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Analyses of different brown cattle breeds and their crosses in Switzerland

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Introduction

- In Swiss mountain regions it has become common to inseminate dairy cows of the Swiss Brown Cattle breed (BV) with bulls of the Swiss Original Brown Cattle breed (OB).
- BV originates from crosses of OB-cows with US-Brown Swiss (BS)-sires starting back in the sixties of the last century. BV-cows usually have a high percentage of BS-blood (>75%).
- The goals of crossing BV x OB - which is especially practiced on organic farms in mountain regions - are to improve robustness and animal health and to turn the character of the breed to a dual purpose breed

The two brown cattle breeds in Switzerland

Swiss brown cattle (BV = OB x Brown Swiss)

dairy

Swiss Original Brown cattle (OB)

dual purpose

Aims of this study

- To search for effects of cross breeding BV x OB on different phenotypic characteristics (i.e. heterosis)
- To examine differences between F1-crosses and F1 x OB-crosses as well as F1 x BV-crosses, compared to “pure” breeds (OB and BV).
- To derive practical consequences for breeders and advisors

Methods I

› The sample consisted of 1st-lactation-data from 163'734 cows, born between 2000 and 2010.

› Animals were grouped into 6 breed categories:

I:	OB	7'819 cows
II:	BV	147'679 cows*
III:	OB x BV (F1)	4'880 cows
IV:	F1 x BV (F2)	2'695 cows
V:	F1 x OB (F2):	961 cows
VI:	F1 x F1 (classic F2)	45 cows (⟹ omitted)

*Random sample of animals living in valley regions was eliminated, to get the same ratio of animals from mountain regions and from valley regions as in the OB-category.

Methods II

› General linear models (GLM) were calculated using LSQ-means:

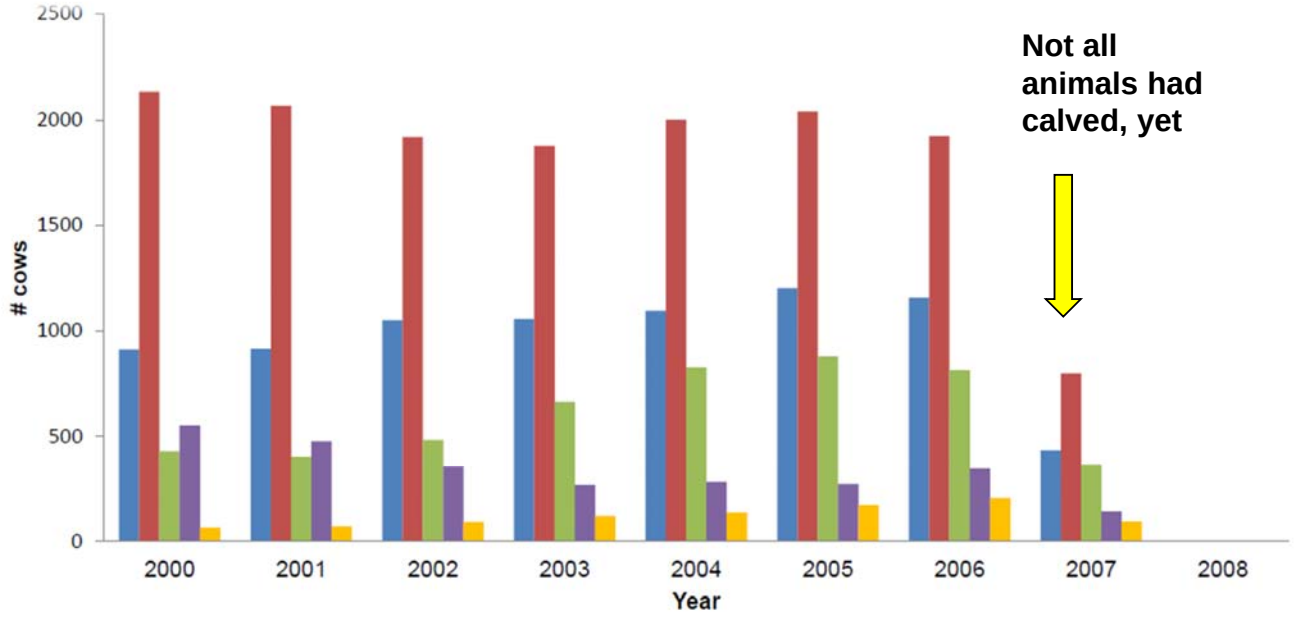
› Dependent variables:

- milk-production traits (kg, %) and persistency
- somatic cell score (SCS)
- fertility traits
- life production and lactation number (n= 83'495)

› Fixed effects: breed category, production area, age at first calving, calving month, and days open (the latter only in models with SCS, persistency, and milk production parameters as dependent variables).

