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Alternative Modeling of Body Condition Score from Walloon Holstein Cows to Develop Management Tools

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Context

A regular evaluation of Body Condition Score (**BCS**) is a valuable **management tool** for dairy farmers.

- BCS assess the **stored energy reserves** of the cow
  (indicator of energy balance status)
- It is linked to production, fertility and health traits

Context

- BCS has been recorded **since April 2006 in 76 dairy herds** (nearly 100 herds now) in the Walloon Region
- **Monthly** collected by the milk recording agent
- Scoring from 1 (emaciated cow) to 9 (obese cow)

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"Herd BCS Balance Sheet"

- sent to farmers after each milk recording
- allows to point across time cows which are not in the range of desirable scores

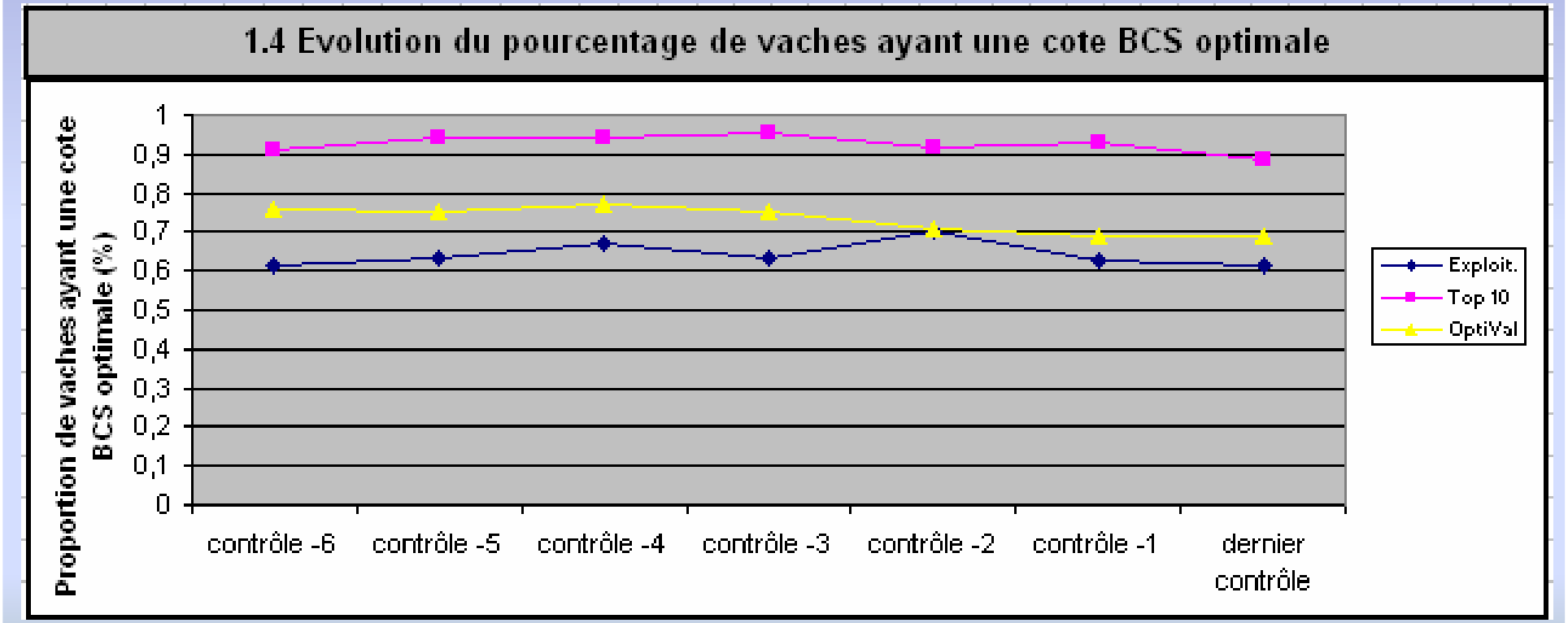
Context: “Herd BCS Balance Sheet”

Number of primiparous in each class of days in milk according to their BCS

1.1 Répartition des PRIMIPARES en fonction de leur BCS										
Classe	Total	BCS								
		1	2	3	4	5	6	7	8	9
Tarissement	1					0	1			
de 0 à 45 jours	0				0	0	0			
de 45 à 100 jours	6			0	3	1	2			
de 100 à 200 jours	11				2	4	5			
de 200 à 270 jours	13				4	2	5	2		
de 270 jours au tarissement	13				1	1	8	3		

Context: “Herd BCS Balance Sheet”

Evolution of percentage of cows presenting optimal BCS



Objective

Model BCS to **predict a BCS value for each day of the lactation** in order to develop decision-making indicators for dairy farmers

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1. Define the model
2. Assess its usefulness
   - overall fit
   - ability to predict missing and future records
3. Develop potential decision-making indicators

Data & Model

Data

54,955 BCS records from 5,123 cows collected between the 1st April 2006 and the 31st March 2008

Data & Model

Fixed effects

- Herd x test-month period
- Classes of 5 DIM
- Milk recorder x classes of 14 DIM
- Age at calving
- State: lactating or dried

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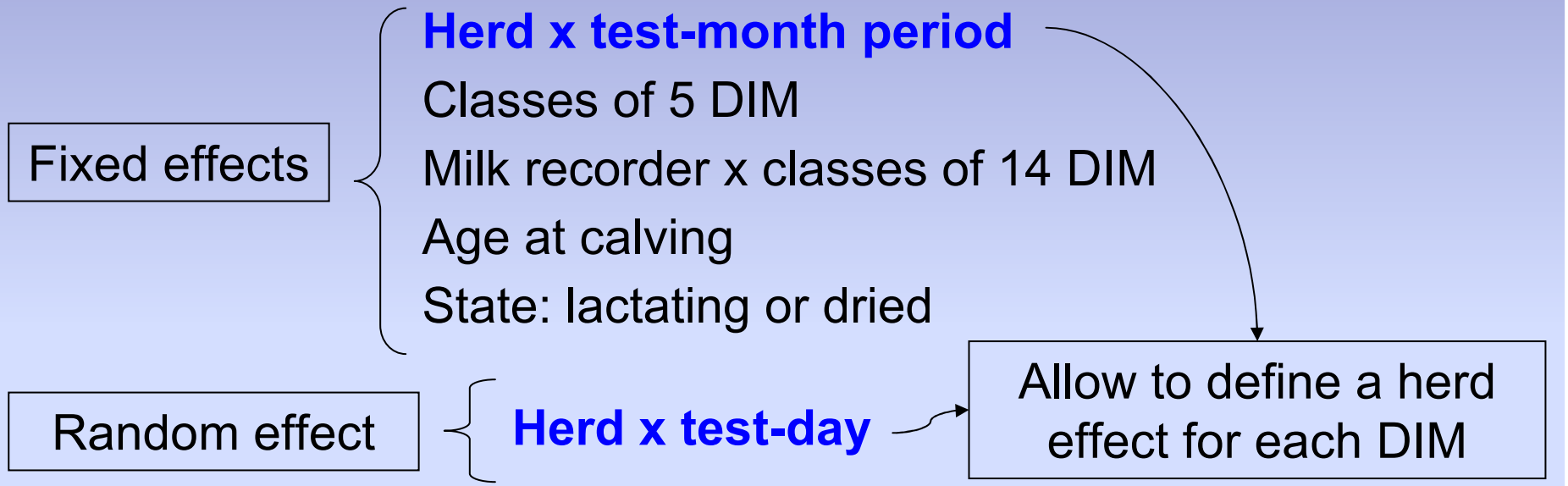
Random effect

- Herd x test-day

Data & Model


Fixed effects
Herd x test-month period
Classes of 5 DIM
Milk recorder x classes of 14 DIM
Age at calving
State: lactating or dried
Random effect
Herd x test-day
Allow to define a herd effect for each DIM

Data & Model

Fixed effects
- Herd x test-month period
- Classes of 5 DIM
- Milk recorder x classes of 14 DIM
- Age at calving
- State: lactating or dried

Random effect
- Herd x test-day

Random regression effects
- Permanent environment within lactation
- Permanent environment across lactation
- Genetic effect

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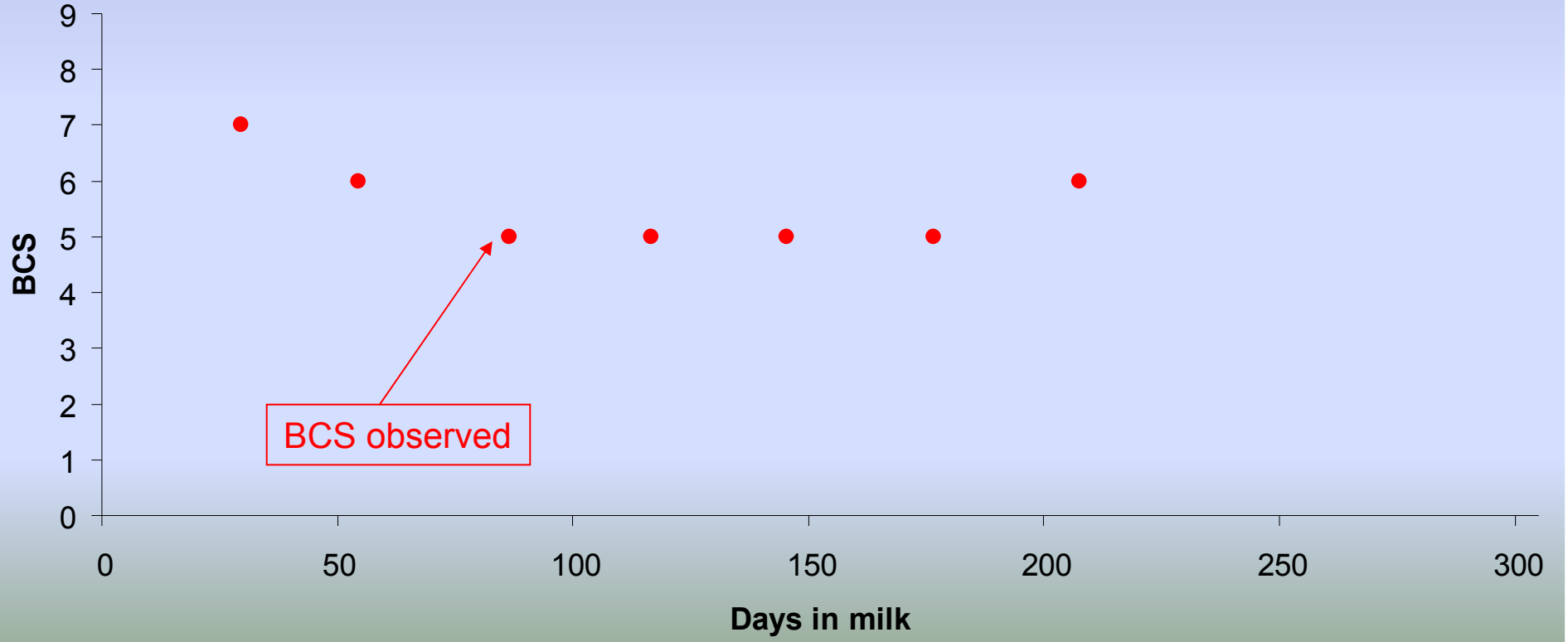
Regression curves modelled with 2nd order Legendre polynomials

