What is an optimal body condition profile for reproduction in dairy cows?

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MINISTÈRE DE L'AGRICULTURE ET DE L'ALIMENTATION
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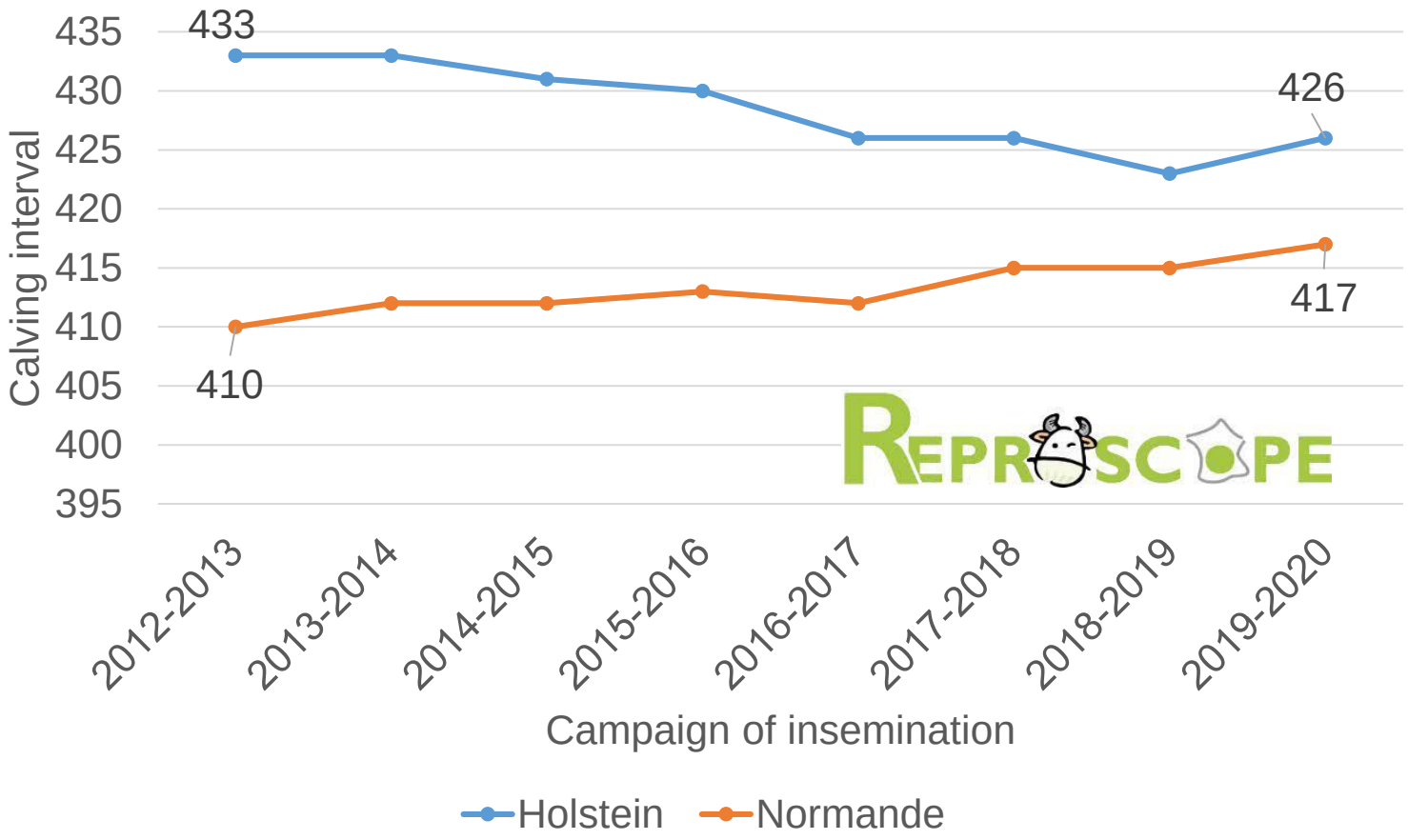
Context: Reproductive performances vary a lot between cows

Evolution of calving interval in French dairy herds



¼ of cows > 456 days for calving interval
¼ of cows < 361 days for calving interval

¼ of cows > 441 days for calving interval
¼ of cows < 357 days for calving interval

There is more than 90 days between cows in the first quarter and cows in the last quarter

Data have been compiled from reproscope.fr

Aim of the study

- Existence of an ideal BCS profile to preserve reproductive performance (Royal et al., 2000; López-Gatius et al., 2003; Chagas et al., 2007; Friggens et al., 2010; Bedere et al., 2018).
- Individual profiles of BCS vary greatly between cows

The objective of this work was to study the relationships between reproductive performance and different BCS profiles

Material and Methods: Data base

- 2 breeds: Holstein and Normande
- 6 experimental dairy farms with seasonal calving (5 with HO and 2 with NO)
- At least 5 BCS from 5 days pre calving to 210 days post calving
  ➔ Weekly BCS were obtained using an interpolation spline
- Reproductive events: dates of calving, dates of inseminations, dates of next calving
- Production performances: Milk yield, fat and protein contents over 44 weeks

Nb of lactation	Primiparous	Multiparous	Total
Holstein	787	898	**1685**
Normande	183	292	**482**

- Ovarian activity (P4 profile): commencement of luteal activity, normal P4 profile
  ➔ only 721 HO and 414 NO

