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Effect of temperature in the context of climate change on nutrient requirements of lactating sows

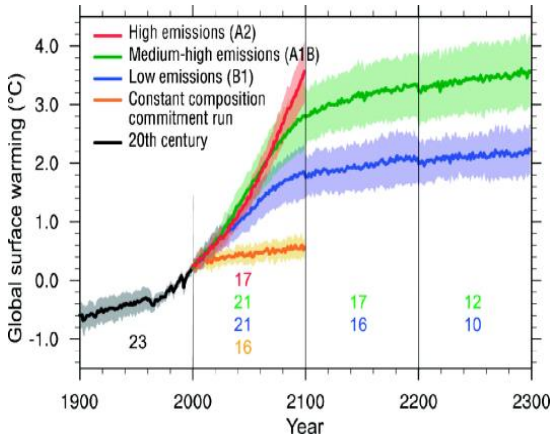
J.Y. Dourmad[1], J.L. Gourdine[2], D. Renaudeau[1]

[1]PEGASE, INRA Agrocampus Ouest, France
[2]URZ, INRA, Guadeloupe, France

Context

✓ Climate change

- ⇗ Frequency and intensity of heat stress periods
- ⇗ Pig production under hot climate (tropical, sub tropical regions)



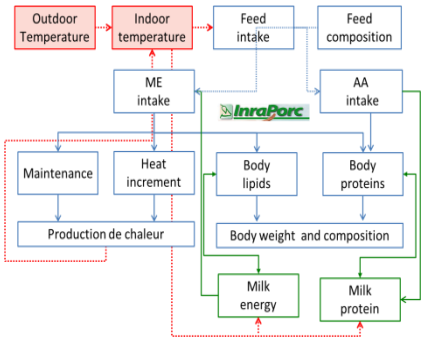
✓ The lactating sow

- A low thermo-neutral zone (12-22°C)
  - high feed intake per kg $BW^{0.75}$
  - high heat production (high milk production)

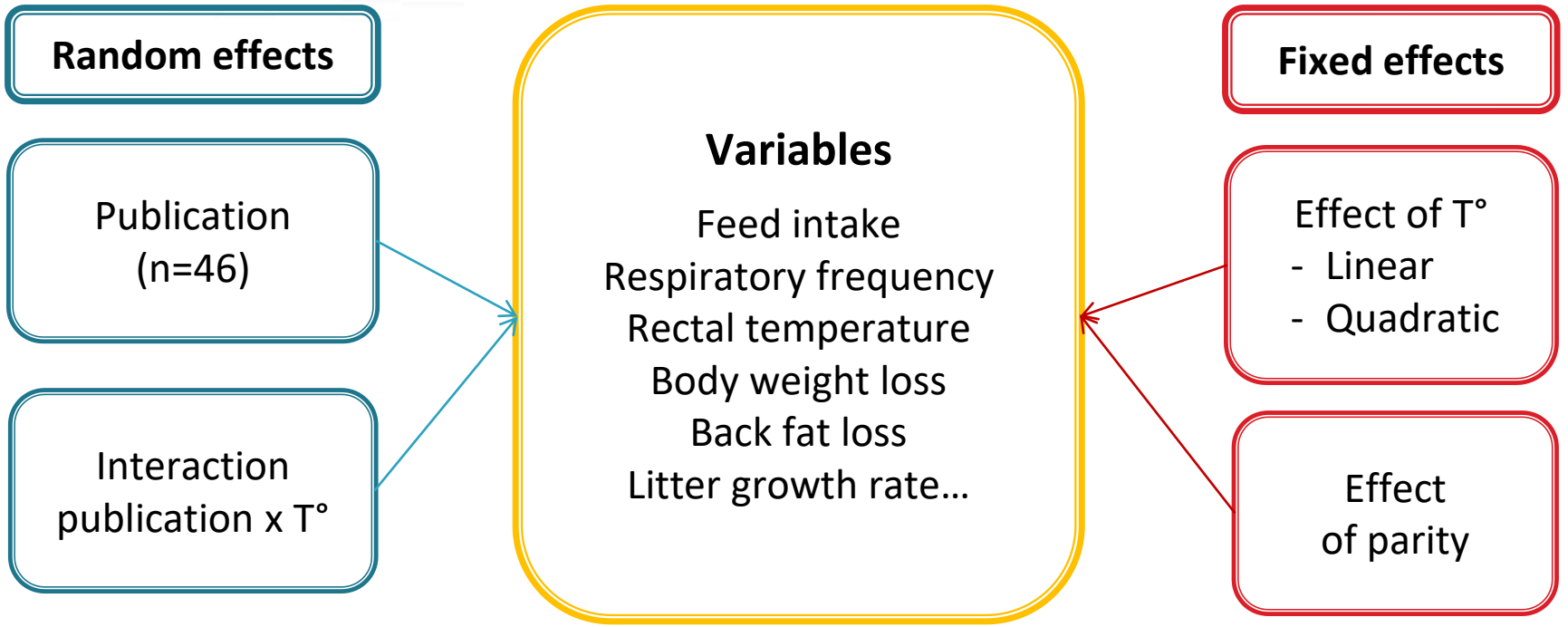
  => very sensitive to heat stress
- ....

