Environmental impacts and their association with performance and excretion traits in growing pigs

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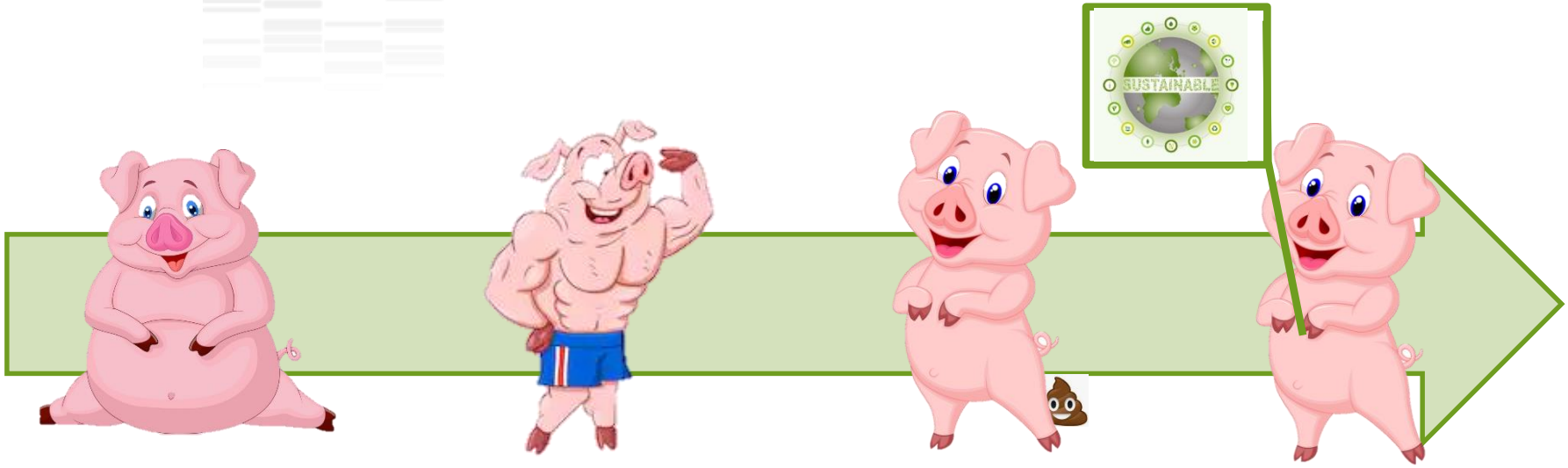
Context

- ✓ **Environmental impact of animal production**
  - ⇒ a major issue for sustainability
- ✓ **Different approaches available to reduce environmental impacts of pig production**
  - Improve housing and manure management
  - Improve the production of feed ingredients and feeding strategies
  - Improve pigs' efficiency of use of feed and reduce their excretion

Selection criteria are changing over time



Growth rate
Feed efficiency

Carcass and
Meat Quality

Nitrogen
Excretion

Environmental
sustainability ?

N excretion as a selection criteria !

- **N Excretion** is related to both feed efficiency and environmental impact

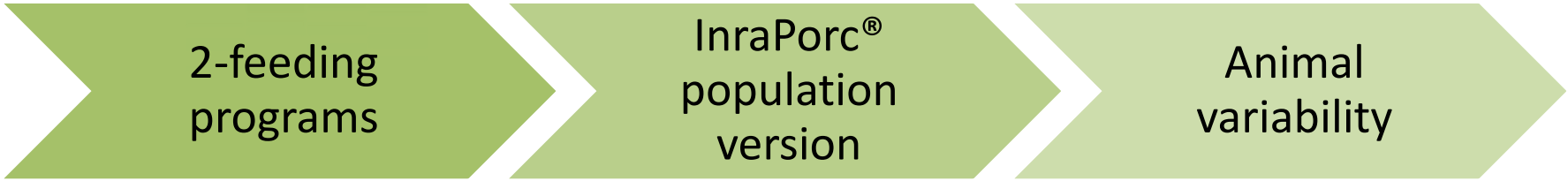
But limited signification because the pig supply chain involves a complex system
=> feed production, animal raising, manure disposal...

