



# Beef on Dairy genomic evaluation for feed efficiency, methane emission and meat quality

Kevin Byskov<sup>1</sup>, Huiming Liu<sup>1</sup>, Kresten Johansen<sup>2</sup>  
and Mahmoud Shirali<sup>1</sup>

1: SEGES Innovation P/S, 2: Aarhus University

**Interbull Open Session, Lyon 2023**

STØTTE AF  
Kvægaftifonden

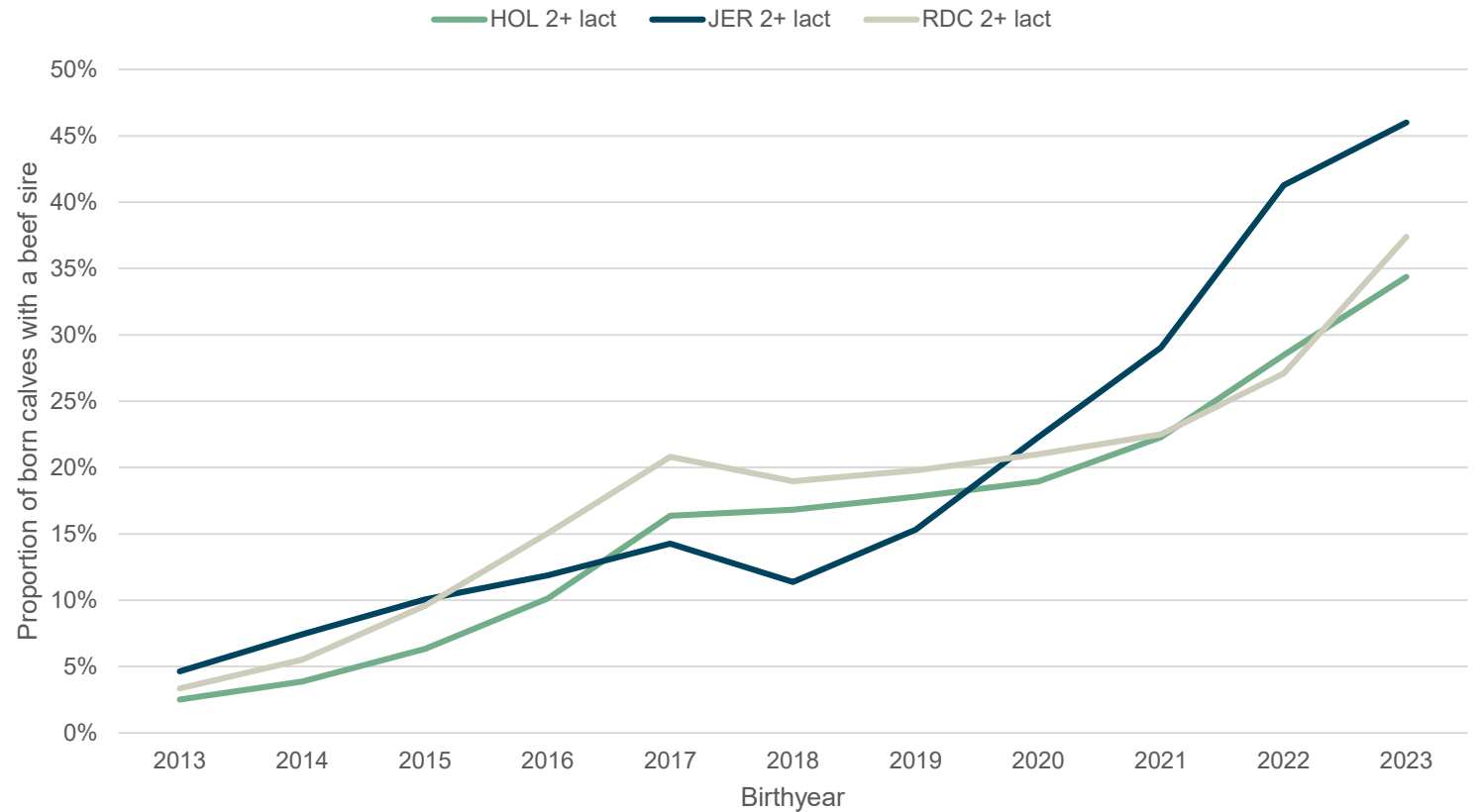


FRONTMATEC



**SEGES**  
INNOVATION

# Development in the Beef on Dairy segment



## Aim of FutureBeefCross project



### FutureBeefCross



To produce quality meat, improve production economy and lower climate impact by utilizing genetic potential for meat quality, feed efficiency and methane emission traits



