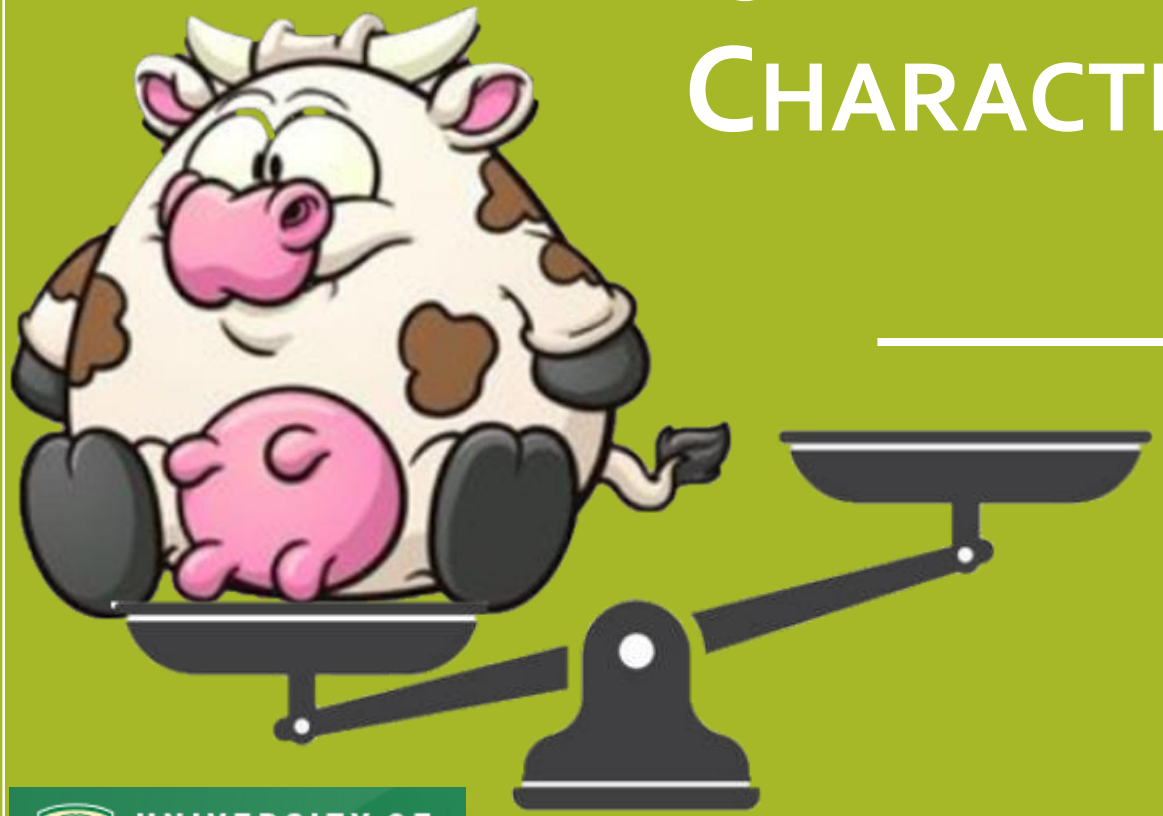
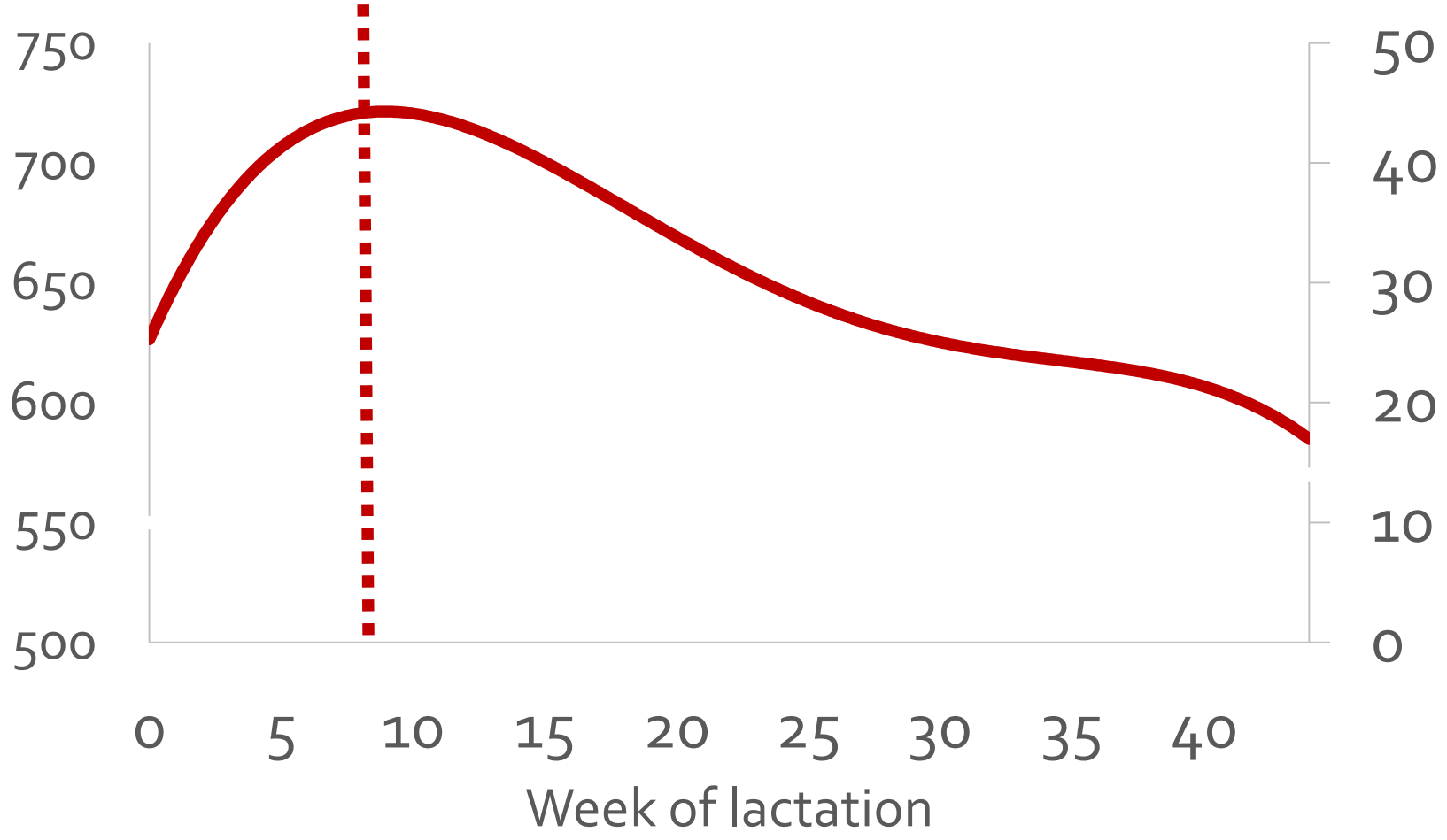
Validation of the Prediction of Body Weight From Dairy Cow Characteristics & Milk MIR Spectra



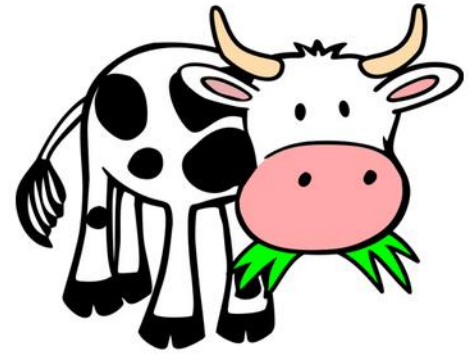
Soyeurt, H., Froidmont, E., Dufrasne, I., Wang, Z., Gengler, N., Dehareng, F., Consortium, G.P.L.U.S.E., Grelet, C.