Life Cycle Assessment (LCA) provides much better indicators of environmental impacts

Objectives

To investigate, using a modelling approach, the relationships between **production traits**, **N and P excretion** and **LCA impacts** of individual growing pigs

Simulation approach combining a growth model and LCA



- 2-phases
- “Precision feeding”

- 1,000 pigs (variance-covariance matrix, 5 parameters)

- Individual performance

- **Determination of animal performance and excretion**
- **LCA for each pig according to its own performance and excretion**

LCA - System boundaries

Functional unit

1 kg of BWG at farm gate

LCA impacts

- Climate Change
- Eutrophication
- Acidification
- Land Occupation

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Effect of feeding strategy on growth performance, N excretion and LCA impacts

Mean (CV%)	Feeding program		
	two-phase	Precision	
Feed intake (kg/d)	2.31 (11.2%)	2.32 (11.2%)	ns
ADG (g/d)	864 (13.6%)	876 (13.2%)	*
FCR (kg/kg)	2.69 (10.6%)	2.67 (12.1%)	t
N excreted (kg)	3.83 (18.1%)	3.20 (17.5%)	***
Climate Change (kg CO_2 eq/kg)	2.34 (10.8%)	2.31 (12.2%)	*
Eutrophication (g PO_4 eq/kg)	17.4 (13.4%)	16.1 (13.8%)	***
Acidification (g SO_2 eq/kg)	48.1 (15.1%)	43.3 (15.2%)	***

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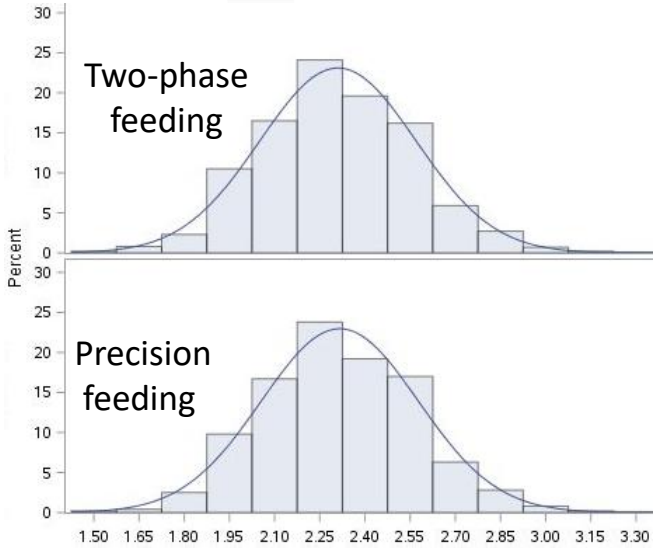
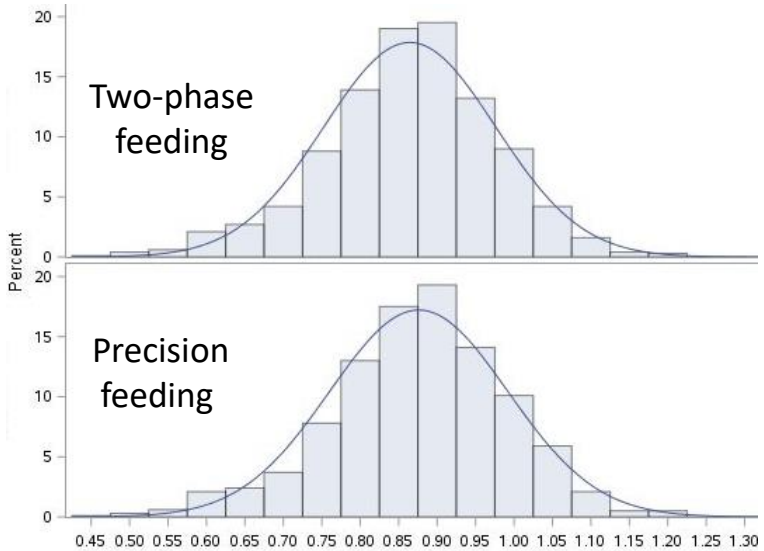
Variability of performance – Effect of feeding strategy



