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Combined analysis: Genetic and phenotypic trends in German Holstein dairy cattle

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Motivation

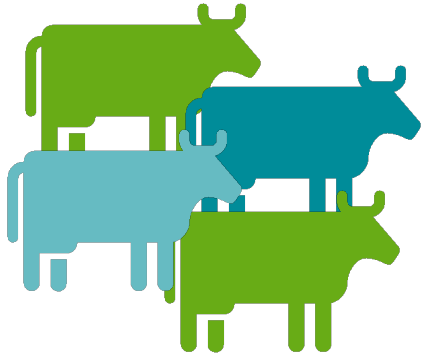
- Drastic changes in dairy cattle breeding programs over the last 20 years
  - New technologies (sperm sexing, embryo transfer, …)
  - Introduction of genomic selection
  - New traits (health, calf survival…)

- Intensifying discussions about animal welfare, climate care, future of livestock

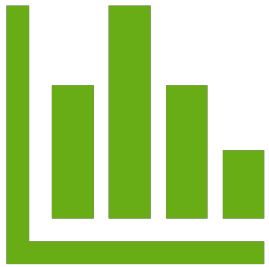
- Status Quo?
- Role of breeding?
- How much of the phenotypic progress is based on breeding progress?

Aim of the study

Analyse genetic and phenotypic trends



Overview over whole German population



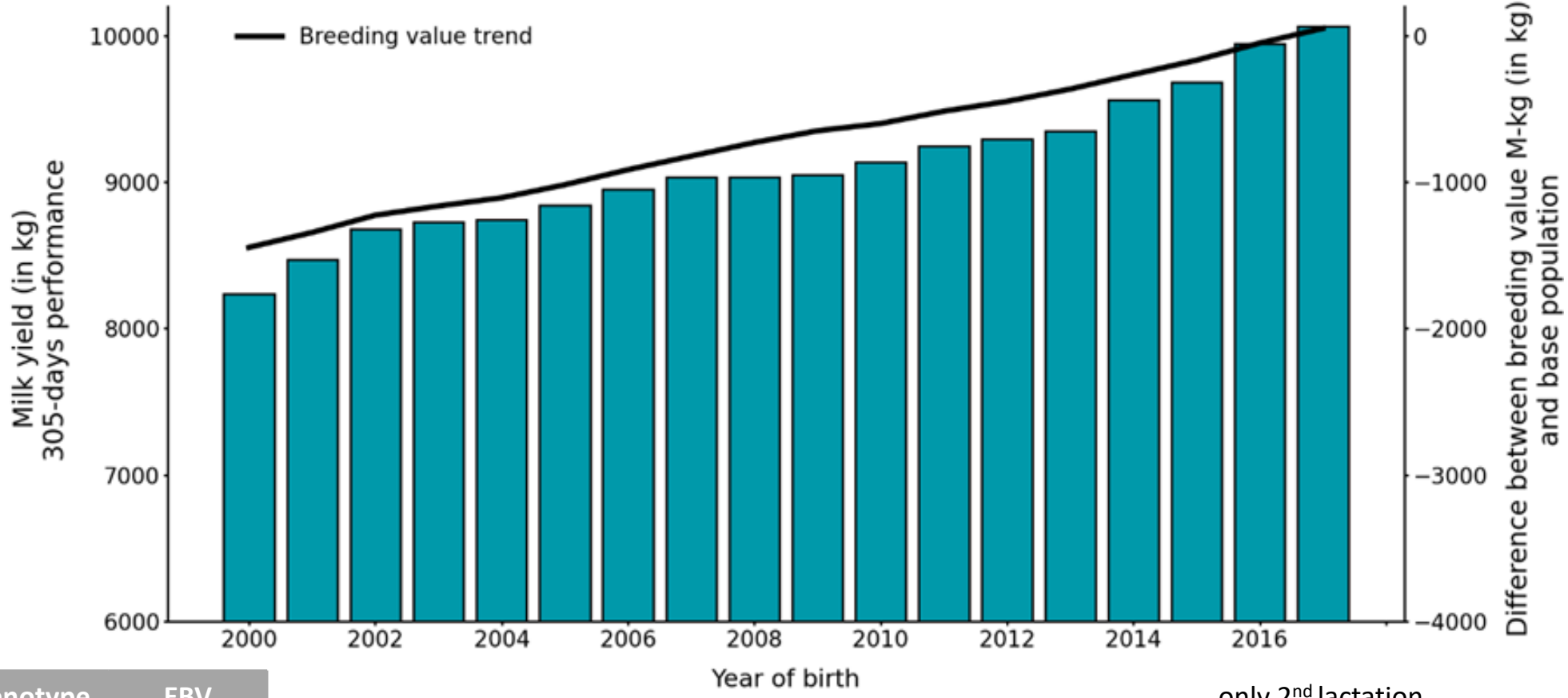
Deliver objective facts to underpin public discussions

