The effect of **phenotyping** & **genotyping**, and using **conventional** or **organic sires** on genetic gain in an **organic** pig population

EAAP 2023 • Session 28 • 29/8/23 • Roos Zaalberg • QGG, Aarhus University, Denmark

Collaborators

PorganiX
project

Miljø- og Fødevareministeriet

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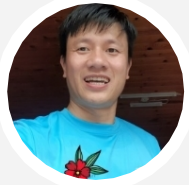

Miljø- og Fødevareministeriet

gudp

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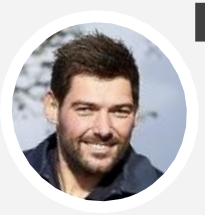

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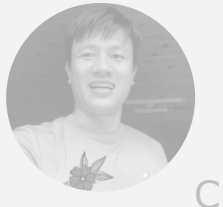

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BOVBJERG

ØKOLOGI

Introduction

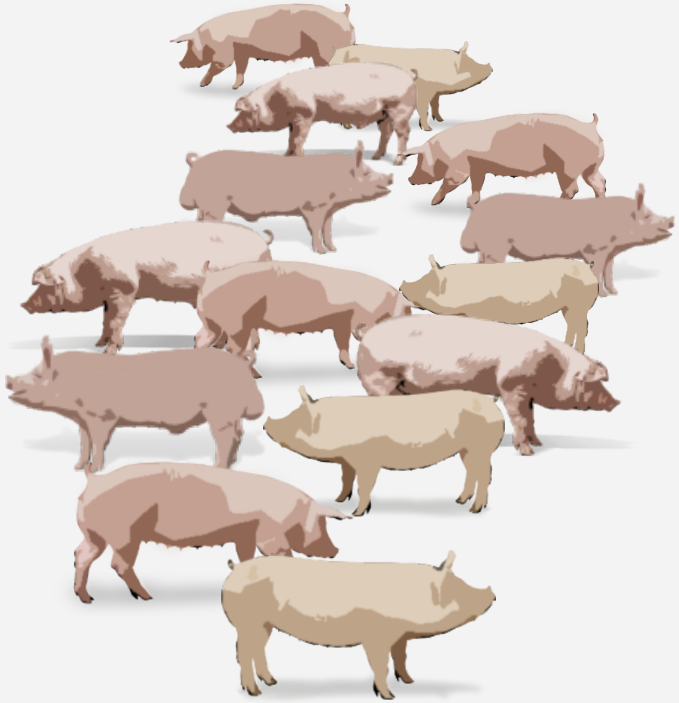
Welfare & pork

8,6%

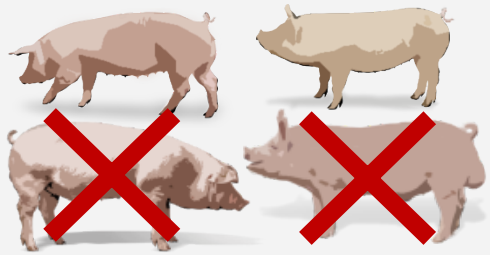
>10%

Organic pig breeding

conventional



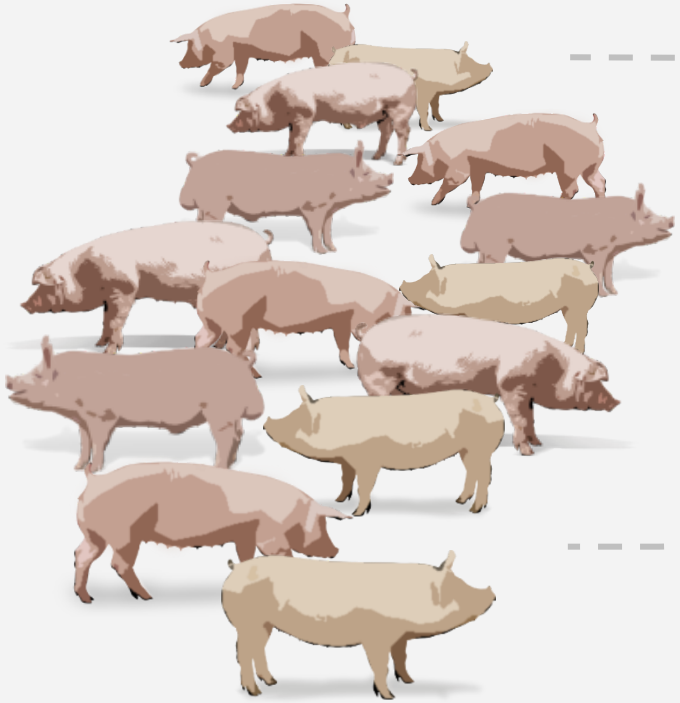
