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Precision feeding of lactating sows: development of a decision support tool to handle variability

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Context and objectives

Feeding, a major lever for swine production

- Control of sow body reserves
- Animal welfare & Behaviour
- Reproduction

- Feeding cost

- Releases of pollutants in soil and water
- Non-renewable resources (phosphate)

➥ **Adapt nutrient supply to energy, amino acids and mineral requirements**

IFIP, GTTT; Jondreville and Dourmad, 2005; Dourmad and al., 2008

Evolution of feeding practices

- New feeding practices :
  - Individual feeding instead of group feeding
  - New feeders offering the possibility of mixing different diets

- Availability of new technologies :
  - Individual identification of animals (RFID tags)
  - New sensors
    - Animal (physical activity, feeding behaviour, weight)
    - Breeding conditions (temperature, dampness …)

New perspectives to :

➥ **Improve sow feeding and their welfare**

➥ **Reduce environmental impacts and feeding costs**

Objectives and approach

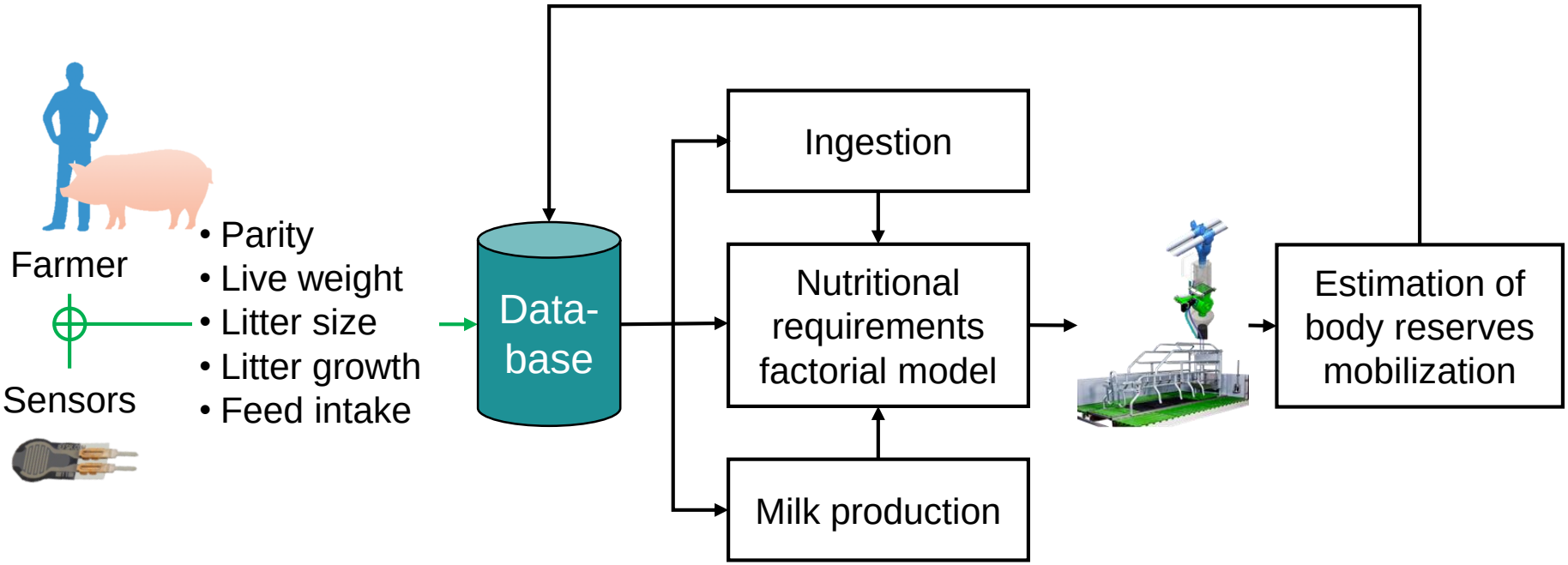
- **Objectives**
  - Calculate individual requirements for lactating sows
  - First step through a new DSS* that could be embedded in automated feeding equipment