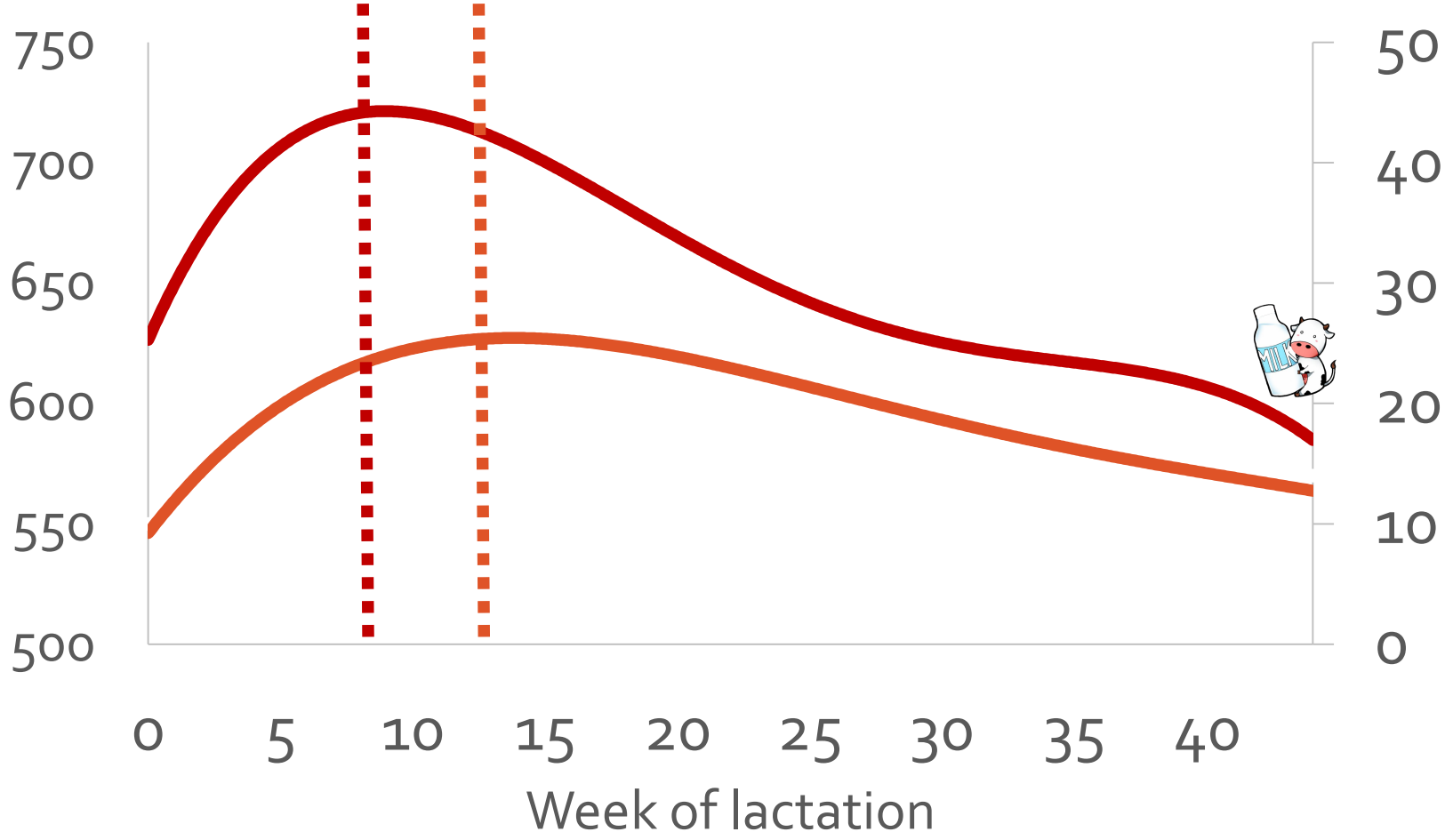
EAAP meeting, August 2019, Ghent

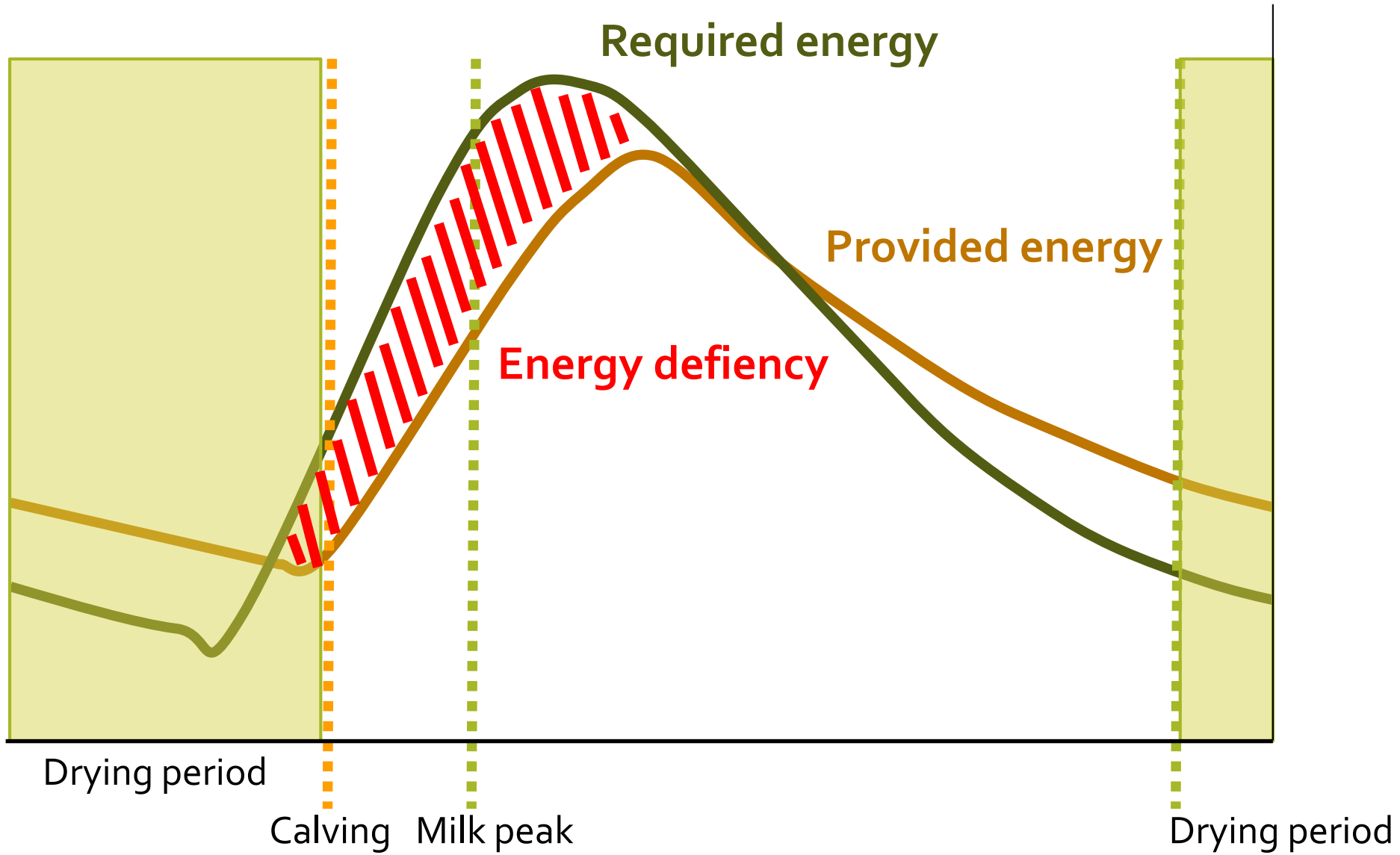
Milk production



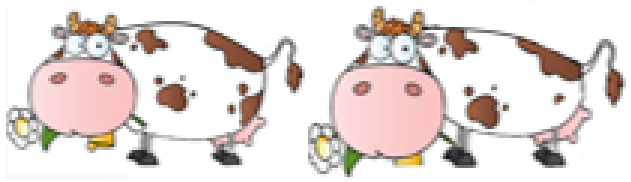
Dry matter intake

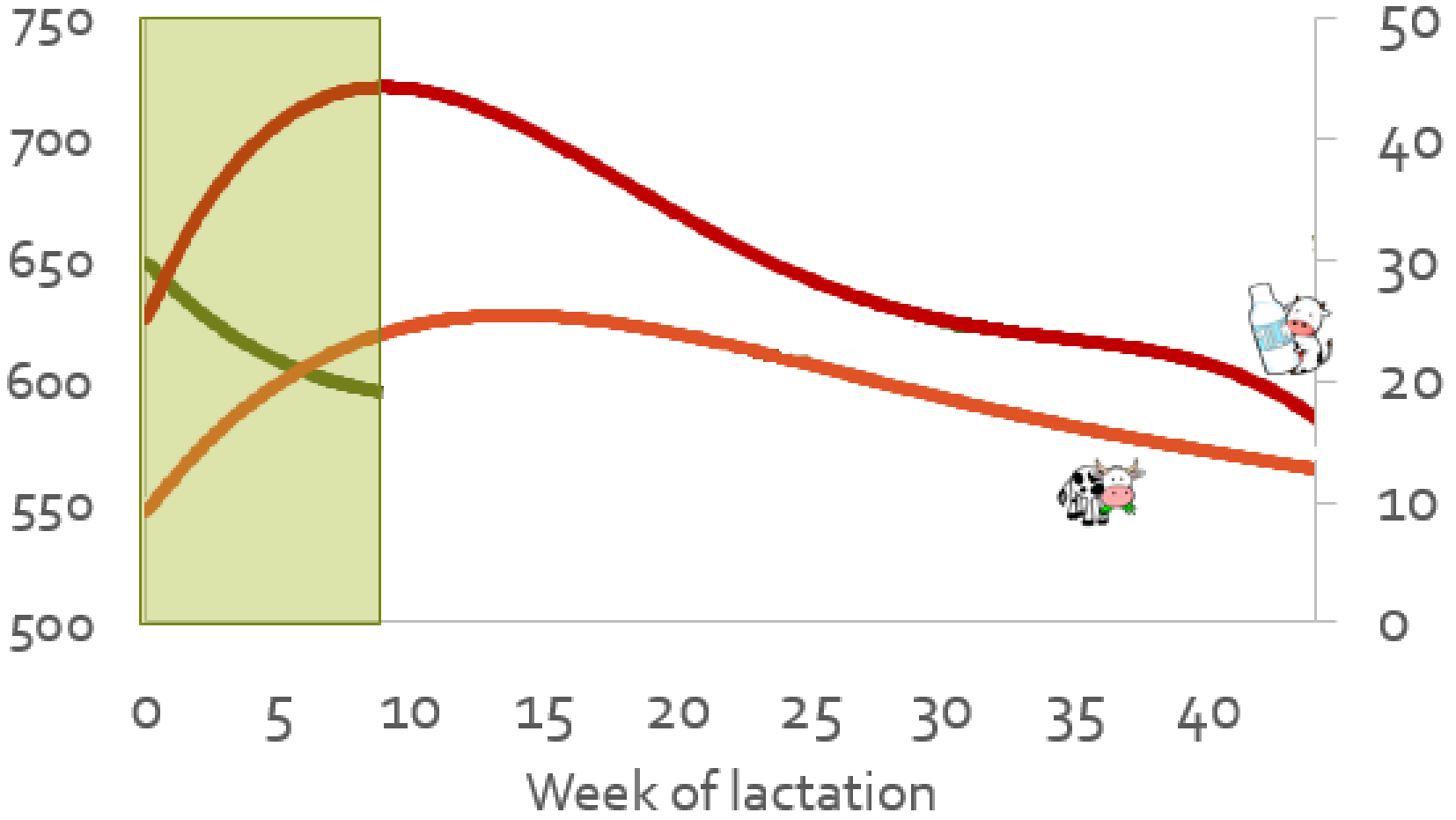





Required energy
Provided energy
