



# EAAP 2018

Dubrovnik, Croatia, 27<sup>th</sup> to 31<sup>st</sup> August 2018



## 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**

# Evolution of feeding practices

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- **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

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- **Objectives**

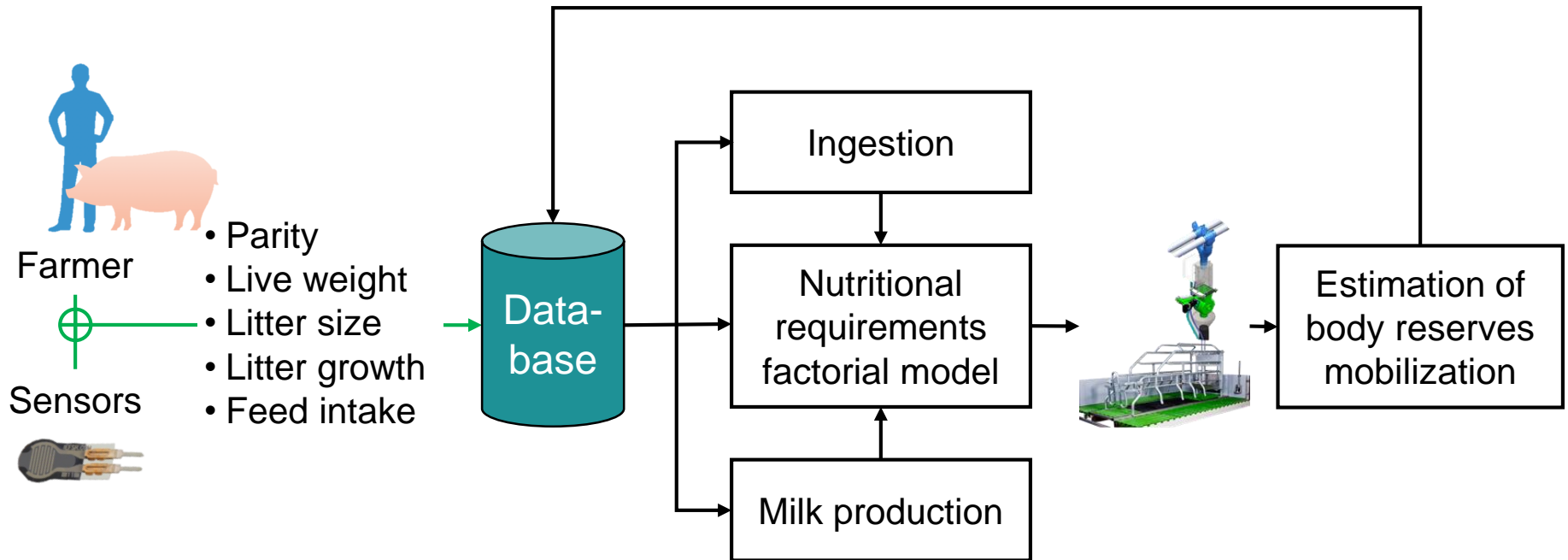
- Calculate individual requirements for lactating sows
- First step through a new DSS\* that could be embedded in automated feeding equipment

