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Estimates of genetic parameters among body condition score and calving traits in first parity Canadian Ayrshire cows

C. Bastin[1], S. Loker[2], N. Gengler[1,3] & F. Miglior[4,5]*

[1] Animal Science Unit, Gembloux Agricultural University, Belgium
[2] CGIL, Dept. of Animal and Poultry Science, University of Guelph, Canada
[3] National Fund of Scientific Research, Brussels, Belgium
[4] Dairy and Swine Research and Development Centre, Agriculture and Agri-Food Canada, Sherbrooke, Canada
[5] Canadian Dairy Network, Guelph, Canada

Corresponding author's e-mail: bastin.c@fsagx.ac.be

Context: BCS

- Body Condition Score (BCS)
  - subjective measure of the stored energy reserves of the cow
  - indicator of the energy balance status
  - linked to:
    - production
    - fertility
    - health
    - calving

Context: BCS – calving

- A phenotypic relationship between calving traits and BCS has been identified

Excessive body condition score before calving
↓
Intrapelvic fat deposition
Reduction in pelvic area
↓
Dystocia

➡ BCS higher than 4 (5-point scale) is a significant risk for dystocia and consequently stillbirth.
Chassagne et al. (1999)

Objective

Estimate genetic correlations between calving traits (calving ease and calf survival) and BCS for Canadian Ayrshire cows

➡ Considering BCS records
- before and after calving
- for 1st and 2nd calving

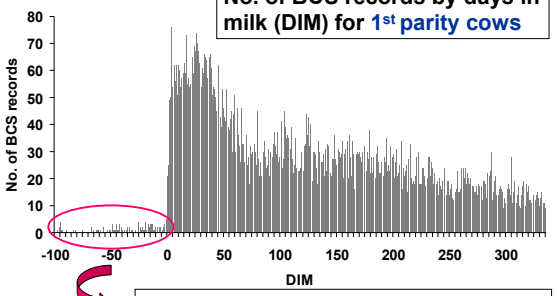
Part of a larger project which aims to develop a genetic evaluation for BCS in Canada

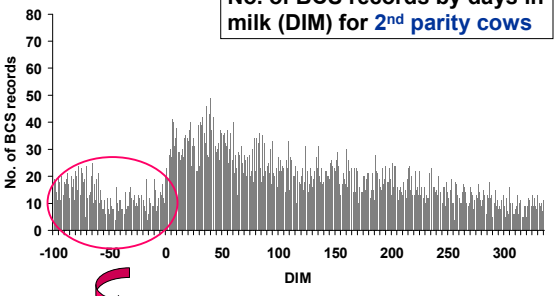
Data edits

- 1st and 2nd parity Ayrshire Canadian cows
- Calving traits:
  - Extracted for herds with at least 1 BCS record
  - Calving ease (CE)
    - ➡ coded from 1 (unassisted) to 4 (surgery)
  - Calf survival (CS)
    - ➡ coded as 0 (dead) and 1 (alive) within 24-hr from birth

Data edits

- Body Condition Score records
  - coded from 1 (thin) to 5 (fat)
  - collected by Valacta field staff in herds from Québec between 2001 and 2008
  - edits on herds (number and distribution of observations) and on records (deviant, high days in milk)
  - data extracted from -100 to +335 days in milk





Data

- Variance components estimation was done by REML using the whole population

Trait	1st parity	2nd parity
BCS	2.87 ± 0.40 *9,739*	2.90 ± 0.49 *8,032*
CE	1.34 ± 0.58 *12,042*	1.23 ± 0.49 *10,637*
CS	0.92 ± 0.27 *11,633*	0.94 ± 0.23 *10,432*

Models

- For each parity, two 2-trait models including random regressions were used
  - Allow to assess the genetic correlations between BCS (as a longitudinal trait) and calving traits (single parity record) all over the lactation
    - from 1 to 335 DIM for 1st parity cows
    - from -100 to 335 DIM for 2nd parity cows

Models

BCS	CE – CS
year of calving x season of calving (F)	year of birth x season of birth (F)
age at calving x stage of lactation (F)	age at calving x season of calving x sex of calf (F)
herd x year of calving (RR)	herd x year of birth (R)
permanent environment (RR)	environment linked with BCS (R)
genetic (RR)	genetic maternal (R)
	genetic direct

Models

BCS	CE – CS
year of calving x season of calving (F)	year of birth x season of birth (F)
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permanent environment (RR)	environment linked with BCS (R)
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	genetic direct

Regression curves modeled with Legendre polynomials of order 2

No correlation assumed

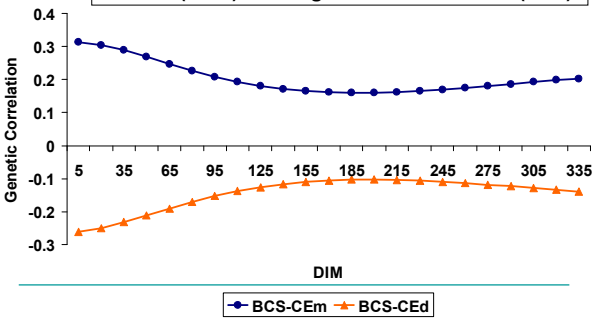
Models

BCS	CE – CS
year of calving x season of calving (F)	year of birth x season of birth (F)
age at calving x stage of lactation (F)	age at calving x season of calving x sex of calf (F)
herd x year of calving (RR)	herd x year of birth (R)
permanent environment (RR)	environment linked with BCS (R)
genetic (RR)	genetic maternal (R) genetic direct

