

**Selection response from an experiment
using a cross-classified mating design
between direct and maternal genetic
selection groups for piglet survival**

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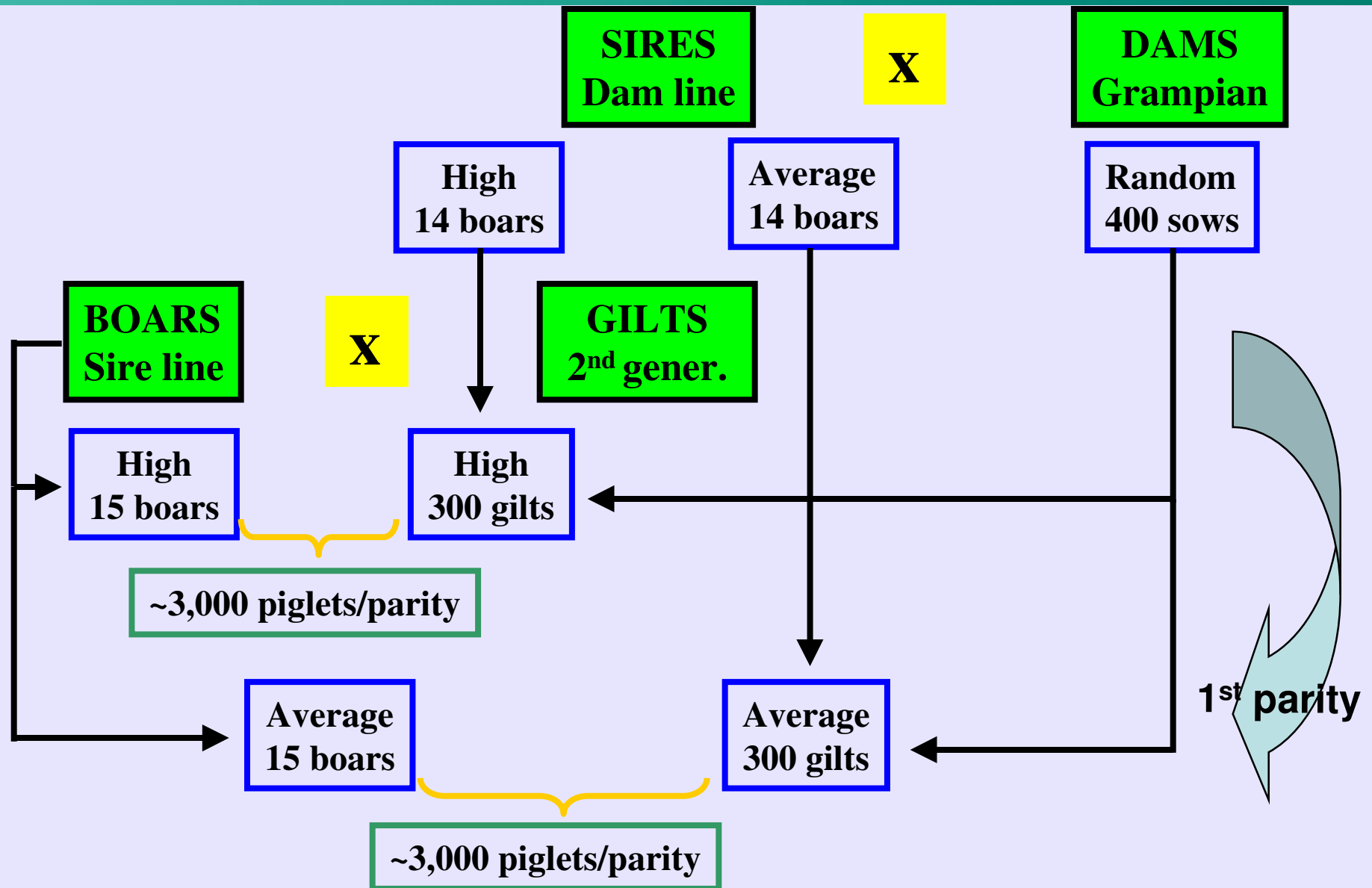
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Background and objectives

