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Genetic evaluation for body condition score in the Walloon Region of Belgium

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Objectives

Body Condition Score (BCS) = stored energy reserves

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Indicator trait for improving fertility and health

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The Walloon Region of Belgium has been taking part to the international BCS genetic evaluation since Sept 2008.

↓

Objectives

1. Extend the current model to data of the first 3 lactations
2. Express BCS breeding values as an indicator optimizing genetic gain on fertility

Data and model

- The previous model included **first lactation BCS** and **angularity** records.
  - ⇨ including angularity improved reliabilities of BCS breeding values (Bastin et al., 2007, Interbull Bulletin 37)

- The **new model** includes :
  - ❑ repeated BCS records (on average 6 per lactation) collected by trained staff between 5 and 365 DIM on lactating cows in **parity 1 to 3**
  - ❑ angularity records collected by classifier between 5 and 365 DIM for cows in **parity 1**

Data and model

No. of	Final data set	'Variances' data set
BCS1 records	30,081	
BCS2 records	22,545	
BCS3 records	15,102	
Angularity records	86,351	
Cows	89,123	
Cows with both records	3,303	
Herds	1,364	

Cows born after 1996 and coming from herds with at least one cow with both BCS and angularity records

Data and model

No. of	Final data set	'Variances' data set
BCS1 records	30,081	27,454
BCS2 records	22,545	20,576
BCS3 records	15,102	13,767
Angularity records	86,351	7,088
Cows	89,123	9,842
Cows with both records	3,303	3,235
Herds	1,364	86

