2018 Review of Nordic Total Merit Index

Introduction to the NTM-model

Assumptions on biological, economic and production circumstances

Basic results

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Nordic Total Merit Index

Nordic Total Merit Index = Index weight_{Yield} \times (Yield index-100)
+ Index weight_{Fert.} \times (Fertility index-100)
+ Index weight_{Udderhealth} \times (Udder health index-100)
+ and so on: 15 main indexes

Behind the 15 main indices there are: 90 single traits

Calculation of economic values are based on the value of each of the single traits
Definition of economic value

- The value of improving the trait with one unit – keeping the remaining traits constant

- Future production circumstances – for dairy cattle 10 years into the future:
  - Economy and production systems should be as expected in 2028
  - BUT especially economy is difficult/impossible to predict – mostly based on current circumstances

Economic values for single traits

Annual account for a herd (in an Excel sheet)
- Income from production: Milk and beef
- All variable costs included

- The bottom line:
  - Annual profit for the herd
  - Annual profit per average cow (annualized cow)
Economic values for single traits
Example: Protein yield

- **Base situation: Profit per cow**
- **Protein breeding value increased by 1 kg for all 1st lactation cows: Profit per cow**
  - *Protein yield in later lactations constant*
  - *Milk and fat constant*
  - *All other traits unchanged*

- **Difference in profit per cow**
  - = value of increasing protein breeding value by 1 kg in 1st lactation

Economic scenarios

**Workshop 2017:**
Increased production in organic herds should be considered
Current share of milk from organic NAV herds: ~15 %

- Separate calculation of economic values in a Conventional and Organic scenario
- Separate economic scenarios per country (DNK, SWE, FIN)
### Scenarios DNK SWE FIN

*Biological parameters: Production levels per breed and country*

**DNK:** RDM, DH, Jersey  
**SWE:** SRB, SLB  
**FIN:** FAY, HOL

*Parameters that differ per breed and country (in “2018 Review of Nordic Total Merit Index – Appendix; Biological and economic assumptions”)*

- Weights, Calving age, Yield, Fertility, Stillbirth rate
- Calving difficulty, Frequency of diseases, Claw health, Young stock survival

### Changes since 2008

**New traits**

- Claw health introduced 2011
- Young Stock Survival introduced 2016

- In General health 2017: Ketosis and other metabolic become separate traits
Changes since 2008: Economic assumptions

Much more detailed than in 2008

- Milk price more fluctuating than before
- Beef prices higher – very high in SWE (But, costs of producing surplus heifers have increased, due to higher feed costs)
- Generally increased costs (e.g. Wages, AI)
- Veterinary costs
  - Much higher costs
  - Health agreement schemes reduce costs for some diseases (especially mastitis) – common in DNK, similar programs tested in SWE and FIN. For 2028 it is assumed that health agreement schemes are common in all countries
- Organic: No health agreement schemes

Changes since 2008

Biological assumptions – production levels

- In many cases of no/low importance (e.g. yield)
- Calving ease: Lower freq. of difficult calvings: It will reduce economic value of calving ease
- Replacement rate: Lower replacement rate More surplus heifers
### Calving ease (4 categories):
Pct. difficult with vet. ass. (high cost - category)

<table>
<thead>
<tr>
<th>Year</th>
<th>RDC (HOL is similar)</th>
<th>DNK</th>
<th>SWE</th>
<th>FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008, 1st</td>
<td></td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>2018, 1st</td>
<td></td>
<td>0.4</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Difference, 1st</td>
<td></td>
<td>-1.1</td>
<td>-0.9</td>
<td>-0.9</td>
</tr>
<tr>
<td>2008, later</td>
<td></td>
<td>1.0</td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td>2018, later</td>
<td></td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Difference, later</td>
<td></td>
<td>-0.6</td>
<td>0.0</td>
<td>-0.4</td>
</tr>
</tbody>
</table>

### Replacement rate, pct.

<table>
<thead>
<tr>
<th>Year</th>
<th>HOL (JER similar – RDC smaller difference)</th>
<th>DNK</th>
<th>SWE</th>
<th>FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td></td>
<td>42.4</td>
<td>41.6</td>
<td>39.4</td>
</tr>
<tr>
<td>2018 conventional</td>
<td></td>
<td>37.1</td>
<td>35.9</td>
<td>32.5</td>
</tr>
<tr>
<td>2018 organic</td>
<td></td>
<td>34.5</td>
<td>32.6</td>
<td>30.1</td>
</tr>
<tr>
<td>Dif. conventional</td>
<td></td>
<td>-5.3</td>
<td>-5.7</td>
<td>-6.9</td>
</tr>
<tr>
<td>Dif. organic</td>
<td></td>
<td>-7.9</td>
<td>-9.0</td>
<td>-9.3</td>
</tr>
<tr>
<td>2028 assumed</td>
<td></td>
<td>32.0</td>
<td>32.0</td>
<td>32.0</td>
</tr>
</tbody>
</table>
Changes since 2008
Structural changes due to use of sexed semen

Use of sexed semen for 1st AI (data from 2016)

<table>
<thead>
<tr>
<th></th>
<th>RDC</th>
<th>HOL</th>
<th>JER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DNK</td>
<td>SWE</td>
<td>FIN</td>
</tr>
<tr>
<td>Heifers</td>
<td>30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Cows</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Workshop 2017:
Increased use of sexed semen should be considered

Replacement rate, sexed semen and beef semen

2017 situation
- Replacement rate much lower than in 2008
- Sexed semen used mostly for heifers (most in DNK)

