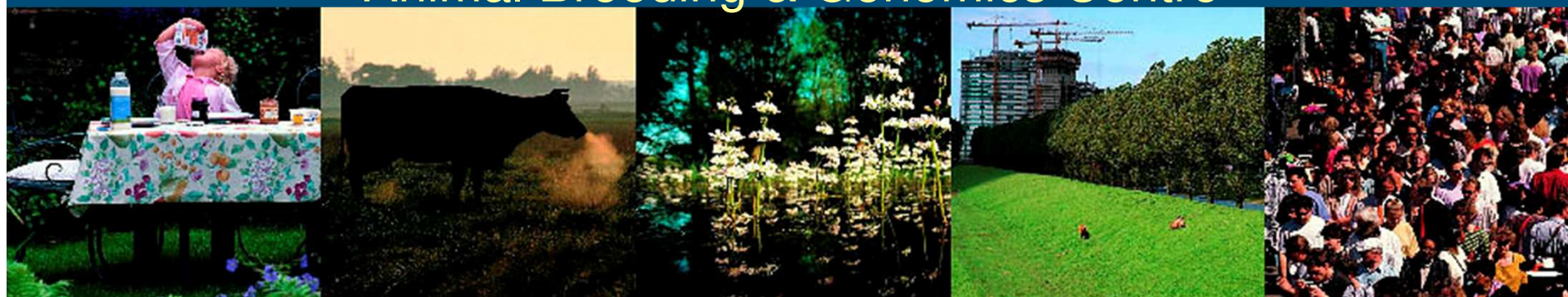


# Predicted response of genomic selection for new traits using combined cow and bull reference populations

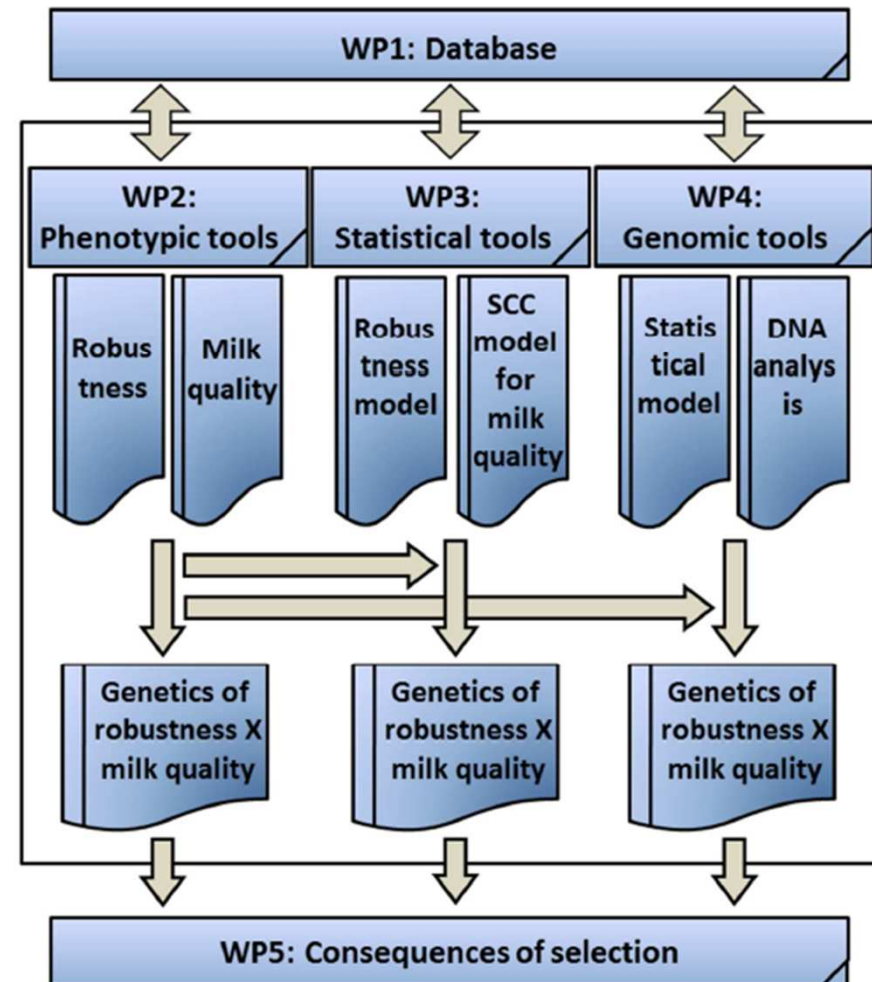
Mario Calus  
Yvette de Haas  
Marcin Pszczola  
Roel Veerkamp

