

Evolution of genetic parameters of production traits and conception rate in the Dutch Holstein population

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Evolution of genetic variances

- Evolution of genetic variances: 2 processes under artificial selection
 - Reduction due to drift
 - Independent of selection
 - Only due to demographic factors
 - Reduction due to selection
 - Bulmer effect
 - (pre)selection
- Impact on genetic gain

Aim

To evaluate the evolution of
genetic variances, covariances and correlations
for milk production traits and conception rate
in the Dutch Holstein population
since 1990

Data

■ Phenotypes

- Period: 1990-2020
- First-parity cows
- 305-DIM milk, fat & protein yields (855,185 records)
- Conception rate (0/1) at first insemination (676,641 records)

■ Pedigree

- Extracted up to 1970

Bivariate models

■ 305-DIM yields

- **Fixed:** Herd x year of calving, Age at calving, Year x season of calving
- **Random:** Animal, Residual
- Pre-corrected for heterogenous residual variances (by herd x year of calving)

■ Conception rate

- **Fixed:** Herd x year of calving, Year x month, Day of the week, Age of bull, Sexed semen
- **Random:** Service sire, Animal, Residual

Estimation of genetic parameters – approach

- Gibbs sampling approach

- Following Macedo *et al.* (2021) & extended to bivariate models
- gibbsf90+
- 150,000 iterations
- 900 samples of EBVs (stored each 150 iterations)

- 30 groups of cows with records born between 1990 and 2019

- 28 groups of sires born between 1990 and 2017

Estimation of genetic parameters – approach

Genetic variance in the **base population**
($\hat{\sigma}_a^2$)

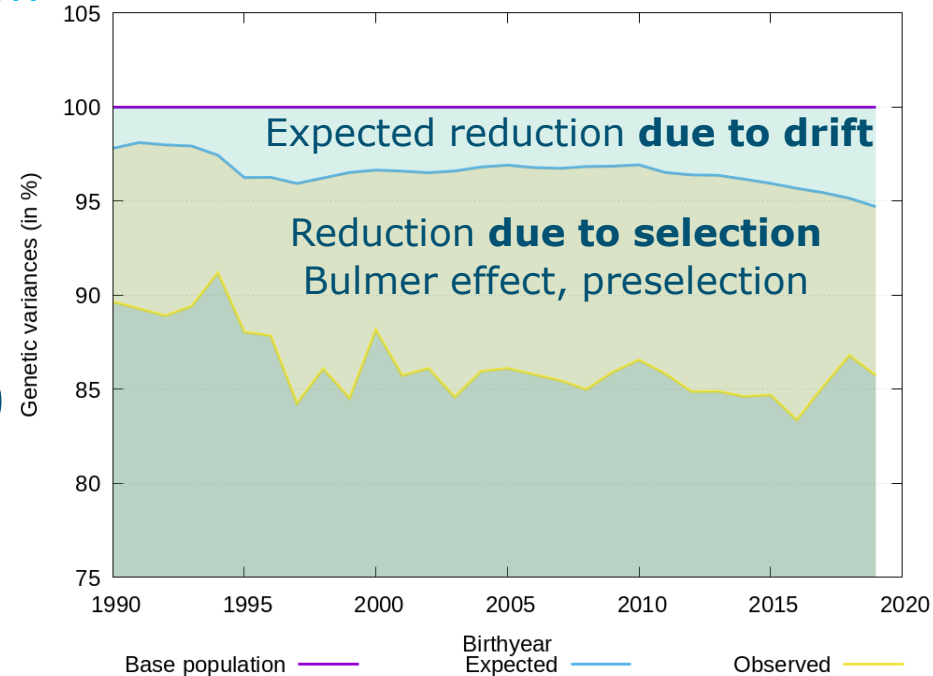
For each **group** (sex x birthyear)

