

Genomics in breeding for better health in horses

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Introduction:

Breeding for better health is complex

- Recording difficult
 - expensive, subjective, challenge, late in life
- Heritability low

Accurate breeding values => progeny testing:

- even later in life (generation interval)
- even more costly
- only available on stallions
- too few progeny → small studbooks!

Genomics for complex traits

Genomic information useful for complex traits breeding.

- Breeding values for all animals (incl. mares)
- At an early age
- Independent from phenotype

But: genomic information often not complete

Aim:

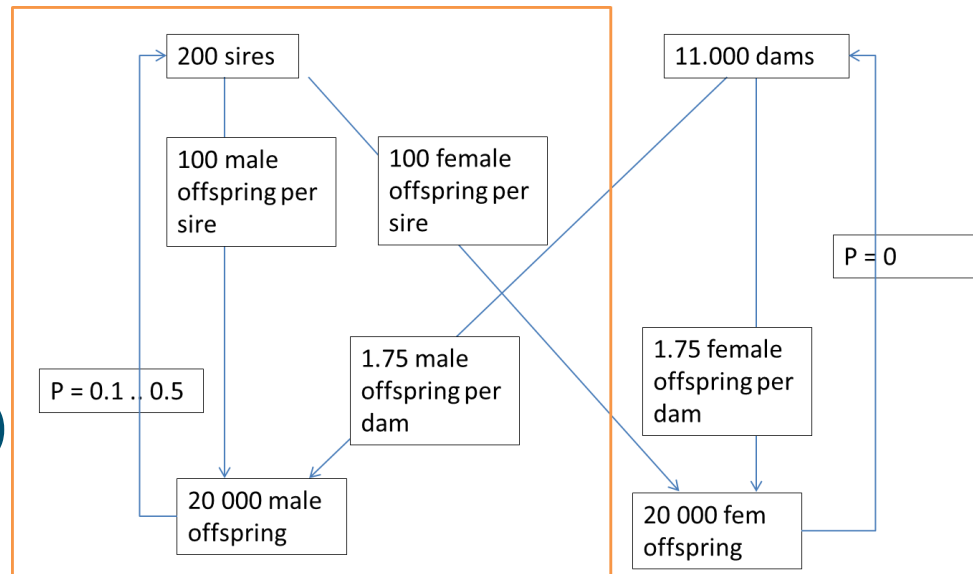
How can genomic information be used in breeding against complex traits?

- varying amount of genomic information?
- smaller studbooks?

Methods: simulation of breeding program

Base breeding program

- selection for disease
- $h^2 = 0.10 ; 0.25$
- selection: $p=0.1$
- progeny testing ($n=20$)
- no selection in mares



Smaller studbooks

- $p=0.2 , 0.5$
- progeny testing ($n=10$)

