How to assess the diversity of dairy cows adaptive capacities?
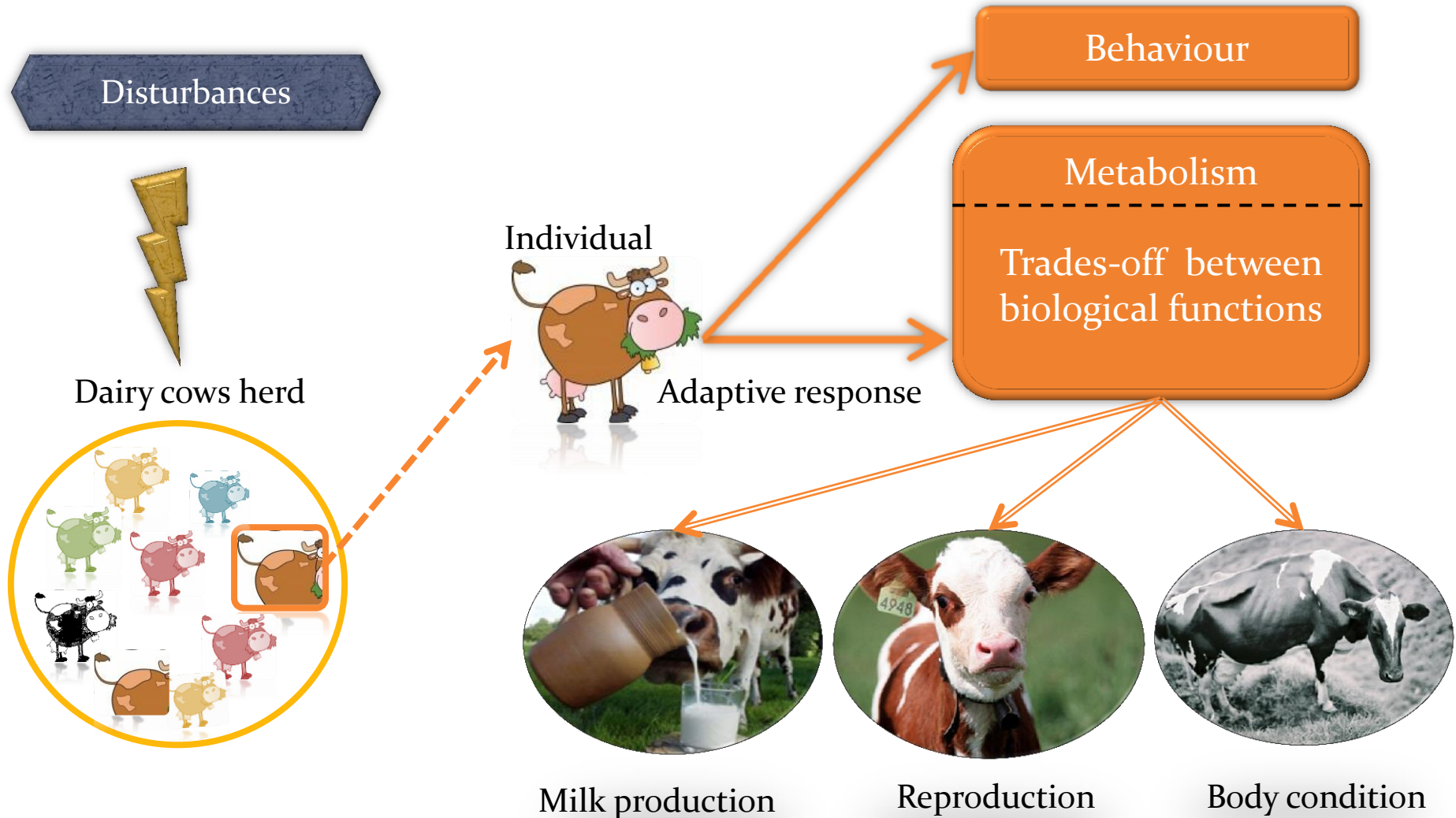
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28th of April 2013, 64th EAAP meeting, Nantes