organic



Organic pig breeding

conventional

organic



semen

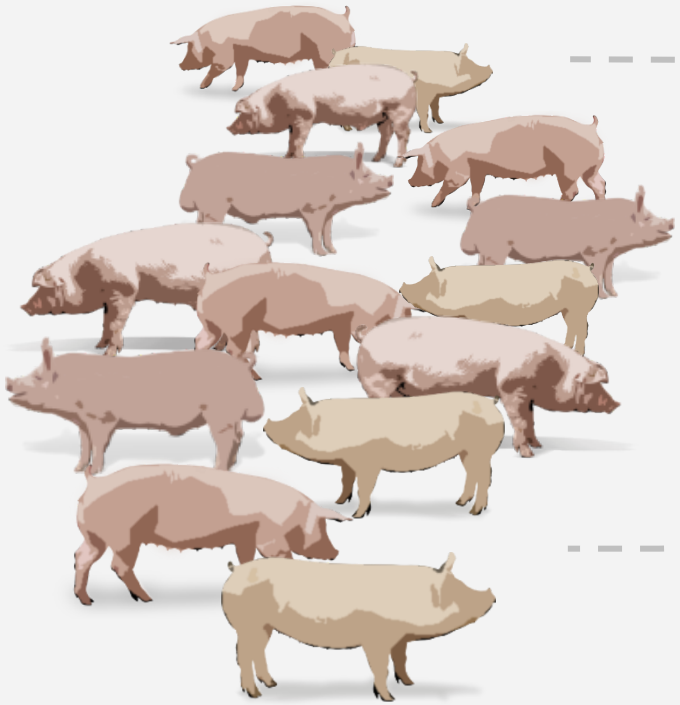
sows

sows

Problem

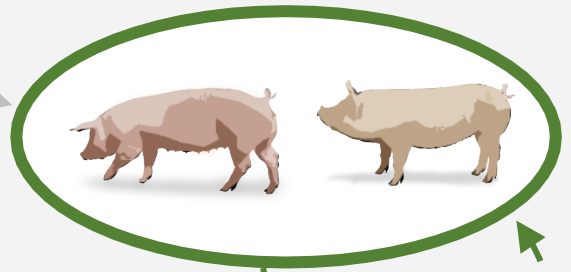
conventional

organic



semen

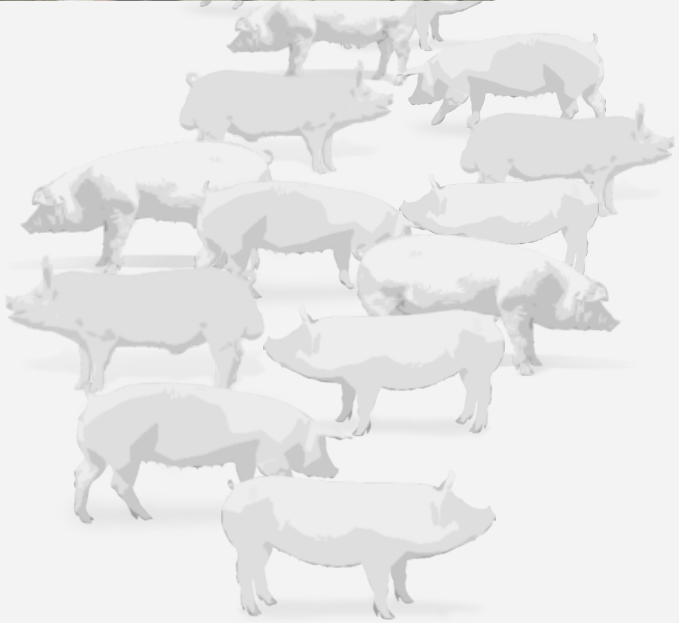
sows



sows

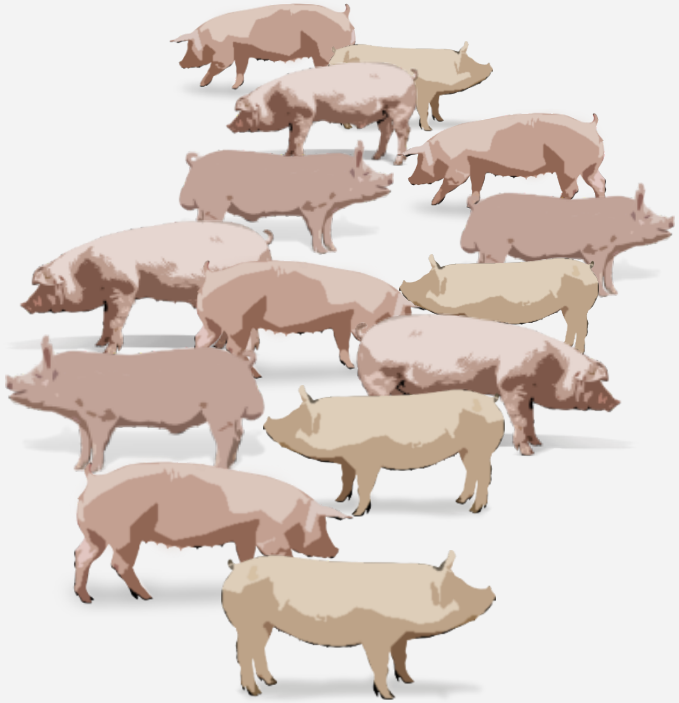
Problem

≠

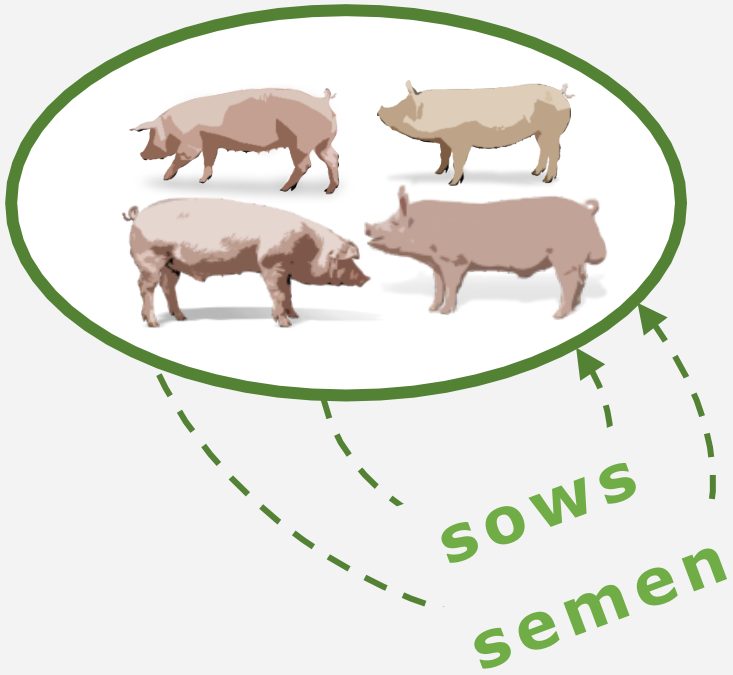


Solution

conventional

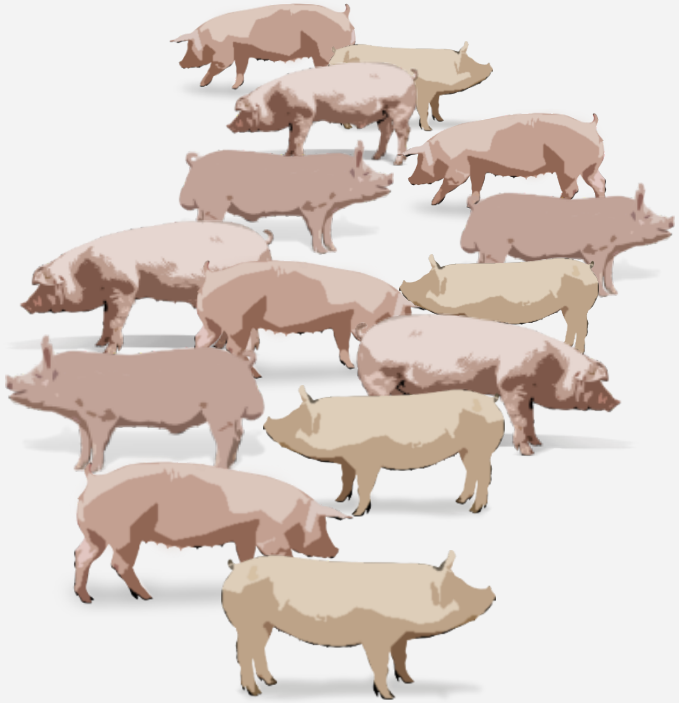


organic



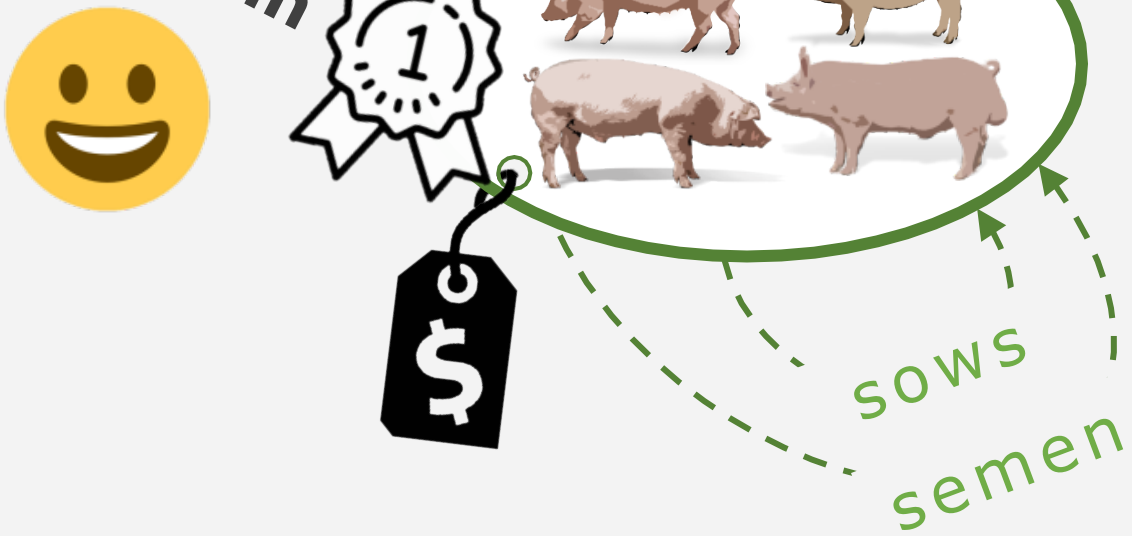
Solution

conventional



organic

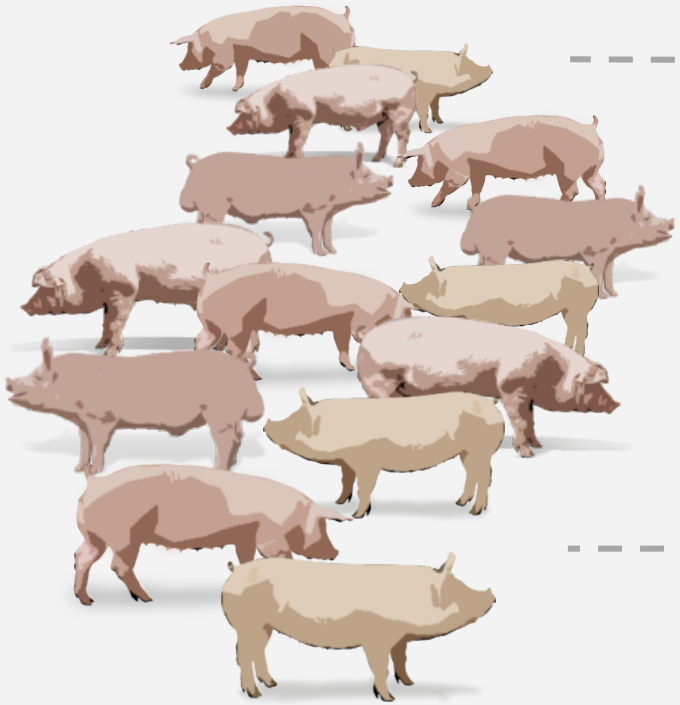
best genetic gain



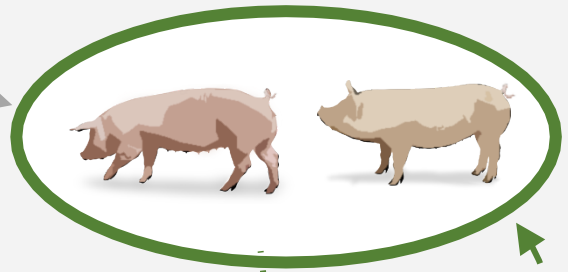
Reality check

conventional

organic



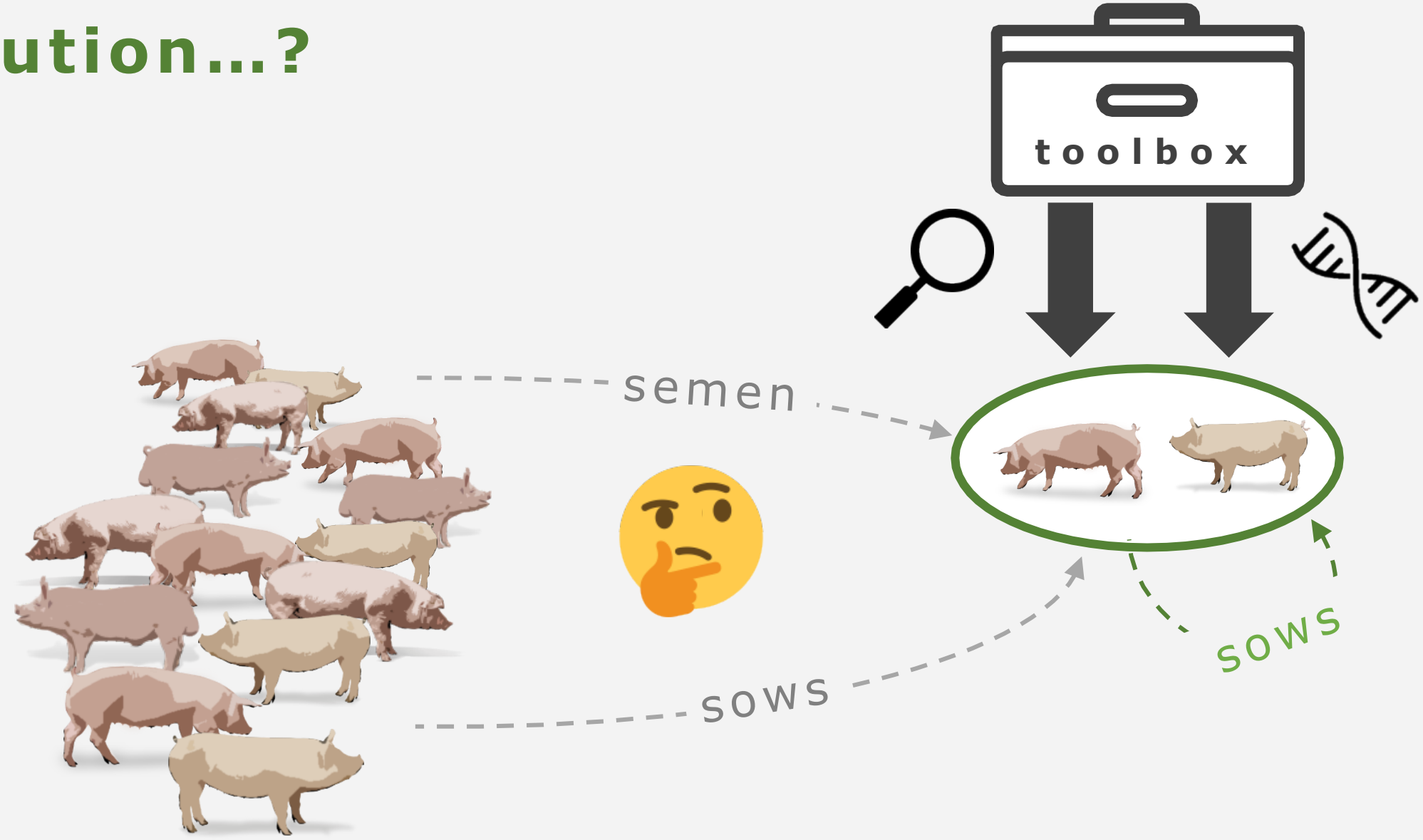
semen



sows

sows

Solution…?



Questions

Can we develop an

efficient breeding program

aimed at **organic** systems?

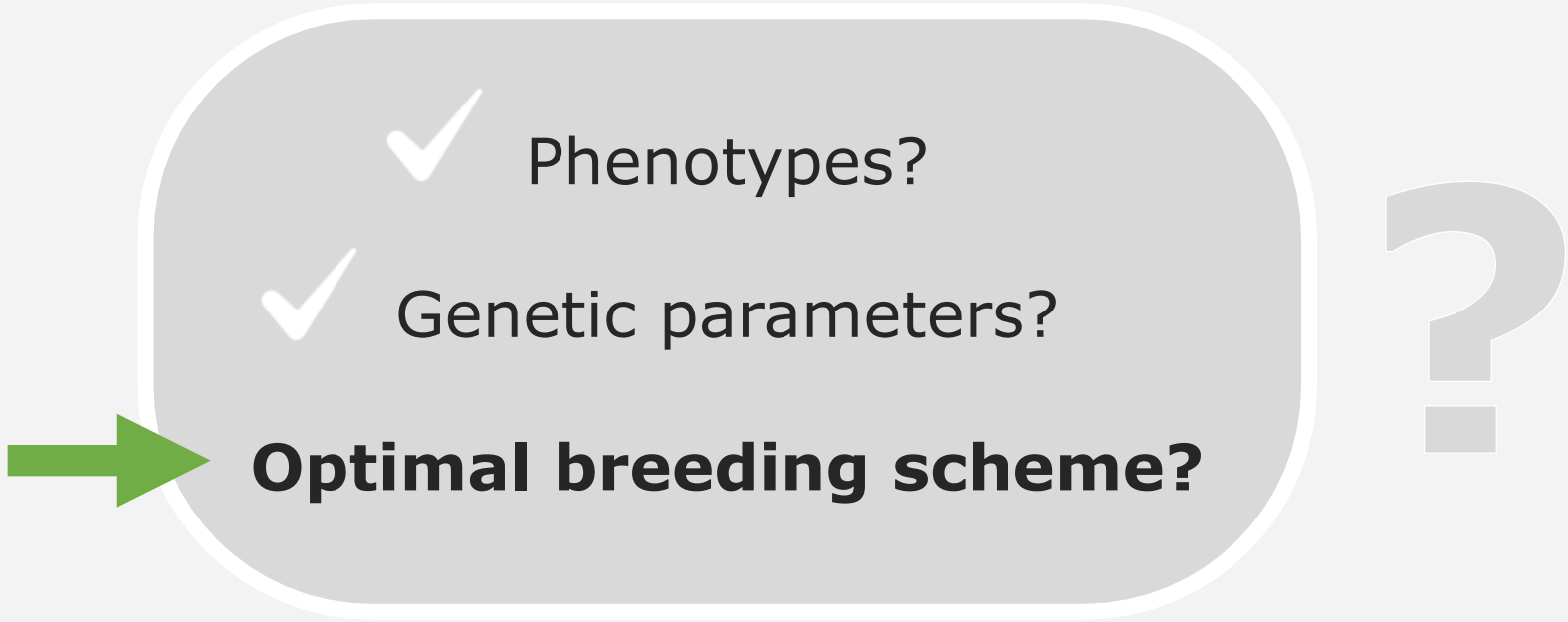
?