› Interactions between breed category and production area were integrated in separate models.

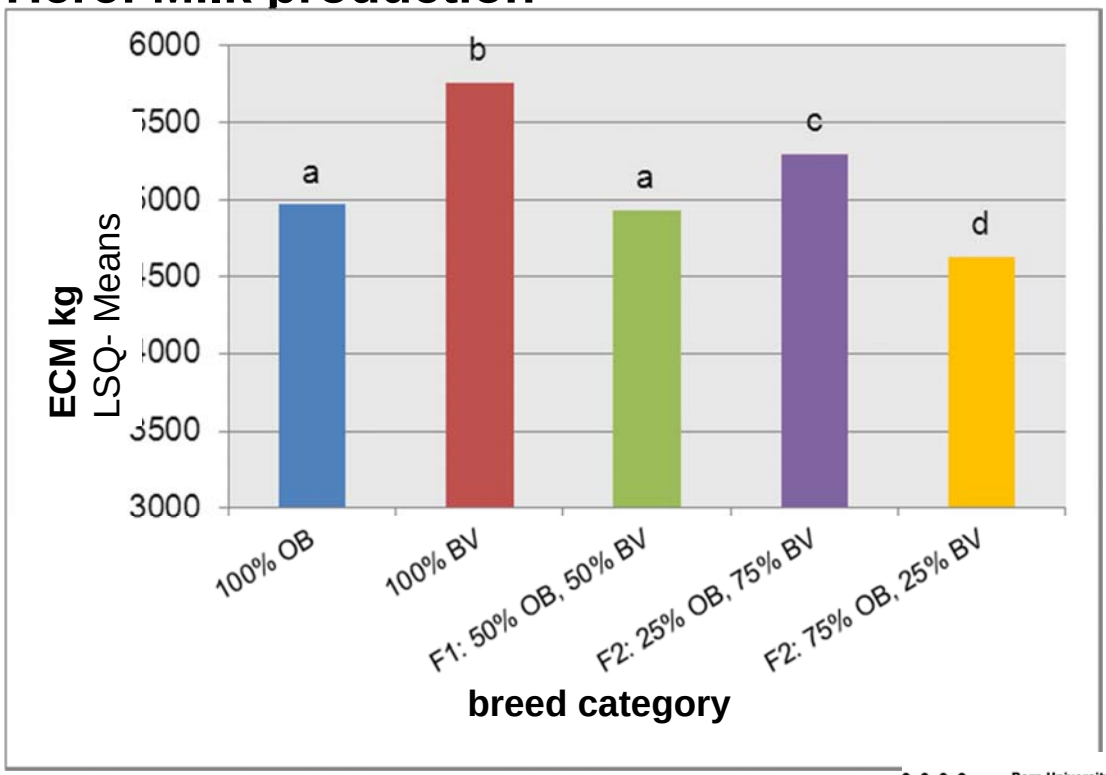
Results I: Development of number of animals in different breed categories



I = OB II = BV, number /10 III = OB x BV (F1) IV = F1 x BV (F2) V = F1 x OB (F2)

