ECOGEN

WEBINAR SERIES 2026

Impact of heat stress on fertility traits in dairy cows in the Netherlands

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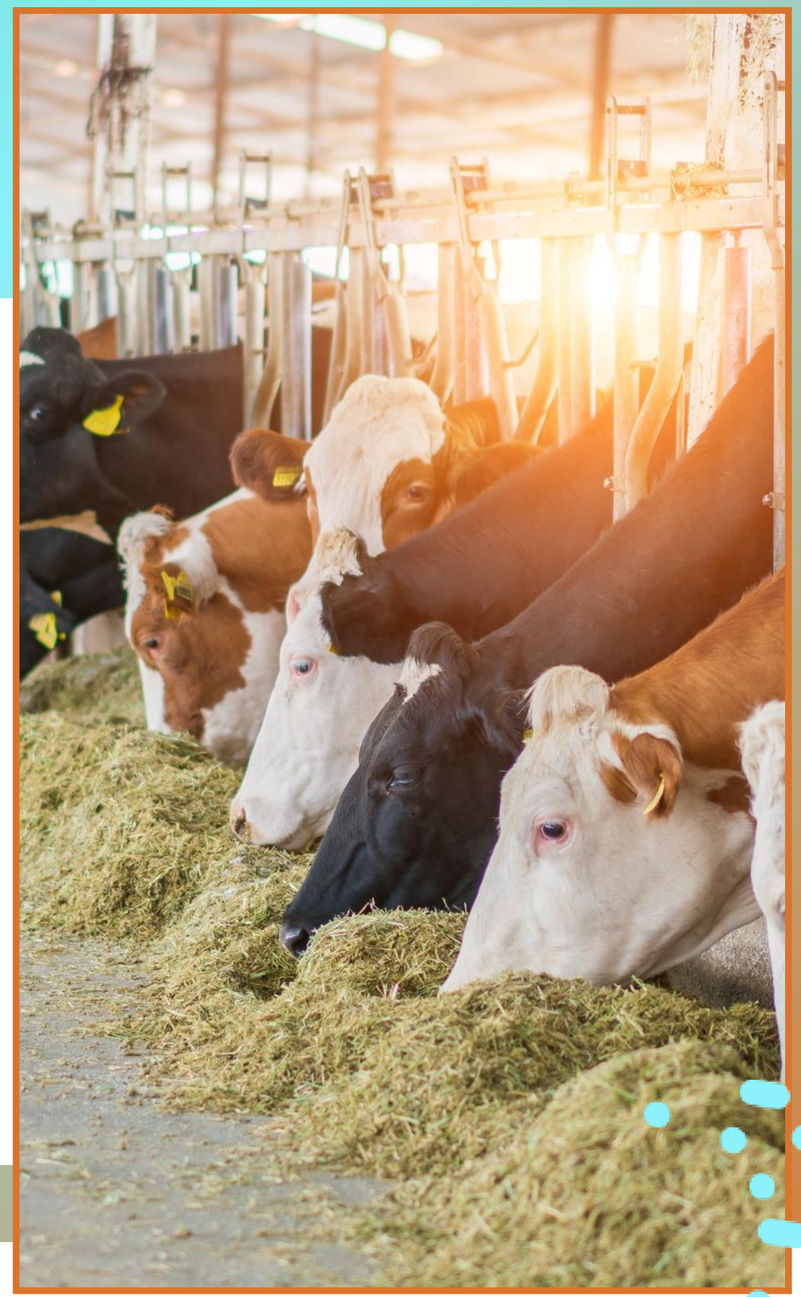

HoloRuminant Understanding microbiomes of the ruminant holobiont

Re-Livestock RESILIENT FARMING SYSTEMS

GERONIMO GENOME AND EPIGENOME ENABLED BREEDING IN MONOGASTRICS

Rumigen

3D'omics

Acknowledgements

Rumigen

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Heat stress

Has a negative effect on fertility:

- Oestrus detection more difficult due to fewer signs
- If detected and inseminated, fertilization success is lower