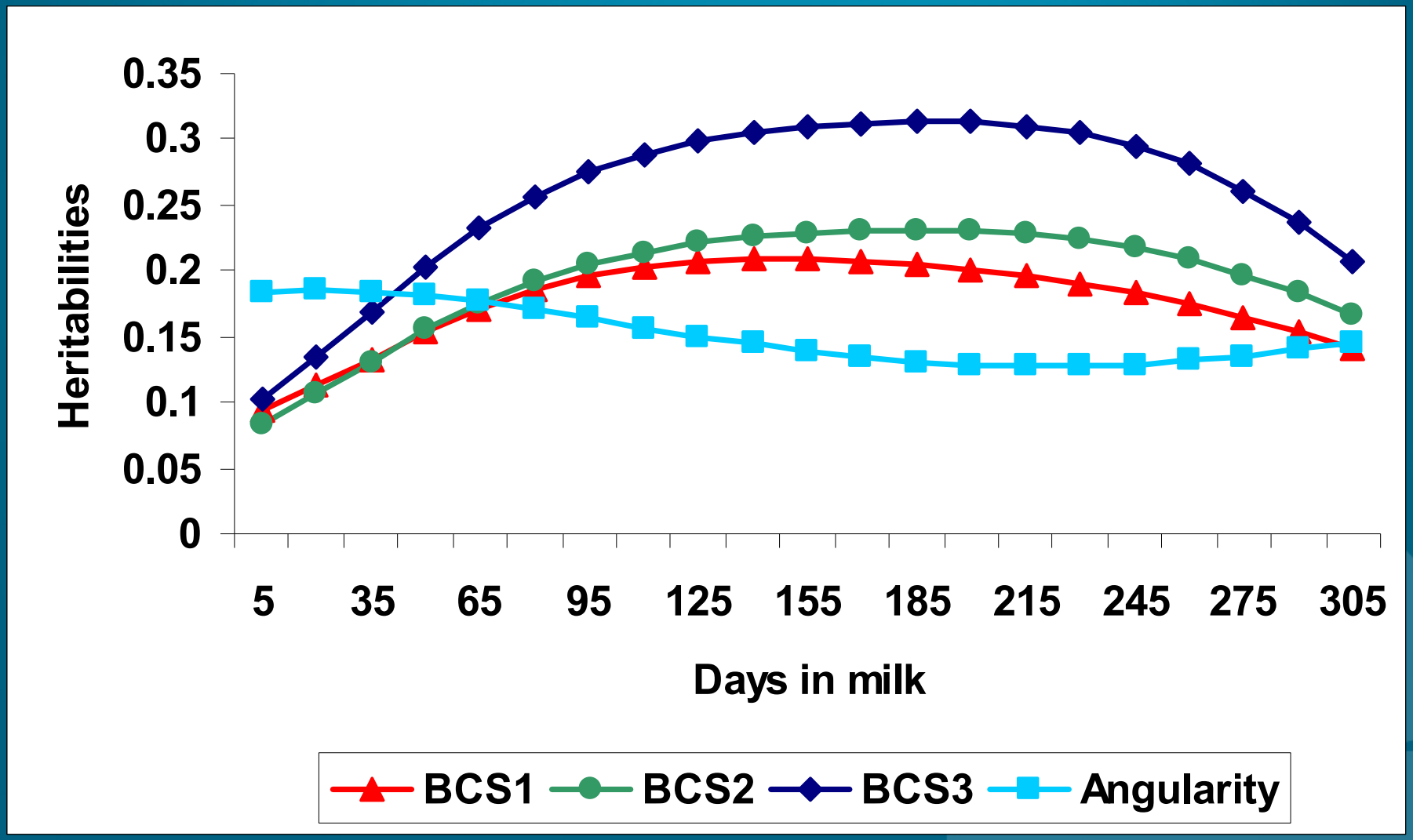
Data and model

$$Y = X\beta + Q\,(Ww + Zp + Za) + e$$

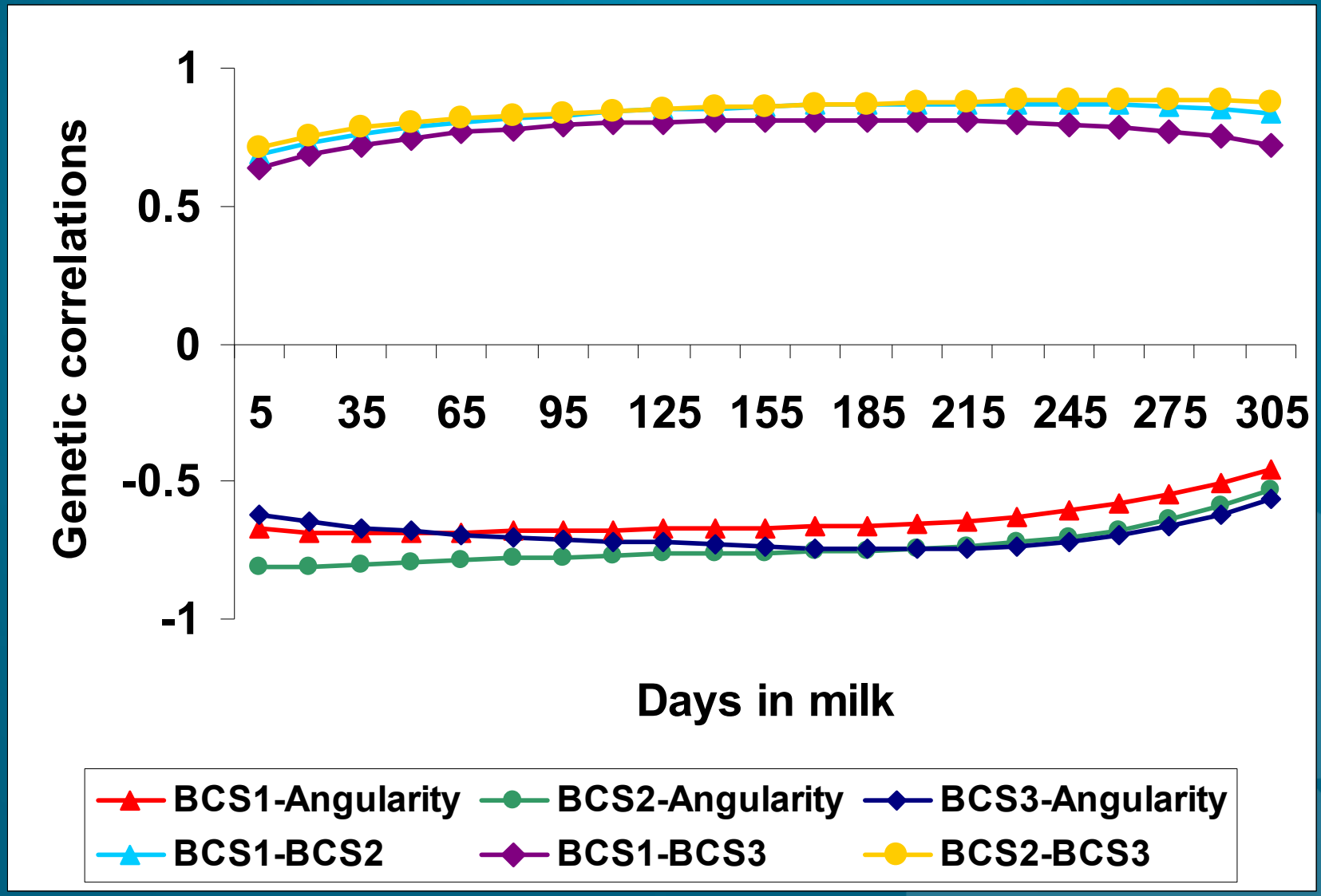
- y = observations (BCS1, BCS2, BCS3, angularity)
- β = fixed effects
  - stage of lactation x age at calving
  - herd x BCS scoring date
  - herd x date of scoring x classifier x system
- w = BCS recorder
  - classifier x system
- p = permanent environment
- a = additive genetic