- **Approach**
  - Based on InraPorc model 
  - Modelling of the effect of litter size, litter growth and feed intake on individual requirements

*DSS: Decision Support System

Description of the DSS

Description of the Decision Support System



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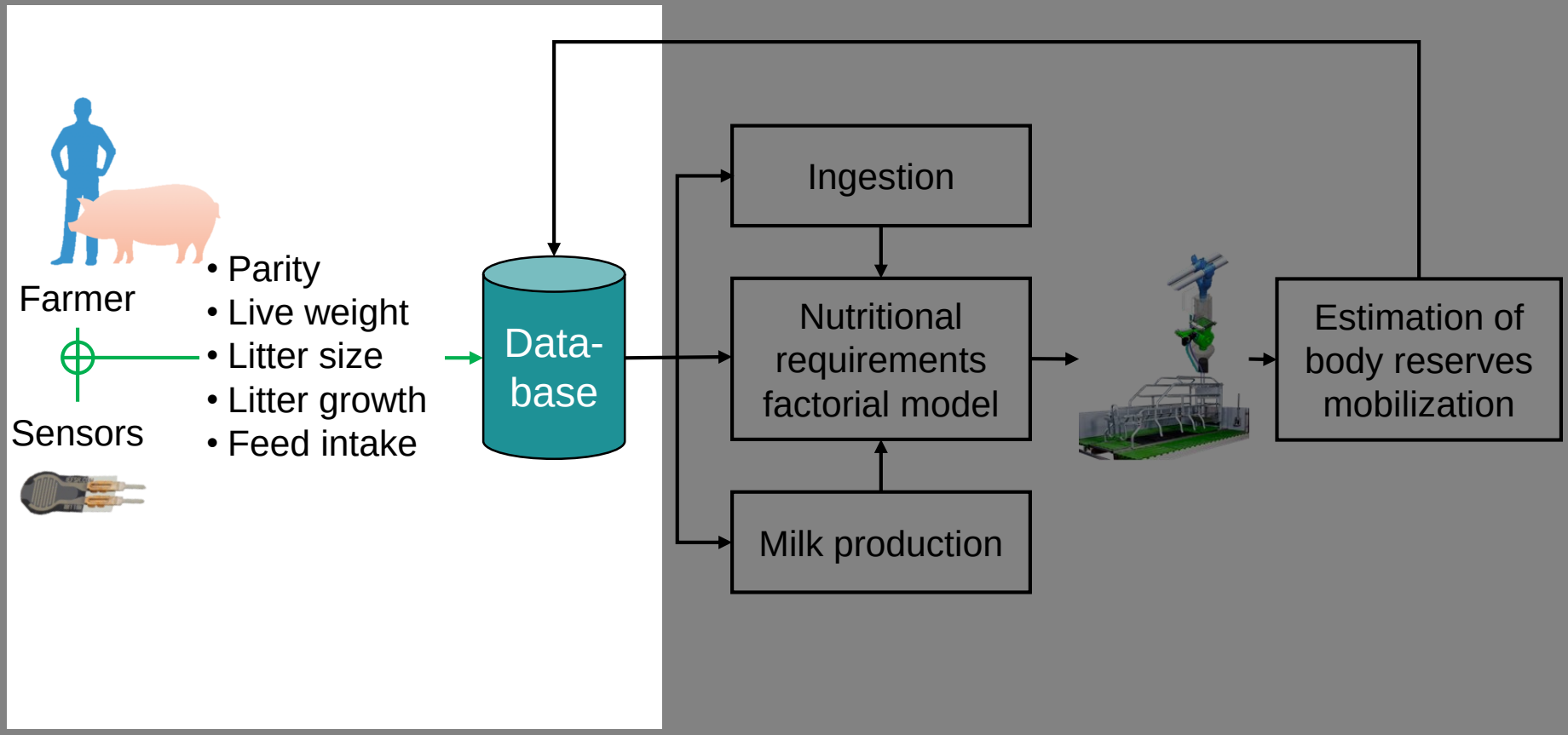