Energy defiency
Drying period
Calving
Milk peak
Drying period

Body weight




750
700
650
600
550
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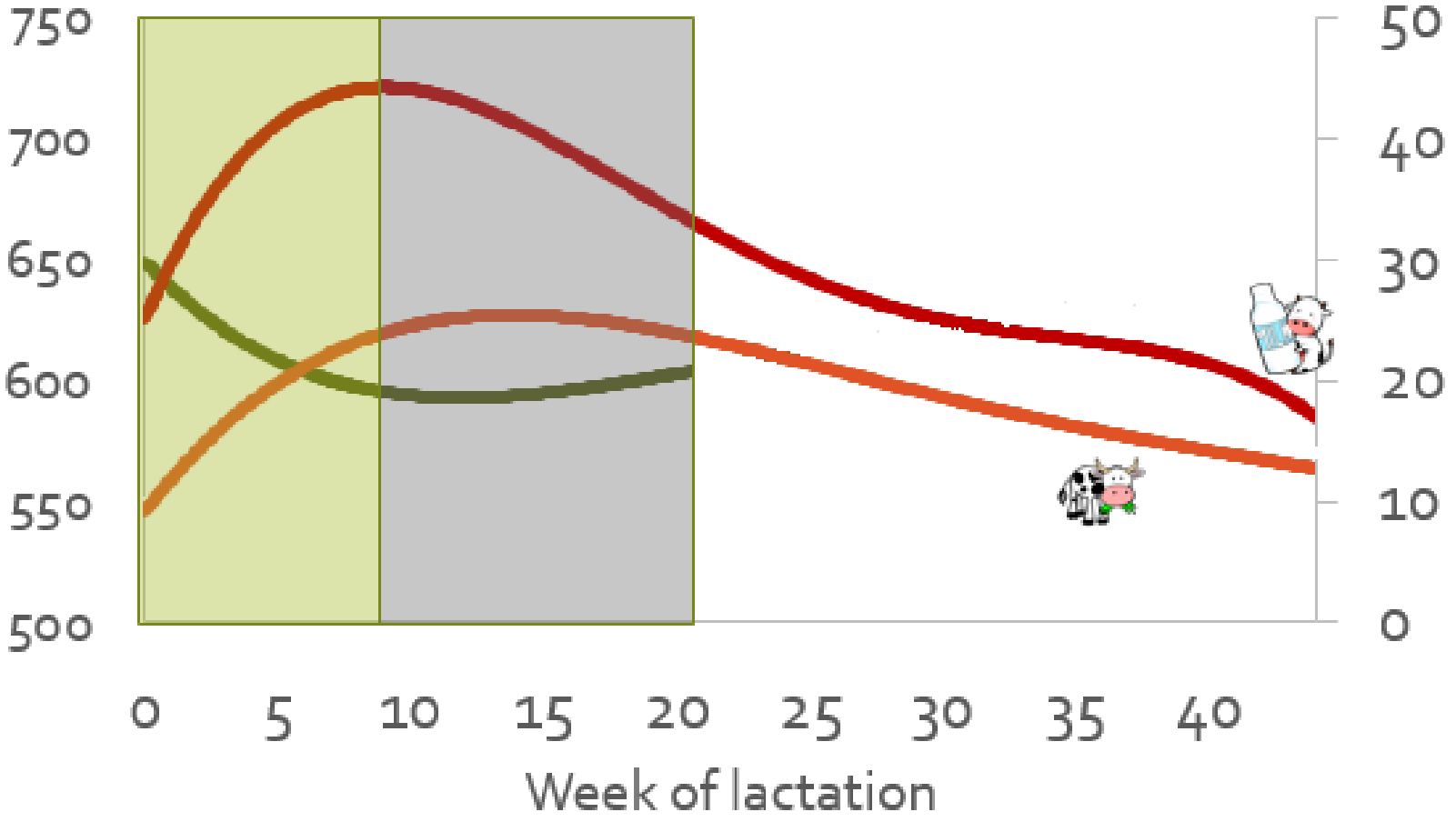
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Week of lactation