Results

Based on known information, it is possible to predict a BCS value for each day in milk of a given cow



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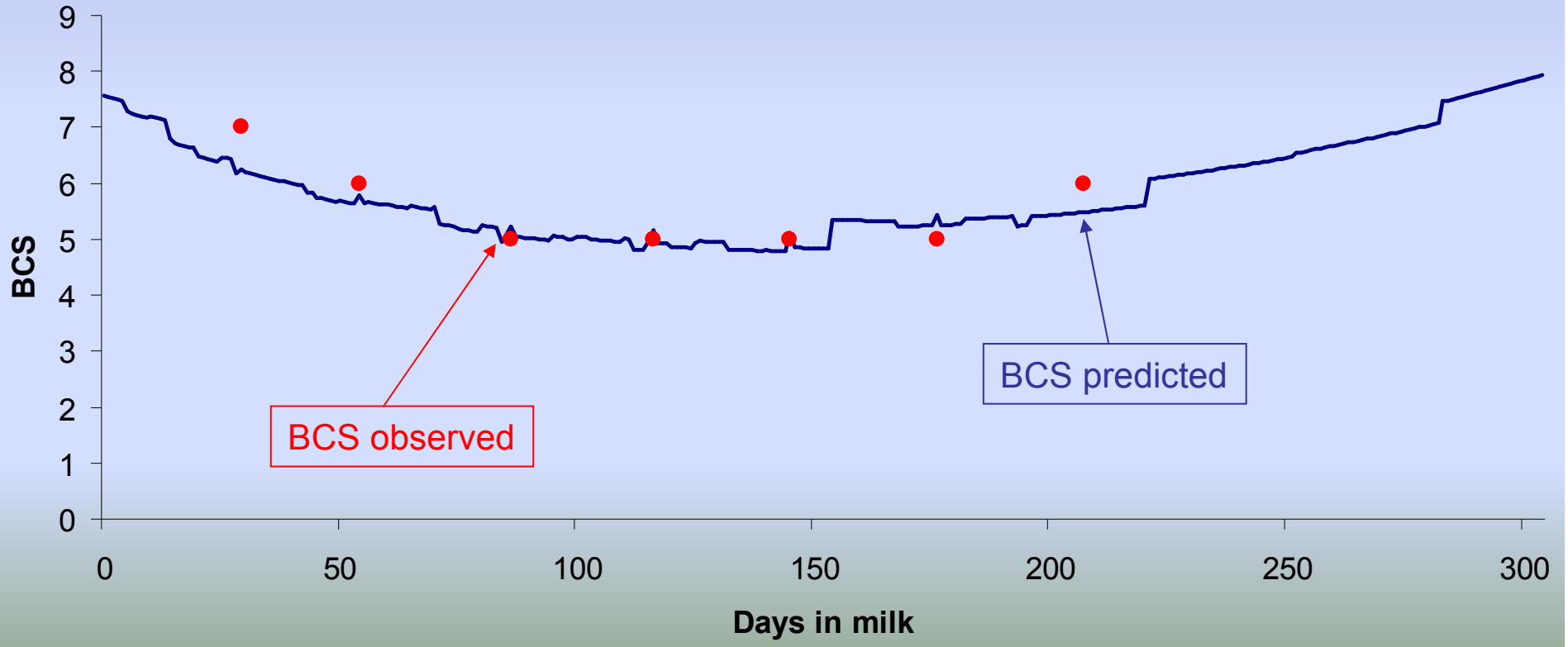
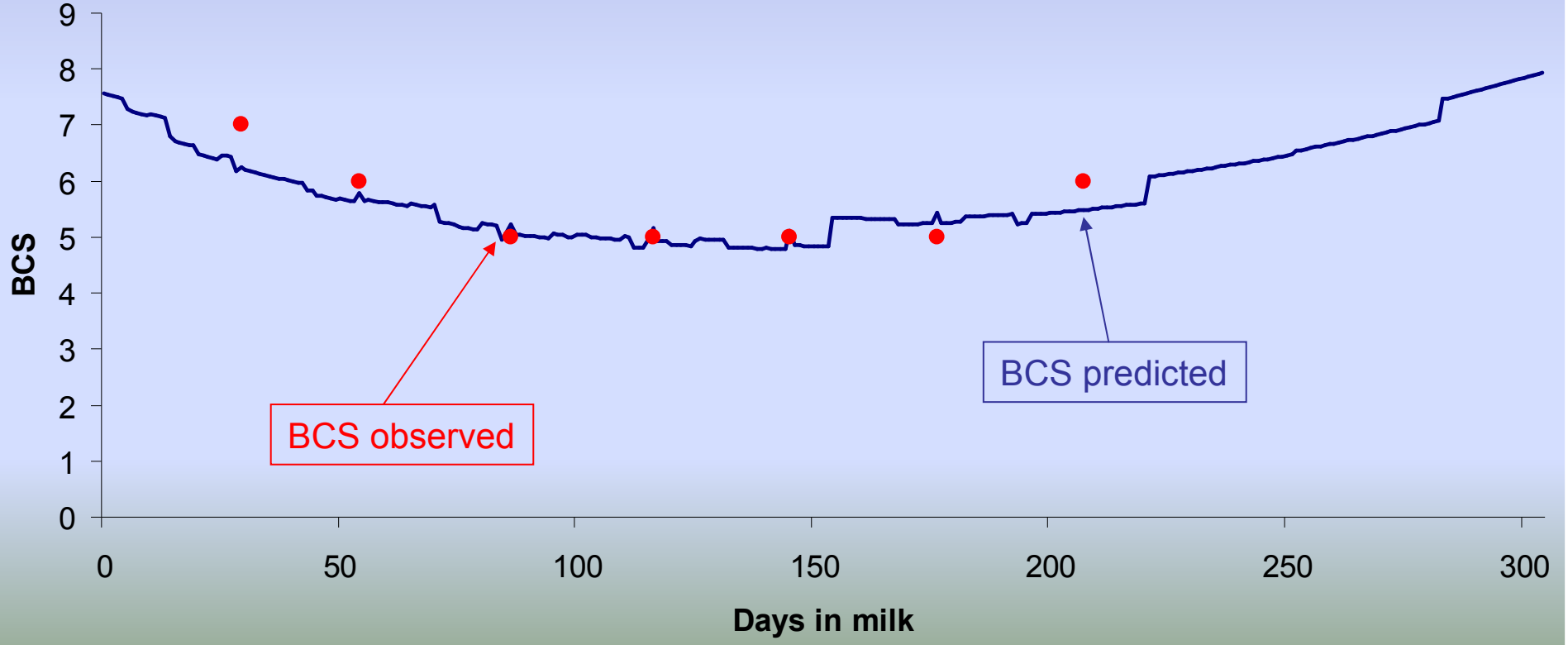


Results

Use this modeling for management purposes requires :

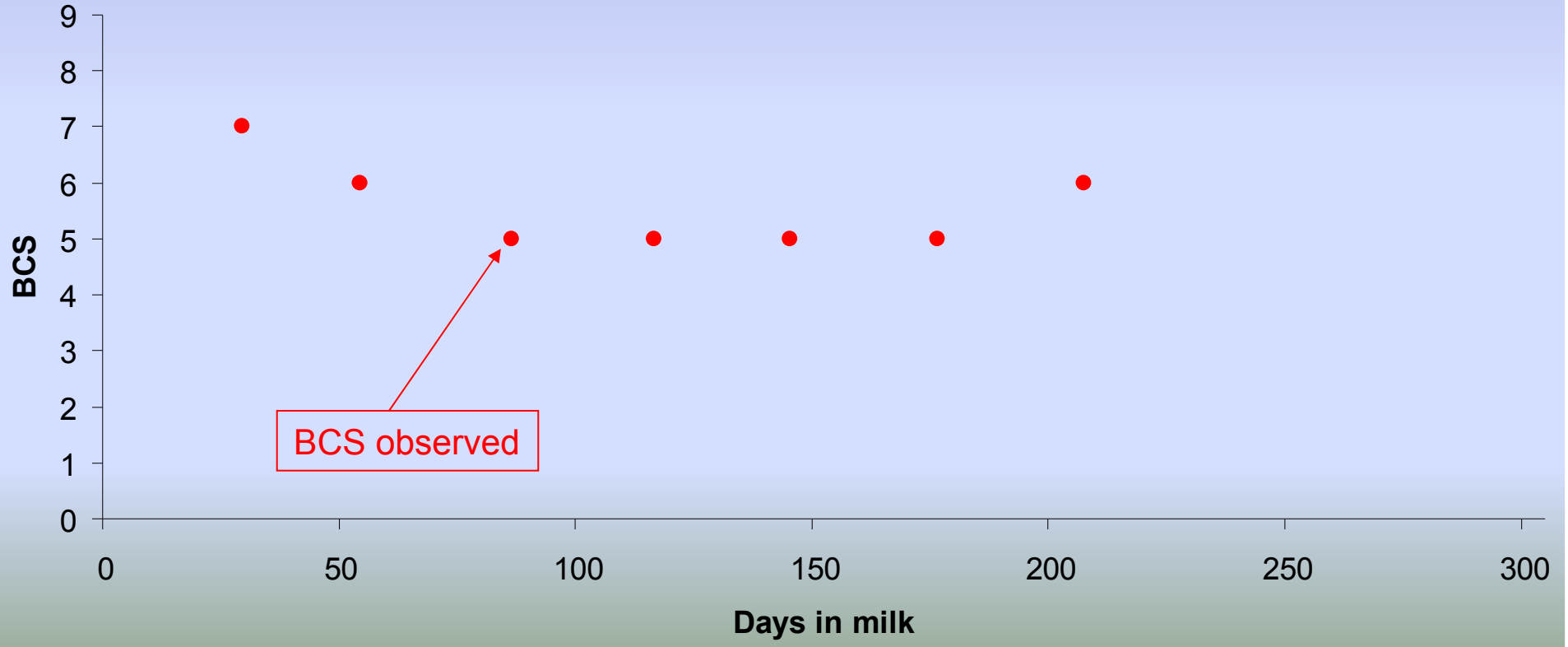
- **good adjustment** on data used for the solution estimation
- **good predictive ability** for **missing** and **future** records



