Predicted response of genomic selection for new traits using combined cow and bull reference populations

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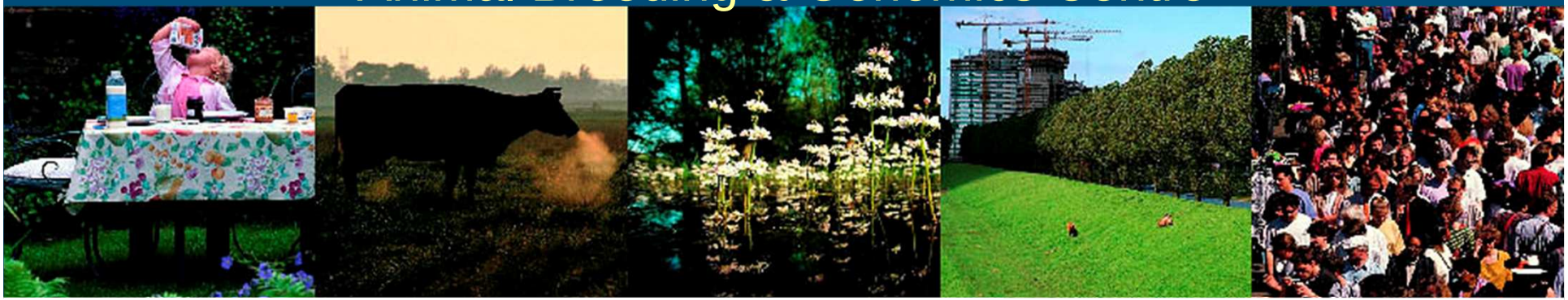

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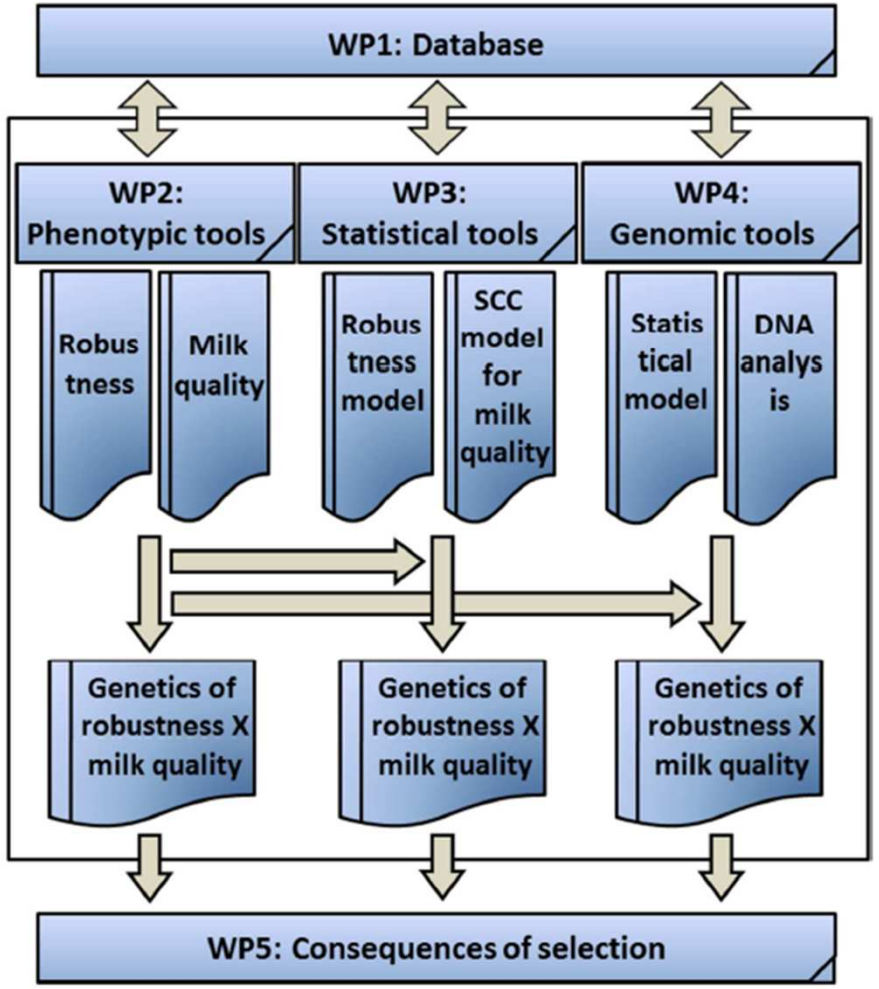
SEVENTH FRAMEWORK PROGRAMME

Develop innovative and practical breeding tools for improved dairy products from more robust dairy cows



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Introduction

Genomic selection:

- Beneficial for dairy cattle breeding programs
  - Reduces generation interval
  - Cheaply increases selection intensity
- Allows selection for ‘new’ traits
  - Relaxes requirement (daughter) performance recording
  - Expensive or hard to measure
- New traits:
  - Progesterone; Energy balance; Methane emission

→ How promising is this?