Objective and approach

- **Objectives**
  - Quantify physiological and performance responses of lactating sows and their litter to temperature
  - Integrate these responses in an decision support tool for sow nutrition
- **Approach**
  - Meta-analyses of the literature
  - Modeling of the effect of ambient temperature on sow and litter performance
  - Simulation of the effect of different climatic series on sow performance and nutritional requirements



Meta-analysis – Mixed model



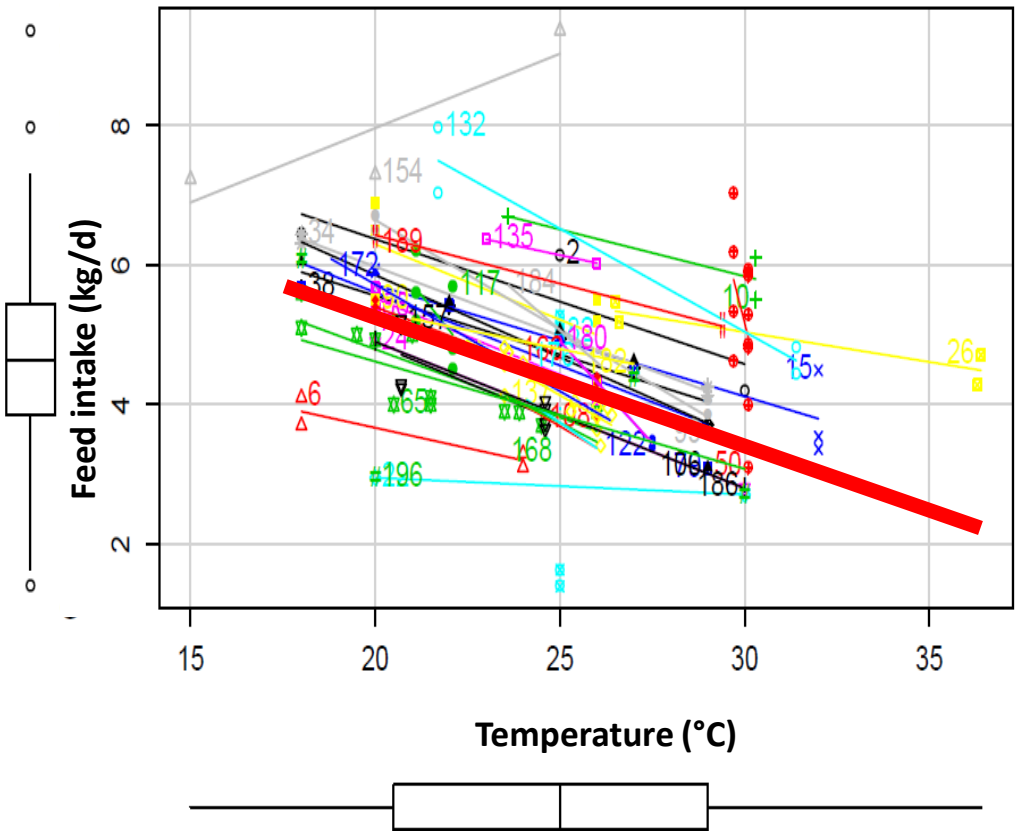
$$Y_{ij} = b_0 + b_1 T_{ij} + s_i + a_i T_{ij} + e_{ij}$$
$$Y_{ij} = b_0 + b_1 T_{ij} + b_2 T_{ij}^2 + s_i + a_i T_{ij} + e_{ij}$$
$$Y_{ij} = b_0 + b_1 T_{ij} + b_2 T_{ij}^2 + s_i + a_i T_{ij} + d_{1p} + d_{2p} T_{ij} + e_{ij}$$

Effect of ambient temperature on sow feed intake

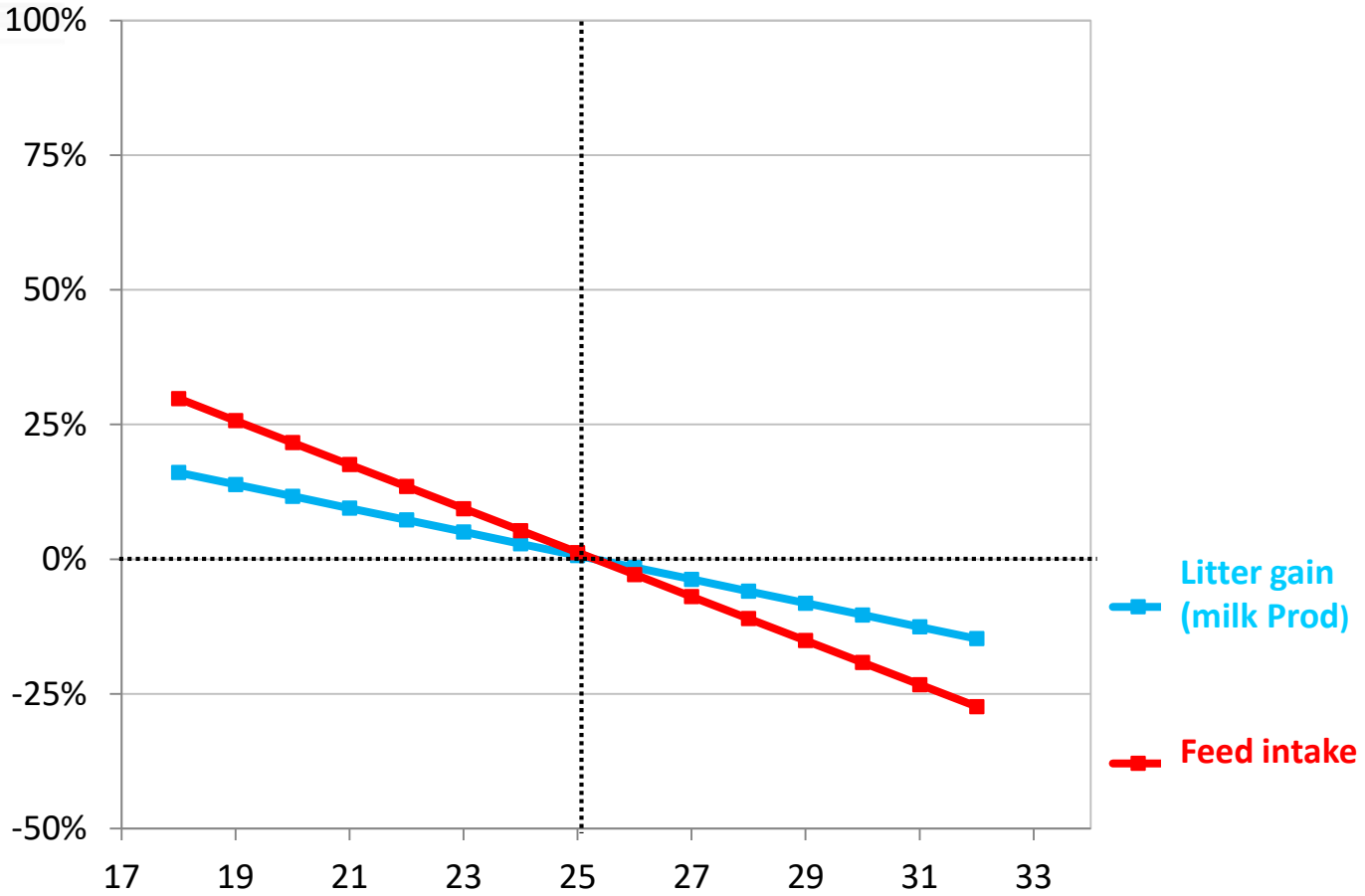
n = 202
(38 publications)