Effects of heat stress at different levels

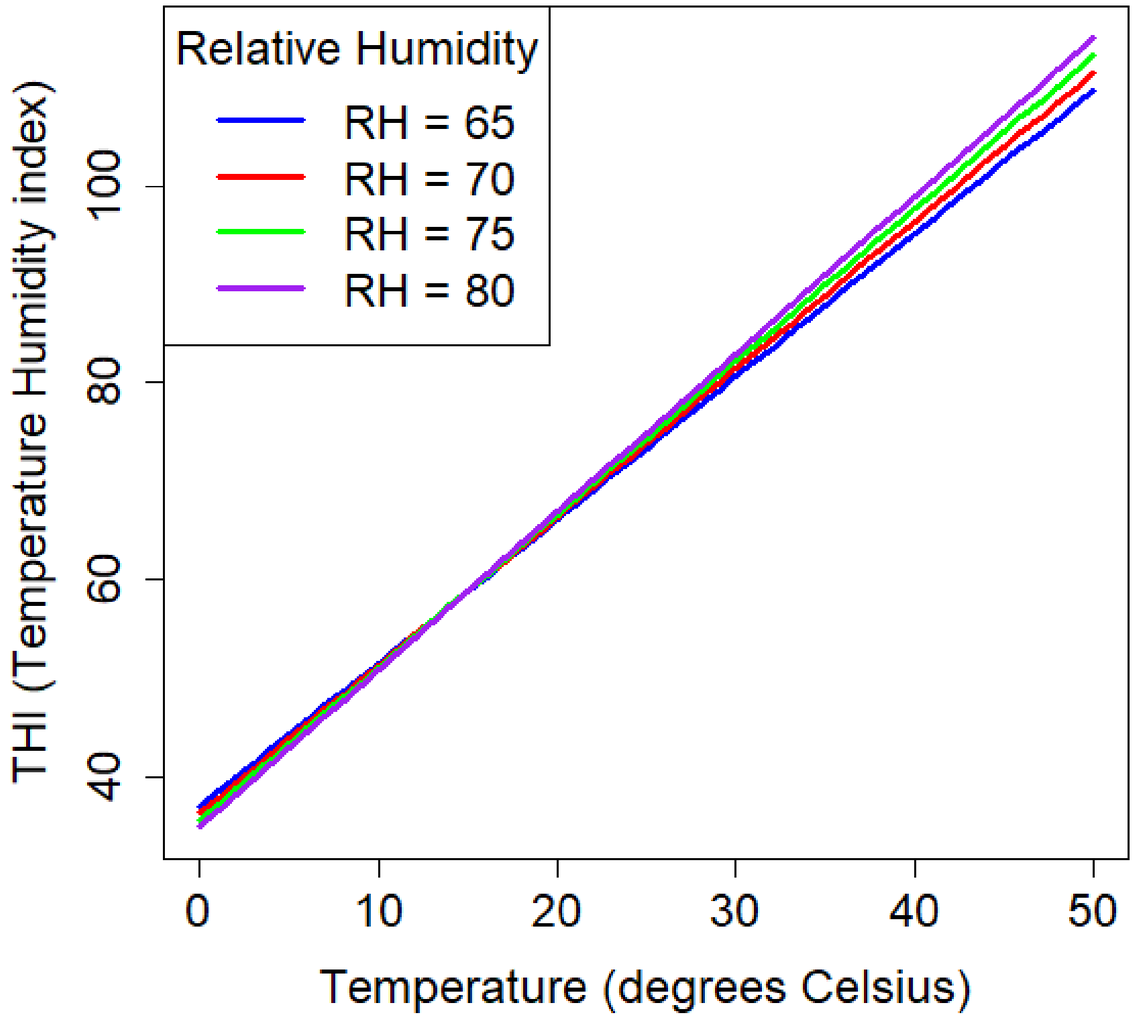
Population / phenotypic level:

- Average level of fertility decreases with increasing THI
- THI = Temperature Humidity Index
- *At which THI level does heat stress start?*

Genetic level – differences between animals may:

- Change in scale
- Lead to different ranking
- *How large are those changes?*

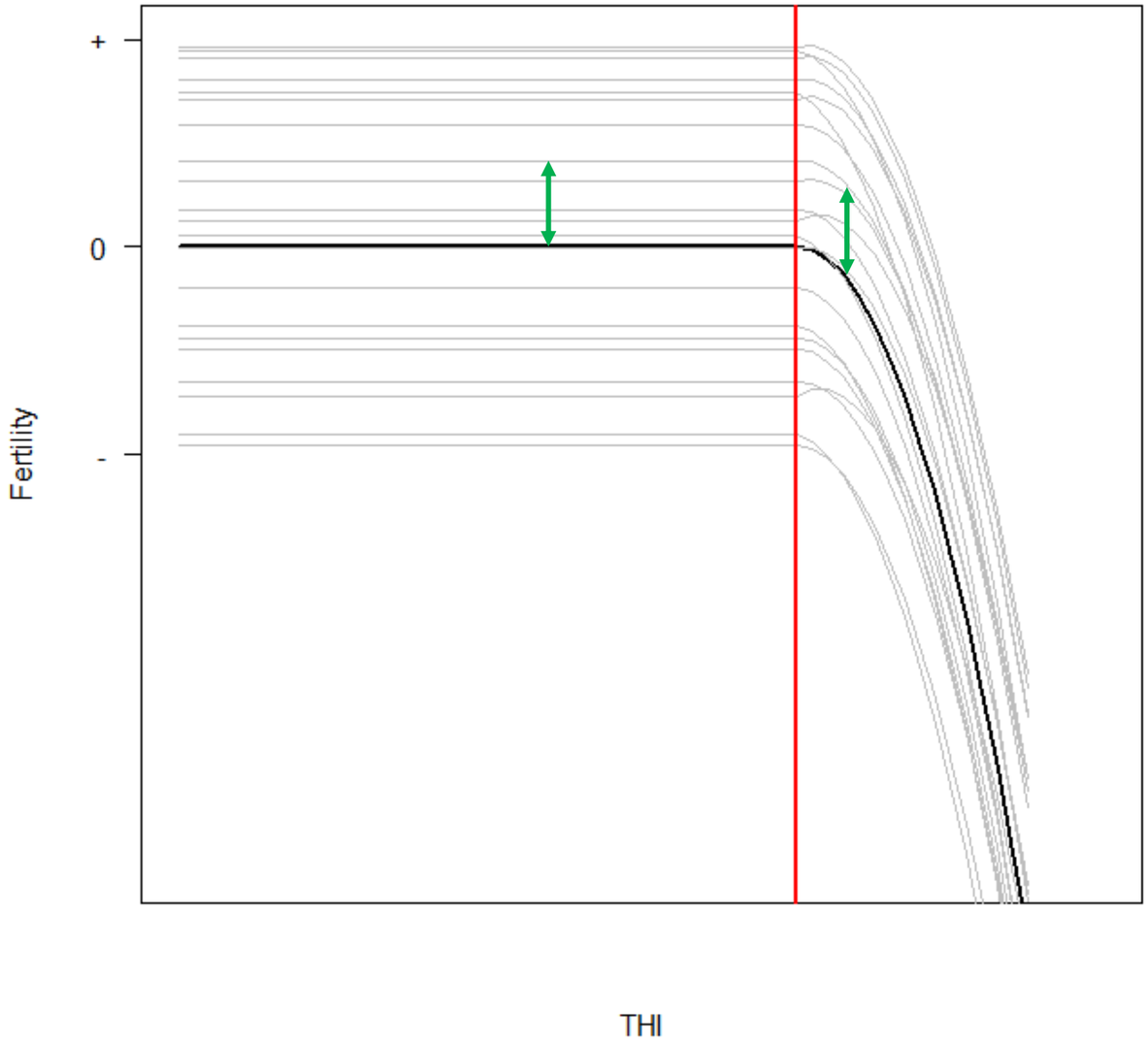
Relationship THI & Temperature



THI is driven:

- Mostly by Temperature
- Much less by Relative Humidity

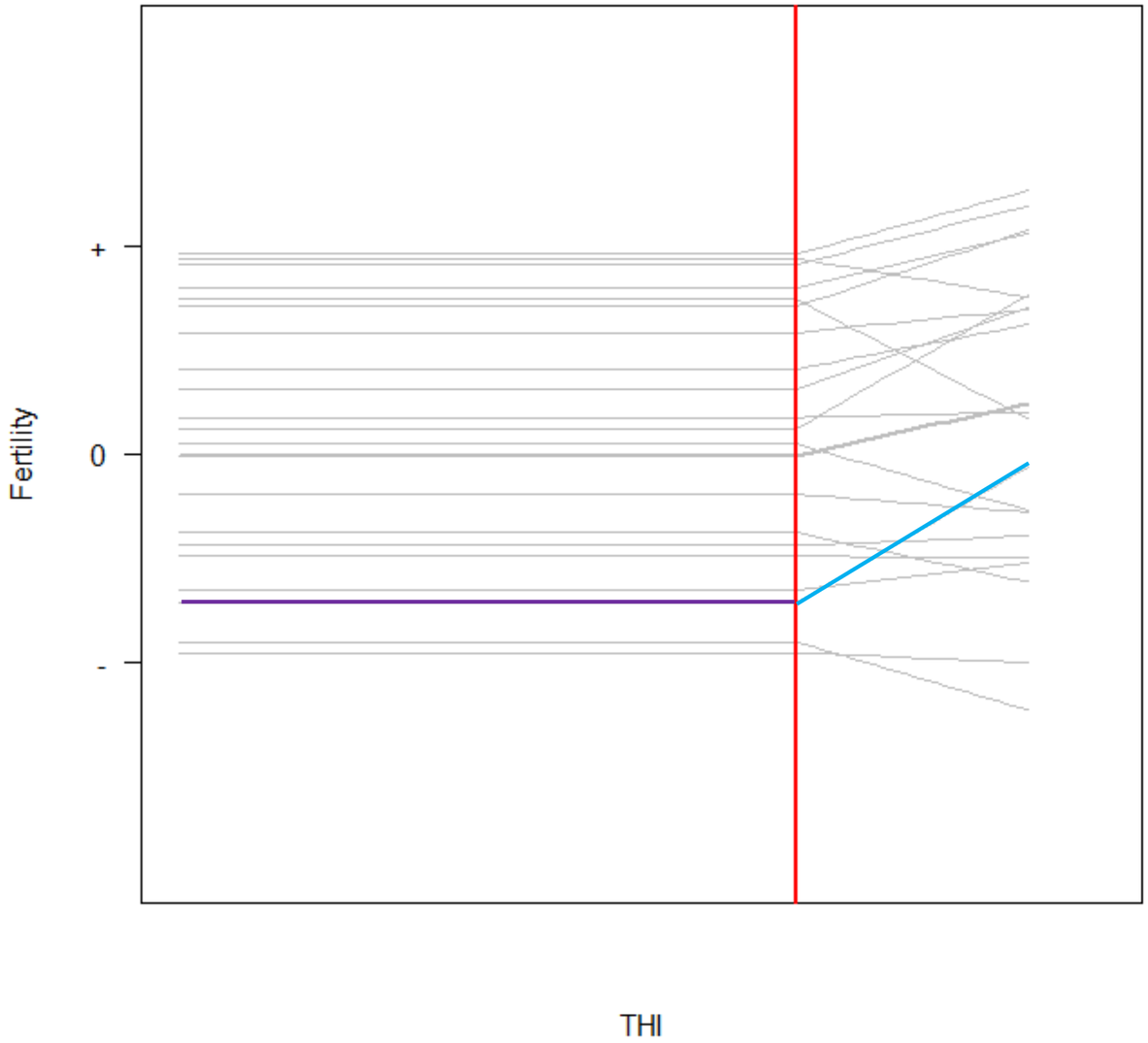
Phenotypic & Genetic level



Need to identify:

- Population **mean**
- THI threshold onset heat stress
- Individual deviations from the mean, before & after threshold

Genetic level



Need to identify:

- Breeding values for individual deviations from the mean, before & after threshold
- Genetic correlation between **intercept** & **slope**
- Using a “Broken-stick” model

Data used – Holstein in the Netherlands

1st lactation only:

Trait	Nr. of records
Conception Rate (at 1st insem.)	416,814
Interval Calving to 1st insemin.	416,793
Interval first to last insemination	416,726
Calving interval	317,213

Multiple lactations for Conception Rate:

Parity	Nr. of records
0	402,604
1	416,814
2	341,927
3	245,182

THI:

- Obtained from nearest weather station (14.6km on average)
- Averaged across 3, 7, 10, 30, 50 days surrounding insemination

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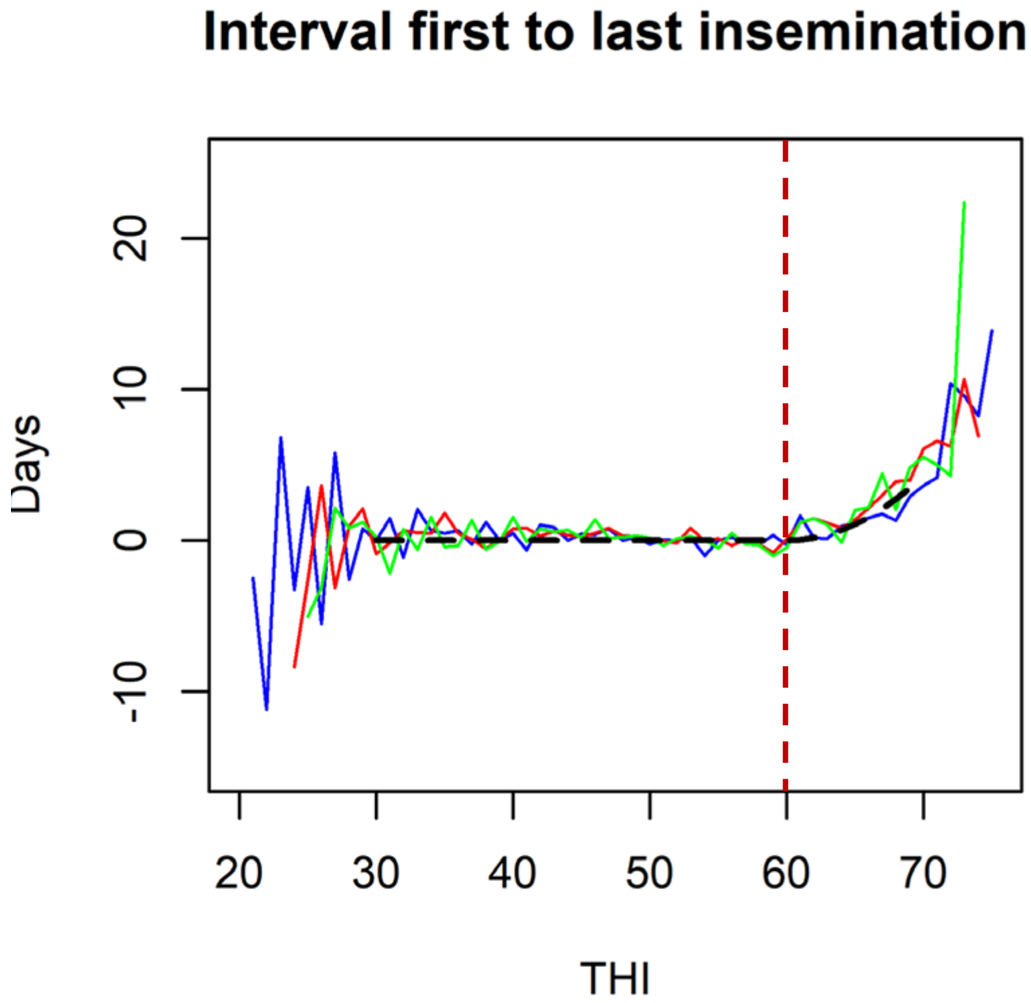
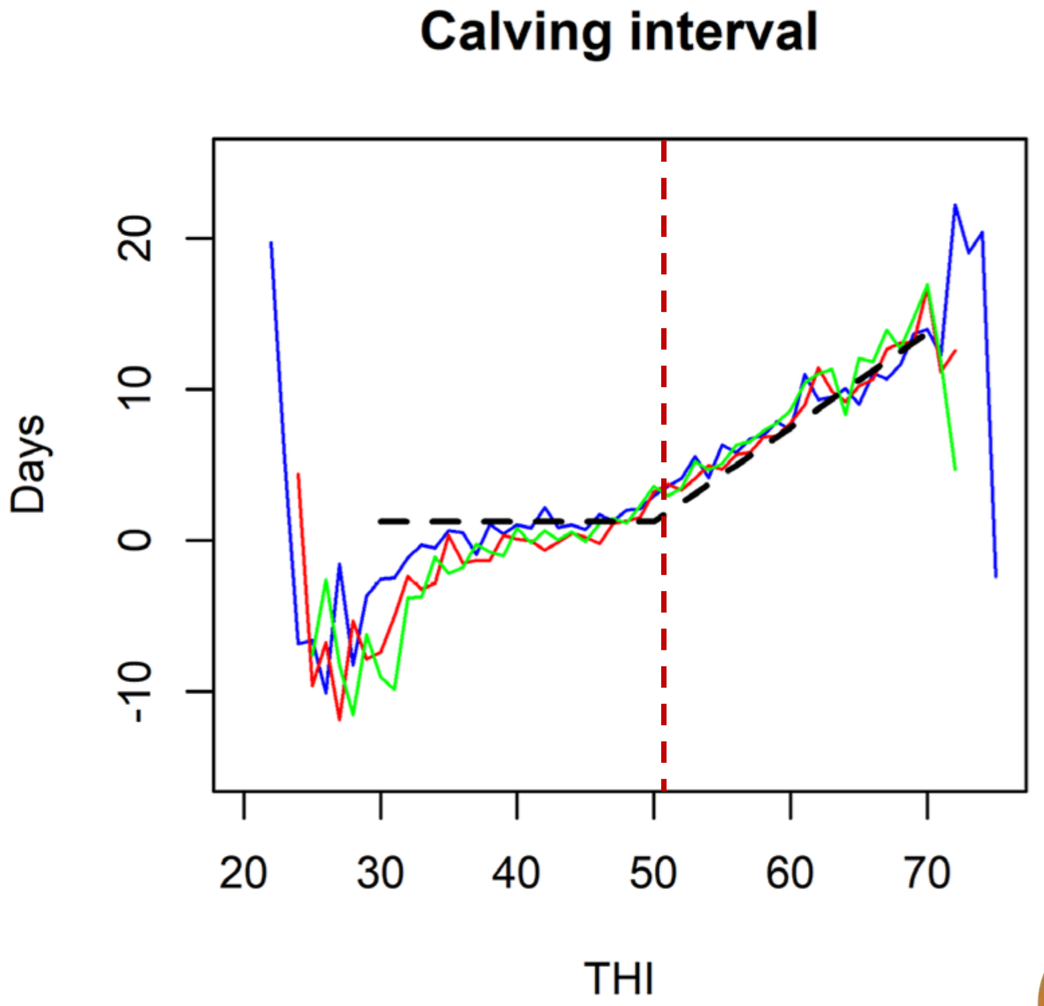