Material and methods

- Data for conventional breeding value estimation (status: august 2022)
  - Pedigree-based EBV for cows
  - Base population: cows born from 2016-2018
- Breed: Holstein Friesian
- Phenotypic records from 2000 to 2021
- Statistical analysis: mean values of EBV and phenotypes per year

Trait		Number of animals
Milk (2nd lactation)	Phenotype	7,540,245
	Breeding Value	6,474,139
Longevity	Phenotype	6,584,374
	Breeding Value	6,188,770
Stillbirth	Phenotype – cows	11,772,191
	Phenotype – records	21,596,655
	Breeding value	8,689,281

Results – Milk yield

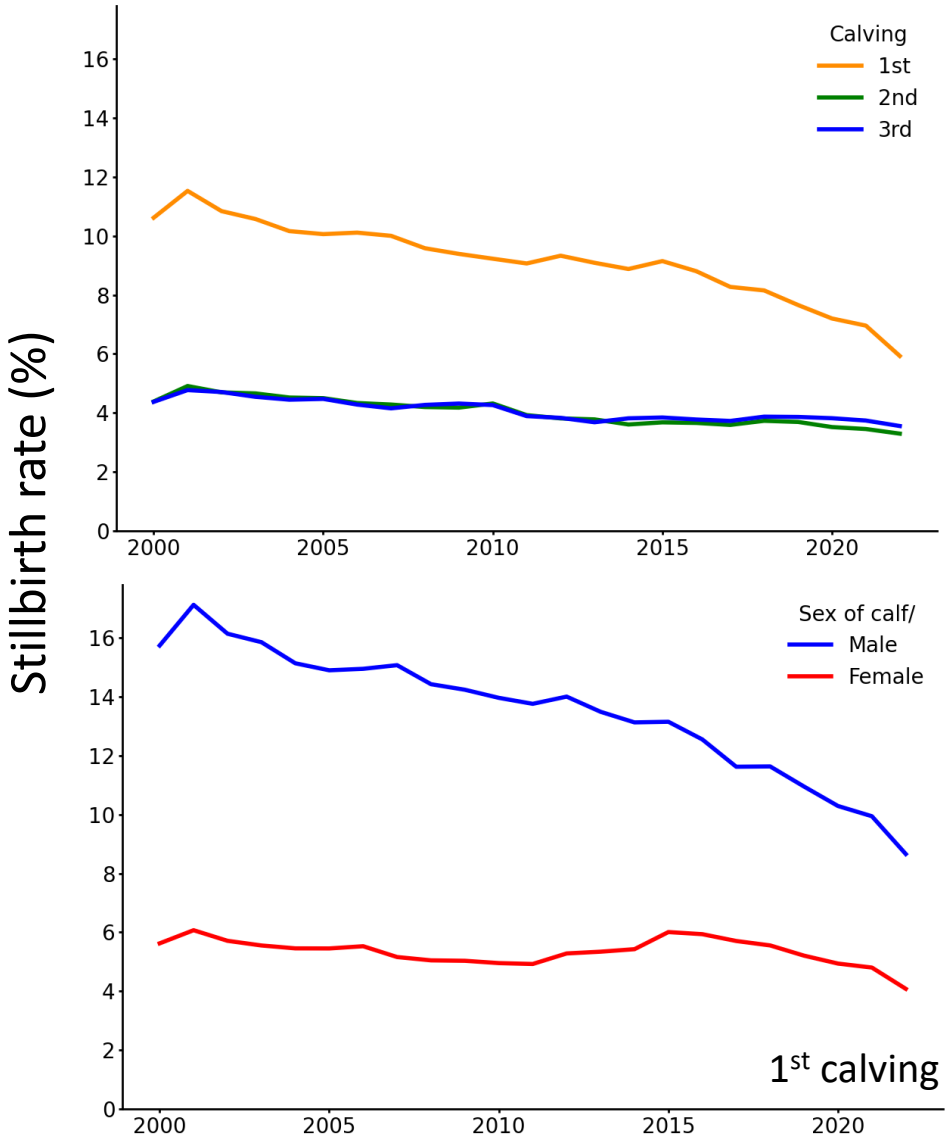


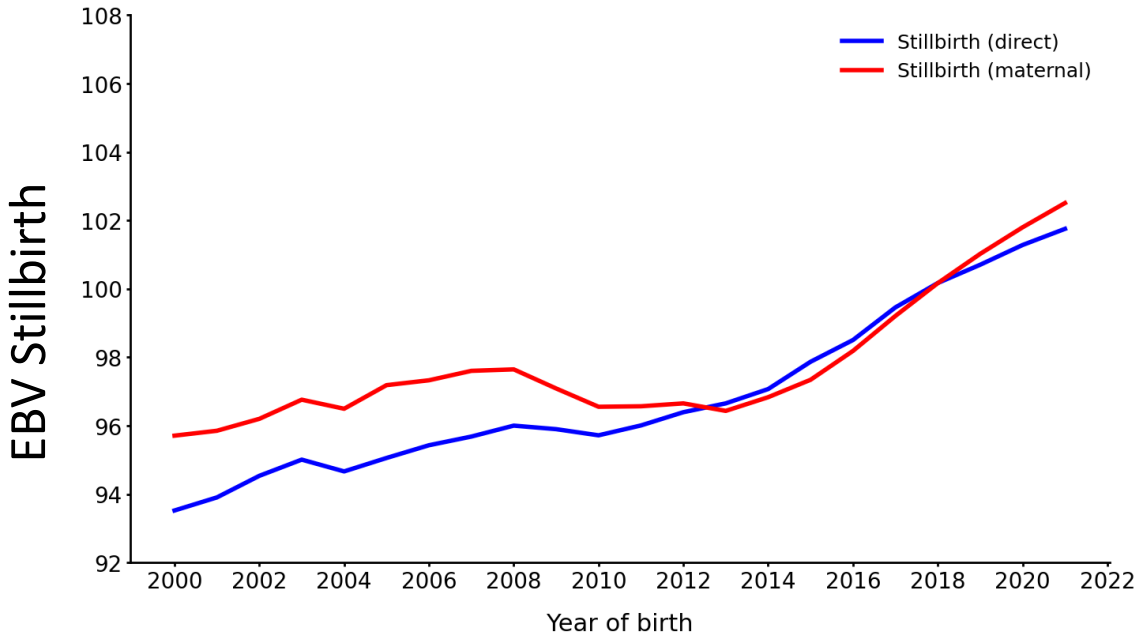
only 2nd lactation

Per year	Phenotype	EBV
2000 – 2009	+ 90.16 kg	+ 88.82 kg
2010 - 2017	+ 132.26 kg	+ 93.58 kg