Animal Breeding & Genomics Centre





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



[www.robustmilk.eu](http://www.robustmilk.eu)

# 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

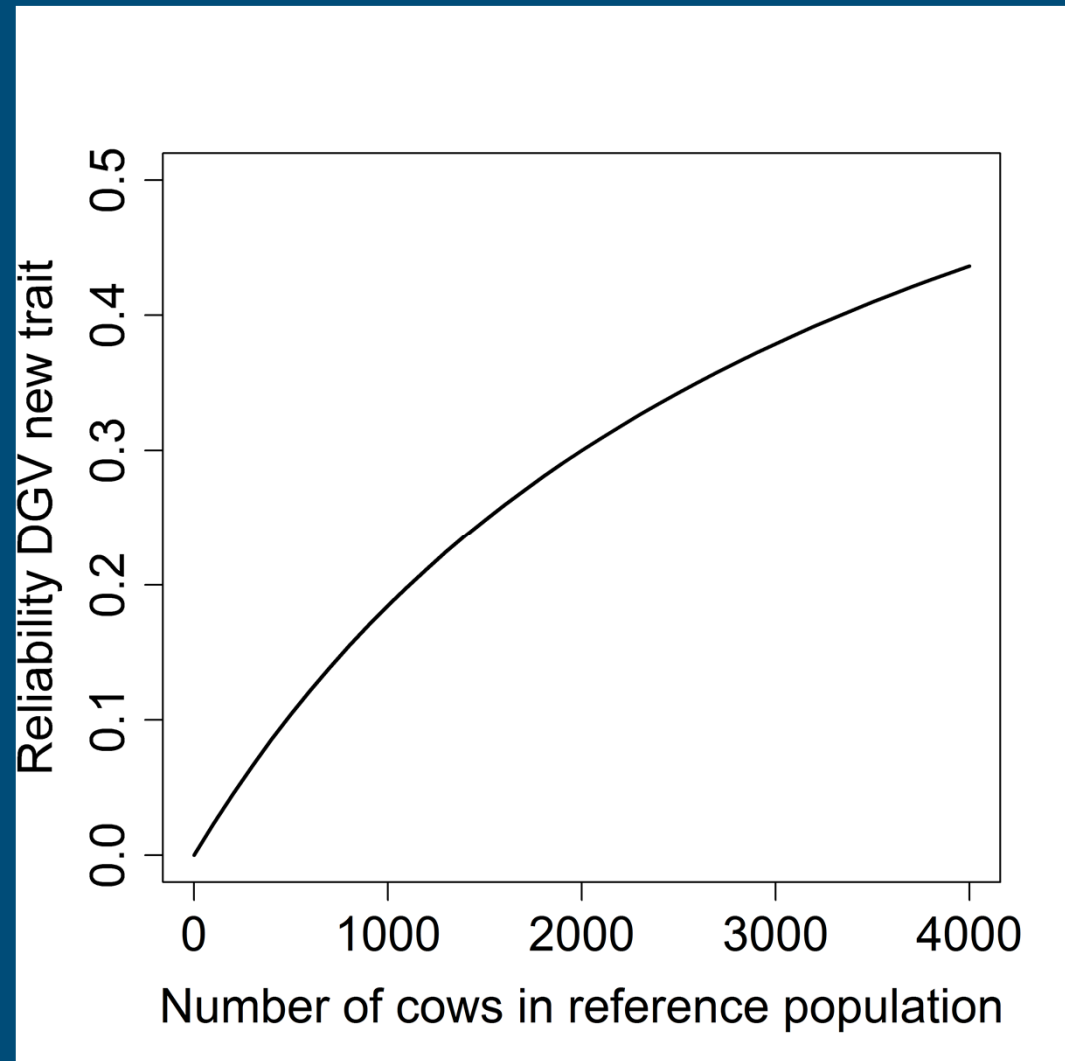