Objective

Investigate for a new trait measured on a limited number of cows only (e.g. methane emission):

- DGV reliability:
  - Using cows only
  - When adding sires with known DGV for correlated trait
- The selection response

Deterministic simulation

- Reliabilities predicted (Daetwyler et al., 2009)
  - For cows and bulls separately
  - Blended using ‘information source method’ (Harris & Johnson, 1998)
- Selection response predicted using SelAction (Rutten et al., 2002)
  - 4 selection pathways with different generation intervals
- Simultaneous selection of new trait and index

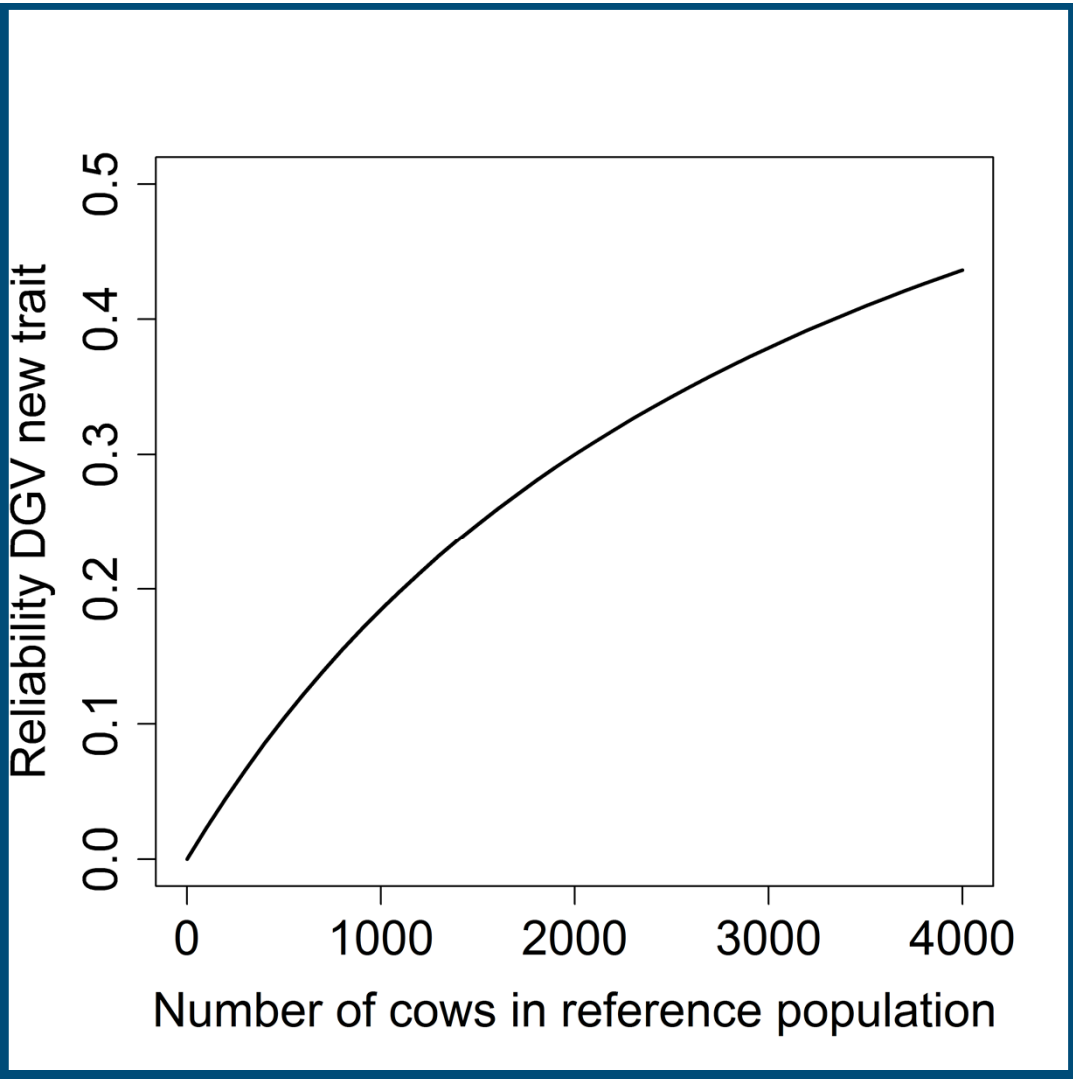
Parameters

- # Cows: 0 – 4000
- # Bulls: 0, 200, 500, 2000, 5000, 20,000

Trait	h^2	DGV reliability	Economic value
Index	0.3	0.64	1
New trait	0.3	0.0 – 0.64	1

