Consequences of selection for milk quality and robustness traits

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An increasing number of non-productive traits are included in dairy breeding objectives
- e.g., conformation, SCS, fertility, longevity
- also new traits? e.g., animal welfare, products quality, environmental impacts of dairy production

Towards a better overall economic efficiency

But consequences of selection for these new traits should be investigated ...
Objective

Estimate consequences of selection for new robustness and milk quality traits on genetic gain in other economically important traits

- New traits
  - For robustness: Body Condition Score
  - For milk quality: dUNSAT and dMONO → Indices that represent the relative part of milk fat that is unsaturated and mono-unsaturated

- Two steps:
  1. Estimate genetic correlations among traits
  2. Which breeding scenarios to be tested?
Part of ROBUSTMILK project

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

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Genetic correlations

- Approximated as correlations among EBVs of Holstein bulls with rel ≥ 0.85 from the August 2011 official routine run for the Walloon Region

- For traits available in Wallonia:

<table>
<thead>
<tr>
<th>Production</th>
<th>Milk, fat and protein yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
<td>Longevity = survival over successive lactations</td>
</tr>
<tr>
<td></td>
<td>Udder health = SCS, low values desirable</td>
</tr>
<tr>
<td></td>
<td>Fertility = pregnancy rate</td>
</tr>
<tr>
<td>Conformation</td>
<td>Overall udder score and overall feet and legs score</td>
</tr>
<tr>
<td>New traits</td>
<td>Robustness → Body Condition Score</td>
</tr>
<tr>
<td></td>
<td>Milk quality - fatty acids → dUNSAT and dMONO, two indices that represent the relative part of milk fat that is unsaturated and monounsaturated, high values are desirable</td>
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</tbody>
</table>
Breeding scenarios

- 6 scenarios including traits available in Wallonia
- Reference point = “current selection scenario” (scenario 2)
Expected relative genetic gain (%) under each breeding scenario

<table>
<thead>
<tr>
<th></th>
<th>Milk</th>
<th>Fat</th>
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Scenario 1: High improvements in milk, fat and protein yields but negative impacts on fertility, udder health, and overall udder score

“balanced” indices required
1. Production only
   - Production: 100

2. Current selection
   - Production: 45
   - Longevity: 20
   - Udder health: 5
   - Fertility: 15
   - Conformation: 15

3. Selection pressure on fertility and udder health
   - Production: 33.75
   - Longevity: 20
   - Udder health: 15
   - Fertility: 20
   - Conformation: 11.25

4. Inclusion of BCS
   - Production: 40.5
   - Longevity: 18
   - Udder health: 4.5
   - Fertility: 13.5
   - Conformation: 13.5
   - BCS: 10

5. Inclusion of milk quality
   - Production: 40.5
   - Longevity: 18
   - Udder health: 4.5
   - Fertility: 13.5
   - Conformation: 13.5
   - BCS: 10

6. Selection pressure on functionality and new traits
   - Production: 18.75
   - Longevity: 20
   - Udder health: 15
   - Fertility: 20
   - Conformation: 6.25
   - BCS: 10
   - BCS: 10

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**“Balanced” indices**

- lower improvements in yields but favourable genetic gain in most of the other traits
- 20% emphasis on fertility $\rightarrow$ genetic gain of $+9\%$
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Inclusion of BCS Only</th>
<th>Other Traits Not Significantly Affected</th>
<th>Improvement of Fertility (+17%)</th>
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• Changes in the balance between production and other traits did not affect dUNSAT and dMONO
• 5% of emphasis on dUNSAT and dMONO provides genetic gain
Conclusion

- Current breeding goals with balanced emphasis on both production and non-production traits
  - favorable genetic gain in yields but also in most of the other traits
  - new traits are not strongly affected

- Inclusion of new traits?
  - BCS and milk quality traits (dUNSAT and dMONO)
  - other traits slightly affected
  - economic weights require further research
Conclusion

- Limitations of the study:
  - approximation of genetic correlations
  - results assumed equal reliabilities but accuracy will differ due to heritability and different recording

- Further studies:
  - more reliable genetic correlation estimates
  - inclusion of other new traits (e.g., udder health, energy balance indicators)
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