Results

Adjustment

On data used for the solution estimation



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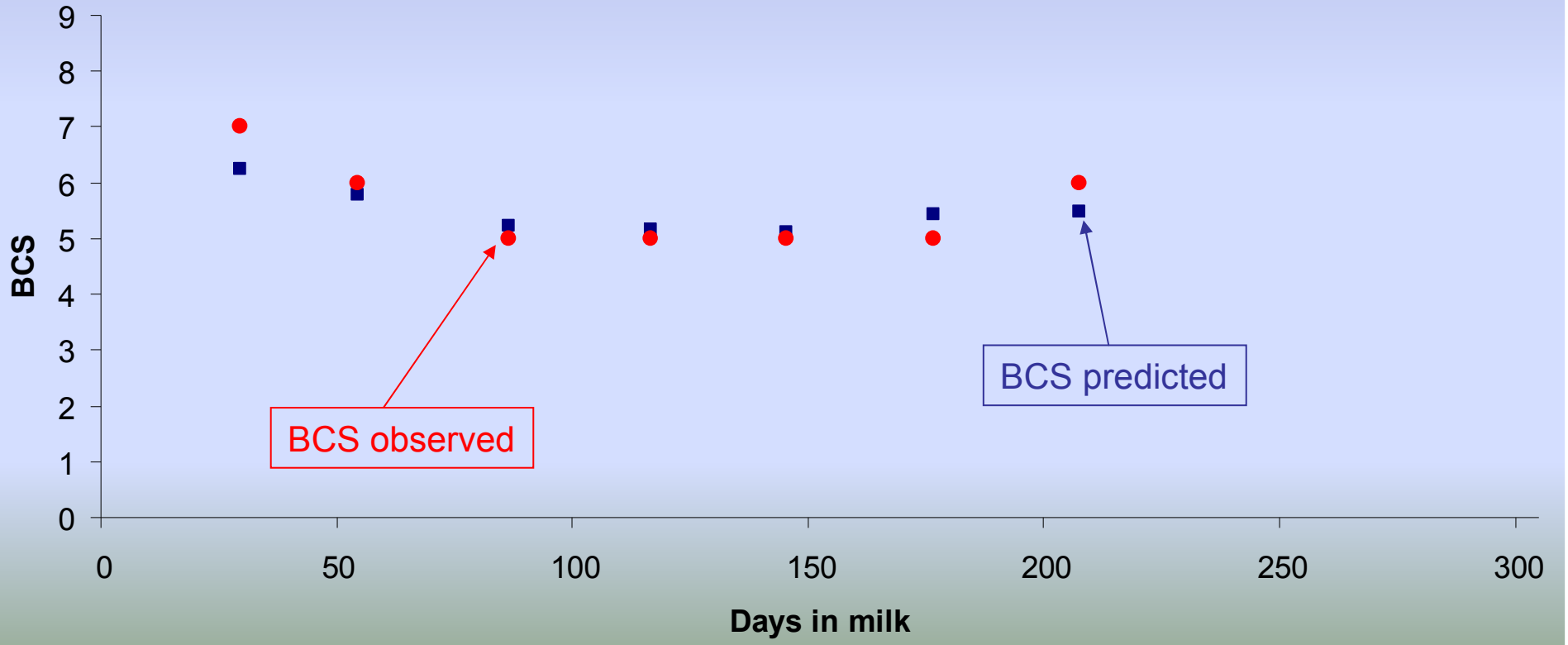
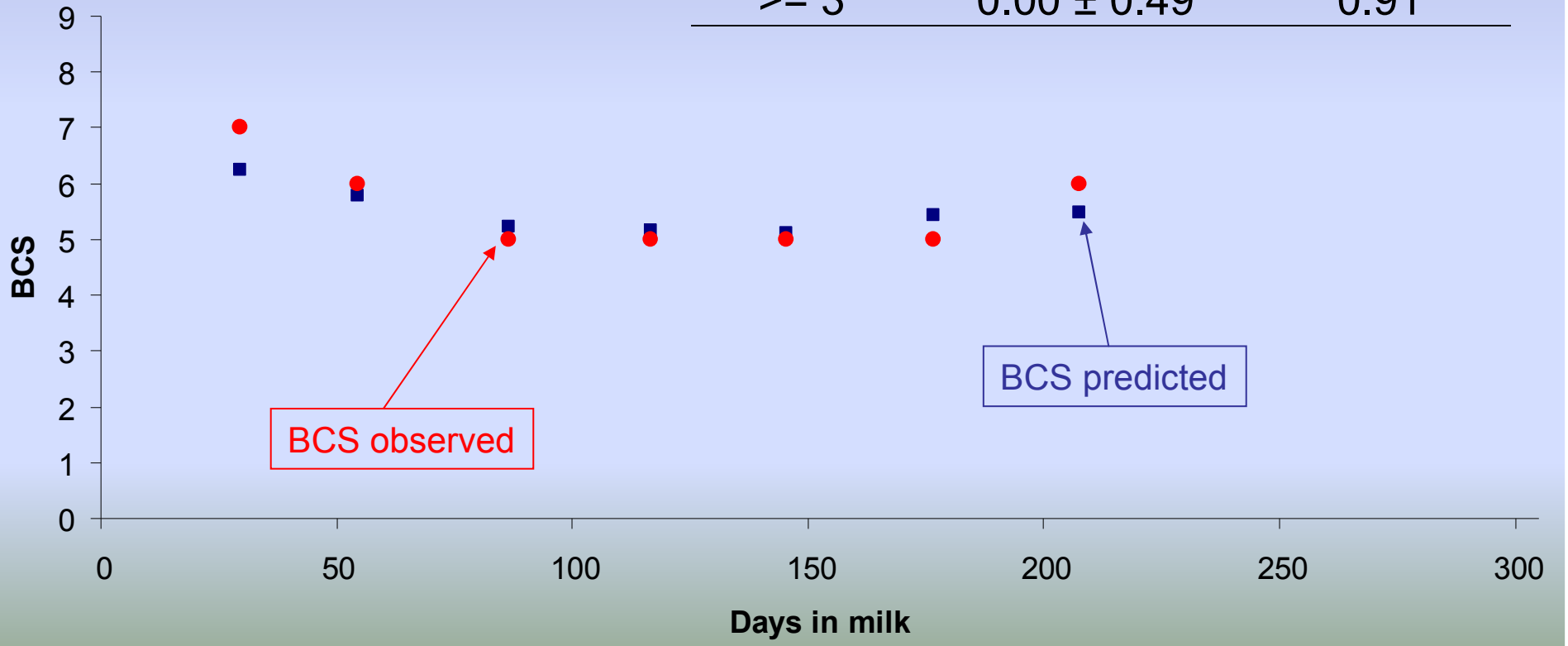


Results

Adjustment

On data used for the solution estimation

Lactation	Prediction error mean ± STD	Correlation
1	0.00 ± 0.47	0.88
2	0.00 ± 0.46	0.91
>= 3	0.00 ± 0.49	0.91