Introduction

Disturbances

Dairy cows herd

Individual

Adaptive response

Behaviour

Metabolism

Trades-off between biological functions

Milk production

Reproduction

Body condition

Objective

- **Global objective**:
  - Create method to describe and assess the adaptive capacities of dairy cows based on the biological trades-off
  - ➔ Evaluate herd robustness

- **To that end**: test two hypotheses
  - Not possible to assess adaptive capacities with one scoring indicator BUT possible to describe them through several profiles of adaptive responses:
    - milk production dynamics
    - Reproduction results
    - Body condition scoring
  - Adaptive capacities vary according to different factors: breed, lactation rank, genetic merit, physiological stage....

Material & Method (1)

- **Material**: Data from Inra experimental dairy units of Le Pin-au-Haras, Marcenat, Mirecourt, Orcival, 1999-2012

- Detect disturbance:
  - Herd level
  - Inductive detection (all but not sanitary)
  - Milk as indicator
    - Significant change in milk production : visual and non parametric test)

- Define a **disturbed period**
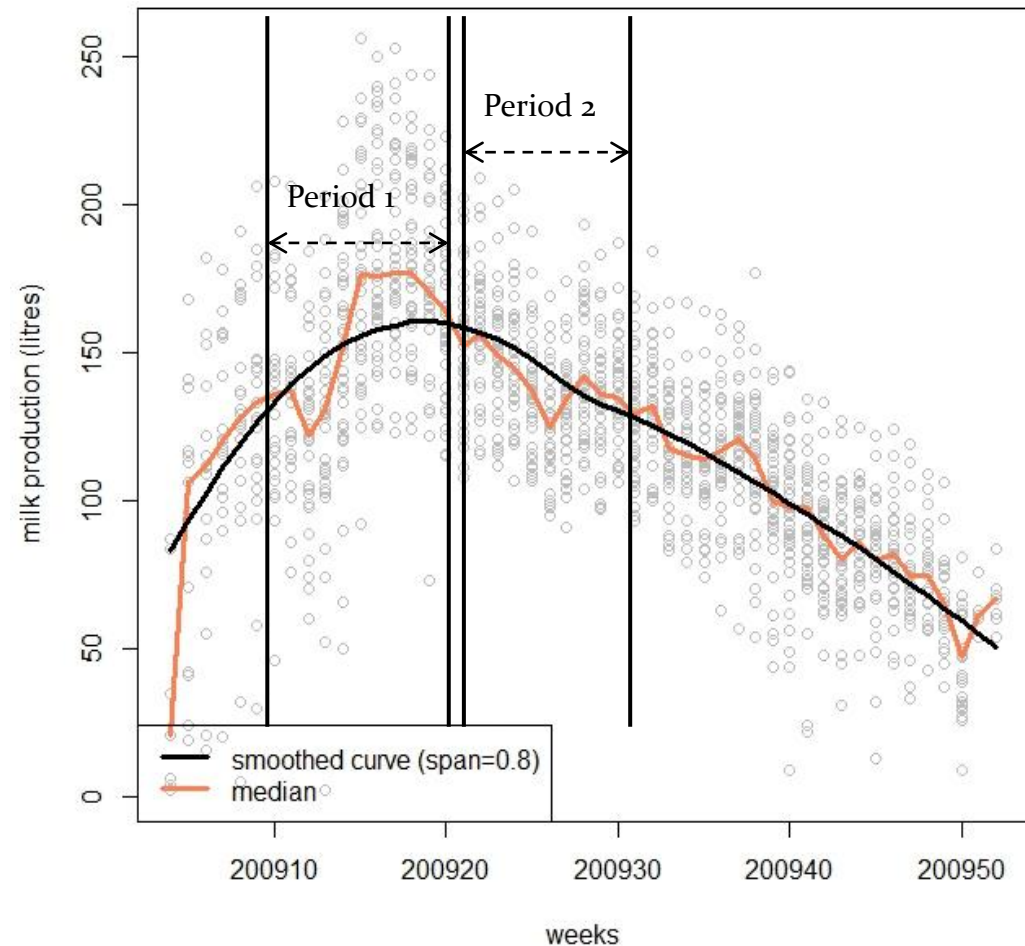
Data from Inra Mirecourt, 2009

