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Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

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Umweltsystemwissenschaften



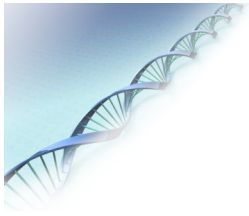
Optimization of dairy cattle breeding programs using genomic selection

Sabrina Bütler

Master thesis, 2014

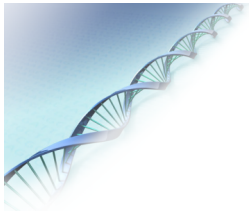
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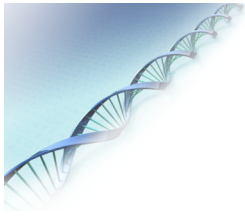
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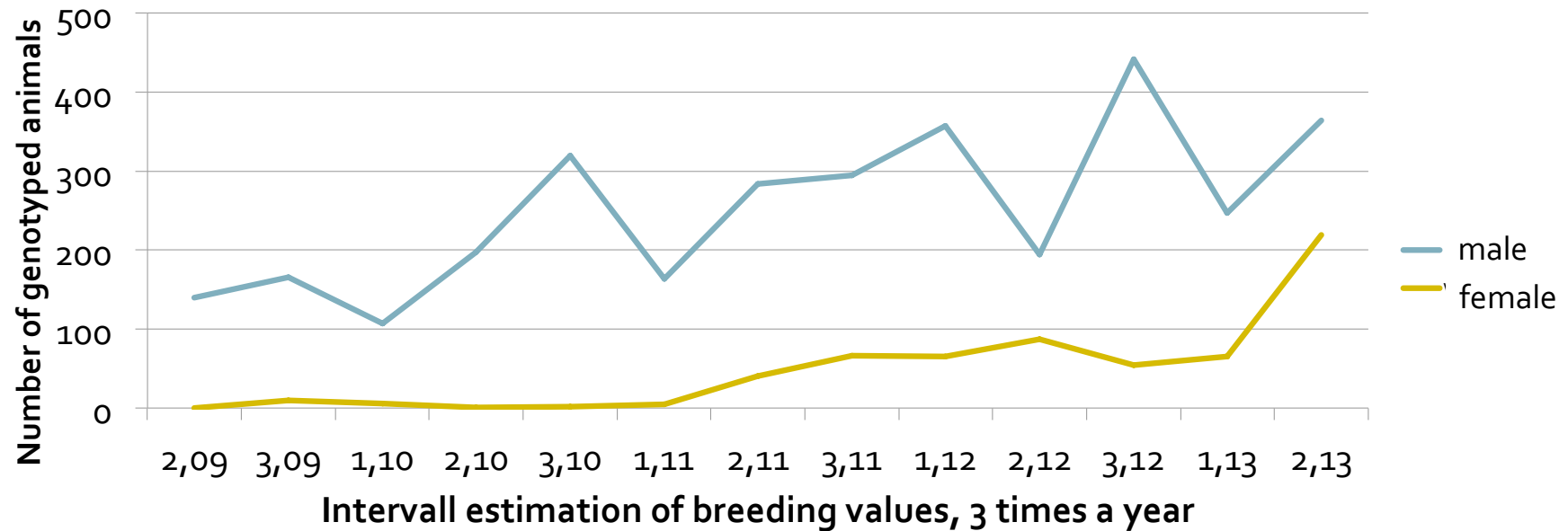


1. Background (1)

- New breeding strategies by using GEBV
- Earlier selection decision by higher accuracy of the GEBV
- Model calculations have shown, that genomic selection has an influence on **breeding progress** and **genetic gain** (Schaeffer, 2006)
- A. I. Organizations only buy bull calves with GEBV
- A. I. Organizations distribute semen from selected bulls which do not have yet second crop daughters (Optimis)