Methods: alternative scenarios

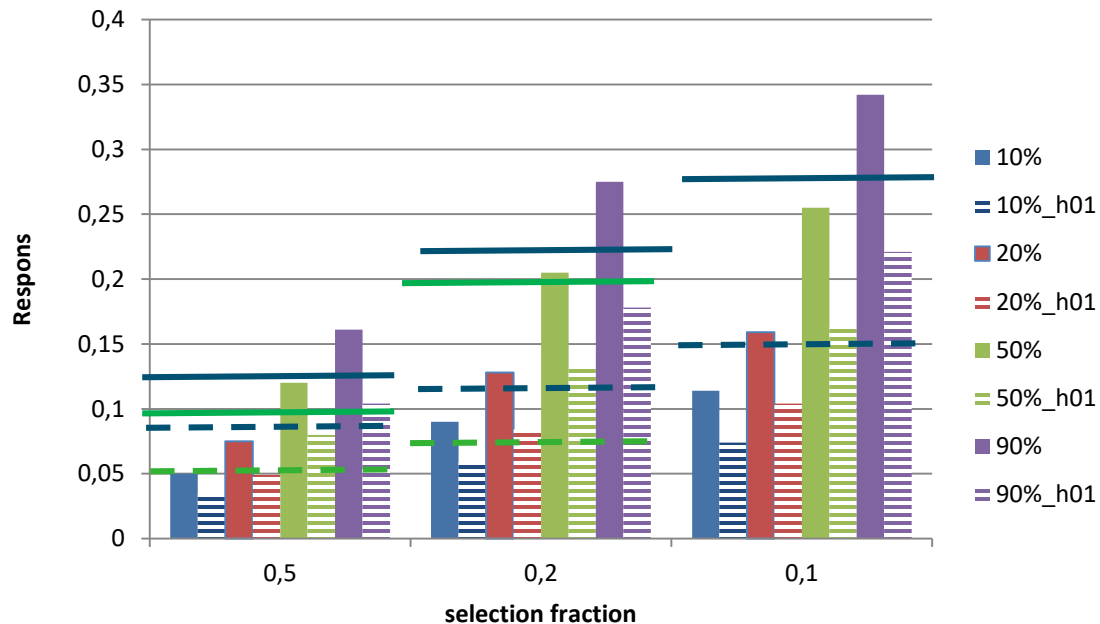
Alternatives

- QTL info available, explaining 10 – 90%
- additional selection in mares
- pre-selection using QTL (= two-stage selection)
 - stage1 selection on QTL
 - stage2 progeny testing

What is the response relative to the base-scenario?

Results: Response from QTL selection

effect of %var and selection fraction ($h^2=0.25$ and 0.10)