Basis is development of new methods to phenotype 12,000 Danish Beef on Dairy crossbred calves

# Experimental setup

Project started January 2019

5 commercial slaughter calf herds

- 4 feeding pellet diets and 1 feeding TMR
- Capacity to test feed intake on ~4500 calves/year
- Capacity to measure methane on ~3600 calves/year

Beef on Dairy crosses on Holstein dams

- Danish Blue
- Charolais
- Angus



## Marbling score (MS) / Intramuscular fat (IMF)

- Hand-held camera solution at slaughterhouse.
  - Q FOM™ Beef (Frontmatec, Denmark).
- Picture taken off *Rib Eye* between 5<sup>th</sup> and 6<sup>th</sup> rib.
- Both MS and chemical IMF can be predicted.
- Ear cut of for genotyping



If you want to know more – Monday afternoon Session 18

16.30: *The precision and accuracy of the Q-FOM grading camera predicting rib eye traits in beef carcasses*

By S.M. Stewart, M. Christensen, H. Toft, T. Lauridsen and R. O'reilly

18.25 (poster session): *Beef on dairy – meat quality and prediction of intramuscular fat on the slaughter line*

## Marbling score (MS) / Intramuscular fat (IMF)

- 1686 BBLxHOL calves with phenotype from 65 sires
  - 876 with both genotype and phenotype
- Heritability from phenotypic bivariate AM is 0.15 for both IMF and MS
  - Genetic correlation is estimated to 0.93 (0.09)
- Goal is a SS multibreed AM model including data from calves from HOL dams and CHA, AAN and BBL sires.

# Methane and Feed data

- Age of calves in test (6-8 months).
- Length of test period ~3 weeks.
  - Body weight at start and end.
  - Feed intake pr visit (Allfeed, Allflex).
- 8 sniffers connected to 6 feed boxes each (Guardian® NG, Edingburg Instruments Ltd).



## Feed efficiency – genetic RFI model

- 4266 BBLxHOL calves with phenotype from 74 sires
  - 2029 with both genotype and phenotype
- Model is a bivariate SS RR AM for daily dry matter intake (DDMI) and body weight (BW)
- Goal is a SS RR multibreed AM model including data from calves from HOL dams and CHA, AAN and BBL sires.



# RFI Calculation

Genetic RFI was calculated following Esfandiari and Jensen (2021) and Shirali et al. (2018).

$$RFI = TDMI - b_{gain}GAIN - b_{mbw}MBW$$

Total dry matter intake (TDMI) was the sum of DDMI from 200 to 280 days of age.

$$a_{TDMI} = \sum_{t=200}^{280} l_{q1}(t)a_{DDMI}$$

GAIN was the total body weight gain during 200 to 280 days of age.

$$a_{GAIN} = (l_{q1}(t_{280}) - l_{q1}(t_{200}))'a_{BW}$$

Mean body weight (MBW) was the average body weight during 200 to 280 days of age.

$$a_{MBW} = \frac{1}{2}(l_{q1}(t_{280}) + l_{q1}(t_{200}))'a_{BW}$$

$b_{gain}$  and  $b_{mbw}$  are the regression coefficients obtained from Genetic variance covariance matrix.

# Feed efficiency complex – pedigree model results

The heritabilities (diagonal) and genetic correlations (off diagonal) are as follow:

	TDMI	RFI	GAIN	MBW
TDMI	0.24			
RFI	0.84	0.21		
GAIN	0.43	-0.12	0.21	
MBW	0.46	0.00	0.80	0.35

# Methane emission

- Work has just started no results yet.
- Decided to use  $\text{CH}_4/\text{CO}_2$  ratio as phenotype
  - Ongoing work on alternative phenotype ( $\text{CH}_4$  production/day)
- Goal is SS multibreed AM model



# Perspective



- Include GEBVs for RFI, Methane emission and Marbling score in the combined index for Beef on dairy.
- Danish Beef on Dairy index already includes:
  - **Production** (e.g. net daily gain, carcass conf., slaughter %)
  - **Direct calving traits** (calving ease and survival)
  - **Young stock survival**
  - **Health traits** (pneumonia, diarrhea, Foot rot)
- A combined index, only relating to traits expressed after calves are sold from the dairy herd, is an integrated part of prize setting of Beef on Dairy calves.
- Using genetic superior beef bulls → higher sales price of crossbred calves.

# Thanks to:

STØTTET AF

**Kvægafgiftsfonden**



**MSD**  
Animal Health



**AARHUS**  
UNIVERSITET



**DANISH CROWN**

**FRONTMATEC**



VIKINGDANMARK



VIKINGGENETICS

**SEGES**  
INNOVATION