Material and methods: determining BCS profile within breed

Weekly BCS from 0-210d pp

5 variables of BCS

BCS at calving | BCS at 28d pp | BCS at 56d pp | BCS at 98d pp | BCS at 210d pp

4 variables of BCS variation between these stages

- Δ BCS 28d pp – BCS at calving
- Δ BCS 56d pp – BCS 28j pp
- Δ BCS 98d pp – BCS 56d pp
- Δ BCS 210d pp – BCS 98d pp

PCA and HCA

Sankey diagram and Kappla coefficients between successive lactations

Material and methods: analyses between performance and BCS profile

Reproduction variables

Ovarian activity variables

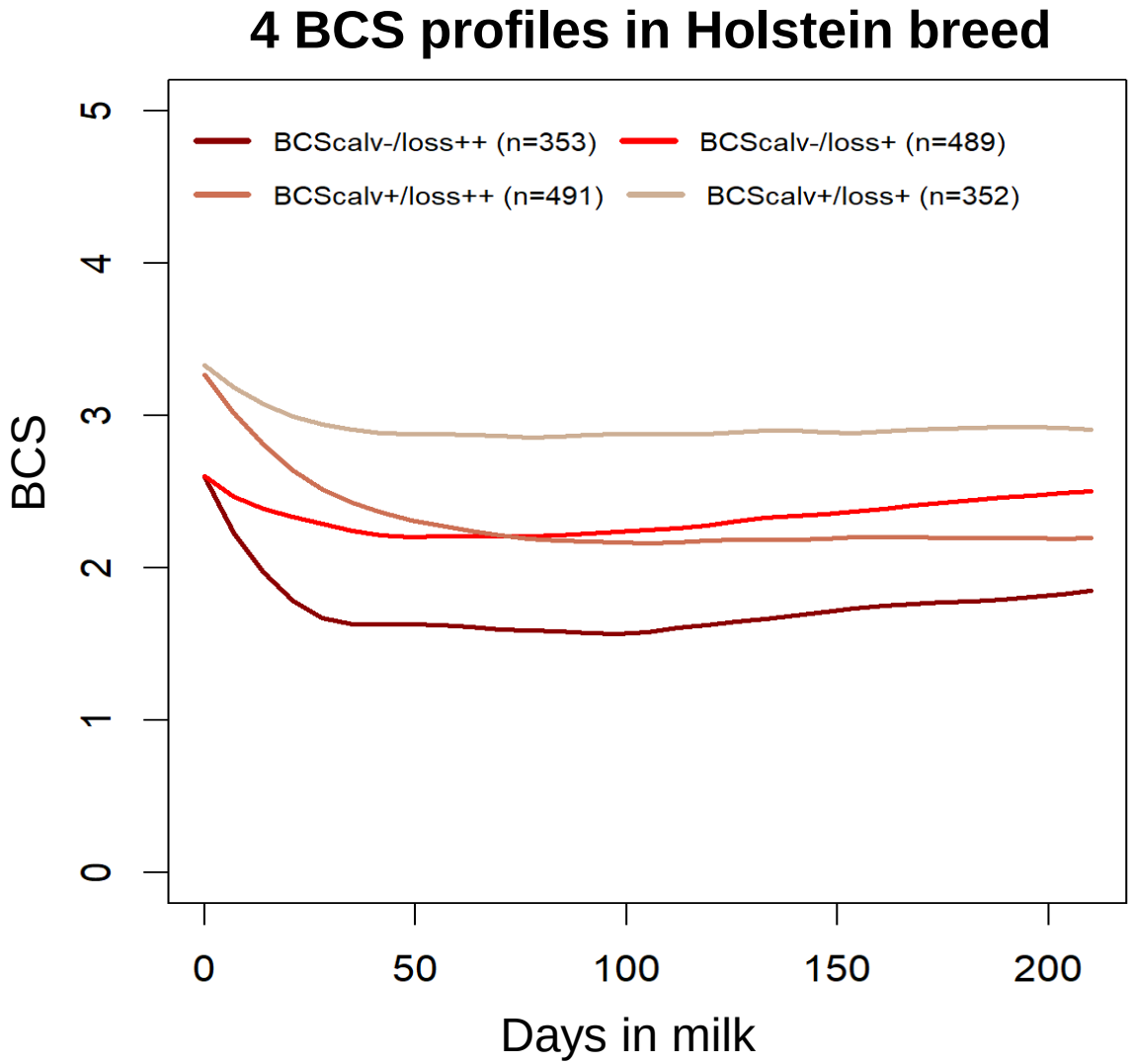
Production variables

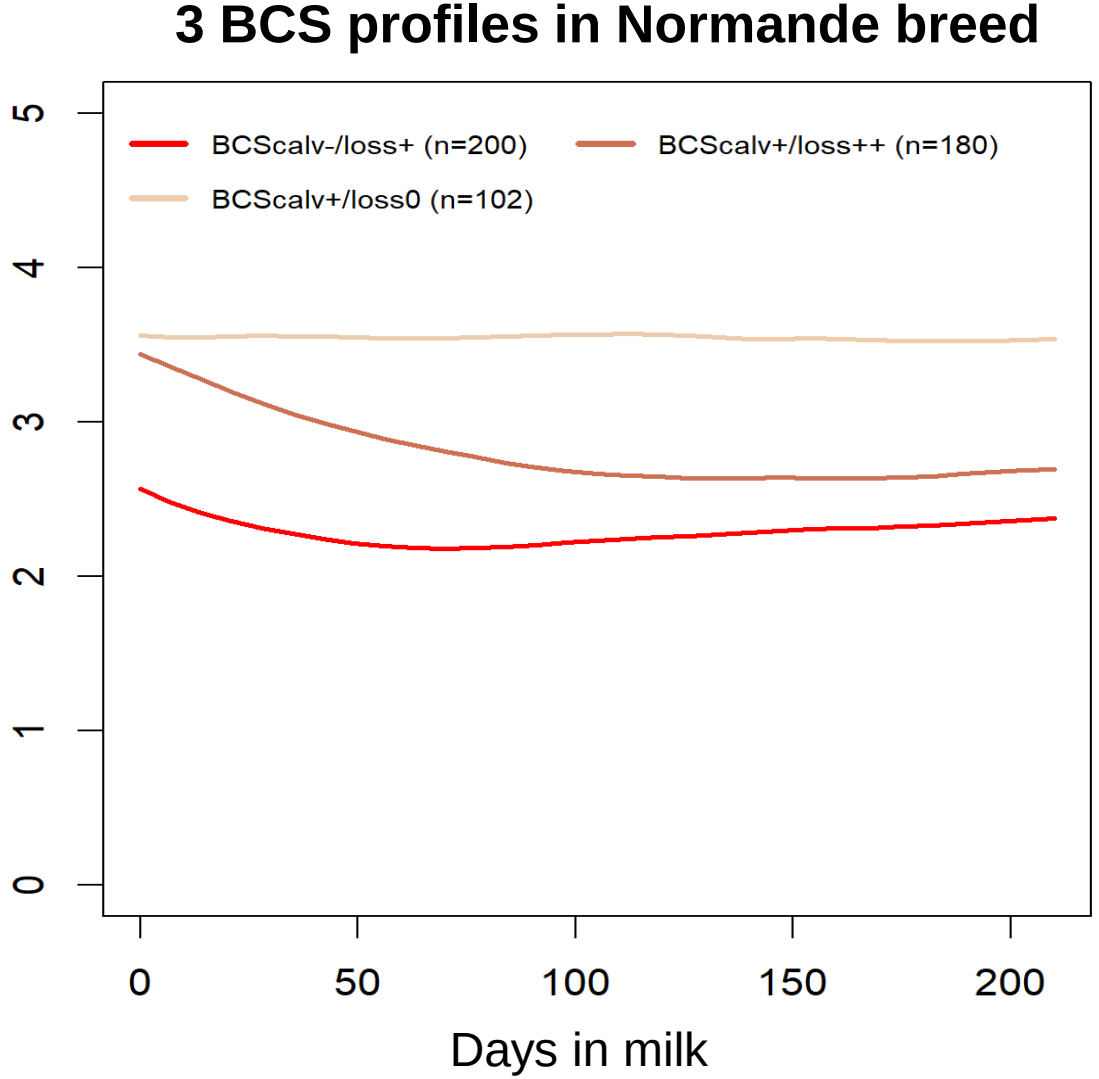
~ BCS profile + Calving-beginning of AI campaign + Calving difficulties + Year*Herd