average = 4.77 kg/d
std dev. = 1.20 kg/d

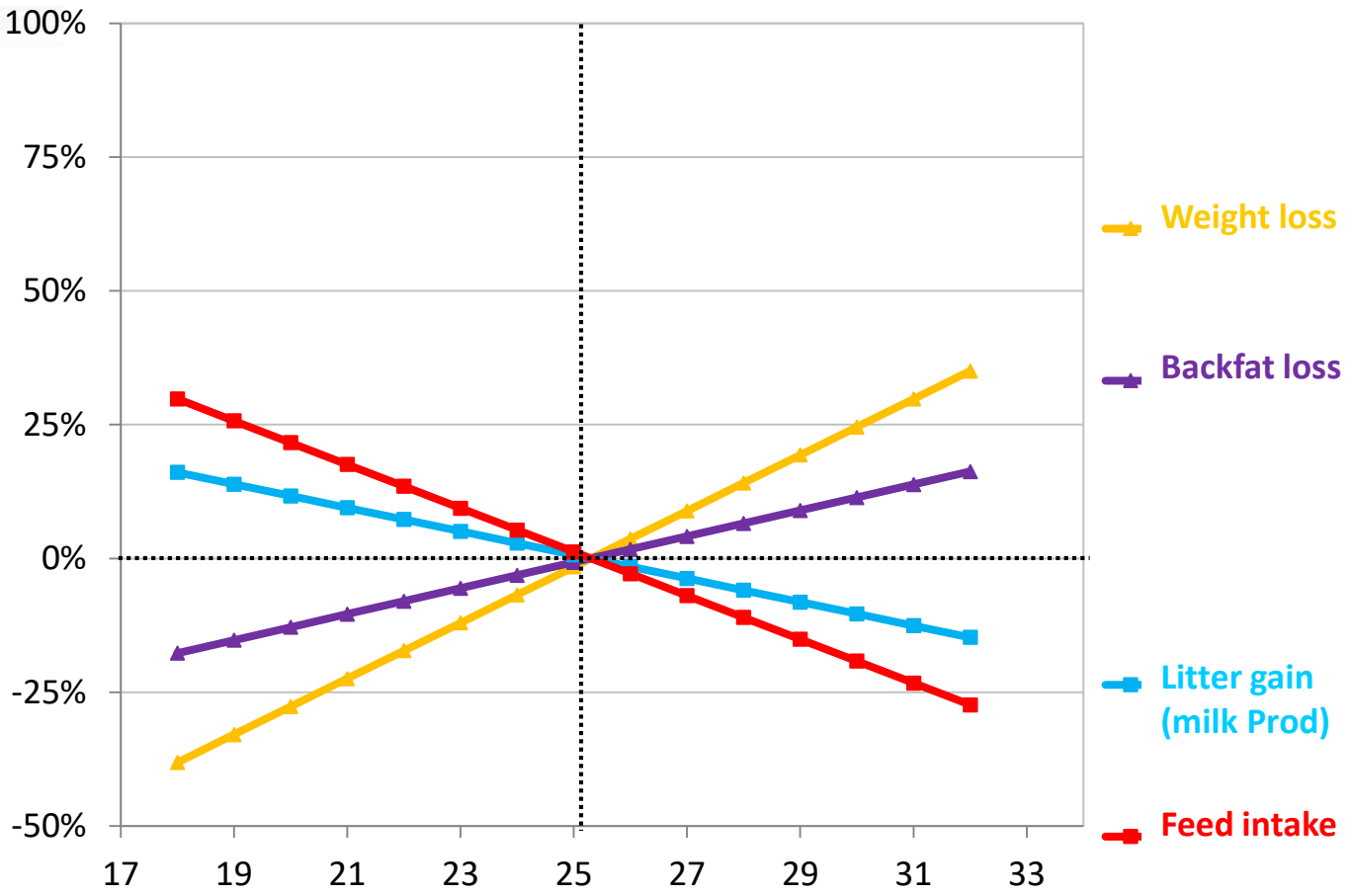
FI = 9.41 - 0.189 x T°
R^2 = 0,80



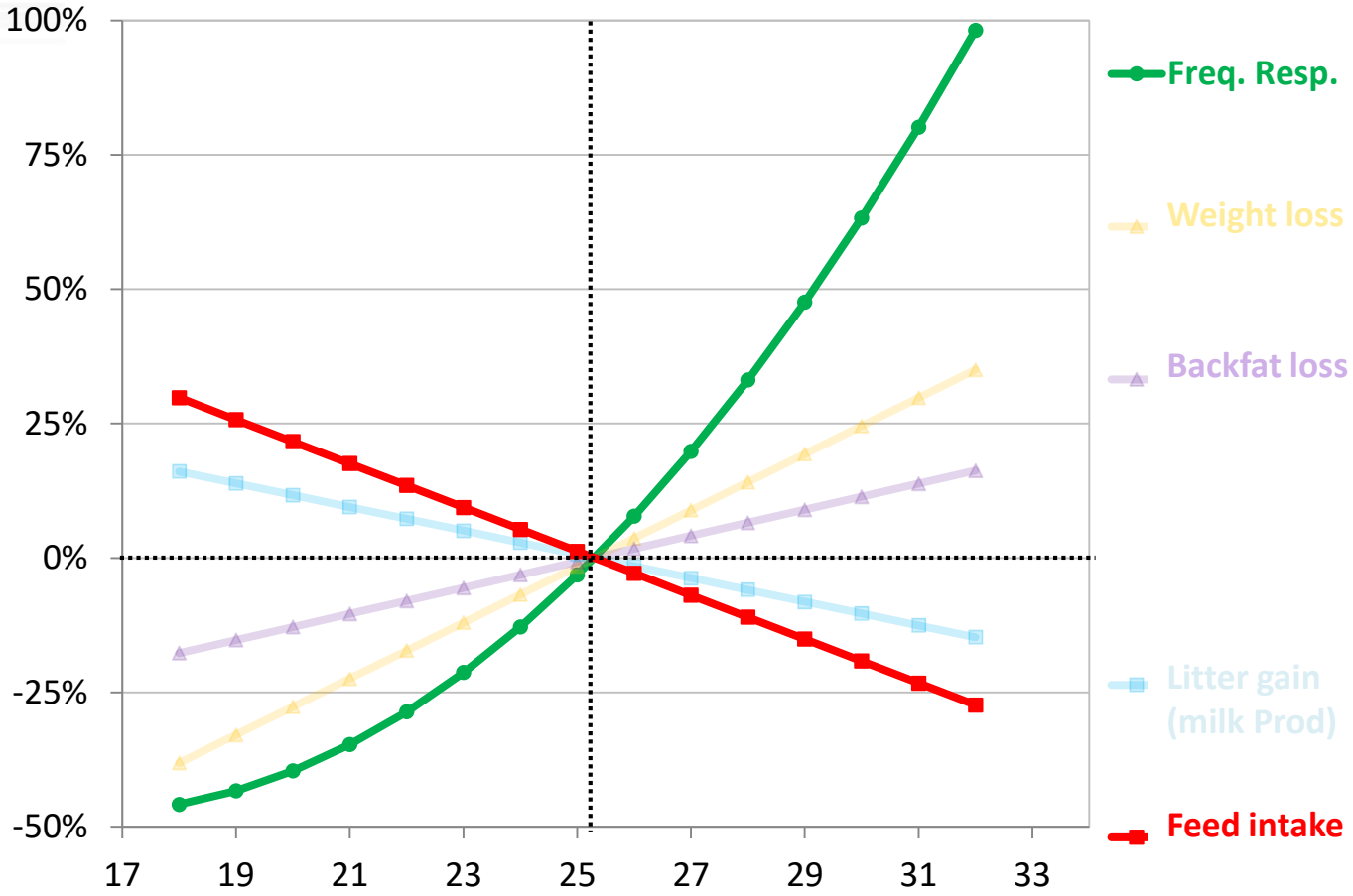
Relative response to temperature



