Comparison of models for genetic evaluation of Icelandic horses

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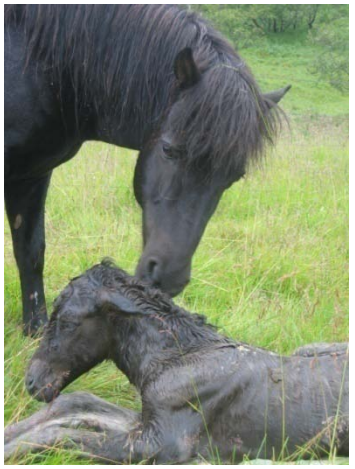
Estimation of breeding values

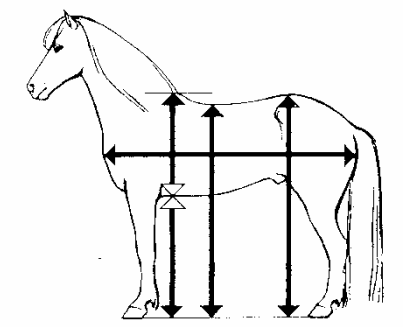


- BLUP method
  - Multiple-trait animal model
- Includes 17 traits
  - The 15 traits assessed at field tests
  - Total score
  - Height of withers

- One assessment *per* horse

Breeding field tests

- Stallions, geldings and mares
  - Separate age-classes
    - 4; 5; 6; >6 years old



- Assessment of 15 traits
  - 8 conformation traits
    - measurement and evaluation of various body parts
  - 7 riding ability traits
    - shown on a straight track
    - second ridden assessment

- Scores range 5.0-10.0
  - 0.5 intervals

Competition traits

- Moderately strong genetic correlation **(0.30-0.50)** with
  - Some conformation field test traits
    - Neck, withers and shoulders; back and hindquarters; proportions; hooves
- Strong genetic correlation **(>0.70)** with
  - Most riding ability field test traits

Pre-selection before testing

- Less than 15% of registered horses assessed
- Test-status defined: an all-or-none trait
  - **No** record ➡ Value of 0
  - **1 or more** records ➡ Value of 1
- Significantly heritable
- Strong genetic correlations with breeding field test traits
  - Pre-selection more in riding qualities

Objective

Study effect of integrating:

- Test status
- Competition data

on:

- Bias and precision of breeding values
- Predictive ability of observations

Data

- Breeding field test records 1990-2008
  - 19,954 individual records
  - 11 countries
- Competition results 1998-2008
  - 44,160 records on 7,687 horses
  - Iceland and Sweden
- Test status
  - Horses born in Iceland 1990-2005

Horses

- Pedigree covered 10 generations
  - 213,591 individuals

- 668 sires with 5 or more tested offspring

Different genetic evaluations

- Current
  - 15 breeding field test traits
- Current + test-status
  - 15 breeding field test traits
  - test status
- Current + competition
  - 15 breeding field test traits
  - 4 competition traits
- Current + test-status + competition
  - 15 breeding field test traits
  - 4 competition traits
  - test status

Comparison of genetic evaluations

- Data randomly split 50-50
  - Predict breeding values and estimate fixed effects in one half
- Bias in breeding values
  - Regression of breeding values from whole data on breeding values from first half
- Predictive ability
  - MSEP=$1/n \sum(y_i-\hat{y}_i)^2$
  - Use results from first half to predict phenotypes in second half

Comparison of genetic evaluations

- Accuracy
  - Standard errors of prediction of breeding values
- Correlations between breeding values
- Ranking of stallions

Bias in breeding values

- Estimated breeding values **largely unbiased**

	Breeding field test	Test status	Compe-tition
Current	1.010		
+ test-status	1.023	1.024	
+ competition	1.009		1.011
+ test-status & competition	1.024	1.027	1.042

Values close to one desirable

Predictive ability

- Very small differences
- Ranking of models
  1. Breeding field test + competition
  2. Breeding field test + test-status + competition
  3. Breeding field test
  4. Breeding field test + test-status

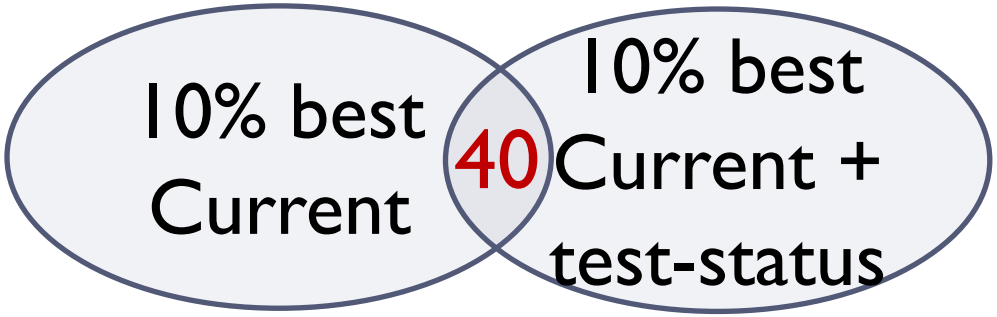
Reliability of breeding values

- Test-status gave larger improvement than competition

	Breeding field test	Test status	Compe-tition
Current	67.6		
+ test-status	68.4	75.8	
+ competition	67.8		63.9
+ test-status & competition	68.7	76.2	64.8

Sires with 5-19 offspring

Effect on stallion rankings



	Current	+ test-status	+ com-petition
+ test-status	40		
+ competition	30	29	
+ test-status & competition	38	43	38

Sires with 5-19 offspring

Conclusions

- Addition of new traits
  - Trivial differences between models
    - Method R and MSEP
  - More reliable breeding values
  - Difference in ranking of sires
- Immediate inclusion of competition traits
- Fine-tuning of definition of test status needed?