Logistic regression and estimation of odds ratio

Mixed linear model and estimation of LSmeans

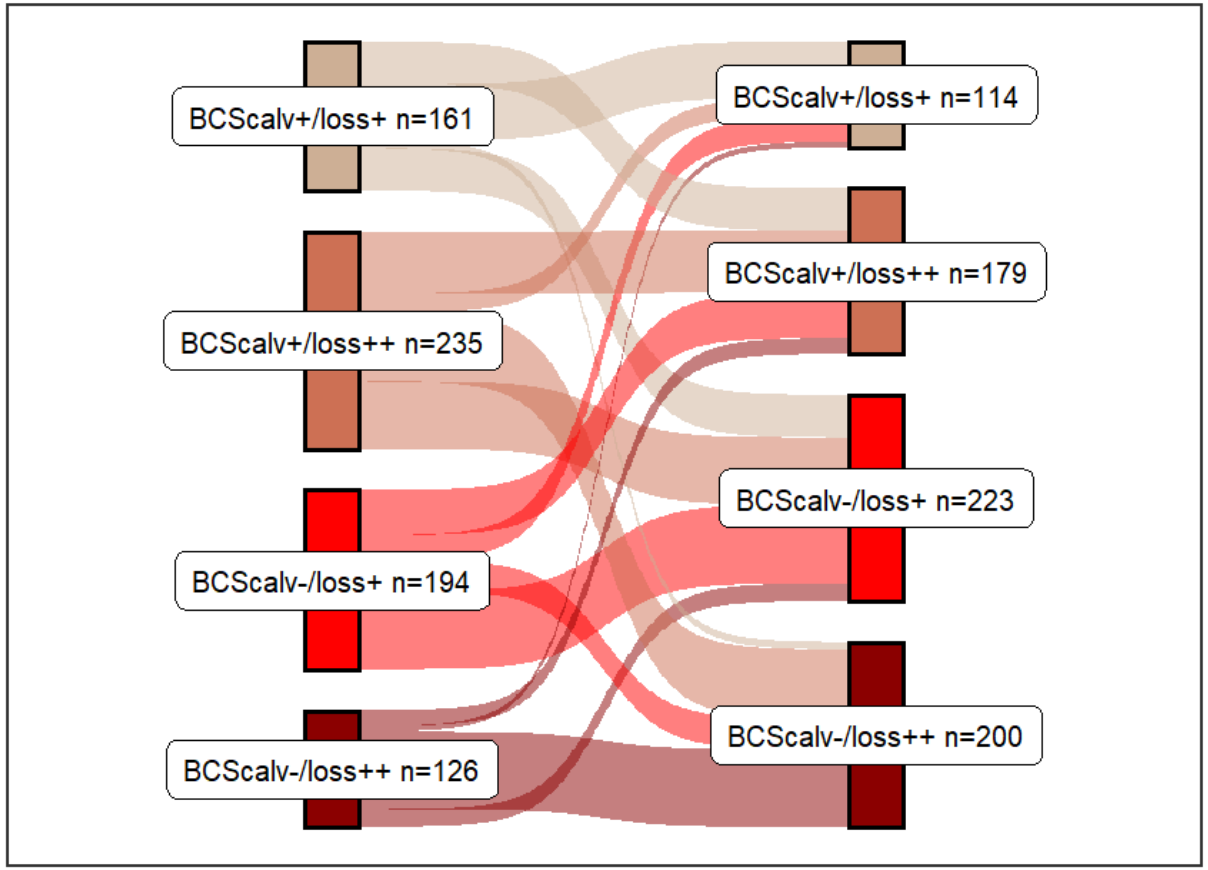
Results: BCS profile identified





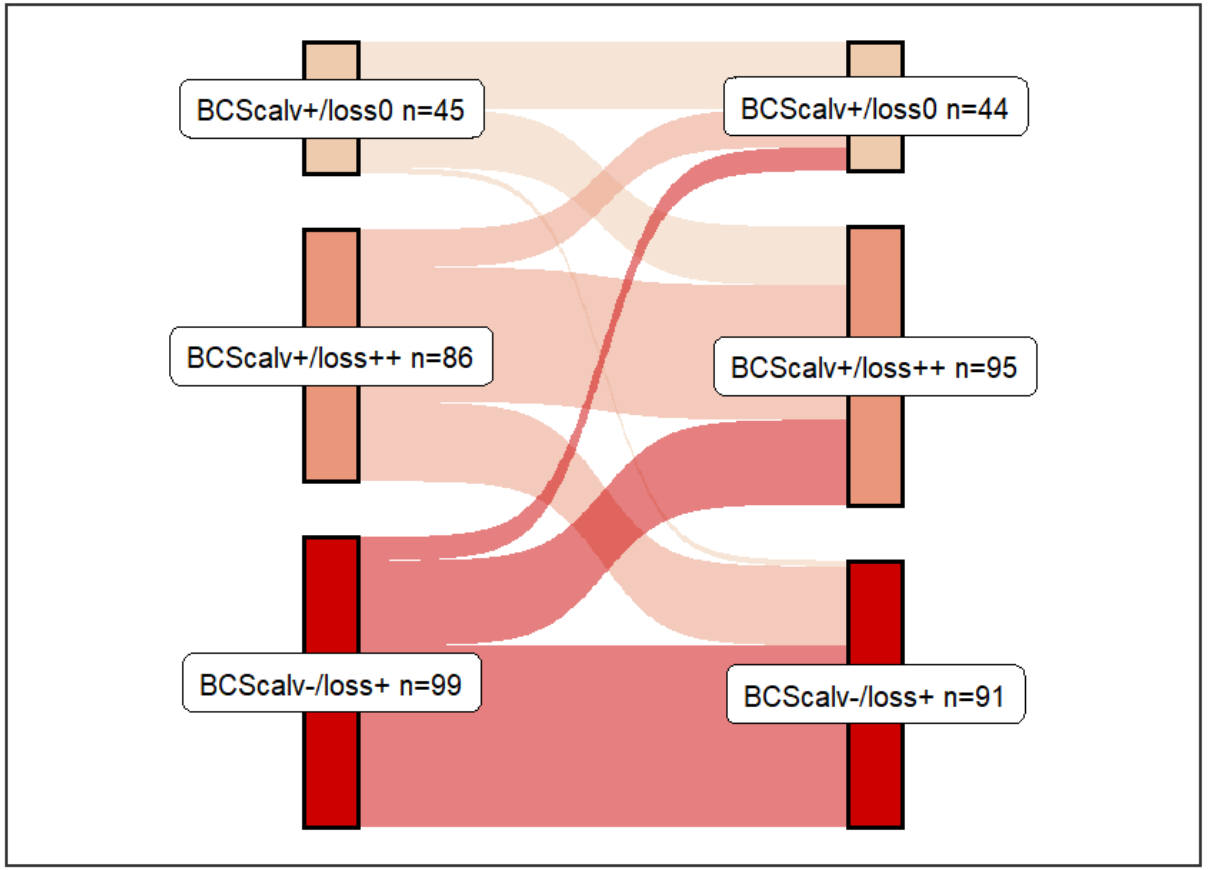
Results : Concordance of BCS profile through successive lactations

Sankey diagram HO cows (n=716)



Previous Lactation Next Lactation

Sankey diagram NO cows (n=230)

