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session 89. Free communications in animal nutrition

Impact of long-term precision feeding based on energy and lysine on the productive, economic and environmental performance of gestating sows

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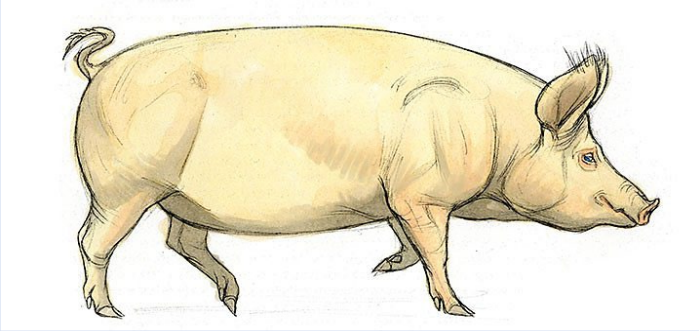
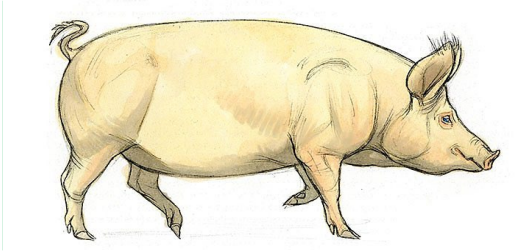
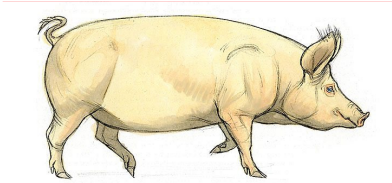
Financial support

