Stochastic simulation of alternative future blue fox breeding strategies

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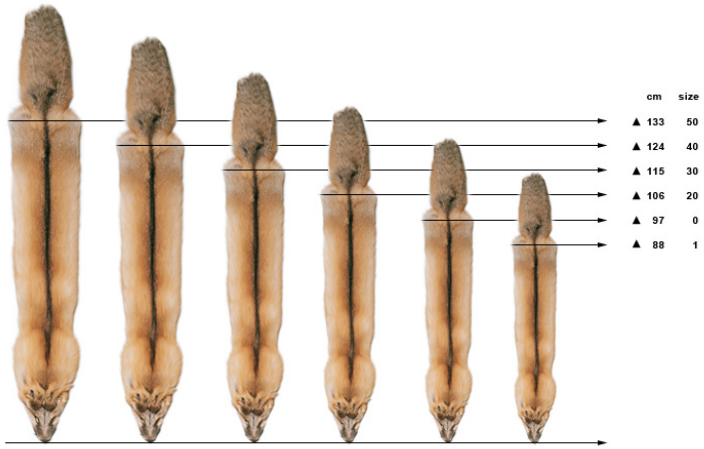
Introduction

Breeding goals in blue fox production:

Better fur quality:

Larger pelt:



Better fertility:

New traits?

Production efficiency:

- ✓ Feed efficiency

Welfare:

- ✓ Front leg conformation

Introduction

Production structure:

- ✓ More than 95 % AI
- ✓ All farms have their own:
  - Database
  - BV evaluation (BLUP)
  - Female selection
  - Male selection
  - Mating planning
  - Some exchange of breeding animals between farms

Introduction

Production structure:

- ✓ 2014 common national database and BV evaluation (BLUP)
- ✓ But still all farms have their own:
  - Female selection
  - Male selection
  - Mating planning

- ➢ Possibility to more accurate selection, especially males
- ➢ **Possibility to alternative selection strategies**

Goal of the study

What happens to genetic gain and rate of inbreeding, if:

- New traits are included to the selection criteria?
- Male selection and mating is done across farms instead of within farm?
- Genotype information from male pups is used?

Methods

Traits in selection objective (all selection scenarios):

- ✓ Animal size at grading, scale 1-5
- ✓ Pelt quality, scale 1-5
- ✓ Litter size at birth
- ✓ Front leg conformation, scale 1-5
- ✓ Feed efficiency g growth / kg DM feed

Trait in current selection criteria (Scenario I) [first three traits]

Trait in new selection criteria (Scenarios II-V) [all five traits]

Methods

Selection scenarios

		Traits in selection criteria	Genotyping	Accuracy of Gbv
Scenario I (Current)		3	no	-
Selection of males and matings within farm				
Scenario II		5	no	-
Scenario III	**a**	5	yes	0.30
	b	5	yes	0.50
	c	5	yes	0.80
Selection of males and matings across the farms				
Scenario IV		5	no	-
Scenario V	**a**	5	yes	0.30
	b	5	yes	0.50
	c	5	yes	0.80

Methods

Selection scenarios III a-c and V a-c:

- Best 50 % of male pups were genotyped before actual male selection stage
- Direct genomic breeding value without simulating markers, genes or chromosomes was applied using pseudo-genomic method (Buch *et al.* 2012)
- Accuracies of GBV’s were the same for all traits within each scenario

Methods

All scenarios had:

✓ 5 farms with equal herd size (1352 females, 140 males)

✓ Fixed age structure within farm and litter size:

Age (years)	Females		Males
	n (%)	Litter size	n (%)
1	600 (44)	7	92 (66)
2	352 (26)	9	34 (24)
3	200 (15)	9	14 (10)
4	128 (9)	9	-
5	72 (5)	8	-