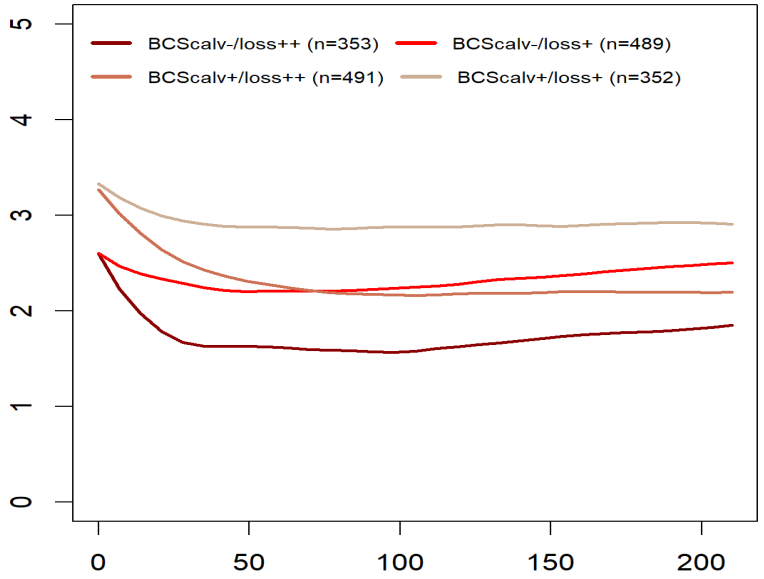


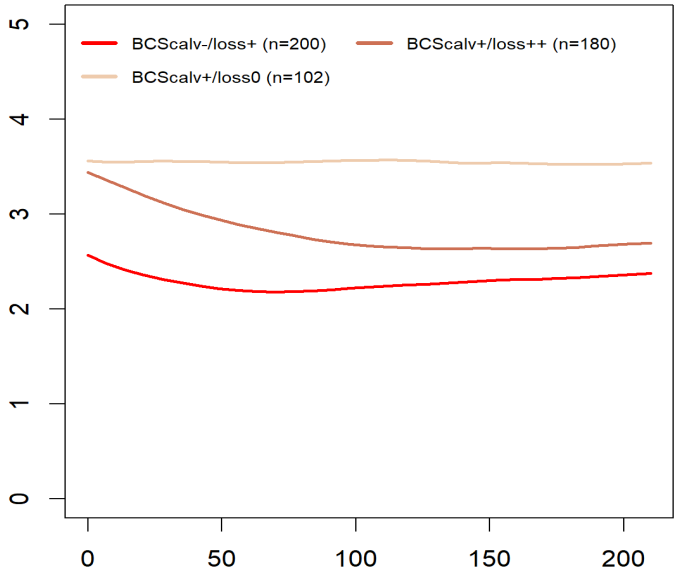
Previous Lactation Next Lactation

Results: Performance for reproduction for each BCS profile

Holstein breed	BCScalv-/ loss ++	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss +
Number of lactations	**353**	**489**	**491**	**352**
Proportion of cows calving after 1 AI (OR (IC))	0.85 (0.64-1.13)	0.84 (0,64-1,10)	**1**	0.97 (0.73-1.30)
Proportion of cows calving again (OR (IC))	**0.64 (0.45-0.92)**	0.99 (0.70-1.41)	0.80 (0.57-1.11)	**1**

Normande breed	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss 0
Number of lactations	**200**	**180**	**102**
Proportion of cows calving after 1 AI (OR (IC))	0.90 (0.60-1.35)	1	**0.55 (0.33-0.93)**
Proportion of cows calving again (OR (IC))	1	0.97 (0.61-1.56)	0.65 (0.38-1.11)





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Calving-1st AI interval (days)	85.1 b	83.1 ab	80.7 a	82.3 ab

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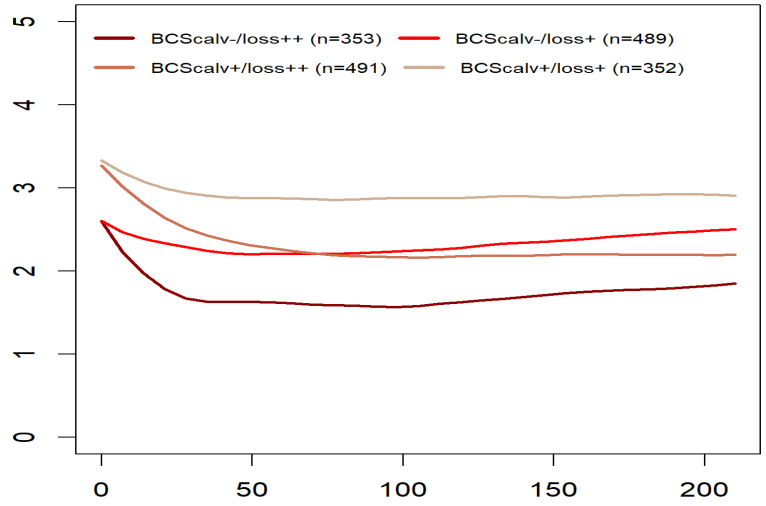
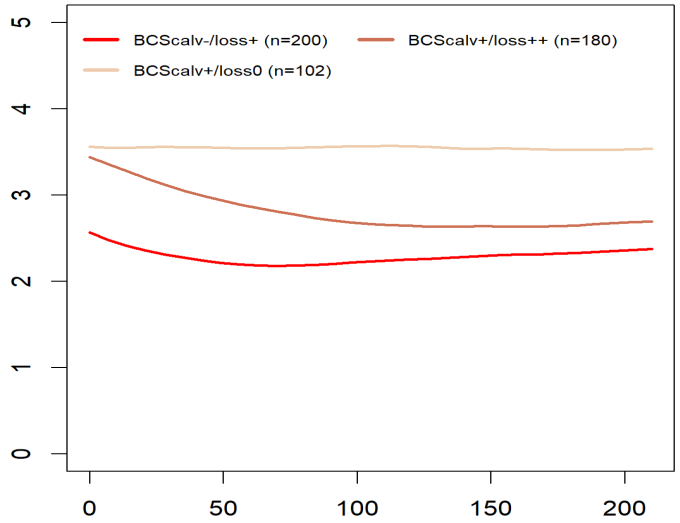
Calving-1st AI interval (days)	82.0b	72.1 a	71.7 a