Results

The overall fit of the model is good

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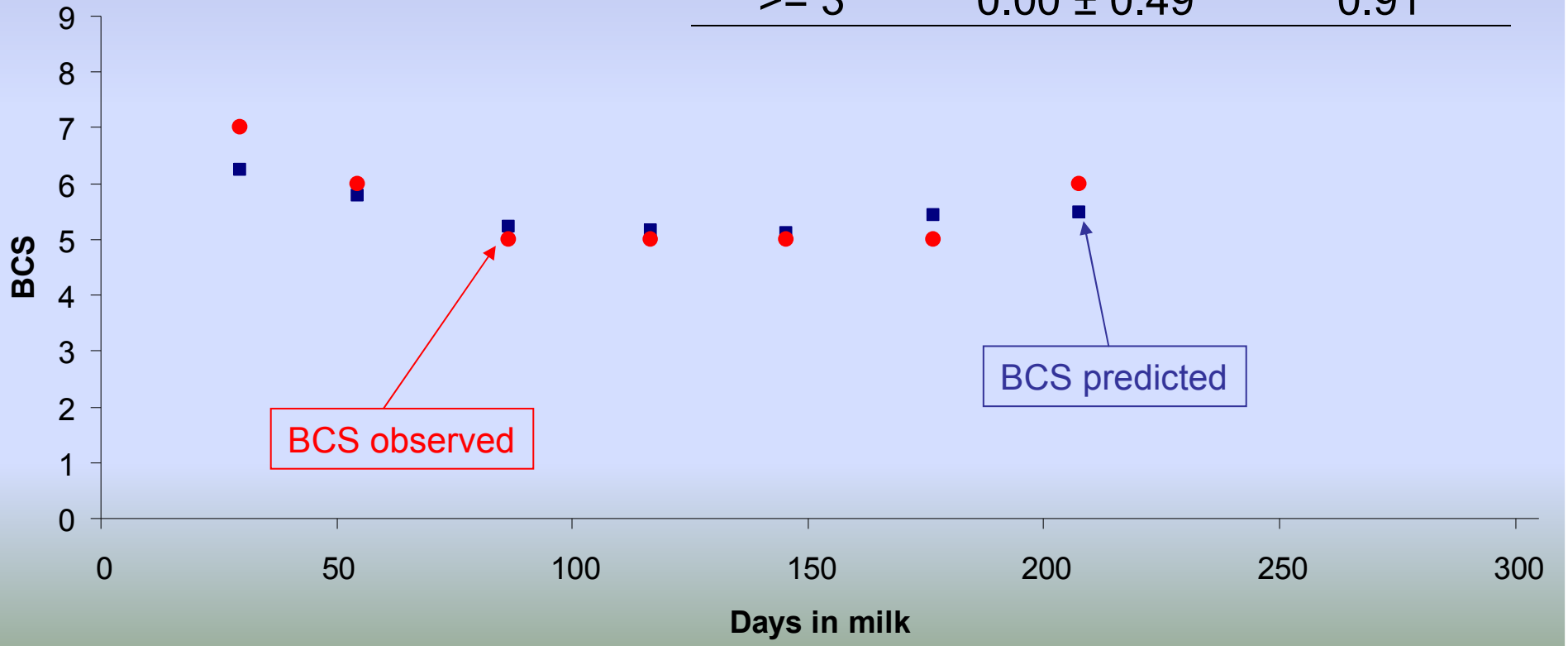
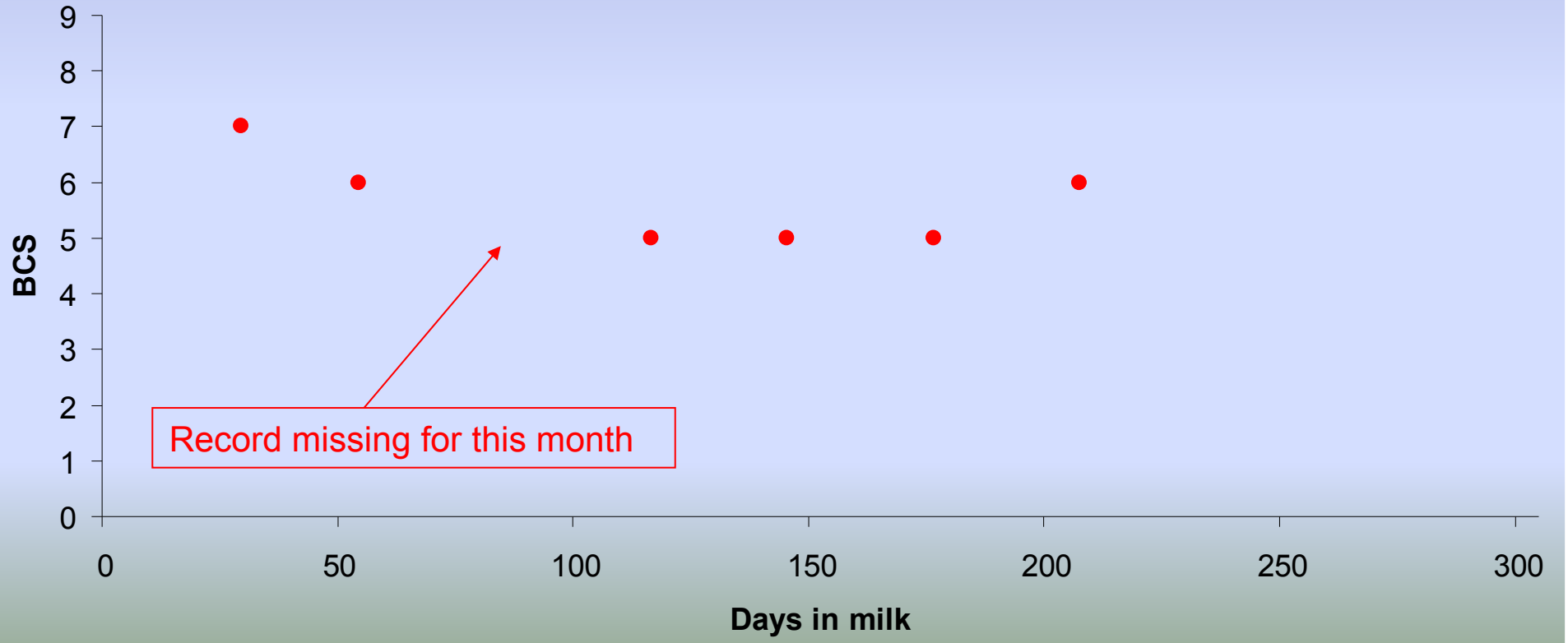


Results

Predictive ability for **missing** records

On data of March 2007



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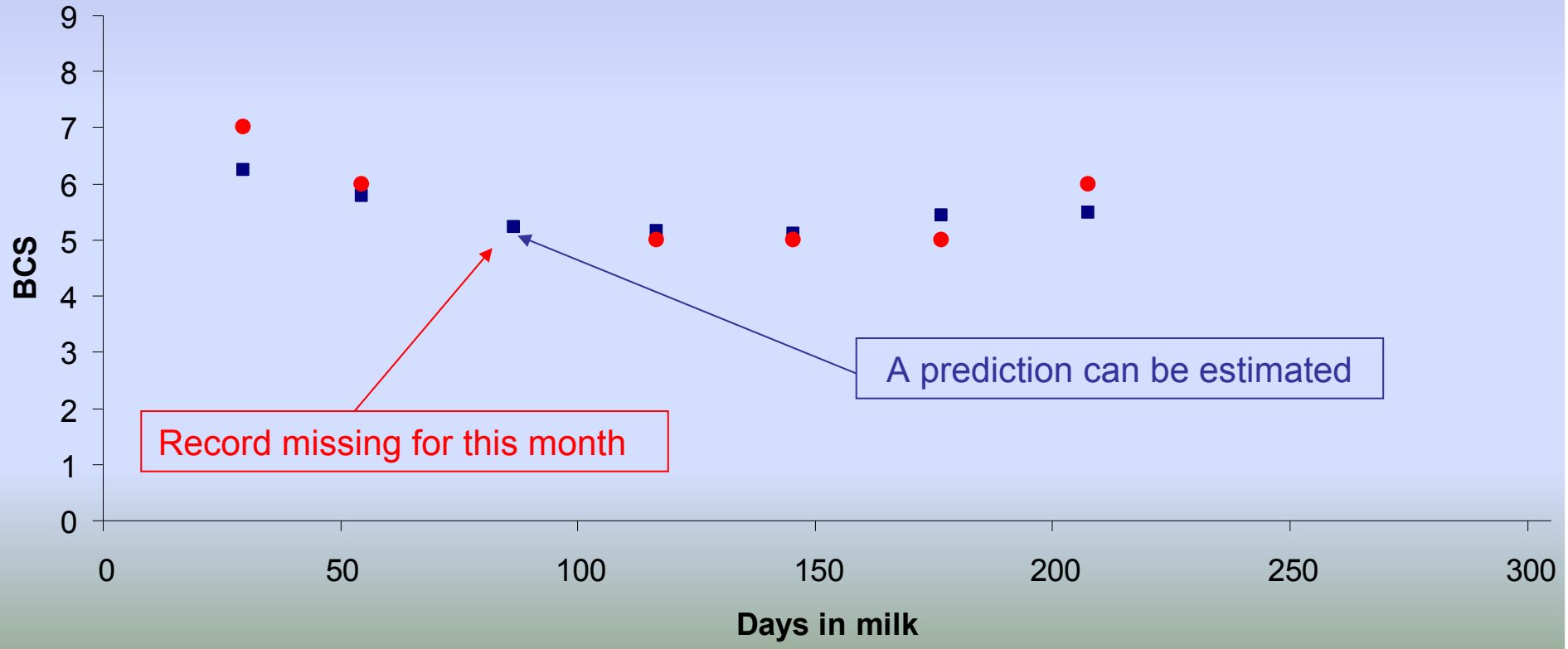

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Lactation	Prediction error mean ± STD	Correlation
1	-0.34 ± 0.78	0.64
2	-0.42 ± 0.84	0.58
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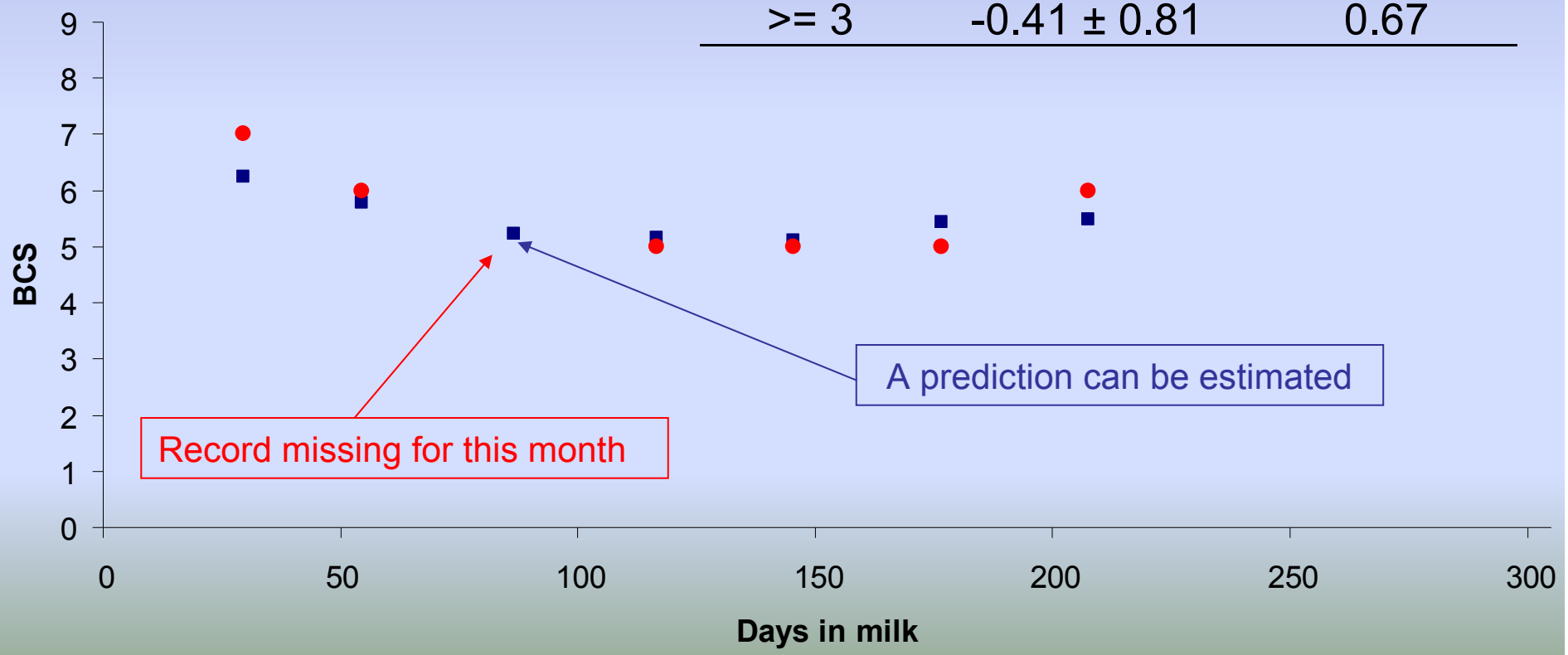