Data used for the calculation of sows requirements

	No	Mean	SD	10th percentile	90th percentile
Sow parity	817	1.9	0.8	1.0	3.0
Sow BW*, kg	817	218	25	186	250
Sow BF*, mm	817	14.5	4.0	9.2	20.3
Sow feed intake, kg/d	817	5.8	1.3	4.2	7.6
Lactation length, d	817	18.6	2.6	15.0	22.0
Sucking litter size, piglet/d	817	11.9	1.2	10.3	13.3
Litter weigh gain, kg/d	817	2.6	0.6	1.9	3.3

adapted from Lemay and Guay, 2017

*BW: Body Weight; BF: Back Fat Thickness

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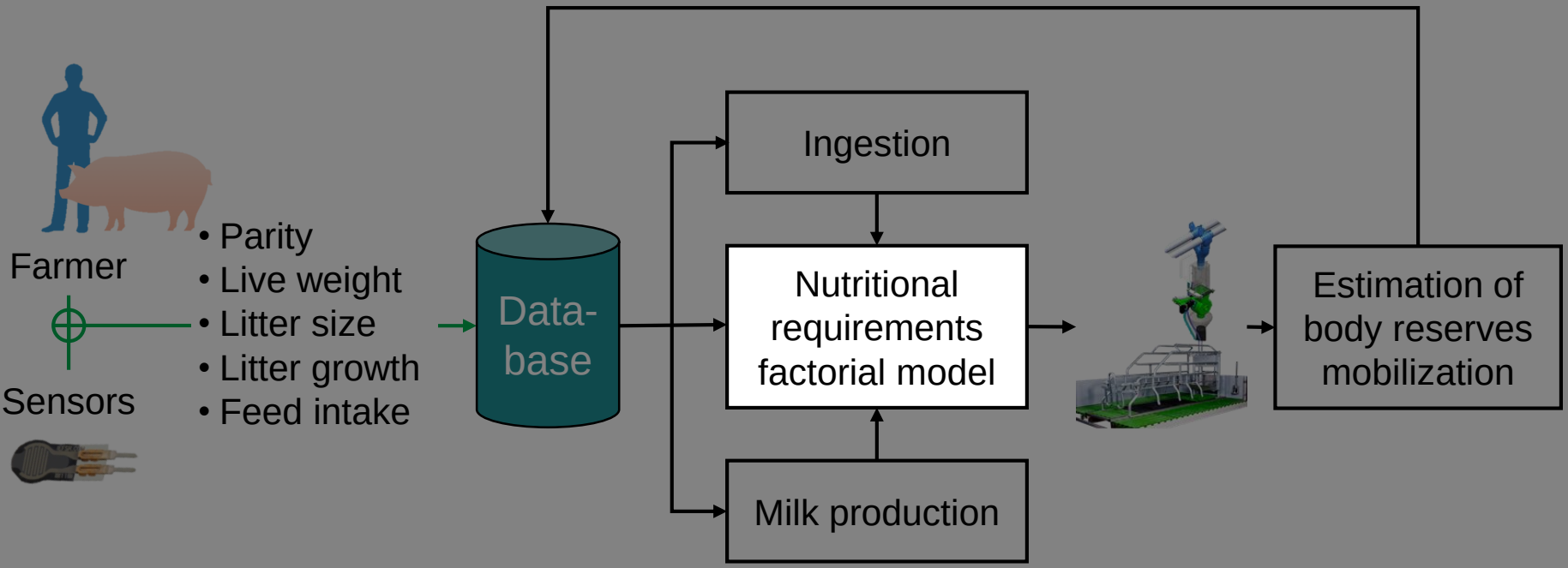
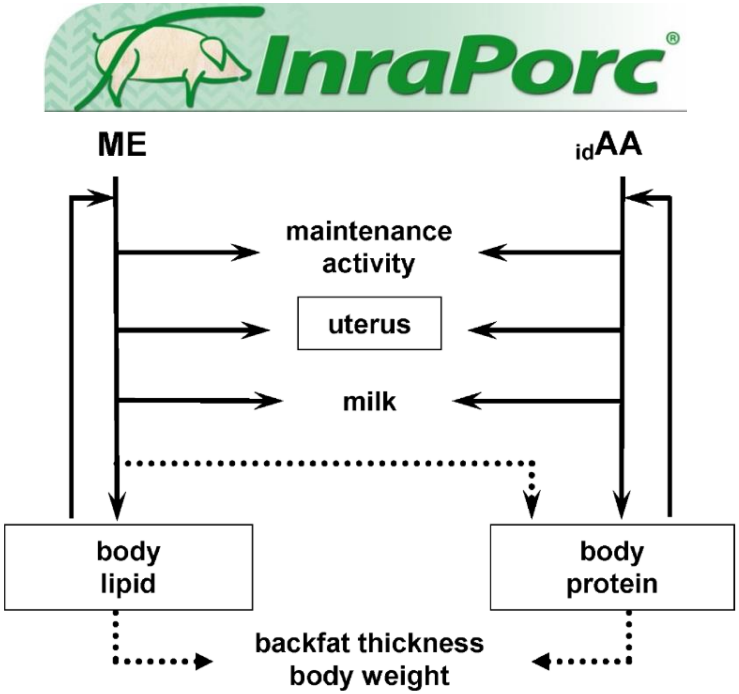
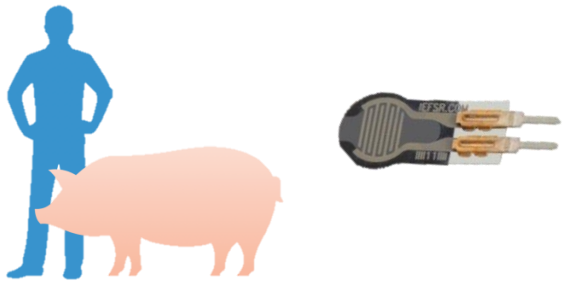


