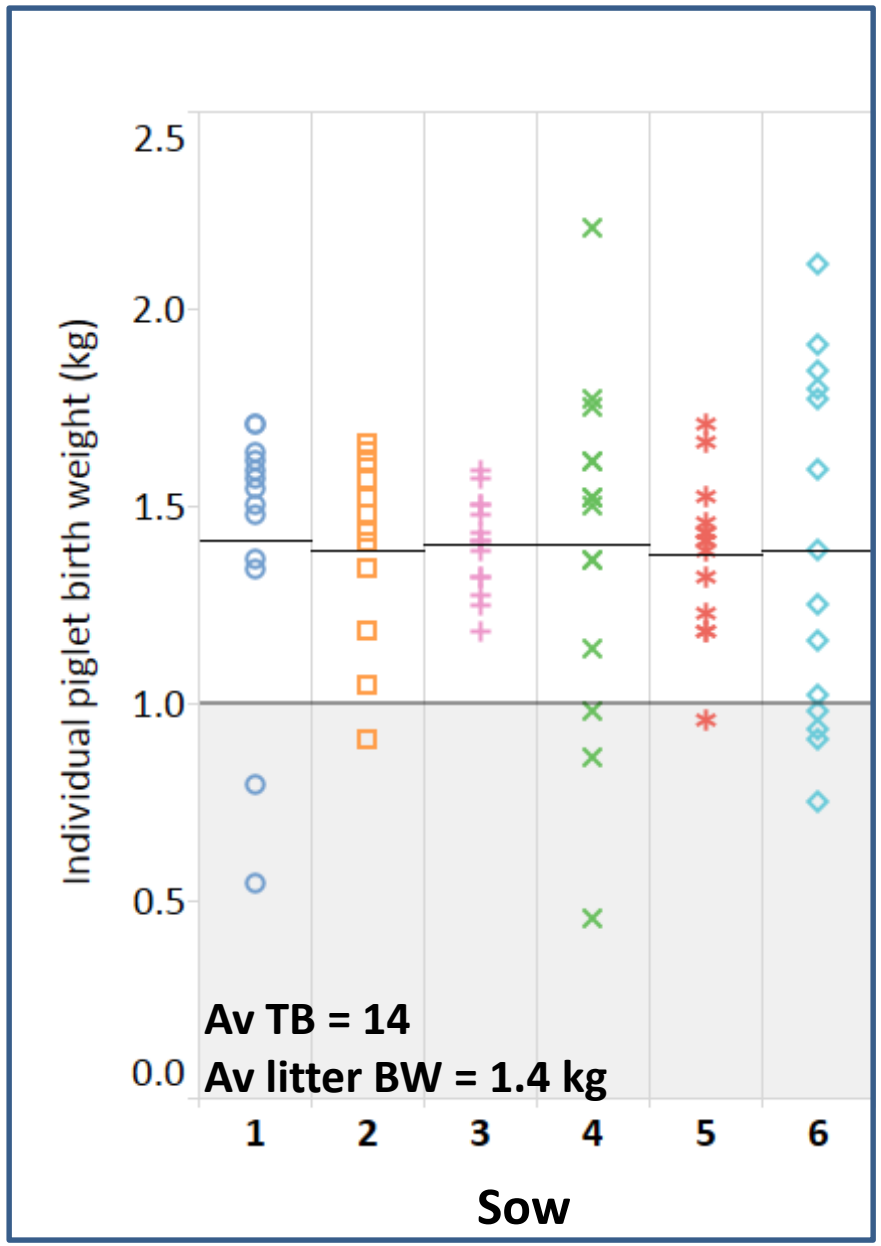


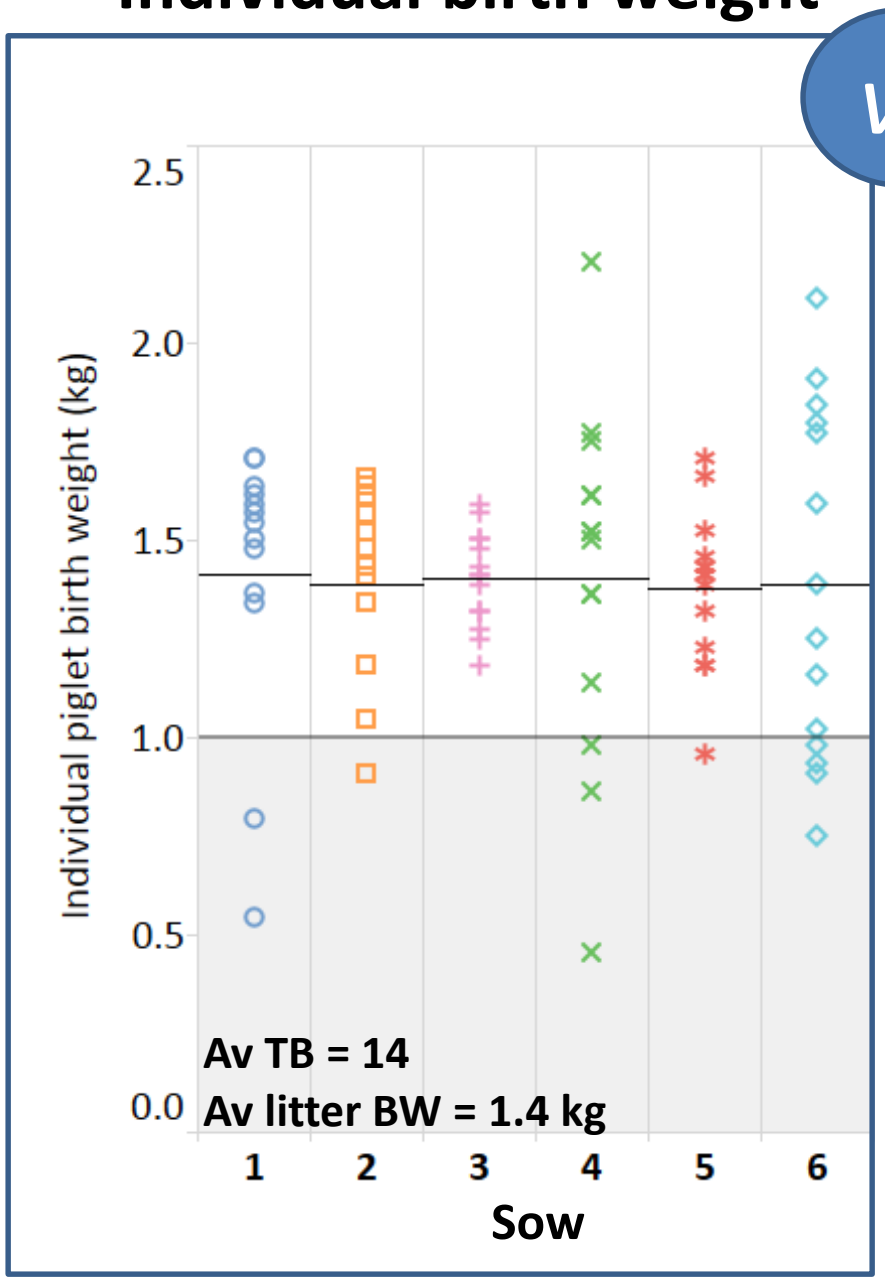
Individual birthweight



Low birth weight offspring are a major concern for the swine industry & have detrimental consequences on:

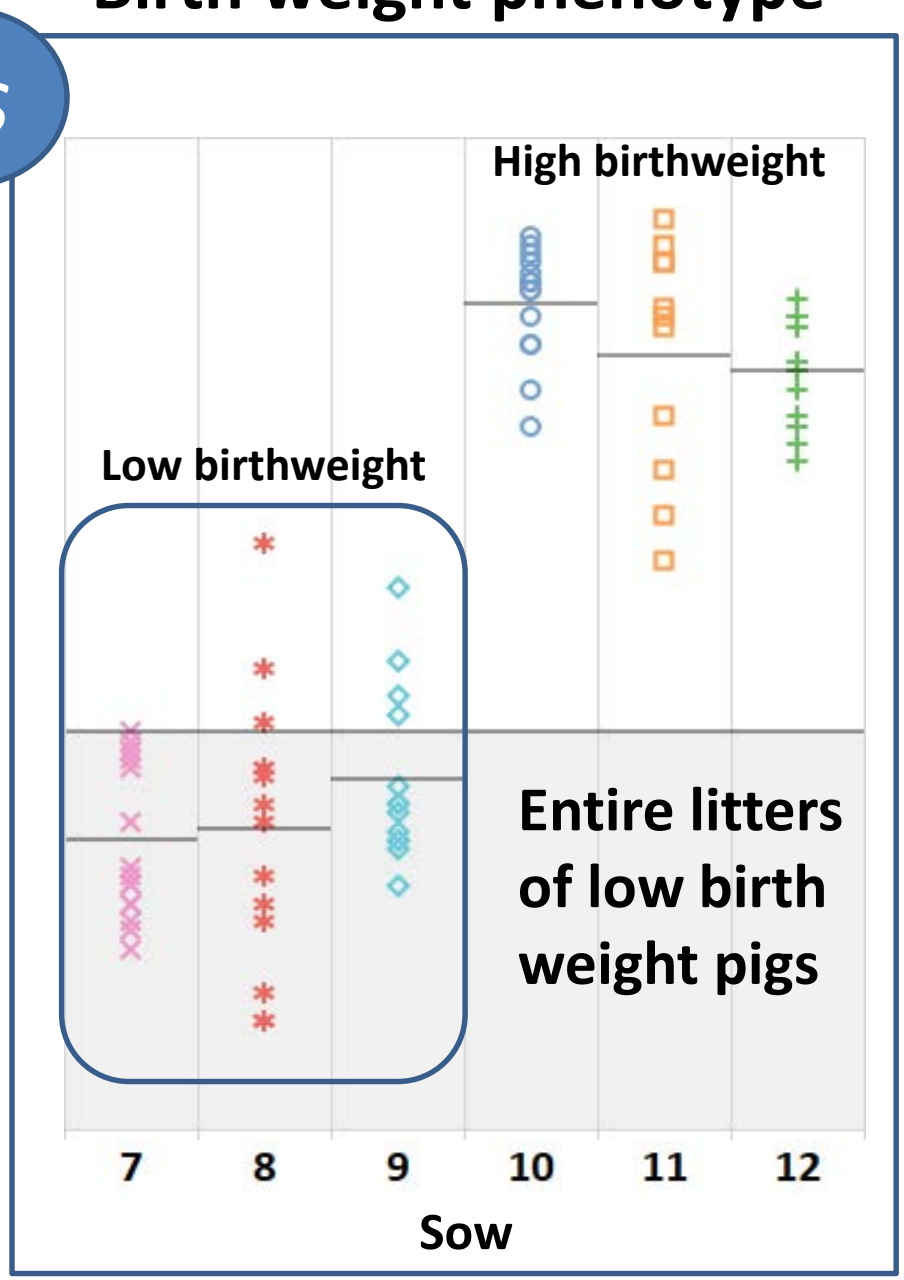
- **40% pre-weaning mortality** in pigs with a birth weight <1 kg (Roehe and Kalm, 2000)
- Gilts with a birth weight of <1.1 kg will have **compromised survival and growth** (Magnabosco et al., 2015).
- Birth weight <1.0 kg **negatively influences piglet production and longevity** (Magnabosco et al., 2016).
- Gilts below a minimum birth weight (<1.1 kg) **do not have the reproductive machinery** to be efficient reproductively no matter how well they are managed later in life." (Flowers, 2015).