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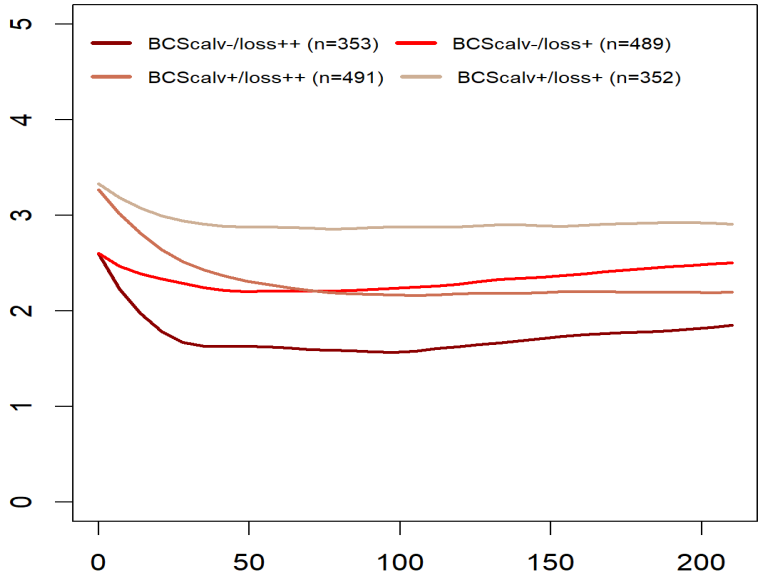
Proportion of cows calving again (OR (IC))	**0.64 (0.45-0.92)**	0.99 (0.70-1.41)	0.80 (0.57-1.11)	**1**
Calving-1st AI interval (days)	**85.1 b**	83.1 ab	**80.7 a**	82.3 ab
Number of lactations	**241**	**370**	**347**	**263**
Calving interval (days)	380 ab	**383 b**	**377 a**	379 ab

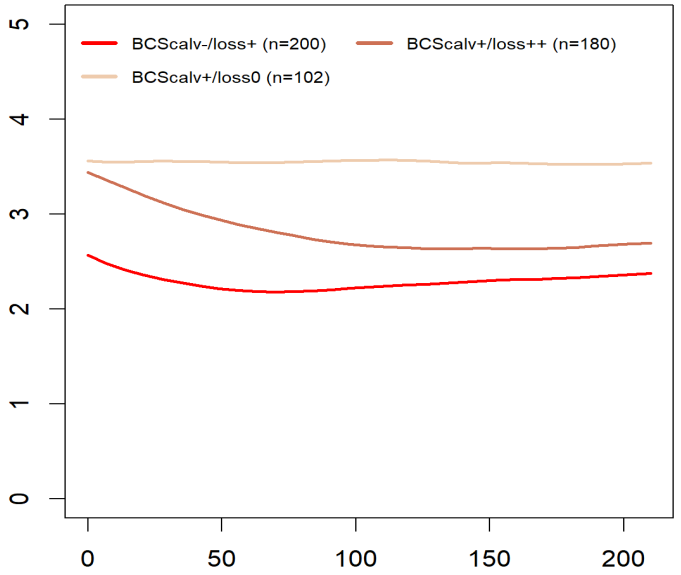
Normande breed	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss 0
Number of lactations	**200**	**180**	**102**
Proportion of cows calving after 1 AI (OR (IC))	0.90 (0.60-1.35)	1	**0.55 (0.33-0.93)**
Proportion of cows calving again (OR (IC))	1	0.97 (0.61-1.56)	0.65 (0.38-1.11)
Calving-1st AI interval (days)	**82.0b**	72.1 a	71.7 a
Number of lactations	**144**	**130**	**65**
Calving interval (days)	**383 b**	373 a	377 ab

Results: Ovarian activity according to BCS profile

Holstein breed	BCScalv-/ loss ++	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss +
Number of cows	*121*	*306*	*162*	*132*
CLA (days)	**26.8 b**	**24.8 b**	23.6 ab	**20.7 a**
Proportion of normal ovarian cyclicity	**46%**	62%	**55%**	**69%**
OR (IC)	**0.39 (0.23-0.68)**	0.74 (0.46-1.18)	**0.59 (0.36-0.98)**	**1**