Feed intake, kg / d



Average daily gain kg/d

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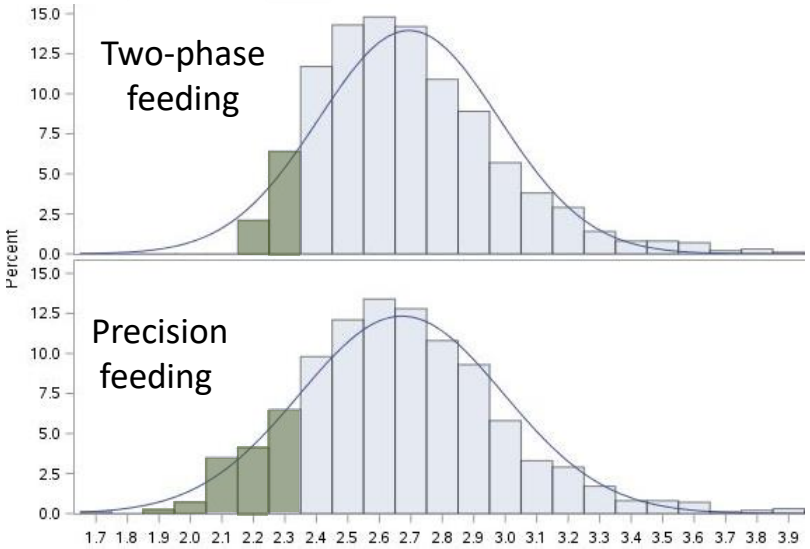
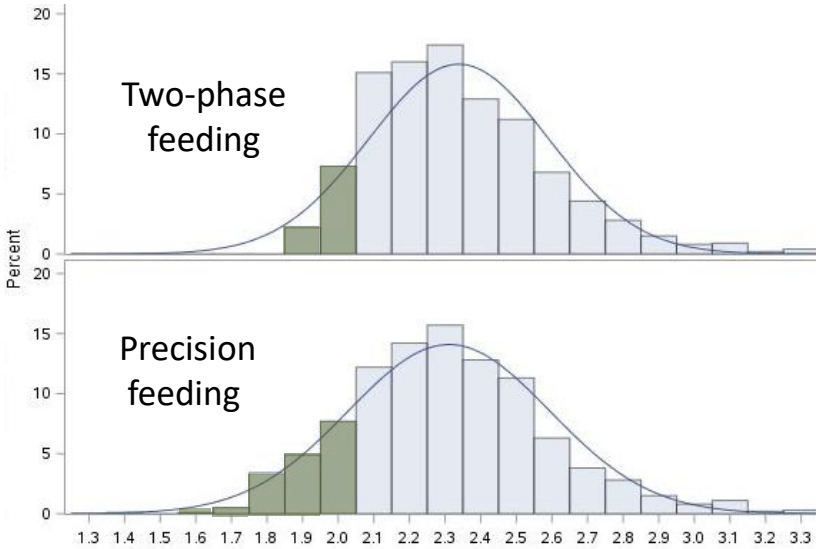
Variability of performance – Effect of feeding strategy



Feed Conversion Ratio, kg feed / kg gain



Climate Change, kg eq-CO_2 / kg gain

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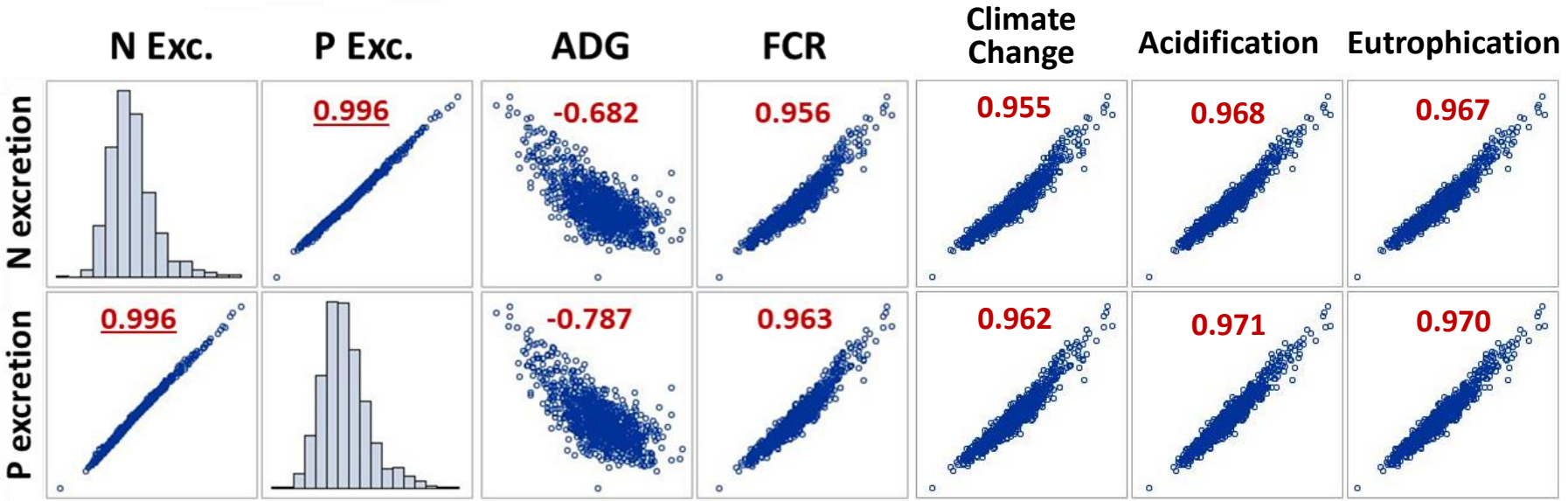
Correlation matrix: Excretion data & LCA