# Parameters

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

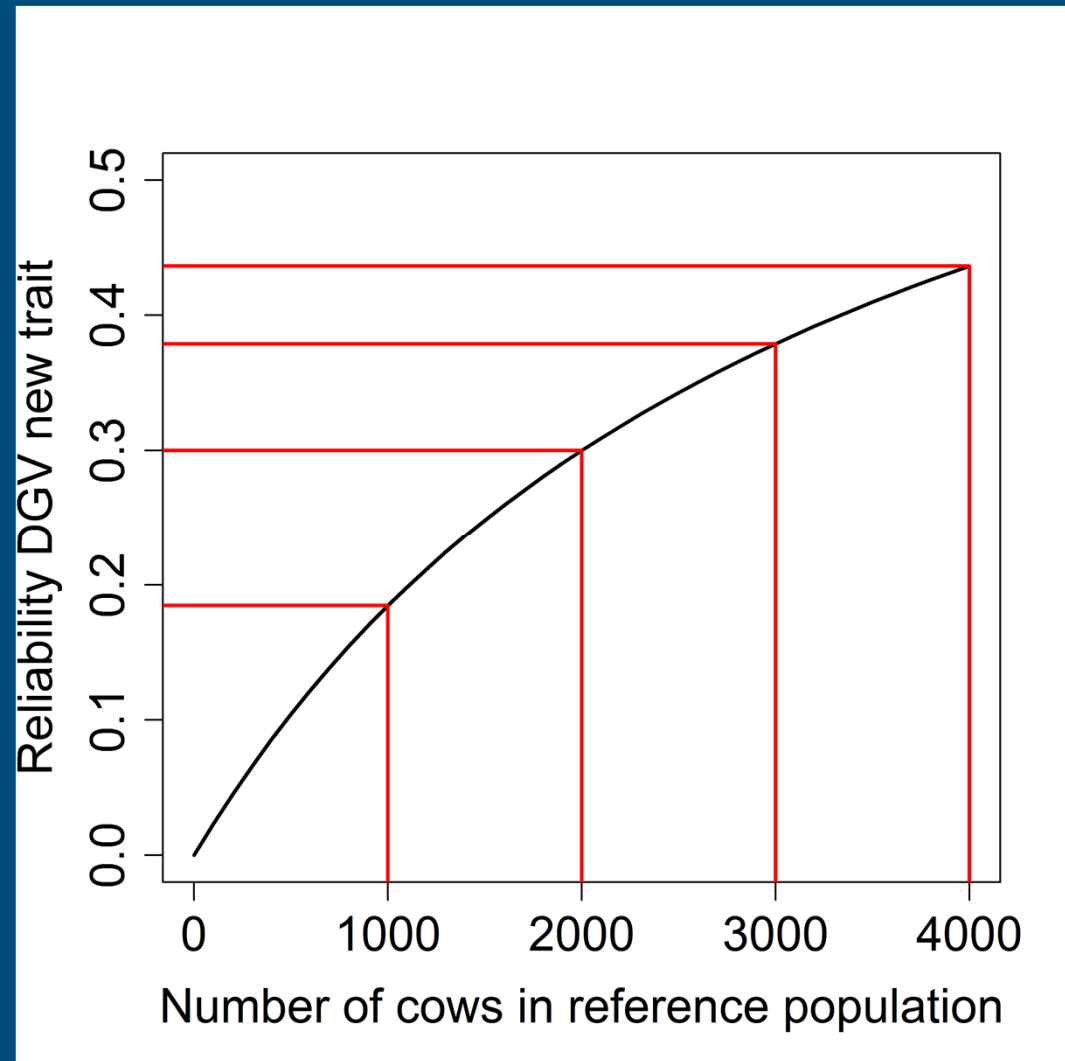
Trait	$h^2$	DGV reliability	Economic value
Index	0.3	0.64	1
New trait	0.3	0.0 – 0.64	1

- $r_g(\text{index, new trait}) = -0.5, 0, \text{ or } 0.5$
- Breeding program with 1-stage genomic selection