Feeding of gestating sows



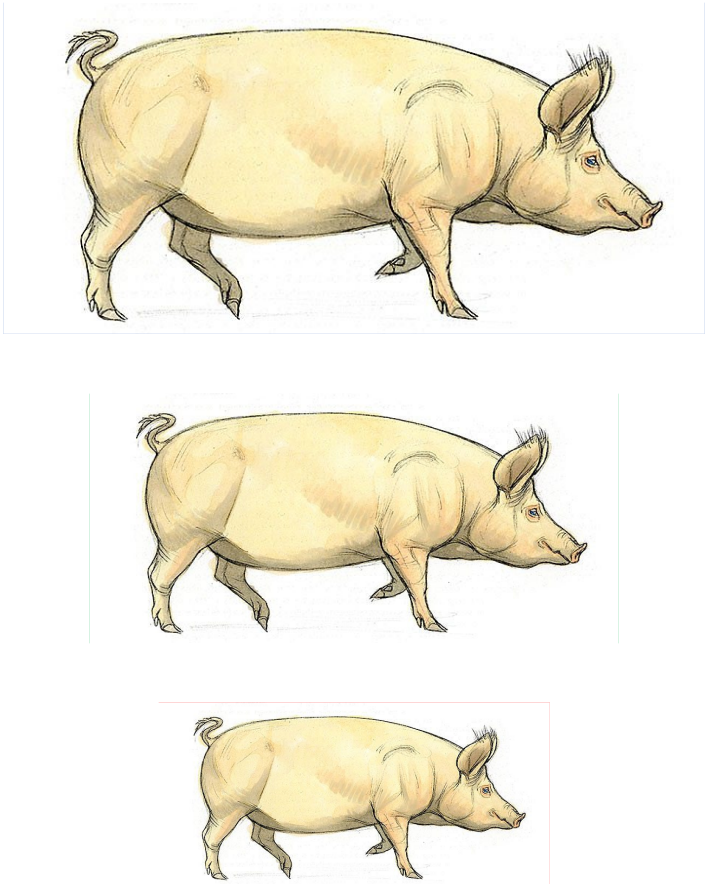


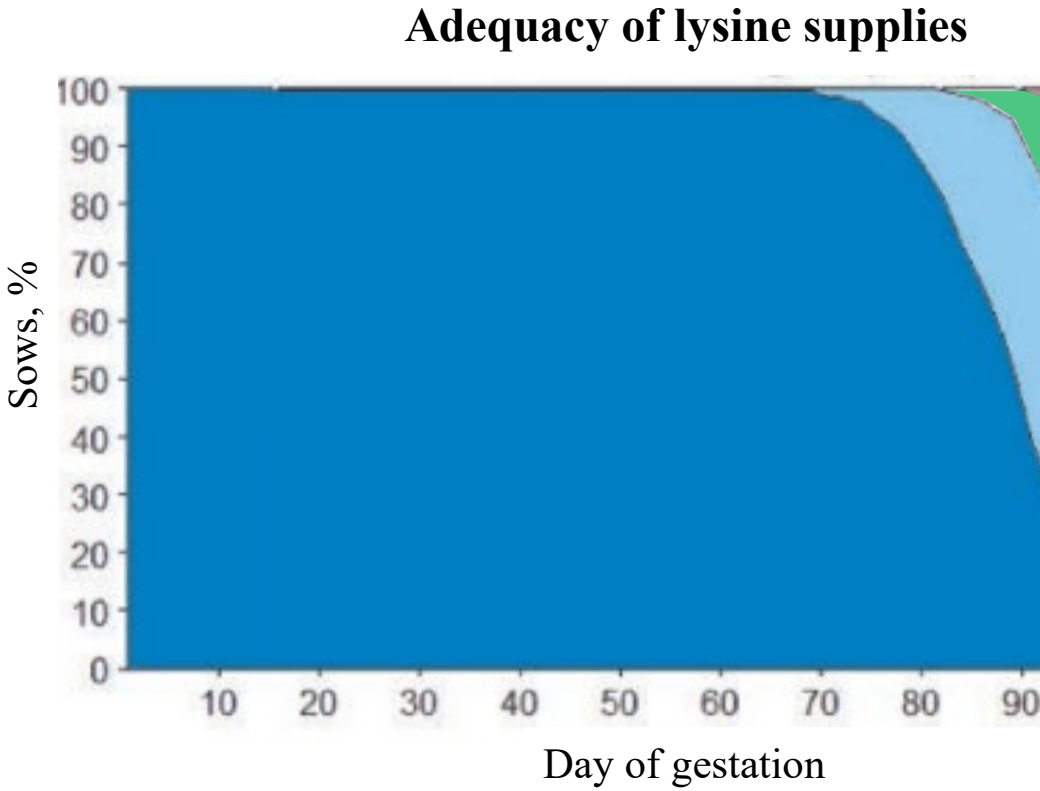


Feeding of gestating sows

Age,

Body weight





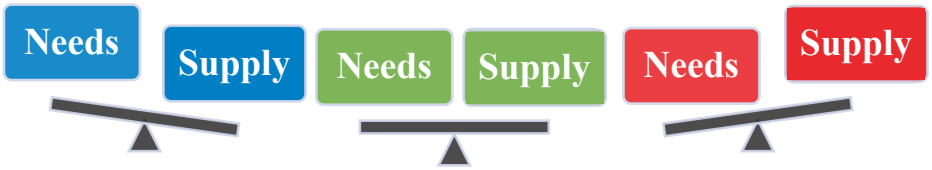
Excess, Adequacy, Deficiency

Gaillard et al (2020)

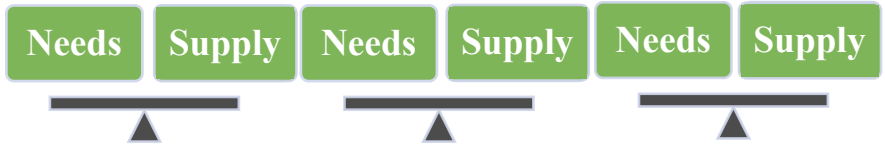
Precision feeding (PF)

- Precision feeding: Dynamic adjustment of nutritional intake (in quantity and quality) to the needs of each animal (Pomar et al, 2009)

Accounting for inter-individual variability of needs



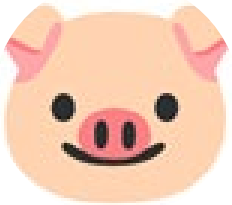
Individual adjustment of supplies to requirements



Daily adjustment in our study

Remus et al (2019)

Estimation of individual daily requirements



Input data

Age, body weight (BW) and backfat (BT):

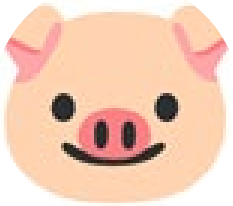
- ❑ Initial: at insemination
- ❑ Objectives: at farrowing

Housing conditions

Gestation module

Dourmad et al (2008)

Estimation of individual daily requirements



Input data

Age, body weight (BW) and backfat (BT):
- ❑ Initial: at insemination
- ❑ Objectives: at farrowing

Housing conditions

python™

InraPorc®

Energy requirements

Amino acids (AA) requirements

In utero fetal growth

Allocation to maternal reserves

Evolution of sow weight

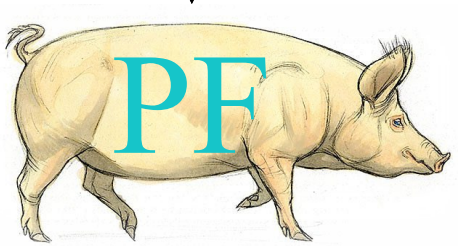
Gestation module

Output data J+1

Net energy

Digestible AA

supplies

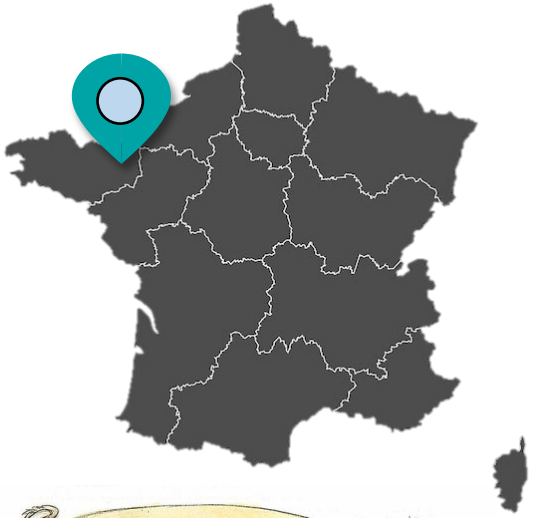


Dourmad et al (2008)

Experimental design

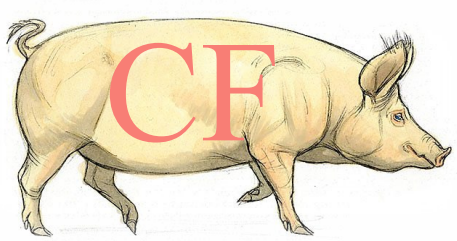
Automatic feeders at UE3P farm

Location: Pig Physiology and Phenotyping Experimental Facility (UE3P), Saint-Gilles, France