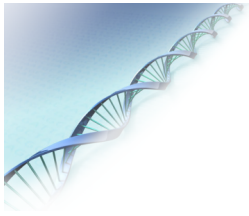
Background (2) – Number of genotyped animals in Switzerland



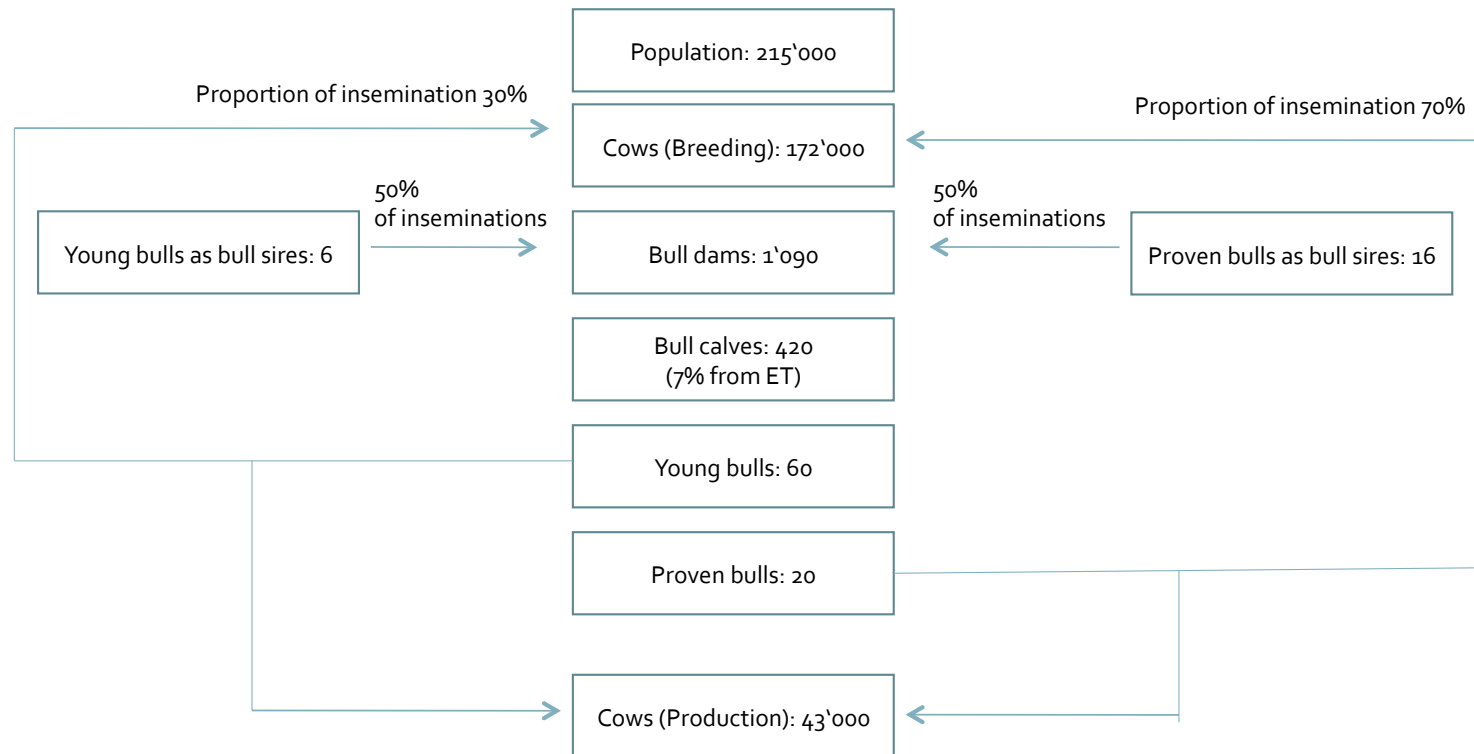
Routine genetic evaluation system GEBV