Nutritional requirements factorial model

- Use of InraPorc Model
  - Energy requirements
  - BW and BF gain, and protein mobilization
  - SID* amino acid, and mineral requirements
  - AA* provided by the regressing uterus
- Sow characteristics at parturition:
  - Parity, BW, BF Thickness
- Daily information:
  - Litter size, feed intake



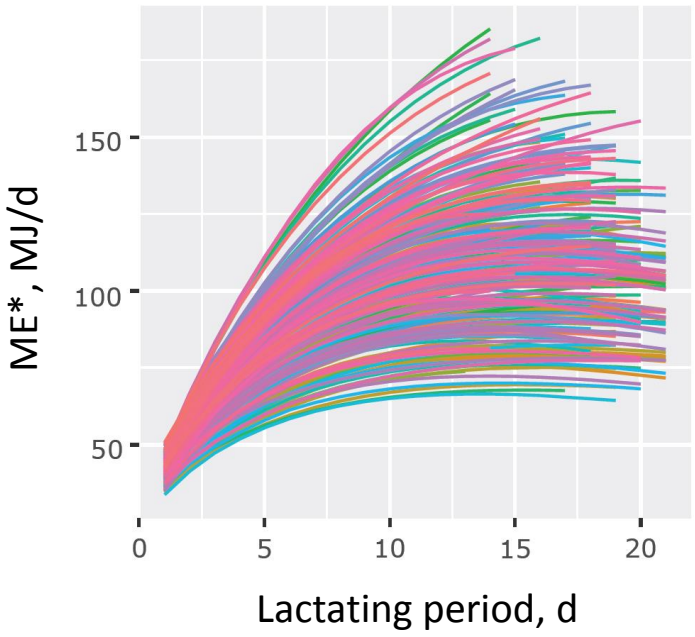