- **Approach**

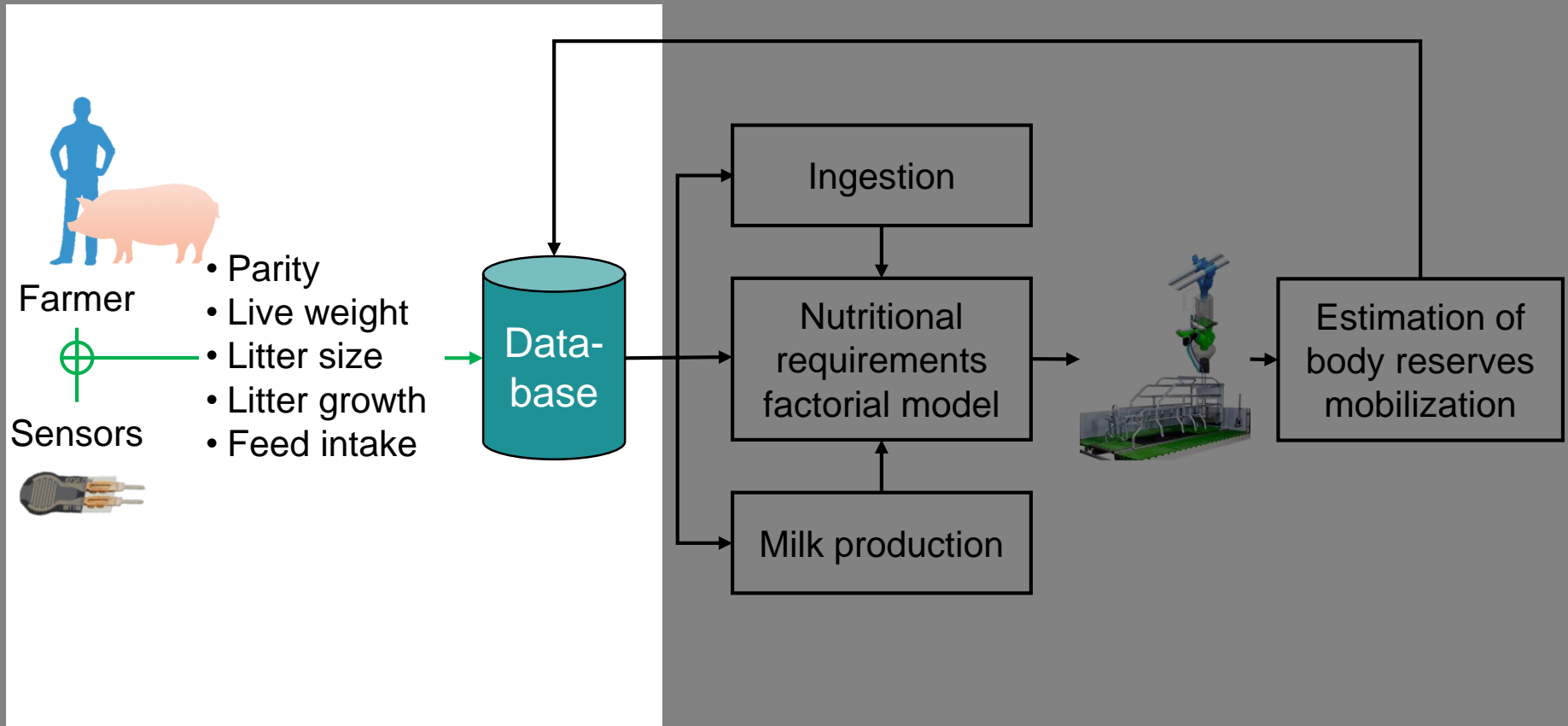
- Based on InraPorc model 
- Modelling of the effect of litter size, litter growth and feed intake on individual requirements