Normande breed	BCScalv-/ perte +	BCScalv+/ perte ++	BCScalv+/ perte 0
Number of cows	*169*	*155*	*90*
CLA (days)	27.4 a	28.2 a	29.7 a
Proportion of normal ovarian cyclicity	79%	72%	**59%**
OR (IC)	1	0.7 (0.4-1.2)	**0.4 (0.2-0.7)**

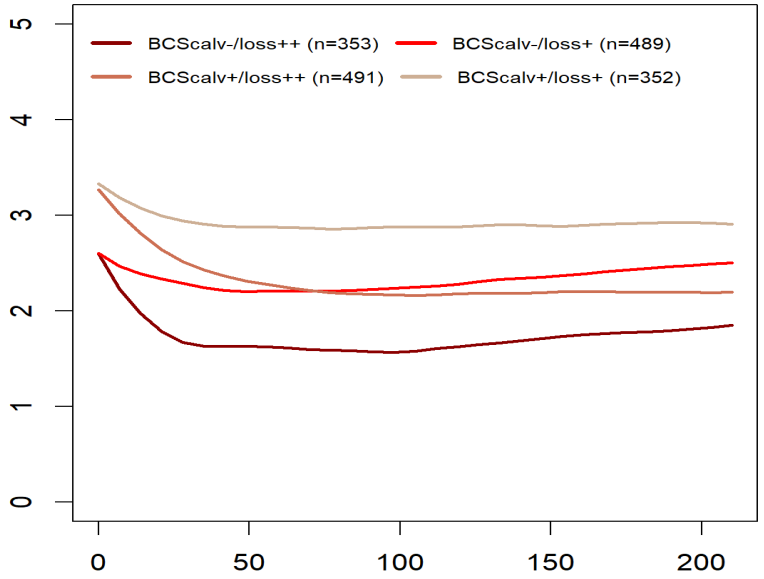


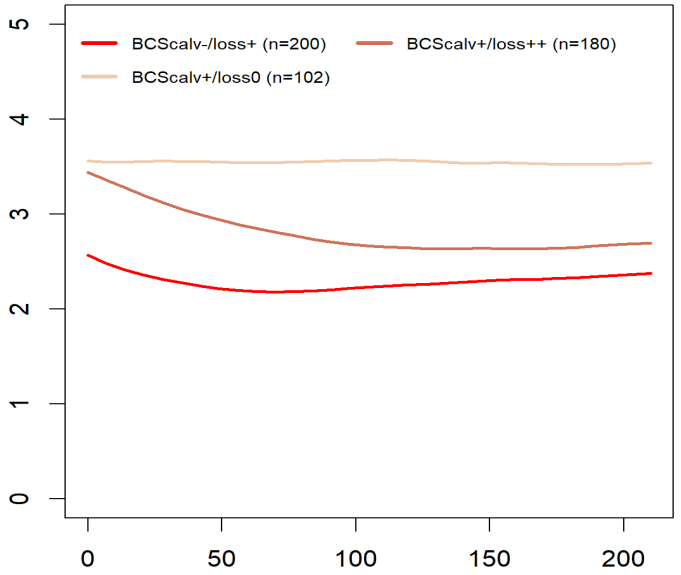


Results: Performance of production for each BCS profile

Holstein breed	BCScalv-/ loss ++	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss +
Total milk yield over 44w	**7792 a**	7291 b	7319 b	**6963 c**
Fat content over 44w	39.2 a	40.0 ab	39.8 ab	**40.2 b**
Protein content over 44w	31.3 a	32.1 b	31.5 a	**32.5 c**

Normande breed	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss 0
Total milk yield over 44w	**5 178 a**	5 869 b	5 664 b
Fat content over 44w	40.6 a	40.6 a	**42.0 b**
Protein content over 44w	33.3 a	33.1 a	**34.9 b**