*SID: Standardised Ileal Digestible; AA: Amino Acids
Dourmad and al., 2008

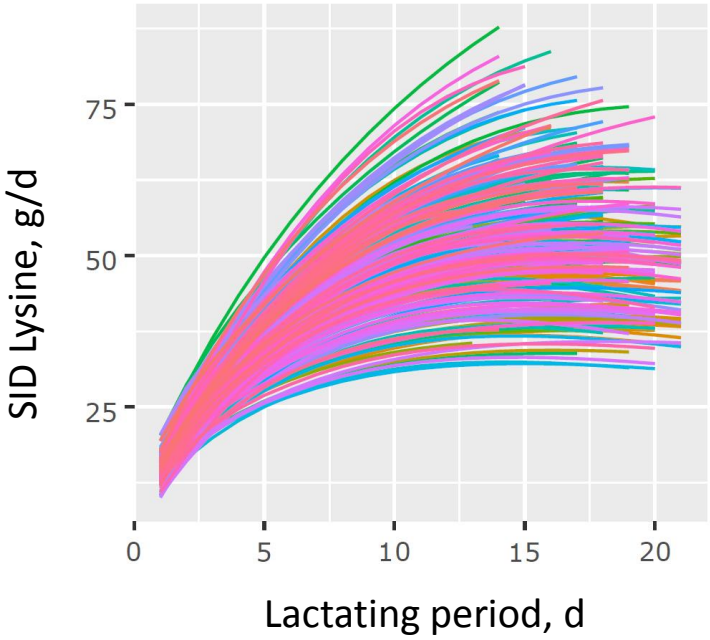
Tests and validation

Nutritional requirements evolution across the lactating period

Energy requirements



Lysine requirements

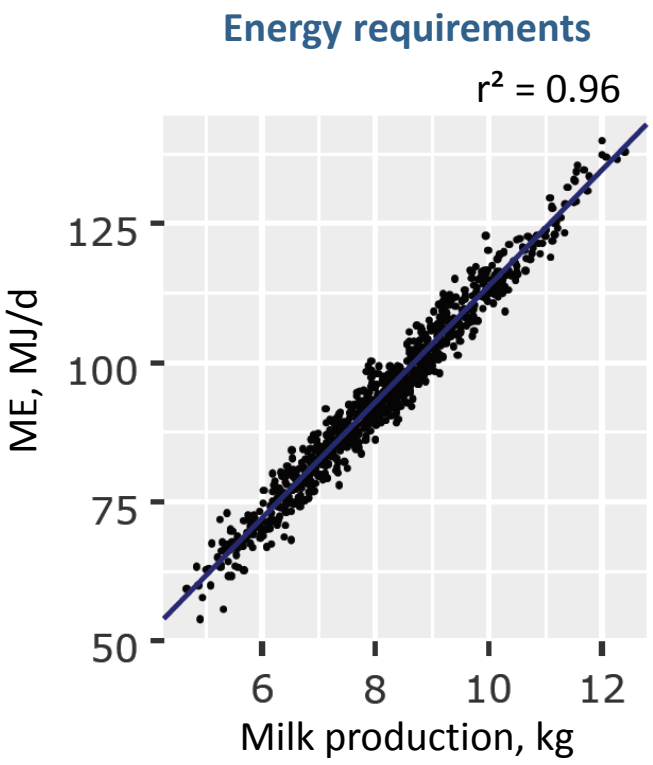


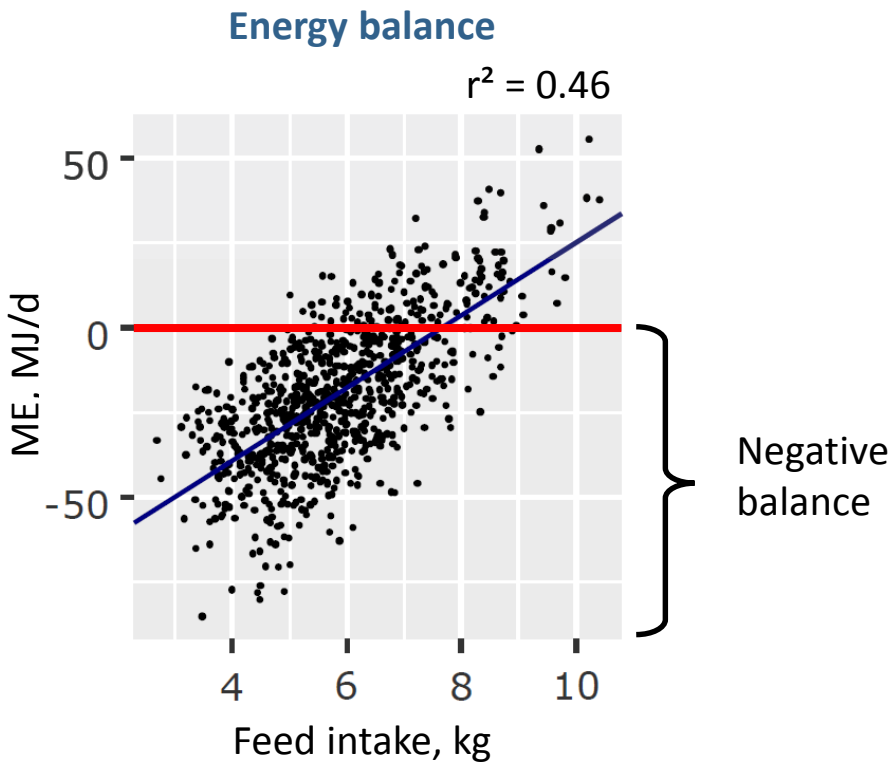
A huge variability of nutritional requirements:

- ➥ **between lactating sows**
- ➥ **accross the lactating period**

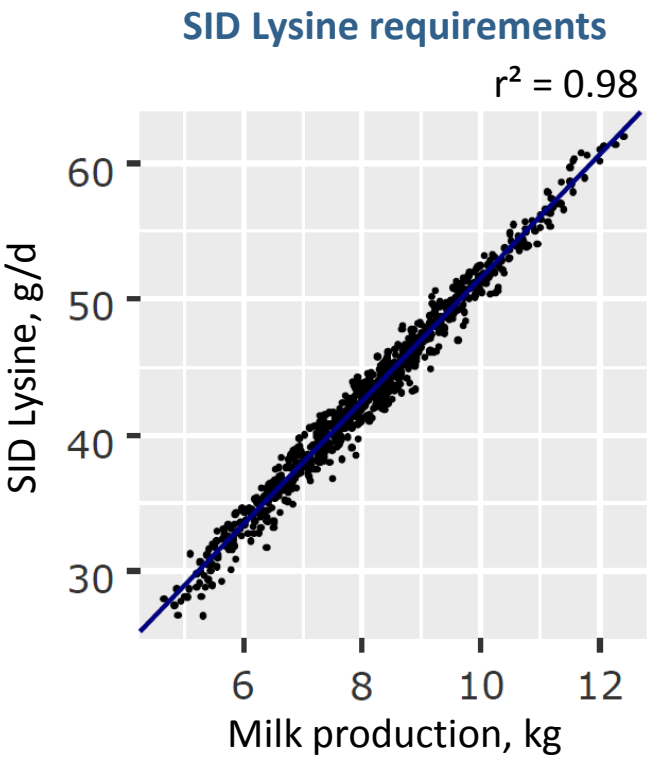
*ME: Metabolizable Energy

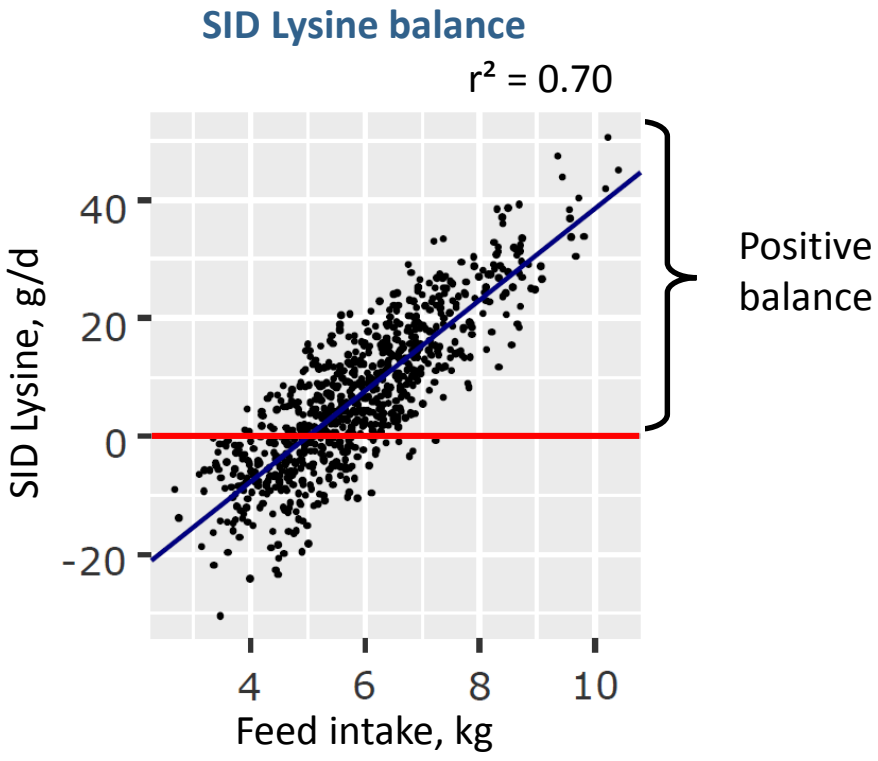
Individual energy requirements and balance