Material & Method(2)

- Step down to individual level

- Redraw individual lactation curves readjusted for lactation stage (from calving to drying off)

- Use of Wood's lactation curve model to draw the "undisturbed" reference curve for each individual

- Calculated indicator of milk production variation in response to the disturbance:

   *(observed-undisturbed)-(observed period average)*

Material & Method (3)

- Principal component analysis➔ classify cows in groups according to their dynamic of response in milk production

- Characterization of each group of adaptive response according to the individuals:
  - reproduction success/failure/delay the following year
  - body condition score dynamics of evolution (+ , -, =) over the disturbed period
  - Animal characteristics (breed, lactation stage...)

Results (1)

- Example with 34 cows, 2 breeds, fed pasture + complements, *(Inra, Le Pin-au-Haras,* disturbed period from the 12/06/2006 to the 04/09/2006) (RS: reproductive success rate)
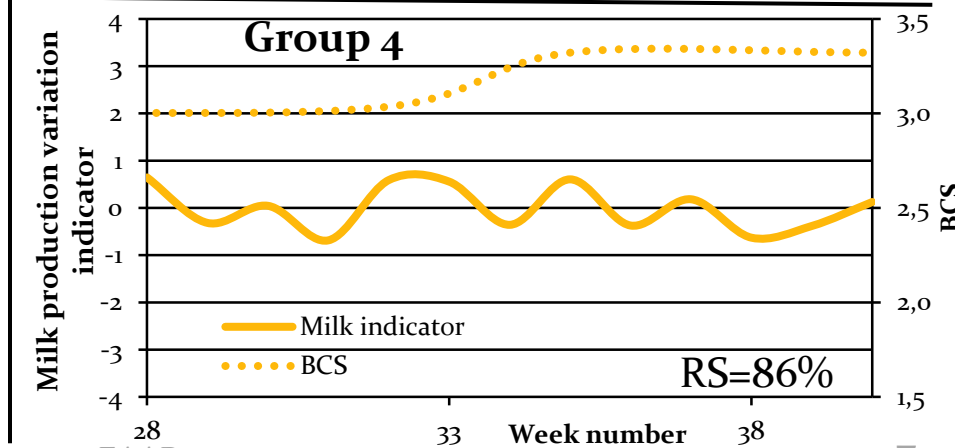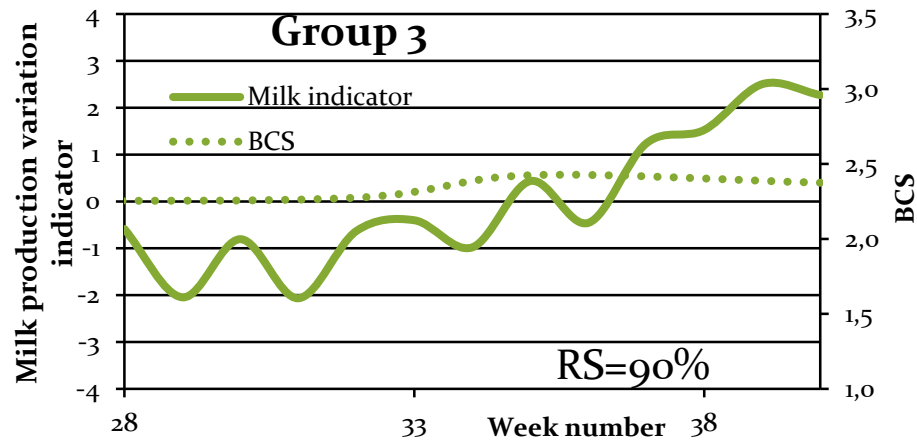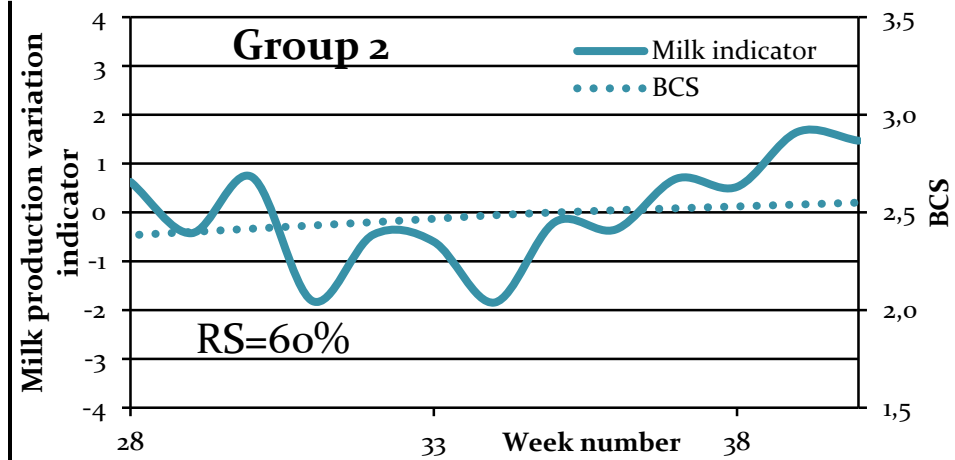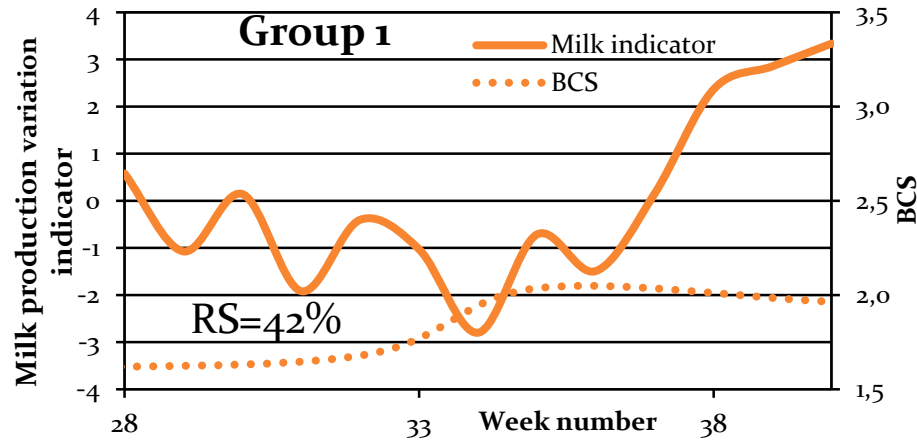
Results (2)

- Groups characterization:

Groups	1	2	3	4
N (cows)	7	10	10	7
Breed (Holstein or Normande)	85% H	60% N	50% H /N	100% N
Lactation rank	71% L2/L3	50% L1	60% L1	mixed
Average milk production (l/day)	29	24	25	20
Average lactation stage (weeks)	27	25	26	28

➔ Differences in adaptive capacities seem associated with breed parity, milk production….

Conclusion and Perspectives

- The method considered for the assessment of dairy cows adaptive capacities diversity combining :
    - Disturbance detection at the herd scale
    - PCA on milk dynamics➜ groups
    - Groups characterization(to be completed…)

- This method will be implemented using the big dataset: larger view on the range of adaptive responses

- The final target➜ study combinations of cows adaptive capacities to assess the robustness of the herd facing a range of disturbances

Thank you very much for you attention

Acknowledgements to:

- Inra experimental unit of Mirecourt and to J.M Trommenschlager

- Inra experimental unit of Le Pin-au-Haras and to L. Delaby & S. Colette-Leurent

- Laurent Pérochon (UMR-Métafort)

Any questions?