Individual birth weight



VS

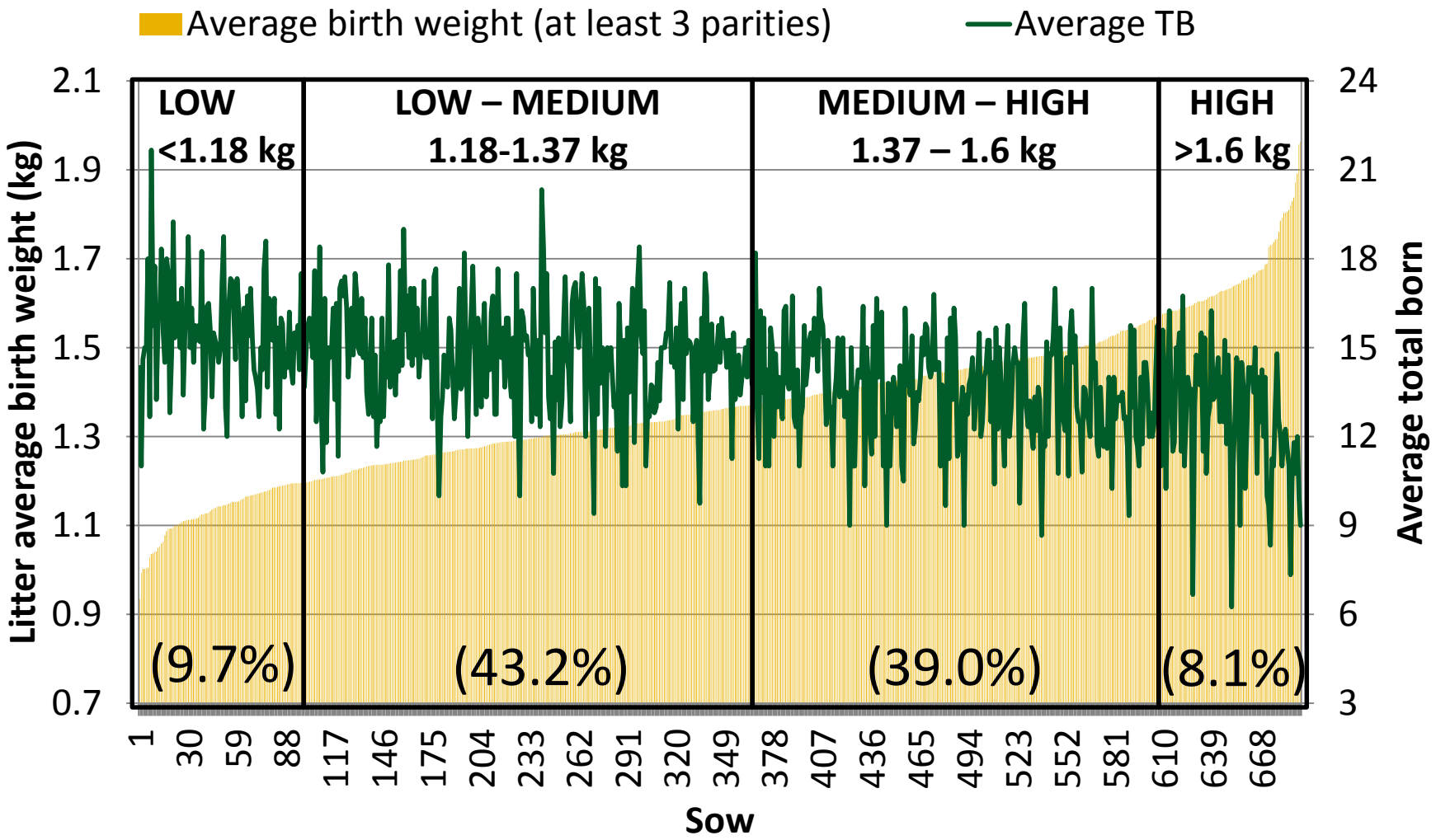
Birth weight phenotype



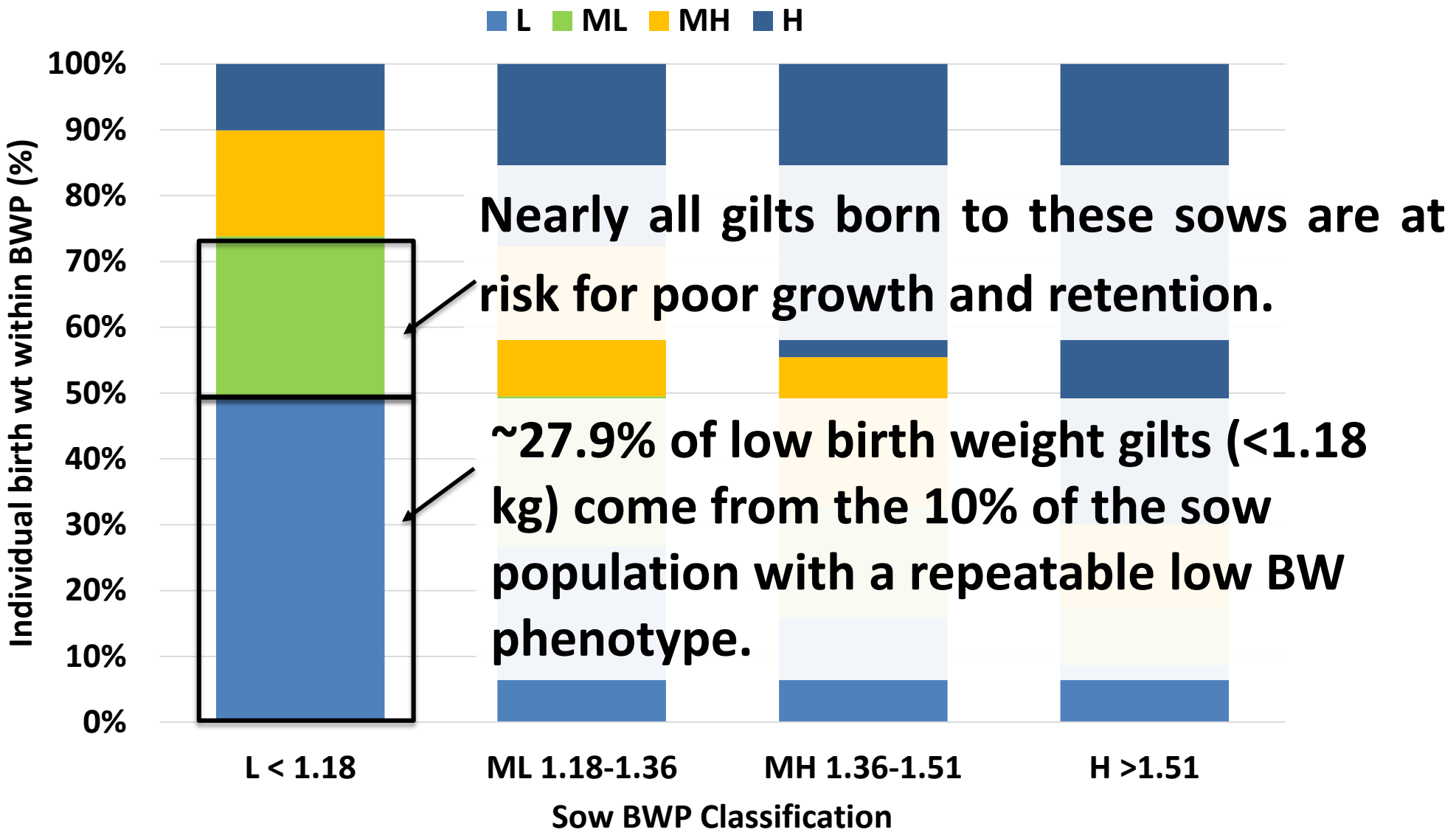
- The detrimental effects of low birth weight are not only restricted to small pigs within in a litter, but extend to entire litters (**litter phenotype**).
- **Birthweight phenotype is repeatable**

The effect of “litter of origin” on sow lifetime productivity

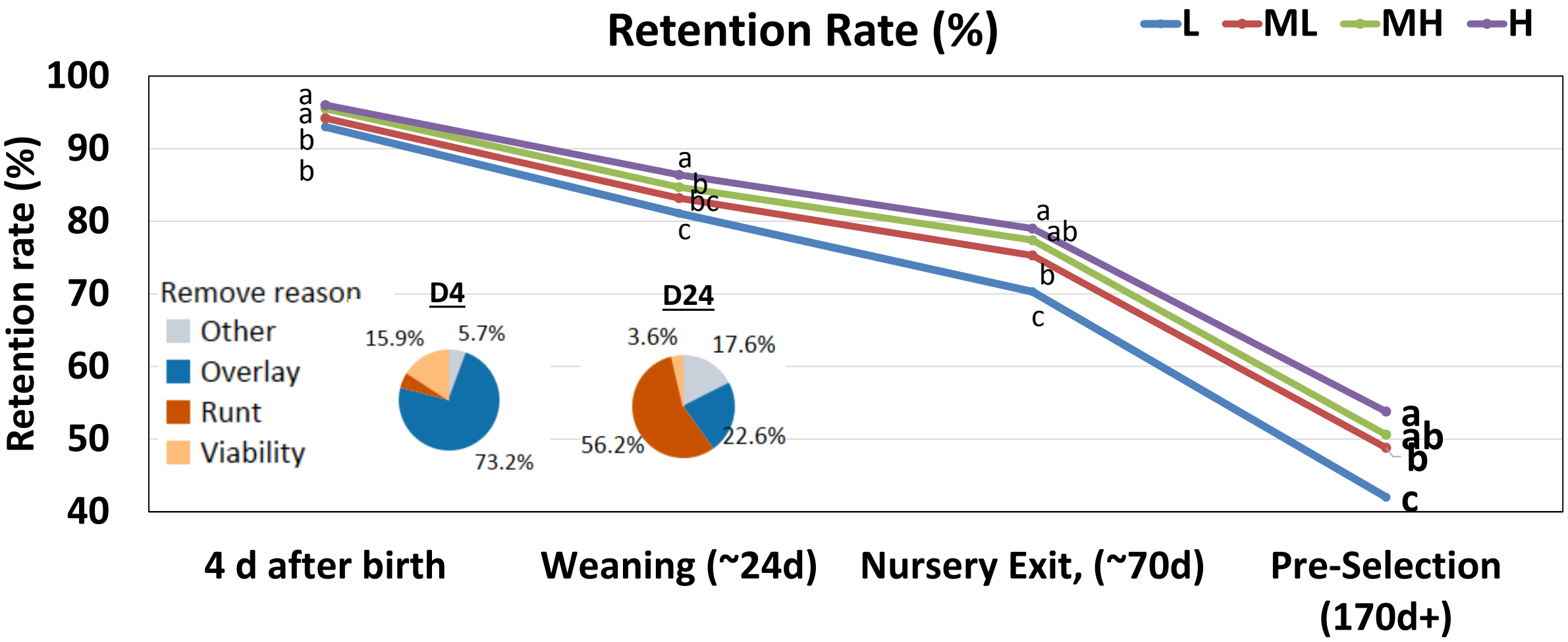
- 1096 L3 sows at the multiplier
- >47,000 piglets weighed, mean litter birth weight = 1.37 kg
- Litter birthweight phenotype determined on 651 sows on <u>at least 3 litters:</u>



Most gilts born to “low birth weight phenotype” sows are at risk for low poor growth and retention



A low birth weight phenotype reduces the retention rate of replacement gilts

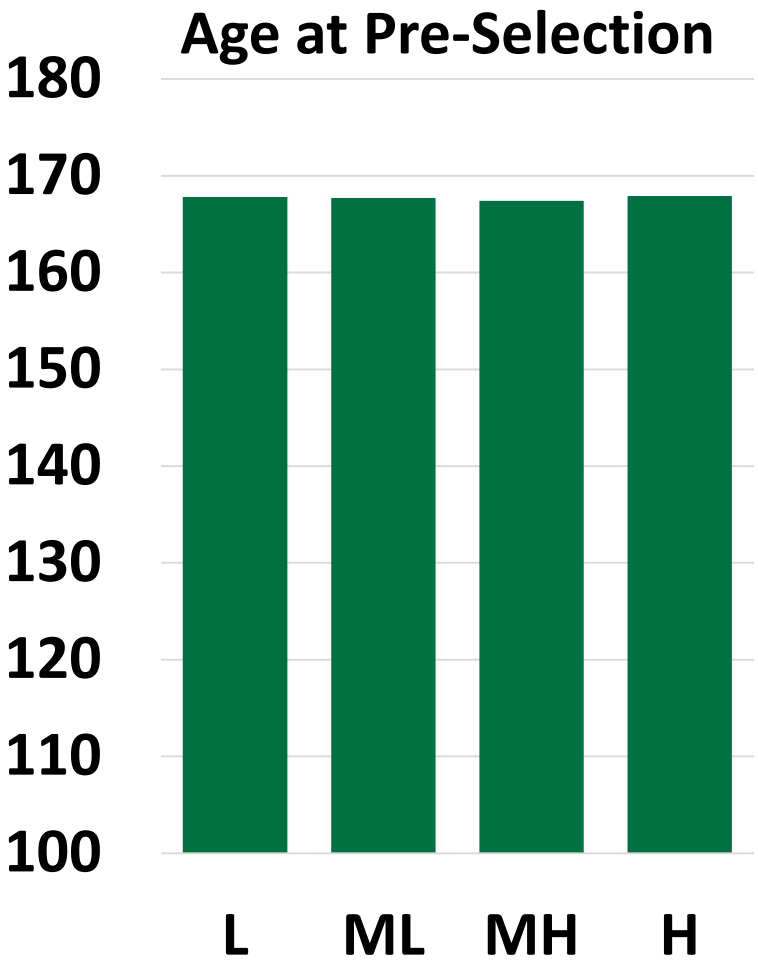


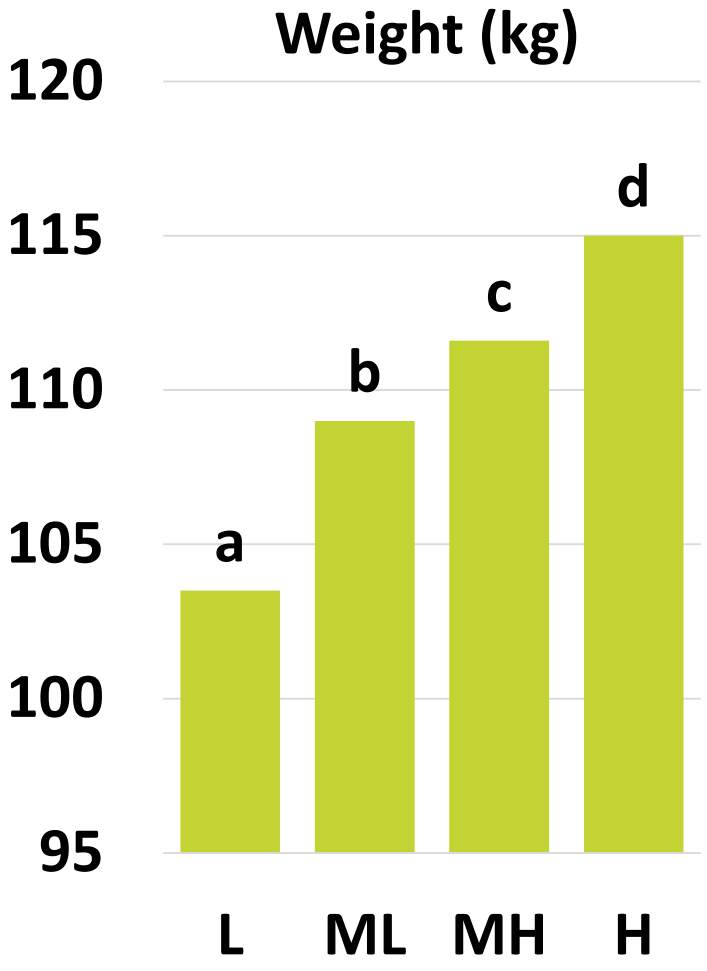
A low "litter birth weight phenotype" is a risk factor for low retention of gilt progeny until selection.