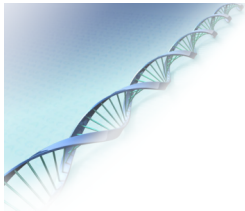
Label Elite cows

Price cutting LD-Chip

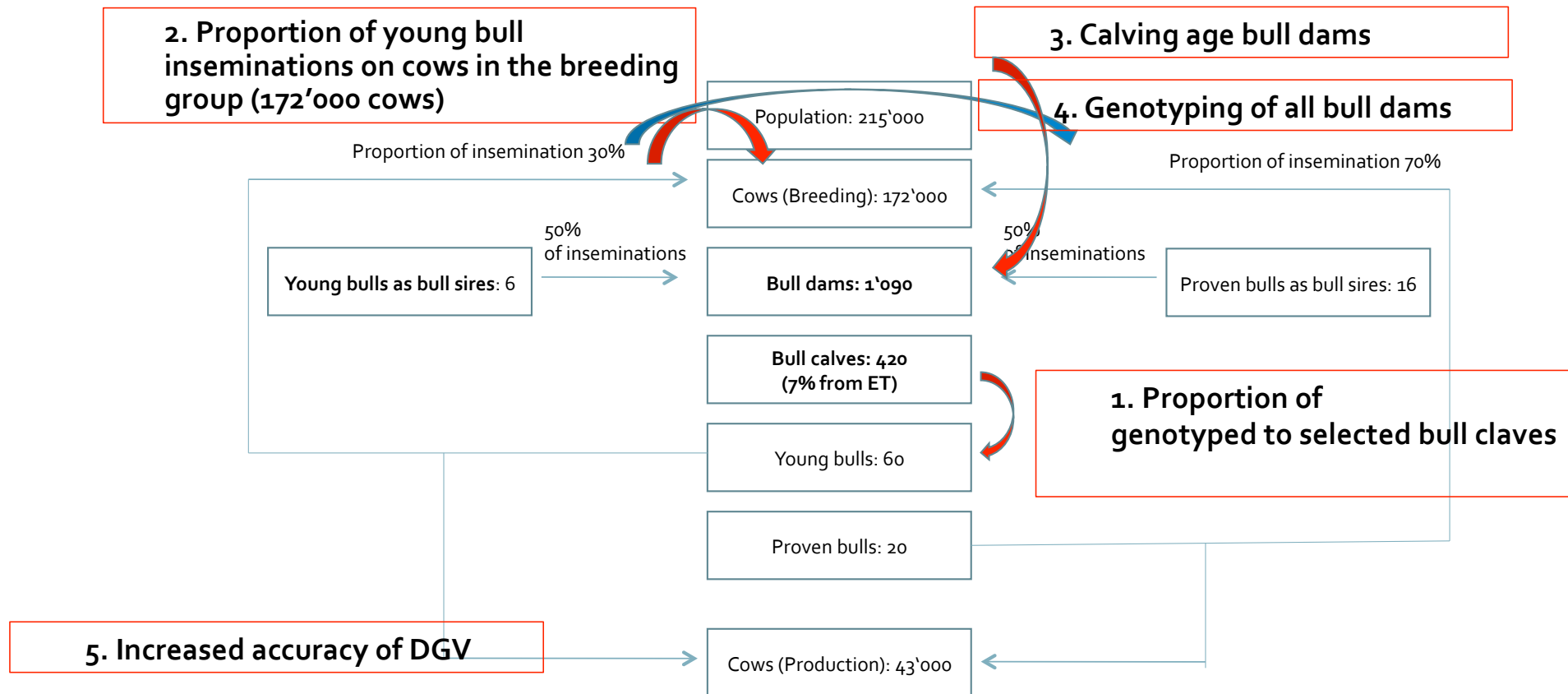


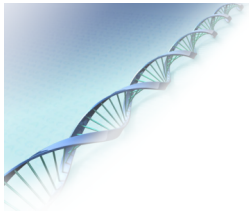
Background (3) – Breeding program Braunvieh 2013