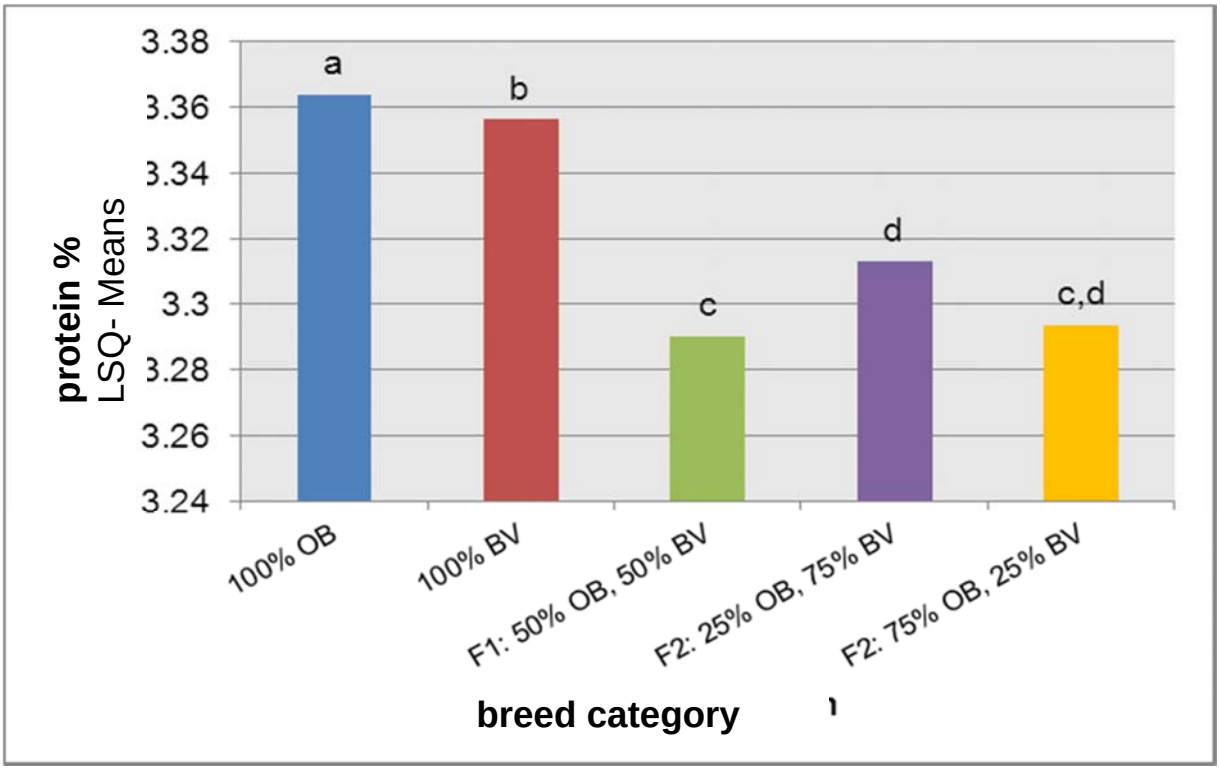
A trend to replacement crossings with OB can be observed

Results II: Effect of breed category was significant in all models. Here: Milk production



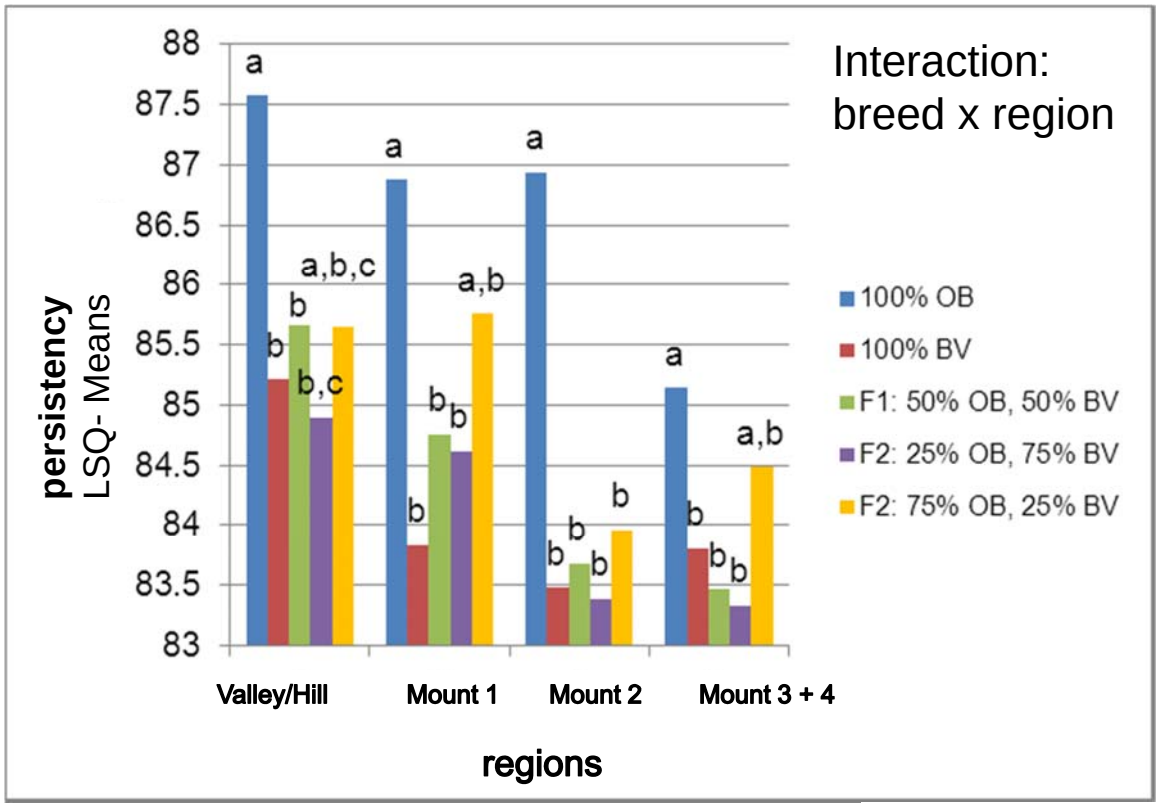
GLM, Tukey-Kramer (p<0.05)