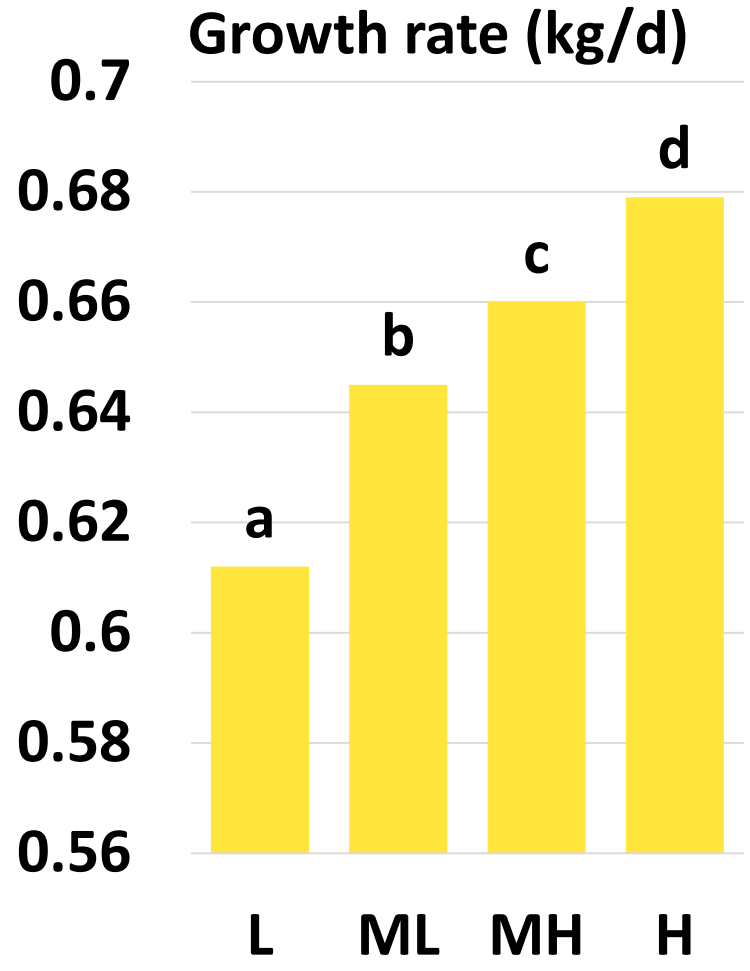
Some sows are very unproductive and never produce a replacement gilt (gilt served).

A low birth weight phenotype is negative for pre-selection growth rate

BUT low birth weight gilts still have adequate growth for achieving sexual maturity in GDU (> 0.55 kg/d)

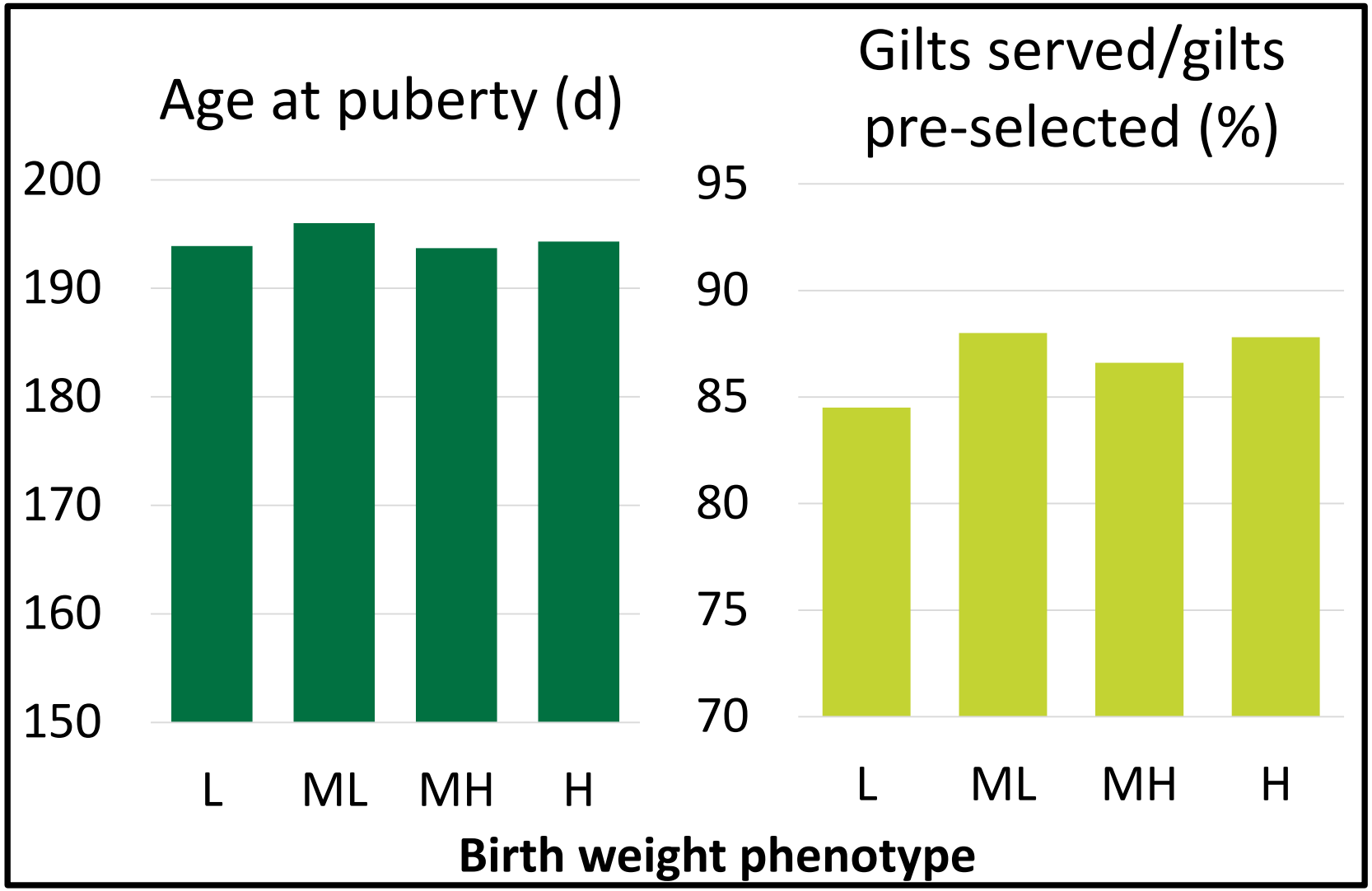


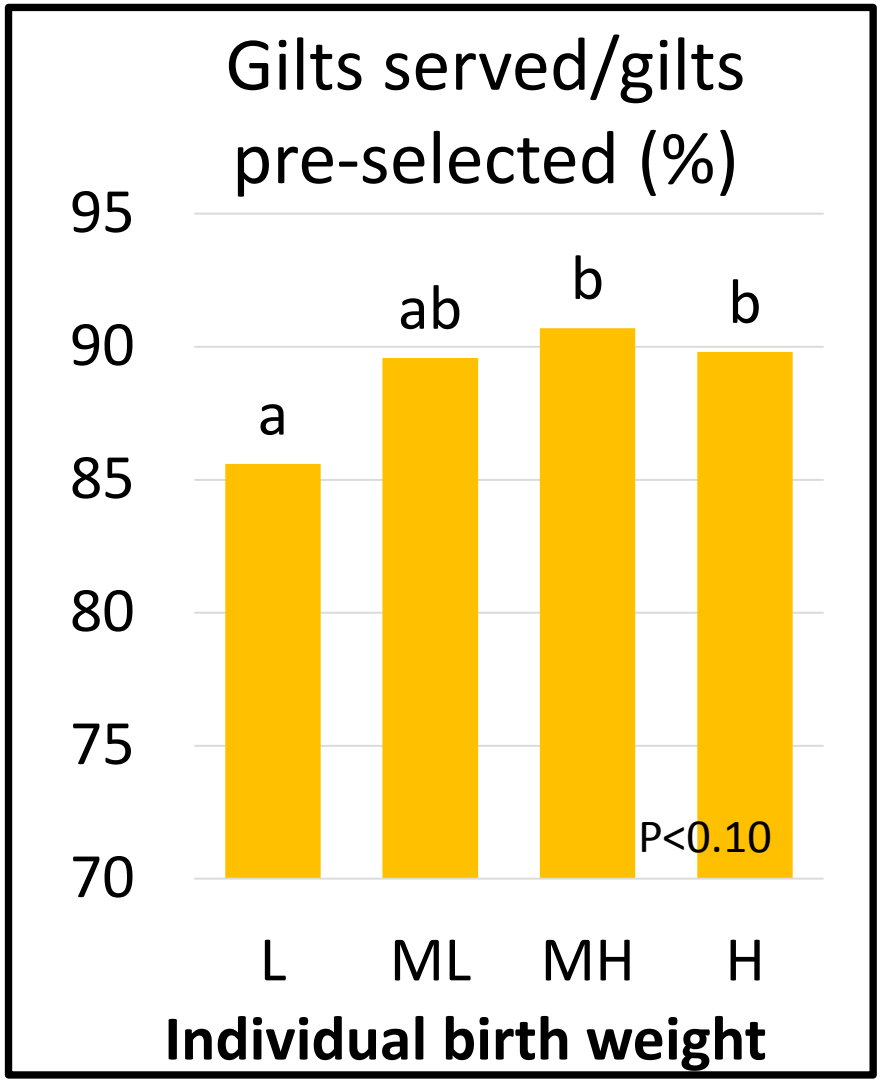




Are high birth weight gilts an increasing problem for SLP?

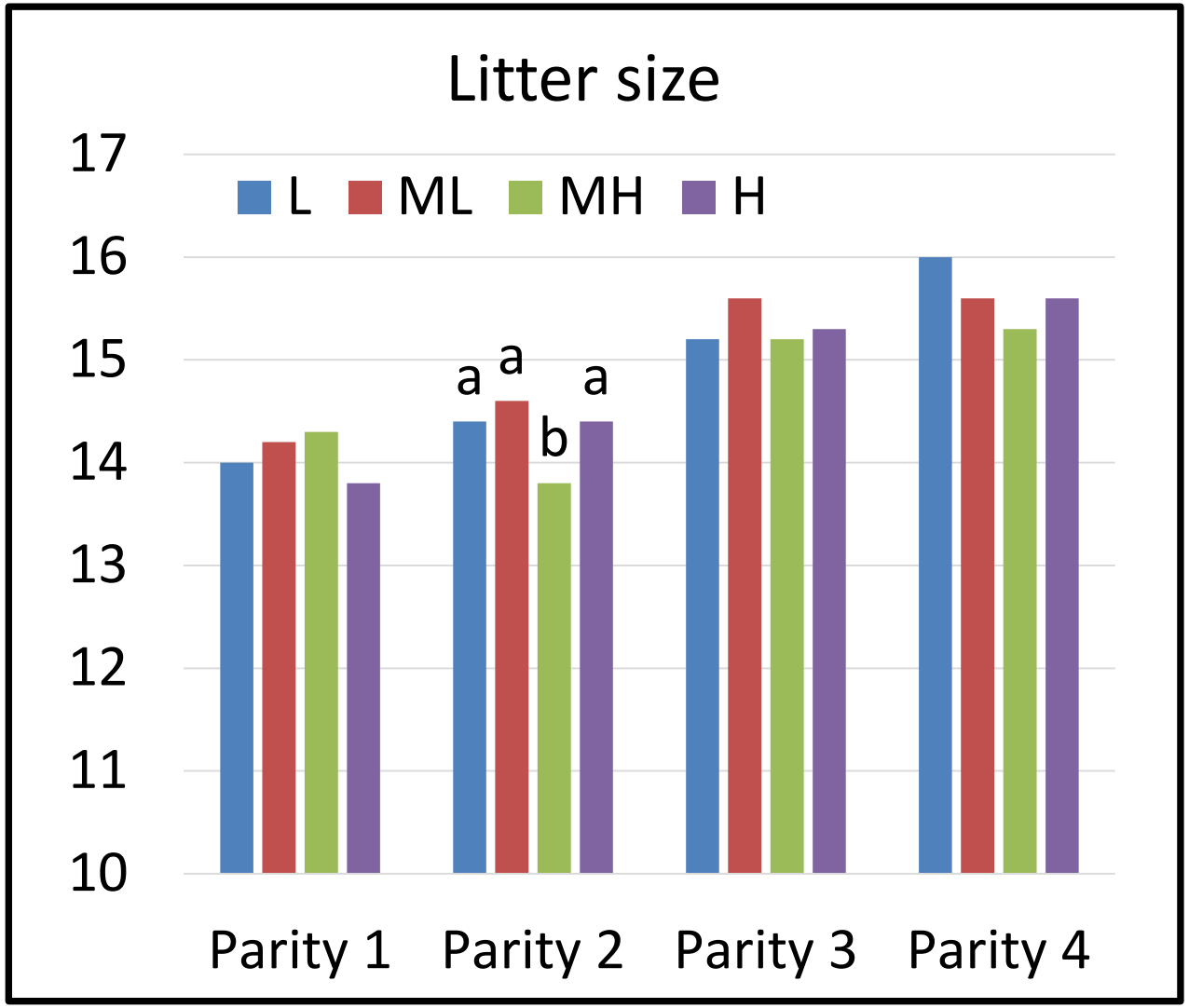
Using effective gilt stimulation programs, there was little impact of birth weight phenotype on puberty attainment in “pre-selected” gilts.