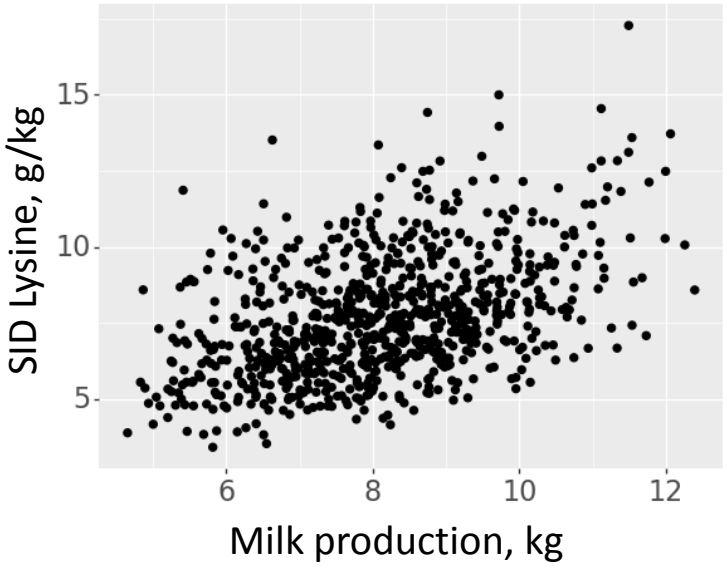
Individual SID Lysine requirements and balance