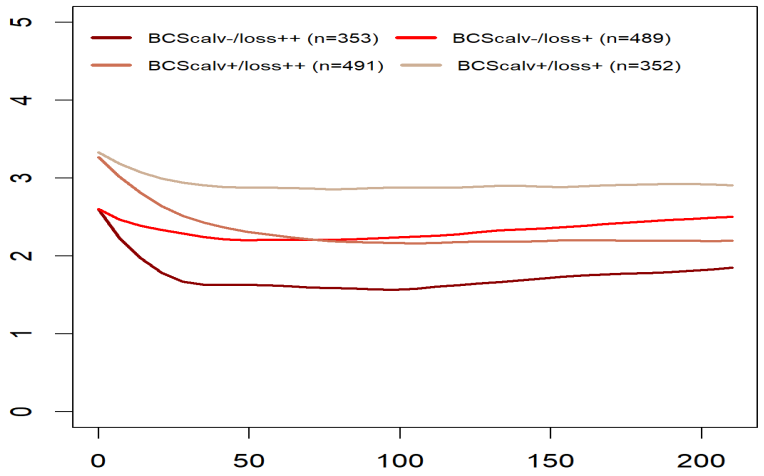


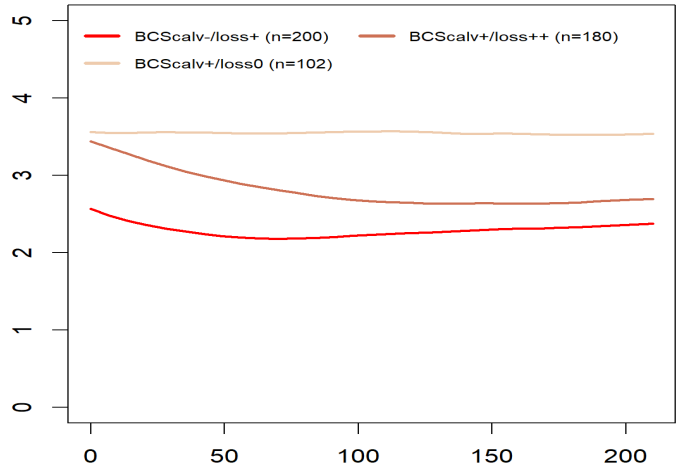


Conclusion

Holstein breed	BCScalv-/ loss ++	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss +
Calving again	☹	🙂	🙂	😊
Delay to obtain a pregnancy	😐	☹	😊	🙂
% of normal ovarian activity	☹	😊	☹	😊

Normande breed	BCScalv-/ loss +	BCScalv+/ loss ++	BCScalv+/ loss 0
Calving again	😊	😊	😐
Delay to obtain a pregnancy	☹	😊	😐
% of normal ovarian activity	😊	🙂	☹





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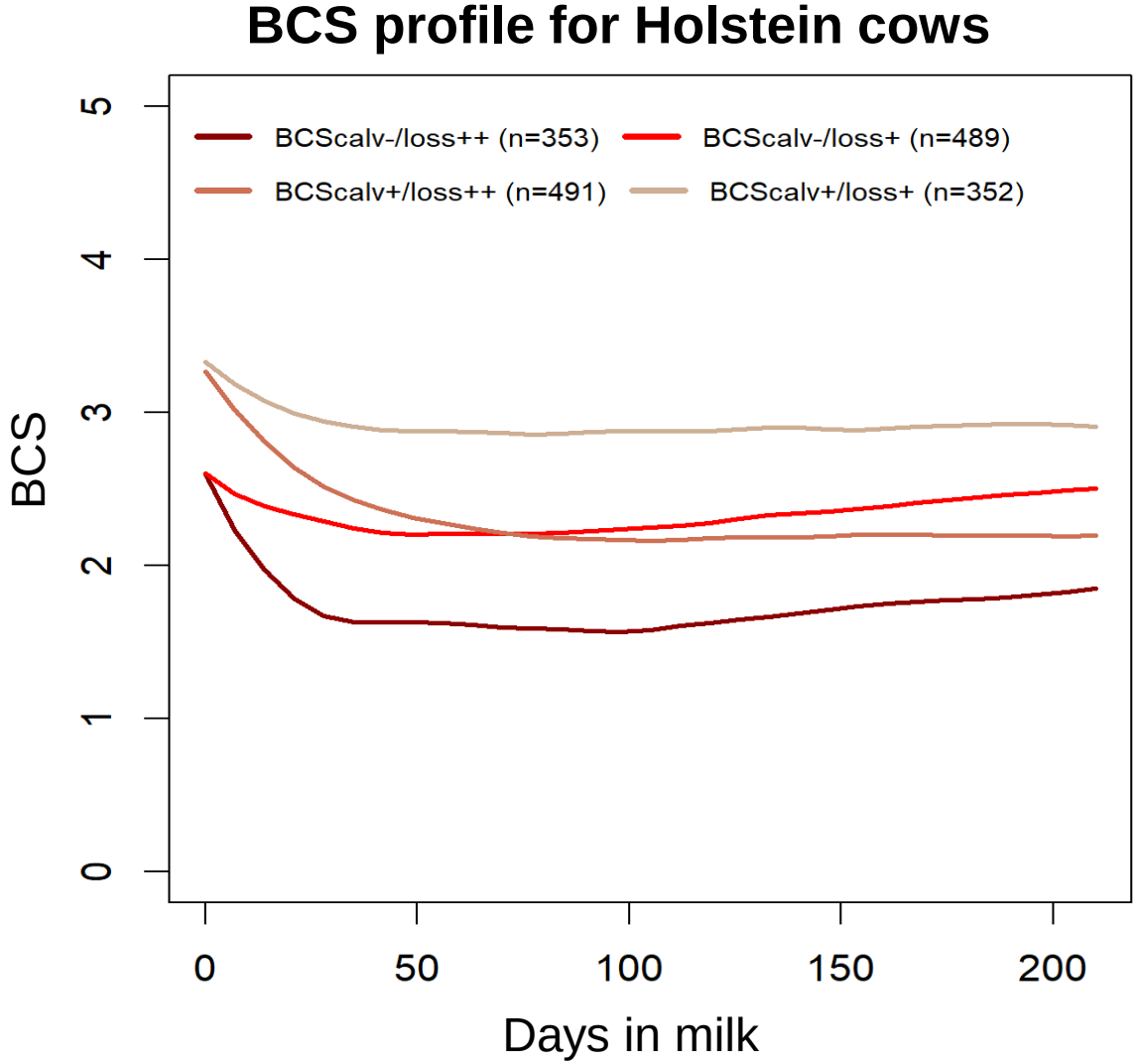

BCScalv+/loss+ → Failure of reproduction explained mainly by a milk yield effect

BCScalv+/loss++ → Strong effect of BCS loss on success of first AI

BCScalv-/loss + → ? Main effect to identified

BCScalv-/loss ++ → Success of reproduction mainly affected by the start of reproduction

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Thank you

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