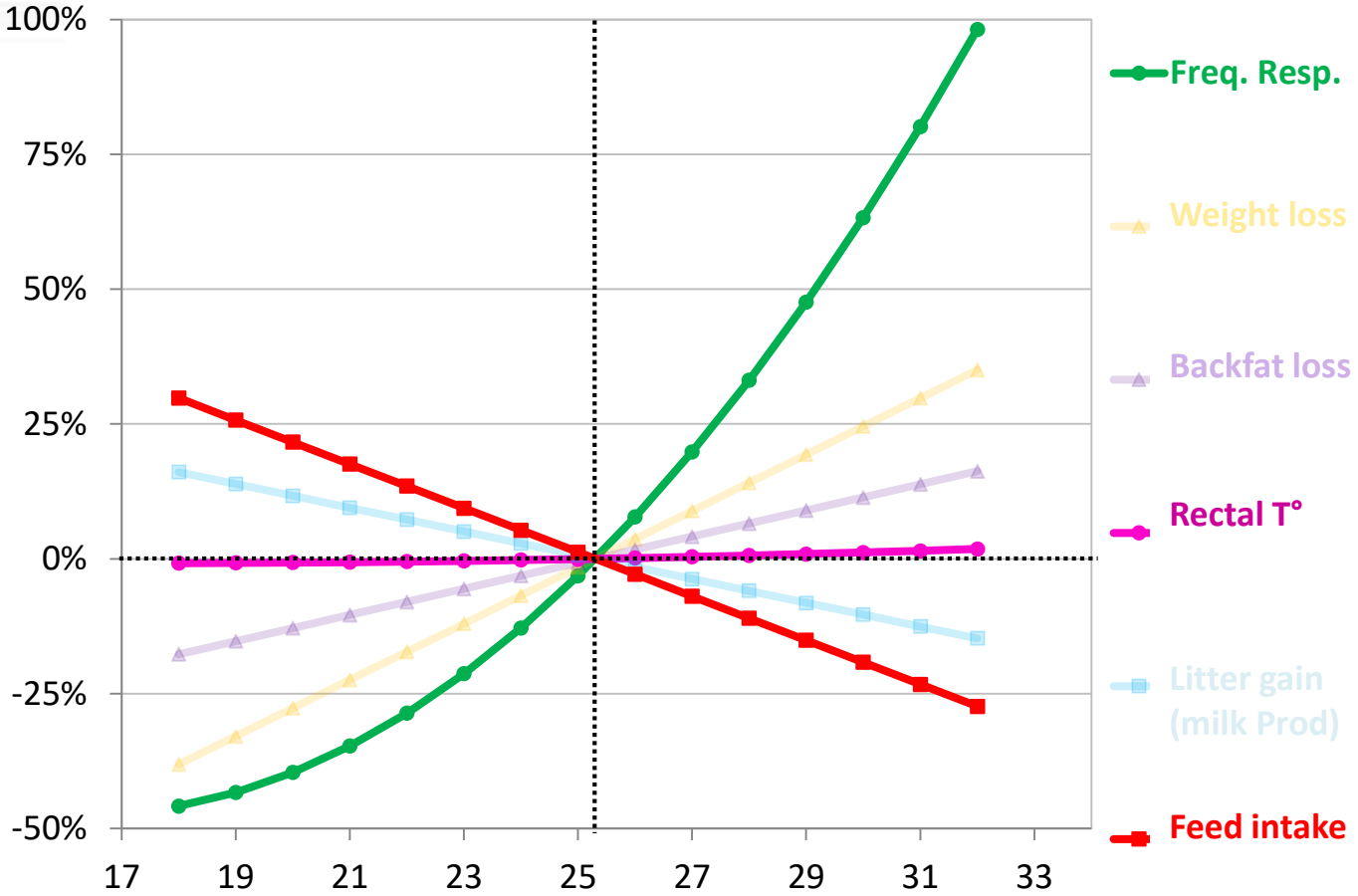
Relative response to temperature



Relative response to temperature



Relative response to temperature

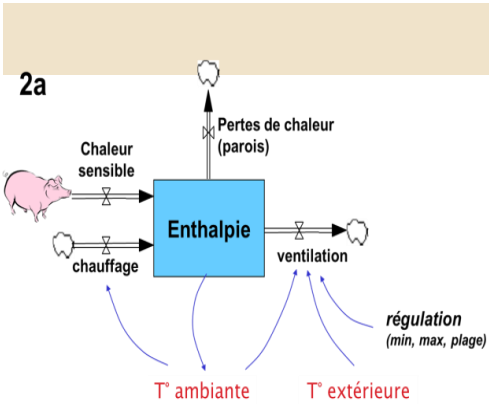


Modeling and simulations