- **Expected** genetic variance

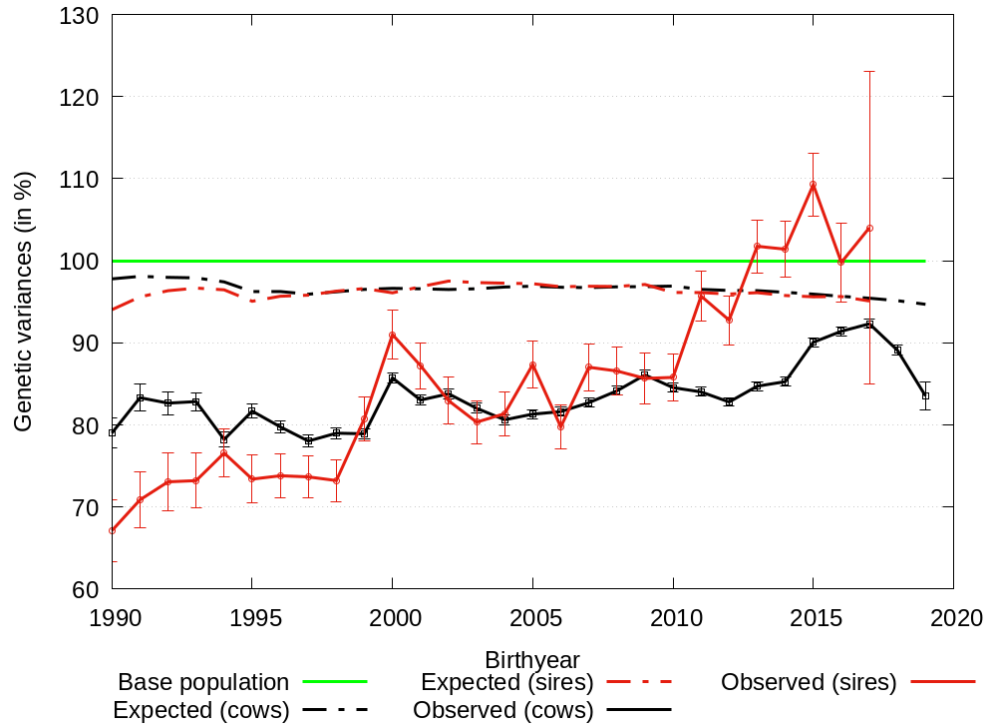
- $\hat{E}(\sigma_{a(b,s)}^2) = \hat{\sigma}_a^2(1 + \bar{F}_{(b,s)} - \bar{A}_{(b,s)})$