- **Peri- and postnatal piglet mortality between 16 to 31%**
- **Genetic improvement of piglet survival has great benefits**
 - **animal welfare, economic, environment**
- **Response to selection for piglet survival**
 - **maternal genetic effects**
 - **piglet's direct genetic effects**
 - **Interactions between maternal & direct effects**
- **Two generation selection experiment**
 - **cross-classified mating design**
 - **disentangle direct and maternal selection response**

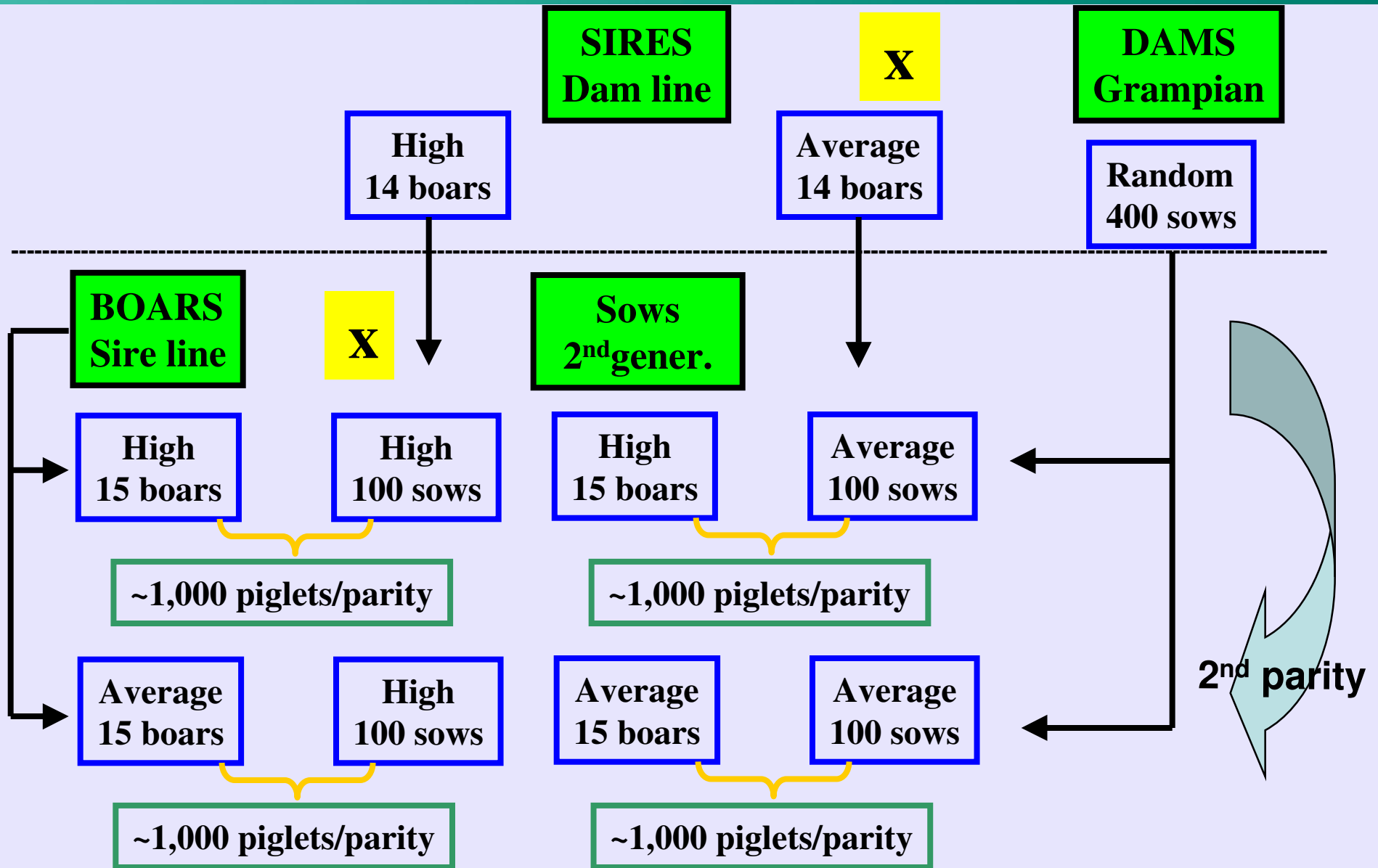
Two generation selection experiment

- 2nd generation, 1st parity: matched mating

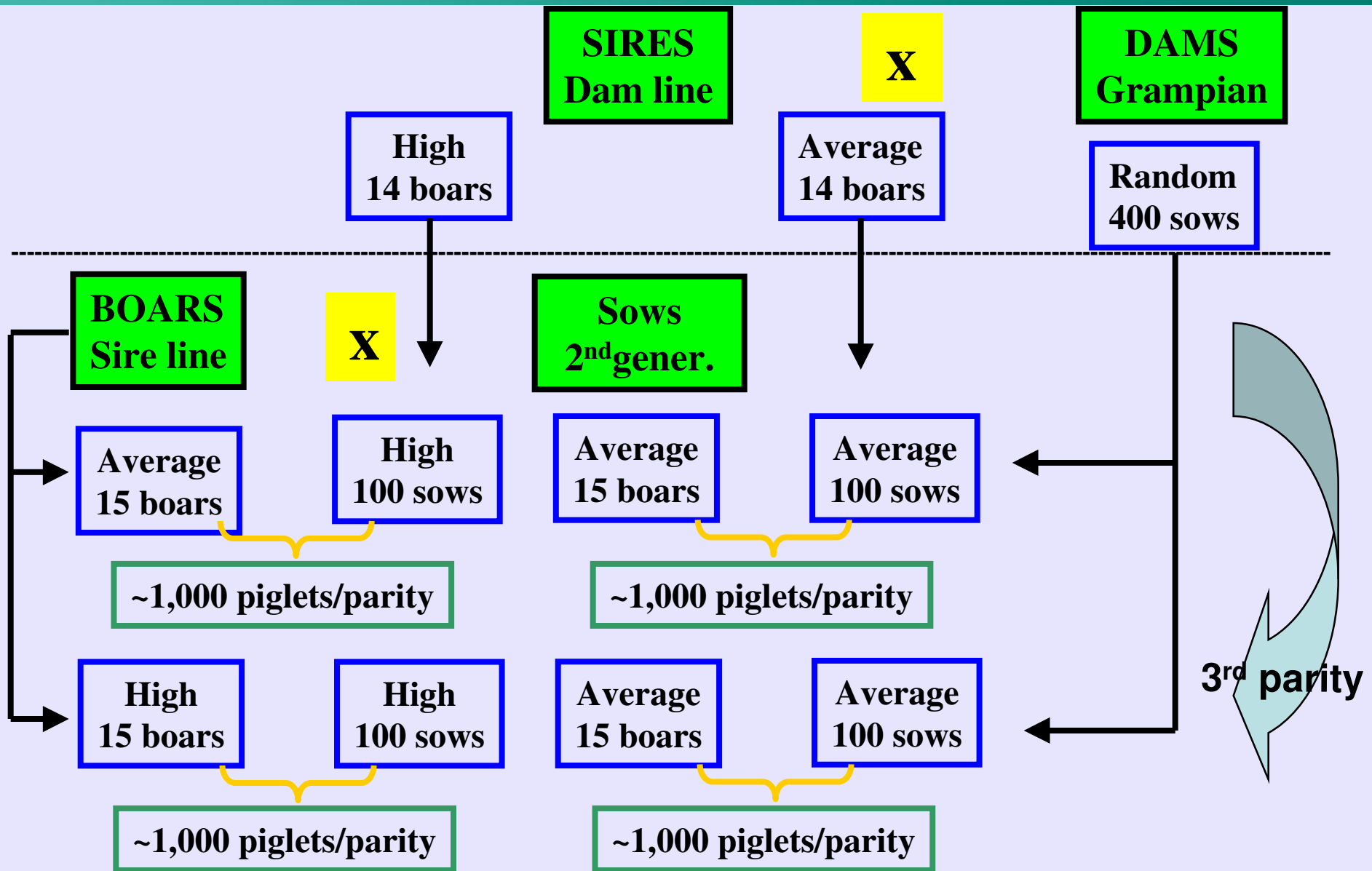


Two generation selection experiment

- 2nd generation, 2nd parity: cross-classified mating



- 2nd generation, 3rd parity: cross-classified mating, changing the mating groups of previous parity



Selection experiment

- **21,835 individual piglet observations**
 - survival at birth
 - survival during the nursing period