Modeling of the effect of climate on indoor T° perceived by the sow

Modeling of sow's response to ambient T°

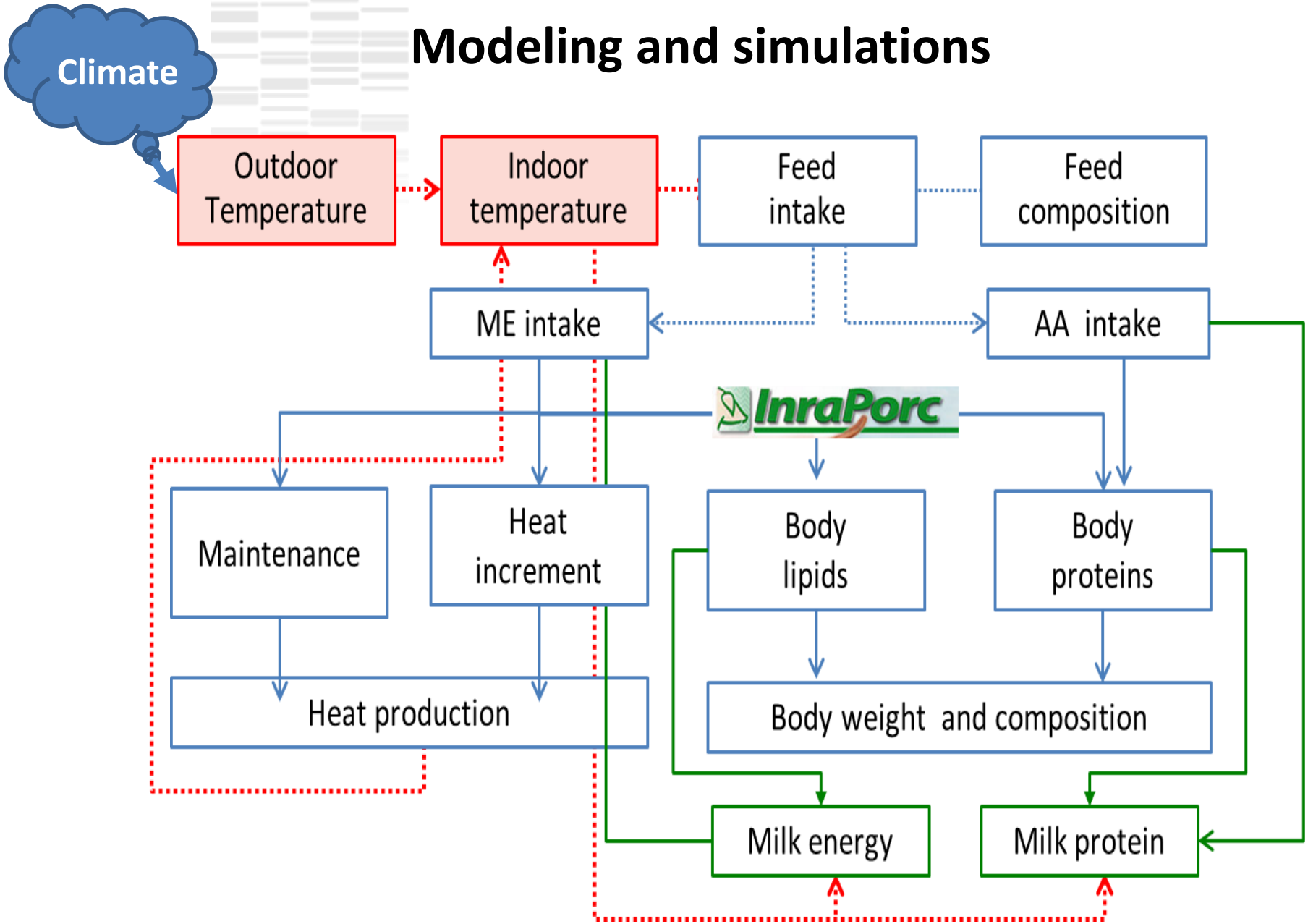
Simulation with recent and predicted climatic series