Questions

- ✓ Phenotypes?
- ✓ Genetic parameters?
- Optimal breeding scheme?

?

Questions



Aim

Estimate the effect of

pheno- & genotyping strategies, and origin of the sire

on the genetic gain in a simulated organic pig population

Materials & methods

Simulations

Software ADAM, DMU and LMT

Simulations

Software ADAM, DMU and LMT

Parameters *Villumsen et al., 2021*

Chu et al., 2022

Zaalberg et al., 2022 & 2023

Simulations

Software ADAM, DMU and LMT

Parameters *Villumsen et al., 2021*

Chu et al., 2022

Zaalberg et al., 2022 & 2023

Simulation

1) Period of 10 years
2) 100 replicates
3) ΔG and ΔF

Simulations

Simulations

Simulations

Origin of the sire *organic or conventional*

Simulations

Origin of the sire *organic or conventional*

Phenotyping DYL *yes or no*

Simulations

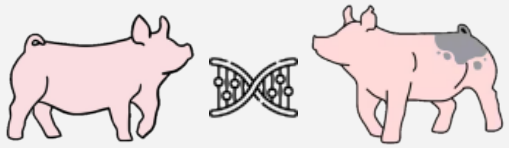
Origin of the sire *organic or conventional*

Phenotyping DYL *yes or no*

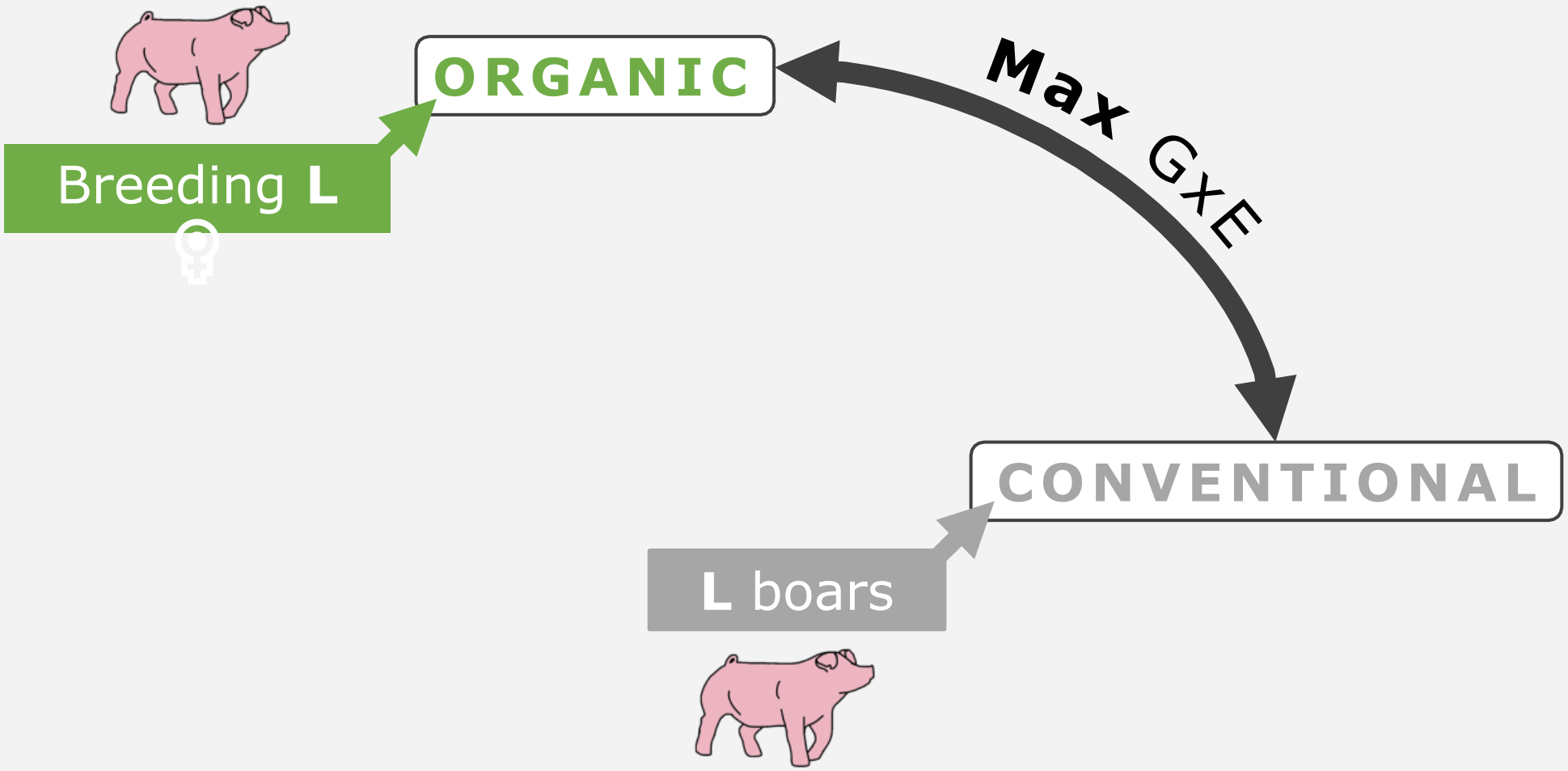
Genotyping purebreds and/or crossbreds *yes or no*

Simulations

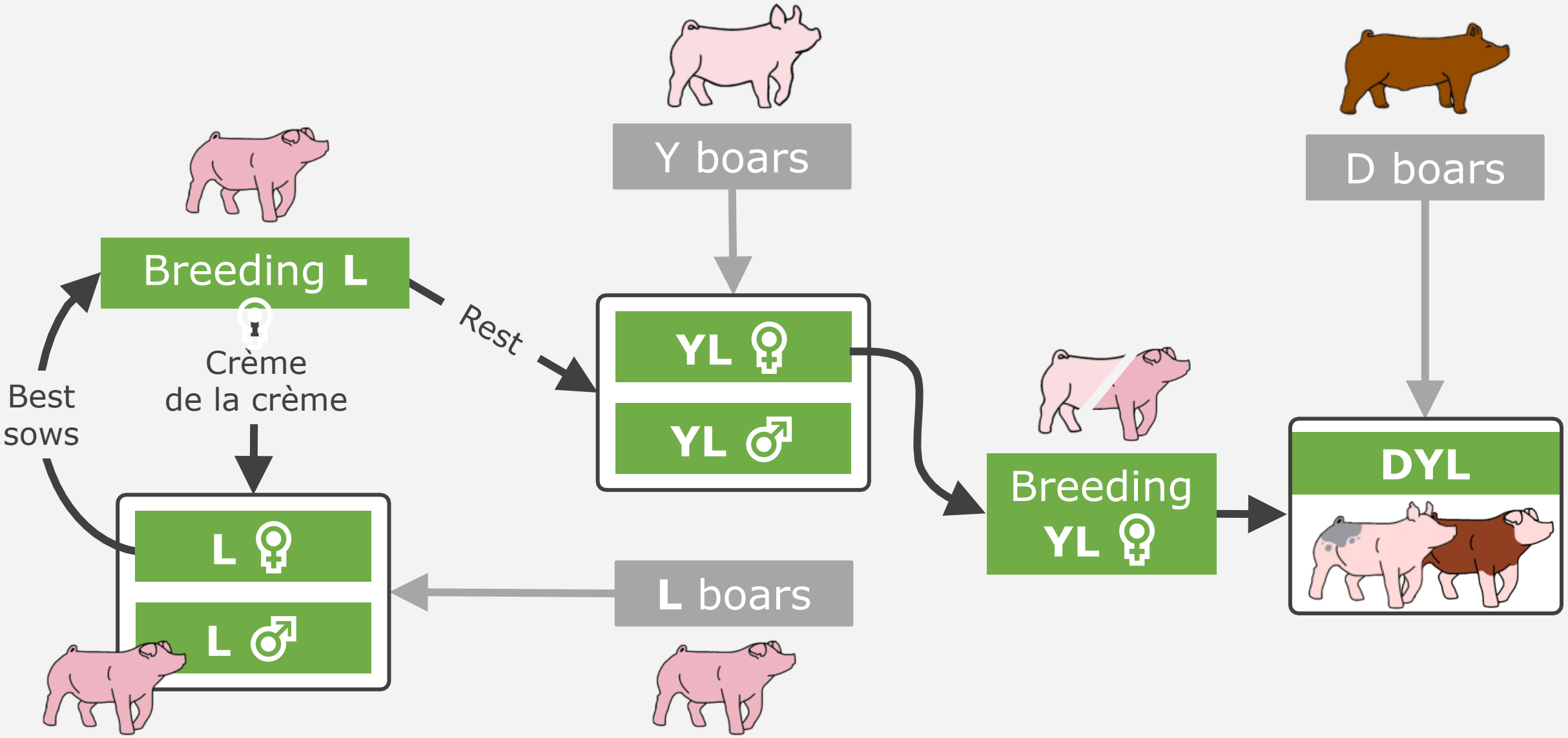
Origin of the sire	*organic or conventional*
Phenotyping DYL	*yes or no*
Genotyping purebreds and/or crossbreds	*yes or no*
r_g between purebreds and crossbreds	*weak (0,6) or strong (0.9)*