- r_g(index, new trait) = -0.5, 0, or 0.5
- Breeding program with 1-stage genomic selection

Results: DGV reliabilities – cows only



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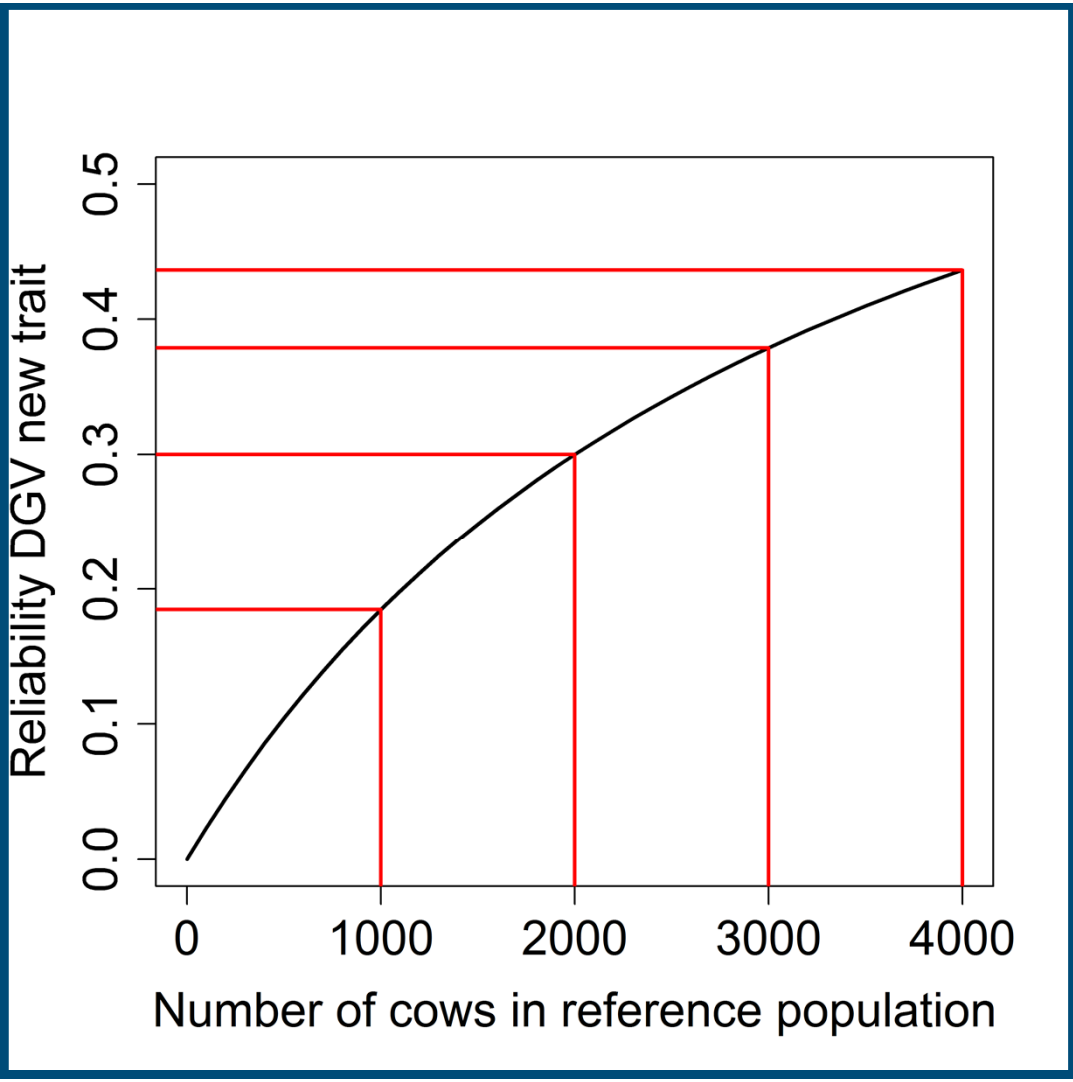
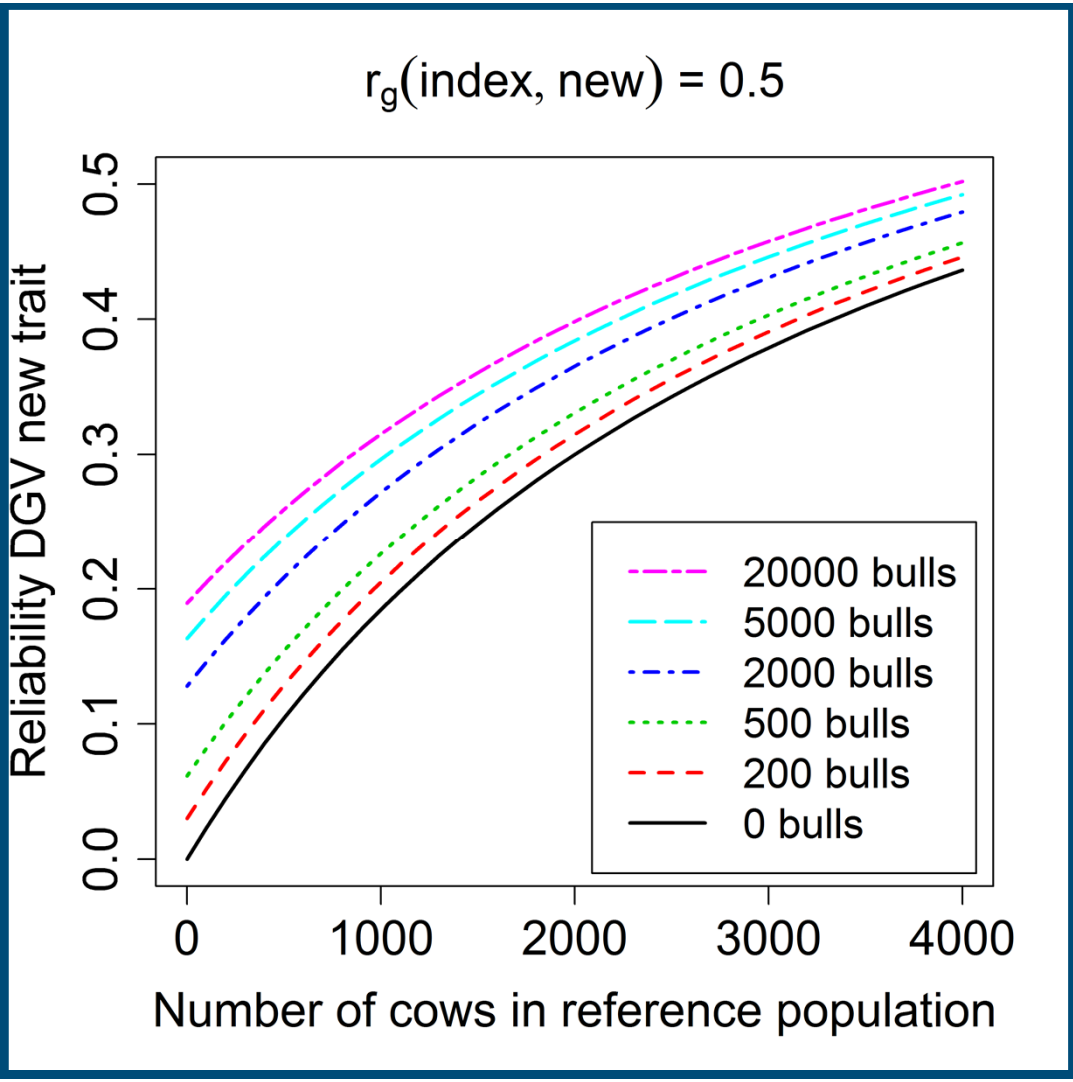