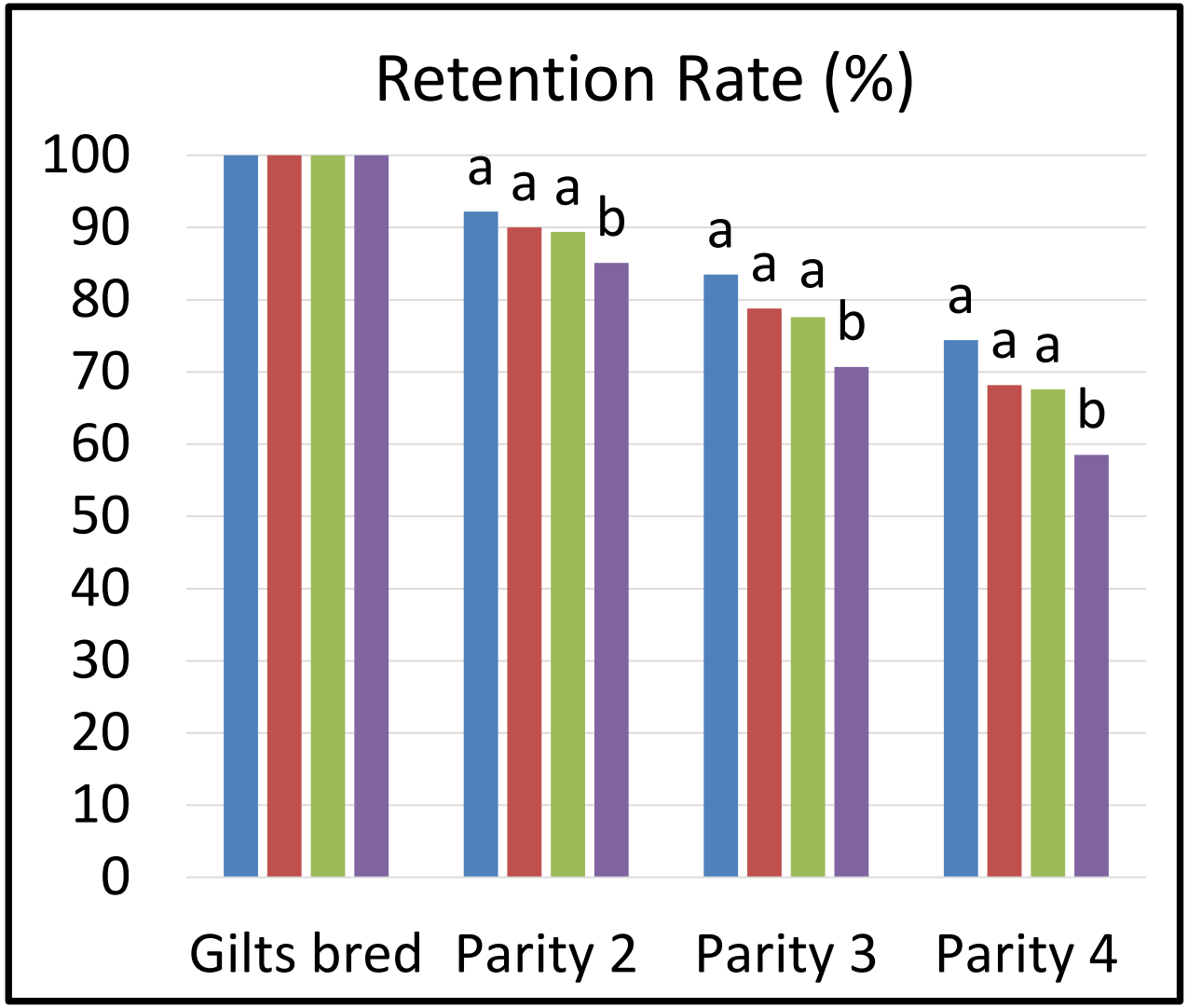




Low birth weight gilts are marginally compromised, fewer gilts respond to boar exposure within 35 d.

Effect of birth weight phenotype on SLP (litter size and retention rate)





Very little effect of LBW phenotype on litter size to parity 4

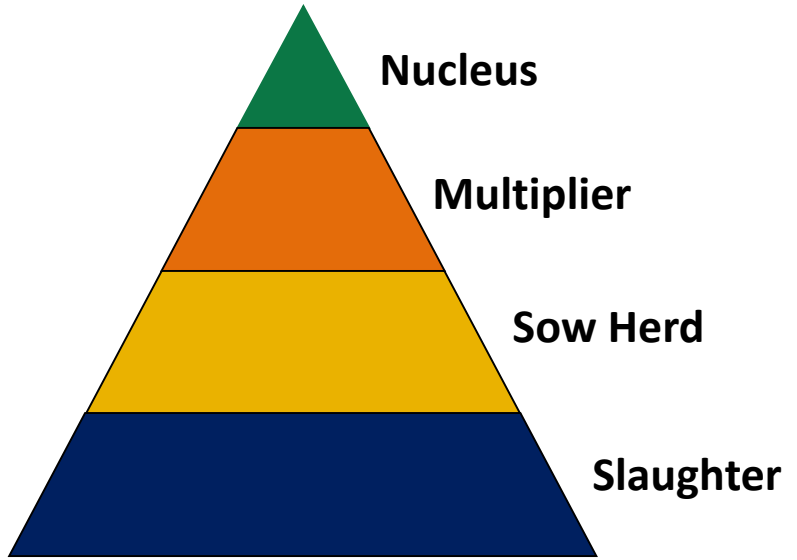
Gilts born to sows with a "high birthweight" phenotype had a lower retention rate to P4.

Summary – Birth Weight Phenotype

- **Low birth weight** offspring are a major concern for the swine industry.
- **Sows with a repeatable 'low birth weight phenotype'** are also a concern for the swine industry.
  - **Nearly all gilts born to these sows are at risk for poor growth and retention.**
  - **They are inefficient in producing replacement females.**
  - **They produce fewer numbers and quality of replacement females.**

Management strategies:

- Determine sow phenotype (weigh litters or individual pigs).
- Ensure post-farrowing care to reduce hypothermia and ensure adequate colostrum ingestion.
- Strategic cross fostering of potential replacement females – a smaller litter size in lactation.
- Strategic culling of LBWP sows at the nucleus/multiplication level will improve:
  - the efficiency of the genetic transfer program and
  - the number of select gilts produced per sow bred.



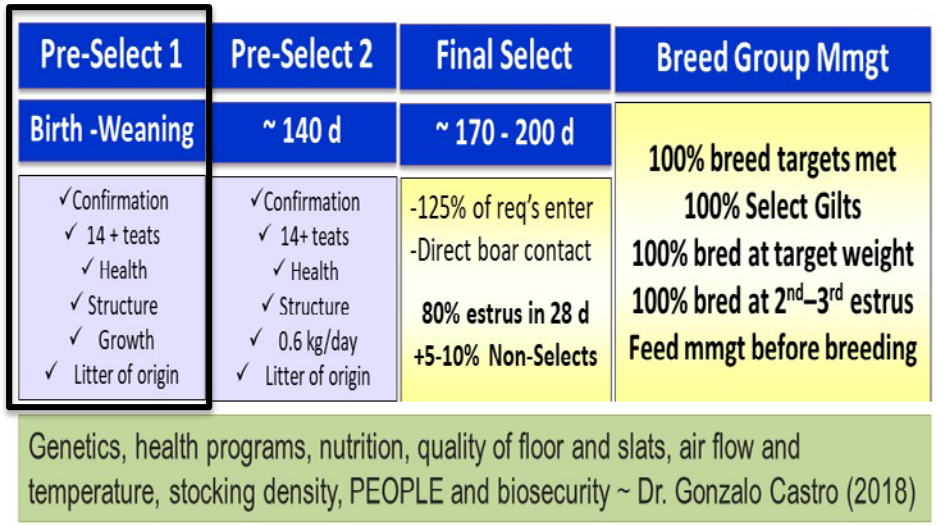
Sex ratio & future performance

Gilts from male-biased litters:

- were more likely to fail to conceive on their first mating (Drickamer et al., 1997)
- had less teats than gilts from a female-biased litter (Drickamer et al., 1999)
- were more aggressive (Seyfang et al., 2017)
- were delayed in reaching puberty (Lamberson et al., 1988), or had no effect on puberty (Parfet et al., 1990)

Sows from female-biased litters:

- have larger litters than sows from male-biased litters (Edgerton and Cromwell 1987).
- tended to farrow and wean larger litters (Rekiel et al., 2012)



2. Effective gilt selection programs (puberty stimulation and recorded heats) resolve many SLP issues

Pre-Select 1	Pre-Select 2	Final Select	Breed Group Mmgt
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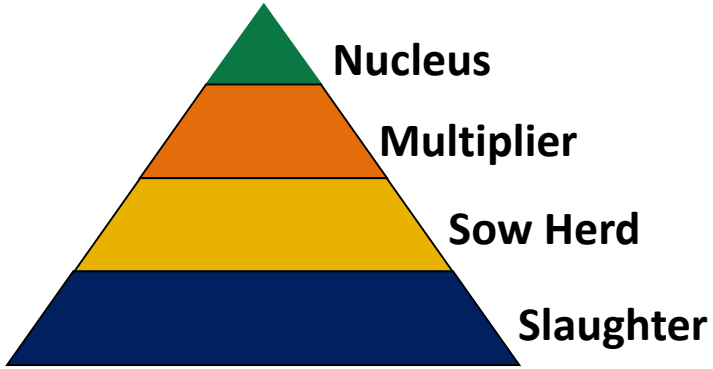


1. A final selection program that identifies the most fertile gilts.
2. A program that provides a consistent supply of service eligible gilts.
3. Appropriate management of body state at breeding.

Response to boar stimulation is an effective method to identify more productive gilts

Gilts must respond to boar exposure within a pre-established window of time

⇩

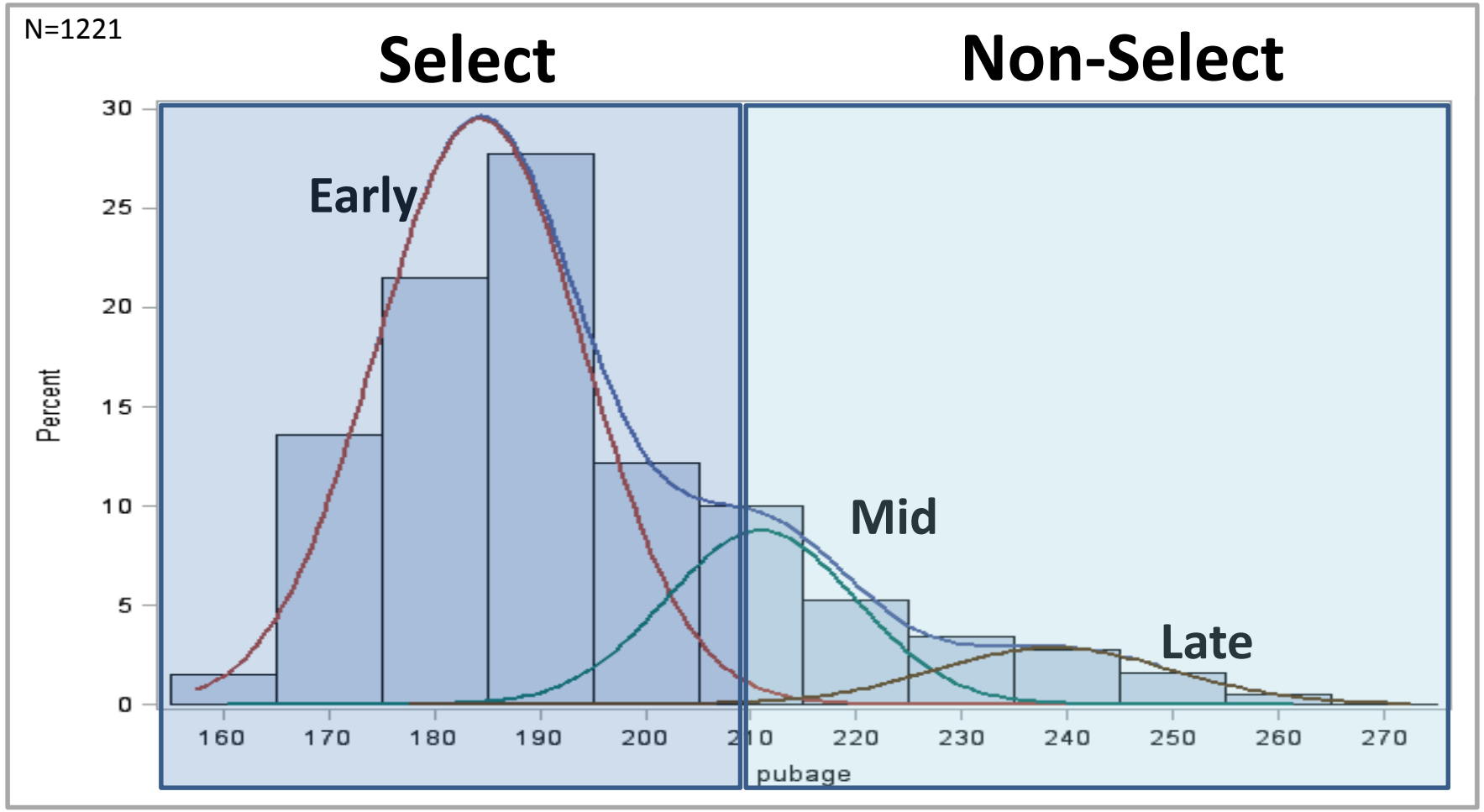
Identify early maturing gilts

⇩

Take advantage of the link between early sexual maturity and improved SLP

Patterson et al., 2016

Identifying “Select” gilts



- **94.2% of gilts displayed standing estrus** (Calderón Díaz et al. 2016).

Gilts naturally cyclic after 30 days of boar exposure are “Select” gilts.