Body weight


750
700
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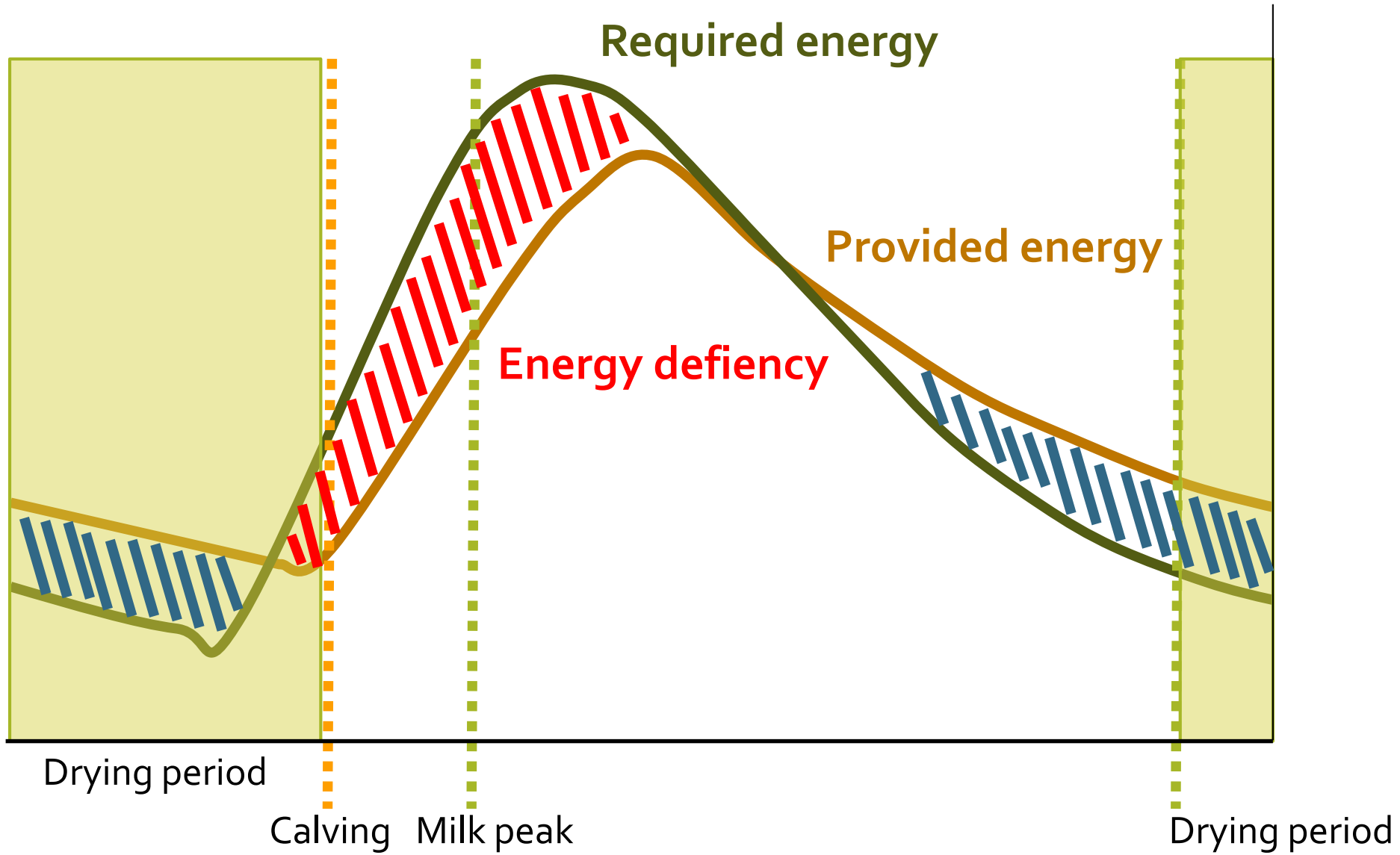
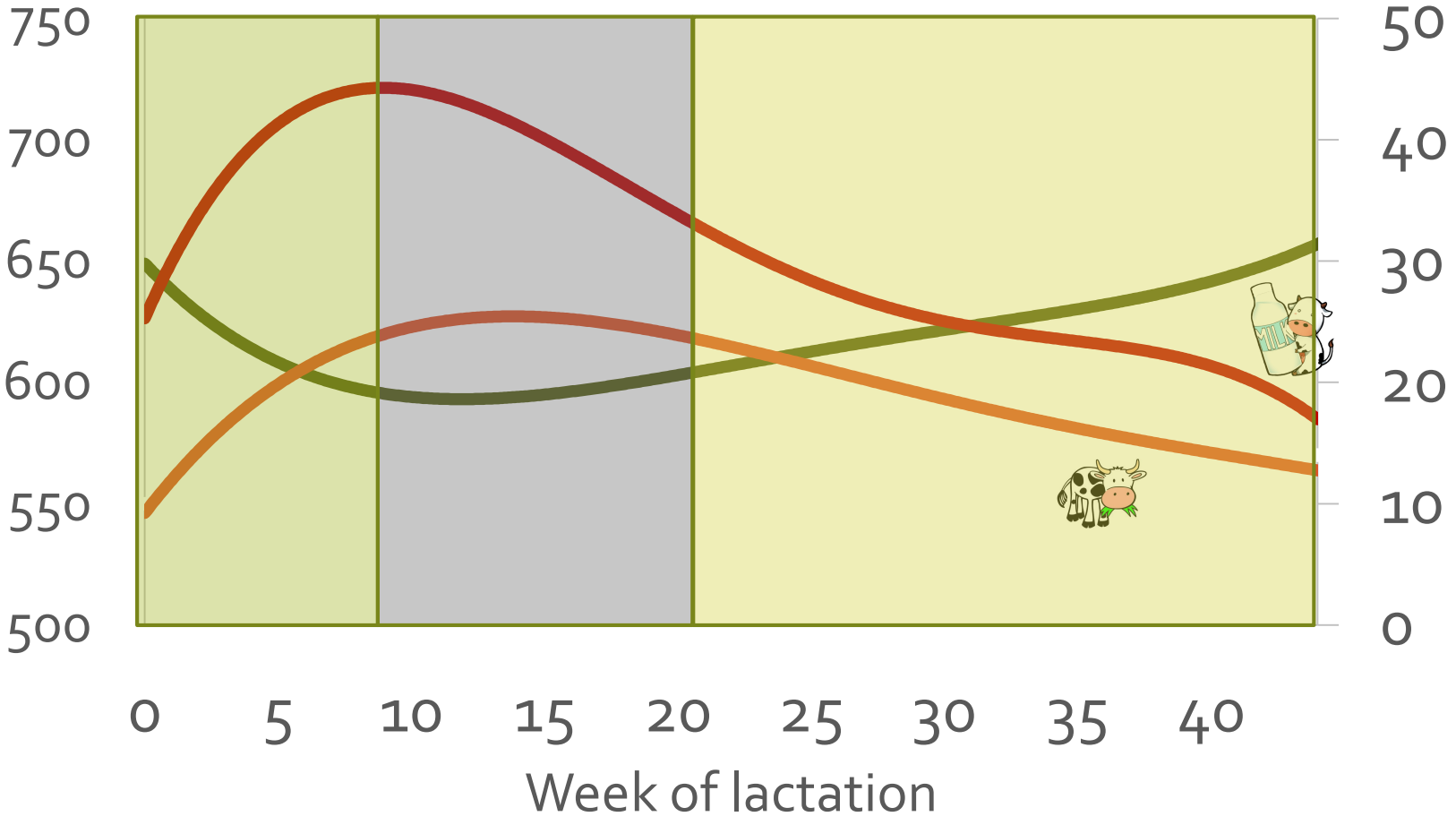
10
0
0
5
10
15
20
25
30
35
40
Week of lactation


Required energy
Provided energy
Energy defiency
Drying period
Calving
Milk peak
Drying period

Body weight


750
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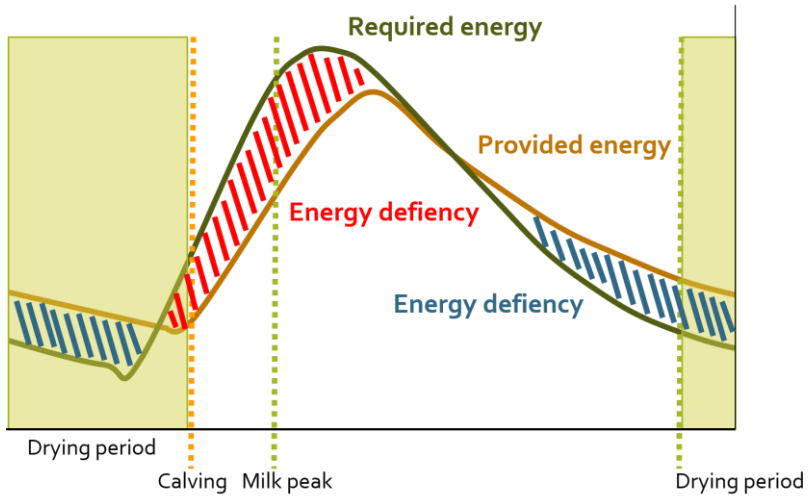
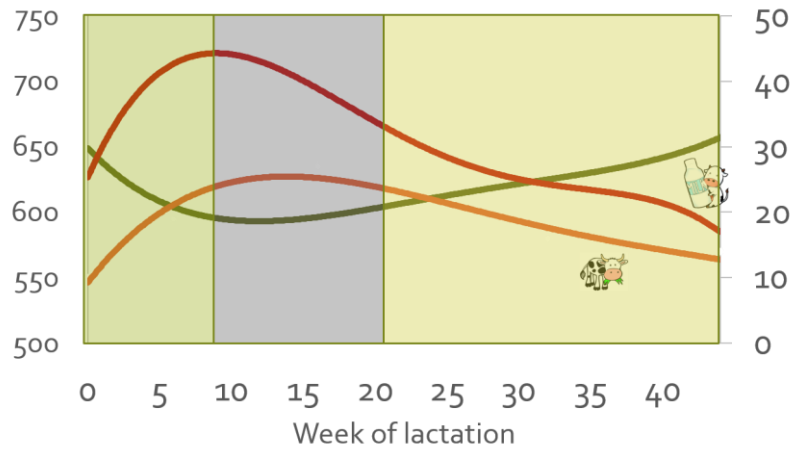
Week of lactation