# Results: DGV reliabilities – cows only

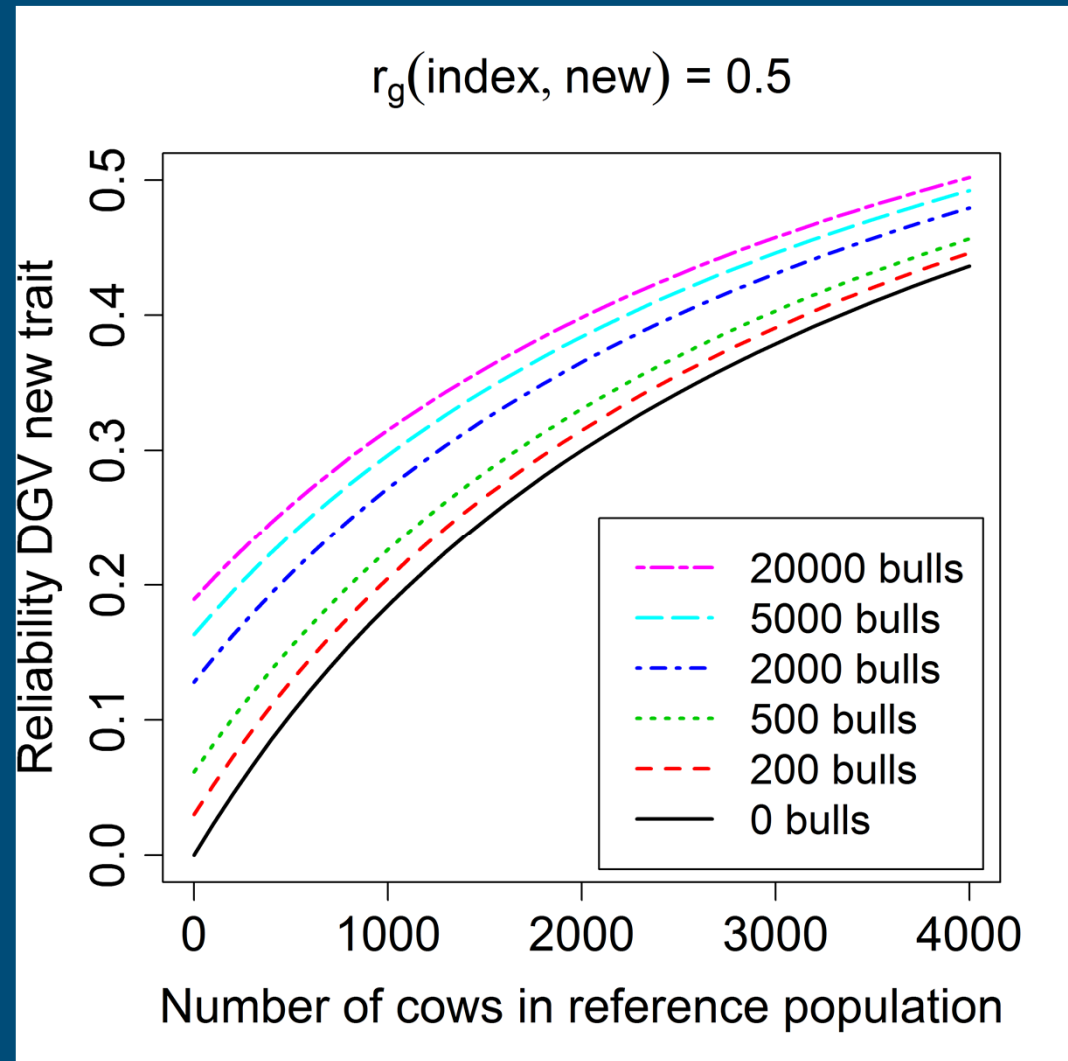


# Results: DGV reliabilities – cows only