Methods

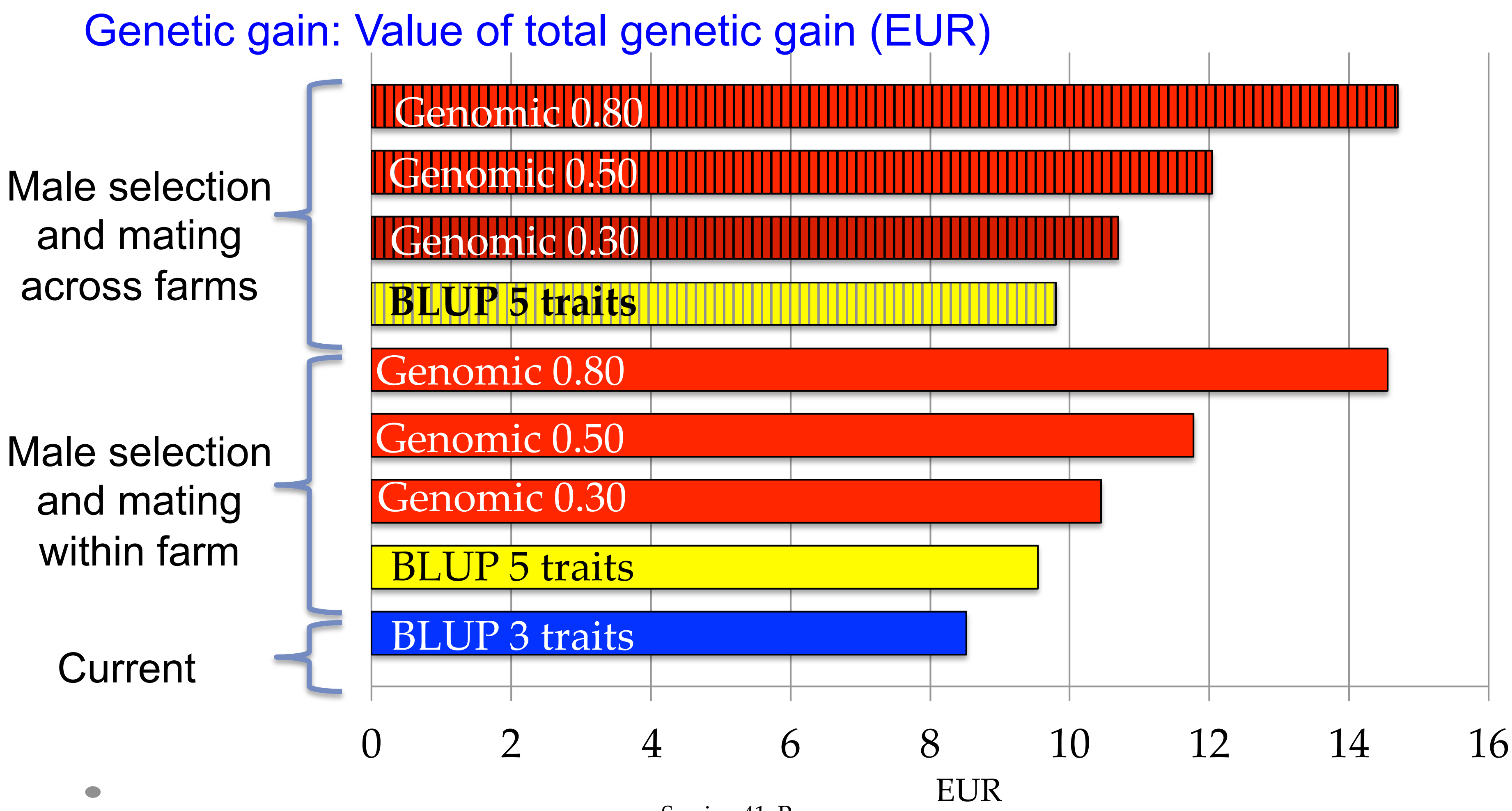
Heritabilities, economic values, and genetic correlations:

	EUR/unit	h^2	Pelt quality	Litter size	Front leg conf.	Feed efficiency
Animal size	8.43	0.32	0.17	-0.10	-0.51	-0.09
Pelt quality	26.08	0.28		-0.05	0.00	0.05
Litter size	14.91	0.12			0.00	0.00
Front leg conf.	0.00	0.22				-0.11
Feed efficiency	0.40	0.25				

Methods

- 10 years, 50 replicates
- Average genetic gain and rate of inbreeding were estimated between years 6 to 10
- Stochastic simulation by ADAM software (Pedersen *et al.* 2009) was used to estimate genetic gain and rate of inbreeding
- Breeding values were estimated multitrait animal model using DMU software (Madsen *et al.* 2006)