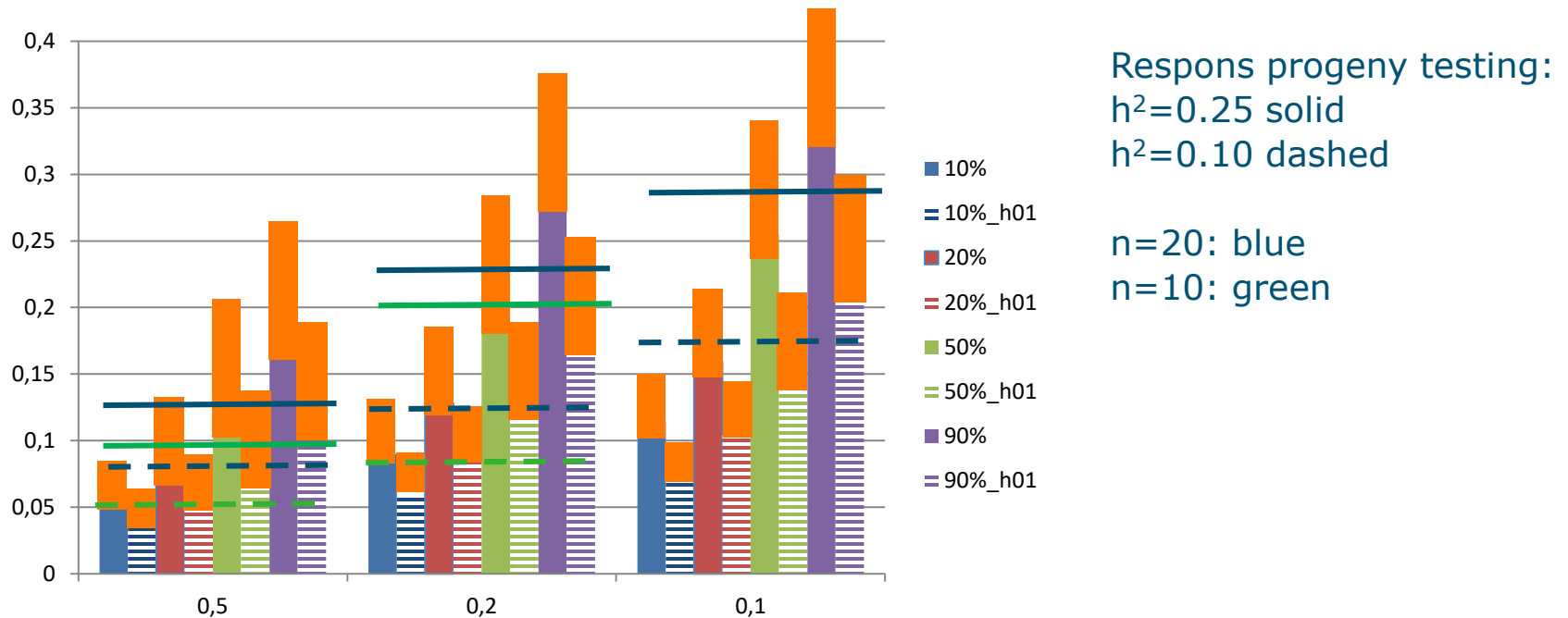


Response progeny testing:
 $h^2=0.25$ solid
 $h^2=0.10$ dashed

$n=20$: blue
 $n=10$: green

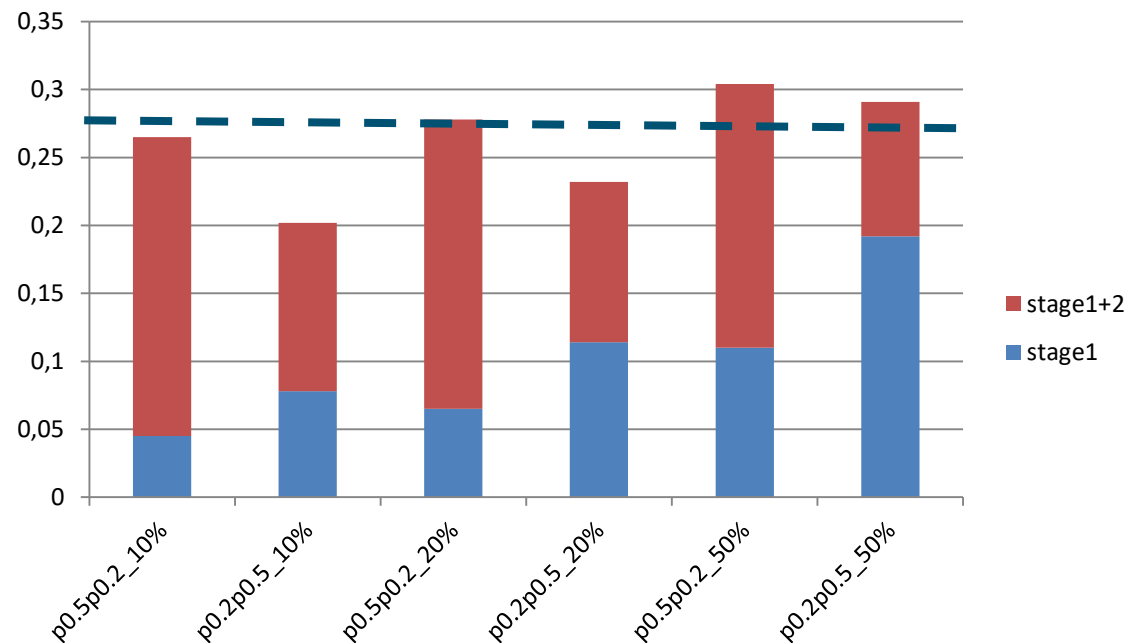
Results: Response from QTL selection

Inclusion of QTL selection in mares (p=0.5)



2-stage selection: ($h^2=0.25$, $n=20$)

Compared to progeny testing ($n=20$) ($p_{\text{total}} = 0.1$)



- comparable response at %var=20%
- half of progeny tested

Conclusion and discussion

Genomic information on a (complex) disease

when %var=50%

- ~ can replace progeny testing in males
- esp. when h^2 is low

Accounting for generation interval? → %var=20 sufficient

Allows for selection in mares:

- 25 - 30% extra response in base program
- progeny testing can sooner be replaced
- beyond control studbooks?

Conclusion and discussion

2stage breeding scheme:

- QTL selection in stage1; progeny testing in stage2
- Extra response achieved even at lower %var
- possibilities to reduce progeny tested
 - at %var=20% , half progeny tested required

Genomic information in disease can improve selection for better health

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