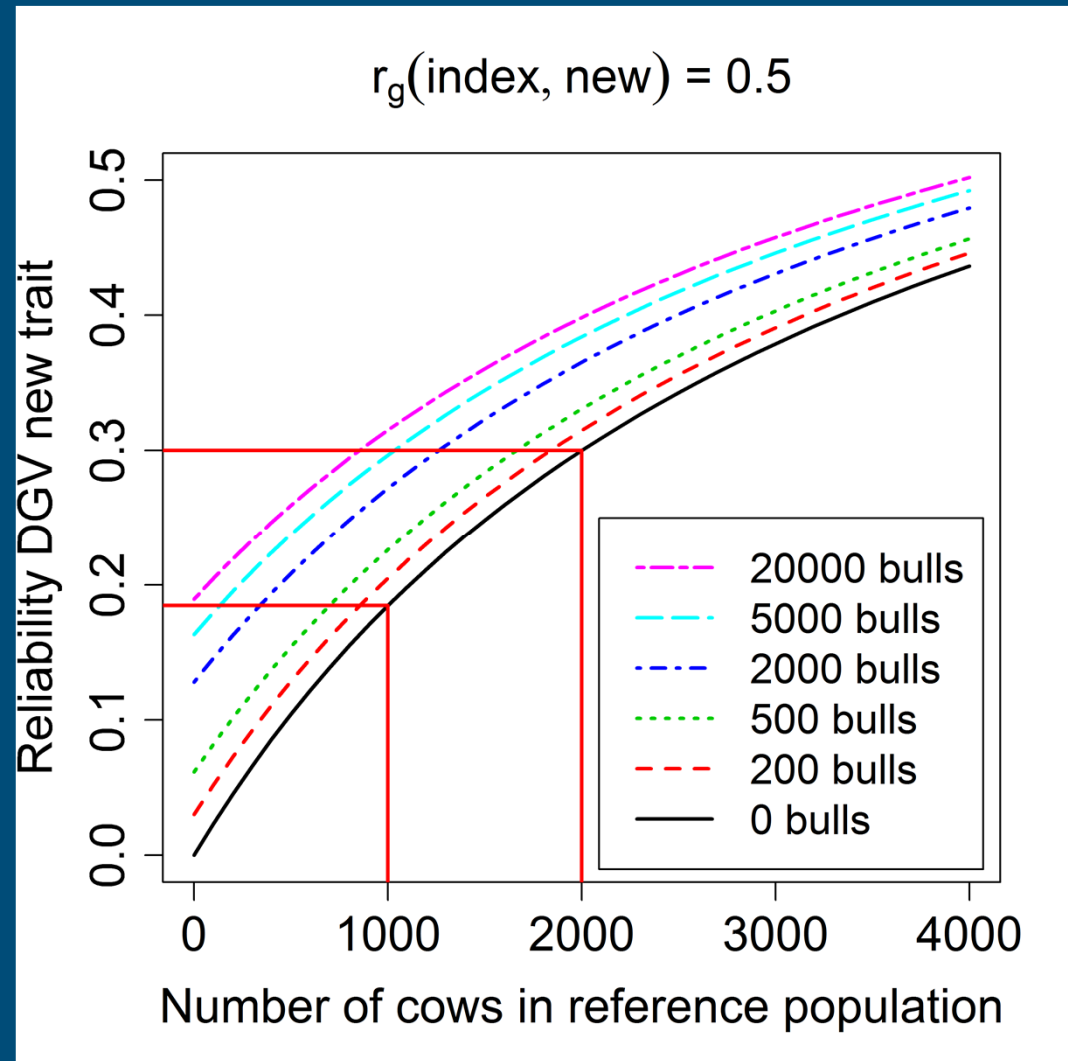




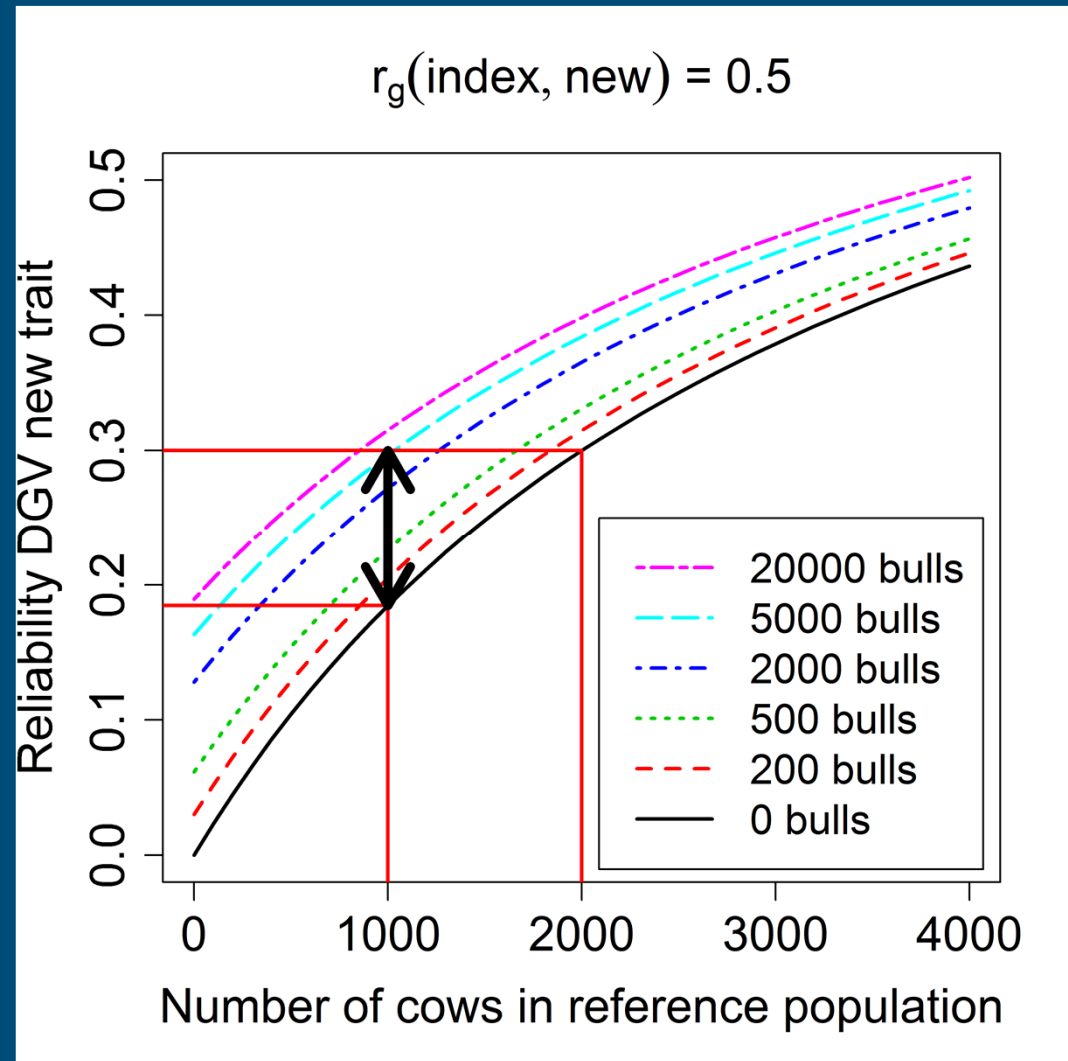
# Results: DGV reliabilities – bulls added