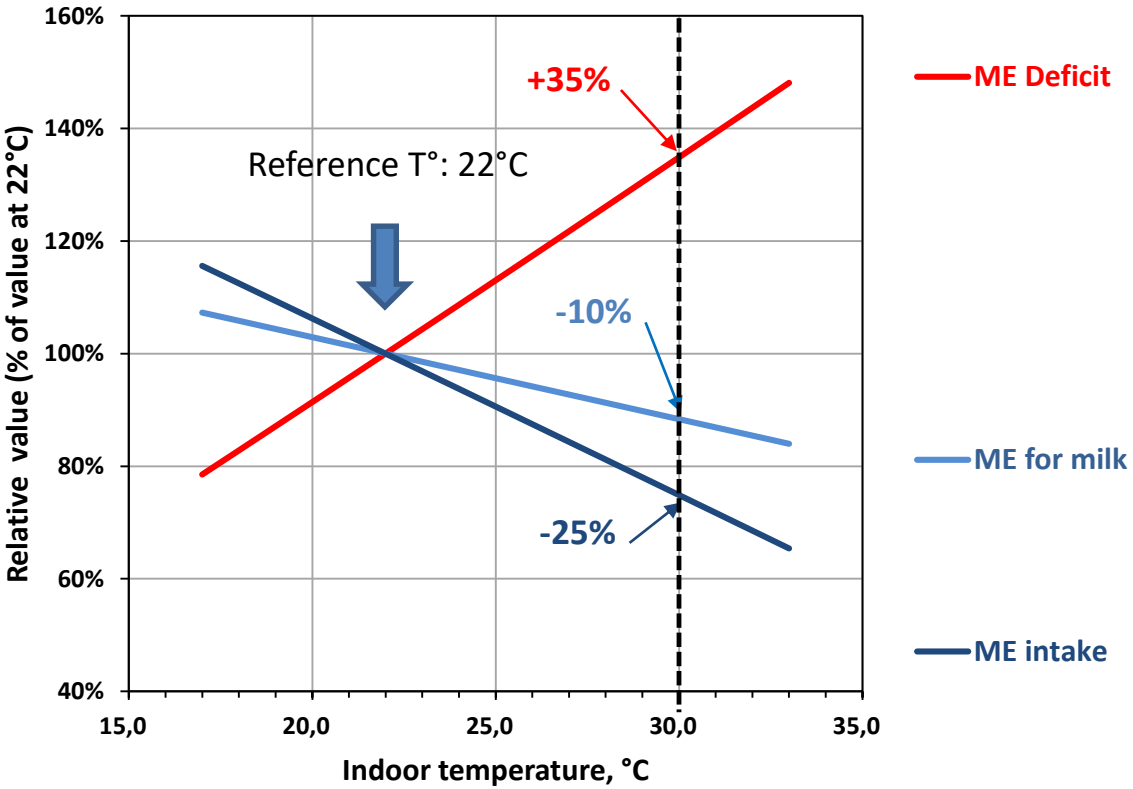
+ results from the meta-analyses

- **Two locations :** Toulouse, Rennes
- **Two periods :** 2000 – 2045
- **Sows :** primiparous et multiparous

Modeling and simulations



Sensitivity analyses of the model to ambient temperature : ME balance and digestible lysine requirement