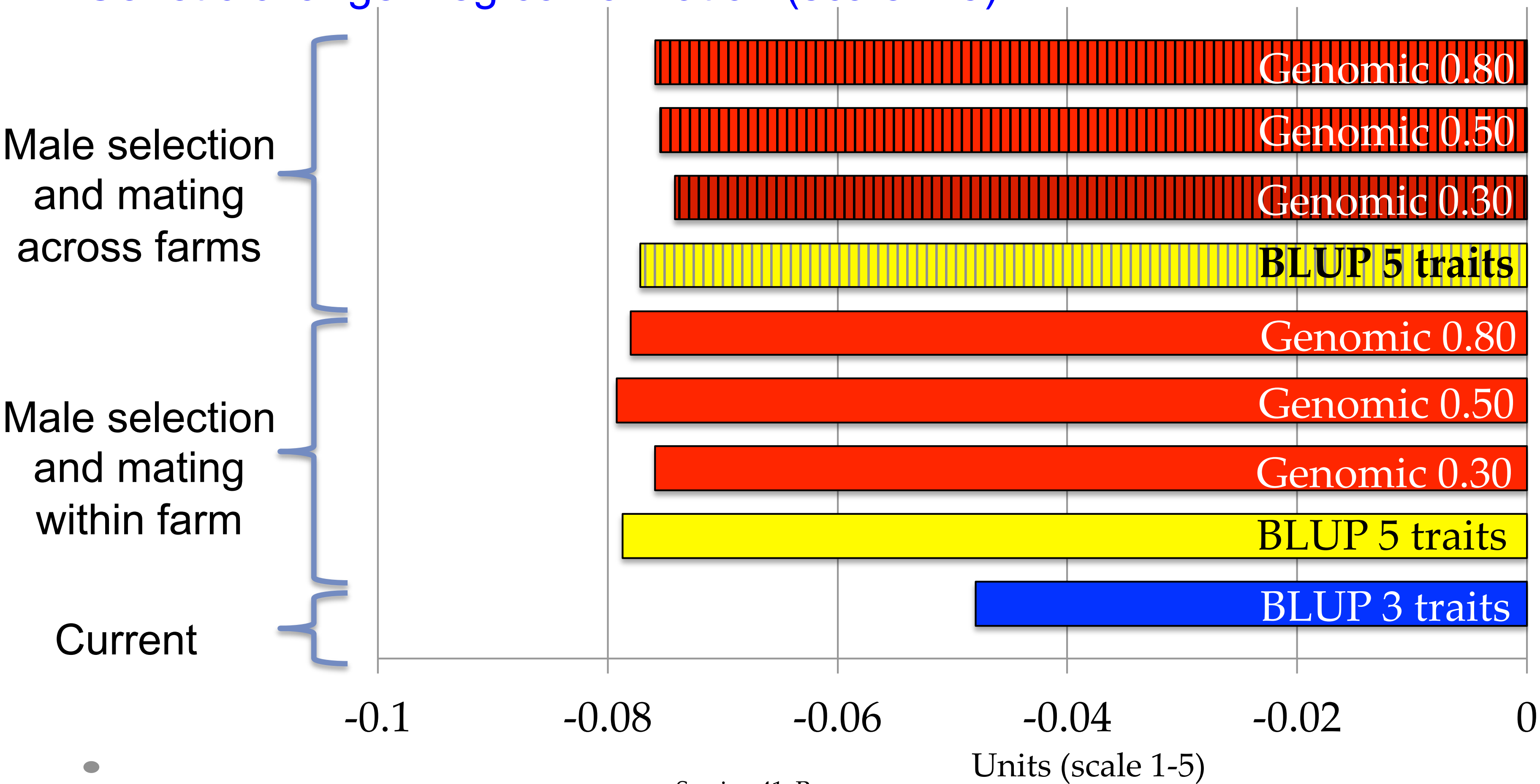
Results



Genetic gain: Value of total genetic gain (EUR)
Male selection and mating across farms
Male selection and mating within farm
Current
Genomic 0.80
Genomic 0.50
Genomic 0.30
BLUP 5 traits
Genomic 0.80
Genomic 0.50
Genomic 0.30
BLUP 5 traits
BLUP 3 traits
0
2
4
6
8
10
12
14
16
EUR