Regression curves modelled with 2nd order Legendre polynomials

Results: daily heritabilities



Results: genetic correlations



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Breeding values definition

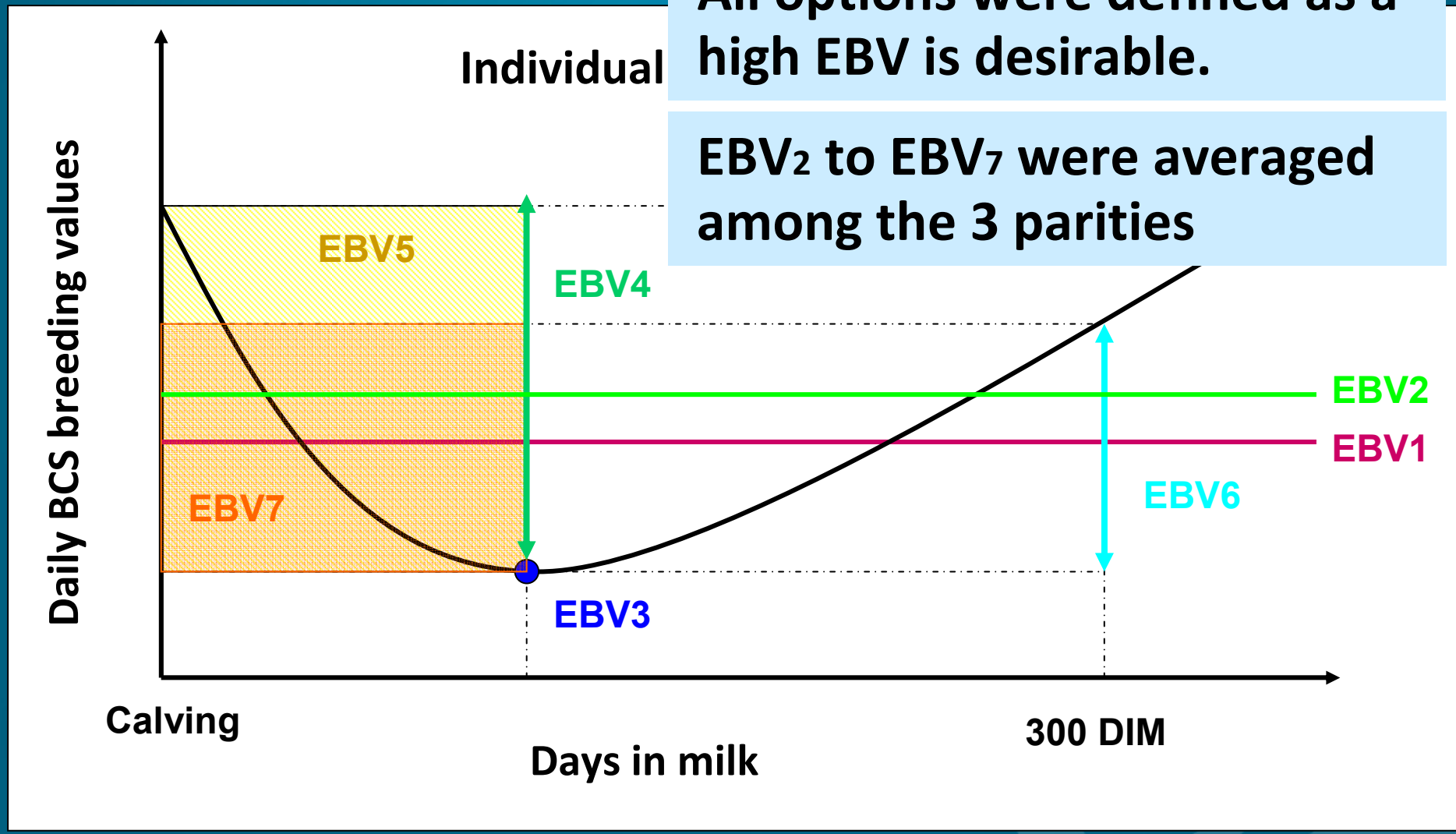
- BCS **target values vary** across the lactation contrary to most of the other traits (e.g. milk yield) for which high values are desirable.
- Random regression models provide **individual daily breeding values**.