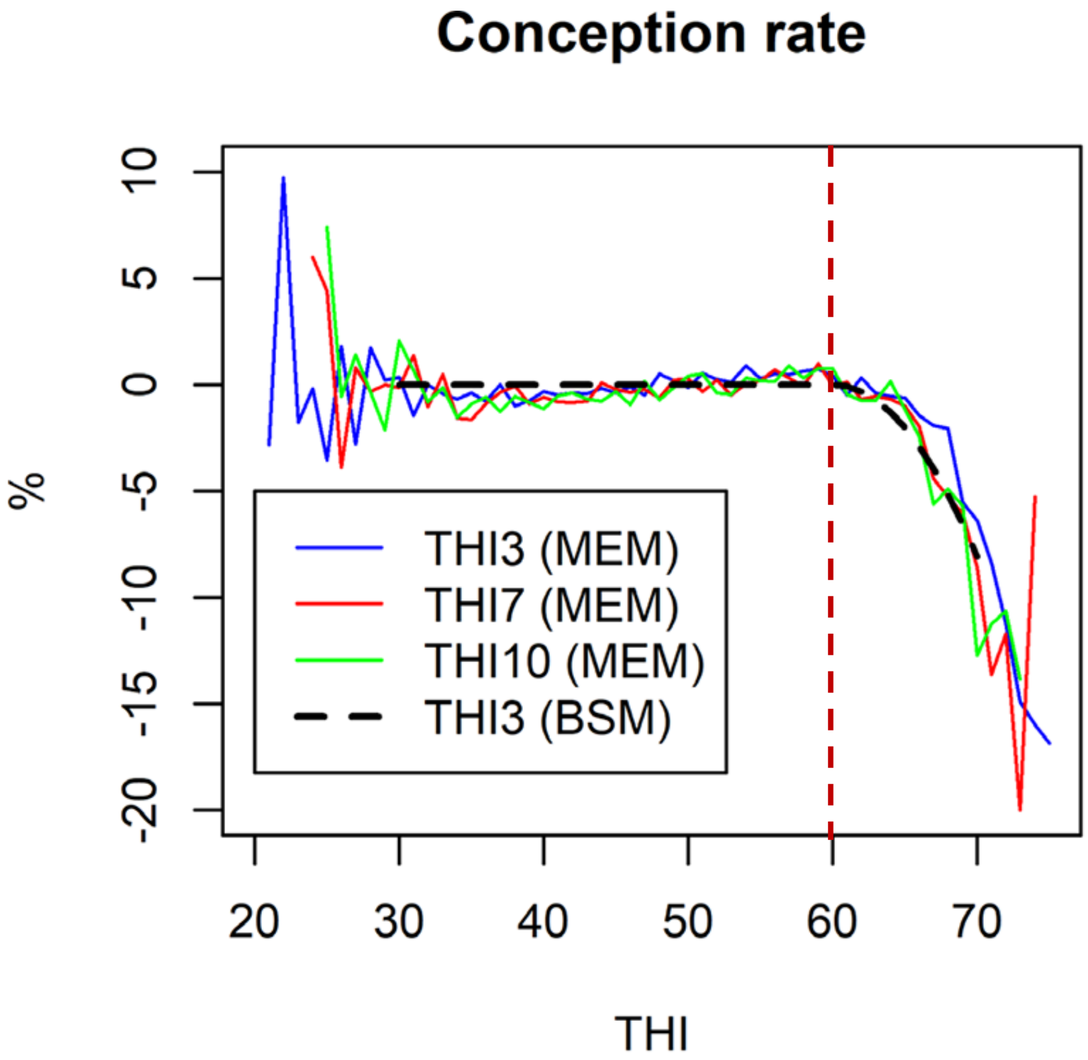
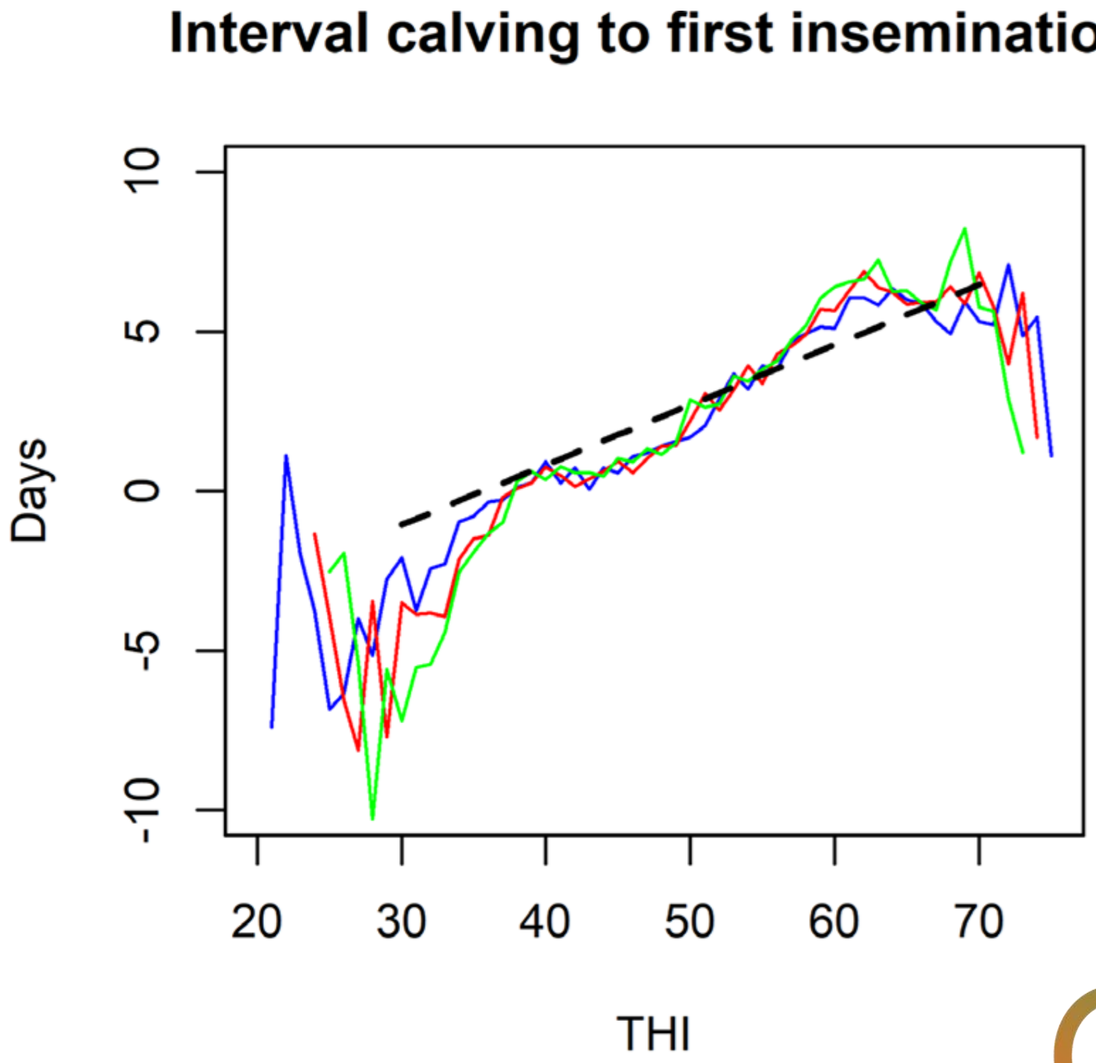
Results 1st lactation – population / phenotypic level