Additional “opportunity” gilts could enter the herd if needed

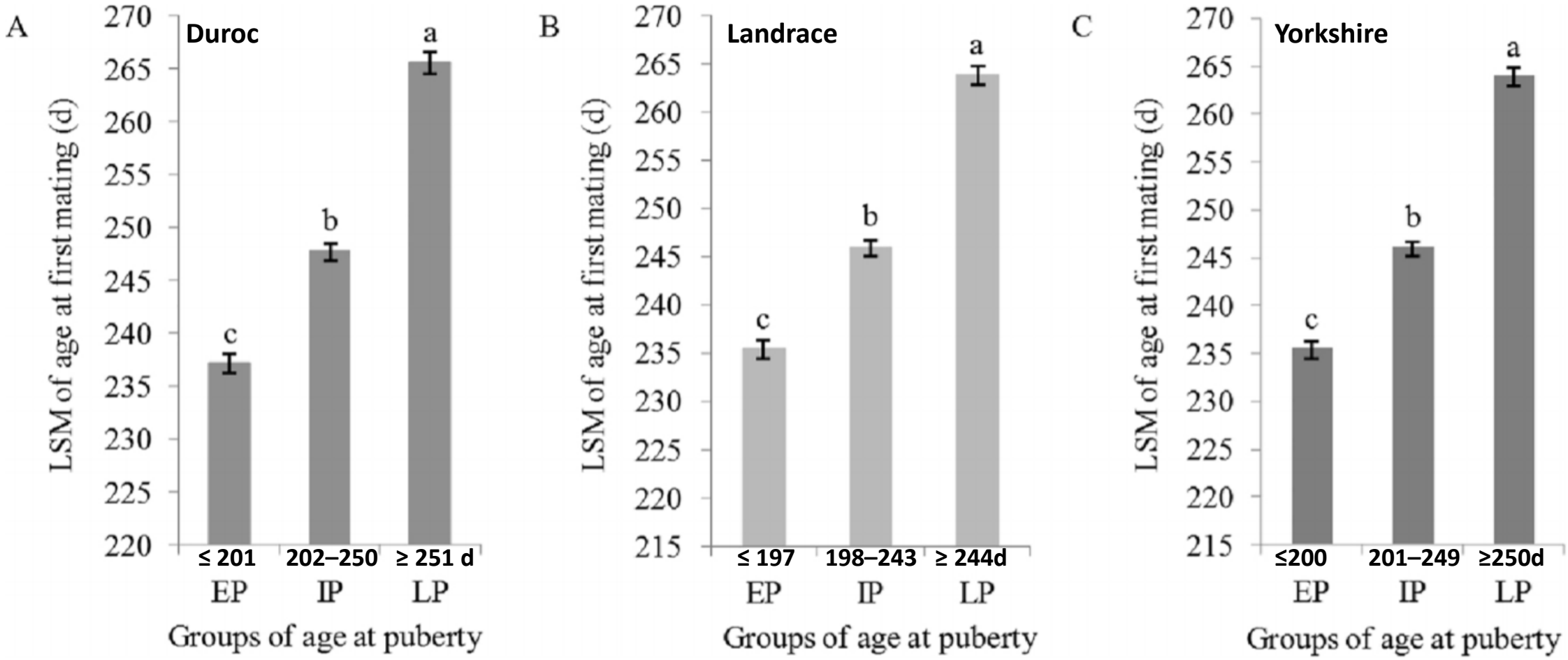
Vallet, 2015

Estrus characteristics at puberty are predictive of future performance:

Gilts with stronger estrus symptoms	→	are more likely to farrow.
Gilts with delayed puberty tend to	→	express delayed estrus and ovulation after weaning their first litter.
Gilts that fail to show a standing reflex at their first ovulation	→	have a greater risk of not showing a standing reflex in association with their first ovulation after weaning.
Gilts with short and weak vulvar signs at puberty also	→	have a higher risk of showing short and weak vulvar signs after weaning.

(Knauer et al., 2010; Sterning et al., 1998)

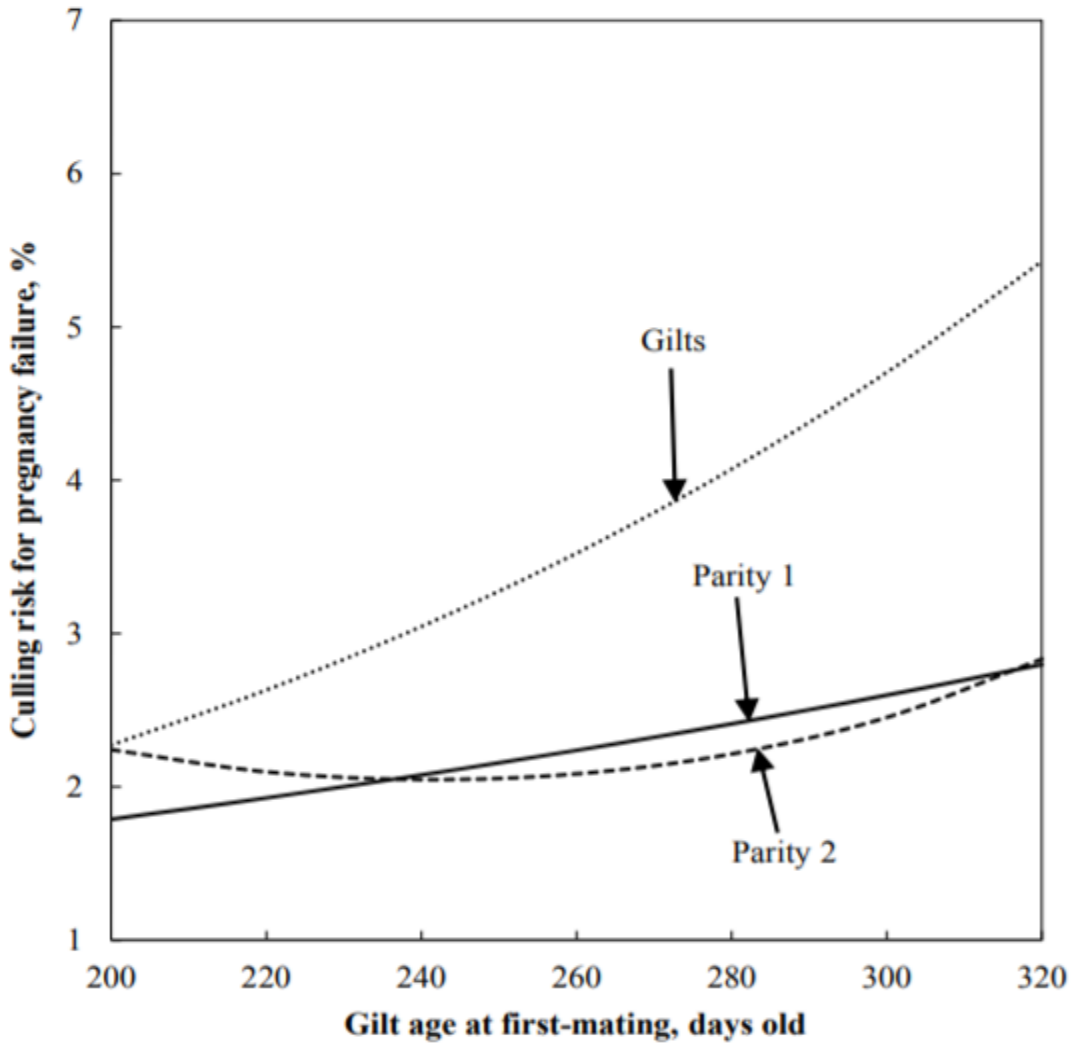
Gilts with early puberty are inseminated earlier & therefore have fewer NPD compared to gilts older at puberty



Li et al., 2018. Animal Reproduction Science 195

Heat checking from 180 to 280 d

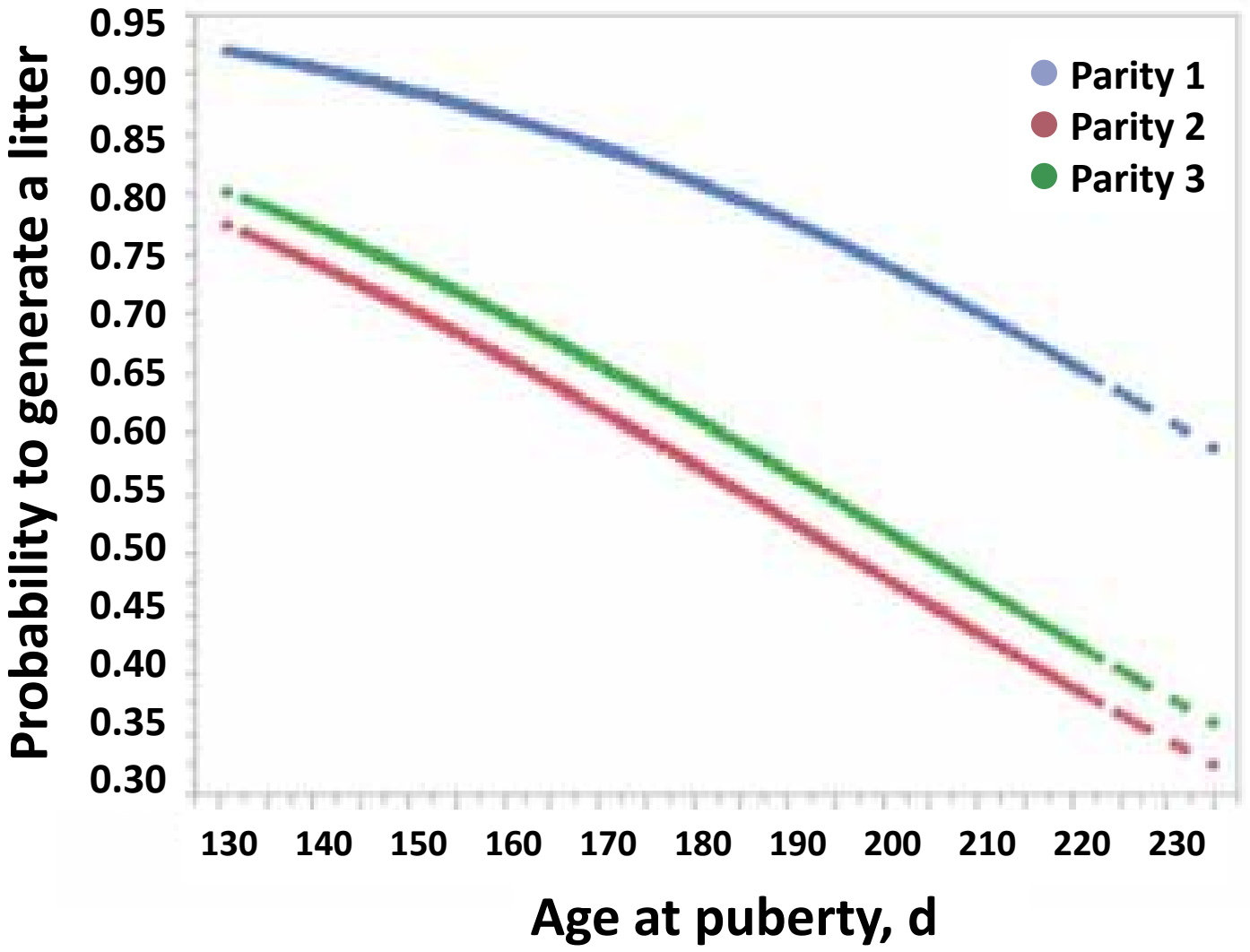
Gilts that are older age at first-mating had an increased predicted culling risk due to pregnancy failure.



- As age at first mating increased from 220 to 300 days the culling risk for pregnancy failure for gilts increased by 2.1%.
- Gilts with high age at first-mating are likely to have
  - immature or delayed maturation of endocrine systems.
  - innately low fertility.

Tani & Koketsu, 2016, Journal of Agricultural Science

Earlier age at puberty is associated with greater chance of producing a first, second and third litter

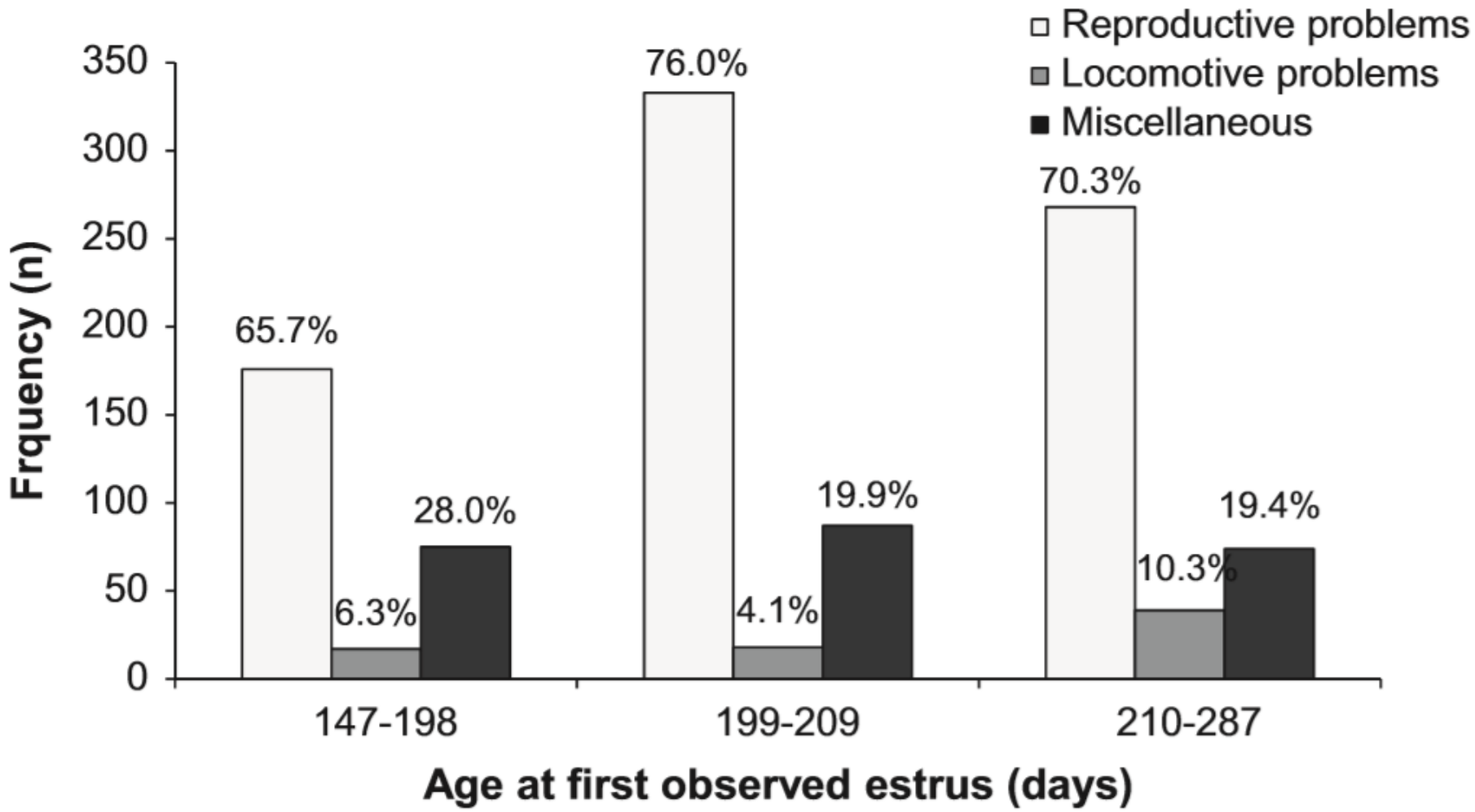


Heat checking from 130 to 240 d

- The likelihood of a parity 1, 2 and 3 litter decreased as age at puberty increased
- Gilts that express puberty early in life have increased rebreeding success and produce more litters and piglets during their lifetime

