Youngstock survival in Nordic Cattle Genetic Evaluation

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Outline

• Nordic Total Merit and survival traits
• Youngstock survival:
  • Data, trait definition and phenotypic averages
  • Genetic parameters and evaluation model
  • Composition of sub-index and publication
  • Economic value and effect in NTM
Nordic Total Merit

- Joint Nordic breeding goal
  - RDC, Holstein, Jersey
  - Denmark, Finland, Sweden

- Survival traits in NTM
  - Economically important
  - Cover the whole life-time of animals

Included sub-indices
- Yield
- Growth
- Fertility
- Birth
- Calving
- Udder health
- Other diseases
- Claw health
- Frame
- Feet & legs
- Udder
- Milkability
- Temperament
- Longevity
- Youngstock survival
Importance of YSS in NTM

- Losing young animals implies economic loss
  - No replacement heifer or reduced beef sales
  - Extra work and possibly health costs
- Animal welfare and consumer concerns
- Selection for more liveborn calves and longlasting cows not enough to improve survival during rearing period
Nordic data and trait definition

- Data: all transfers/deaths of animals registered in central data bases
  - Included: purebred calves born alive from 1998
  - Excluded: animals slaughtered or exported within defined periods
- 4 single traits depending on sex of calf and rearing period
- Phenotypic averages for survival rate vary with population
  - Average survival for HOL and RDC heifers > 93%
  - Rather constant over years

<table>
<thead>
<tr>
<th>Single traits</th>
<th>Rearing period</th>
<th>HOL</th>
<th>RDC</th>
<th>JER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifer period 1 (HP1)</td>
<td>Day 2 up to 1 month</td>
<td>97.5</td>
<td>97.4</td>
<td>92.6</td>
</tr>
<tr>
<td>Heifer period 2 (HP2)</td>
<td>1 up to 15 months</td>
<td>96.3</td>
<td>95.4</td>
<td>93.4</td>
</tr>
<tr>
<td>Bull period 1 (BP1)</td>
<td>Day 2 up to 1 month</td>
<td>96.0</td>
<td>96.1</td>
<td>-</td>
</tr>
<tr>
<td>Bull period 2 (BP2)</td>
<td>1 up to 6 months</td>
<td>96.0</td>
<td>94.4</td>
<td>-</td>
</tr>
</tbody>
</table>
Genetic parameters

- Heritabilities on observed scale
  - Low (few %) ≈ stillbirth and health traits

- Genetic correlations
  - Fairly high w/n period and b/n sexes
  - Lower b/n periods and w/n sex

<table>
<thead>
<tr>
<th></th>
<th>HOL</th>
<th>RDC</th>
<th>JER</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP1</td>
<td>0.8</td>
<td>0.7</td>
<td>1.8</td>
</tr>
<tr>
<td>BP1</td>
<td>0.6</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>HP2</td>
<td>1.0</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>BP2</td>
<td>2.4</td>
<td>3.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>BP1</th>
<th>HP2</th>
<th>BP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP1</td>
<td>0.9-0.95</td>
<td>0.4-0.75</td>
<td>0.3-0.6</td>
</tr>
<tr>
<td>BP1</td>
<td>0.4-0.8</td>
<td>0.4-0.6</td>
<td></td>
</tr>
<tr>
<td>HP2</td>
<td></td>
<td></td>
<td>0.9-0.99</td>
</tr>
<tr>
<td>BP2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Genetic evaluation model

Multiple-trait animal linear model

Fixed effects
- Herd x 5-year birth period
- Country x year x birth month
- Country x transfer to a new herd (0/1) x month of transfer
  - only included for early transfer in HP2 and BP2
- Heterozygosity

Random effects
- Phantom parent groups
  - defined by birth year and original breed group
- Herd x year of birth
- Genetic effect of animal
Composition of sub-index and publication

- YSS EBV published since Nov. 2014
  - Sub-index created by weighing together four single traits
- YSS GEBV published since Feb 2016
- YSS included with economic weight in NTM May 2016
- Economic values for YSS
  - Required additional biological and economical assumptions
**ECONOMIC VALUES FOR YSS**