→ **Parallel increase of phenotype and breeding value**

Results - Stillbirth rate





Results & discussion

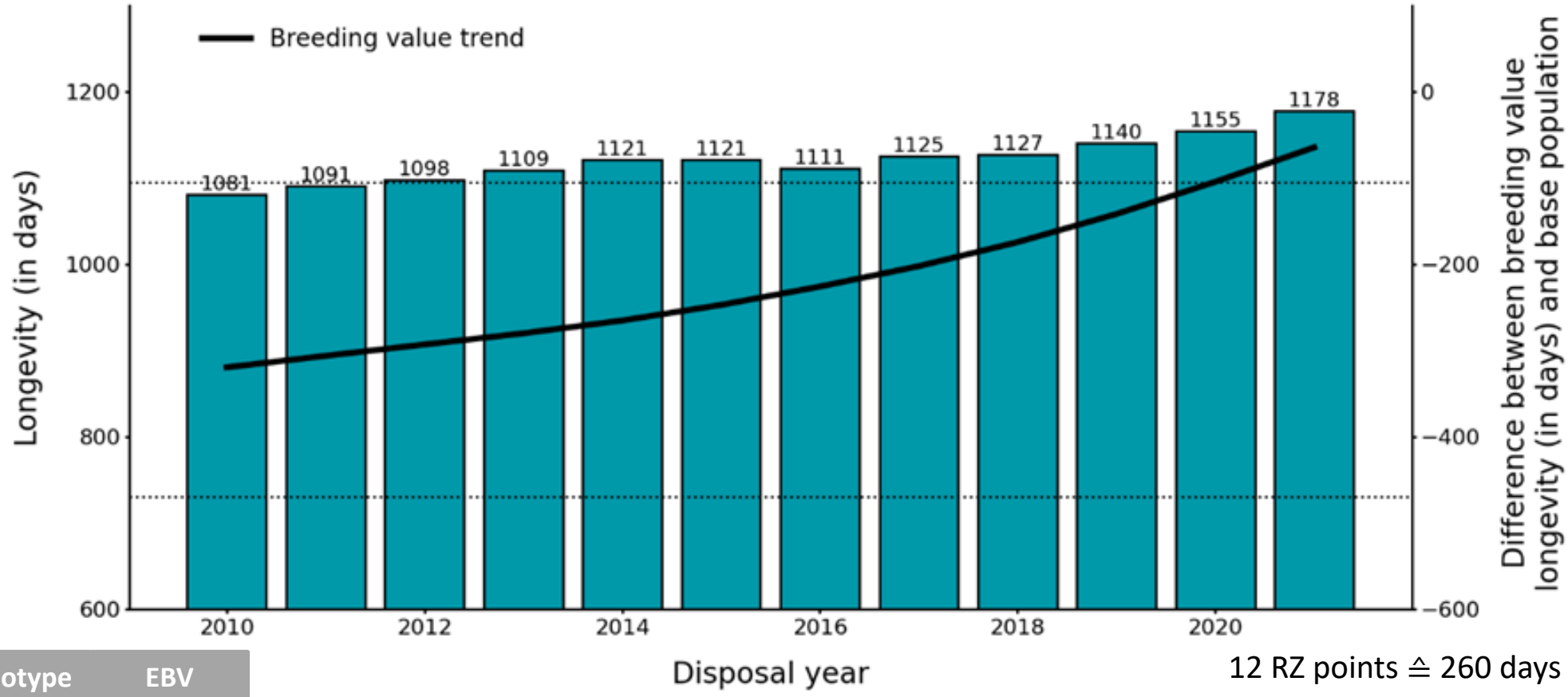
- Higher stillbirth rate:
  - in 1st lactation
  - for male calves

- Positive (= declining) trend
  - Reduction of stillbirth rate by ≈50% over the last 20 years

- Trend of EBVs and phenotypic trend are corresponding
  - Influence from genotype on phenotype is hardly assessable
  - Separation of genetics and environmental impacts are difficult

Results - Longevity

- Longevity = Days between first calving and disposal



12 RZ points ≙ 260 days

Per year	Phenotype	EBV
2010 – 2021	+ 8 days	+ 22 days

Results and discussion

- Minor trend in the phenotypic development whereas the genetic potential increases faster
  - Possible reasons:
    - Limitation of longevity due to common herd management (Vredenberg et al. 2021)
    - → rearing of all purebred female calves as replacement heifers
    - ➢ Replacement rates of over 30%
    - ➢ If every heifer should stay → 1/3 of the cows have to be culled
    - ➢ Prematurely culling of cows which are still capable of producing

vs.

Results and discussion

➢ **Genetic trend can not fully be exploited phenotypically due to management**

- Rearing of youngstock is expensive and needs a lot of resources (Vredenberg et al. 2021)

➢ The goal should be to keep cows as long as possible

  ➢ Costs and climatic impact is relatively lower (Grandl et al. 2019)

- Possible changes in herd management to face this issue:
  - Use of beef semen (beef on dairy)
  - Genomic herd testing → keep only the best female calves
  - Sexed semen
  - Extended lactation

➢ Less replacement heifers → longevity is less limited by the management

➢ The given genetic potential can be expressed in the phenotype

Conclusion

- Positive trends in all traits
- Genetics has a strong impact – but management too
- Decisions in herd management can influence climate impact and the impact of breeding

➢ **Monitoring of genetic and phenotypic trends is important to analyse, detect, react**

Acknowledgment

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Thank you for your attention!

Literature

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