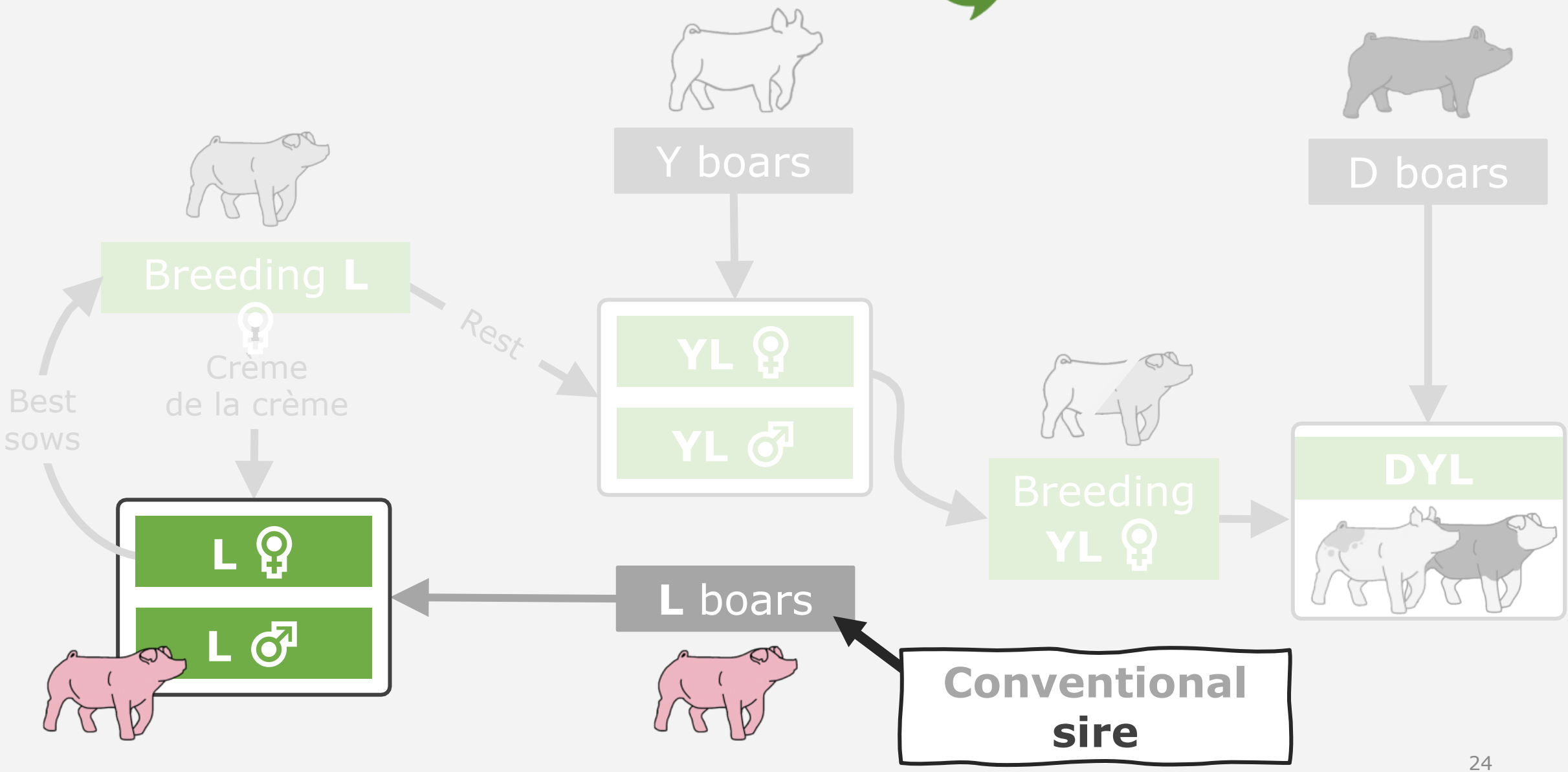
Breeding scheme



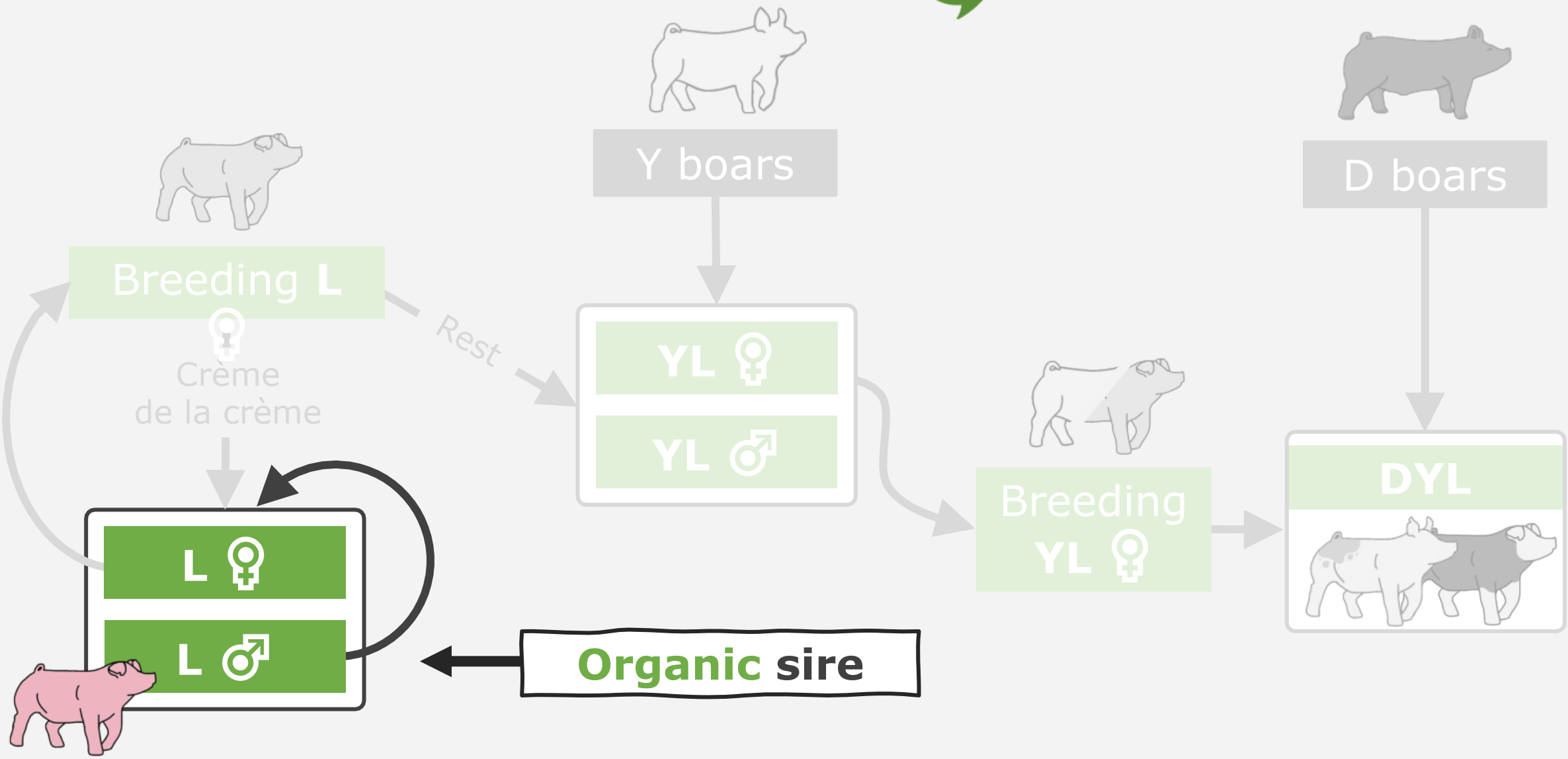
Breeding scheme



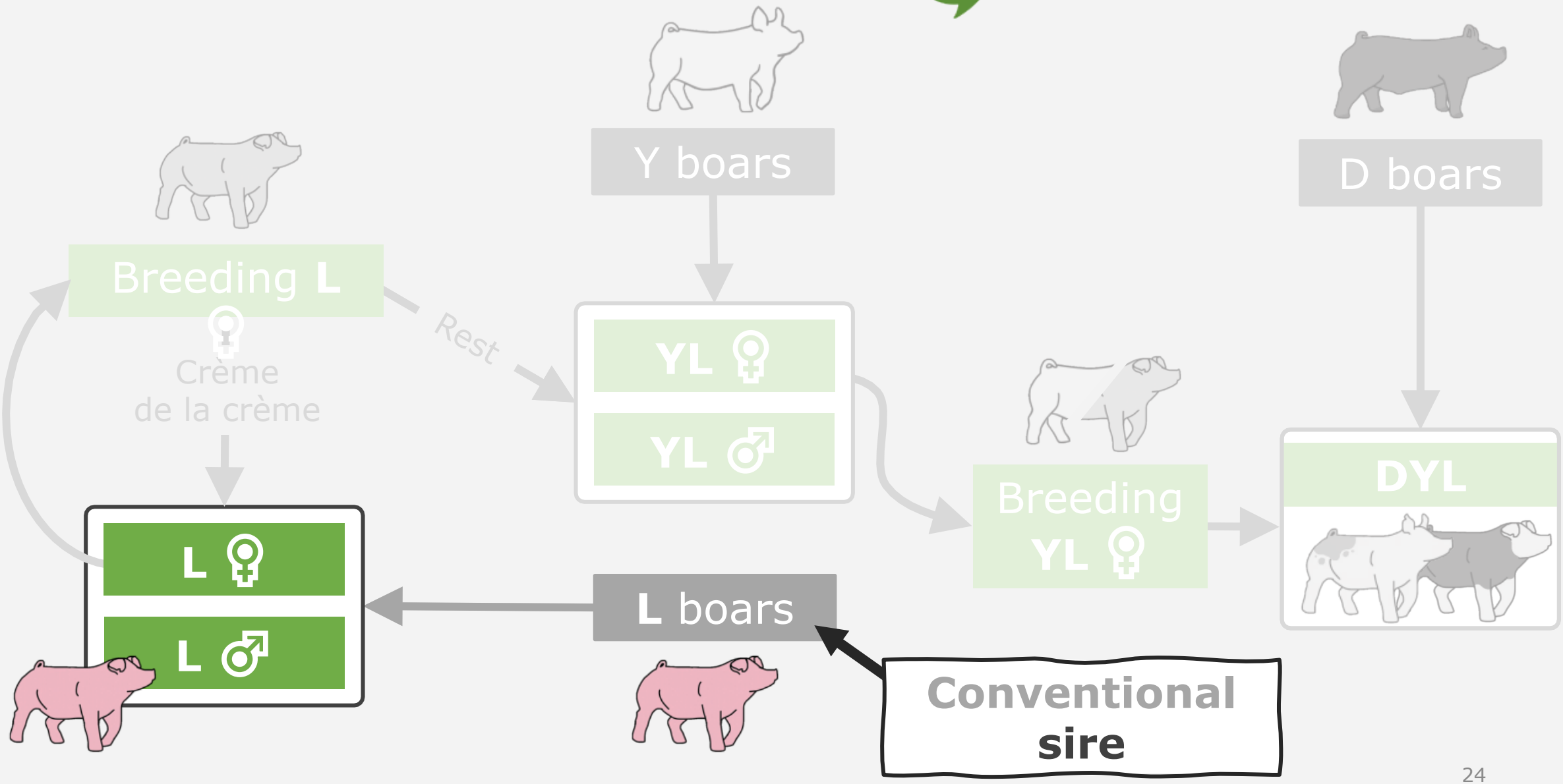
Origin of the Landrace sire



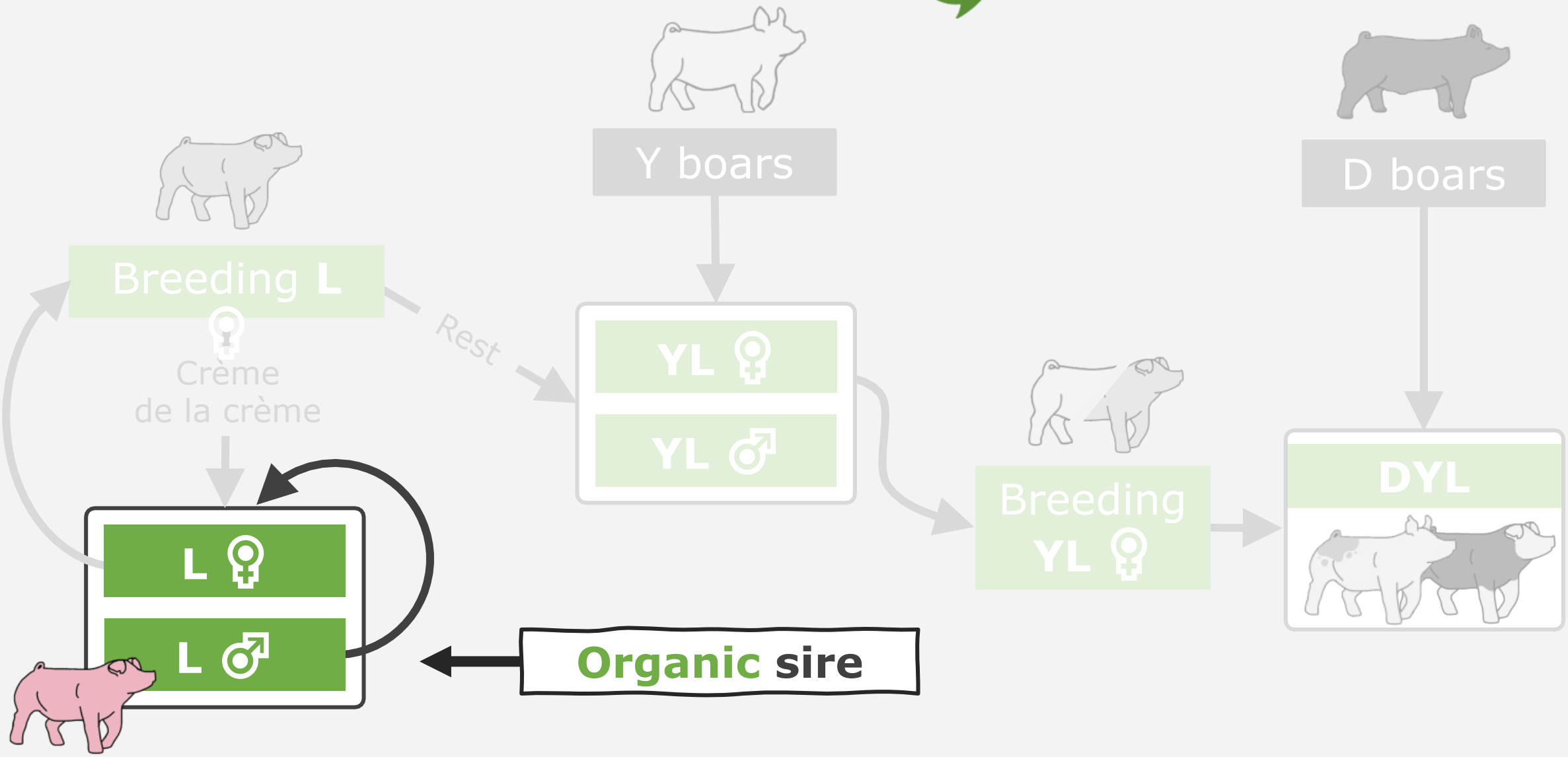
Origin of the Landrace sire



Origin of the Landrace sire



Origin of the Landrace sire



Phenotyping

Y boars

D boars

Breeding **L**

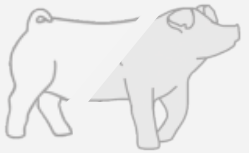
Rest

YL ♀

YL ♂

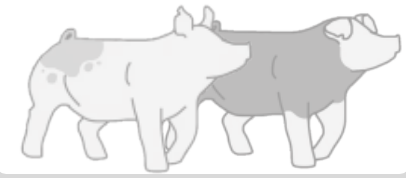
Best sows

Crème de la crème



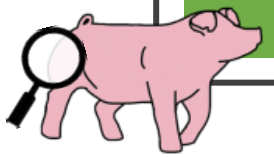
Breeding YL ♀

DYL



L ♀

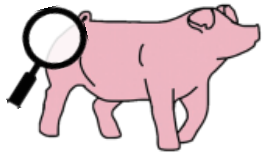
L ♂



Weight

Phenotyping

Litter size
Survival



Breeding **L**

Crème
de la crème

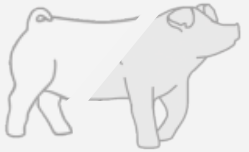
Best
sows

Rest

Y boars

YL ♀

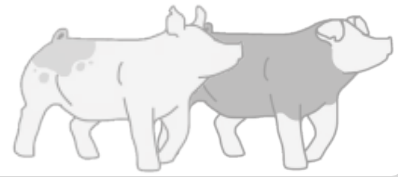
YL ♂



Breeding
YL ♀

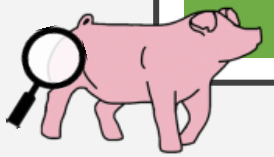
D boars