Tart et al., 2013, Anim. Genet.
Wijesena et al., 2017, Journal of Animal Science

“Select” gilts are culled less due to reproductive problems compared to “non-select” gilts



Roongsitthichai et al., 2013, Livestock Science

“Select” gilts produce more pigs born alive & have a longer reproductive life compared to “non-select” gilts

Measurement	SELECT		NON-SELECT
	150-180		180+
Bred (%)	95	↑ 22%	73
Lifetime total born to 3rd parity	25.4	↑ 2.6	22.8
Lifetime born alive to 3rd parity	23.6	↑ 2.2	21.4
Retention at 3rd parity farrowing	57.8	↑ 10.4	47.4
Parity at culling	1.6	↑ 0.4	1.2

Patterson, et al., 2010, Journal of Animal Science

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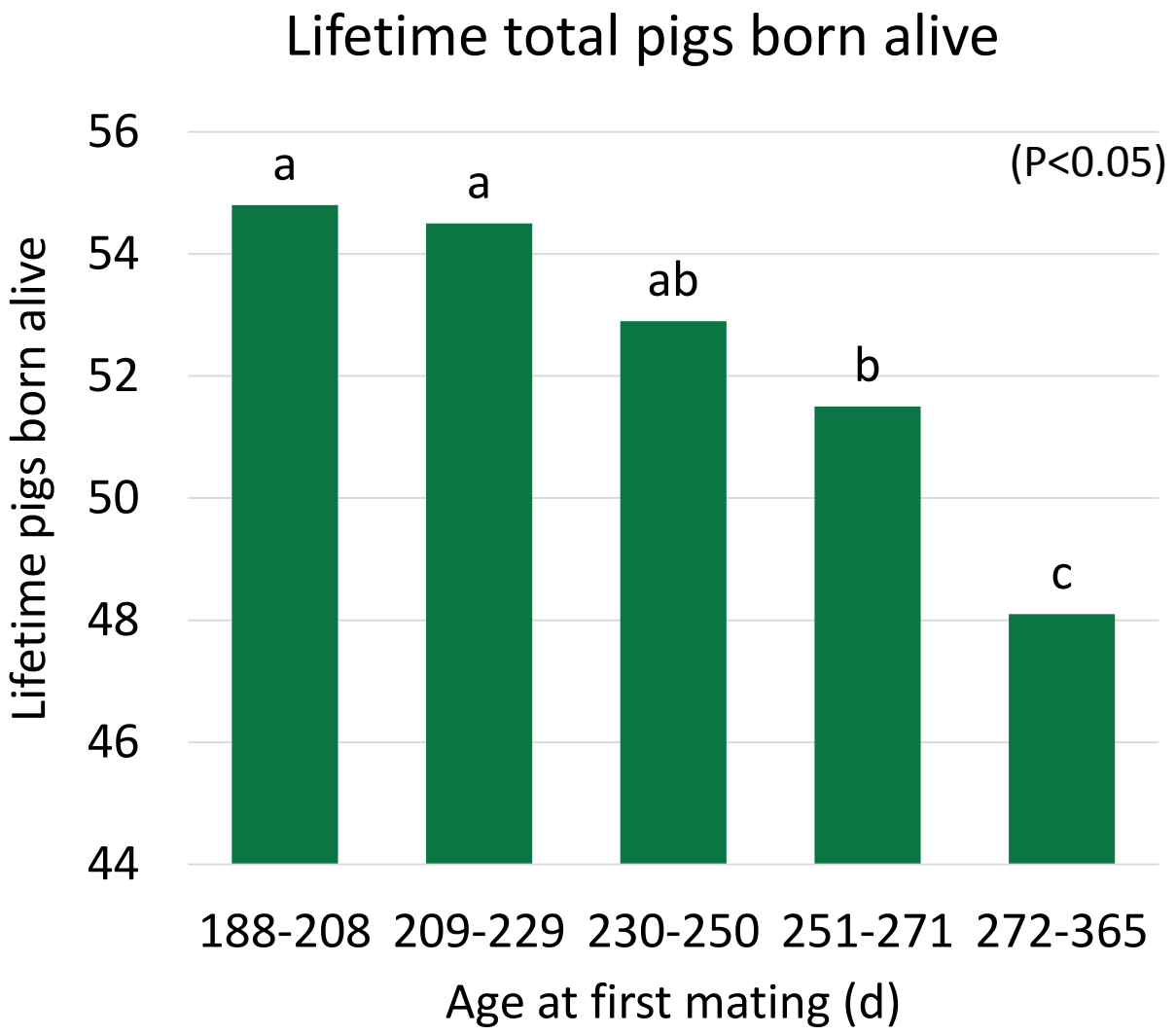
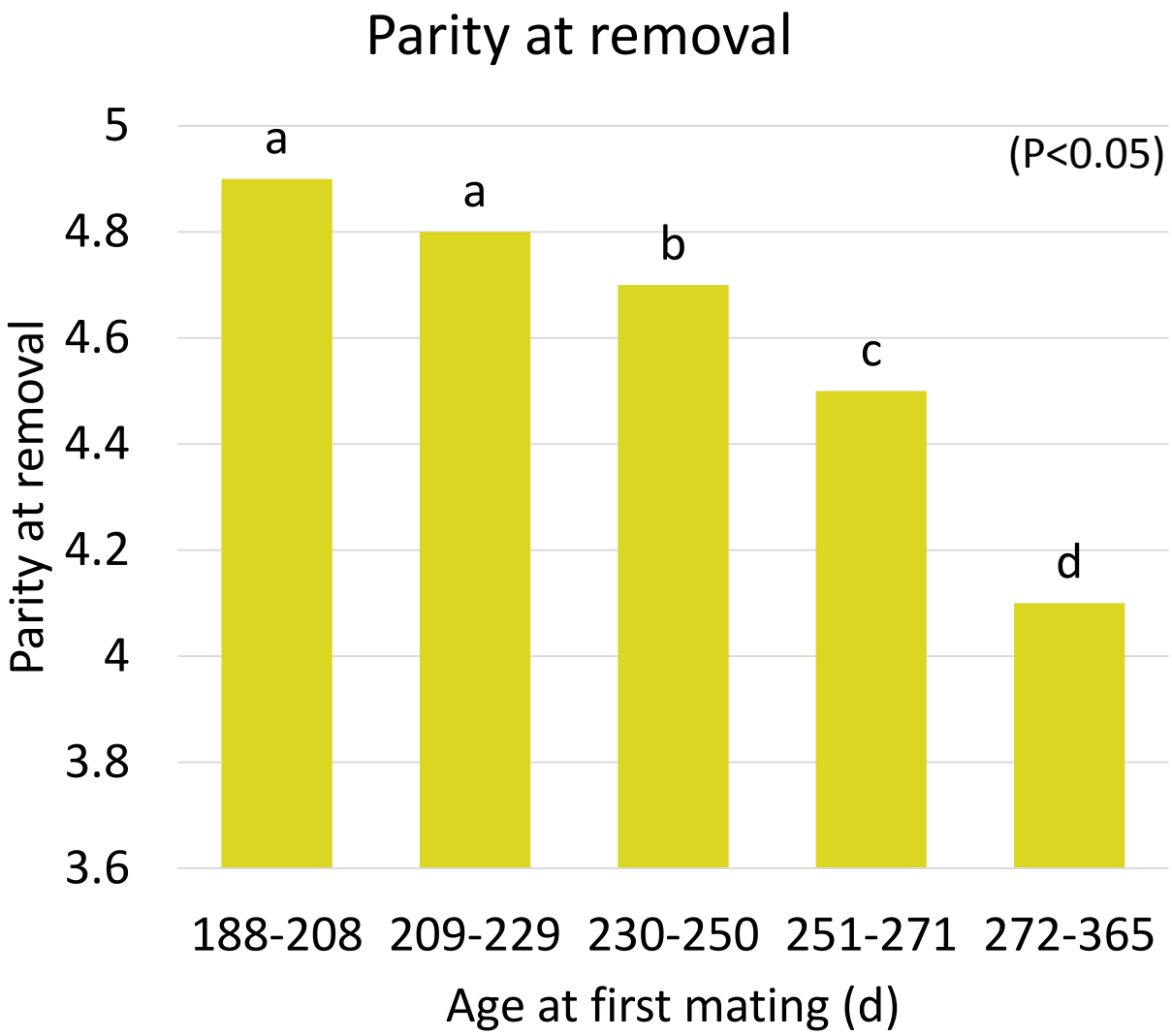
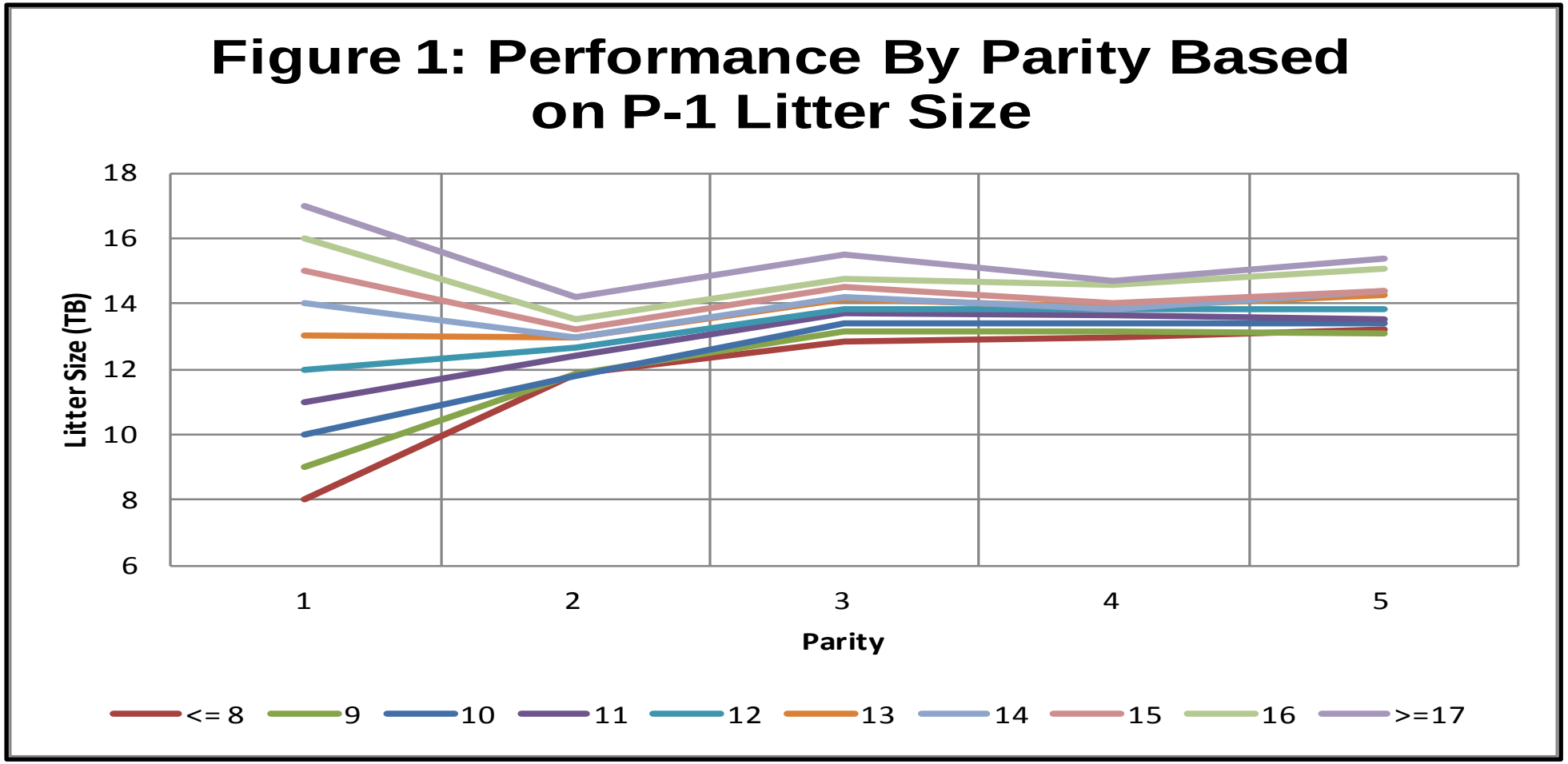