2. Objective of the master thesis: Effect of variation of five parameters on the breeding program:





3. Evaluation criteria

- **Genetic gain (GG)** (only breeding unit)
 - Natural: Average superiority of the progeny of selected animals compared to previous population (natural units per year)
 - Monetary: natural genetic gain expressed in monetary units (Swiss Francs per year)

$$GG / T = \frac{i * r * \sigma_a}{GI}$$

i: Selection intensity

r: Accuracy of breeding values

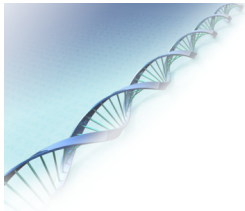
σ_a : additive genetic standard deviation

GI: Generation interval

- **Breeding profit** (breeding and production unit)

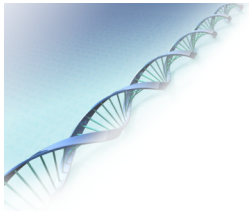
Breeding profit = Breeding return – Breeding costs

- Return: monetary genetic gain over the whole investment period, discounted return per cow
- Costs: fixed or variable



4. Method

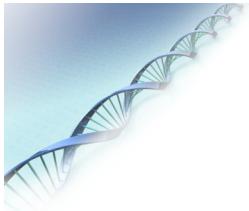
- The computer program ZPLAN (Karras, 1974), Version „z10.for“ (Willam et al., 2008) was used
- ZPLAN optimizes selection strategies based on a deterministic approach
- Core parts of the software are gene flow method (Hill, 1974) and selection index construction (Hazel et al., 1949)
- 14 Selection groups were defined
- Cost and biological parameters have to be defined for each selection group
- Inclusion of genomic information by calculating daughter equivalents based on heritability



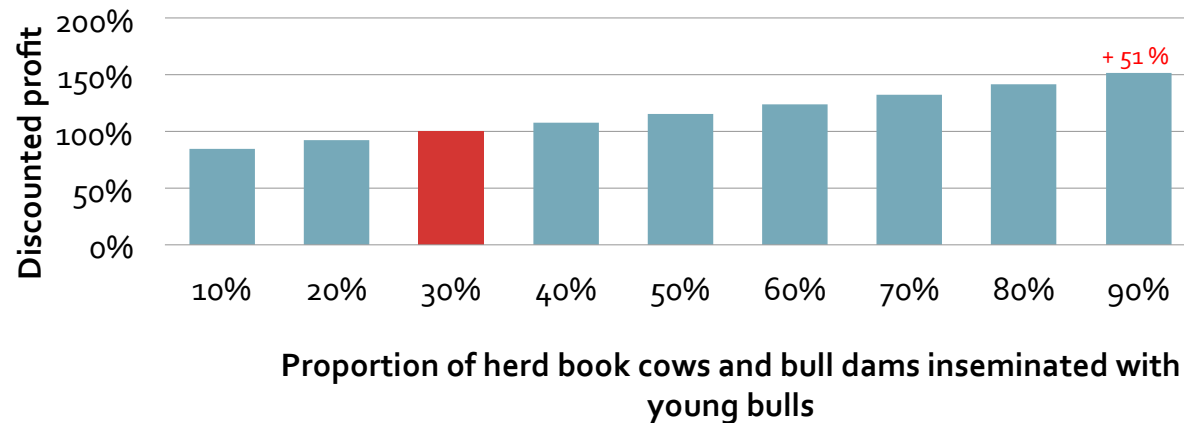
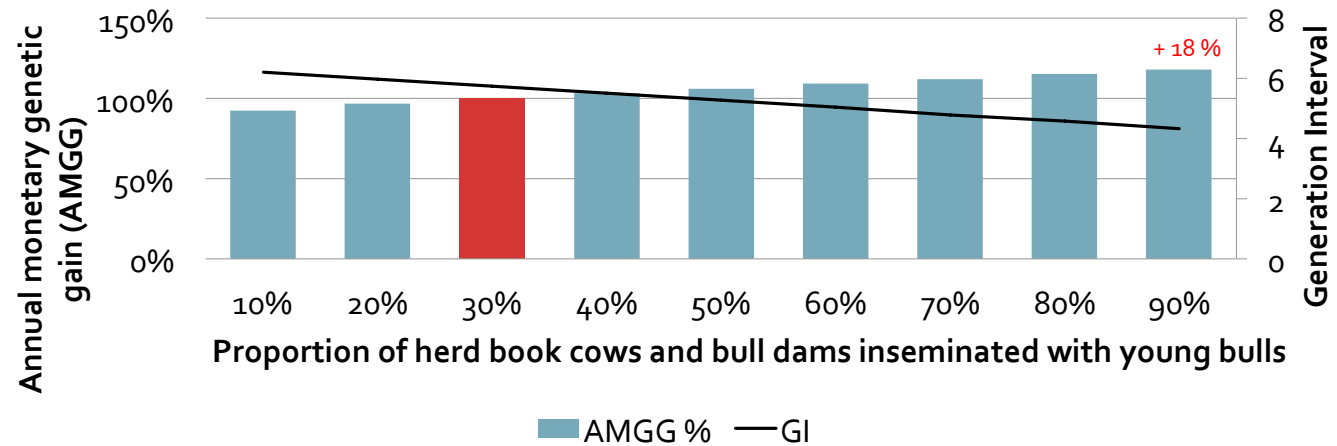
5. Total Merit Index