Results

BCS systematically underestimated and correlations lower

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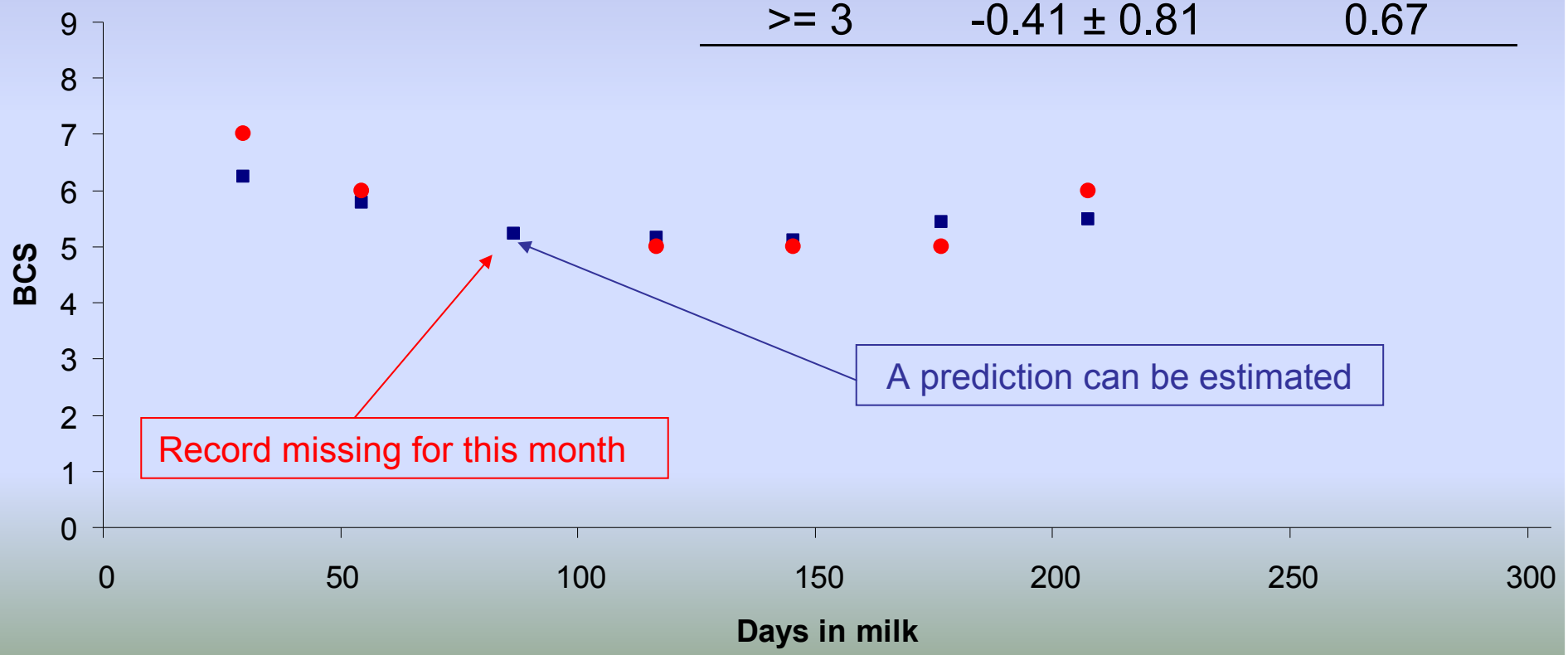

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Predictive ability for **future** records

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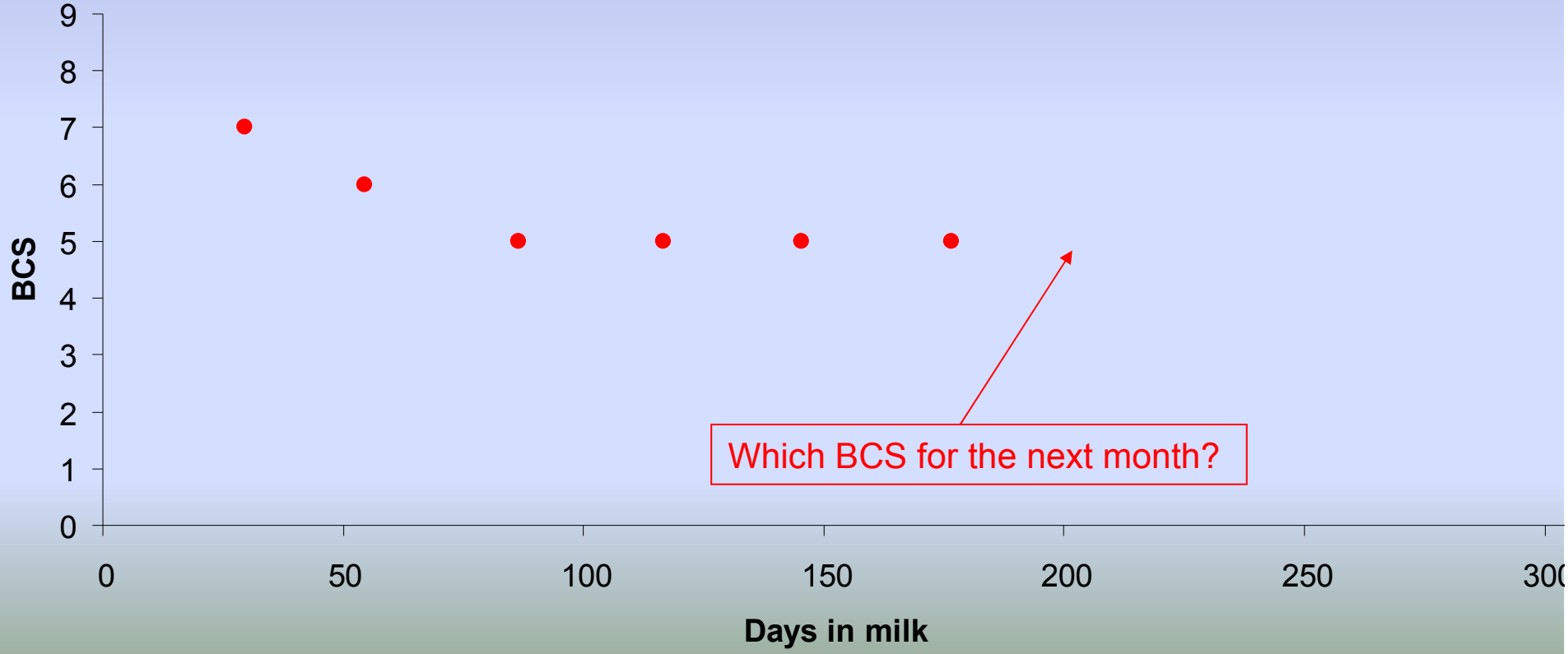

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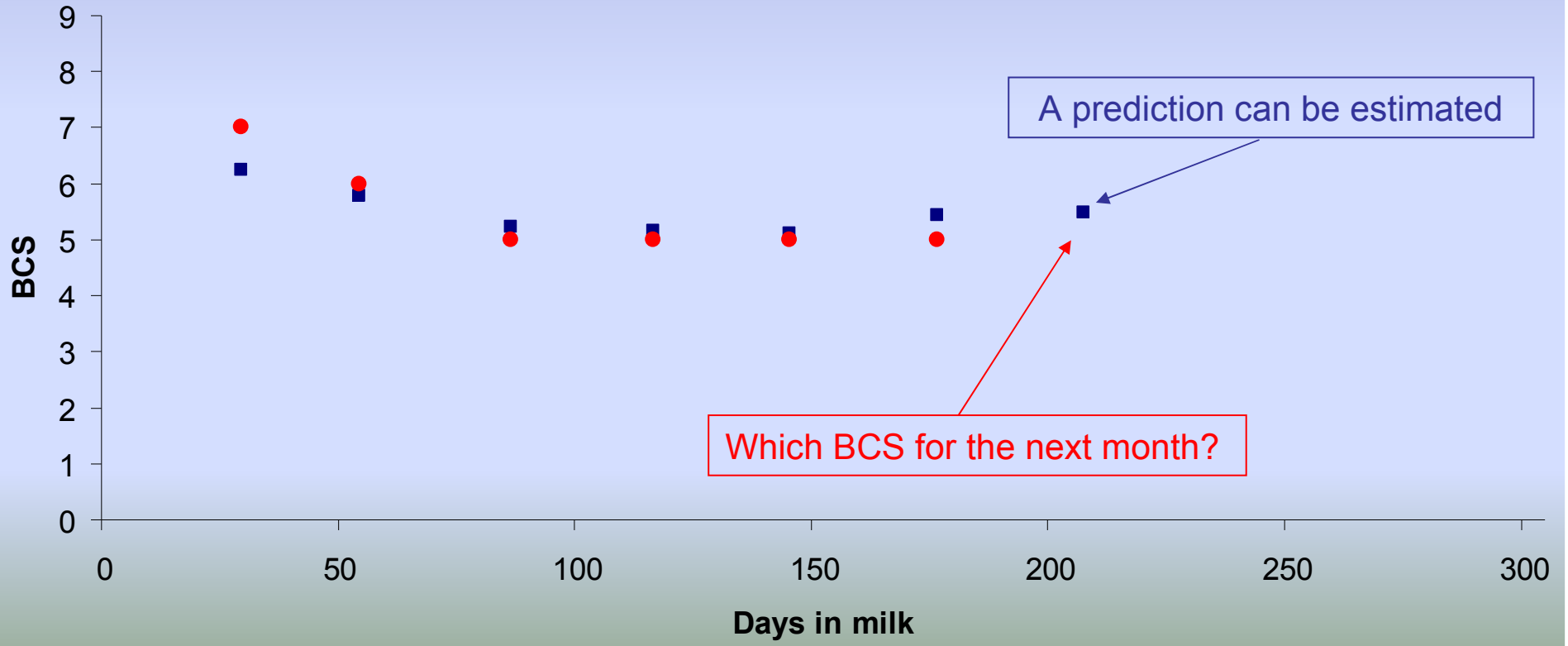