Results II: protein content



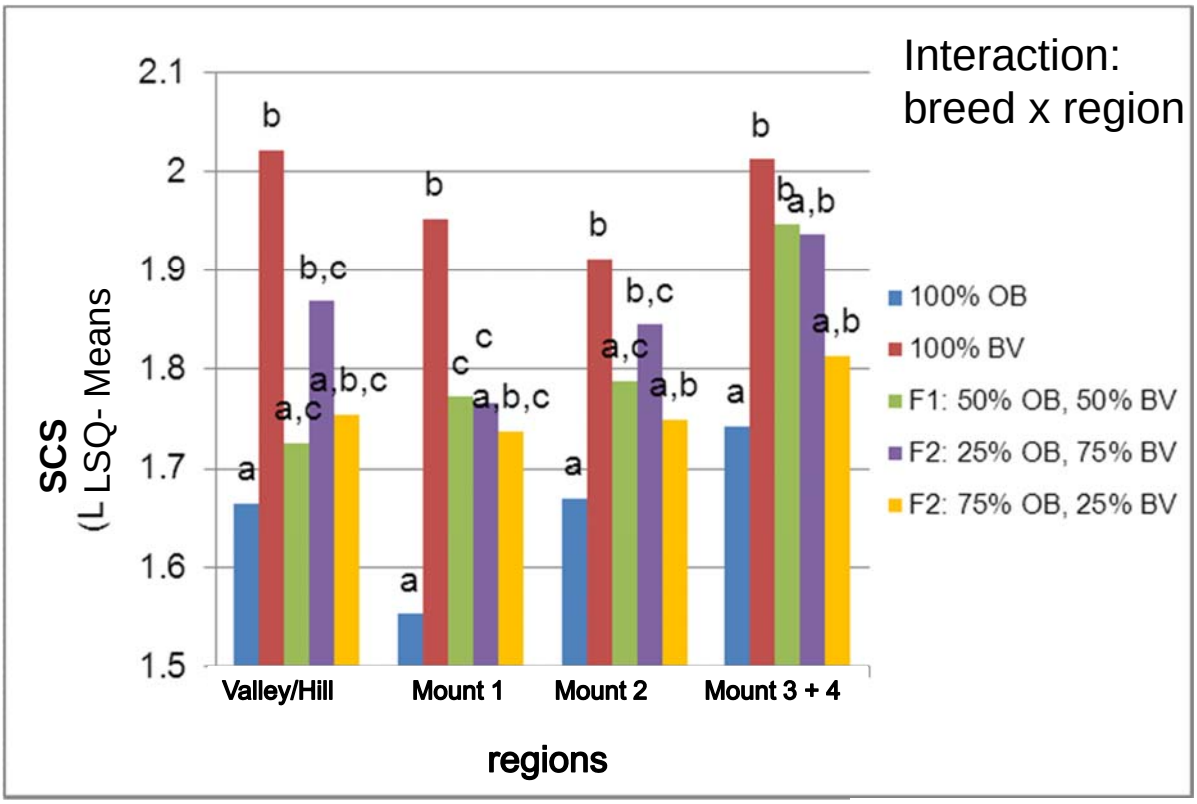
GLM, Tukey-Kramer ($p<0.05$)

Results II: persistency



GLM, Tukey-Kramer ($p<0.05$)

Results II: somatic cell score (SCS)



GLM, Tukey-Kramer (p<0.05)