- Index
 - Heritabilities and genetic correlations are considered between all traits in the total merit index
 - Weighting of traits according to total merit index of Braunvieh Schweiz

Trait	Weight
Production	54%
Milk kg	13%
Protein kg	33%
Protein %	8%
Fitness	30%
Persistency	3%
Length of productive life	10%
Somatic cell count	8%
NRR	6%
Days to first service	3%
Milking speed	6%
Conformation	10%

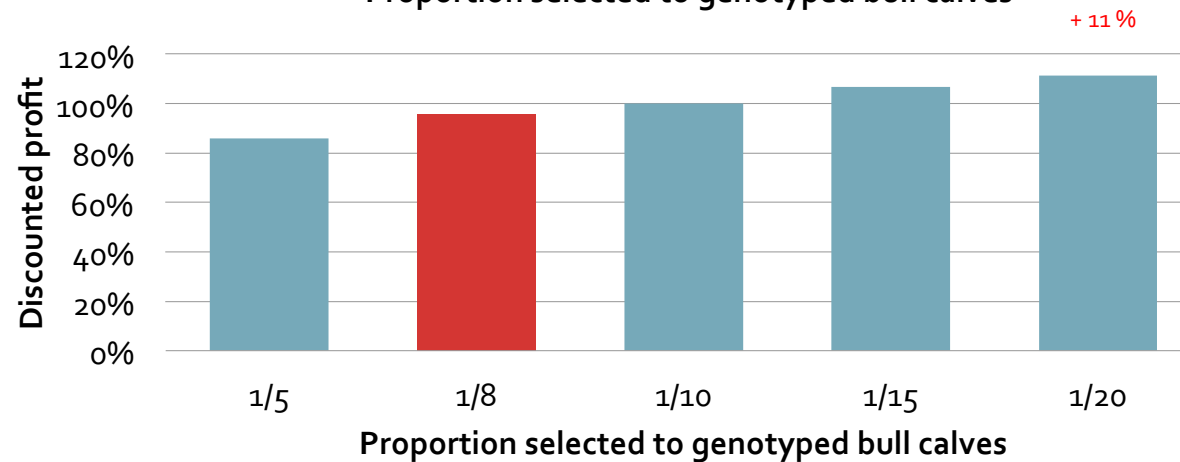
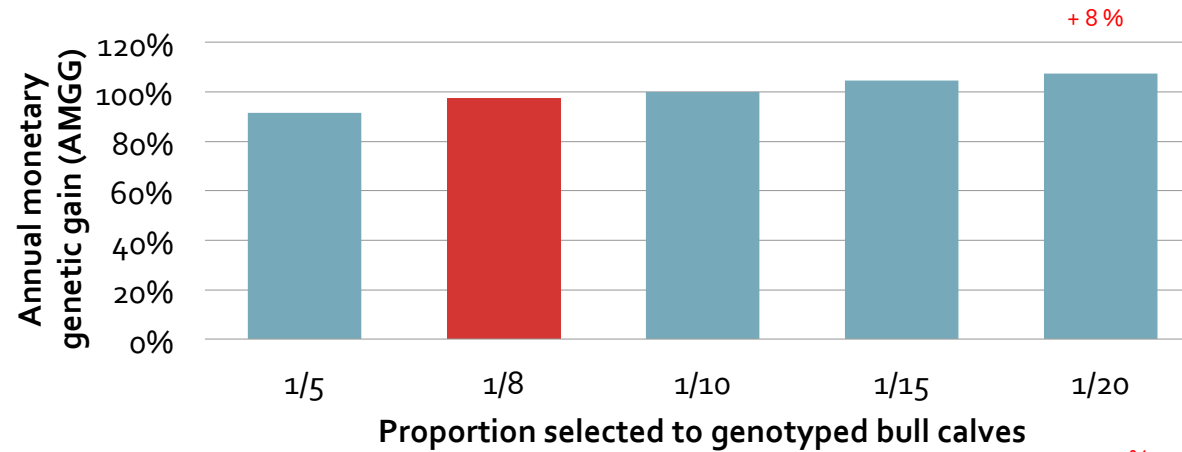


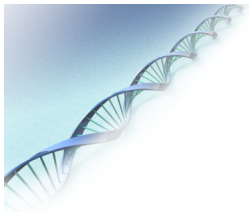
6. Results (1): Proportion of young bulls