 - individual birth weight
 - DNA of each piglet

Estimation of selection response

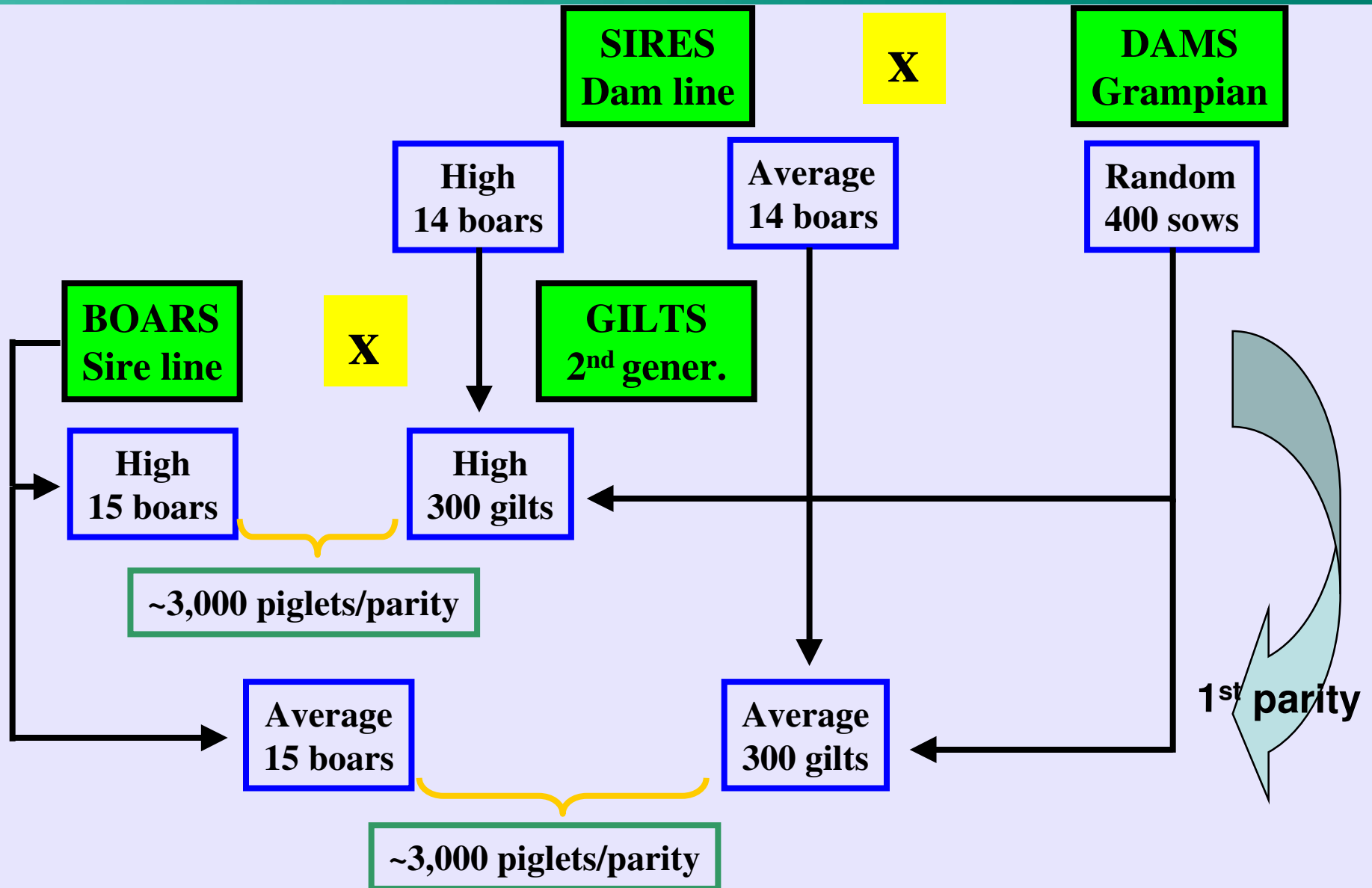
- **Selection response:**
 - **Least Squares Analysis**
 - **Mixed Model Analysis**
 - **Threshold model:**
 - considering categorical survival traits
 - **Linear model:**
 - individual birth weight
 - **Bayesian analysis using Gibbs Sampling**
 - **Animal model with random effects**
 - direct & maternal genetic, and litter effects

