

67<sup>th</sup> EAAP Annual Meeting

# Systematic genotyping of randomly sampled cows to improve reliability of GBVs of young candidates

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# Introduction

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- Increase reliability of GEBV in dairy cattle
  - Enlarge reference population
    - ✓ genotyped and phenotyped males -> exploited
    - ✓ genotype exchange -> limited
    - ✓ genotyping females -> huge potential?

# Introduction

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- Advantages of genotyping females
  - not heavily pre-selected (Schaeffer, 2014)
  - close relationship to recent population
  - especially valuable for new/expensive-to-measure traits

# Introduction

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## □ Aim of this study

- quantify impact of genotyping cows ( $R^2_{\text{dgv}}$ )
- intended strategy:
  - ✓ fixed number of first-crop daughters of each AI bull  
(Edel et al., 2015)

# Material & Methods

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- ❑ Simulation (QMSim)
- ❑ Reference breed: dual-purpose Fleckvieh cattle
- ❑ 10 overlapping generations
- ❑ Per generation:
  - parents: 1500 ♂ and 30000 ♀
  - progeny: 15000 ♂ and 15000 ♀
- ❑  $h^2 = 0.4$
- ❑ Integrate an increasing number of females into the reference set

# Material & Methods

## □ Composition of reference set

Generation	N		
	Base scenario	Extended: Step 1	Extended: Step 2
5	bulls	bulls	bulls
6	bulls	bulls	bulls
7	bulls	bulls	bulls+daughters
8	bulls	bulls+daughters	bulls+daughters

bulls phenotype: DYD based on ~200 daughters

# Material & Methods

## □ Composition of reference set and validation set

Generation	N		
	Base scenario	Extended: Step 1	Extended: Step 2
5	bulls	bulls	bulls
6	bulls	bulls	bulls
7	bulls	bulls	bulls+daughters
8	bulls	bulls+daughters	bulls+daughters



10	validation set
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# Material & Methods

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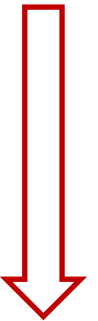
10a	Sire in reference
10b	Sire not in reference



# Material & Methods

## □ Description of the scenarios

Scenario	Reference set	
	Explanation	Total number of animals
<b>Base</b>	bulls (gen. 5+6+7+8)	4200
<b>--/25</b>	bulls + 25 daughters/sire (gen. 8)	30,450
<b>--/50</b>	bulls + 50 daughters/sire (gen. 8)	56,700
<b>--/100</b>	bulls + 100 daughters/sire (gen. 8)	109,200
<b>--/200</b>	bulls + 200 daughters/sire (gen. 8)	214,200