Results: DGV reliabilities – bulls added



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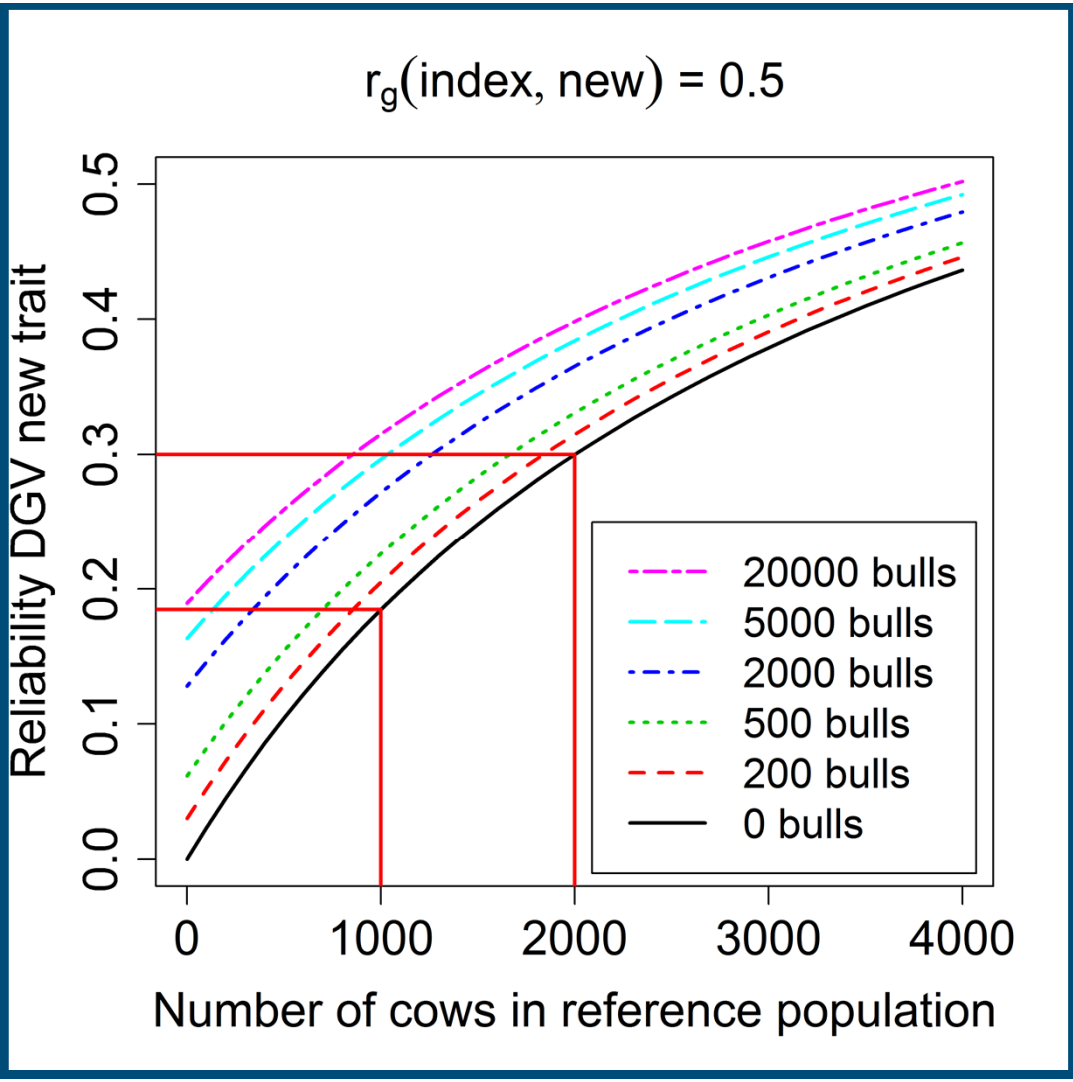