# Description of the DSS

# Description of the Decision Support System




# Description of the Decision Support System





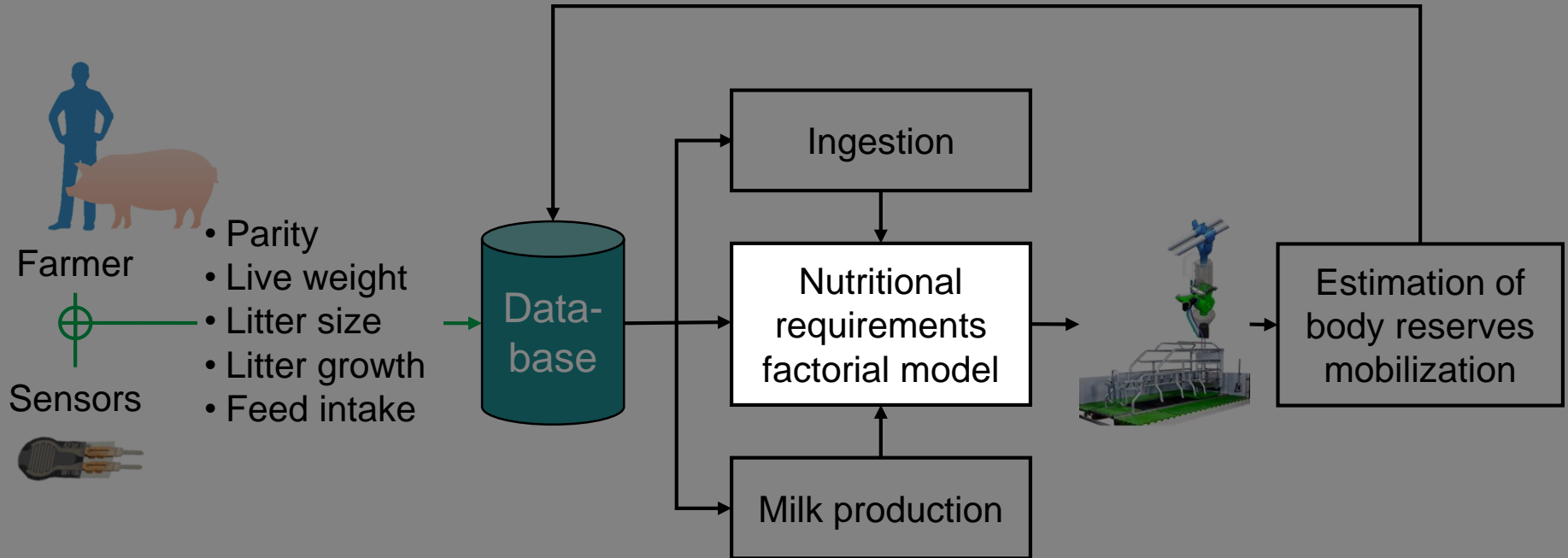
# Data used for the calculation of sows requirements



|                               | No  | Mean | SD  | 10 <sup>th</sup><br>percentile | 90 <sup>th</sup><br>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                            |

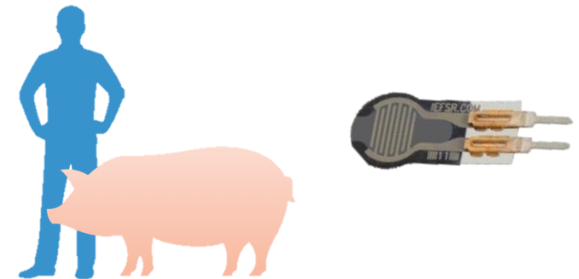
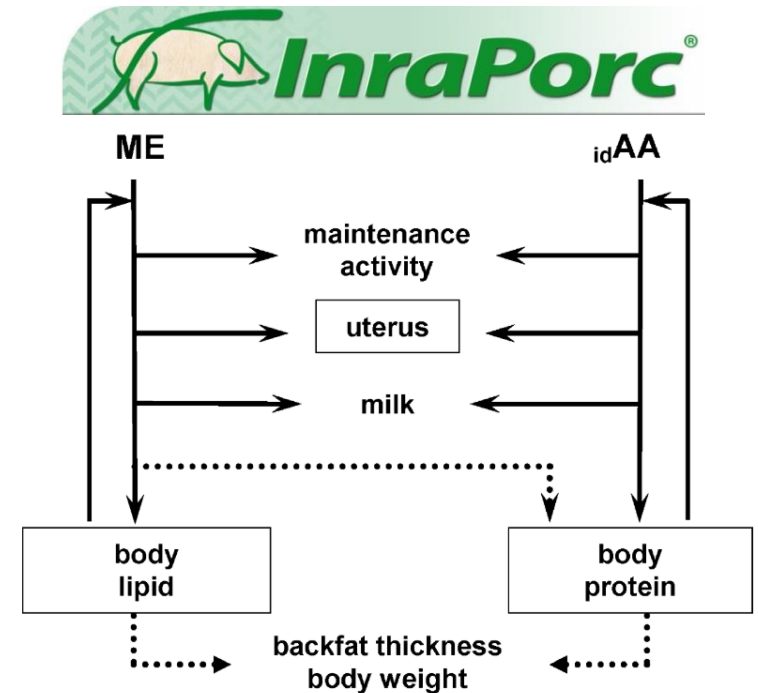
adapted from Lemay and Guay, 2017