→ **7 options** for expressing BCS breeding values were compared: minimum, postpartum loss, recovering, etc.

Breeding values definition

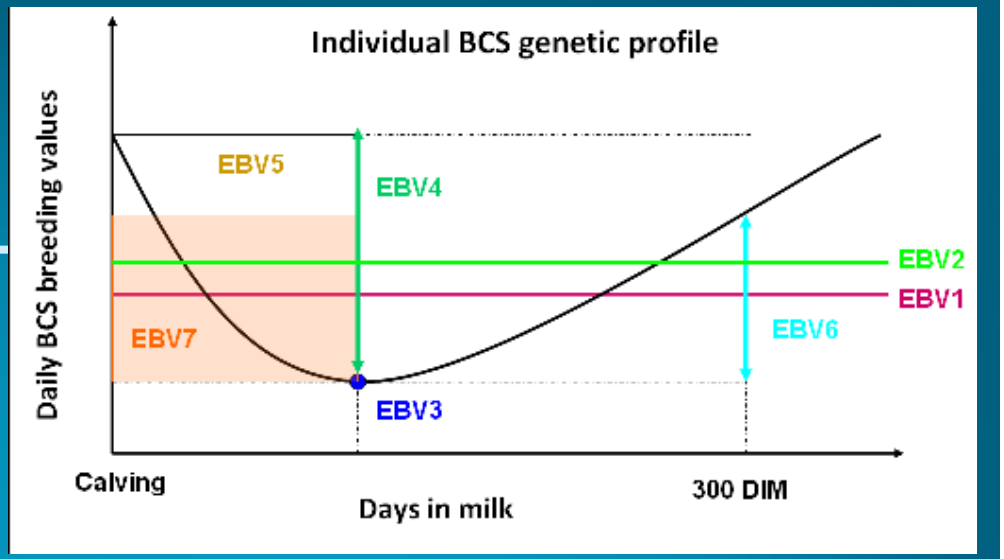
All options were defined as a high EBV is desirable.