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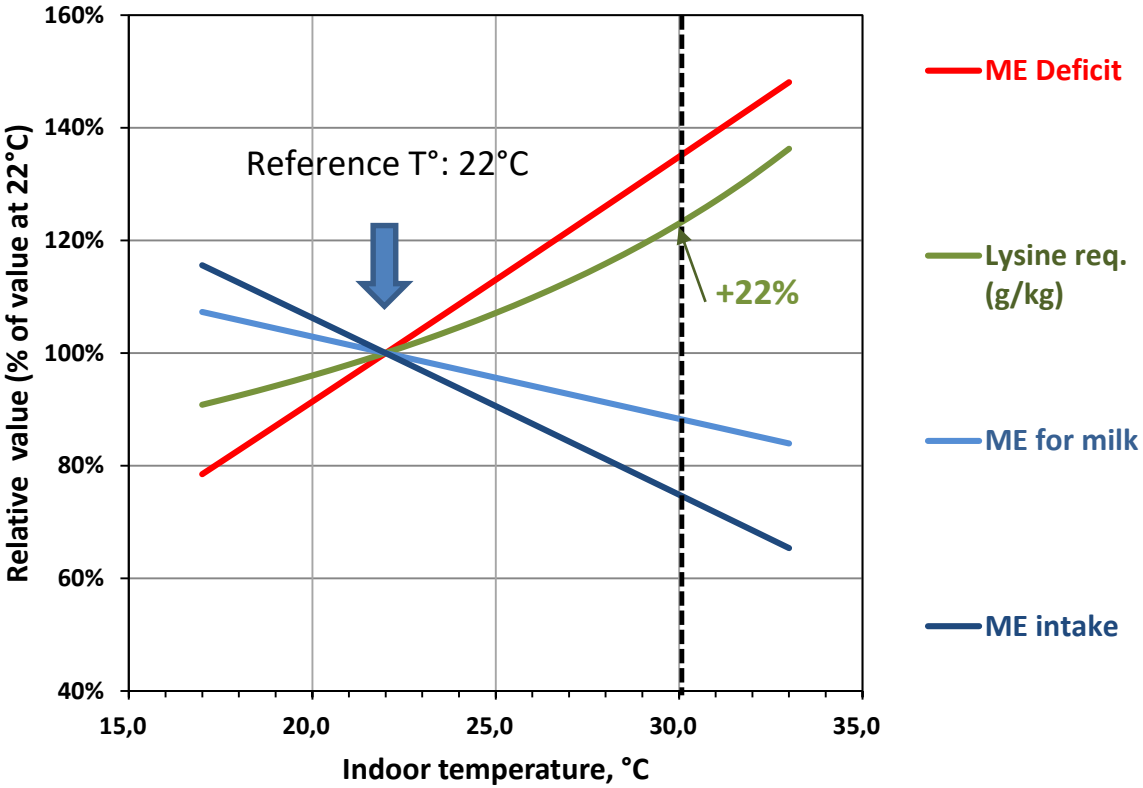
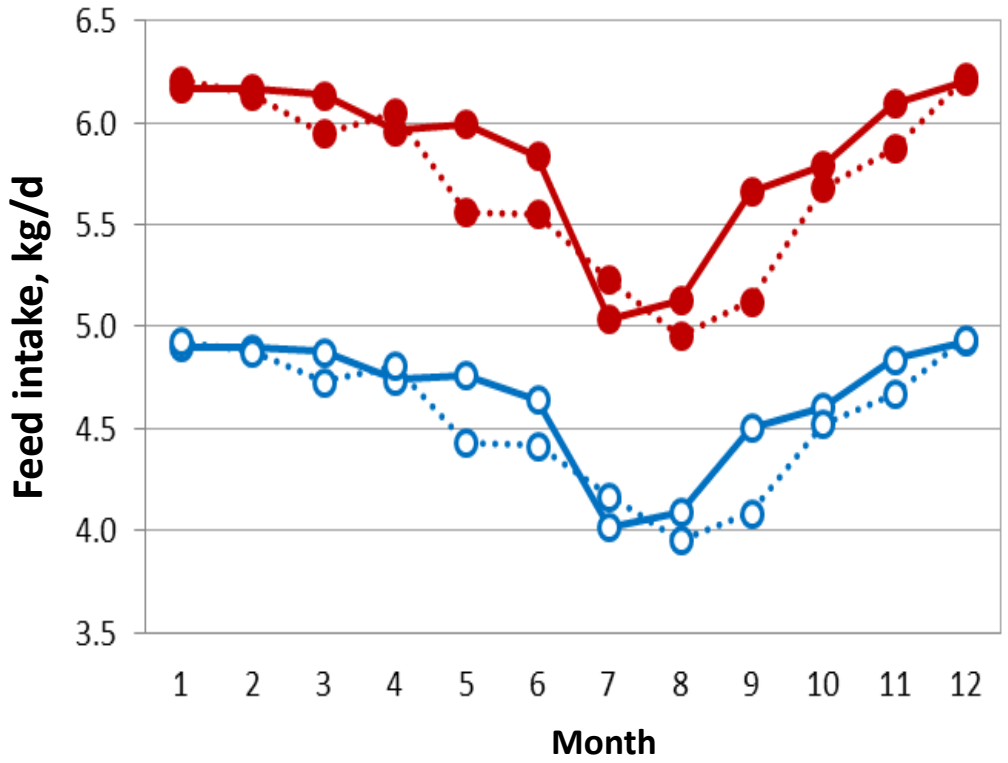
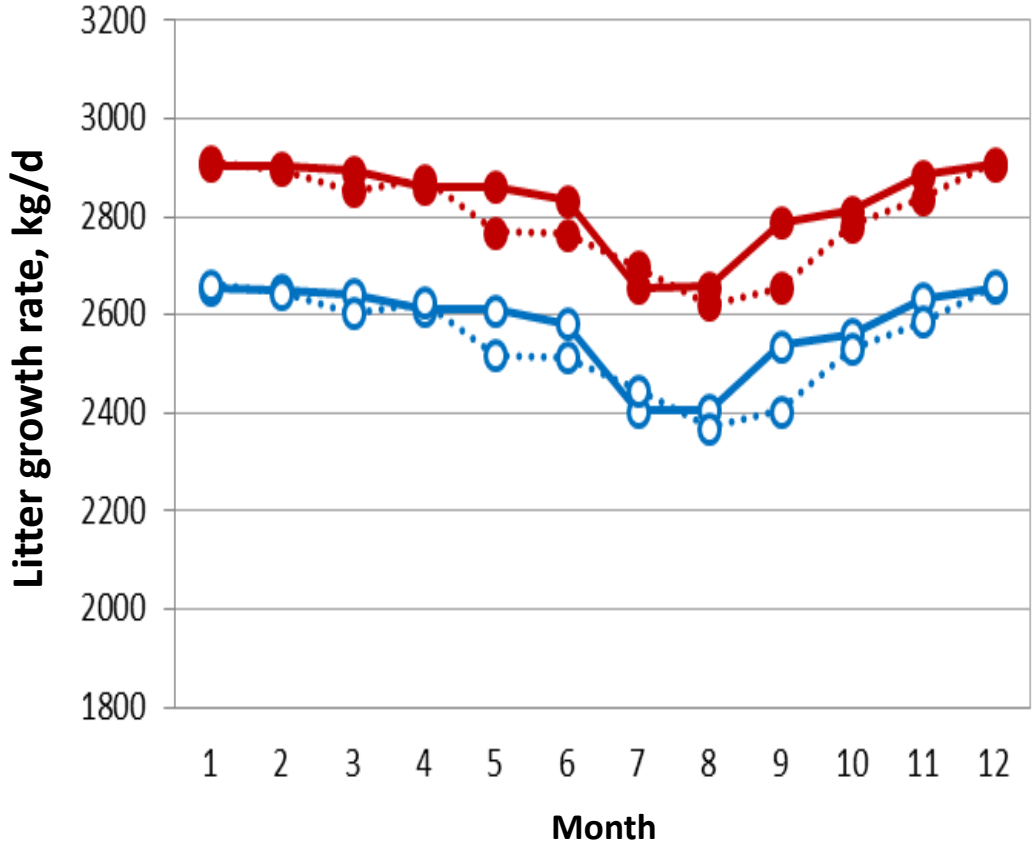