DYL



L ♀

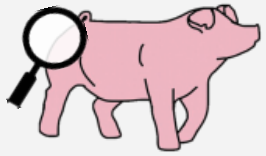
L ♂



Weight

Phenotyping

Litter size
Survival



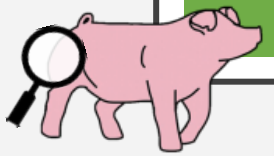
Breeding **L**

Crème
de la crème

Best
sows

L ♀

L ♂



Weight

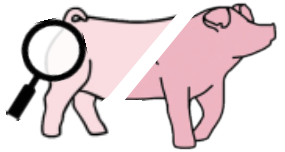
Rest

Y boars

YL ♀

YL ♂

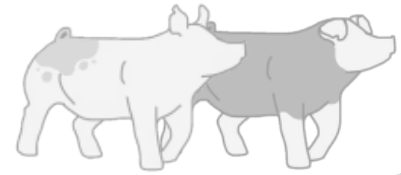
Weight
Litter size
Survival



Breeding
YL ♀

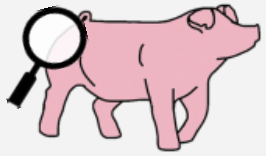
D boars

DYL



Phenotyping

Litter size
Survival



Breeding **L**

Crème
de la crème

Best
sows

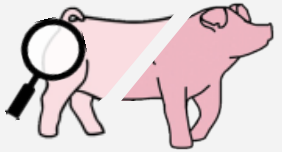
Rest

Y boars

YL ♀

YL ♂

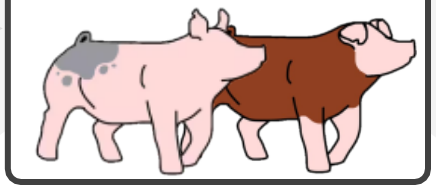
Weight
Litter size
Survival



Breeding
YL ♀

D boars

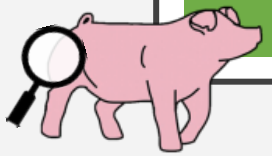
DYL



Weight

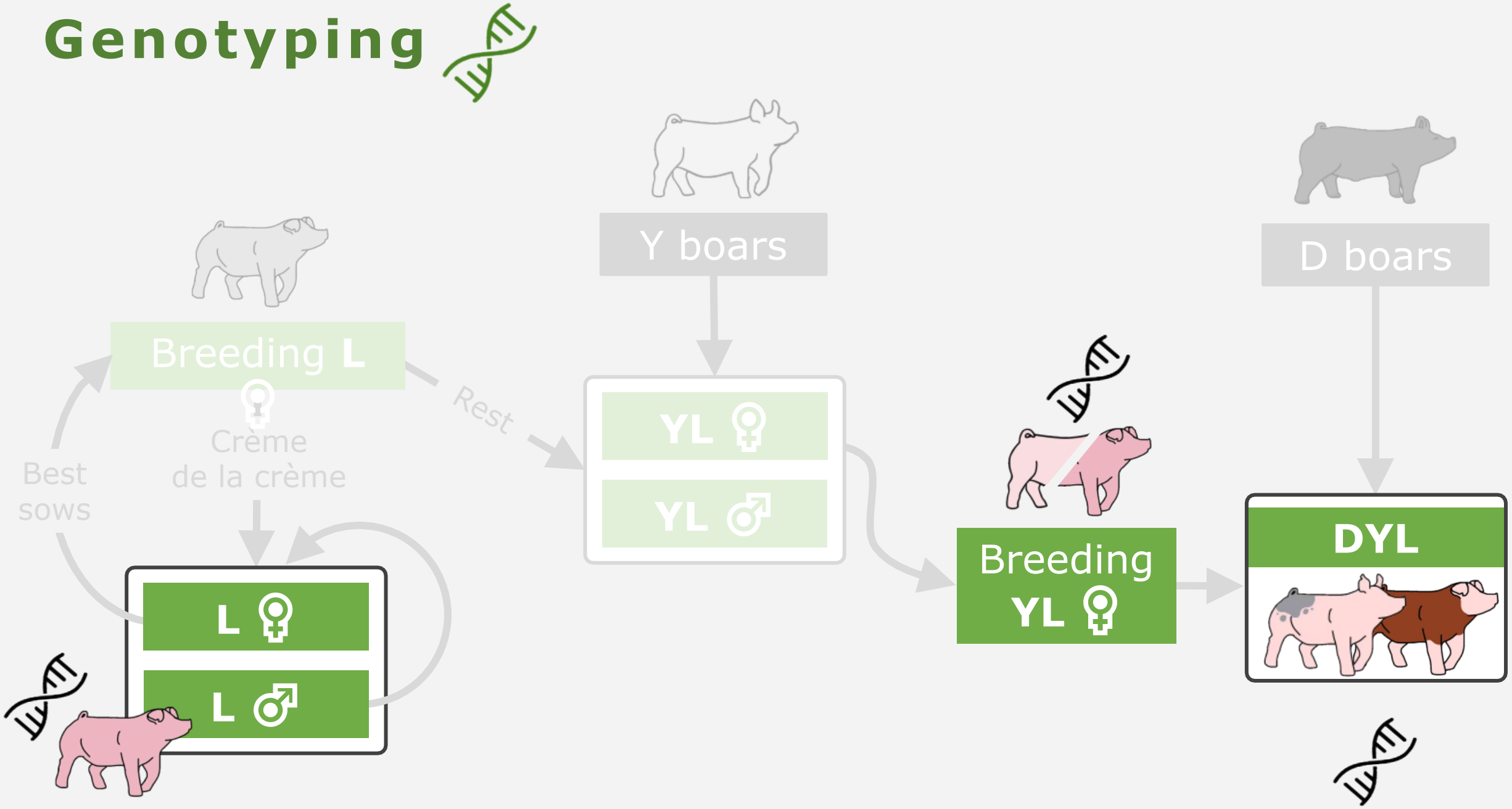
L ♀

L ♂



Weight

Genotyping


Y boars
D boars
Breeding L
Crème
de la crème
Best
sows
Rest
YL
YL
Breeding
YL
DYL
L
L