# Description of the Decision Support System



# Nutritional requirements factorial model

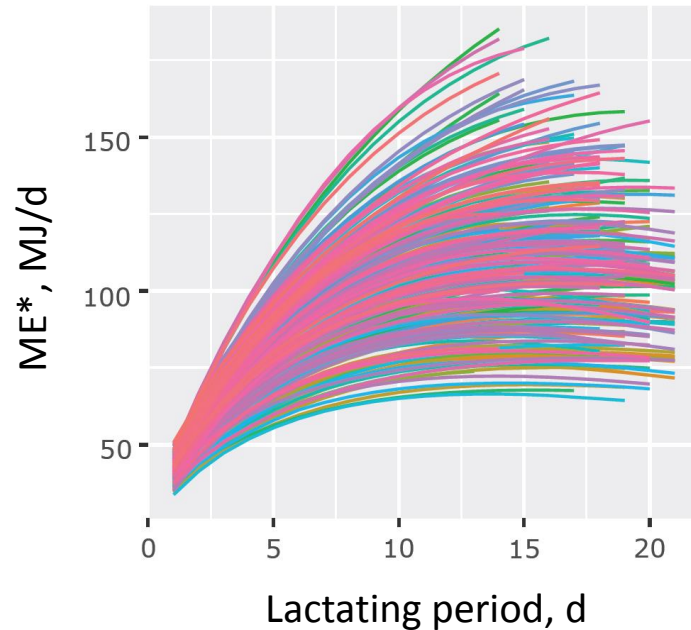
- Use of InraPorc Model
  - Energy requirements
  - BW and BF gain, and protein mobilization
  - SID\* amino acid, and mineral requirements
  - AA\* provided by the regressing uterus
- Sow characteristics at parturition:
  - Parity, BW, BF Thickness
- Daily information:
  - Litter size, feed intake