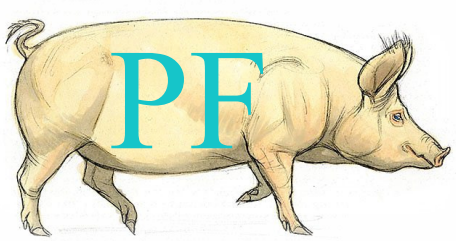


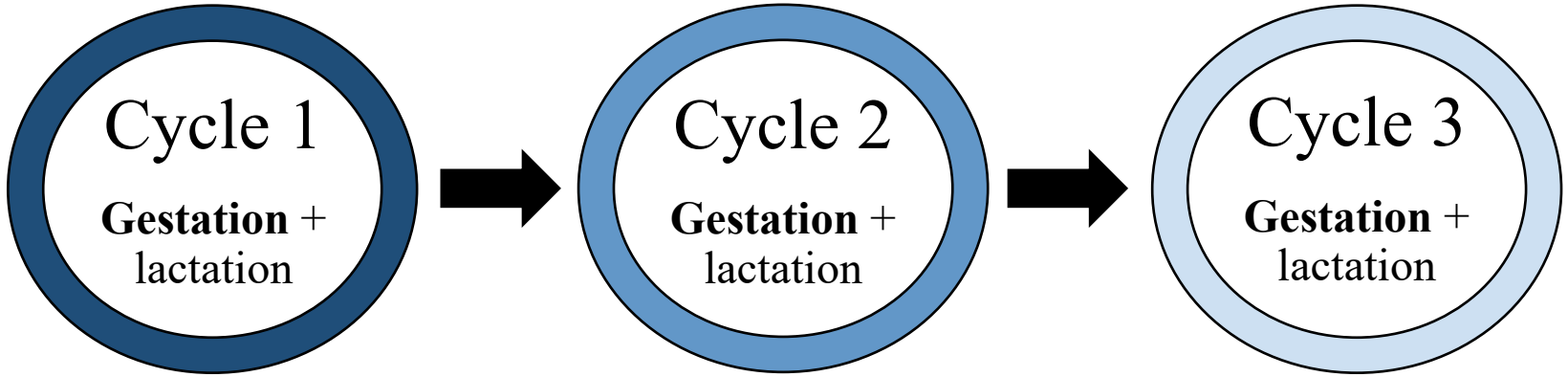
CF: Conventional feeding
PF: Precision feeding

2 batches of 20 sows each



vs.





Feeding strategy

Feed quantity

Day 35 Day 86

Phase 1 | Phase 2 | Phase 3

based on:

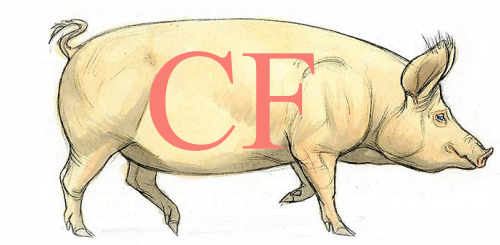
- ❑ Data at insemination
- ❑ Feed rationing plan

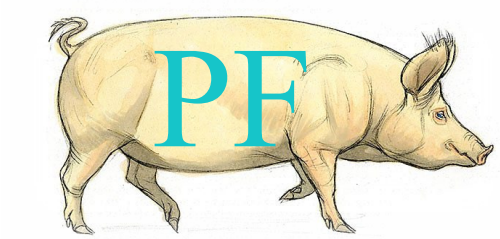
Feed quality

Diet L	Diet H
9.8 MJ/kg	9.8 MJ/kg
3.3 g/kg	8.5 g/kg

NE: net energy

SID Lys: standardized ileal digestible lysine





Feeding strategy

Feed quantity

Day 35 Day 86

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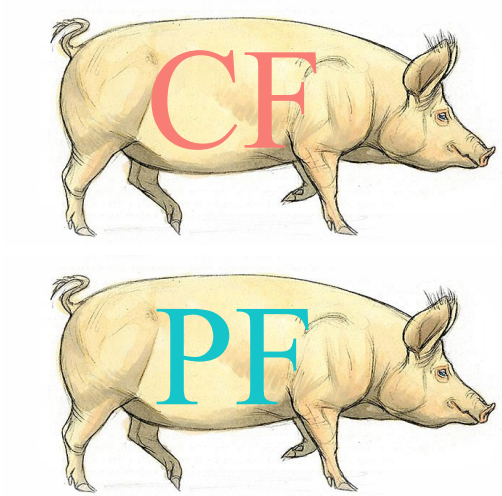

Feed quality

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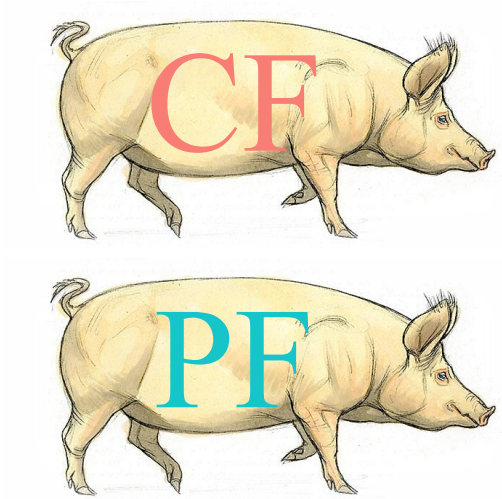