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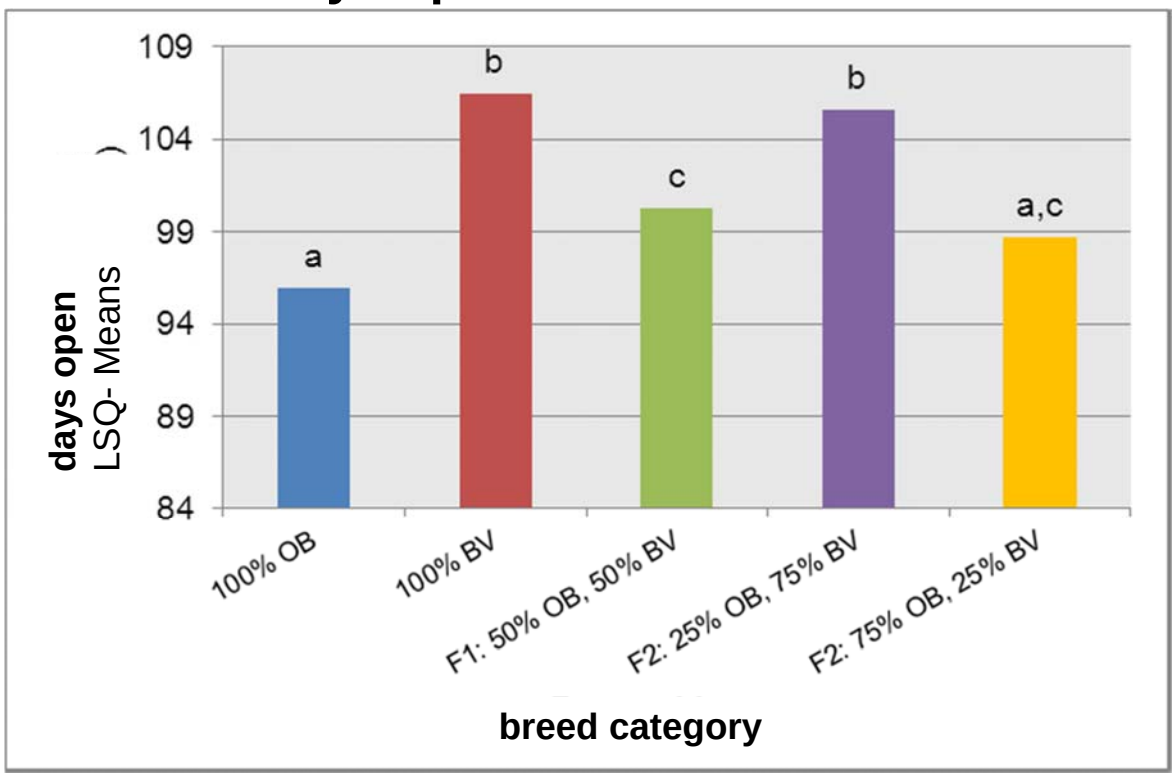
Results II: days open



GLM, Tukey-Kramer (p<0.05)

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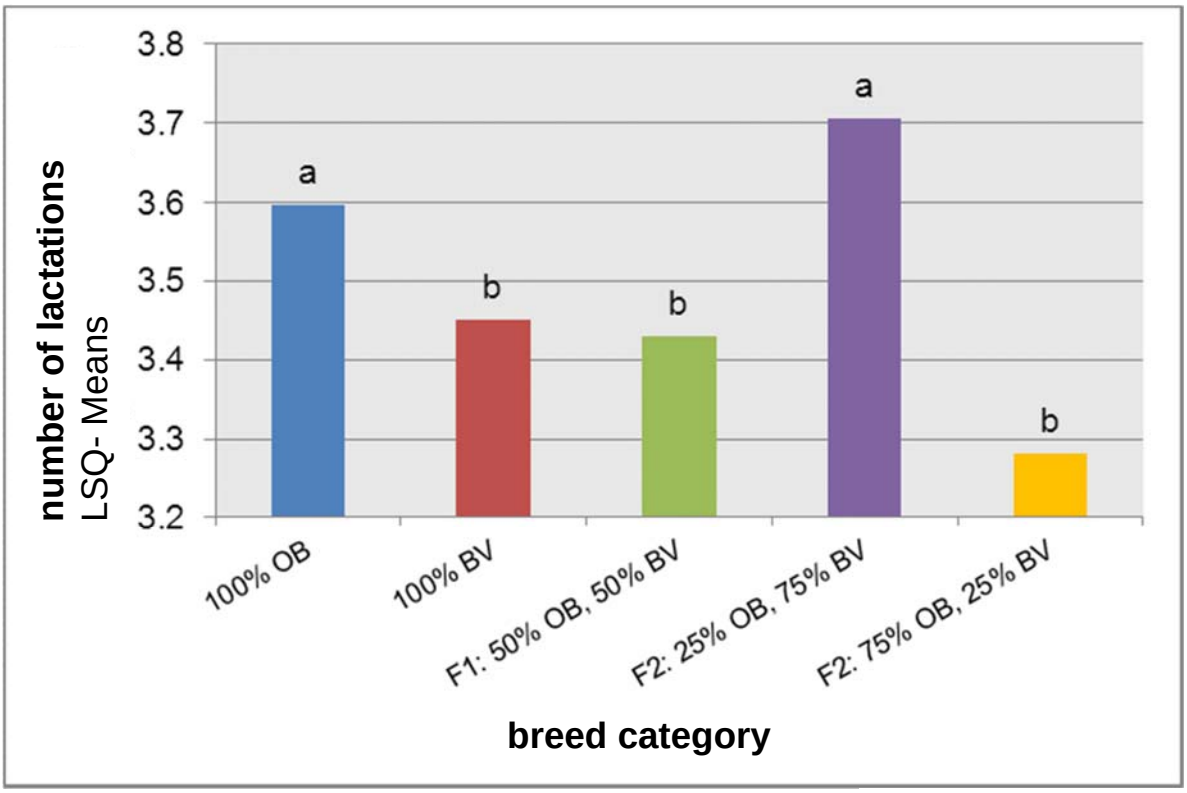
Results II: number of lactations