Saito, Sasaki and Koketsu, 2011, Theriogenology

First and second parity performance can be used effectively to predict subsequent parity and lifetime performance

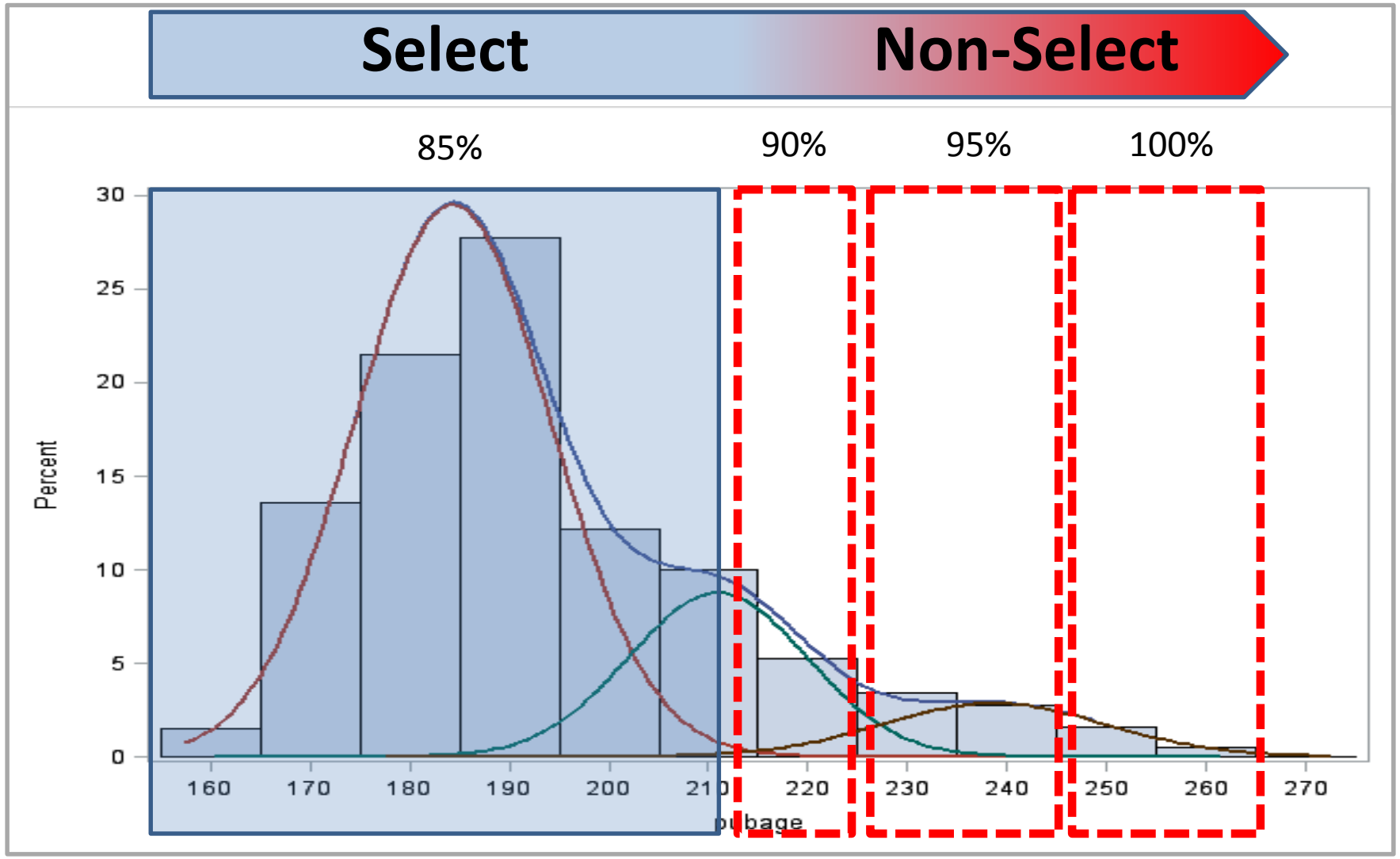


Pinilla et al., 2014, AASV

Good gilts are consistently good sows: big part of SLP is played in P1

What are your gilt selection targets?

~95% of gilts will cycle in 100 days…. BUT….



Vallet, 2015

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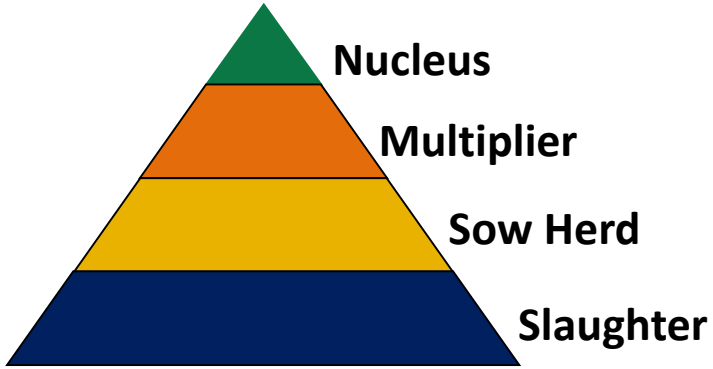


1. A final selection program that identifies the most fertile gilts.
2. A program that provides a consistent supply of service eligible gilts.
3. Appropriate management of body state at breeding.

2. A program that provides a consistent supply of service eligible gilts:

- Implementation of an effective GDU system is absolutely necessary
- Pivotal starting point to select gilts with the greatest reproductive potential.

- ✓ **Direct Boar Contact**
- ✓ **Committed GDU staff**
- ✓ **Record keeping and monitoring**

1. DIRECT BOAR CONTACT

- **The Boar – The most potent stimulus of pubertal onset in gilts.**
  - Boar libido is a critical factor influencing puberty attainment in gilts.
  - Daily exposure to a rotation of mature boars maximize the response to this component of the “boar effect”.
- **Direct boar contact is better than fenceline contact.**
- **Taking the gilts to the boars is more effective compared to taking the boar to the gilts pen**
- **Ensure that multiple boars are available for daily use:**
  - Libido, temperament, size, etc.
  - Replacement programs are important

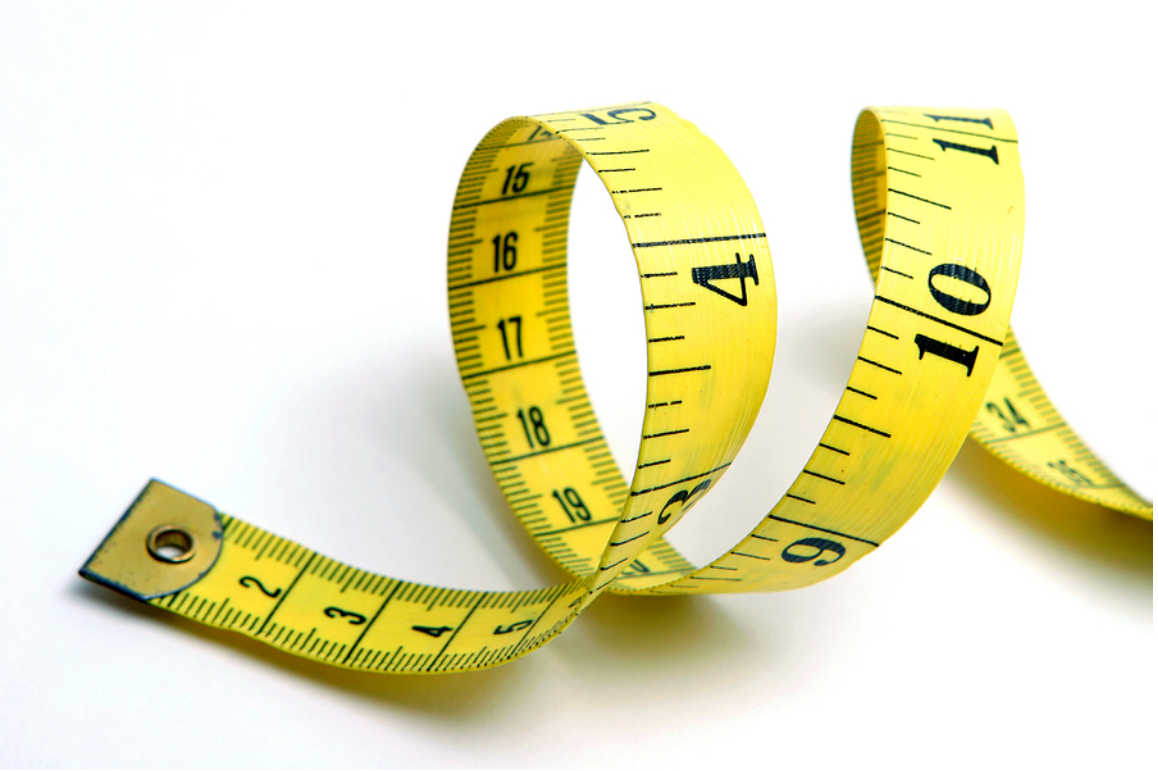
2. COMMITED GDU STAFF

- Family owned company based in Northfield, MN
- 60,000 sows in MN, IA, and WI
- All gilts produced internally by Holden Farms

"The gilt development unit is the future of our farms, we are allocating more staff and management and changing our farms culture." Aaron Hanson, Leman 2018

HOLDEN farms

3. RECORD KEEPING AND MONITORING



"You can't manage what you don't measure."

Peter Drucker

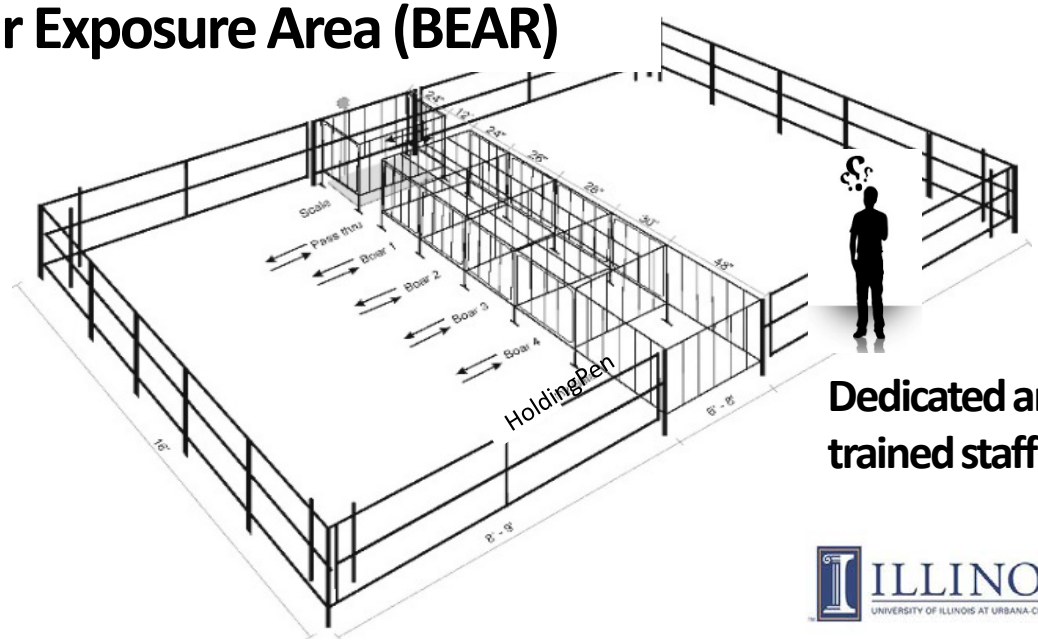
- **Use data that is collected on a daily basis to:**
  - Provide insight to track reproductive success,
  - Enable data-driven decision making.
  - Minimize the negative impact of poor GDU management on lifetime reproductive performance.
- **In the case of the replacement gilt the necessary data is often not collected and/or analyzed.**

Key components of efficient GDU programs

Implementation of gilt stimulation programs

Time	Action: group by group
D1-13	▪ Direct (and fenceline) contact with vasectomized boars
D14	▪ Remix all non-cyclic gilts
D23	▪ "Opportunity" (known non-cyclic) gilts without HNS receive PG600
D28	▪ All eligible gilts are identified ▪ Gilts without HNS are culled

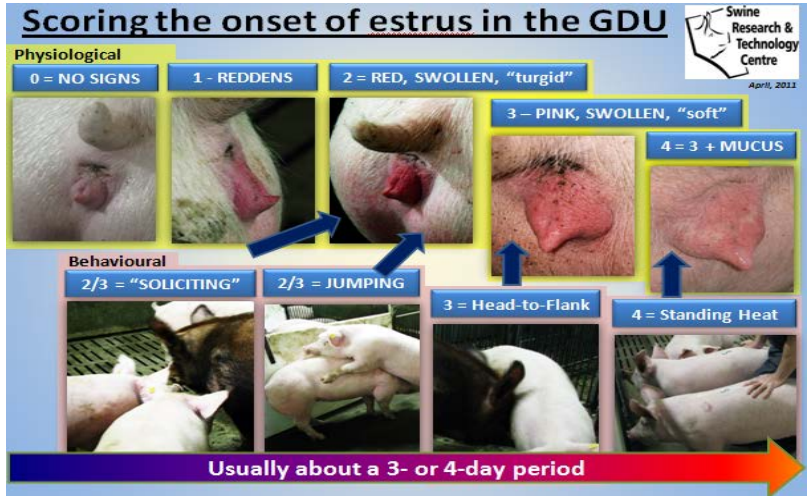
Boar Exposure Area (BEAR)

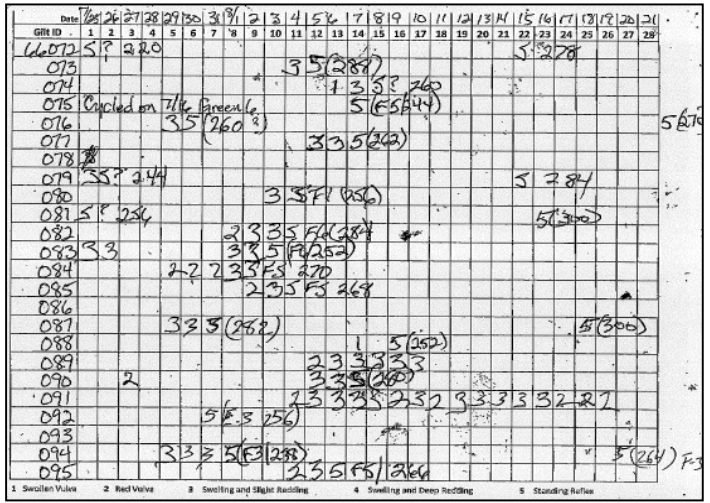


Dedicated and trained staff

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Record Keeping!!