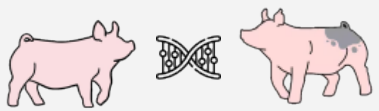
Results & Discussion

Variations

Origin of the sire

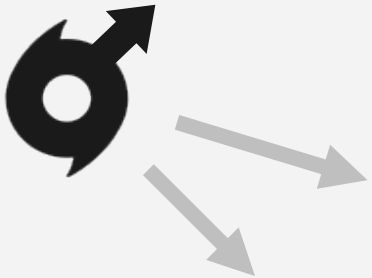
Phenotyping DYL

Genotyping L / YL / DYL



$r_{g\ -\ purebred,crossbred}$

Inbreeding

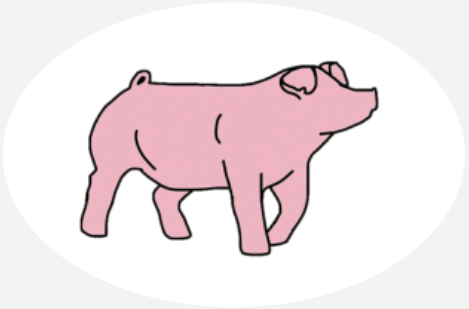


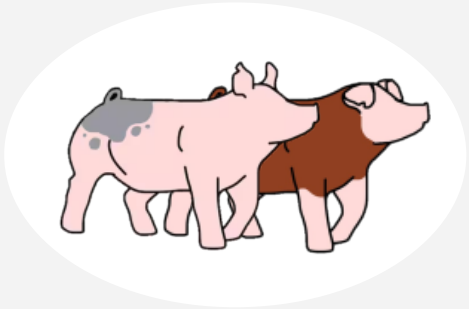
organic sires → **ΔF = 2.04-2.38%**

conventional sires → **ΔF ≈ 0.14%**

! **Use optimal contribution selection to** minimize **ΔF while** maximizing ΔG

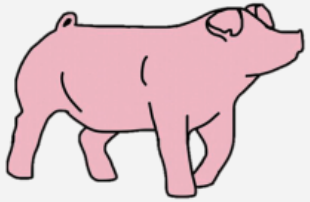
Genetic gain

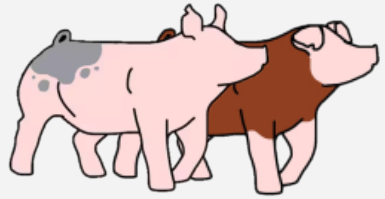




♂	***	**

Genetic gain

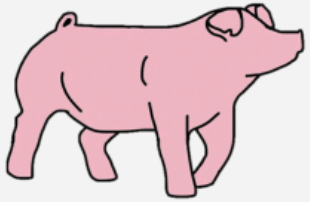


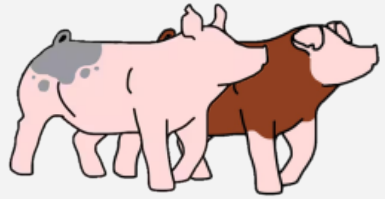


Max GxE ♂

organic sires = more ΔG

Genetic gain



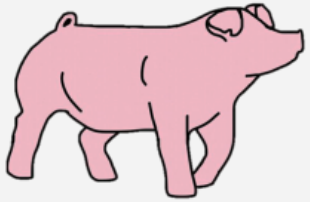


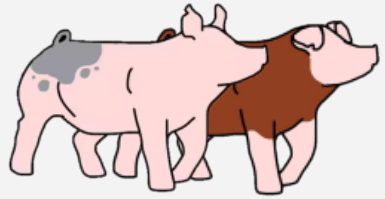
Max GxE

organic sires = more ΔG

NS NS

Genetic gain



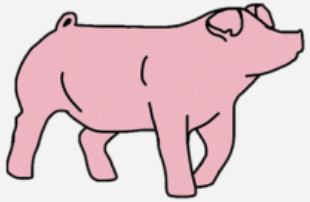


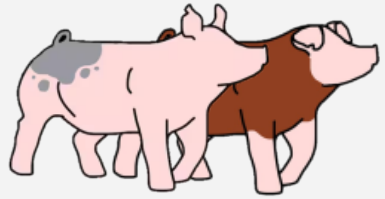
Max GxE

organic sires = more ΔG

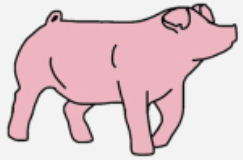
no effect

Genetic gain





Max GxE

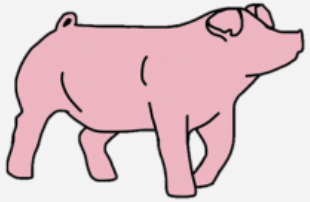


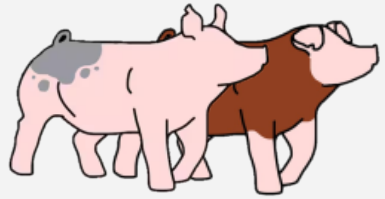
organic sires = more ΔG

no effect

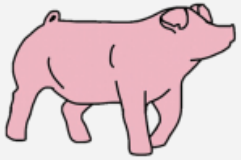
*** **

Genetic gain





Max GxE

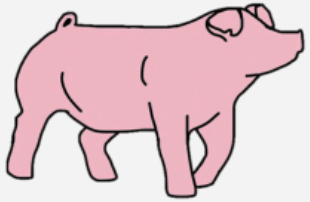


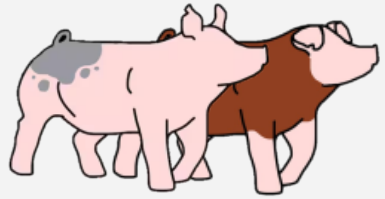
organic sires = more ΔG

no effect

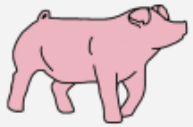
genotyping Landrace = more ΔG

Genetic gain





Max GxE



organic sires = more ΔG

no effect

genotyping Landrace = more ΔG

***

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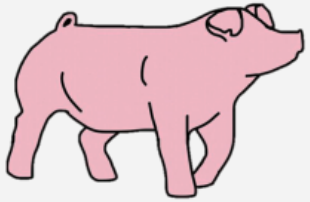
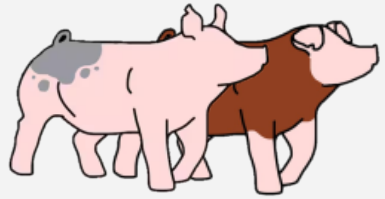
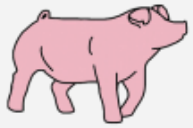
Genetic gain





Max GxE



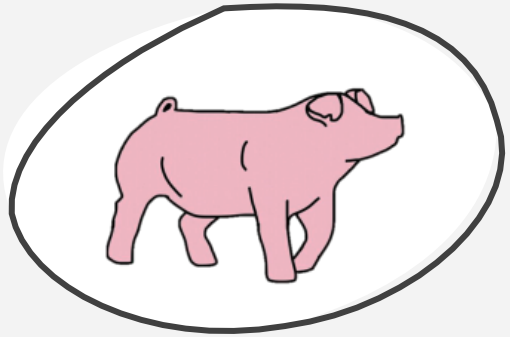
organic sires = more ΔG

no effect

genotyping Landrace = more ΔG

strong $r_{g,pc}$ = more ΔG

Genetic gain



Max GxE

organic sires = more ΔG

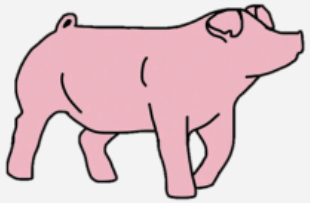
no effect

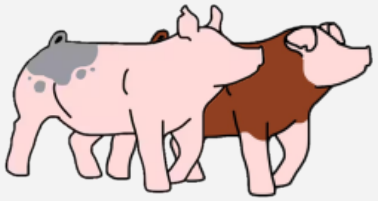
genotyping Landrace = more ΔG

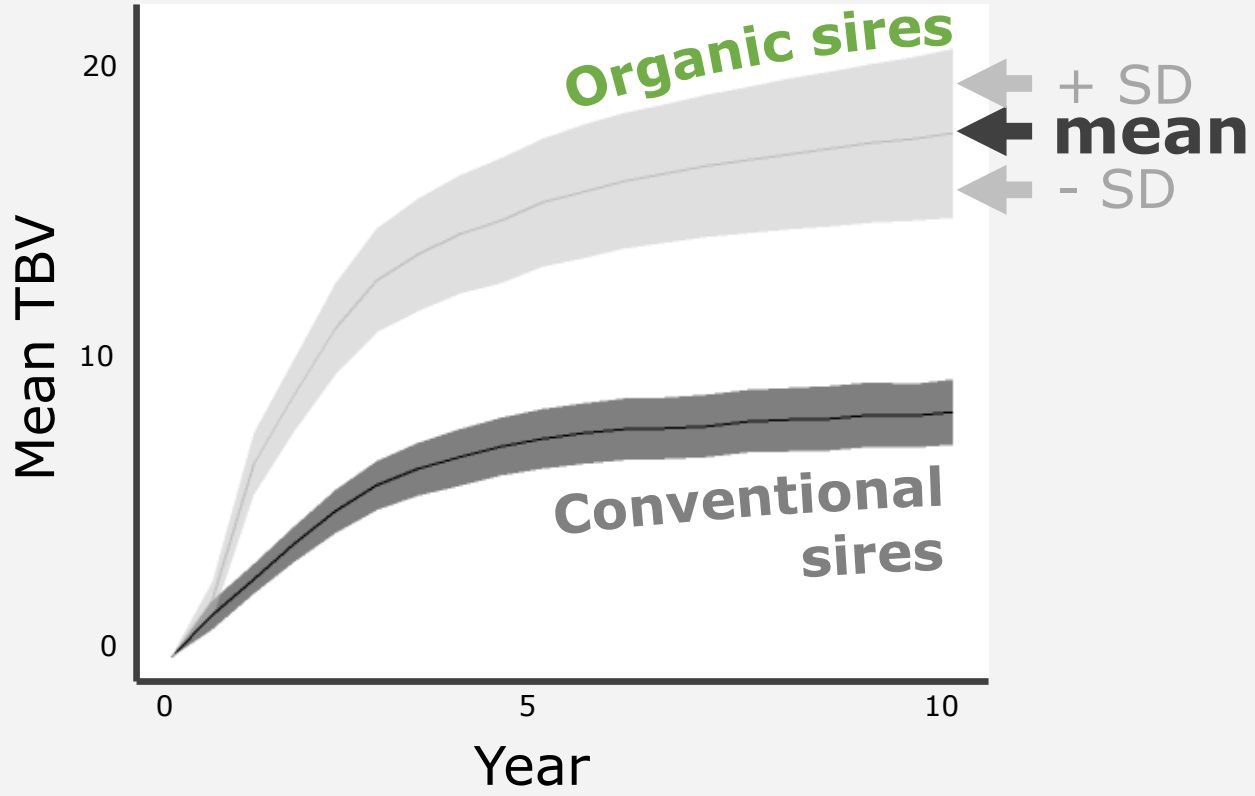
!