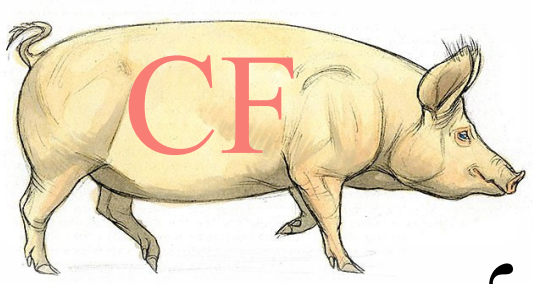
Feed quality

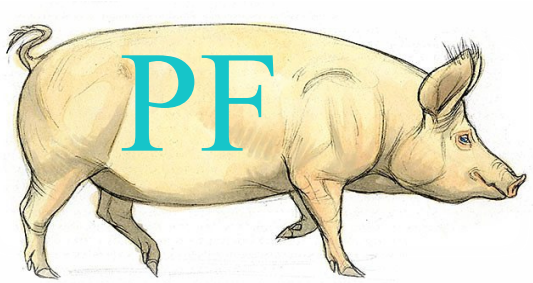
NE: net energy

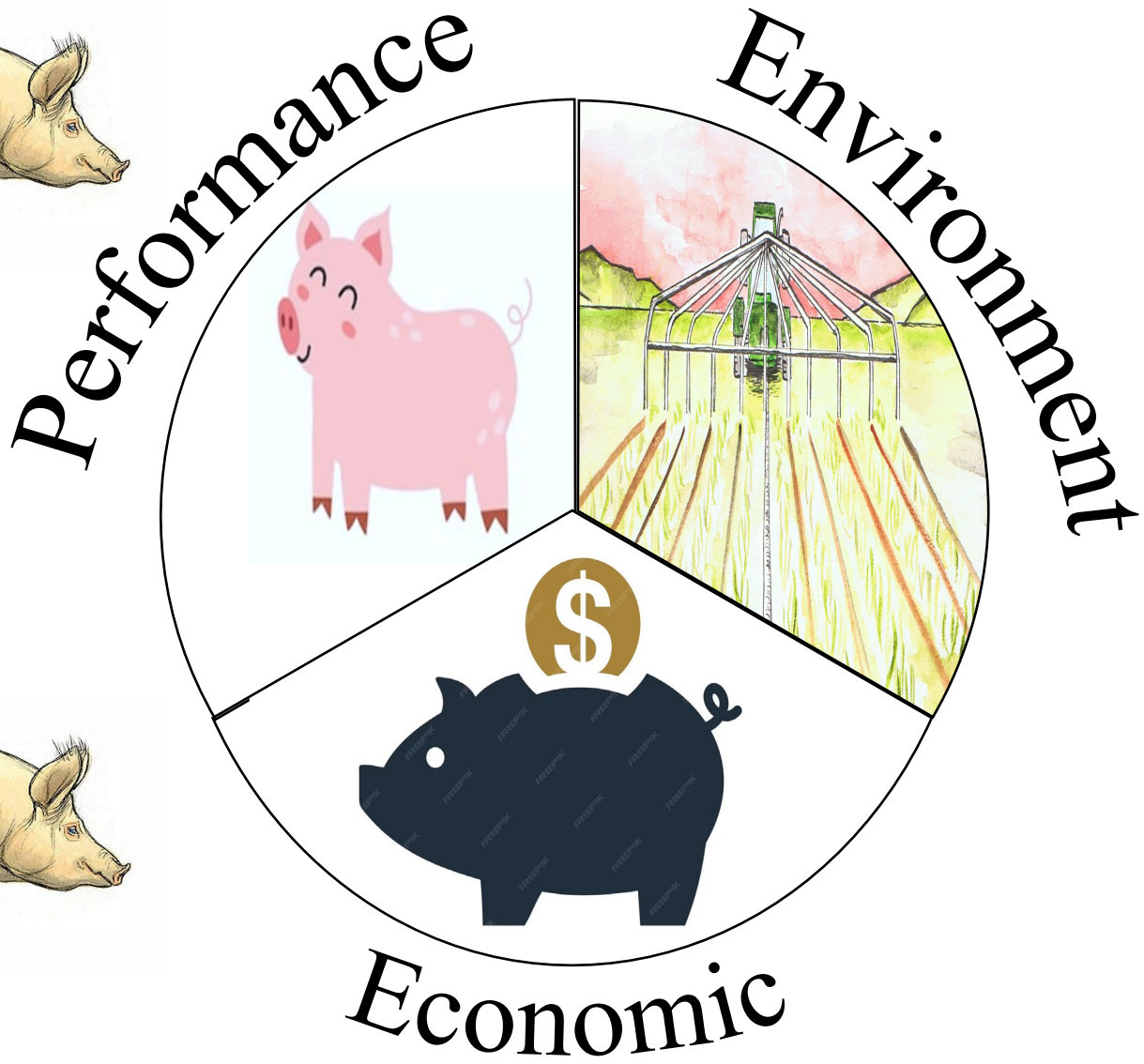
SID Lys: standardized ileal digestible lysine

Diet L	Diet H
9.8 MJ/kg	9.8 MJ/kg
3.3 g/kg	8.5 g/kg
Variable (47-100%)	Variable (0-53%)