EBV_2 to EBV_7 were averaged among the 3 parities



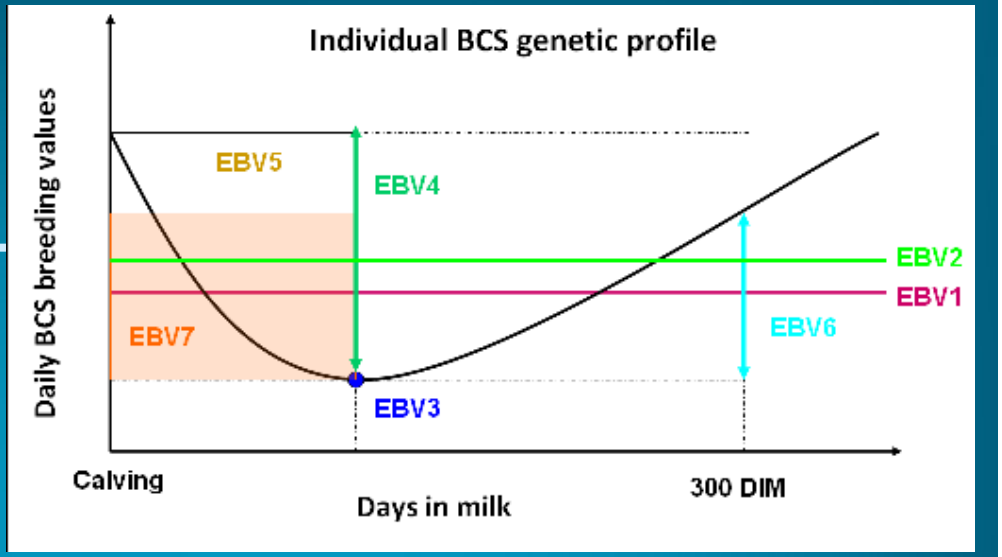
Heritabilities

Trait	Heritability
EBV_1	0.185
EBV_2	0.375
EBV_3	0.416
EBV_4	0.344
EBV_5	0.350
EBV_6	0.406
EBV_7	0.412



Except for EBV_1, heritabilities are moderate and in the same range.

Improving PR



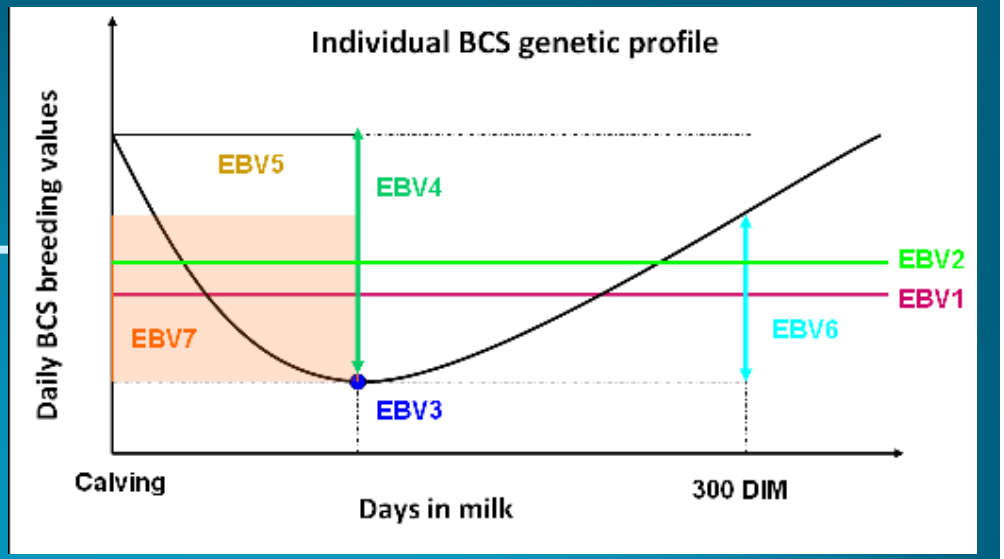
Major interest of including BCS in selection programs : indicator trait of fertility (pregnancy rate – PR)

- Expected response to selection for PR = **0.985%**
- Correlated response on PR as a result of selection on EBV_1 to EBV_7 = from **0.638%** to **0.981%**

	EBV_1	EBV_2	EBV_3	EBV_4	EBV_5	EBV_6	EBV_7
Correlated response to selection on PR (%)	0.638	0.929	0.981	0.843	0.807	0.662	0.838

Correlations

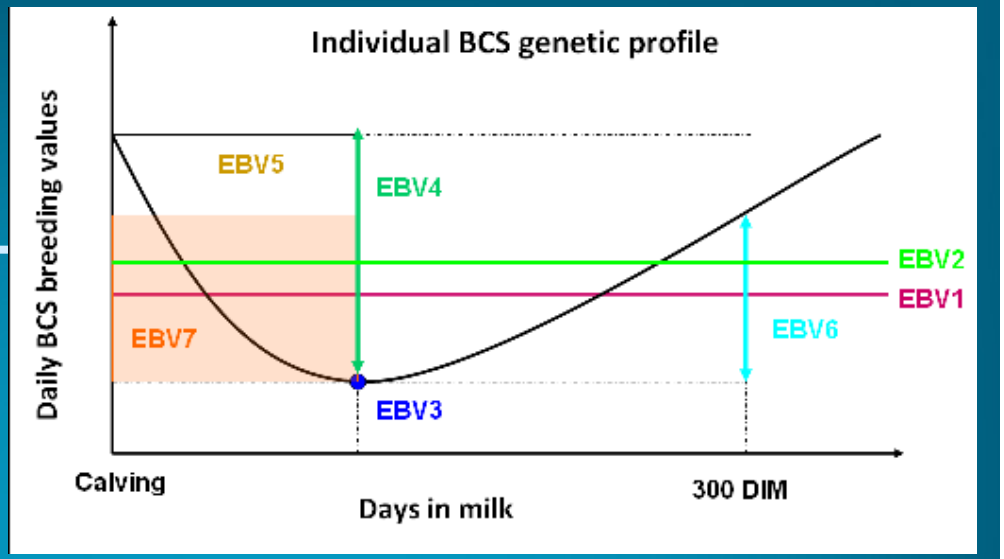
But correlations with economically important traits should also be considered