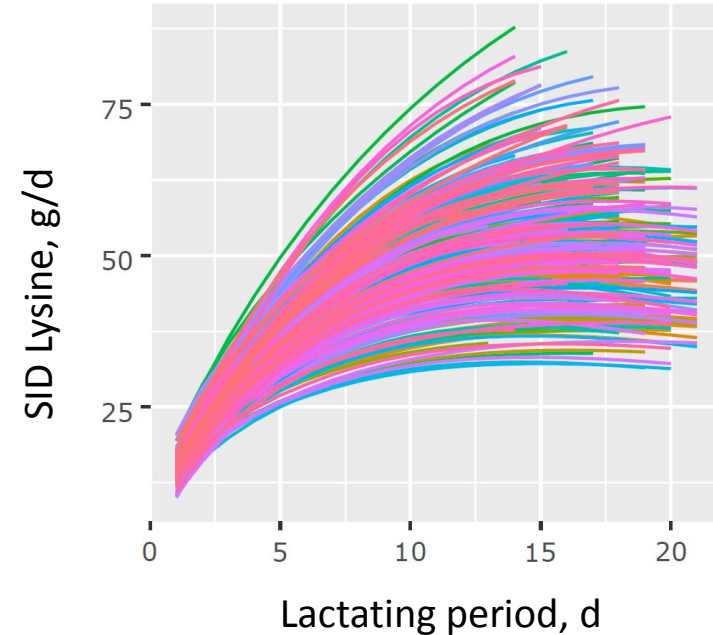
# Tests and validation

# Nutritional requirements evolution across the lactating period

## Energy requirements



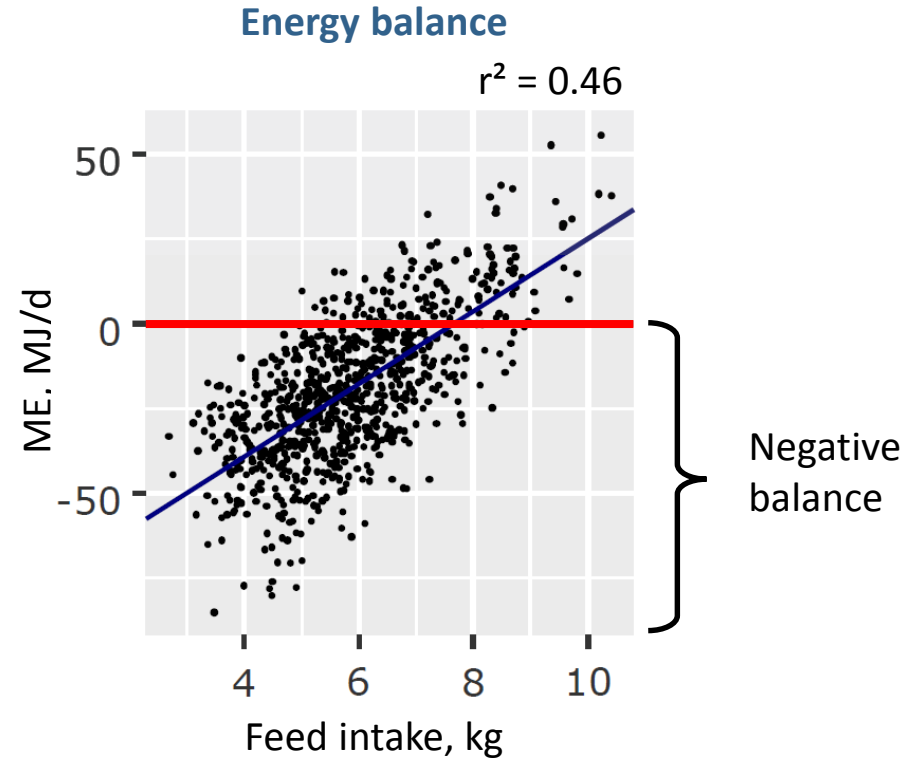
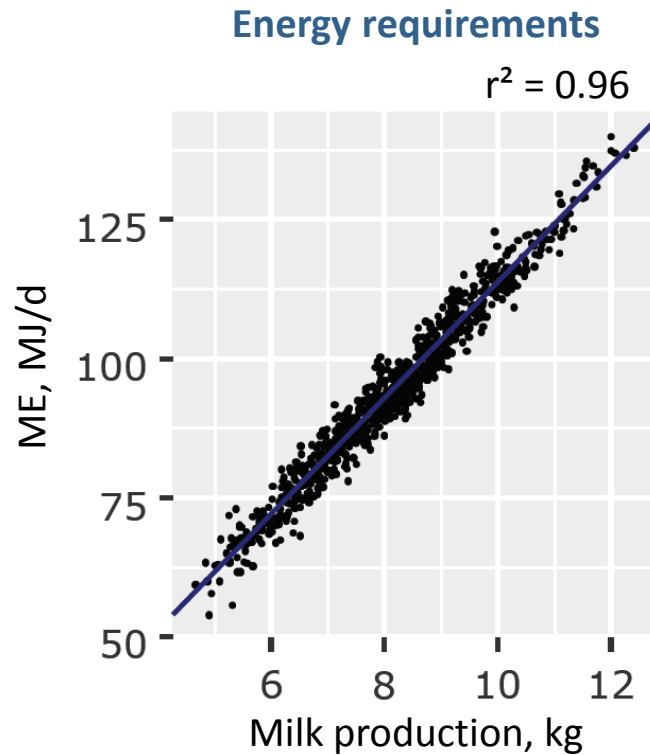
## Lysine requirements



