SENSITIVITY OF BEEF COW REPRODUCTION TO BODY LIPIDS DYNAMICS
A MODELING APPROACH

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Beef cattle production systems

- Grazing systems
- 1 calf/year/cow

Future production conditions

Human population growth
Climate change
Competition for resources

Availability of concentrates for beef production

Beef cow systems ⇒ More extensive

Aby et al, 2012
Limited availability of concentrates
◆ diets mainly based on locally available feed resources
◆ feeding systems more sensitive to climate hazards such as droughts

Risk of an increase of unexpected underfeeding periods that may occur at different stages of the production cycle of cows with various amplitudes and durations.

Robustness of beef cow production systems ??

Cow performances ??
Modeling approach

- to predict the effects of body condition dynamics on the reproductive performance of beef cows
- to study the sensitivity of the cow to changes in nutritional environment at the lifetime scale
The BREsNUS model

A model of Beef cattle REproduction sensitivity to NUtritional trajectories

- time of resumption of cyclicity after calving
- time of ovulations and oestruses
- time of conception

Empirical laws to connect the effects of the nutritional trajectories to reproductive events

Agabriel and Blanc, 2008
Model of the nutritional trajectories ⇒ body lipids dynamics

Context

Baseline trajectory:
Pattern of body reserve changes associated to physiological status

Approach

Energy requirements covered

Results

Implications

Conception

Body lipids mobilization

Body lipids reconstitution

Body Lipids (kg)

Calving (n)

Calving (n+1)

PREGNANCY

time

Friggens et al, 2011
BREsNUS simulates body lipids changes and reproductive performance at the lifetime scale.

Baseline trajectory fitted on experimental data from Charolais cows (Exp. unit, Bourges)
Model of the nutritional trajectories $\Rightarrow$ body lipids dynamics

- **Energy requirements covered**
  - Underfeeding period
  - Deviation
  - Conception

- **Variable nutritional environment**

**Approach**

**Context**

**Results**

**Implications**

**Energy requirements covered** + **Variable nutritional environment**
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<td>BREsNUS a tool to explore beef cows sensitivity to nutritional disturbances</td>
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BREsNUS a tool to explore beef cows sensitivity to nutritional disturbances
Perturbations have different effects according to the time when they occur.

At early pregnancy, underfeeding occurs.

Int. from calving to conception: + 9 days.
Underlying physiological dynamics of body lipids influences the pattern of the adaptative trajectory and the effects on the reproductive performance.
<table>
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Nutritional perturbations have different effects according to their intensity and duration.

- **Short but intense** → + 56 days
- **Long but low** → + 27 days

**Context**

**Approach**

**Results**

**Implications**
Cows with different abilities to cope with underfeeding perturbation

**Context**
- Cows with different abilities to cope with underfeeding perturbation

**Approach**
- Understanding the impact of underfeeding on cows' body lipid reserves

**Results**
- Low ability to reconstitute body reserves:
  - Body lipids decrease significantly.
- High ability to reconstitute body reserves:
  - Body lipids maintain higher levels during underfeeding.

**Implications**
- Early identification of cows with high ability to reconstitute body reserves can improve management strategies.

**Graph Details**
- **Y-axis**: Body lipids (kg)
- **X-axis**: Age (days)
- **Events**:
  - 1: Calving
  - 2: Underfeeding

**Legend**
- **Calving**: Yellow triangle
- **Conception**: Pink star
- **Underfeeding**:
  - Yellow arrow

**Graph Annotations**
- **High ability to reconstitute body reserves**: Green line
- **Low ability to reconstitute body reserves**: Pink line
CONCLUSION
• BREsNUS = a model to study the sensitivity of productivity of beef cows to a variable nutritional environment at the lifetime scale.

• As a perspective, a tool to explore robustness of the herd according to the combination of adaptative types of cows and to the diversity of their physiological states.
**Context**

**Approach**

**Results**

**Implications**

**BREsNUS: a tool to analyse robustness at the herd level?**

**Cows with similar coping abilities**

![Diagram of cows with similar coping abilities](image)

- **Calving dates**
- **PERTURBATION**
- **Pregnancy**
- **Lactation**

**Cows with various coping abilities**

![Diagram of cows with various coping abilities](image)

- **Calving dates**
- **PERTURBATION**
- **Pregnancy**
- **Lactation**
THANK YOU FOR YOUR ATTENTION