	EBV_1	EBV_2	EBV_3	EBV_4	EBV_5	EBV_6	EBV_7
Milk yield	-0.11	-0.14	-0.13	-0.16	-0.17	0.03	-0.05
Fat yield	-0.16	-0.18	-0.18	-0.20	-0.22	0.08	0.00
Protein yield	-0.02	-0.05	-0.04	-0.08	-0.10	0.14	0.06
SCS	-0.01	-0.01	-0.01	-0.01	0.00	-0.09	-0.08
Longevity	-0.18	-0.18	-0.18	-0.16	-0.17	-0.03	-0.08
Pregnancy rate	0.30	0.30	0.31	0.29	0.27	0.21	0.26
V€L	-0.05	-0.06	-0.06	-0.10	-0.12	0.16	0.08
V€T	-0.38	-0.39	-0.39	-0.34	-0.32	-0.31	-0.36
V€F	-0.14	-0.14	-0.14	-0.13	-0.13	-0.01	-0.04
V€G	-0.23	-0.25	-0.25	-0.25	-0.26	0.00	-0.09

Correlations

Except for EBV_6 and EBV_7, correlations were **generally negative** with traits other than fertility (**-0.39 to 0**)



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Milk yield	-0.11	-0.14	-0.13	-0.16	-0.17	0.03	-0.05
Fat yield	-0.16	-0.18	-0.18	-0.20	-0.22	0.08	0.00
Protein yield	-0.02	-0.05	-0.04	-0.08	-0.10	0.14	0.06
SCS	-0.01	-0.01	-0.01	-0.01	0.00	-0.09	-0.08
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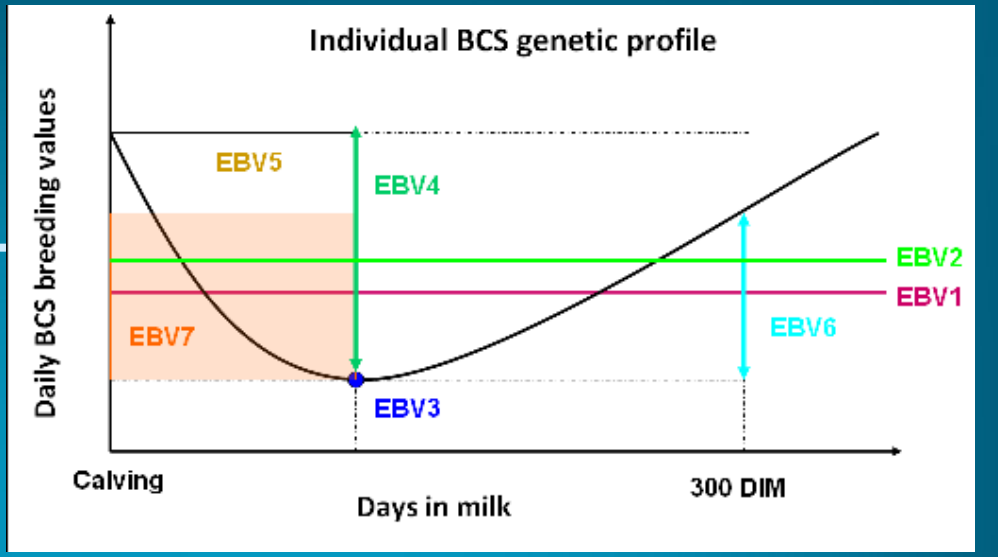
Correlations