Body weight is an indicator of the energy status of the cow

Metabolic disorder

Nutritional requirements

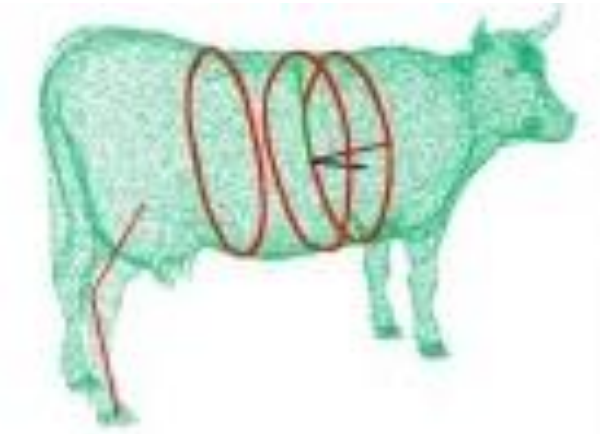
Environment

Measurement of body weight

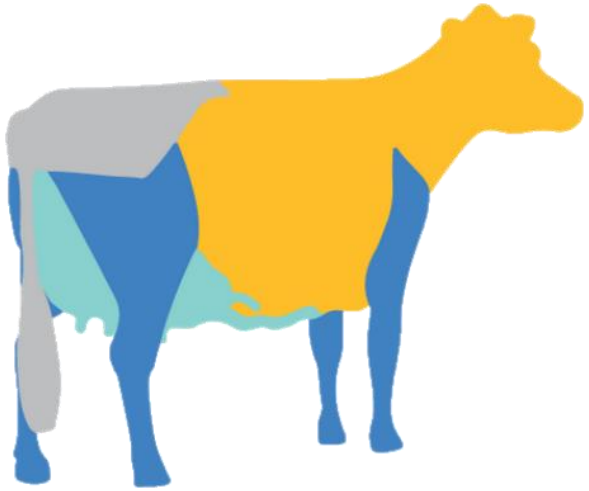
- Not in all farms
- Not always well calibrated

Calibrated electronic or mechanic weighing scale

Measurement of body weight



- Digital image
  - R=0.97 for live weight [Tasdemir et al., 2011]
  - Such camera are not installed in many farms



- Linear classification
  - Not all cows are classified
  - One classification in first lactation

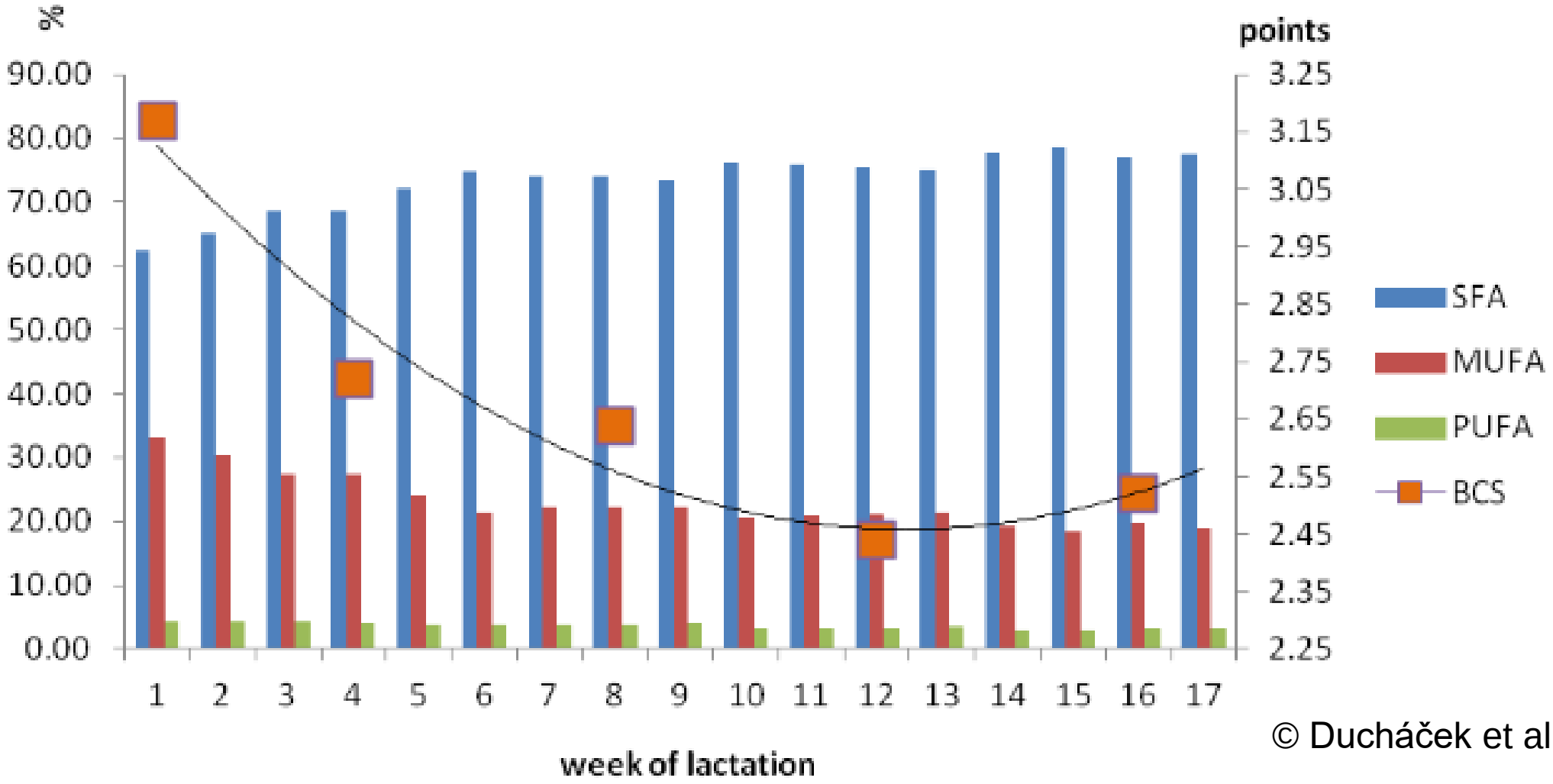
Relationships with milk

- Milk yield
  - Positive association [Roche et al., 2007]
  - But weak [Berry et al., 2003]

- Milk composition: positive links with
  - Fat content
  - Lactose content
  - Protein content

[Roche et al., 2007]