Results compared over the 3 cycles







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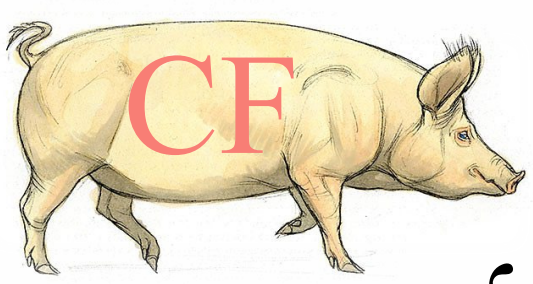
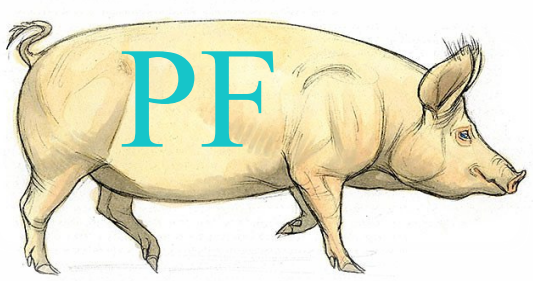
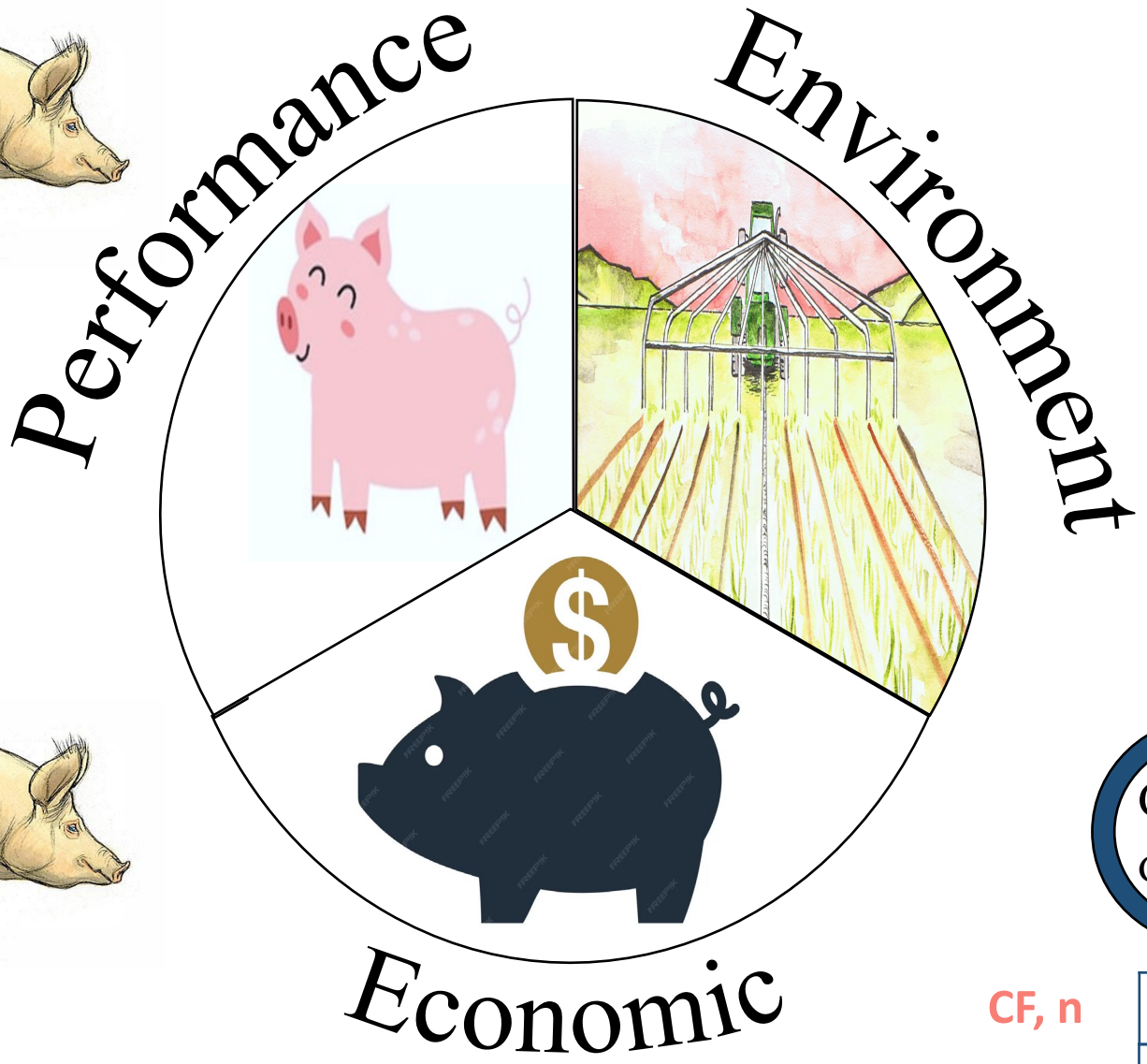
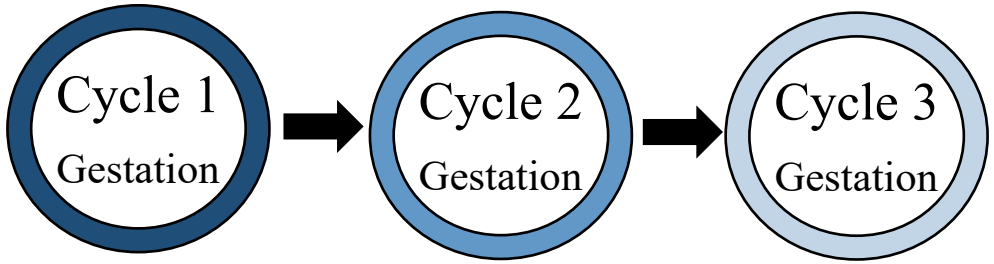