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Predictive ability for **future** records

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Lactation	Prediction error mean ± STD	Correlation
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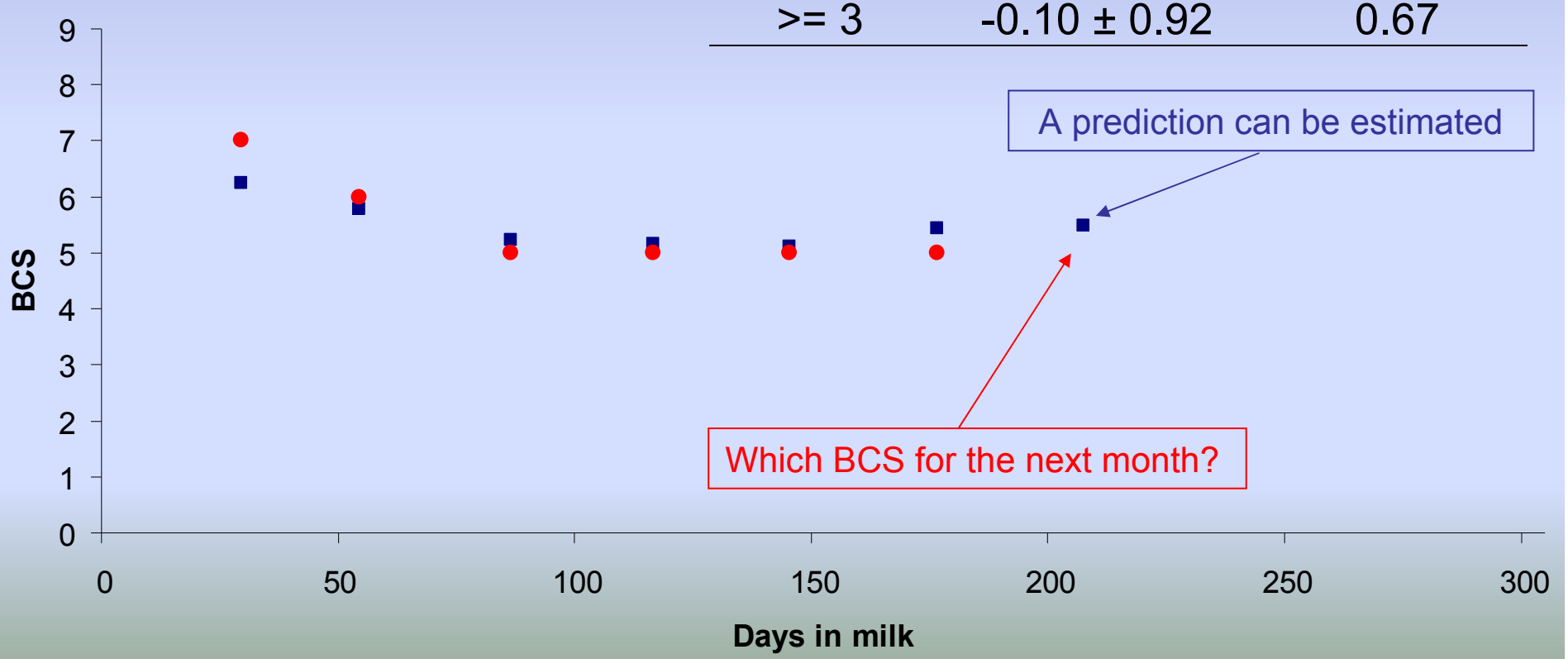

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Results for prediction satisfying considering the structure of data

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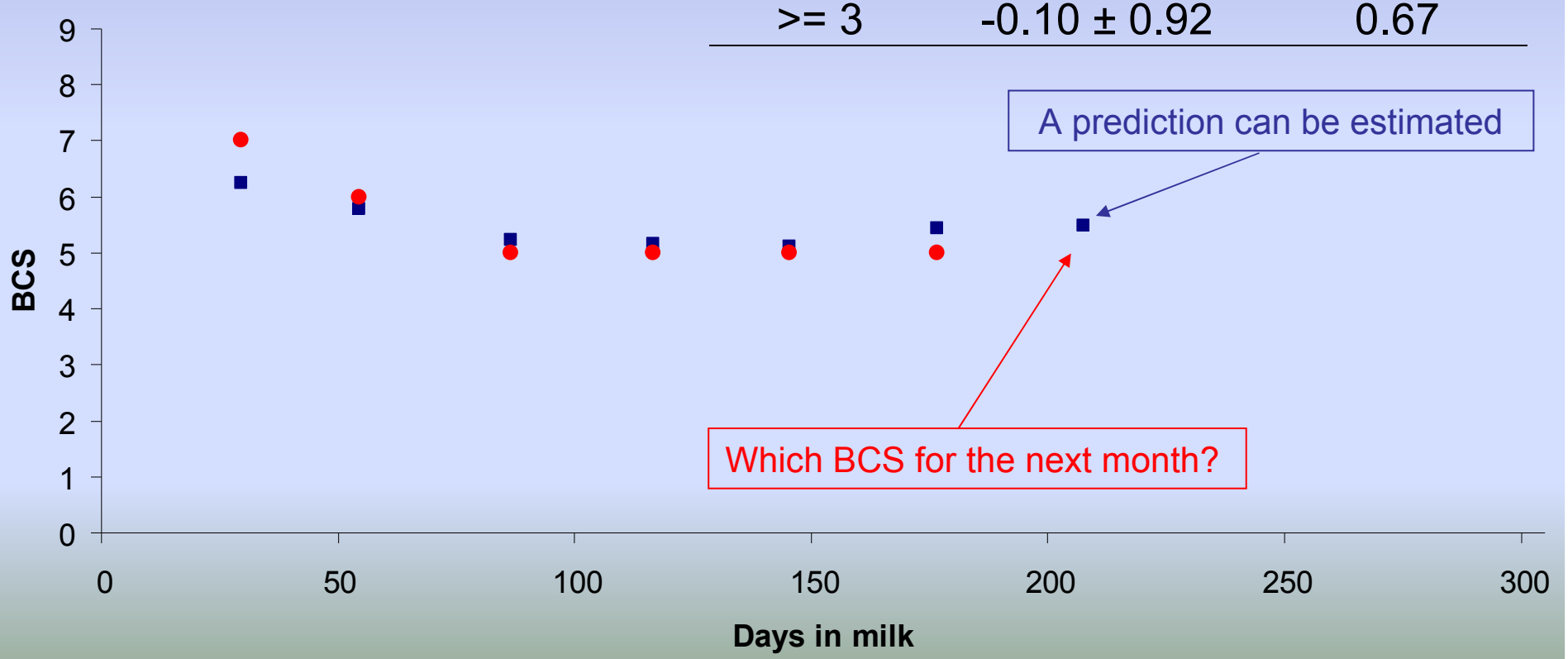
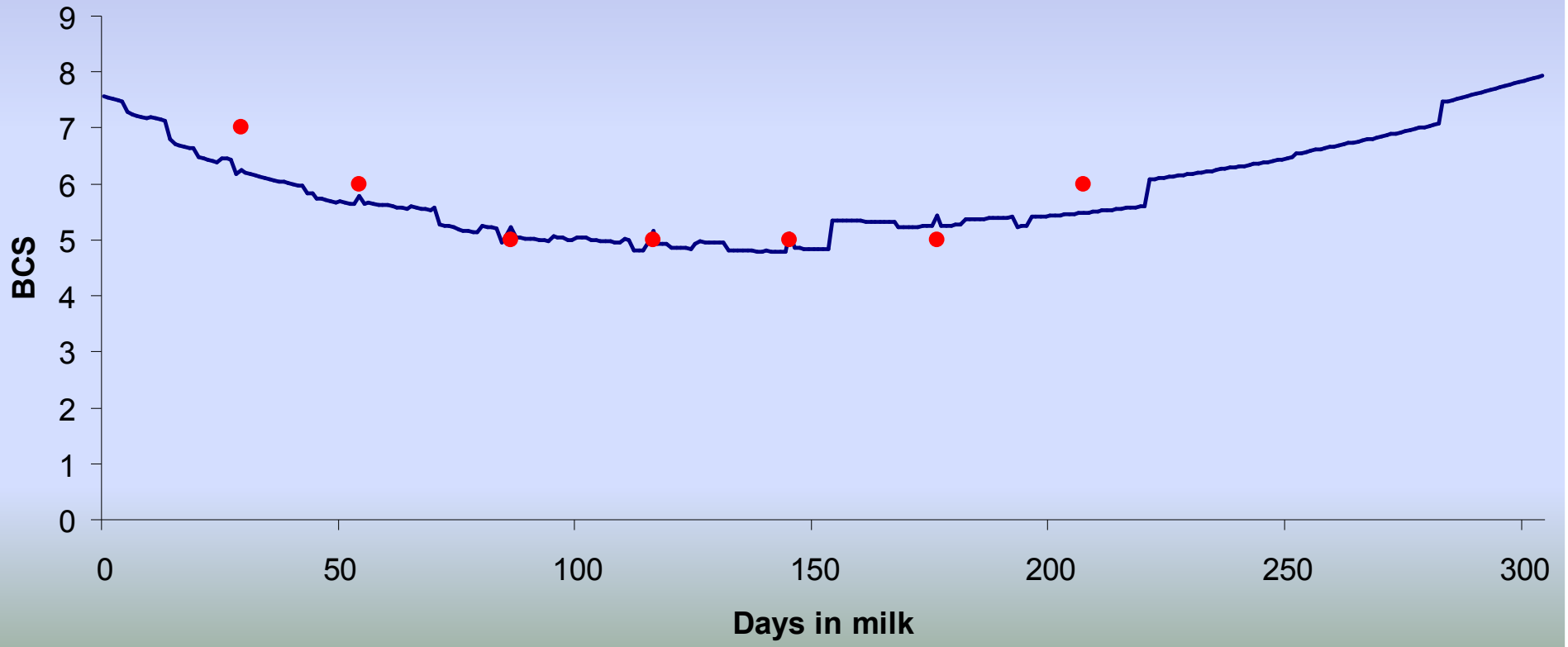