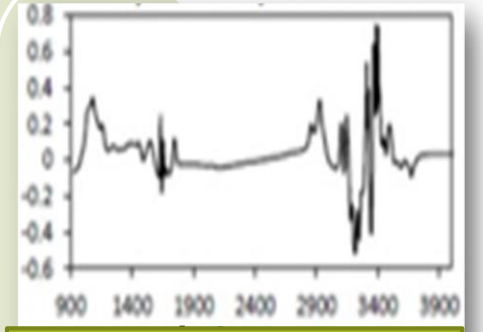
Relationships with milk



© Ducháček et al., 2011

Milk sampling

MIR spectrometry

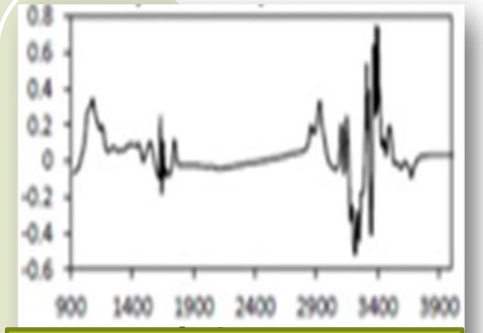


Prédictions

Fat
Lactose
Protein
Fatty acids
…

Milk sampling

MIR spectrometry



Prédictions

Development of a MIR based equation to predict body weight

First results

ELSEVIER

Livestock Science

Volume 227, September 2019, Pages 82-89

Contribution of milk mid-infrared spectrum

st-day body

lactation number,

Z. Wang [d], C. Bertozzi [e], F.G. Colinet [a], F.

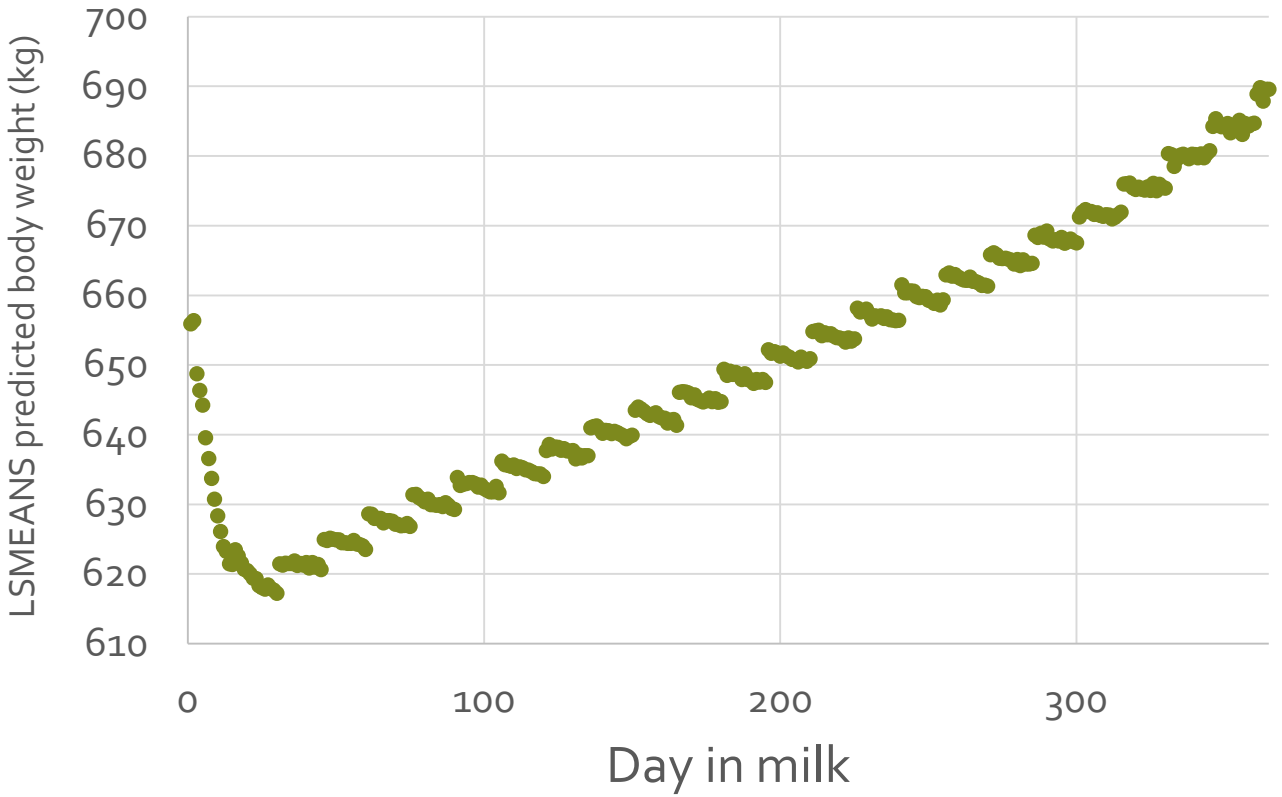
Highlights

- Milk MIR spectrum is an animal specific trait for the prediction of body weight.
- Adding milk MIR spectrum improved of 7% the accuracy of predicted body weight.
- Body weight predicted by easily recorded traits had an error between 37 and 64 kg.

N=717 records
Cross-validation (cv) R^2 = 0.51
RMSEcv = 50 kg.

Implementation on Walloon database

N= 3,205,153 test-day records



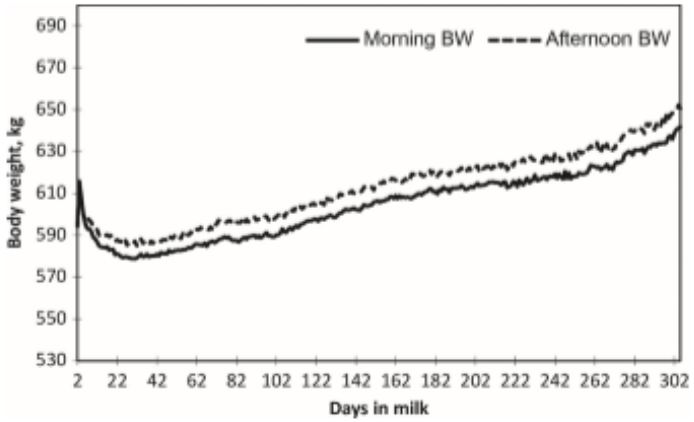
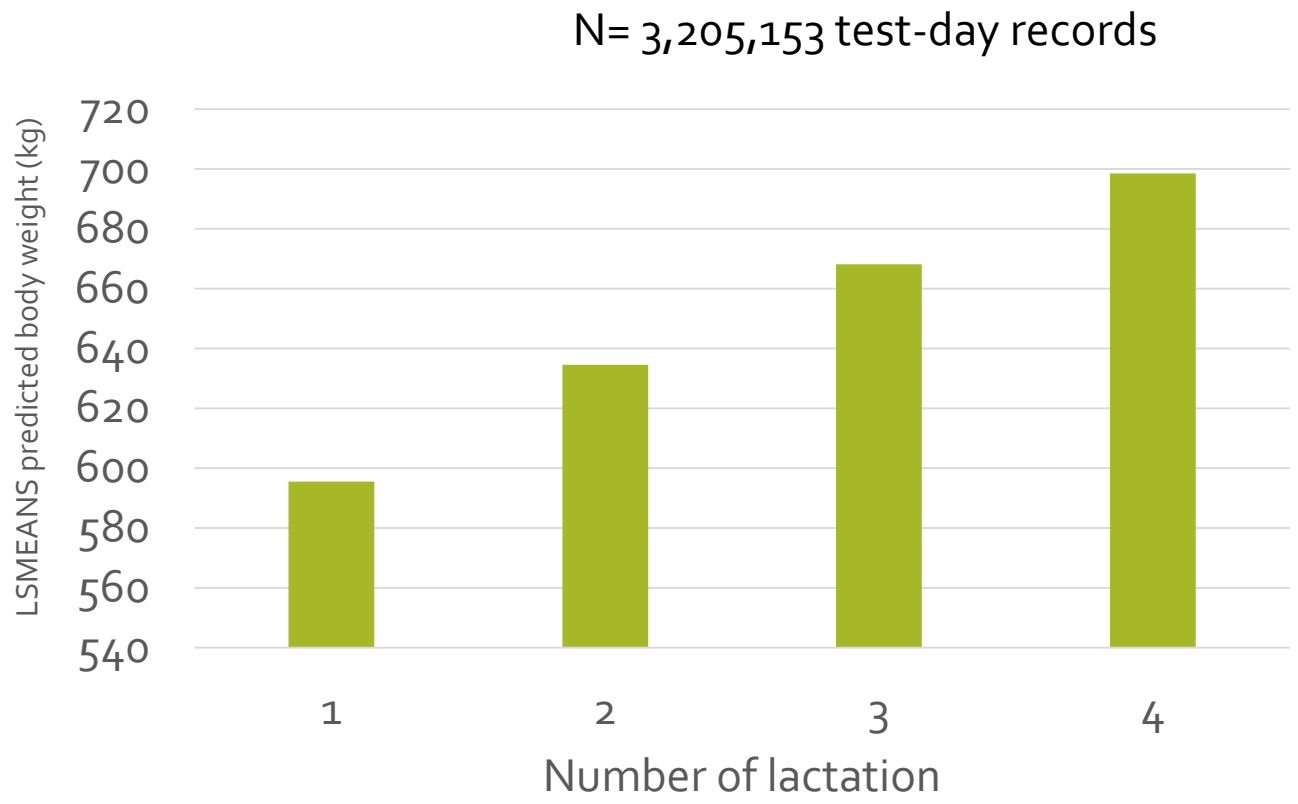


Figure 1. Lactation day averages of morning (around 0700 h) and afternoon (around 1700 h) BW of the Nordic Red Dairy cows (230 cows).