Direct and maternal heritabilities of piglet survival and birth weight

Trait	Direct h^2	Maternal h^2
Survival at birth (SVB)	0.21 (0.14 to 0.28)	0.15 (0.10 to 0.19)
Survival during the nursing period (SVNP)	0.24 (0.14 to 0.35)	0.14 (0.10 to 0.18)
Birth weight (IBW)	0.36 (0.31 to 0.41)	0.28 (0.24 to 0.31)

Selection response

- 2nd generation, 1st parity: matched mating



Selection response of the first-parity sows (2nd generation) in piglet survival during the nursing period

Expected response (EBVs of sires at service)

+3.32%

Phenotypic response

+2.67%

Selection response using LSQ Method

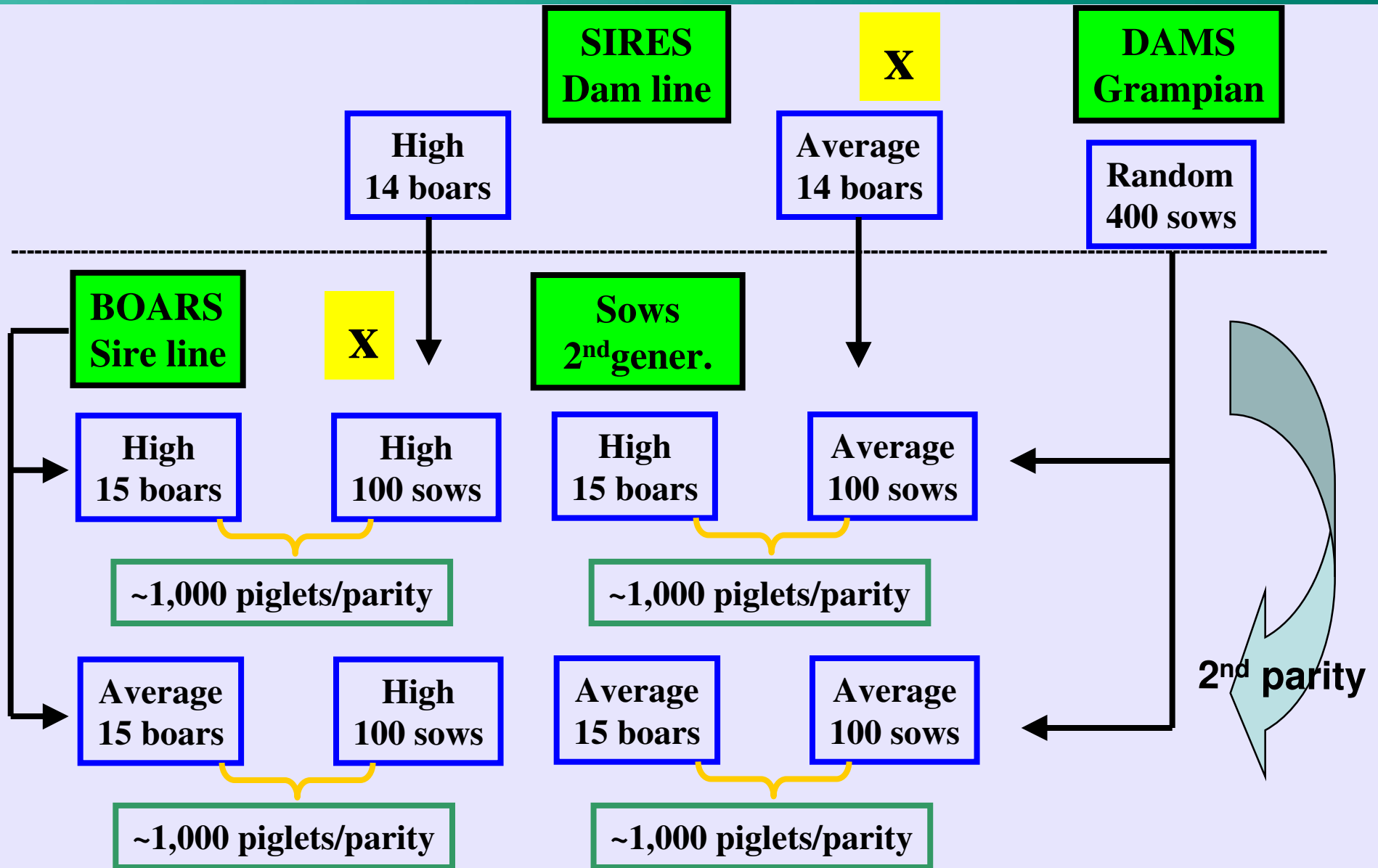
+3.03% ± 1.18

Selection response using Mixed Model technique

+3.33% ± 0.19

Selection response

- 2nd generation, 2nd parity: cross-classified mating



Direct and maternal selection response for survival during the nursing period (2nd parity)

Selection group		Survival response (%)	
Sire (Direct)	Dam (Maternal)	Direct	Maternal
High	High	-0.67 (0.27)	+1.90 (0.32)
High	Control	-2.42 (0.26)	+0.88 (0.31)
Control	High	+0.91 (0.26)	+0.74 (0.31)
Control	Control	0	0

Direct and maternal selection response for survival during the nursing period (3rd parity)

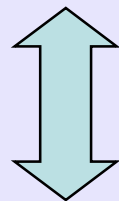
Selection group		Survival response (%)	
Sire (Direct)	Dam (Maternal)	Direct	Maternal
High	High	+0.59 (0.28)	+1.67 (0.35)
High	Control	-0.25 (0.27)	+1.08 (0.35)
Control	High	+0.32 (0.29)	+2.20 (0.36)
Control	Control	0	0

Correlated selection response in birth weight

Selection group		Parity	Birth weight (g)	
Direct & Maternal			Correlated response	Mean
High	Control	1	+51.2 (6.8)	1501
High	Control	2	+47.0 (11.7)	1654
High	Control	3	-58.0 (11.7)	1720

Summary and conclusions (1)

- **Direct heritabilities for survival higher outdoors than indoors**
- **Genetic selection on piglet survival was successful**
- **No Genotype by Environmental Interactions of piglet survival under indoor and outdoor conditions**
- **Correlated positive selection response of birth weight**
 - **in the first two parities only**



Optimal birth weight

- **negative response in the third parity**

Summary and conclusions (2)

- **Interactions between direct and maternal selection groups**
 - **Selection for maternal genetic effects was always successful**
 - **Direct response constrained by maternal genetic effects**
 - **Intense selection for direct genetic effects**
 - without selection for maternal effects -
 - increased competition within litter -
 - ➡ **resulted in negative direct response in survival**
 - **Selection pressure for direct genetic effects has to be matched by maternal response to be successful**

Acknowledgements

PARTNERS

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