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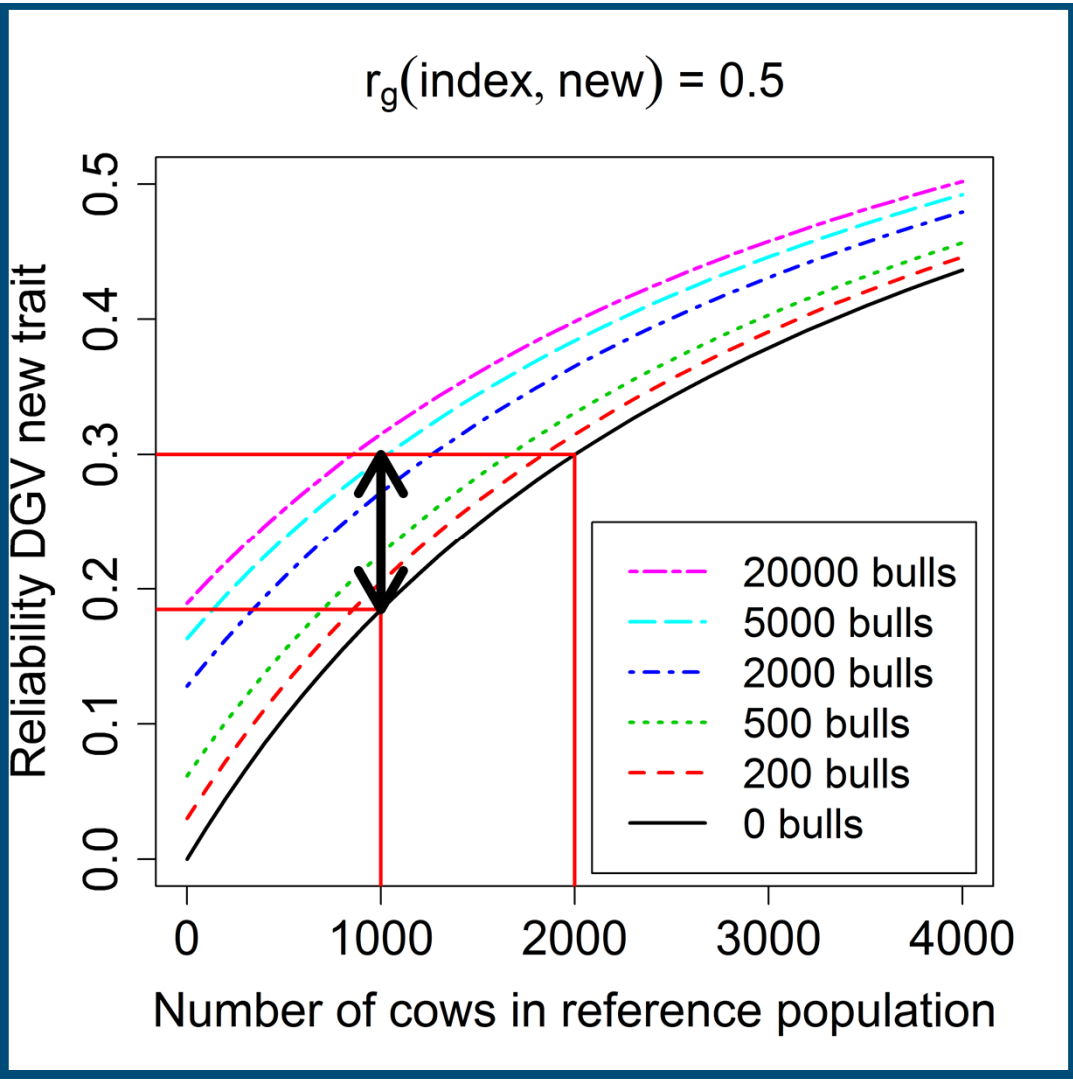
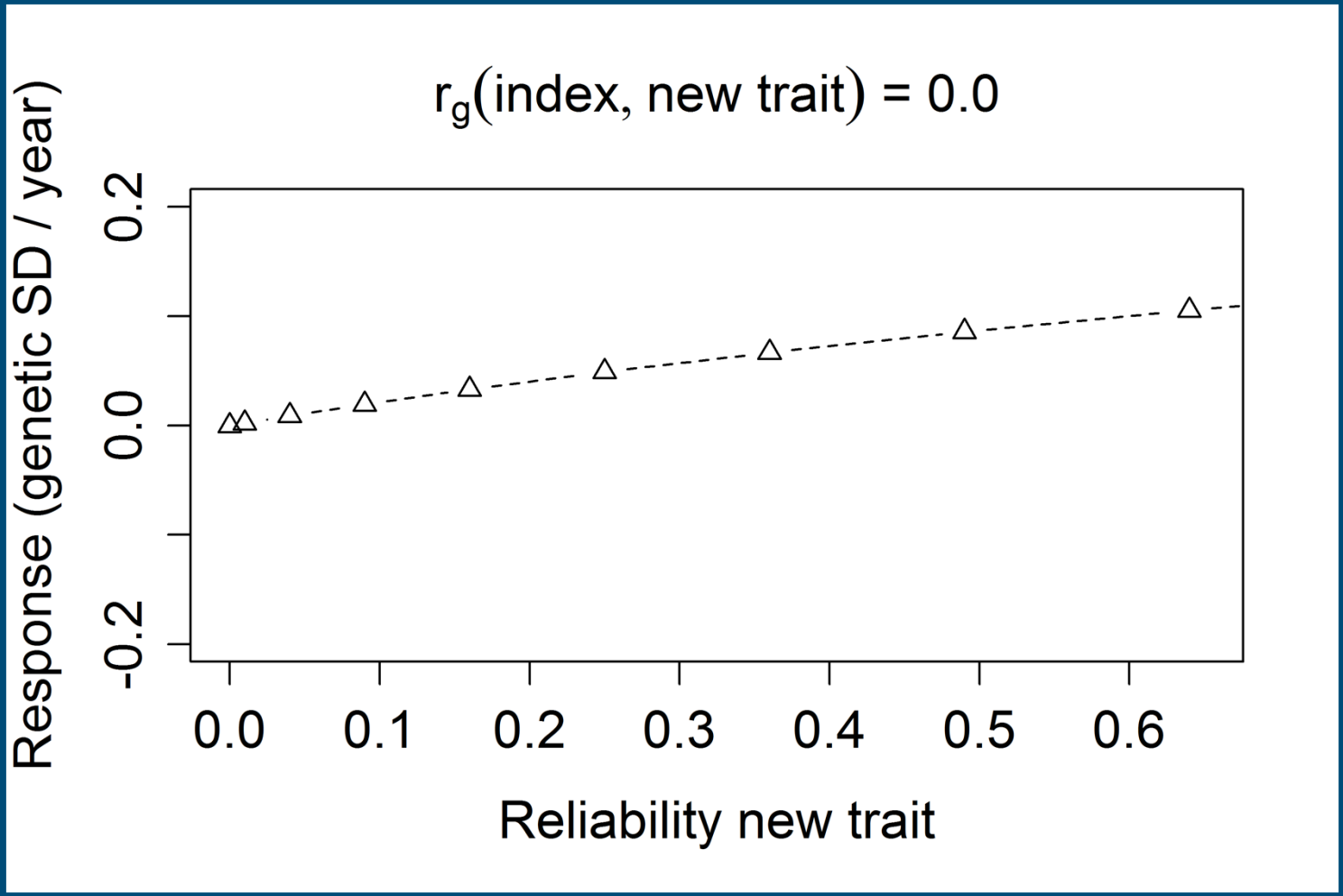