GLM, Tukey-Kramer ($p<0.05$)

Results III: heterosis

crosses	milk kg ECM	fat %	protein %	persis-tency	SCS	days open	# insemi-nations	Interval 1st to last insem. (days)	Interval calving to 1st insem. (days)
F1 (50%OB)	-508.74	-0.04	-0.09	-1.20	0.01	-1.12	-0.11	-4.00	2.88
F2 (25%OB)	-44.67	-0.005	-0.01	-0.23	-0.04	2.52	0.03	1.63	0.89
F2 (75%OB)	-359.22	-0.02	-0.09	-0.60	0.01	0.16	-0.03	-2.08	2.24

= positive heterosis effect
= negative heterosis effect
= no heterosis effect

Results III: heterosis

Comparison of crosses and parental breeds (LSQ-means; phenotypes)

Crosses	com-pa-red to	milk kg ECM	fat %	protein %	persis-tency	SCS	days open	# insemi-nations	# lacta-tions
F1 (50%OB)	OB	→	→	↓	↓	↑	↑	→	↓
F2 (25%OB)	OB	↑	↑	↓	↓	↑	↑	↑	→
F2 (75%OB)	OB	↓	→	↓	↓	↑	→	→	↓
F1 (50%OB)	BV	↓	↓	↓	→	↓	↓	↓	→
F2 (25%OB)	BV	↓	↓	↓	→	↓	→	↓	↑
F2 (75%OB)	BV	↓	↓	↓	↑	↓	↓	↓	→

= crosses better than pure bred animals
= crosses worse than pure bred animals
= crosses similar to pure bred animals

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Results III: heterosis

- Heterosis effects (= difference between crosses and average of parents) were found for several traits:
- F1 (OB x BV)-crossings were better than average of OB and BV in: days open, number of inseminations, and interval from first to last insemination. In all other traits F1-crossings were worse than average of BV and OB.
- F2 (25% OB = BV x F1)-crossings were better than average of parents in SCS. In all other traits they were worse.
- F2 (75% OB = OB x F1)-crossings were better than average of parents in number of inseminations and interval from first to last insemination. In all other traits they were worse.

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Discussion

- All crosses are worse than pure bred BV in all production traits, but **better than** or equal as BV in functional traits.
- Crosses are similar in production traits as pure bred OB, but they are **worse than** or equal as OB in all functional traits.
- In high mountain regions SCS, persistency, and days open of pure OB are better than or equal as crosses and BV. So, OB is functionally the best brown breed for mountain areas.
- Replacement crossings with OB take a long time (more than two generations) until animals show constantly good functional and production traits.
- Crosses show not many positive heterosis effects. The reason for that is that OB are better than crosses or equal as crosses in most traits.

Conclusions

- Crossbreeding with OB is recommended to ameliorate functional traits in BV herds, especially in mountain regions
- Changing to pure OB individuals is expected to lead to a faster and probably more solid success regarding health and robustness
- Since good functional traits are especially important on organic farms the use of OB is warmly recommended to them
- It would be interesting to analyse the effect of crossbreeding in other breeds with similar backgrounds (as for example Holsteins (HO) and Deutsches Schwarzbuntes Niederungsrind (DSN) and their crossings) to know more about characteristics of crossings, which are often used on organic farms

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Thank you for your attention