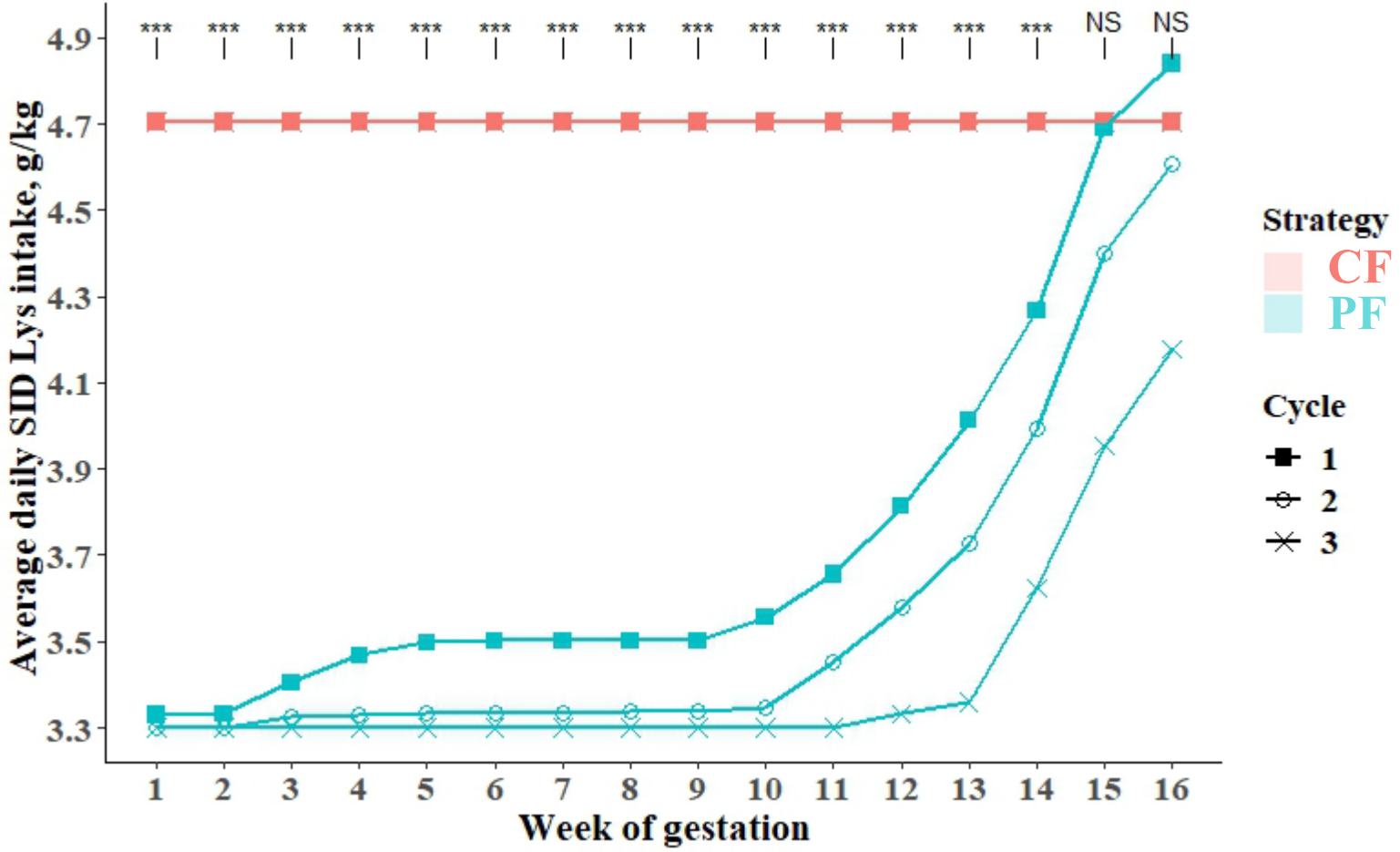
Statistics

- Linear mixed model with an autocorrelation structure of order 1
- Fixed effects:
  feeding strategy (F, n=2),
  experimental cycle (C, n=3)
  and interaction FxC
- Random effect: sow
- Covariate: initial parity



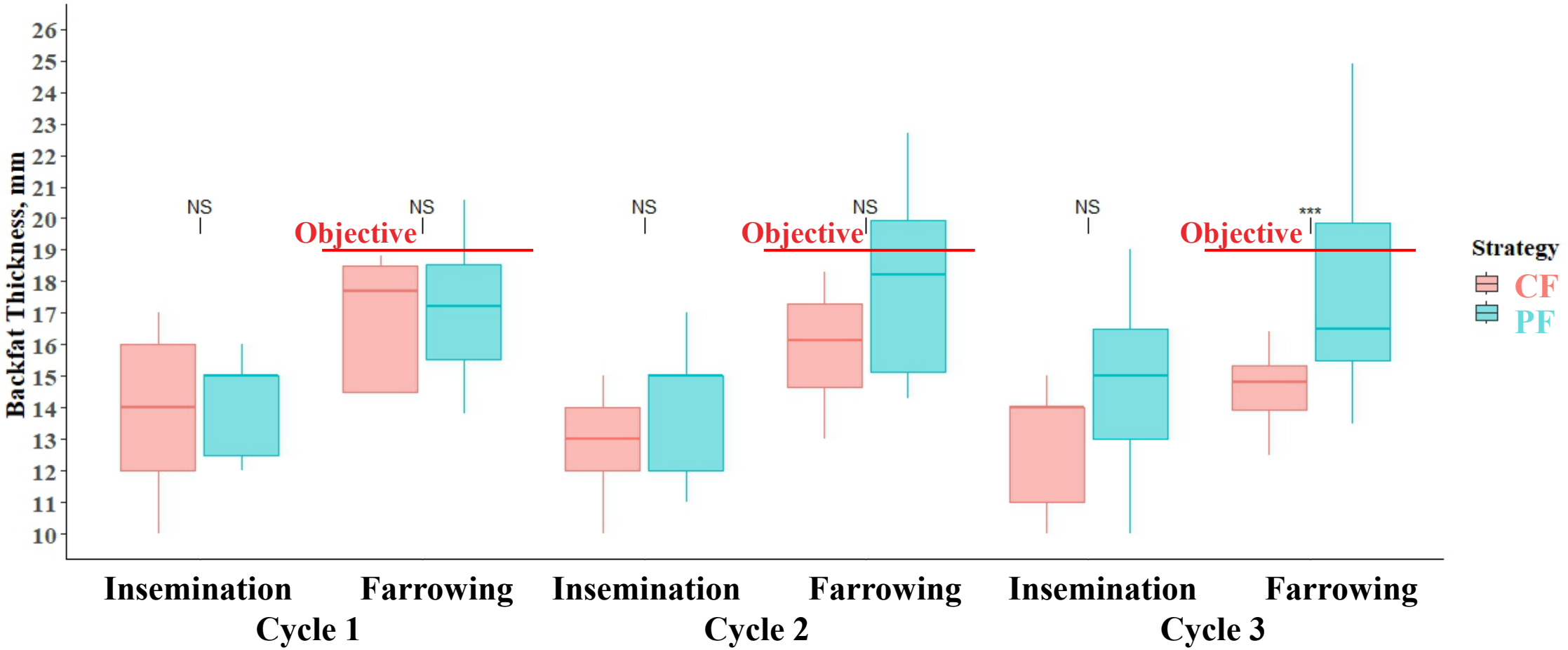
CF, n	30	18	9
PF, n	21	17	11

SID Lysine intake



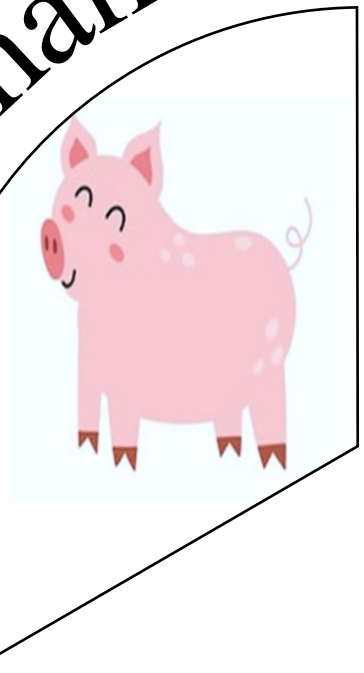
PF: 16% reduction of SID lysine intake mainly through a reduced supply over the first 14 weeks