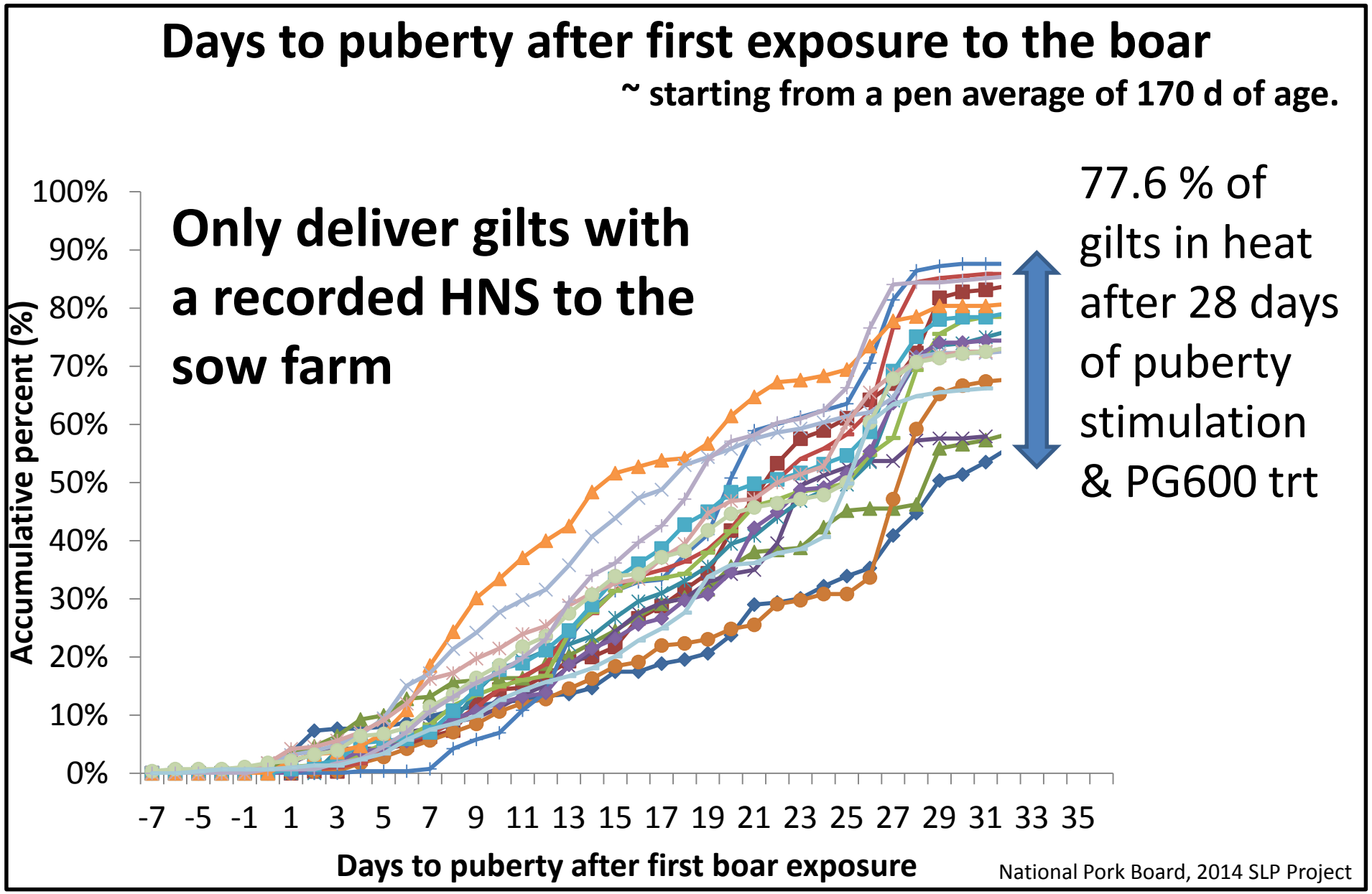


Direct contact with high libido boars!

Item	Fenceline	Direct	
Wk1 heat (%)	20.3	30.5	+10.2%
Wk2 heat (%)	29.5	43.9	+14.4%
Wk3 heat (%)	51.8	76.7	+24.8%
Estrus (%)	79.1	94.2	+15.1%

Knox and Daniels, 2018

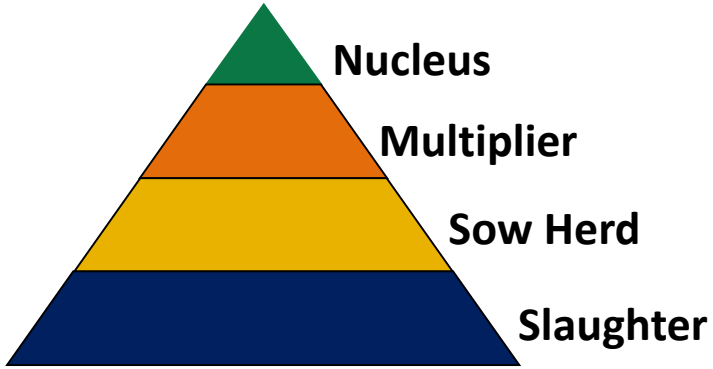
Key components of efficient GDU programs



2. Effective gilt selection programs (puberty stimulation and recorded heats) resolve many SLP issues

Pre-Select 1	Pre-Select 2	Final Select	Breed Group Mmgt
Birth -Weaning	~ 140 d	~ 170 - 200 d	100% breed targets met 100% Select Gilts 100% bred at target weight 100% bred at 2nd–3rd estrus Feed mmgt before breeding
✓Confirmation ✓ 14 + teats ✓ Health ✓ Structure ✓ Growth ✓ Litter of origin	✓Confirmation ✓ 14+ teats ✓ Health ✓ Structure ✓ 0.6 kg/day ✓ Litter of origin	-125% of req's enter -Direct boar contact 80% estrus in 28 d +5-10% Non-Selects	

Genetics, health programs, nutrition, quality of floor and slats, air flow and temperature, stocking density, PEOPLE and biosecurity ~ Dr. Gonzalo Castro (2018)



1. A final selection program that identifies the most fertile gilts.
2. A program that provides a consistent supply of service eligible gilts.
3. Appropriate management of body state at breeding.

ESTRUS AT SERVICE

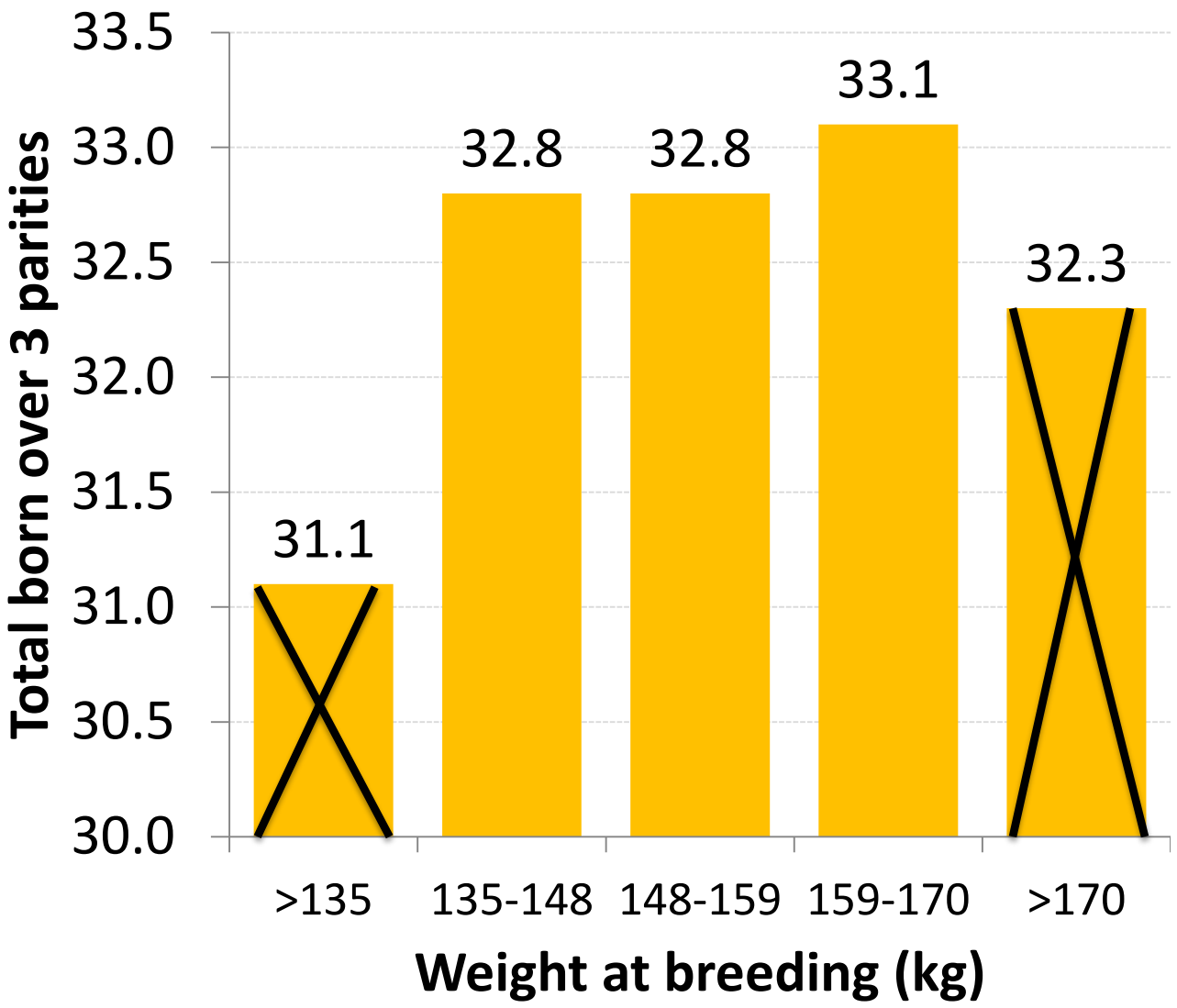
More important than chronological age at mating, is **physiological age (number of estrous cycles).**

Target:
Breed gilts at 2nd or 3rd estrus

Gilts bred at second versus first estrus showed:

- **An increase in the number of piglets born live** at first farrowing (ranged from 0.4 to 1.3) (Levis, 2000).
- **An advantage of 1.3 pigs after four litters** compared to gilts bred at first estrus (Young et al., 1990).
- **An increase in farrowing rate** (Kummer, 2005).

WEIGHT AT SERVICE



Target :
~135-150 kg
> 600 g/d & < 790 g/d

Williams et al, 2005

Avoid breeding gilts too heavy:

- Gilts bred >170 kg:
  - **risk of low retention and locomotion problems over 3 parities** (Amaral Filha, et al,. 2008).
- Heavy gilts at 1st service:
  - Tend to be **heavy at a farrowing &** have **more demands for maintenance** (Bortolozzo et al., 2009).
- Over conditioned **sows produce less colostrum** (Decaluwé et al.,2014)

MANAGEMENT OF FEED INTAKE PRIOR TO SERVICE

Any event that disrupts normal feed intake in the gilt will immediately impact LH secretion and remove the critical priming effect on of LH secretion on follicular development (Foxcroft 2015).

Risk situations for reduced feed intake at critical stages of gilts development would include:

1. Remixing of gilts immediately before boar stimulation
2. Crowding that limits feed intake in timid gilts
3. Moving gilts to stalls immediately before breeding
4. Health-type incidents at any of these times

CONCLUSIONS

Key considerations for improved longevity:

1. **Select gilts from birth litters with the greatest chance of becoming productive females.**

   - Determine sow phenotype (weigh litters or individual pigs).
   - Ensure post-farrowing care & strategic cross fostering of potential replacement females – a smaller litter size in lactation.

   “Non-Select” criteria may include:

   ❖ Individual gilts with a birth weight < 1 kg

   ❖ Gilts born to multiplication sows with a repeatable “low litter birth weight” phenotype

   ❖ Gilts born in litters with high male:female sex ratios

Key considerations for improved longevity:

2. **Implement a final selection program that identifies the most fertile gilts.**
   - ❖ Data suggest the “Select” gilts are most fertile over their productive lifetime.
3. **Implement a program that provides a consistent supply of service eligible (“Select”) gilts.**
   - ❖ An effective gilt stimulation program is essential.
   - ❖ Deliver predictable numbers of high quality breeding eligible gilts to the sow farm.

Key considerations for improved longevity:

4. **Appropriate management of sexual maturity and body state at breeding:**
   - 2^{nd} or 3^{rd} estrus
   - Weight: 135-150 kg
   - Growth rate: > 600 g/d & < 790 g/d
   - Feed intake 14 days prior to service

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