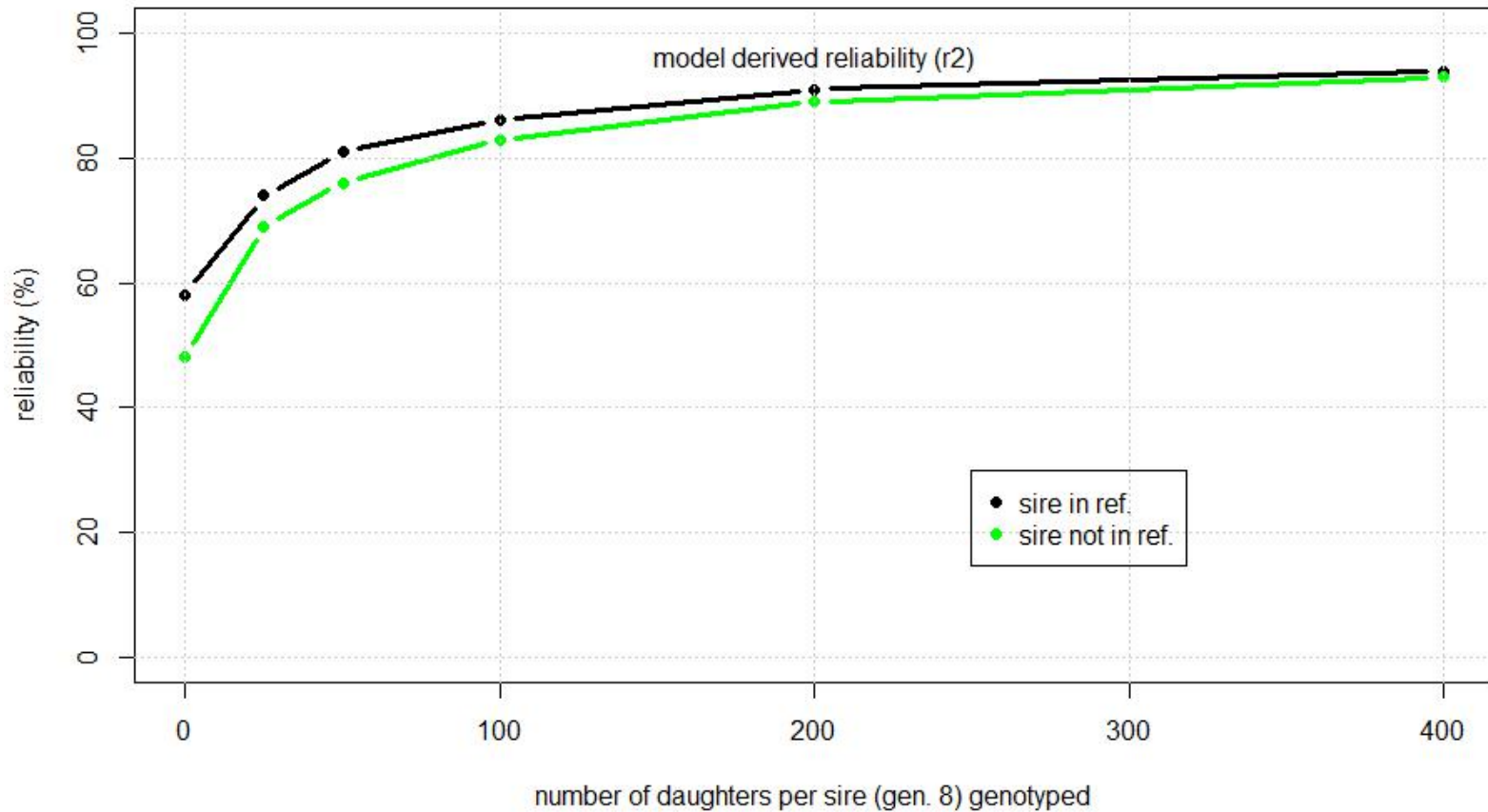


# Material & Methods

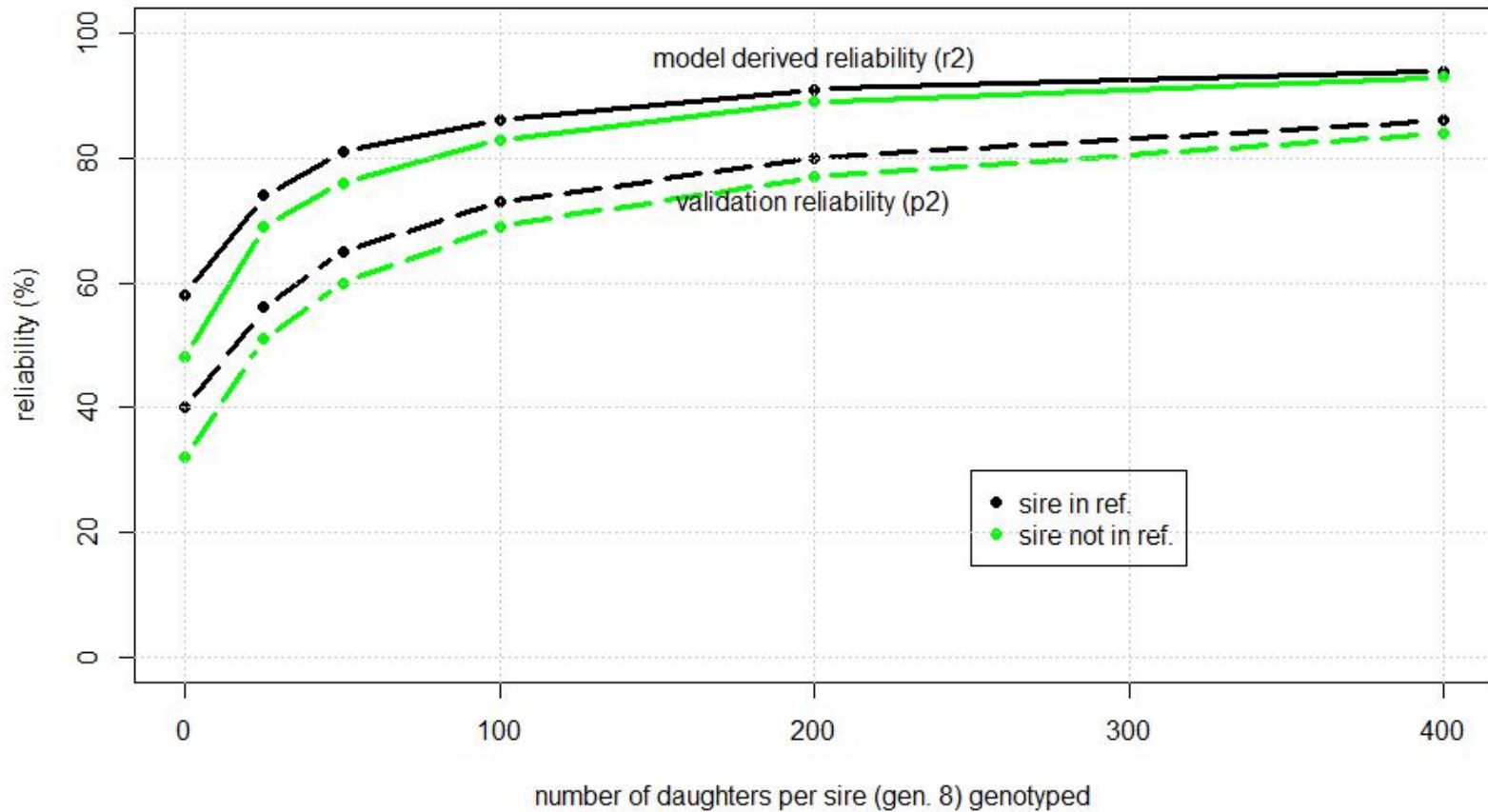
## □ Description of the scenarios

Scenario	Reference set	
	Explanation	Total number of animals
<b>Base</b>	bulls (gen. 5+6+7+8)	4200
<b>--/25</b>	bulls + 25 daughters/sire (gen. 8)	30,450
<b>--/50</b>	bulls + 50 daughters/sire (gen. 8)	56,700
<b>--/100</b>	bulls + 100 daughters/sire (gen. 8)	109,200
<b>--/200</b>	bulls + 200 daughters/sire (gen. 8)	214,200
<b>50/50</b>	bulls + 50 daughters/sire (gen. 7+8)	109,200
<b>100/100</b>	bulls + 100 daughters/sire (gen. 7+8)	214,200
<b>200/200</b>	bulls + 200 daughters/sire (gen. 7+8)	424,200