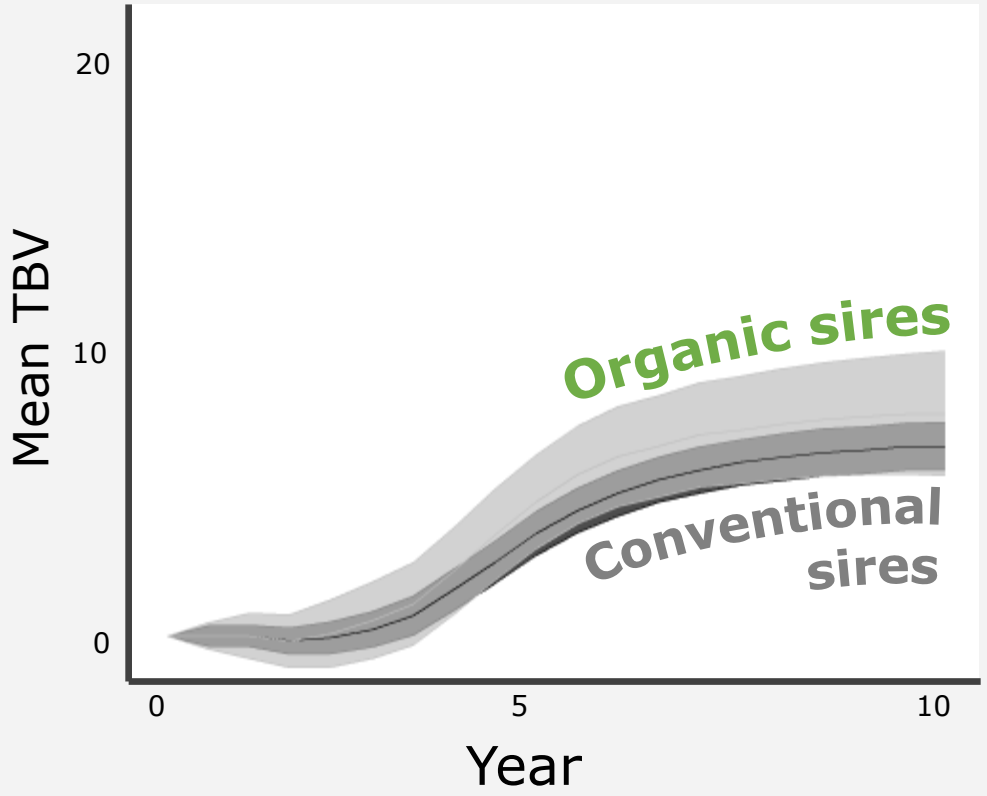
Focus on improving the purebred **Landrace** population

Genetic gain – effect sires

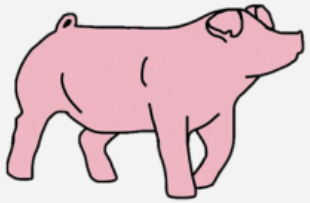


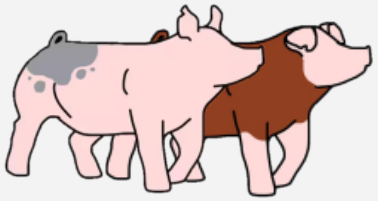


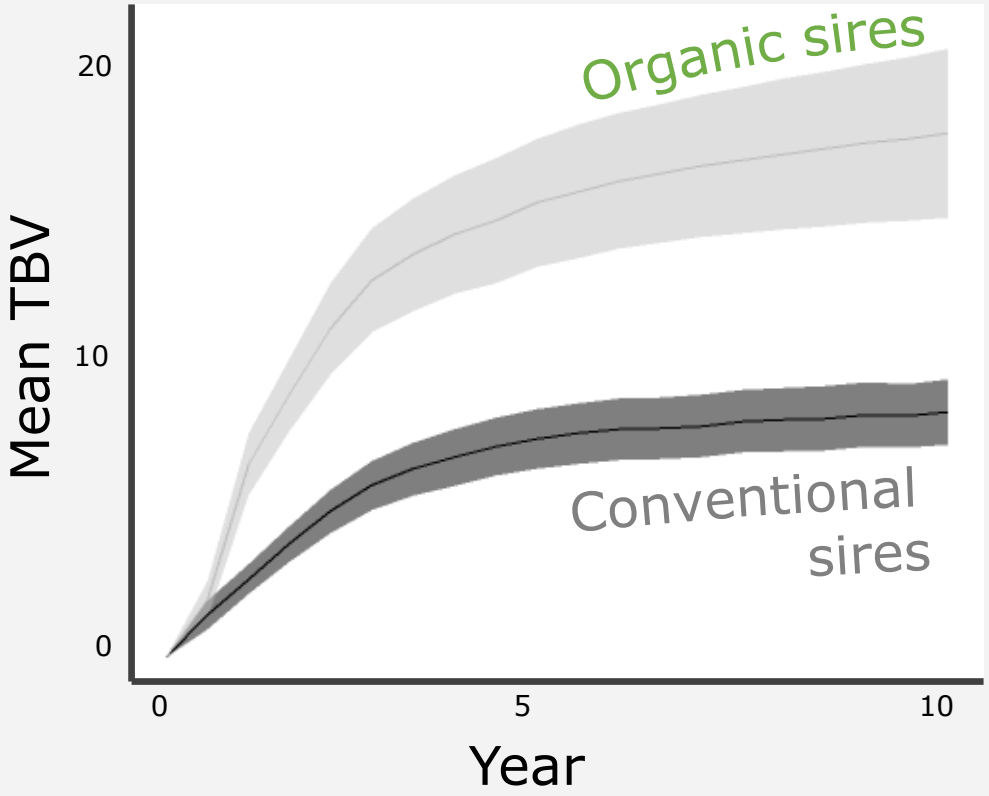


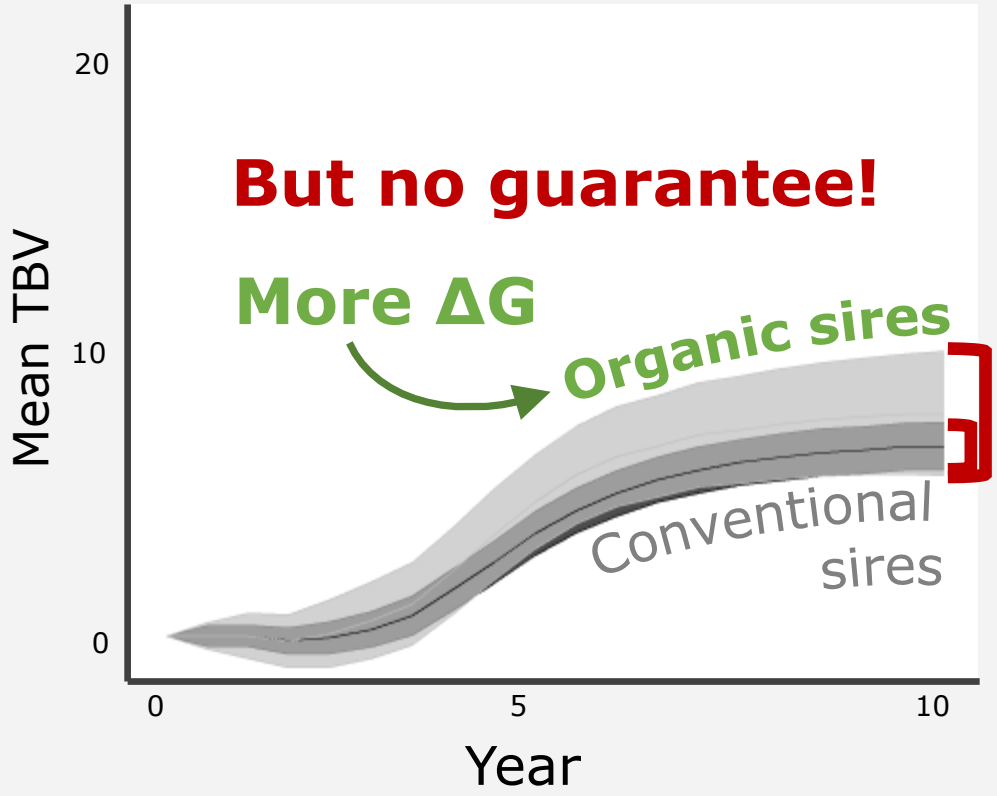


Genetic gain – effect sires



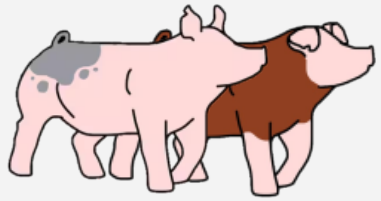


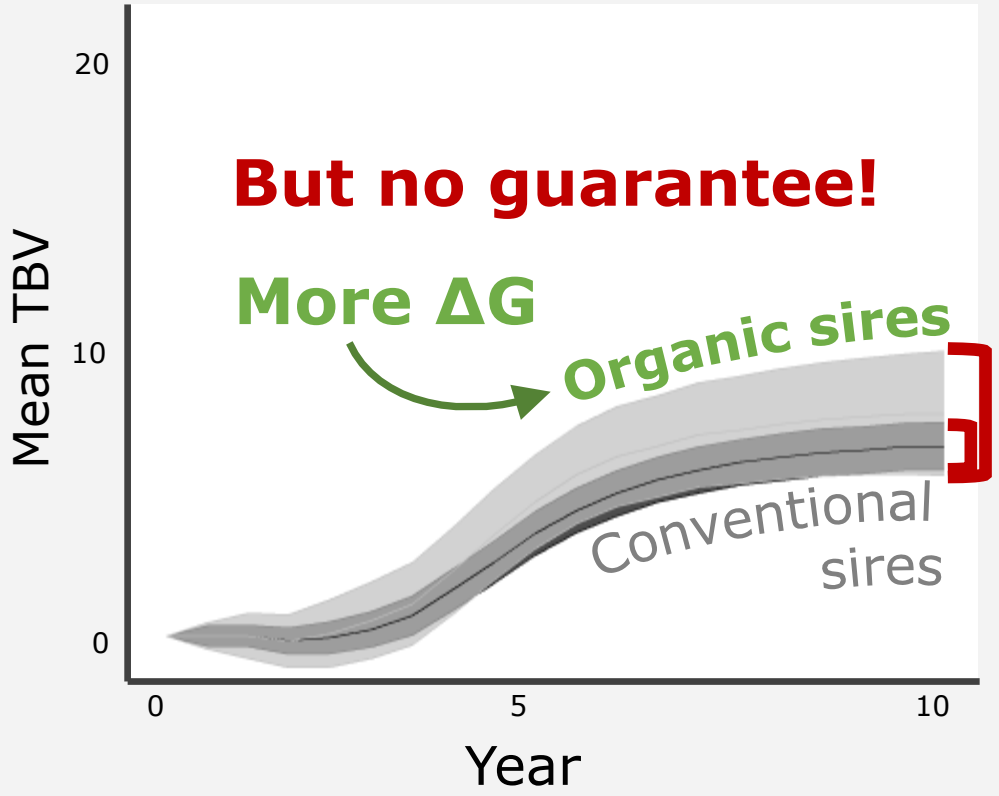




Genetic gain – effect sires

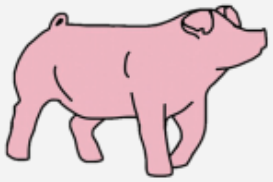
Using organic sires **in a small population is a** risky business





Conclusions

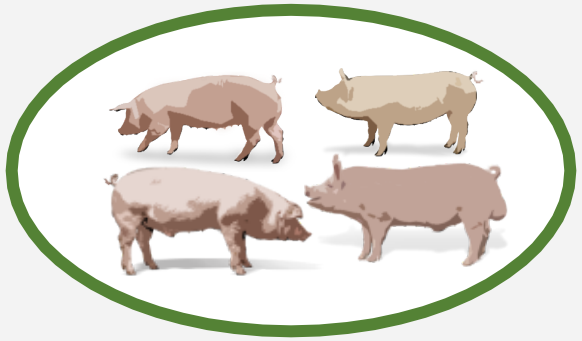
Conclusions

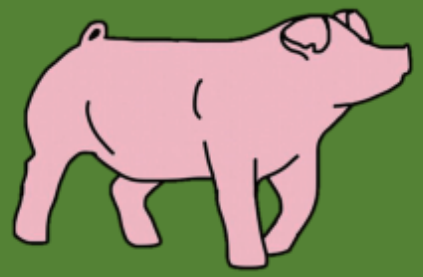


Focus on improving the purebred Landrace population.