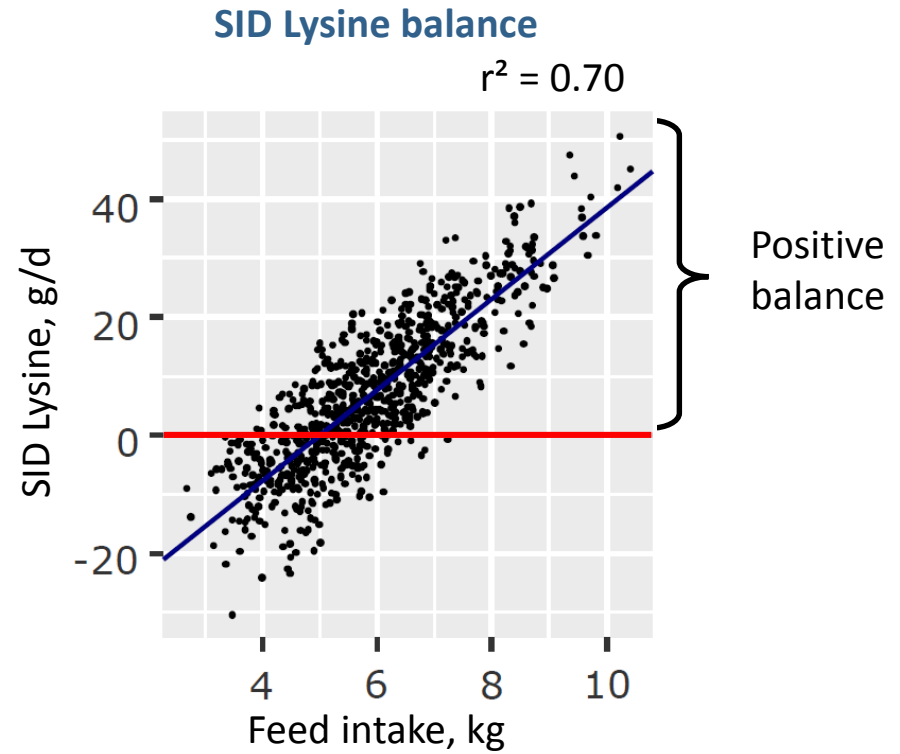
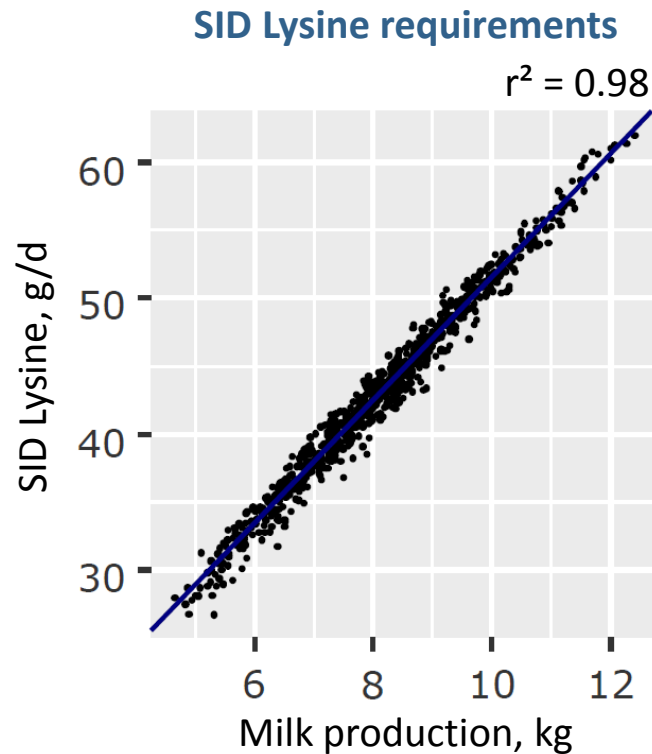
**A huge variability of nutritional requirements:**