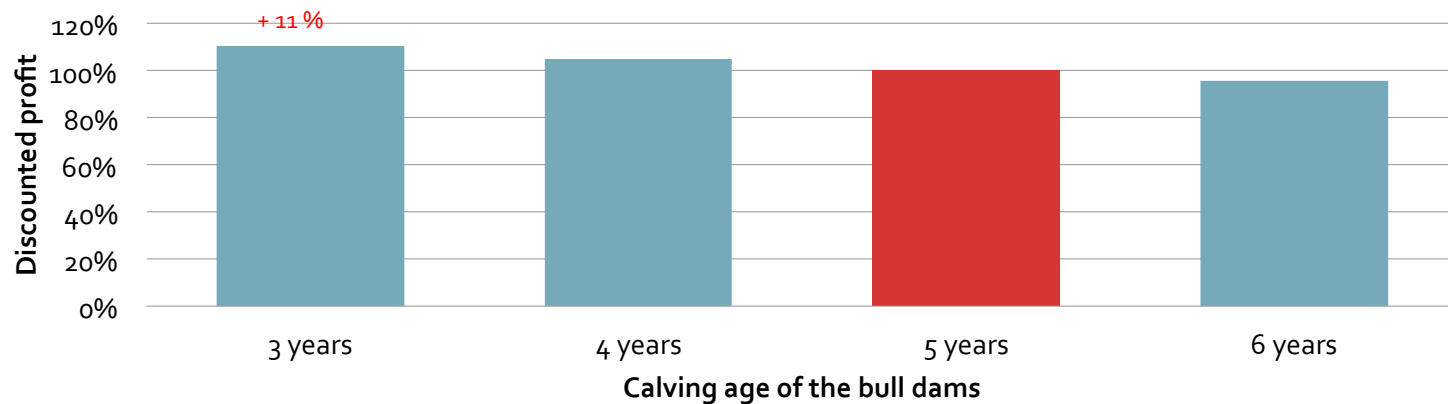
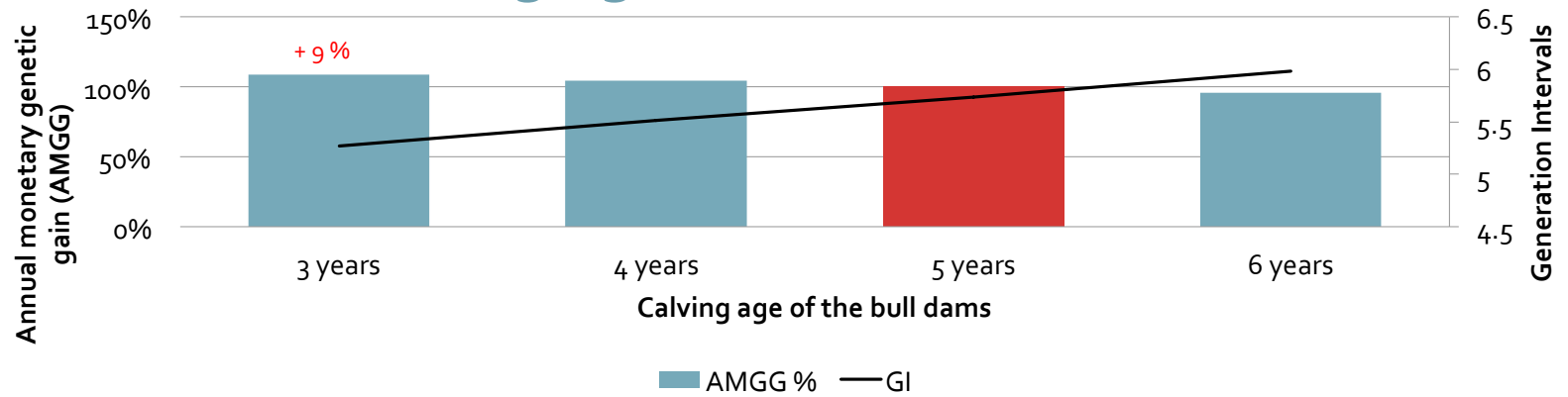


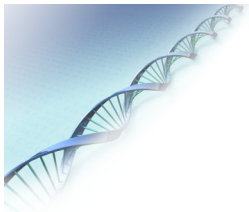
6. Results (2): Proportion selected to genotyped bull calves