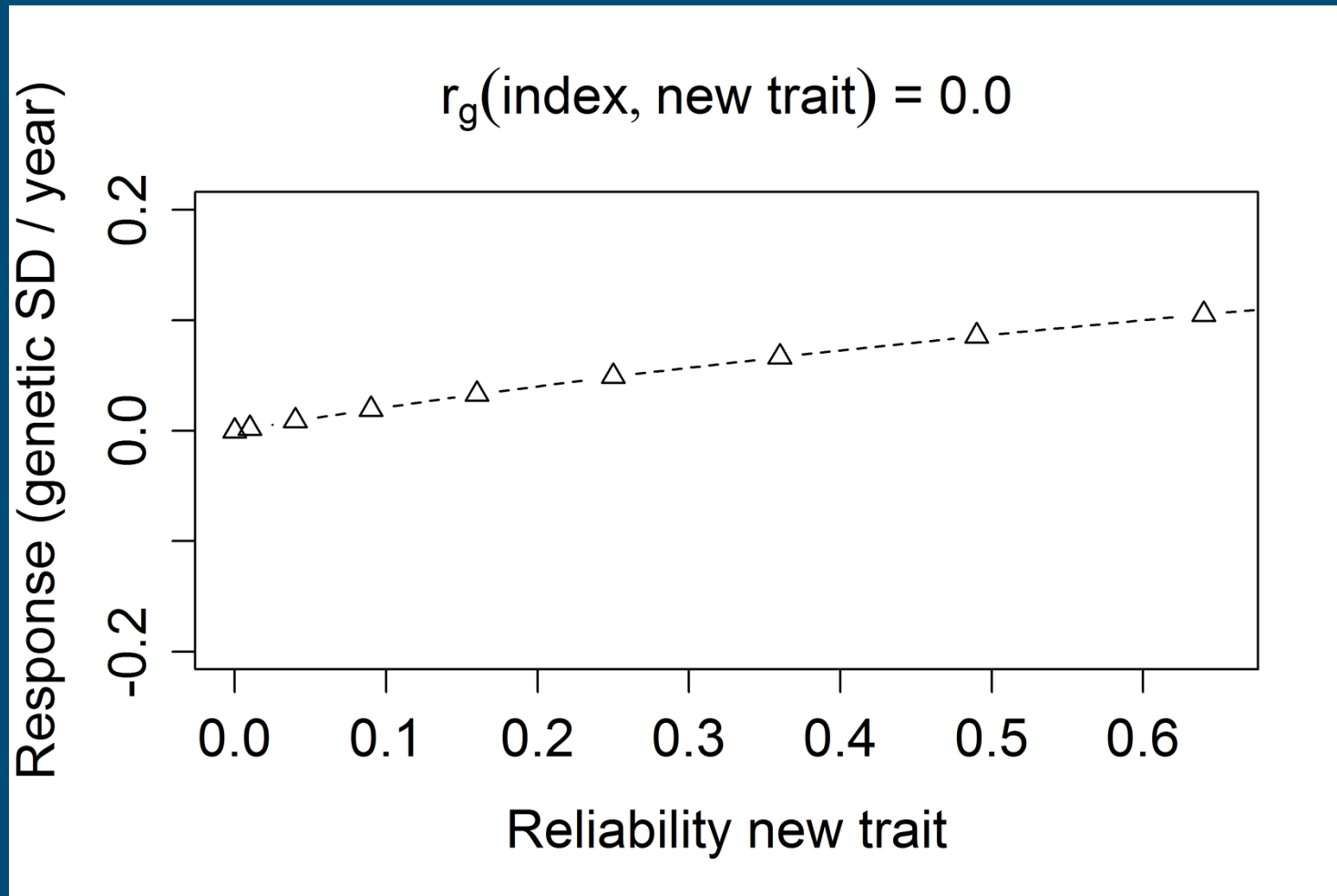
# Results: DGV reliabilities – bulls added