**ECONOMIC MODEL with YSS**

**ECONOMICAL ASSUMPTIONS** = ADDITIONAL COSTS YSS:
- Destruction
- Extra cost to prevent death
- Extra work

**BIOLOGICAL ASSUMPTIONS:**
- Mortality rates
- Average age of death

**NORMAL COSTS:**
- Feed
- Housing
- Labour

**ANIMAL VALUE:**
- Slaughter price
- Heifer
  - RDC/HOL €1200
  - JER €700
### Economic values single traits

- **Value (€) of improving survival by 1% unit per cow and year**
  (Multiply by 100 ≈ value of one calf)

<table>
<thead>
<tr>
<th>Single traits</th>
<th>Value (€) Across countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifer period 1 (HP1)</td>
<td>HOL 3.45, RDC 3.55, JER 2.00</td>
</tr>
<tr>
<td>Heifer period 2 (HP2)</td>
<td>HOL 4.05, RDC 4.15, JER 2.41</td>
</tr>
<tr>
<td>Bull period 1 (BP1)</td>
<td>HOL 1.29, RDC 1.43, JER 0.27</td>
</tr>
<tr>
<td>Bull period 2 (BP2)</td>
<td>HOL 1.79, RDC 2.02, JER 0.79</td>
</tr>
</tbody>
</table>

- Within breed: **highest value for HP2** (≈ €405 for HOL)
- **...and lowest value for BP1** (≈ €129 for HOL)
Economic value of an index unit

Value (€) 1 index unit YSS
= economic wt in NTM
RDC: 2.03 / HOL: 1.40 / JER: 0.92 €

<table>
<thead>
<tr>
<th>Sub-index</th>
<th>HOL</th>
<th>RDC</th>
<th>JER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>7.61</td>
<td>8.33</td>
<td>6.80</td>
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<tr>
<td>Growth</td>
<td>0.61</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fertility</td>
<td>3.15</td>
<td>2.26</td>
<td>1.56</td>
</tr>
<tr>
<td>Birth</td>
<td>1.52</td>
<td>1.21</td>
<td>0.47</td>
</tr>
<tr>
<td>Calving</td>
<td>1.72</td>
<td>1.04</td>
<td>0.47</td>
</tr>
<tr>
<td>Udder health</td>
<td>3.55</td>
<td>2.78</td>
<td>3.44</td>
</tr>
<tr>
<td>Other diseases</td>
<td>1.12</td>
<td>1.04</td>
<td>0.31</td>
</tr>
<tr>
<td>Feet &amp; legs</td>
<td>1.22</td>
<td>0.78</td>
<td>0.31</td>
</tr>
<tr>
<td>Udder</td>
<td>2.54</td>
<td>2.78</td>
<td>2.03</td>
</tr>
<tr>
<td>Milkability</td>
<td>0.81</td>
<td>0.87</td>
<td>0.78</td>
</tr>
<tr>
<td>Temperament</td>
<td>0.30</td>
<td>0.26</td>
<td>0.23</td>
</tr>
<tr>
<td>Longevity</td>
<td>1.12</td>
<td>0.61</td>
<td>0.63</td>
</tr>
<tr>
<td>Claw health</td>
<td>0.81</td>
<td>0.43</td>
<td>0.39</td>
</tr>
<tr>
<td>Youngstock survival</td>
<td>1.40</td>
<td>2.03</td>
<td>0.92</td>
</tr>
</tbody>
</table>
Effect of including YSS in NTM

Sire EBV correlations: YSS vs. old NTM (w/o YSS incl.)

- Low correlations between YSS and other NTM traits
  - Favourable to NTM and functional traits, unfavourable to Frame

Sire EBV correlations: NTM (old or new) and sub-indices

- Largest impact on RDC, smaller on other breeds
  - Correlation new NTM – old NTM: RDC 0.97, JER and HOL 0.99
  - Minor changes most sub-indices, except ↑ progress YSS all breeds
Conclusions youngstock survival

- Small re-ranking of bulls based on NTM
  - However, some effects on progress in other traits
- Improves the economical and ethical value of NTM
  - Increased standard deviation NTM (a few %)
    → greater economic difference between selected bulls and average NTM level
- Gain of adding YSS is larger than other earlier improvements
  - Because of low correlations to other NTM traits

With Youngstock survival in NTM, we have a more economically optimal breeding goal