(precision feeding strategy)



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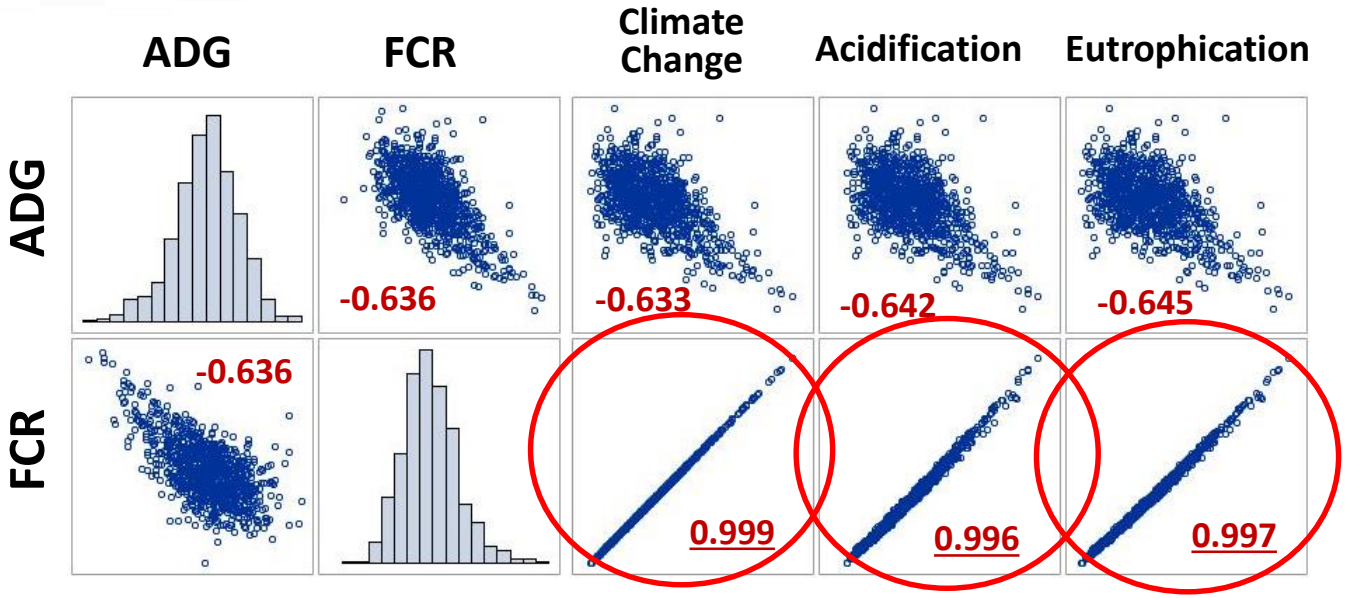
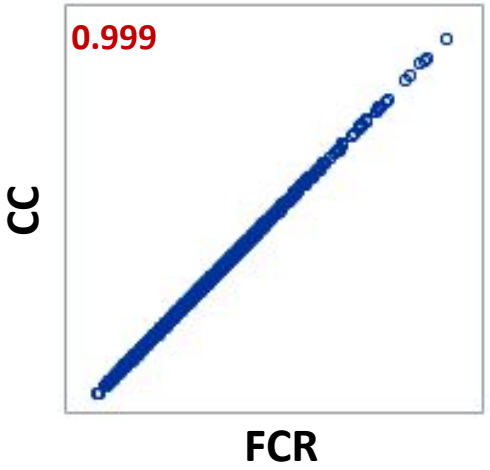
Correlation matrix: Growth performance & LCA