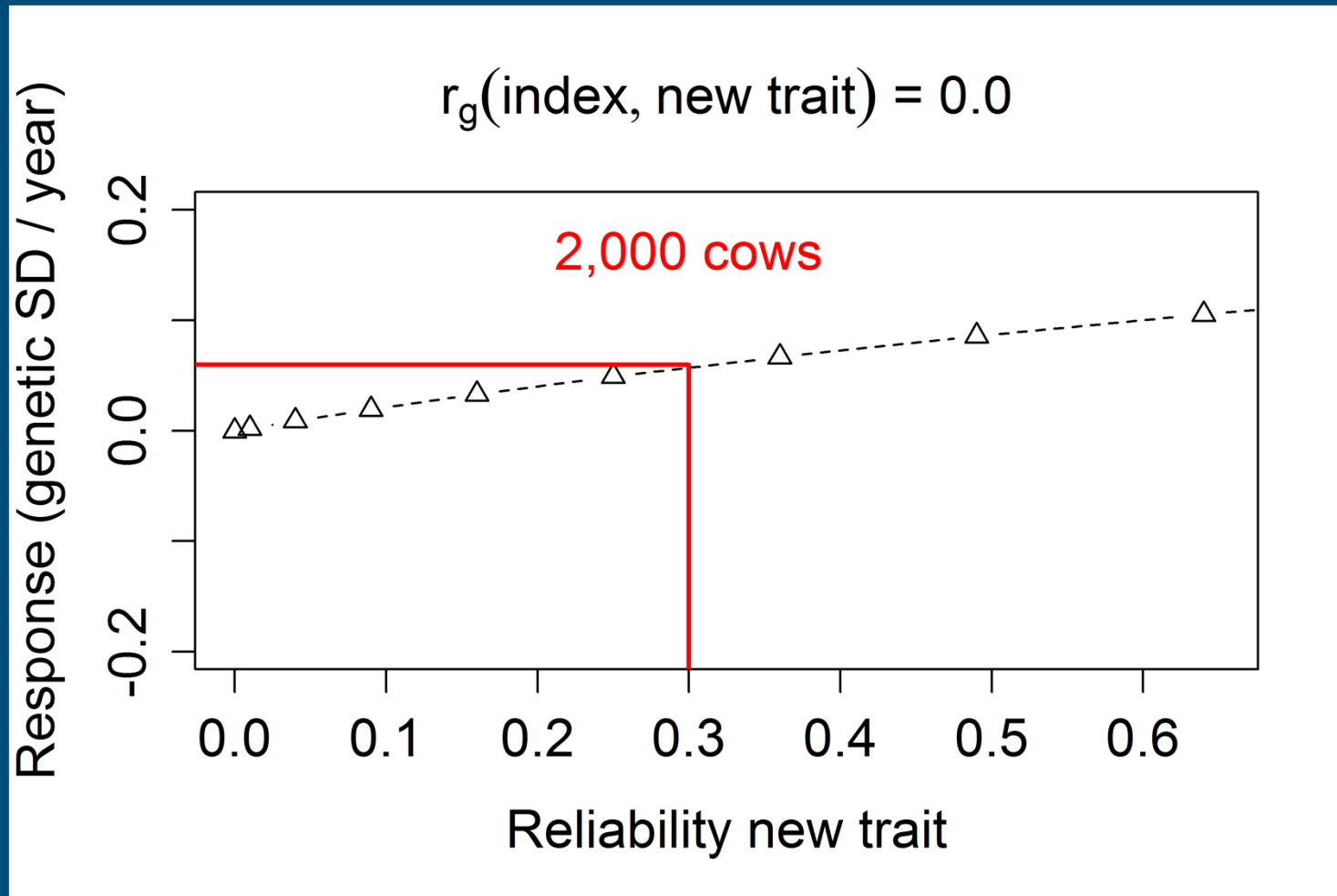
# Results: DGV reliabilities – bulls added