Backfat thickness

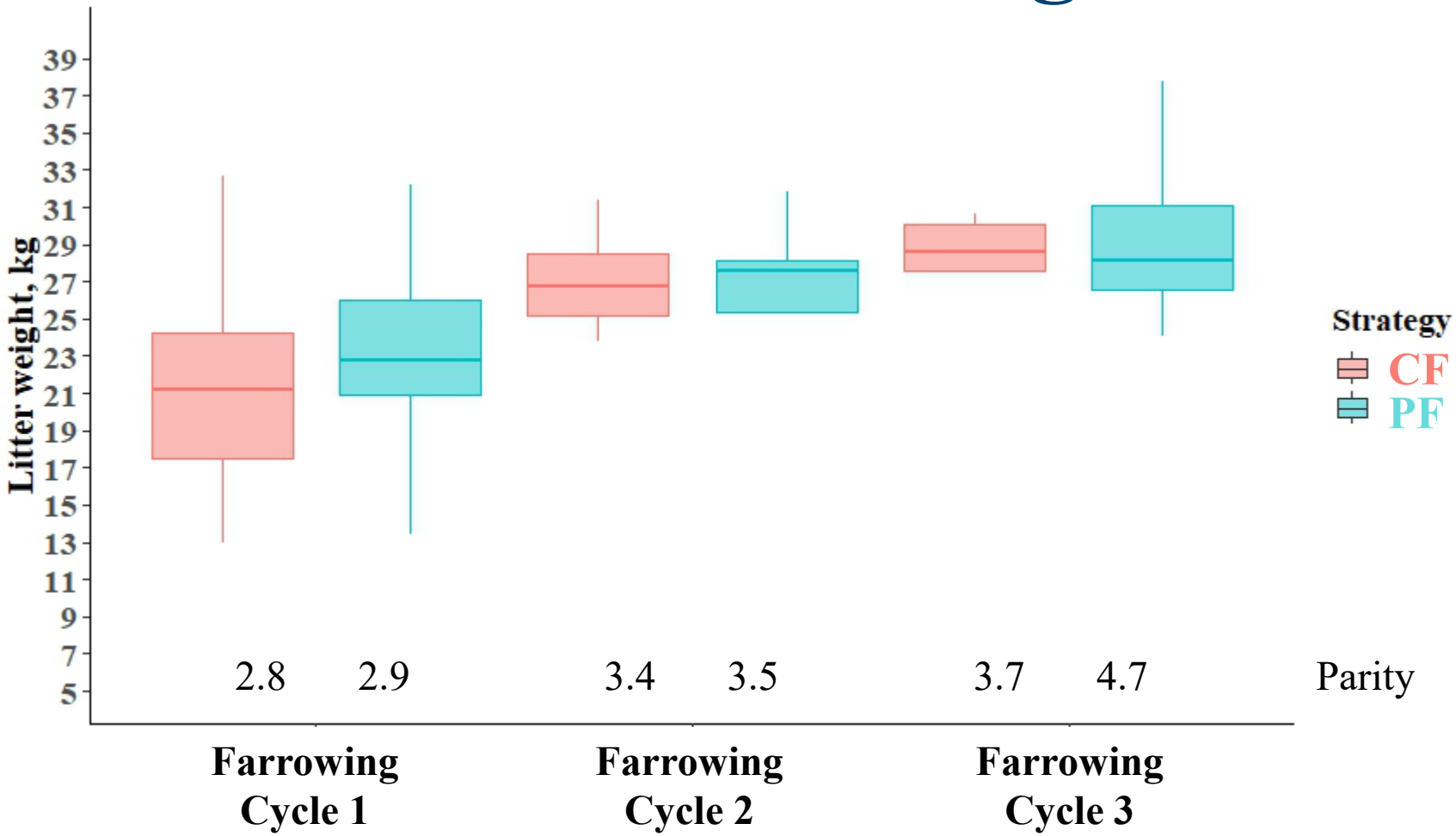


Backfat **CF** sows at farrowing < Backfat **PF** sows at farrowing at the 3rd gestation

Performance



Litter birth weight



No statistical differences

Feed costs / gestation

Savings of 11€ / Ton of feed with PF regarding diet quality

	Diet L	Diet H	Total
	322 €/Ton	371 €/Ton	
CF	73%	27%	335 €/Ton
PF	95%	5%	324 €/Ton

CF 264 kg/gestation

PF 300 kg/gestation

Feed costs / gestation

Savings of 11€ / Ton of feed with PF regarding diet quality

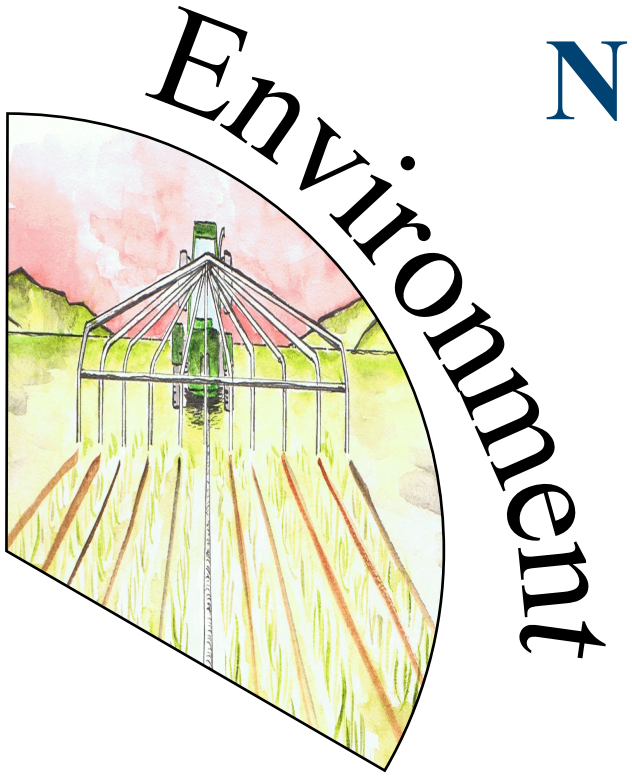
	Diet L	Diet H	Total
	322 €/Ton	371 €/Ton	
CF	73%	27%	335 €/Ton
PF	95%	5%	324 €/Ton