Selection for higher EBV would lead to lower production and longevity



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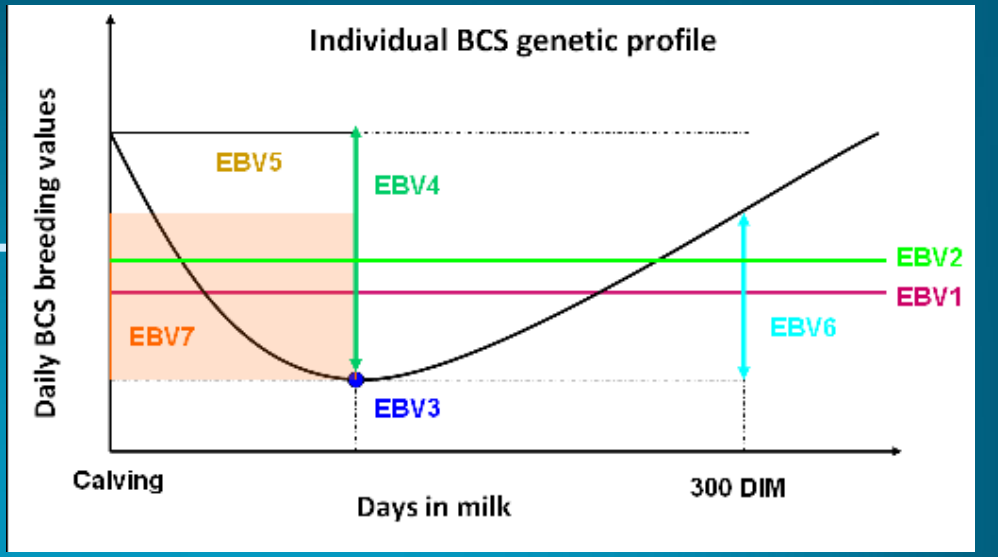
Correlations

Correlations between BCS and V€T due to negative relationship between BCS and dairy character



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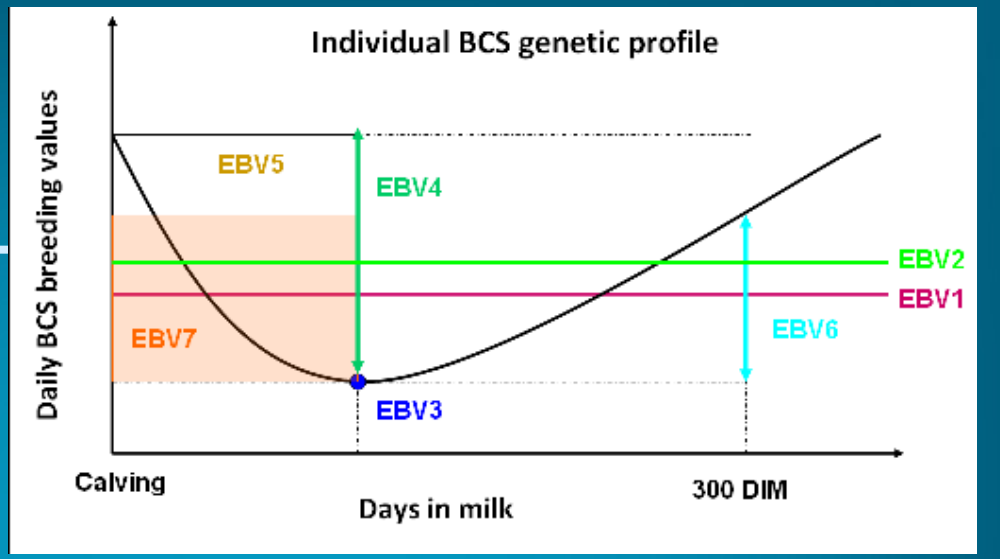
Correlations

Correlations with V€G vary from -0.26 to 0



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Conclusions

- The **new BCS genetic evaluation** in Walloon Region includes BCS records from the first 3 parities and first parity angularity records.
- **Daily BCS heritabilities** ranged between **0.08 and 0.31** according to the number and the stage of lactation.
- BCS could be used as an **indicator trait** for improving fertility:
  - selection for higher **minimum genetic BCS** have a similar response than direct selection on fertility
  - but **negative impacts on other traits** should be considered

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Thank you for your attention!

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