Potential decision-making indicator

Based on this alternative modeling, indicators could be defined:



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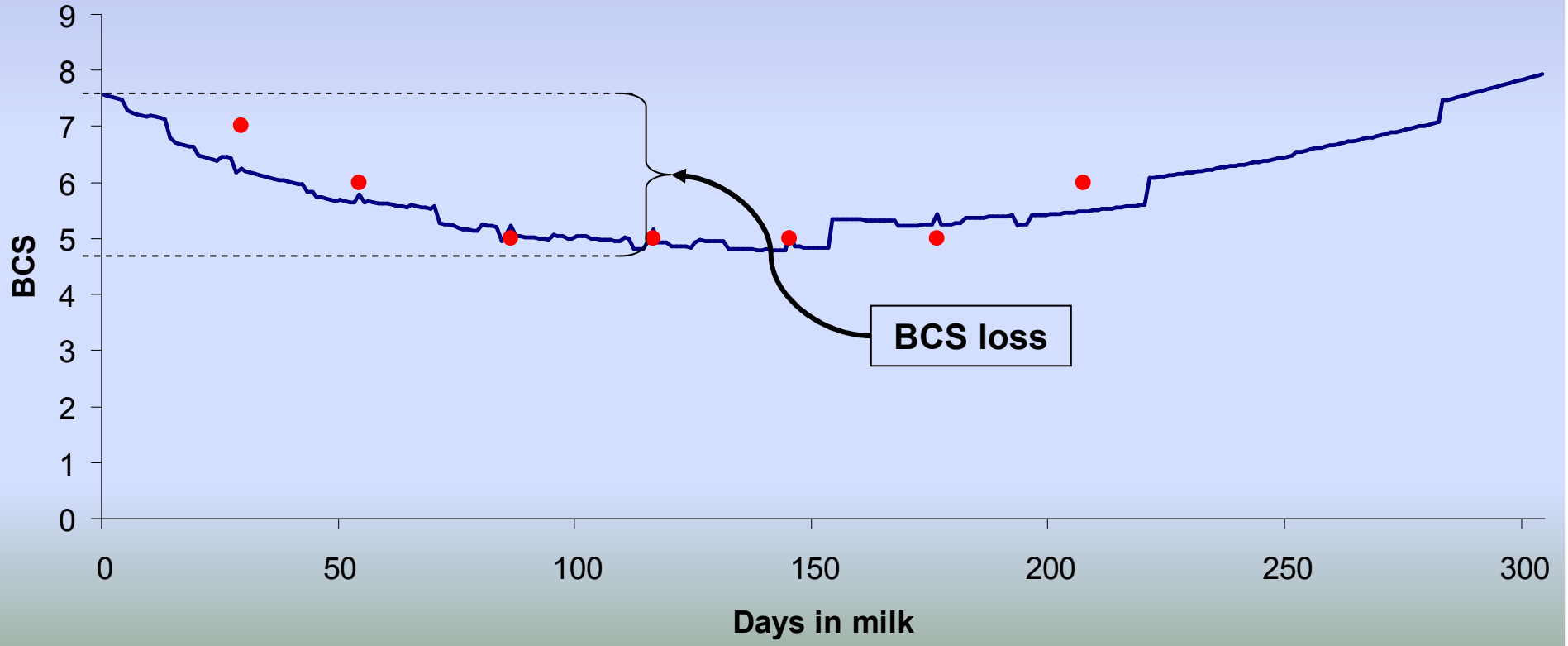
- **BCS loss** at early stage of lactation



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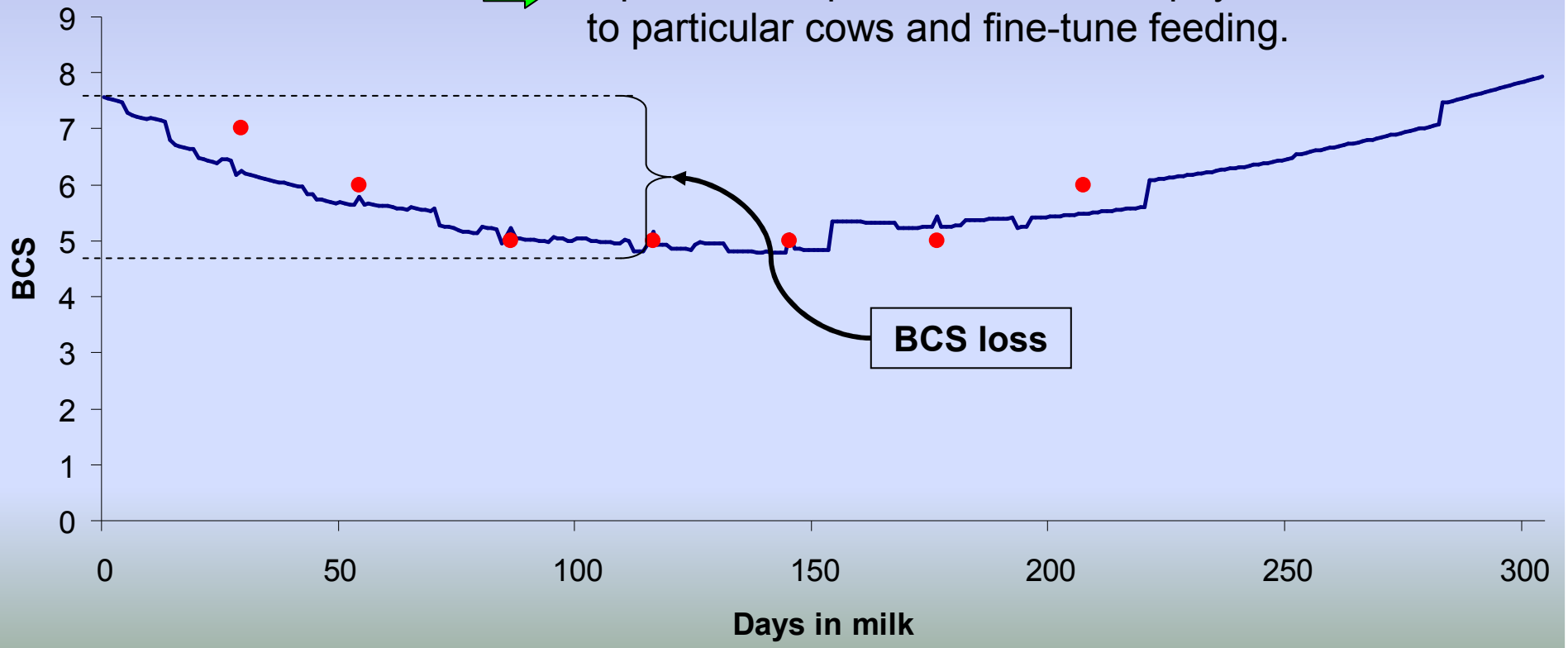
  If predicted a priori, farmer could pay attention to particular cows and fine-tune feeding.