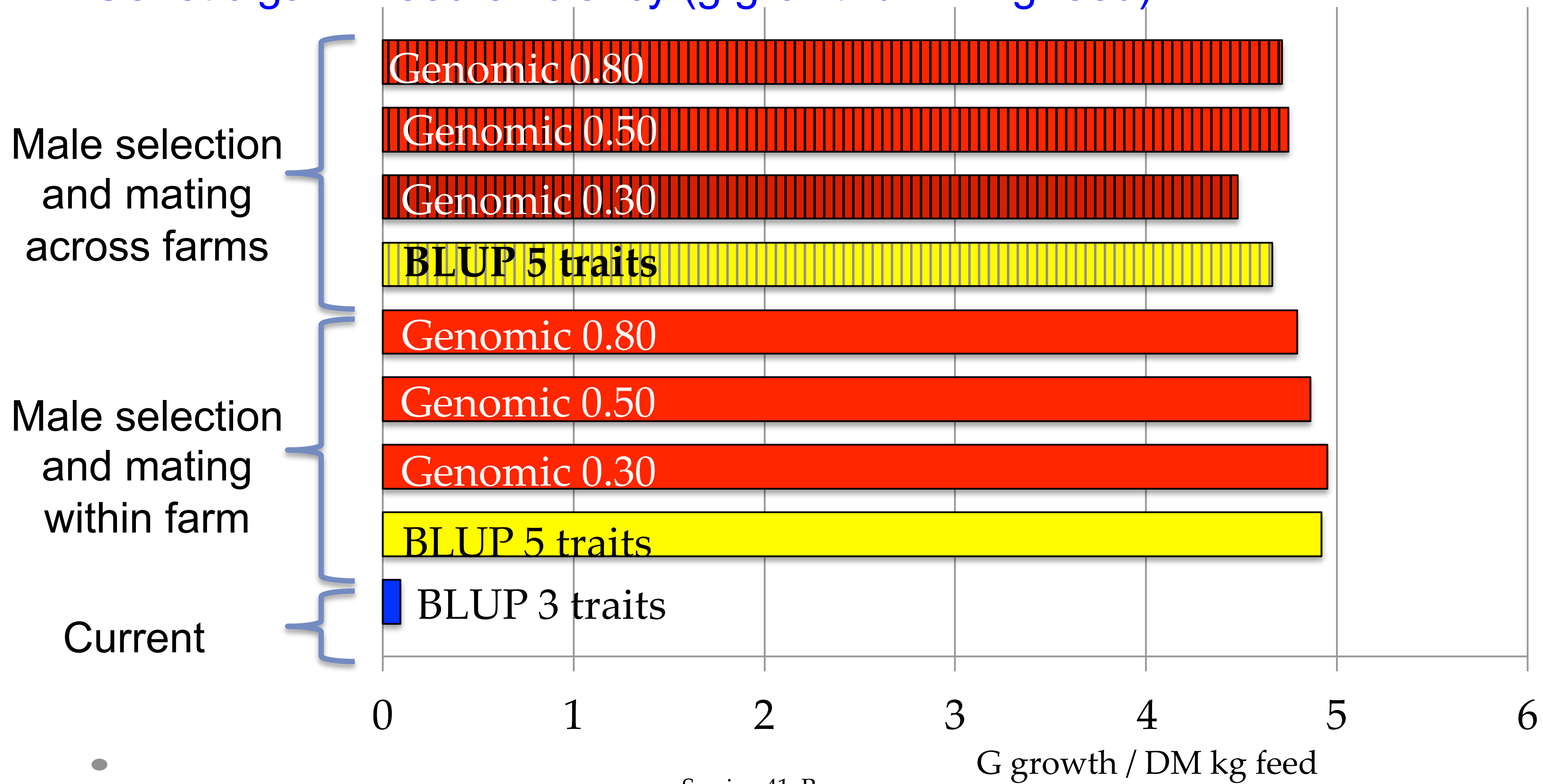
Results

Genetic change: Leg conformation (scale 1-5)