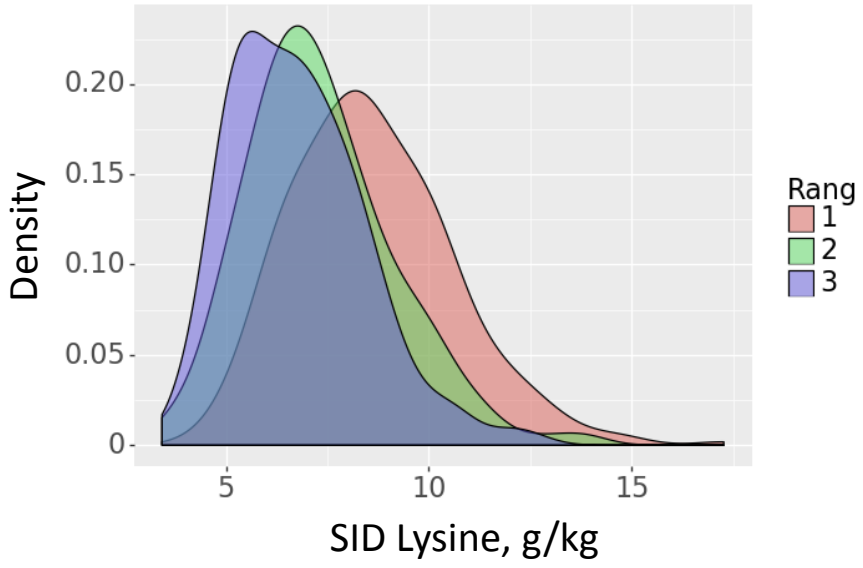


SID Lysine requirements per kilogram of diet

Individual variability



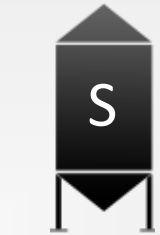
Variability by parity



Strong effects of

- ➥ **Milk production**
- ➥ **Sow's appetite**
- ➥ **Parity**

Virtual experiments



- Standard feeding

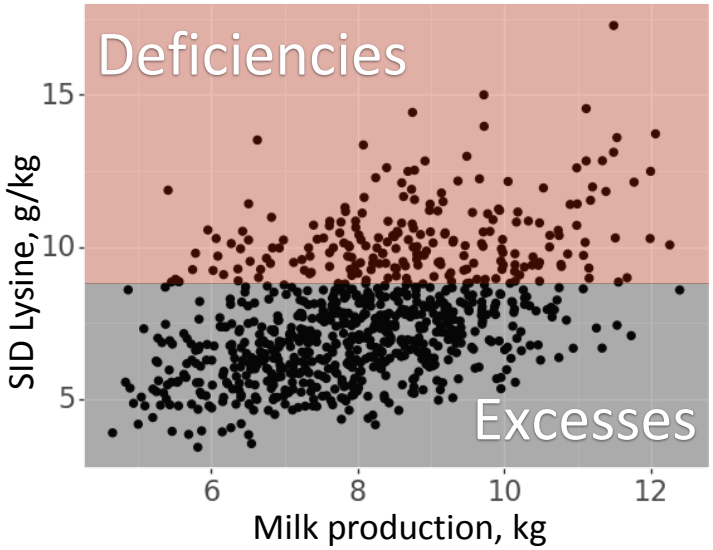
  Single diet for the whole herd

- Precision feeding

  A two-diet mix, for each sow, each day

Variability of digestible lysine requirements per kg of diet

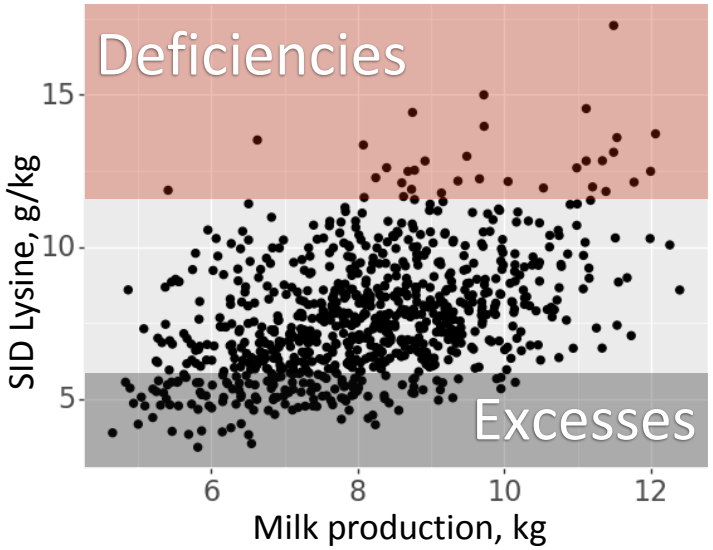
SID Lysine:
S: 8.5 g/kg



	
Feed intake, kg/d	5.84
Mean supply	
SID Lysine, g/kg	8.50
Average balance	
SID Lysine deficient supplies, g/d	5.66
SID lysine excesses, g/d	10.9

Variability of digestible lysine requirements per kg of diet

SID Lysine:
A: 11.5 g/kg
B: 6.0 g/kg



	S	A B	difference
Feed intake, kg/d	5.84	5.84	
Mean supply			
SID Lysine, g/kg	8.50	7.95	-6.2%
Average balance			
SID Lysine deficient supplies, g/d	5.66	2.10	-63%
SID lysine excesses, g/d	10.9	2.73	-75%

Conclusion and perspectives

Conclusion and perspectives

- Nutritional requirements are higly variable between lactating sows and accross time

- A two-diet mix applied to each lactating sow, each day may:
  - reduce lysine and protein intake (–6.2%)
  - while limiting excesses (up to 75%) and deficiencies (up to 63%) for digestible lysine

- Milk production and sow's appetite predictive algorithms will now be developped

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Thank you for your attention!