When setting up an **independent organic breeding program**:

1. Manage the size of the organic pig population
2. Monitor loss of genetic variation
3. Control rate of inbreeding



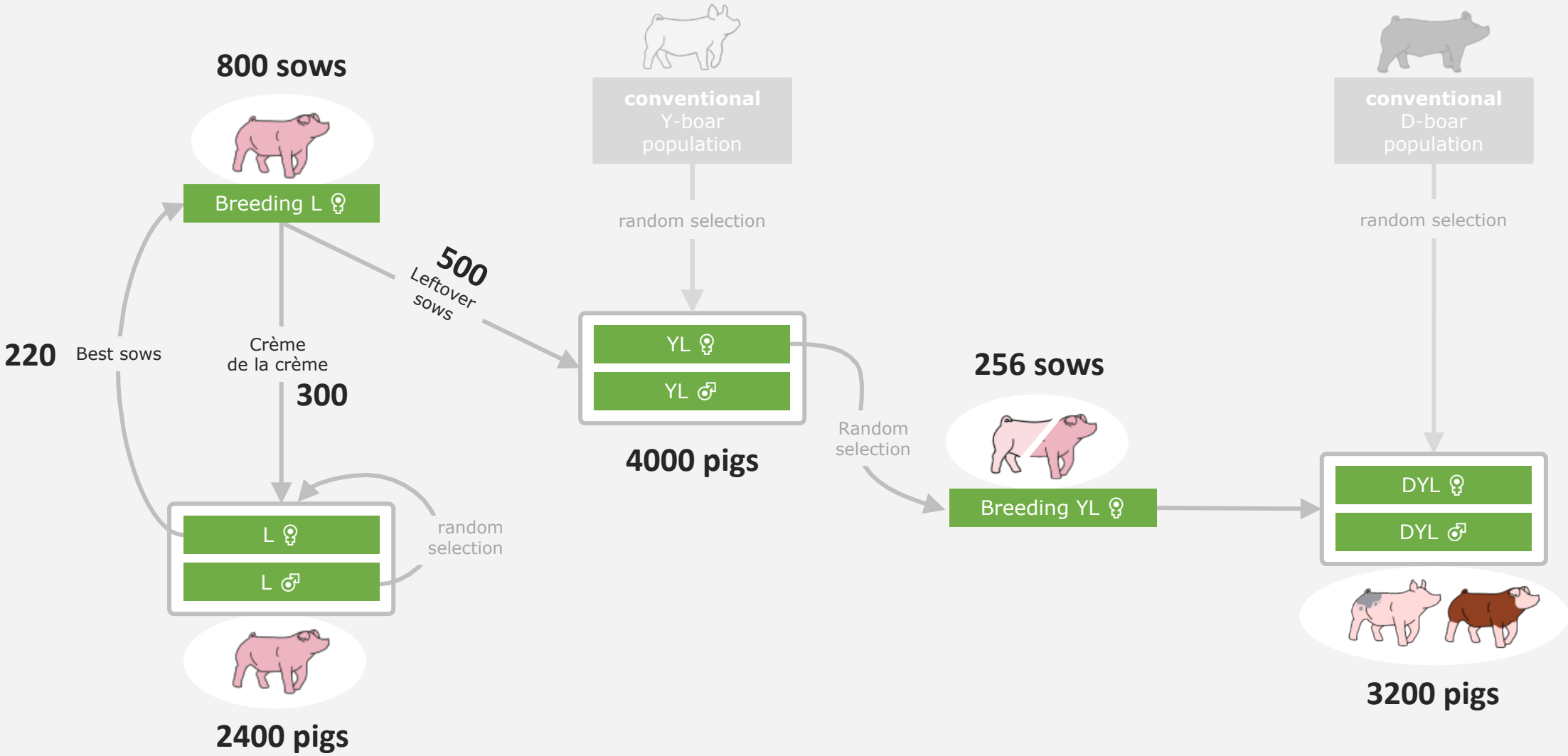


Thank you for listening

Miljø- og Fødevareministeriet
gudp
QGG
AARHUS UNIVERSITY
BOVBJERG ØKOLOGI

Extra slides

Small population (detailed)

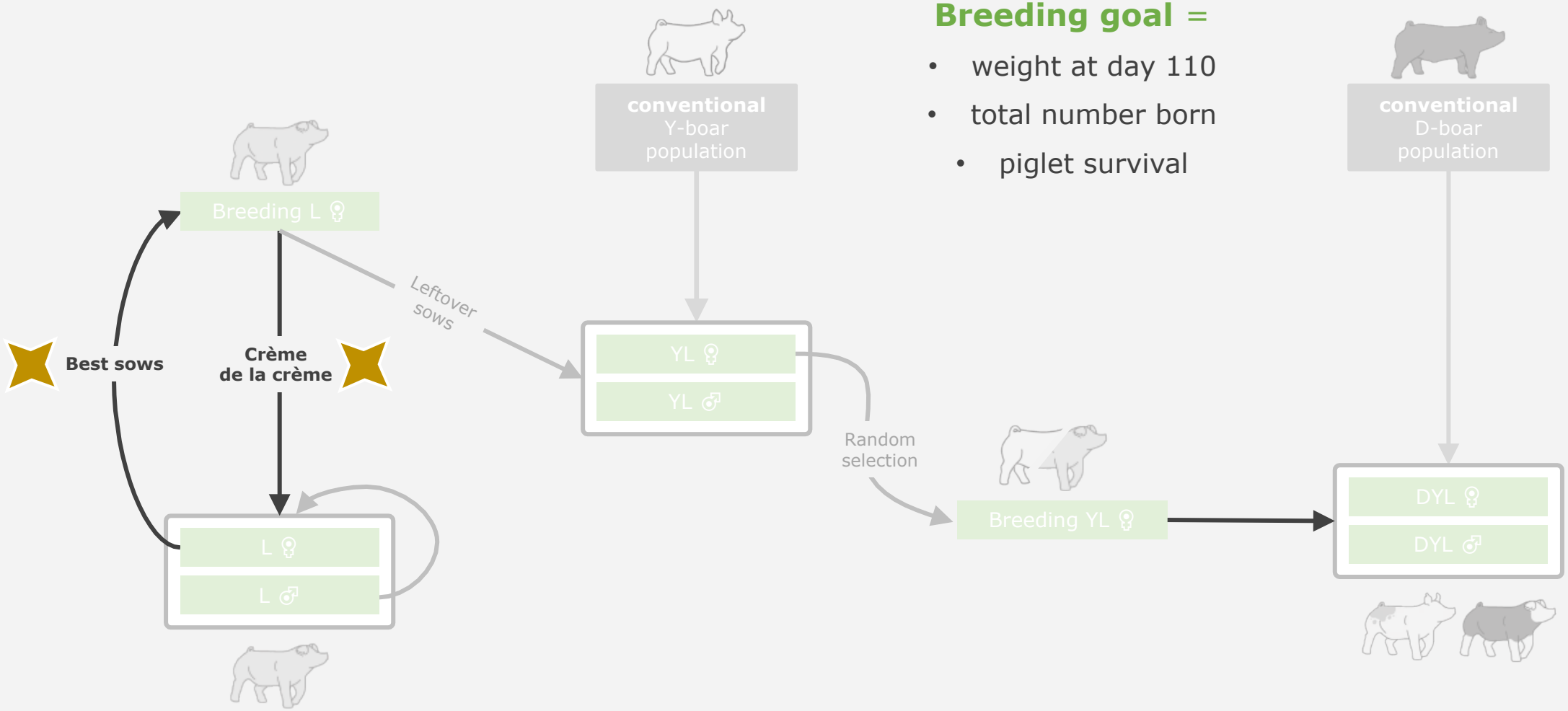


Selection

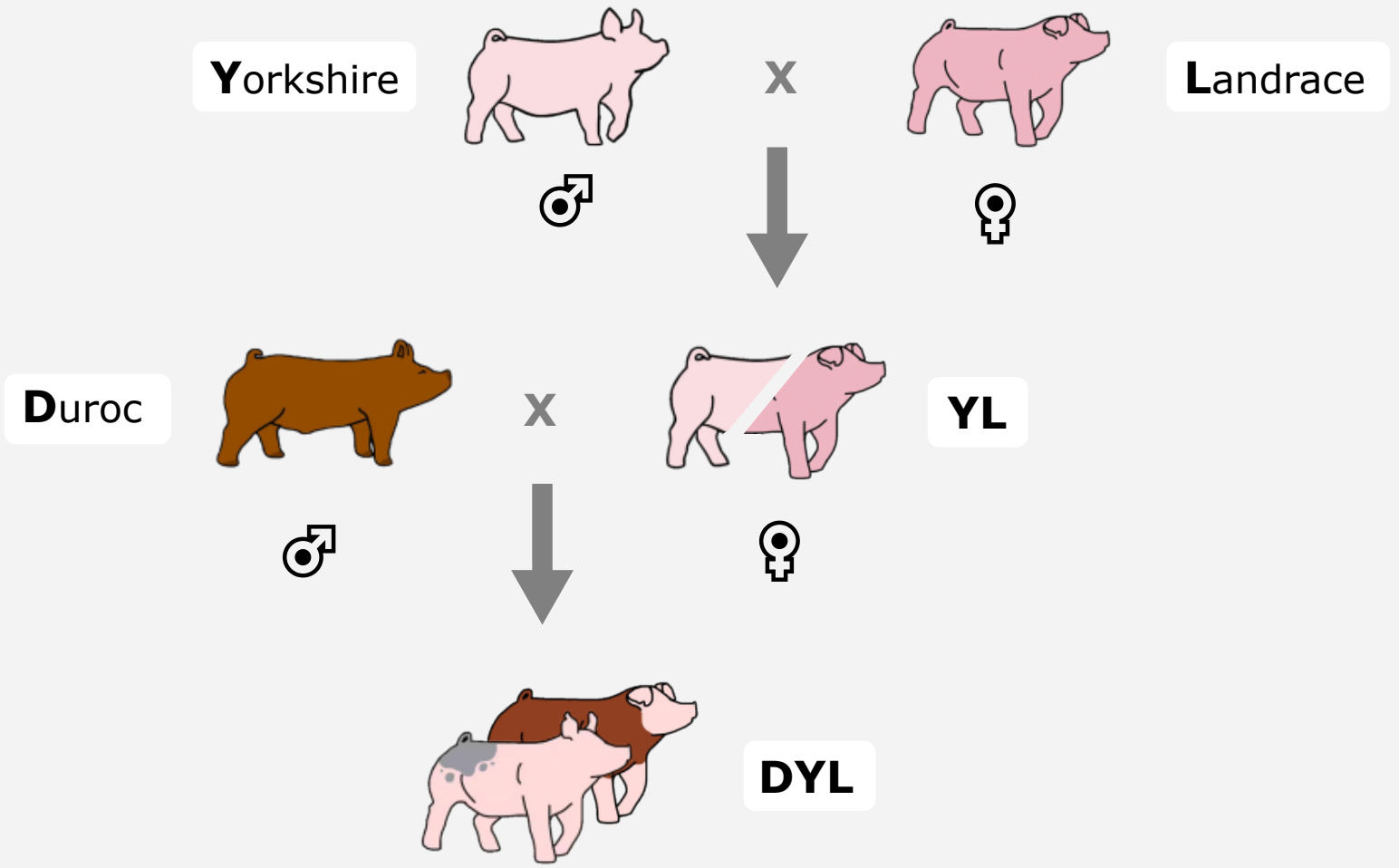
Selection based on **EBV** or **gEBV**

Breeding goal =

- weight at day 110
- total number born
- piglet survival



Breeding scheme



Link to pictures:
https://www.etsy.com/ca/listing/1425541438/show-pig-kiss-cut-vinyl-decals-showpig?ga_order=most_relevant&ga_search_type=all&ga_view_type=gallery&ga_search_query=duroc&ref=sr_gallery-1-3&organic_search_click=1

Genotyping

Focus on small population