[Mäntyssari et al., 2015]

Implementation on Walloon database



External Validation

- 1,161 obs.

GplusE

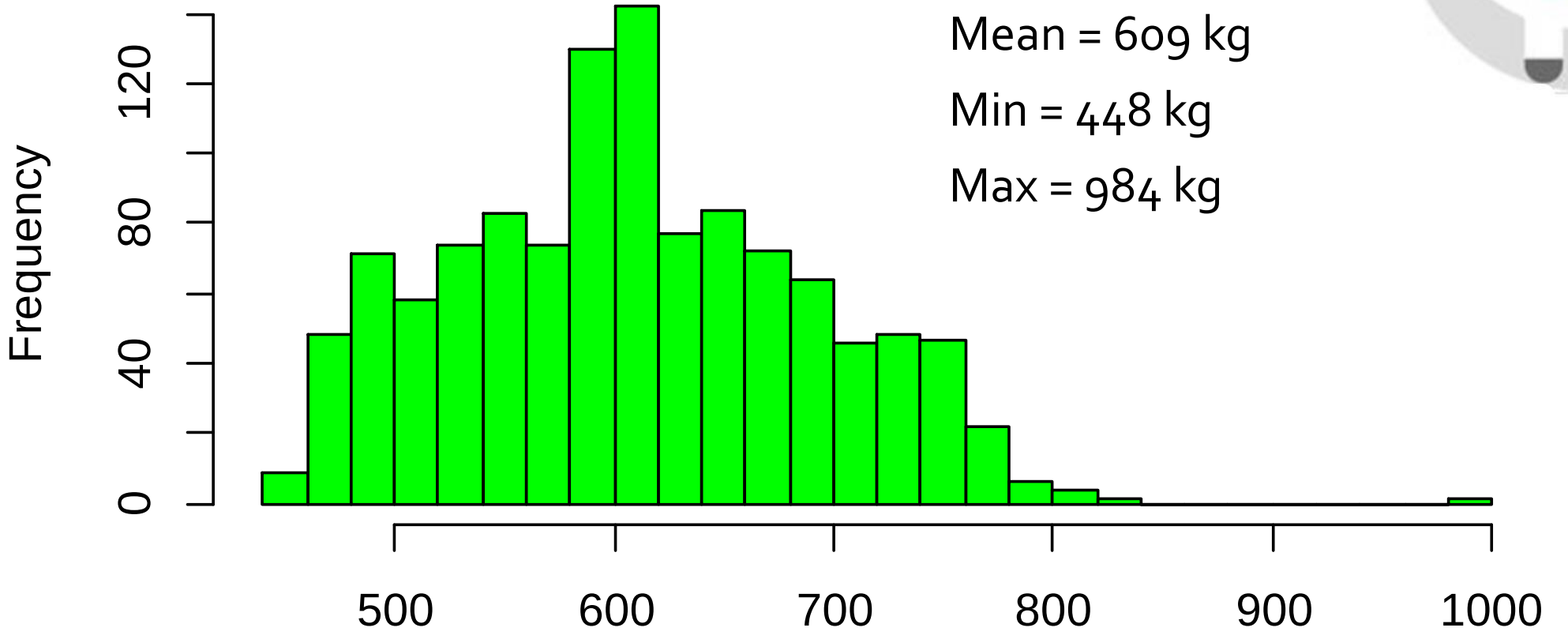
FP7 project

Equation

- Milk yield
- Days in milk
- Parity
- Season of test
- MIR spectra
- PLS regression

Prediction

Distribution of BW data in GplusE project



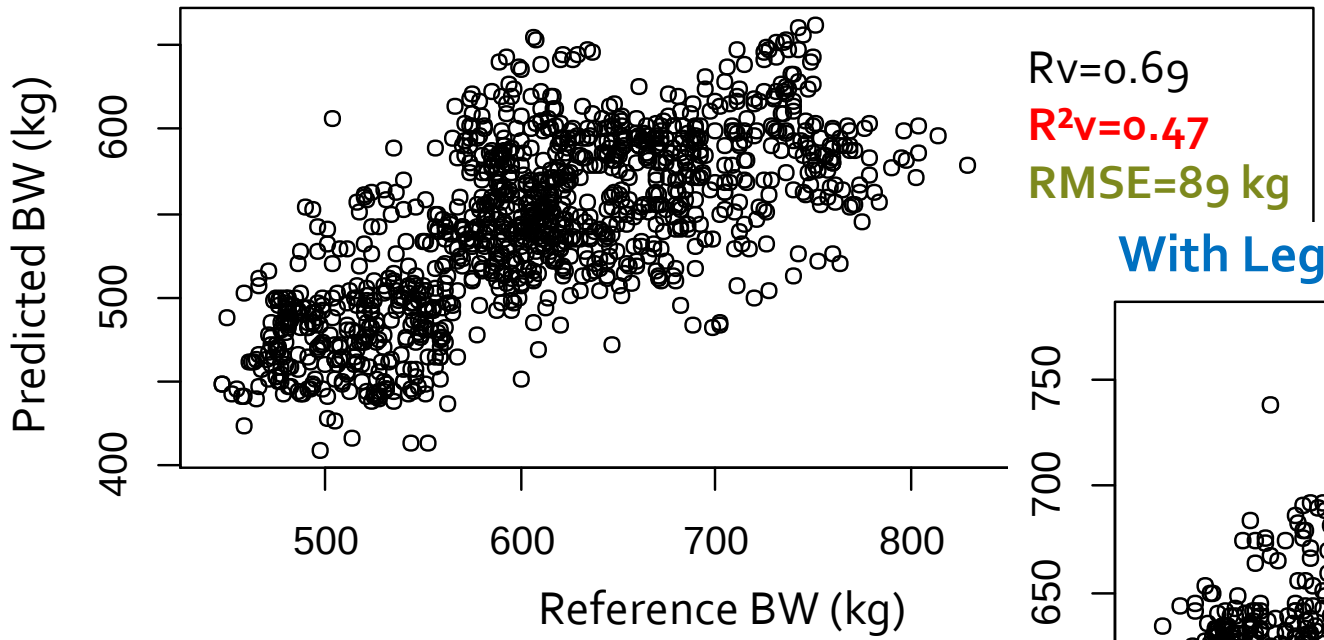
Predictions

Lack of spectral variability

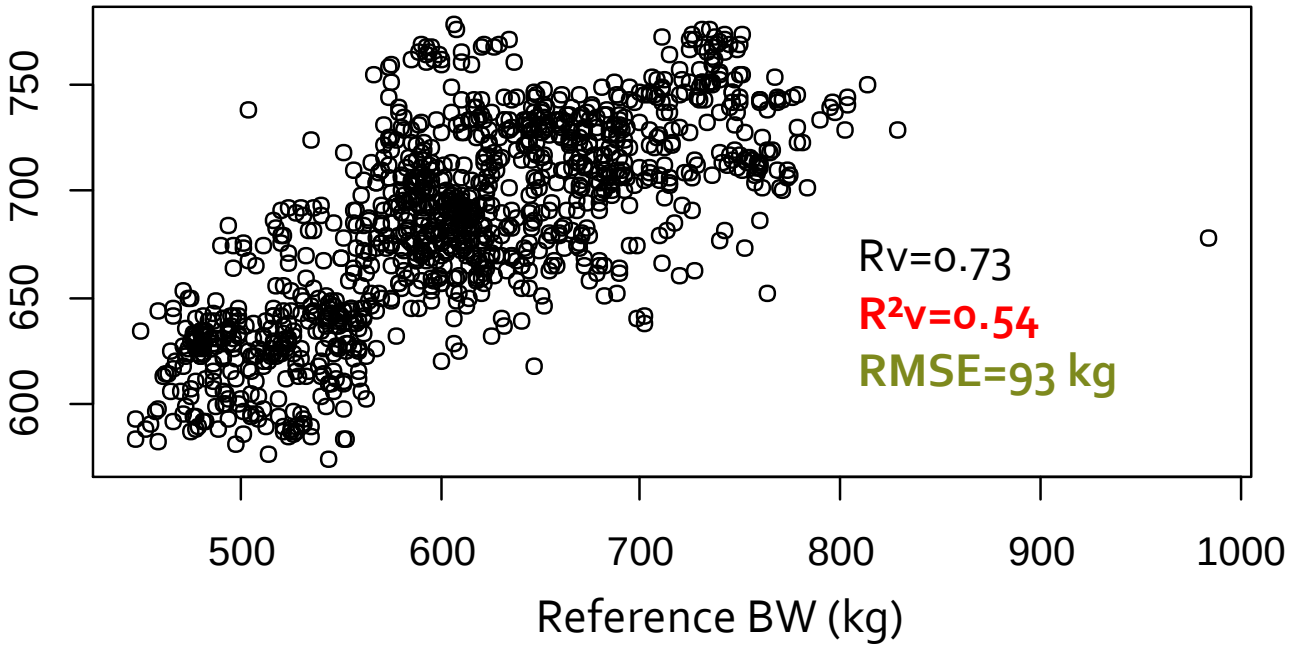
Livestock Science
Volume 227, September 2019, Pages 82-89