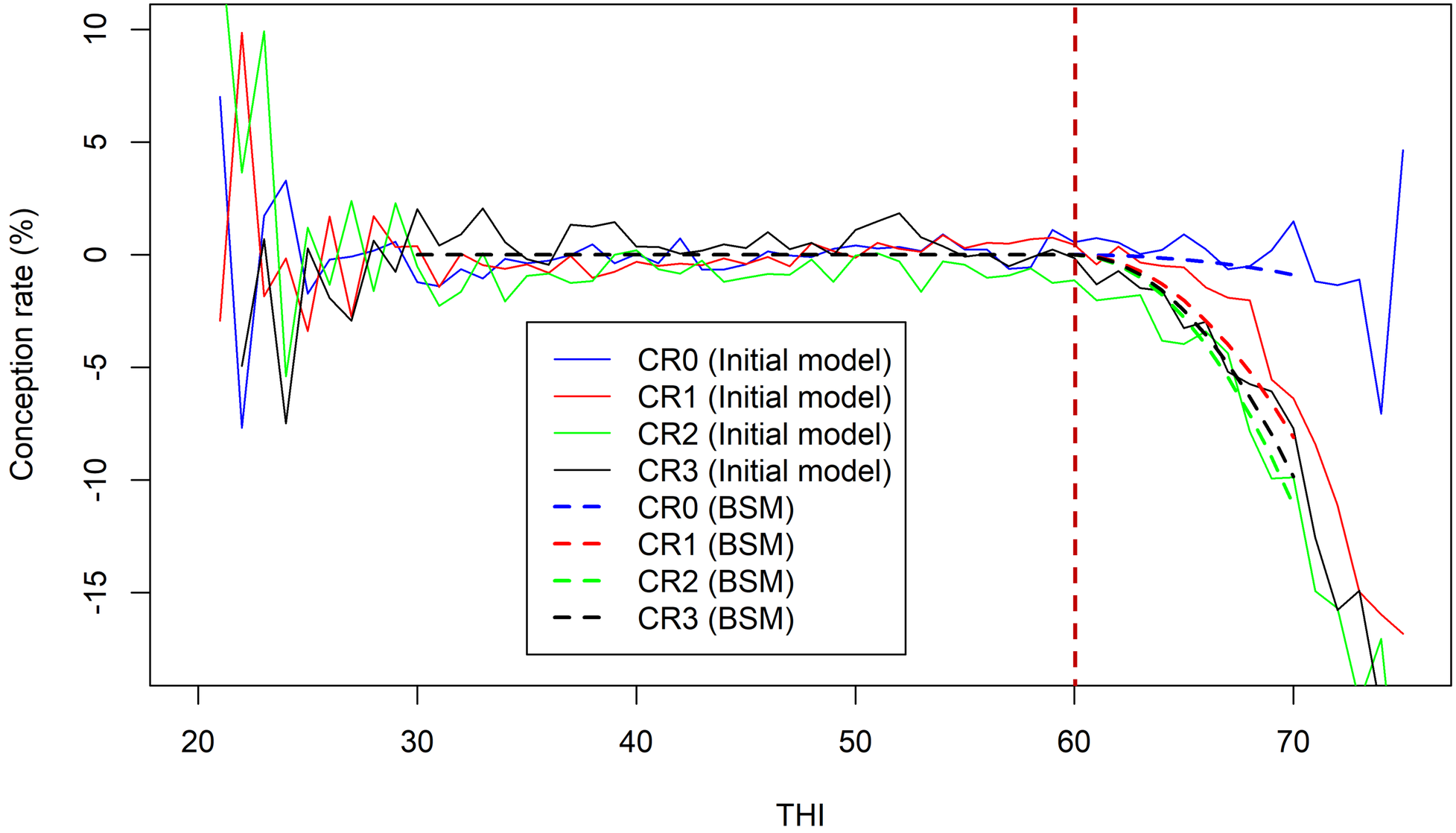


Results 1st lactation – population / phenotypic level

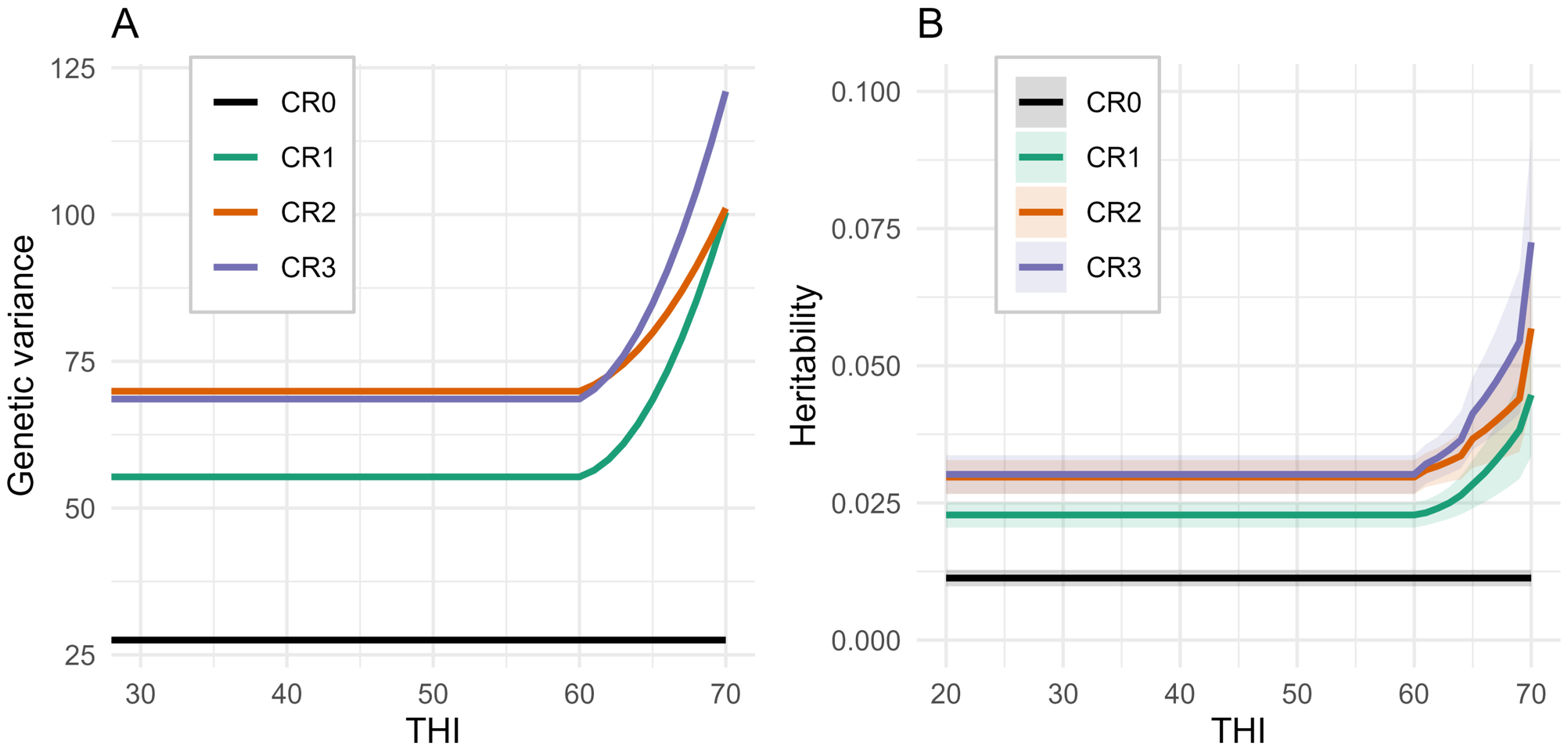




CR all lactations – population / phenotypic level



Heritability Conception Rate - all lactations



Genetic correlations (r_g) CR in different parities

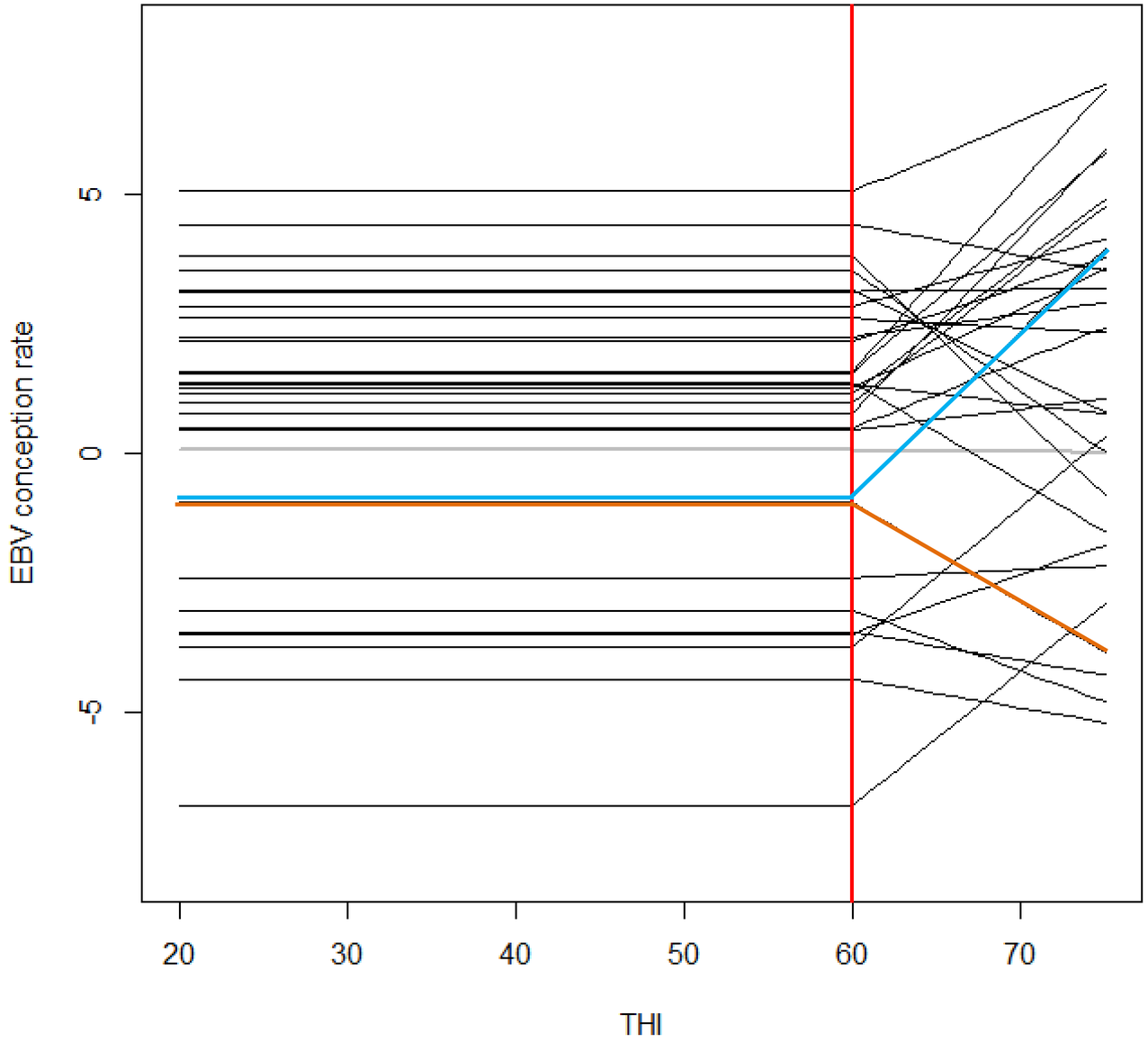
Genetic correlations	Par 0	Par 1	Par 2	Par 3
Intercept & slope	NA	0.09 (0.19)[1]	0.11 (0.25)	0.13 (0.23)
CR at THI ≤60 & 65	1.0	0.93 (0.03)	0.96 (0.03)	0.94 (0.04)
CR at THI ≤60 & 70	1.0	0.79 (0.09)	0.88 (0.08)	0.82 (0.10)

[1]Standard errors.

Similar results for lactating cows in different parities

- Limited r_g between intercept and slope
- Some potentially meaningful re-ranking at higher THI

Estimated breeding values of 20 sires with most daughters



Some devations after THI > 60

Conclusions

Population / phenotypic level:

- Onset of heat stress at THI of 60
  - Average daily temperature 16 °C (min. ~10 to max. ~22 °C)
- Lower than observed in countries with hotter climate

Genetic level:

- Considerable genetic variation in response to heat stress
- Meaningful re-ranking of sires at high THI
- Considering heat stress in breeding values

References

Calus, M. P. L., T. Pook, M. L. van Pelt, and J. Vandenplas. 2026. Genetic analysis of heat stress for conception rate across parities in the Netherlands. J. Dairy Sci. *Under revision*.

Ojo, T. O., J. Vandenplas, H. A. Mulder, M. L. van Pelt, and M. P. L. Calus. 2025. Genetic analysis of the impact of heat stress on fertility traits in dairy cows in the Netherlands. J. Dairy Sci. 108:1699-1713. https://doi.org/10.3168/jds.2024-25316