Results: selection response



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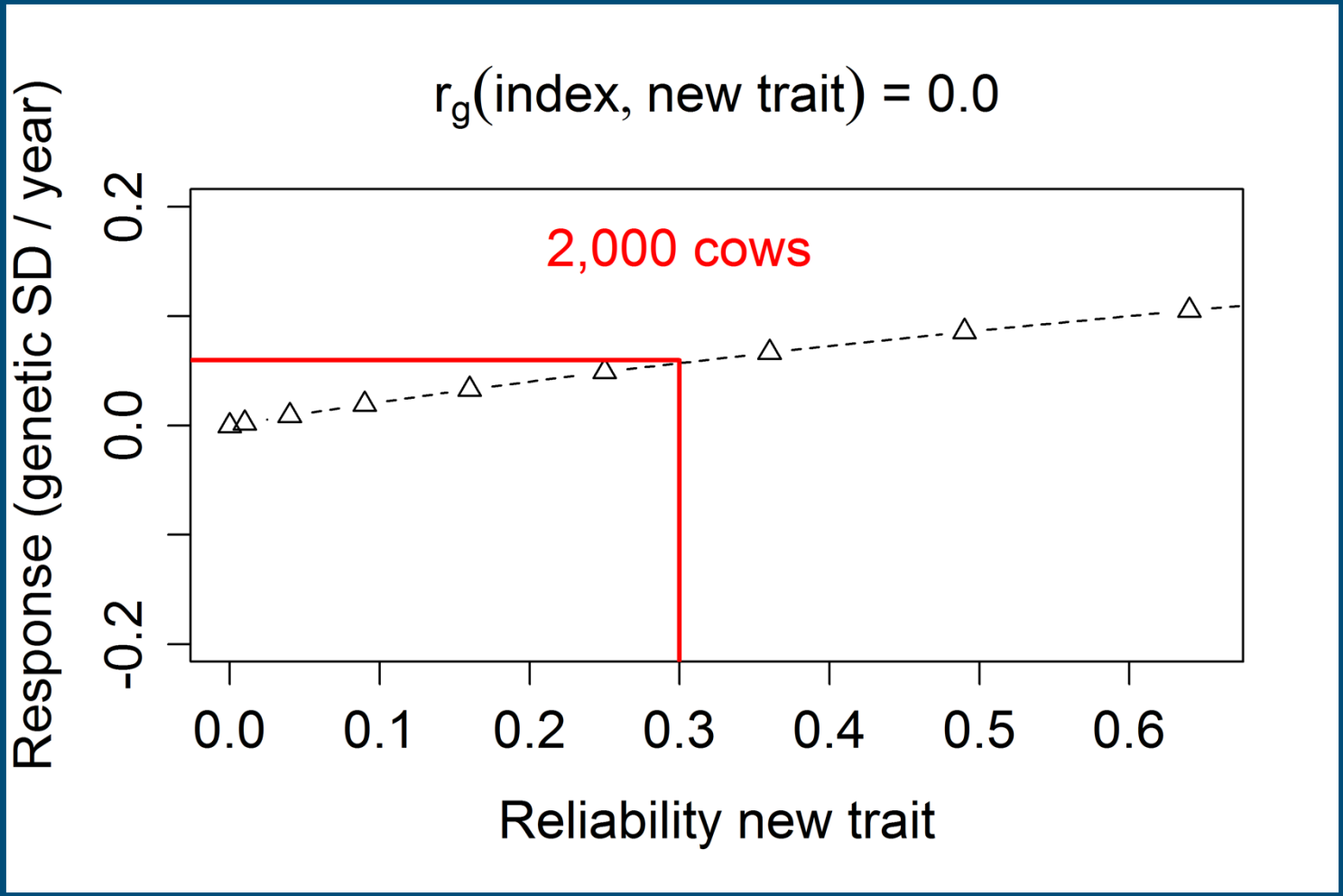