N=717 records
Cross-validation (cv) R^2 = **0.51**
RMSEcv = **50 kg**.

Without Legendre polynomials



With Legendre polynomials



$R^2v = 0.54$

RMSEv = 93 kg

N = 1,161 records

Mean = 609 kg

Min = 448 kg

Max = 984 kg

R^2cv

RMSEcv

Merging the 2 datasets

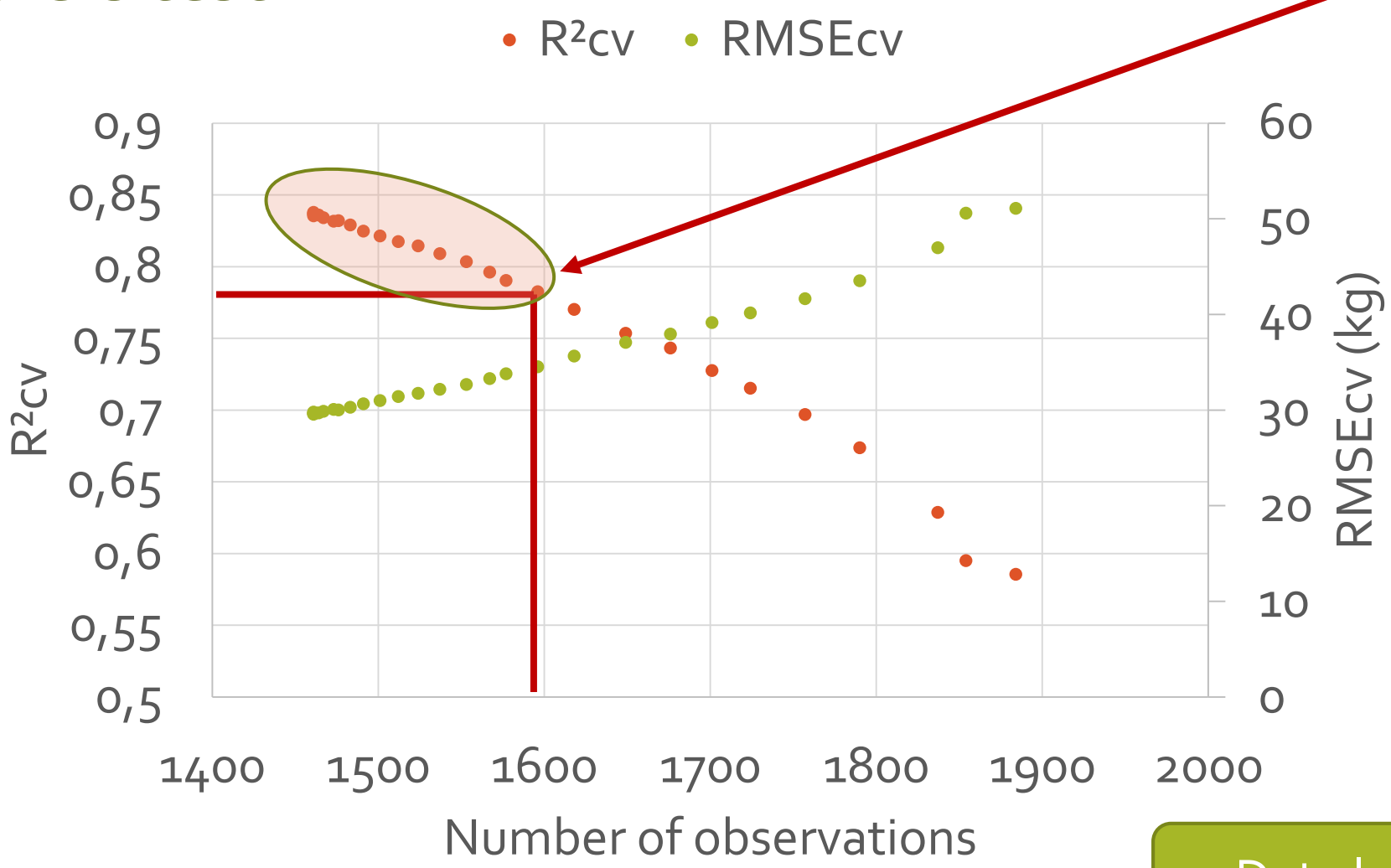
Cleaning for extreme spectra

N = 1,854 records

10 fold cross-validation

PLS regression

T outliers test



N=1,577
R^2c=0.81
R^2cv=0.79
RMSEc=32.34
RMSEcv=33.80

Data loss=14,89%

Without Legendre polynomials

$R^2v = 0.54$

RMSEv = 93 kg

N = 1,161 records

Mean = 609 kg

Min = 448 kg

Max = 984 kg

$R^2cv = \mathbf{0.79}$ N=1,577

RMSEcv = **34 kg**

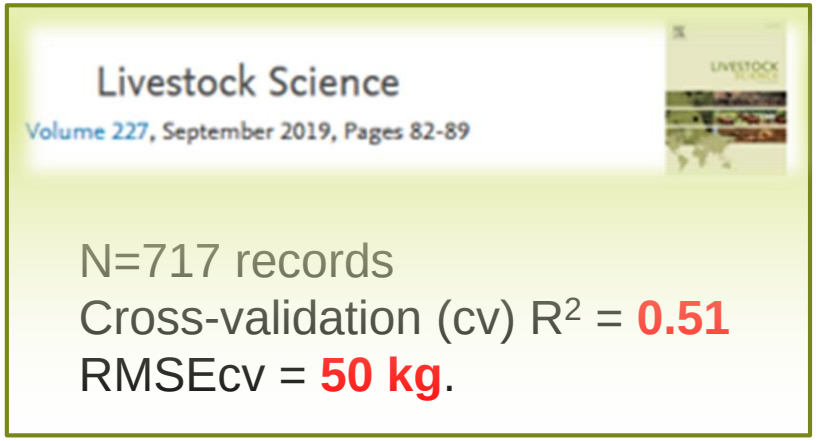
Merging the 2 datasets

Cleaning for extreme spectra

N = 1,854 records

10 fold cross-validation

PLS regression



Better results were obtained thanks to the increase of the dataset

Conclusions

- There was a lack of spectral information in the first dataset
  - ➔ GplusE collaboration
- Better results were obtained due to the increase of the dataset
  - ➔ ↑ collaborations to share the data
- Confirmation of the interest of adding MIR in the calibration model
  - ➔ $R^2cv = 0.79$ and RMSE = 34 kg
- MIR provides information specific to the animal at a specific day in milk with a high recording frequency:
  - Metabolic disorder (e.g., BW changes)
- Possibility to predict past information – Interesting for genetic purposes
  - Environment

Validation of the Prediction of Body Weight From Dairy Cow Characteristics & Milk MIR Spectra

Soyeurt, H., Froidmont, E., Dufrasne, I., Wang, Z., Gengler, N., Dehareng, F., Consortium, G.P.L.U.S.E., Grelet, C.

If you have data to increase the calibration set and you want to share it, contact me : **hsoyeurt@uliege.be**

EAAP meeting, August 2019, Ghent