Correlated effects

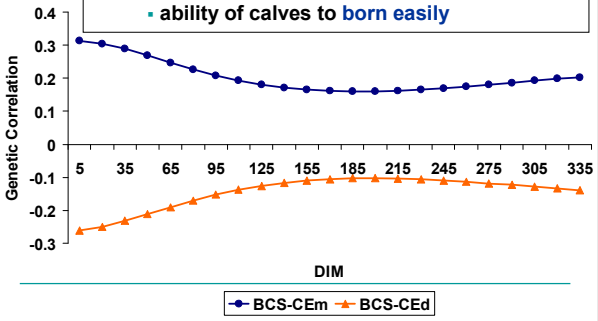
Results: Calving Ease – 1st parity

Genetic correlations are moderate, positive with Mat. CE (CEm) and negative with Direct CE (CEd)



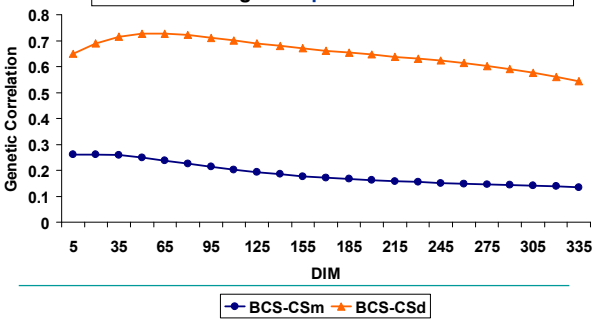
Results: Calving Ease – 1st parity

A genetically high BCS (early lactation) is related with:
- calving difficulty for cows
- ability of calves to born easily



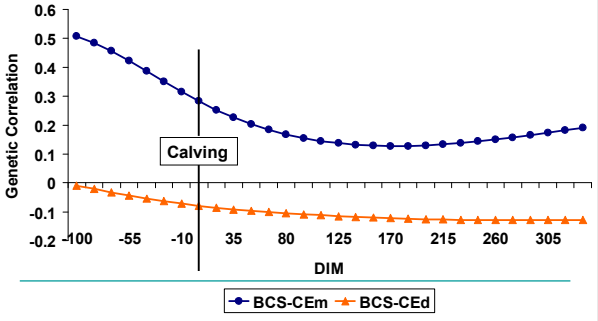
Results: Calf Survival – 1st parity

Genetic correlations between BCS and CS are moderate to high and positive



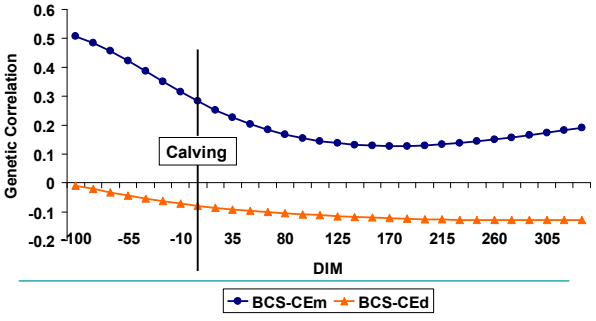
Results: Calving Ease – 2nd parity

A genetically high BCS before calving increases the chance of the cow to calve with difficulty



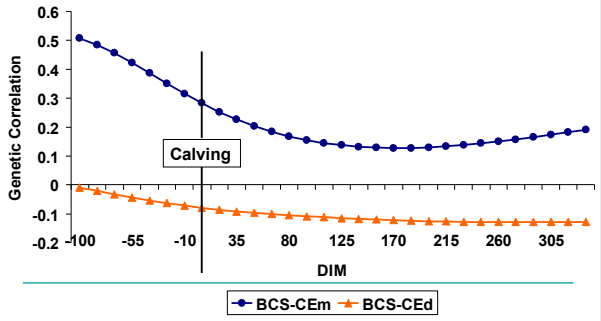
Results: Calving Ease – 2nd parity

A genetically high BCS (after calving) is related with calving difficulty for cows



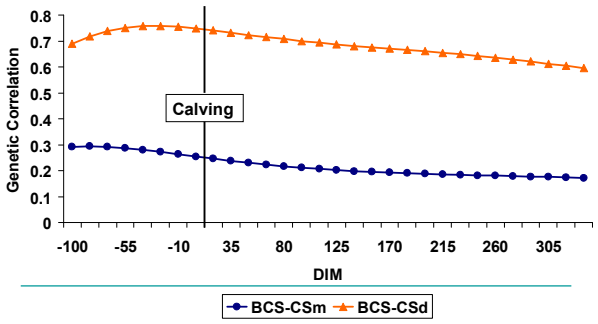
Results: Calving Ease – 2nd parity

Genetic correlation between BCS and Direct CE (CEd) close to 0



Results: Calf Survival – 2nd parity

Trend similar to 1st parity, positive correlations



Conclusions

- Random regression models are useful to assess genetic correlation over time
- Low to moderate genetic correlations between BCS and calving traits have been identified:
  - High BCS before 2nd calving ➔ maternal calving difficulty
  - High BCS after calving is related with:
    - maternal calving difficulty but direct calving ease
    - maternal and direct calf survival

Conclusions

- BCS could be used as an indicator for indirect selection of calving traits.
- But selection on BCS needs to be balanced taking into account genetic correlations with all economically important traits

  ↳ A low BCS
  - suggests a poor health and fertility *(Berry et al., 2003; Lassen et al., 2003)*
  - is linked with high 305-d milk, fat and protein yields *(Veerkamp et al., 2001)*

Corresponding author's e-mail: bastin.c@fsagx.ac.be

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