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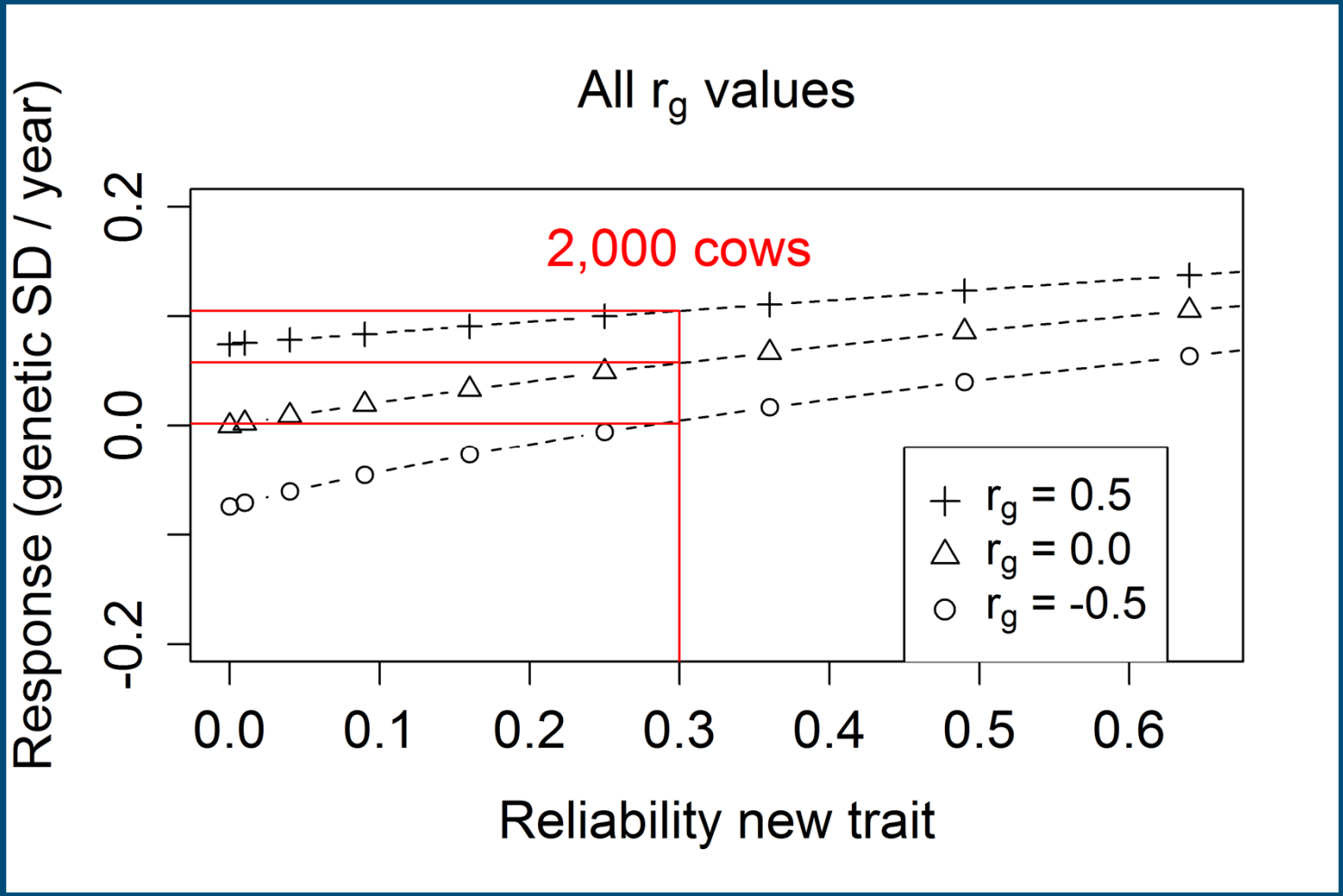

Summarized – impact 2,000 cow reference pop.

→ DGV reliability = 0.3

Compared to no selection for new trait

r_g(index, new trait)	Response (gen. SD / yr)	Increase response (gen. SD / yr)
0.5	0.1	0.02
0.0	0.06	0.06
-0.5	0.0	0.08

Negative trend broken

Conclusions

- Combining cow and bull reference populations can increase reliability DGV of new traits
  - When r_g(index, new trait) ≠ 0
  - Reduces the required size of cow reference population
- Genomic selection for new traits is beneficial, even with a small cow reference population
  - Low DGV reliability is offset by decrease of generation interval

Acknowledgements

- RobustMilk (www.robustmilk.eu)
- Dutch Dairy Board
- GreenHouseMilk

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