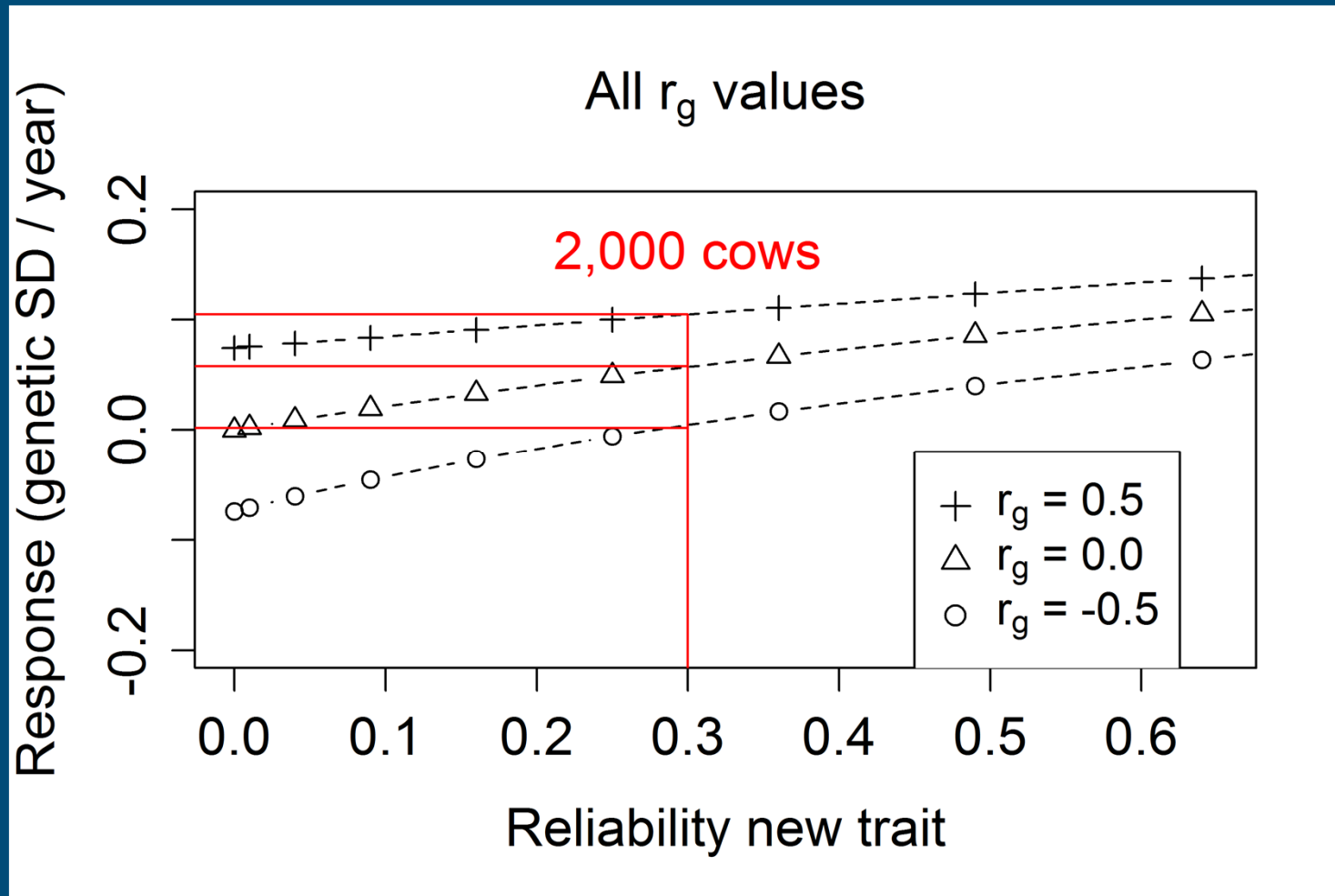
# Results: selection response



# Results: selection response



# Results: selection response



# 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  $r_g(\text{index, new trait}) \neq 0$
  - 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](http://www.robustmilk.eu))
- Dutch Dairy Board
- GreenHouseMilk