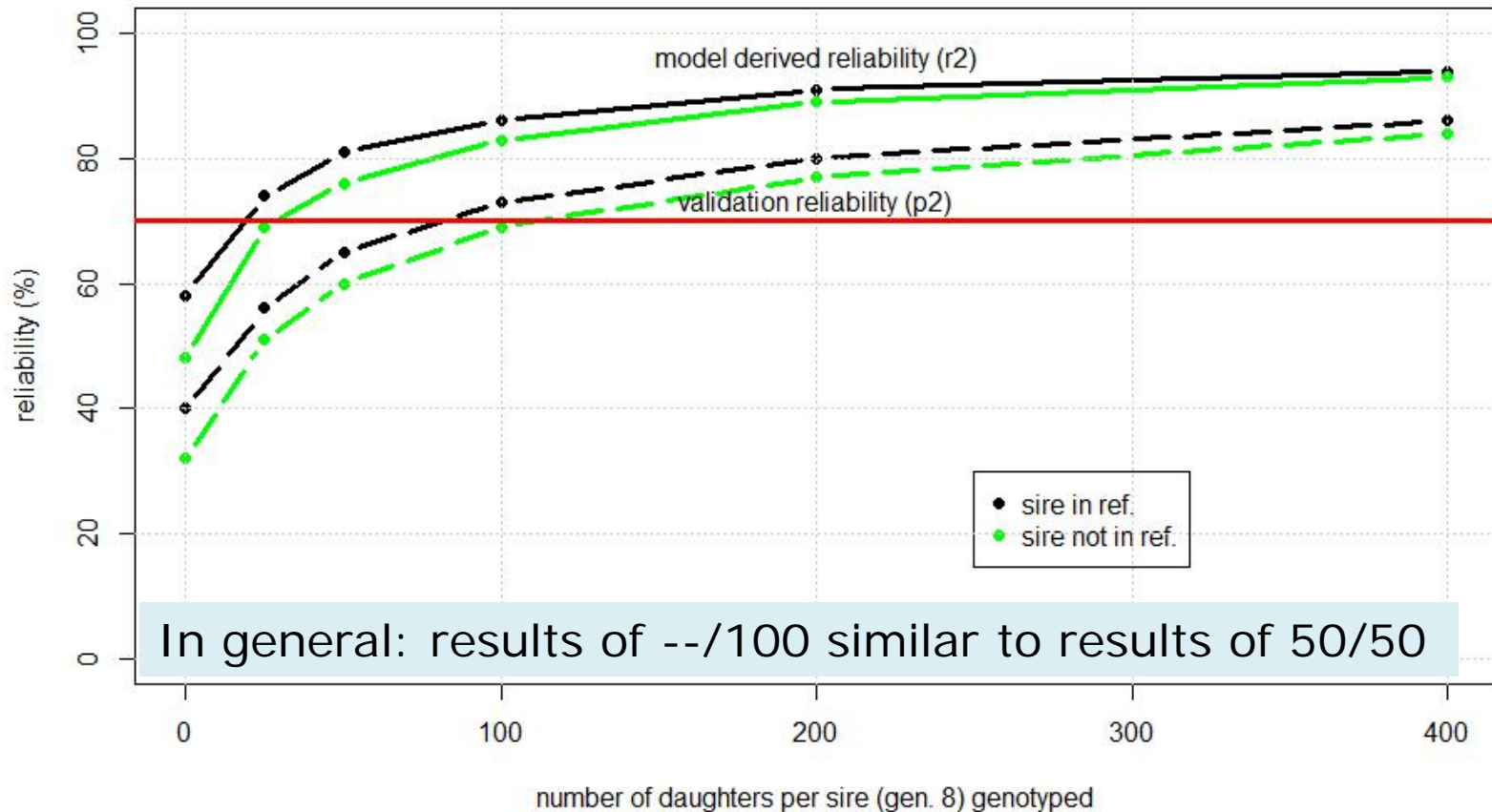
# Results & Discussion



# Results & Discussion



# Results & Discussion



# Material & Methods

Scenario	Reference set	
	Explanation	Total
Base	bulls (gen. 5+6+7+8)	4200
--/50	bulls + 50 daughters/sire (gen. 8)	56,700
--/50 <sub>s</sub>	bulls + 50 <b>selected</b> daughters/sire (gen. 8)	56,700
--/25 <sub>r</sub> 25 <sub>s</sub>	bulls + 25 <b>unsel.</b> and 25 <b>sel.</b> daughters/sire (gen. 8)	56,700
--/50 <sub>ub</sub>	bulls + <b>varying number</b> of daughters/sire (gen. 8)	56,700

# Results & Discussion

Validation	Sire status		--/50	--/50 <sub>s</sub>	--/25 <sub>r</sub> 25 <sub>s</sub>	--/50 <sub>ub</sub>
		$r^2$	$\rho^2$	$\rho^2$	$\rho^2$	$\rho^2$
10a	reference	81	65	42	48	65

# Results & Discussion

Validation	Sire status		--/50	--/50 <sub>s</sub>	--/25 <sub>r</sub> 25 <sub>s</sub>	--/50 <sub>ub</sub>
		r <sup>2</sup>	$\rho^2$	$\rho^2$	$\rho^2$	$\rho^2$
10a	reference	81	65	42	48	65

base scenario:  $\rho^2 = 40$



# Results & Discussion

Validation	Sire status		--/50	--/50 <sub>s</sub>	--/25 <sub>r</sub> 25 <sub>s</sub>	--/50 <sub>ub</sub>
		r <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>
10a	reference	81	65	42	48	65

scenario --/25: ρ<sup>2</sup> = 56

# Results & Discussion

Validation	Sire status		--/50	--/50 <sub>s</sub>	--/25 <sub>r</sub> 25 <sub>s</sub>	--/50 <sub>ub</sub>
		r <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>
10a	reference	81	65	42	48	65

# Results & Discussion

Validation	Sire status		--/50	--/50 <sub>s</sub>	--/25 <sub>r</sub> 25 <sub>s</sub>	--/50 <sub>ub</sub>
		r <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>	ρ <sup>2</sup>
10a	reference	81	65	42	48	65
10b	not ref.	76	60	37	44	60

- --/50s: benefit negligible, results inflated
- --/25r25s: benefit decreased, results deflated
- --/50ub: same reliability, results unbiased

# Conclusion & Summary

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- ❑ Extending the reference population by females **increases reliability** of genomic breeding values
- ❑ ~~Selected daughter sample~~
  - direct selection **decreases** benefits on validation reliability
  - leads to biased results
  - negative effects are hard to compensate for
- ❑ Moderate unbalancedness: no detectable consequences
- ❑ Generation of females not crucial (in short-term)
  - total number of genotypes are more important

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# Thank you for your attention

We gratefully acknowledge:

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