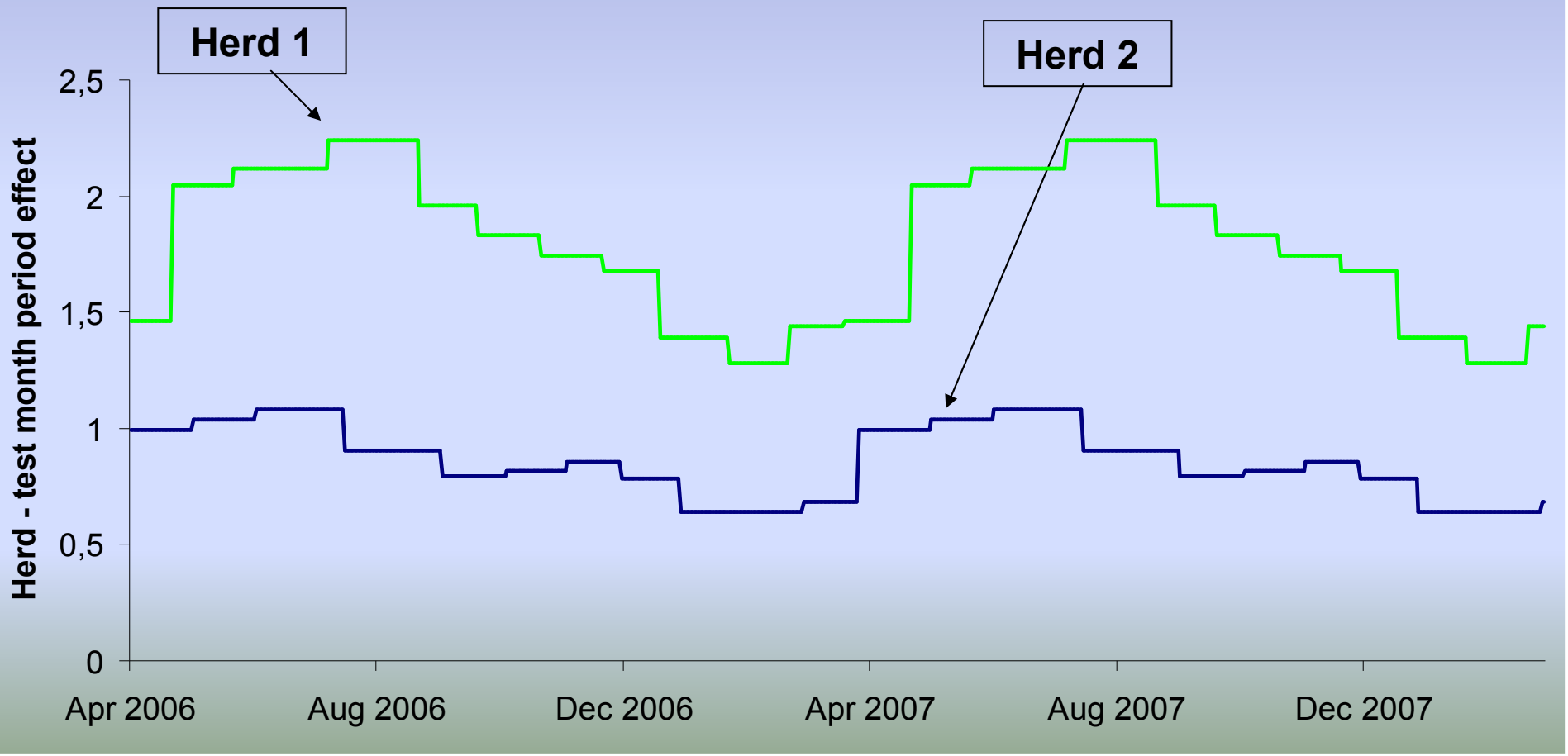
Potential decision-making indicator

Besides individual prediction, **herd indicators** could be defined:

Potential decision-making indicator

Besides individual prediction, **herd indicators** could be defined:

- **herd effect** across time



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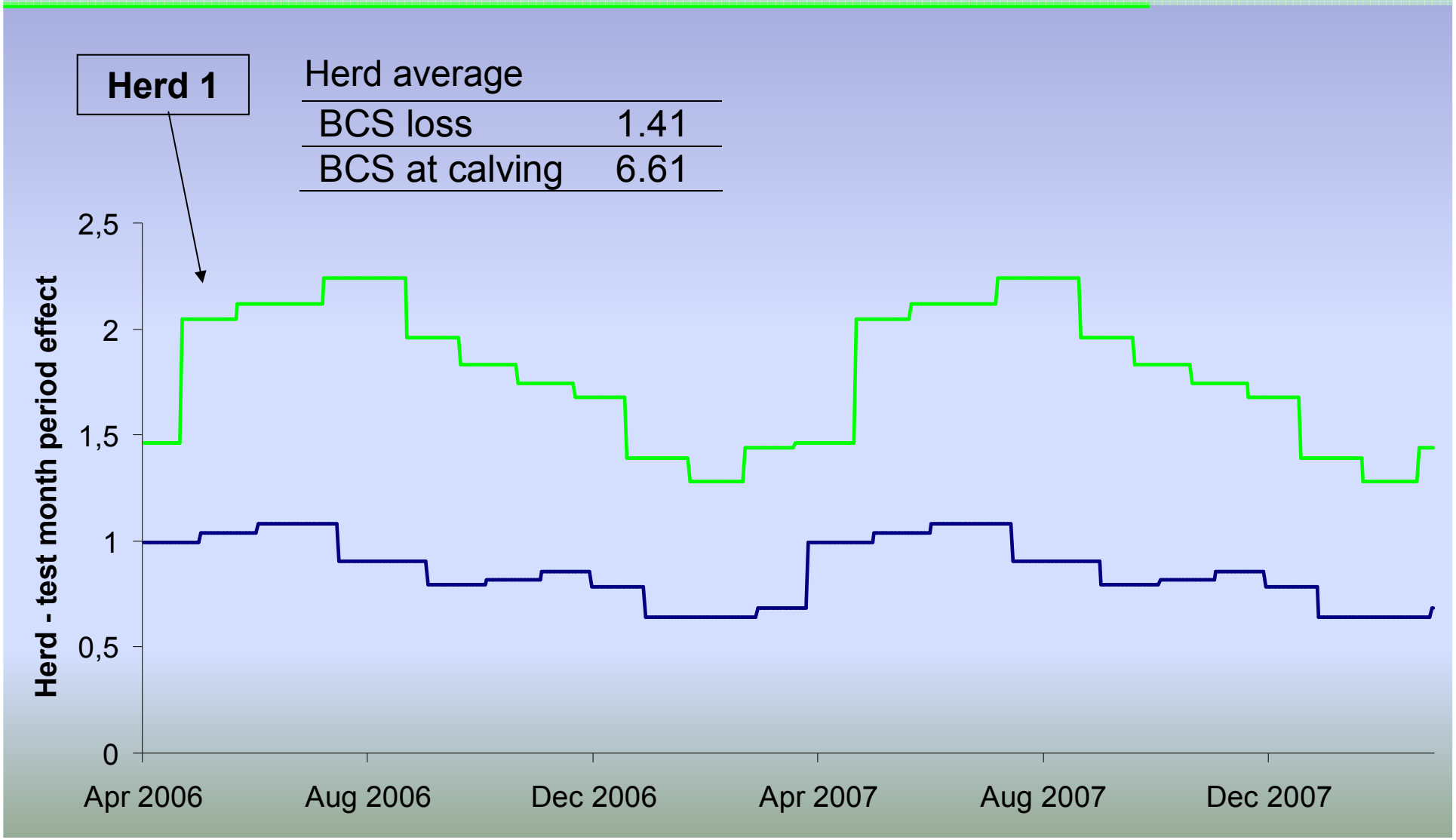

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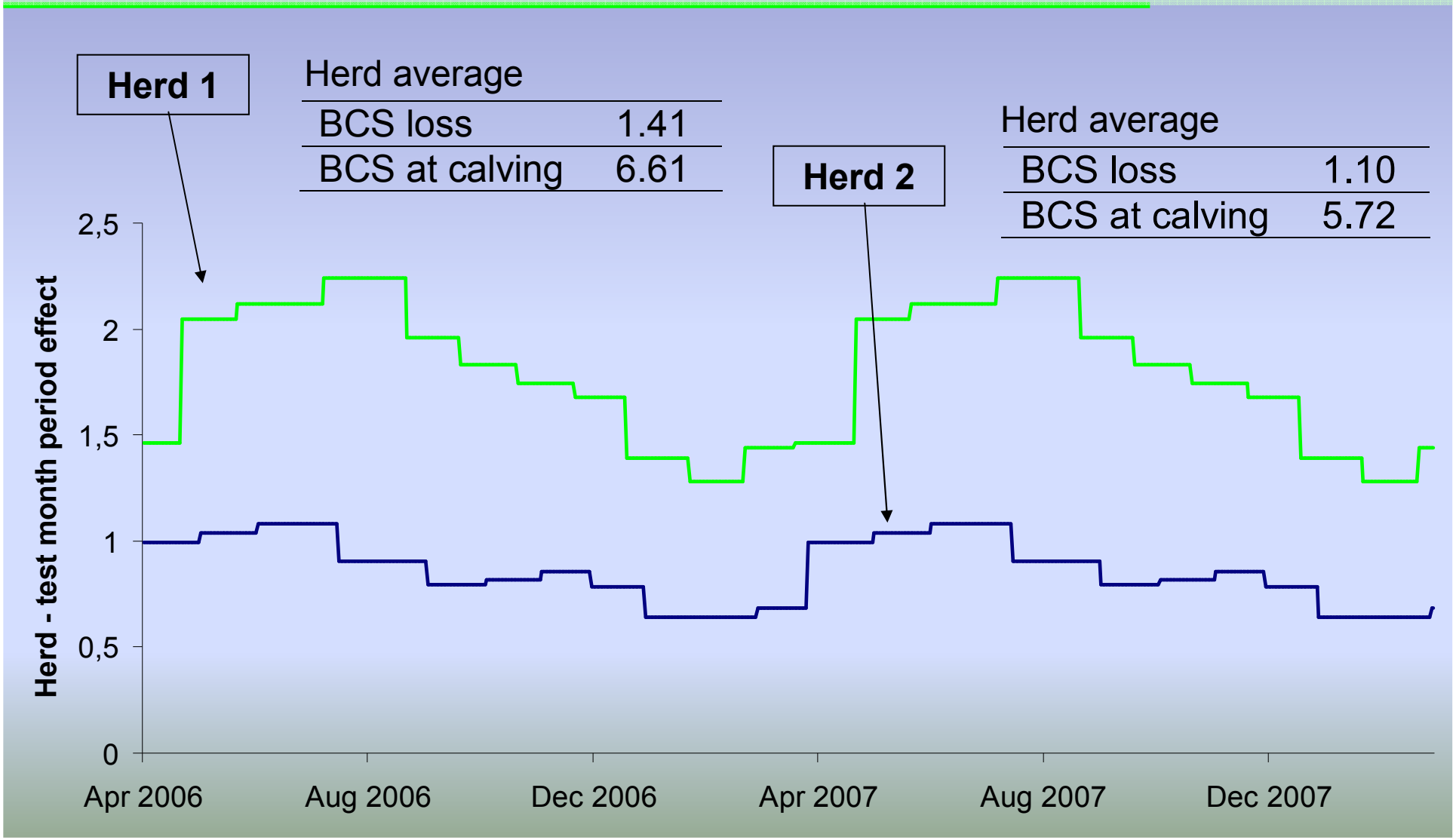

Conclusions & Prospects

- **Adjustment** of the model was **good**
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  - Model improvement could be done

- **Indicators** based on **this alternative modeling** could be developed and included in the current **"Herd BCS Balance Sheet"**

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Thank you for your attention

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