Simulation of the effect of season on feed intake of primiparous or multiparous sows (Toulouse : 2000 —●— 2045 ····●····)



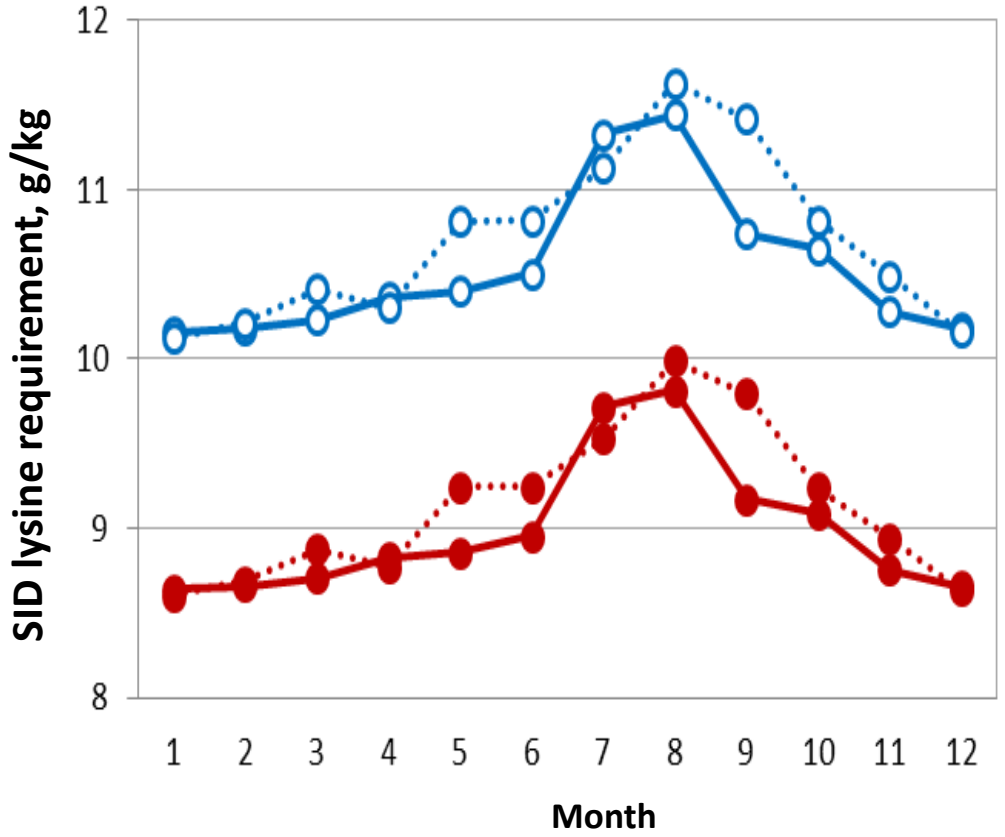
Month : ***
Parity : ***
Year : ***
(Location: ***)

Simulation of the effect of season on litter growth rate of primiparous or multiparous sows (Toulouse : 2000 —●— 2045 ···●···)



Month :	***
Parity :	***
Year :	***
(Location:	***)

Simulation of the effect of season on lysine requirement of primiparous or multiparous sows (Toulouse : 2000 —●— 2045 ····●····)



Month :	***
Parity :	***
Year :	***
(Location:	***)

Conclusion

✓ **Quantification of adaptation mechanisms**

- ⇗ Respiratory frequency ⇗ latent heat loss
- ⇘ Feed intake ⇘ heat production
- ⇘ Milk production ⇘ heat production

✓ **Modeling the effects of ambient temperature**

- On sows and piglets performance
- On nutritional requirements

✓ **Perspectives**

- Integration into InraPorc® decision support tool (growing-finishing phase…)
- In practice :
  - Adaptation of feed composition according to season and localization
  - Precision feeding of lactating sows (mixing of two feeds)

Thank you for your attention…