CF 264 kg/gestation

PF 300 kg/gestation

Based on higher amount of feed delivered in this experiment, no gain with a **PF** strategy

CF	65 €	23 €	88 €/gestation
PF	92 €	5 €	97 €/gestation



Nitrogen utilisation assessed with InraPorc®

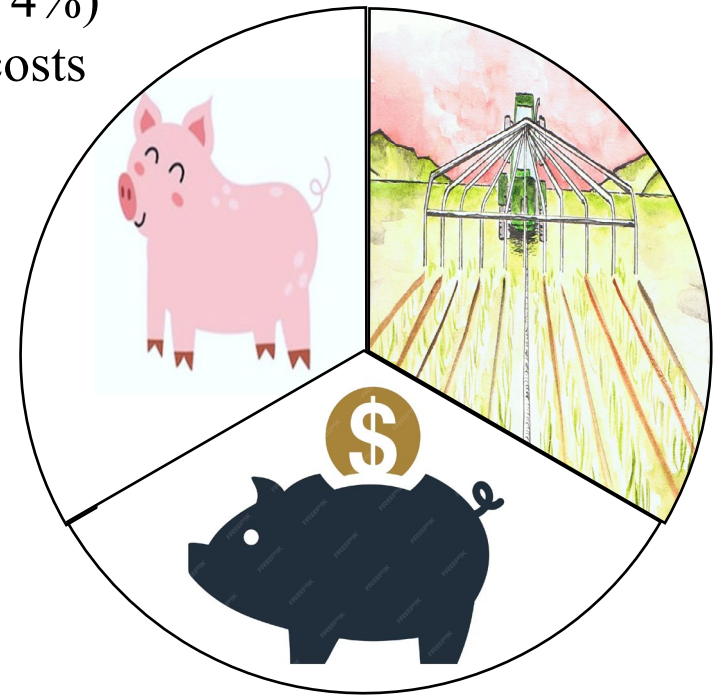
		CF	PF	
N balance kg/gestation	N intake	5.75	5.91	NS
	N retained	1.22	1.45	***
	N output	4.54	4.46	***
N efficiency %	$\frac{\text{N retained}}{\text{N intake}}$	21.1	24.5	***

PF: Increased N efficiency (+3.4 unit pct) and reduced N excretion in particular in cycle 1 (-5%)

Dourmad et al (2008)

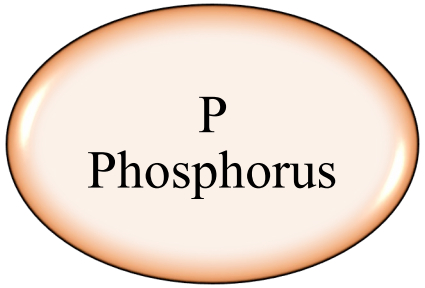
Conclusion

- **A PF strategy over the long term**
  (vs. the CF used in the present study)
- Efficient to reach target body condition at each farrowing
- Similar litter birth weight
- Reduced the excess in lysine supply (-16%)
- Increased N efficiency (+4%)
- Limited impact on feed costs



Next step

➔ A PF strategy adjusted also for minerals



Thank you for your attention!

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LinkedIn

Abstract

Gestating sows are most often fed a single feed throughout gestation. This conventional feeding (CF) leads to deficits and excesses at individual level. Precision feeding (PF) is a way of addressing this problem, by adjusting the quantity and quality of feed for each sow on a daily basis. The aim of this study was to investigate the impact of a PF adjusted for energy and standardized ileal digestible (SID) lysine for gestating sows over 3 consecutive gestations. Quantities were adjusted using a 3-phase strategy over the gestation, with requirements estimated using a nutritional model for PF sows and farming feeding curves for CF sows. The PF sows received a diet which SID lysine content was adjusted daily to their needs; CF sows received a diet with a fixed SID lysine content. Trial began with 40 gestating sows allocated to a feeding strategy (PF or CF), based on their parity, body weight, and backfat thickness (BT). Linear mixed models were used to analyse the effect of the nutritional strategy over 3 gestations. The BT objectives at farrowing were achieved by PF sows over the 3 gestations, unlike CF sows who were below the objective at the 3rd farrowing ($P < 0.001$). Total SID lysine intake was reduced by 16% ($P < 0.001$), with decreased supplies in excess in the first 12 weeks of gestation thereby improving the efficiency of nitrogen by 4% ($P < 0.001$) for PF compared to CF sows. Applying a PF strategy resulted in savings of 10 € per ton of feed over 3 gestations without affecting the farrowing performances ($P > 0.10$). PF is a way of improving the sustainability of livestock farms by making a better use of the dietary nitrogen without compromising herd performance.

References

- Dourmad et al. "InraPorc: a model and decision support tool for the nutrition of sows." Animal Feed Science and Technology 143.1-4 (2008): 372-386.
- Gaillard et al. "Evaluation of a decision support system for precision feeding of gestating sows." Journal of Animal Science 98.9 (2020): skaa255.
- Gaillard et al. "Exploration of individual variability to better predict the nutrient requirements of gestating sows." Journal of Animal Science 97.12 (2019): 4934-4945.
- Pomar et al. "Applying precision feeding techniques in growing-finishing pig operations." Revista Brasileira de Zootecnia 38 (2009): 226-237
- Remus et al. “Estimating real time individual lysine and threonine requirements in precision-fed pigs”. In Energy and Protein Metabolism and Nutrition; Wageningen Academic Publishers: Wageningen, The Netherlands, 2019; pp. 451–452.