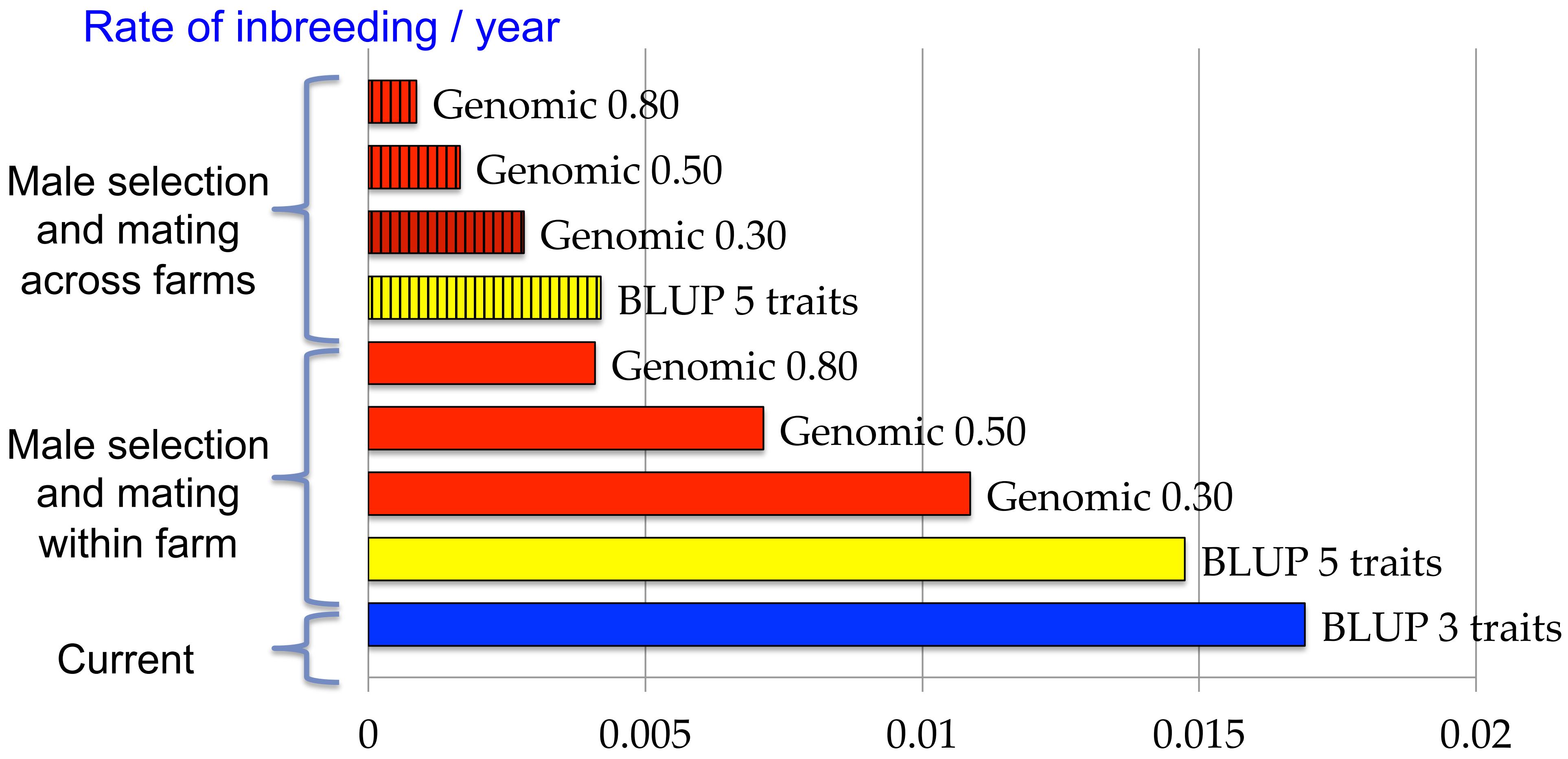


Results

Genetic gain: Feed efficiency (g growth / DM kg feed)



Results


Rate of inbreeding / year
Male selection and mating across farms
Genomic 0.80
Genomic 0.50
Genomic 0.30
BLUP 5 traits
Male selection and mating within farm
Genomic 0.80
Genomic 0.50
Genomic 0.30
BLUP 5 traits
Current
BLUP 3 traits
0
0.005
0.01
0.015
0.02

Conclusions

Genetic gain

- ✓ Scenarios with genotype information gives highest genetic gain (EUR)
  - ➢ Difference between within and across scenarios is small
- ✓ If feed efficiency is not included into the selection criteria, its gain is small
  - ➢ When included, differences between scenarios are small
- ✓ All scenarios lead decrease in front leg conformation
  - ➢ Inclusion of leg confomation into the selection criteria causes even bigger decrease (economic value = 0)

Conclusions

Rate of inbreeding

- ✓ The more information included, the lower is rate of inbreeding
- ✓ Across farm scenarios resulted lower rate of inbreeding than within farm scenarios

Conclusions

To be improved

- ✓ Missing genetic correlations unlikely 0
  - ➢ Genetic gain on litter size may be overestimated
  - ➢ Value of total genetic gain may be overestimated
- ✓ True economic value of leg conformation is not 0
  - ➢ Desired gain?
- ✓ Genotyping 50 % of male pups is a lot
  - ➢ Testing of lower percentages

Conclusions

The next question/research topics are:

- How much does the improvements (update of genetic correlations, economic values and % of genotyped male pups) affect to the results?
- **How much does it cost to built and run scenarios II-V?**
- **What is the profitability of each selection strategies?**

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ProFur

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