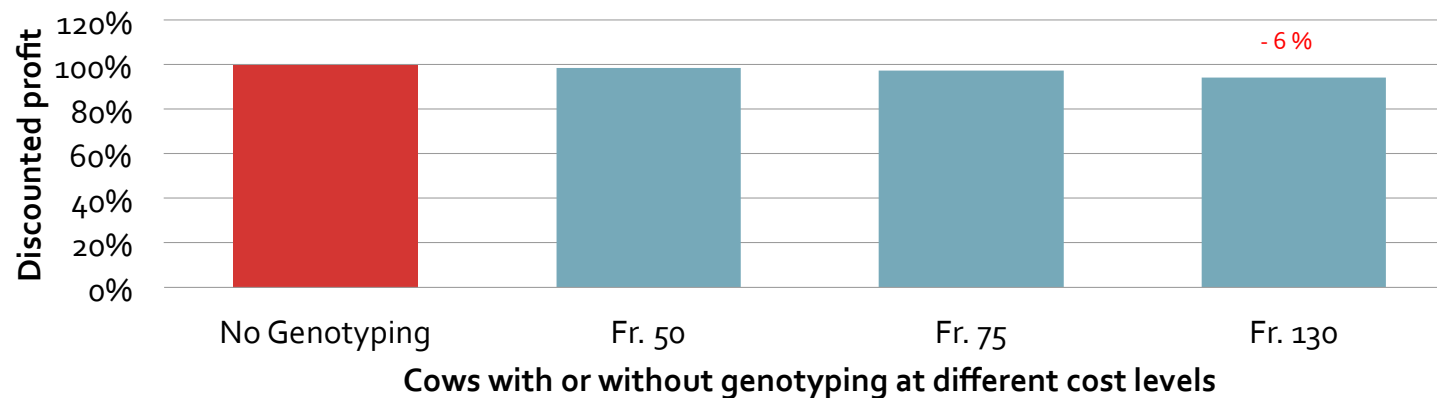
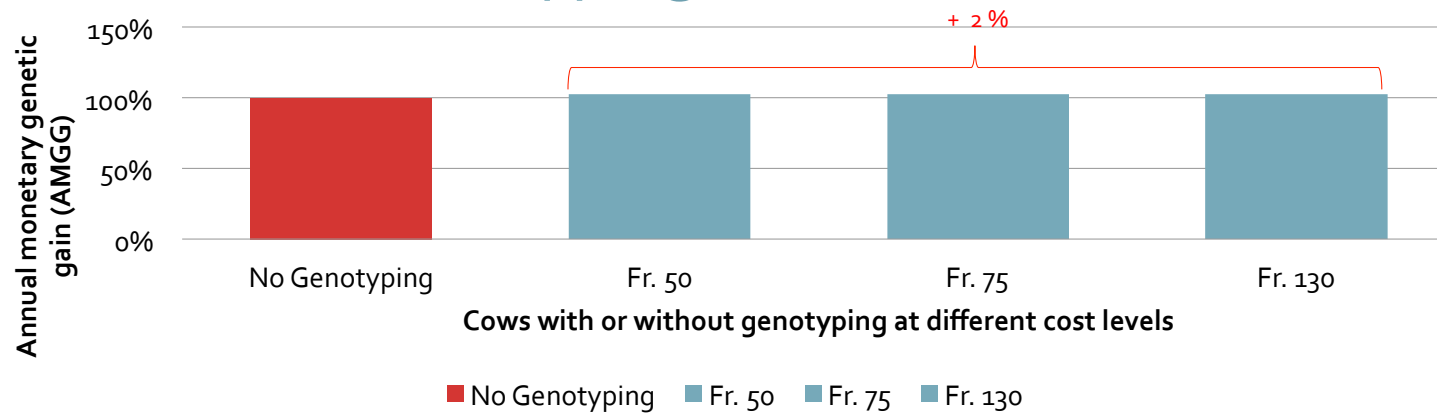


6. Results (3): Calving age of bull dams

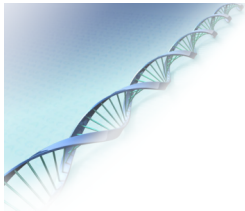




6. Results (4): Genotyping of all bull dams *



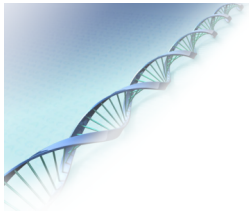
* Increased selection intensity could not be taken into account due to limitation of ZPLAN



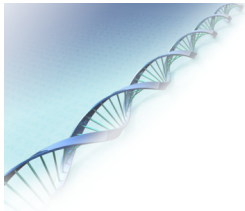
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7. Conclusion

- Increased annual monetary genetic gain and discounted profit by
 - Increased proportion of young bull inseminations
 - Increased number of genotyped bull calves
 - younger calving age of bull dams
- Higher risk by using young bulls, as bulls with GBVs have lower accuracies as proven bulls
- Intensity of the use of genotyped young bulls in practice depends on the
 - Acceptance of the GBVs
 - Accuracy of the GBVs



Questions?



Sources

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