(precision feeding strategy)

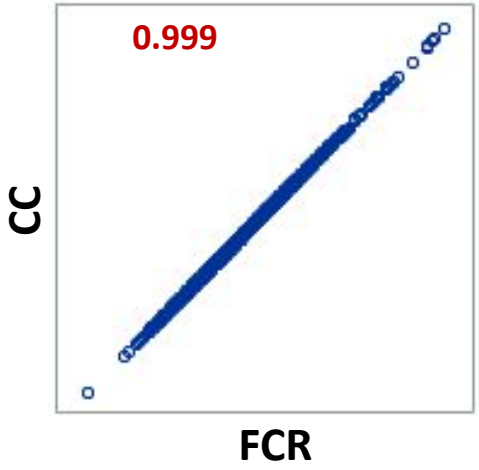


Effect of feeding strategy on prediction of climate change from feed conversion ratio

Precision Feeding

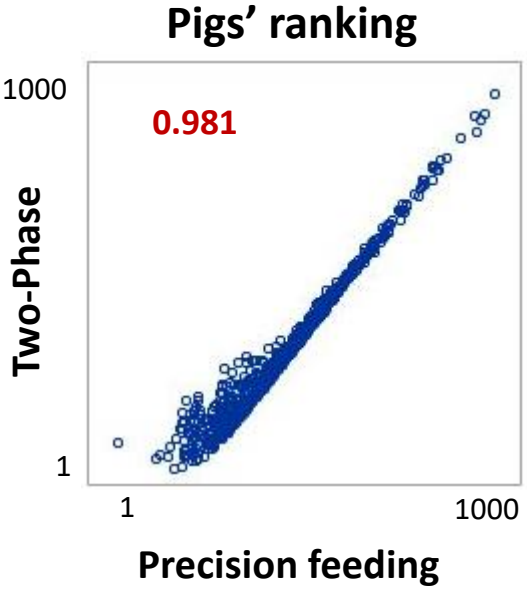


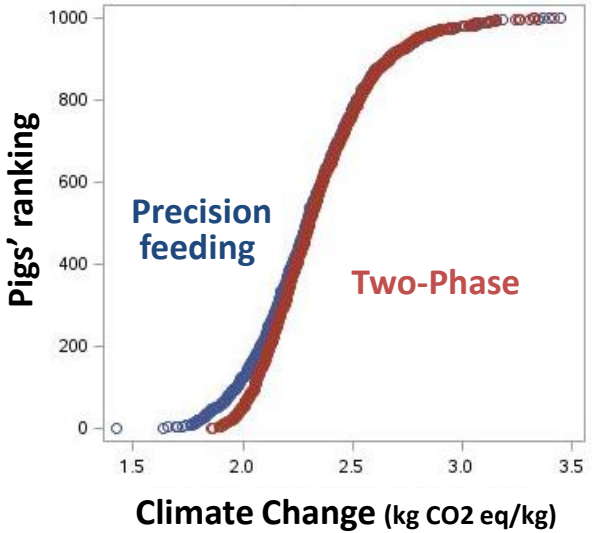
Two-Phase



⇒ no effect on the quality of the prediction

Effect of feeding strategy on ranking of pigs according to their “Climate Change” impact





Conclusion and perspectives

- ✓ FCR appears to be a much better proxy of environmental impacts than N or P excretion
- ✓ The quality of the relationship between FCR and environmental impacts is not affected by the feeding program
- ✓ But absolute values of FCR and LCA impacts depends on the feeding strategy, which may to some extent affect the ranking of pigs

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Conclusion and perspectives

- ✓ **Apply the same approach on real data**
  - LCA calculation of the feeds used
  - hypothesis for housing and manure management
  - LCA calculation of individual pigs
- ✓ **Estimate the genetic parameters of LCA impacts**

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