- ➔ between lactating sows
- ➔ across the lactating period

# Individual energy requirements and balance

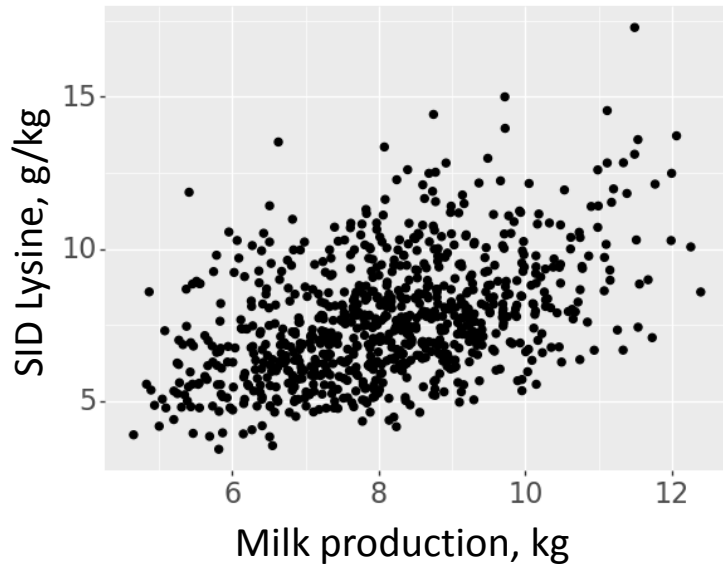


# Individual SID Lysine requirements and balance

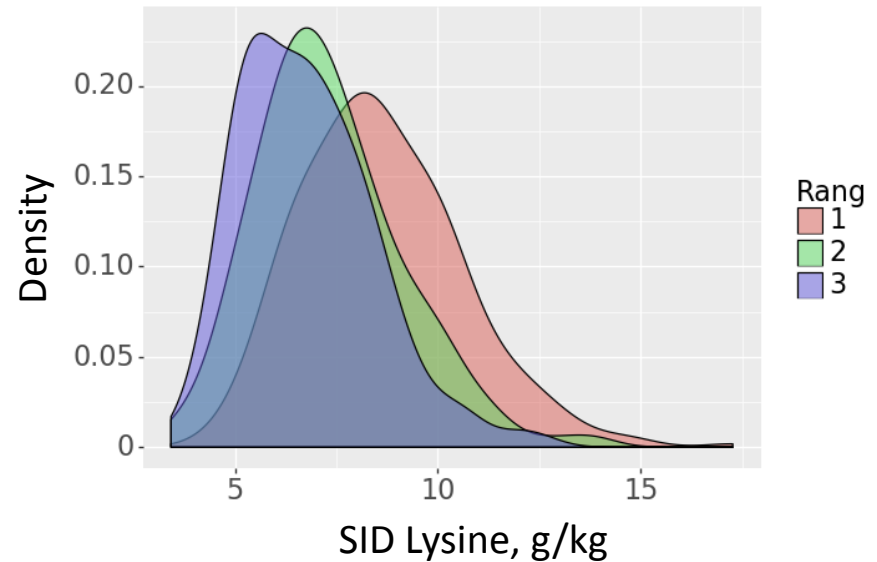


# SID Lysine requirements per kilogram of diet

Individual variability



Variability by parity



- Strong effects of**
- ➔ Milk production
  - ➔ Sow's appetite
  - ➔ Parity



# Virtual experiments

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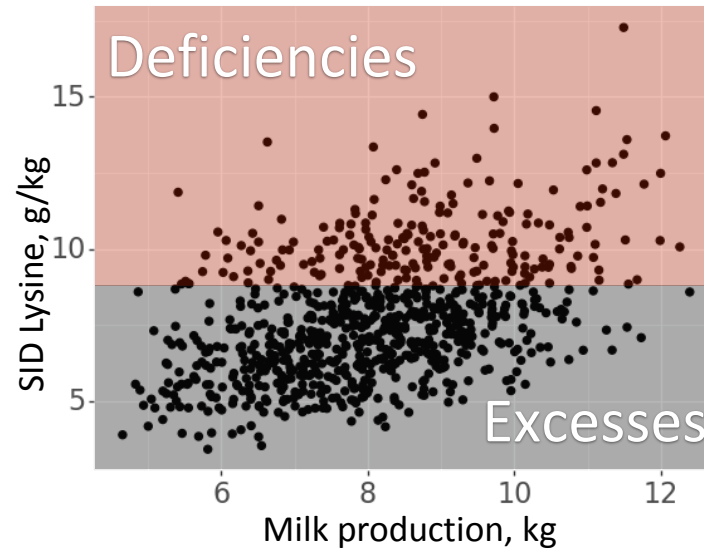


- Standard feeding  
Single diet for the whole herd
  
- Precision feeding  
A two-diet mix, for each sow, each day

# 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 |            |
| <b>Mean supply</b>                 |      |      |            |
| SID Lysine, g/kg                   | 8.50 | 7.95 | -6.2%      |
| <b>Average balance</b>             |      |      |            |
| SID Lysine deficient supplies, g/d | 5.66 | 2.10 | -63%       |
| SID lysine excesses, g/d           | 10.9 | 2.73 | -75%       |

# Conclusion and perspectives

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- Nutritional requirements are **highly variable** between lactating sows and across 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 developed



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**Thank you for your attention!**