- **Observed** genetic variance

- $\hat{\sigma}_{a(b,s)}^2$ = Average variance of within-group BVs



305-DIM Milk yield – Genetic variances



Observed genetic variances

- Compared with base population

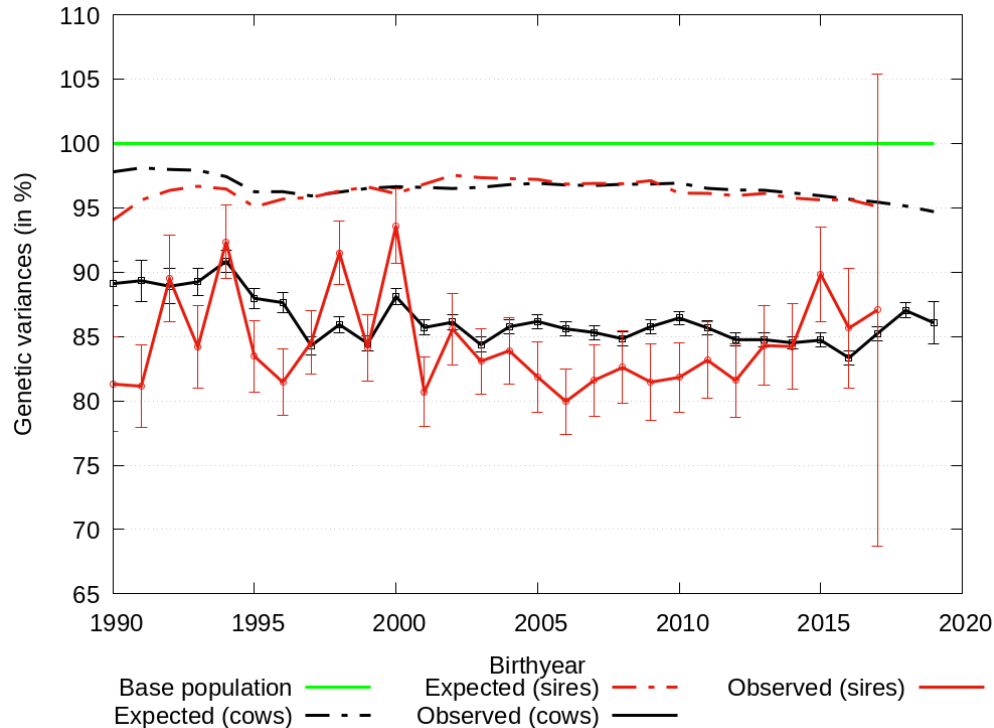
Cows

- 1990: 21% lower
- From 1990: average increase of 0.3% per year

Sires

- 1990: 33% lower
- From 1990: average increase of 1.2% per year
- From 2013: larger than base population

Conception rate – Genetic variances



Observed genetic variances

- Compared with base population

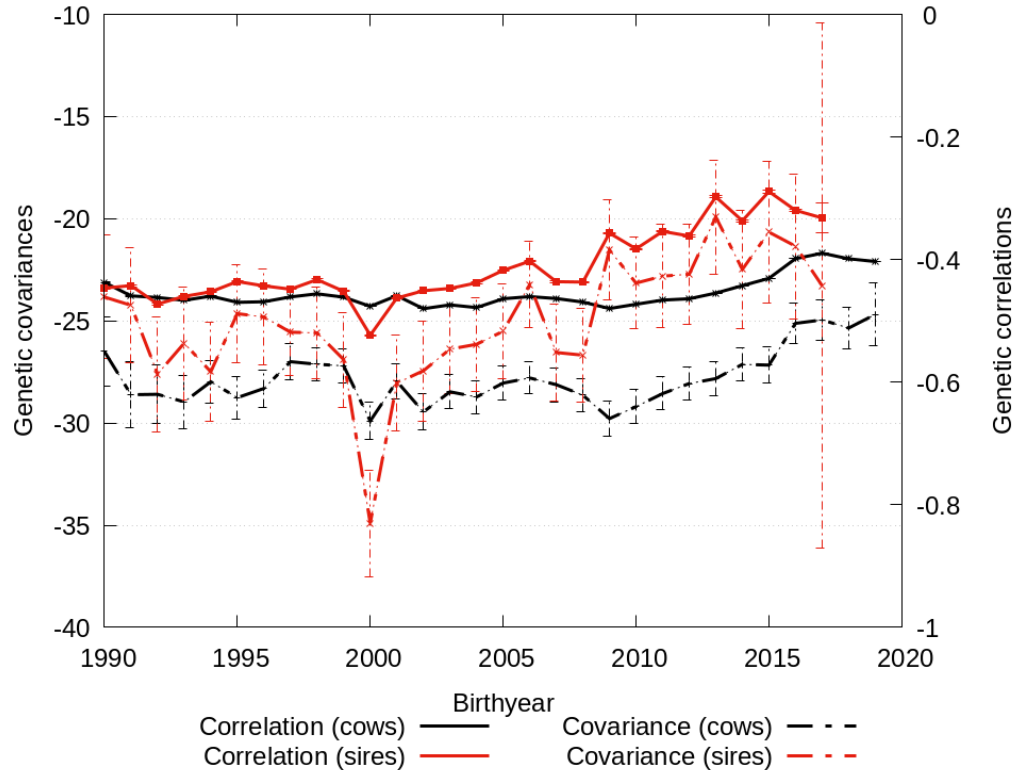
Cows

- 1990: 11% lower
- From 1990: average decrease of 0.1% per year

Sires

- 1990: 19% lower
- From 1990: average decrease of 0.1% per year

MY & CR - Genetic covariances & correlations



- Until 2008-2010
 - Rather stable
- From 2008-2010
 - Increasingly less unfavourable
 - Sires: More pronounced

Conclusions

- Observed genetic variances
 - Lower than base population (except for MY and sires>2012)
 - Evolution
 - Conception rate: limited decrease
 - Milk yield: increase (especially for sire groups)
 - Potentially due to changes in breeding goals
- Observed genetic correlations: increasingly less unfavourable!
- Similar results for 305-DIM fat and protein yields



Thank you for your attention

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