- Consequence: Large surplus of replacement heifers
- Beef semen is used for cows in order to reduce number of surplus heifers
**Future:**
Replacement rate and sexed semen

Replacement rate: 32% all breeds and countries

Use of sexed semen in the NTM-model - Sexed semen only used at 1st AI – otherwise conventional semen

- 52% of calves born at 1st calving are by sexed semen
  Rest (48%) at 1st calving by conventional semen (pure breed)

- 3-4% of calves born by older cows are by sexed semen
  Rest (96-97%) at later calvings are by conventional – pure breed or beef breed

**Future: Beef semen**

Replacement heifers (incl. those disposed before 1st calving):

- Around 65% at 1st calving (45% by sexed semen – 20% conv. semen)
- Rest at later calvings (35% of replacement heifers – 30% of older cows)

For the remaining older cows

- Beef semen (around 70% available)
- In the new NTM-model there are no surplus heifers

Heifer-crosses treated as slaughter animals

*Genetic improvement will only affect crosses by 50% compared to purebred (growth, form, young stock survival, direct calving traits(birth index))
Basic results for single traits
Average of DNK, SWE and FIN

Table 2.2 – 2.8 in “Review of Nordic Total Merit Index – Results”

Results presented
- Original 2008-results
- “Classic”: No sexed semen – no beef semen – otherwise as new model (large number of surplus heifers)
- Conventional: With sexed semen and balancing beef crosses
- Organic: As conventional – but separate economic parameters and production level

Yield, Diseases, Claw health, Conformation
- Values are independent of use of sexed semen and beef semen (similar in “classic” and conventional)

Beef production, Fertility, Calving traits, Young Stock Survival, Longevity
- Values depend of use of sexed semen and beef semen
- Number of animals expressing the traits
### Basic numbers - SWE HOL, 110 cows

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>Classic</th>
<th>Conv.</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of calvings/year</td>
<td>115.16</td>
<td>111.74</td>
<td>111.74</td>
<td>111.74</td>
</tr>
<tr>
<td>Replacement rate</td>
<td>41.6%</td>
<td>32.0%</td>
<td>32.0%</td>
<td>32.0%</td>
</tr>
<tr>
<td>Distribution 1st calvings</td>
<td>39.7%</td>
<td>31.5%</td>
<td>31.5%</td>
<td>31.5%</td>
</tr>
<tr>
<td>Distribution 2nd calvings</td>
<td>27.4%</td>
<td>25.5%</td>
<td>25.5%</td>
<td>25.5%</td>
</tr>
<tr>
<td>Distribution 3rd calvings</td>
<td>32.9%</td>
<td>43.0%</td>
<td>43.0%</td>
<td>43.0%</td>
</tr>
<tr>
<td>Heifer calves born</td>
<td>57.6</td>
<td>55.9</td>
<td>40.4</td>
<td>40.4</td>
</tr>
<tr>
<td>Bull calves born</td>
<td>57.6</td>
<td>55.9</td>
<td>19.6</td>
<td>19.5</td>
</tr>
<tr>
<td>Heifer Beef crosses</td>
<td>0.0</td>
<td>0.0</td>
<td>25.9</td>
<td>25.9</td>
</tr>
<tr>
<td>Bull beef crosses</td>
<td>0.0</td>
<td>0.0</td>
<td>25.9</td>
<td>25.9</td>
</tr>
<tr>
<td>Heifers needed for replacement</td>
<td>45.7</td>
<td>35.2</td>
<td>35.2</td>
<td>35.2</td>
</tr>
<tr>
<td>Preg. sold (Surplus heifers)</td>
<td>4.3</td>
<td>14.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Results: Production traits

<table>
<thead>
<tr>
<th></th>
<th>Original</th>
<th>Classic</th>
<th>Conventional</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of kg standard milk, €/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOL</td>
<td>0.181</td>
<td>0.191</td>
<td>0.191</td>
<td>0.143</td>
</tr>
<tr>
<td>RDC</td>
<td>0.190</td>
<td>0.189</td>
<td>0.189</td>
<td>0.141</td>
</tr>
<tr>
<td>JER</td>
<td>0.160</td>
<td>0.191</td>
<td>0.191</td>
<td>0.145</td>
</tr>
<tr>
<td>Value of net. Daily gain €/(g/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOL</td>
<td>0.171</td>
<td>0.219</td>
<td>0.213</td>
<td>0.077</td>
</tr>
<tr>
<td>RDC</td>
<td>0.187</td>
<td>0.251</td>
<td>0.230</td>
<td>0.092</td>
</tr>
<tr>
<td>JER</td>
<td>0.019</td>
<td>0.216</td>
<td>0.192</td>
<td>0.007</td>
</tr>
<tr>
<td>Value of EUROP form €/point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOL</td>
<td>13.3</td>
<td>14.2</td>
<td>23.8</td>
<td>26.0</td>
</tr>
<tr>
<td>RDC</td>
<td>12.9</td>
<td>14.6</td>
<td>24.4</td>
<td>27.7</td>
</tr>
<tr>
<td>JER</td>
<td>8.5</td>
<td>7.8</td>
<td>13.8</td>
<td>14.7</td>
</tr>
</tbody>
</table>
Mastitis and other diseases

Breeding value of “Frequency of 1st cases”
• 1st, 2nd and 3rd lactation

Value depends on:
• Total number of cases (number of repeated treatments)
• Cost of veterinary treatment (and health schemes)
• Extra work
• Discarded milk

Mastitis and other diseases

Summary of results:
• 2008 – Classic/Conventional: Moderate increase despite large increase in vet. costs – health schemes reduces costs.

• Conventional vs organic: Large increase in value – most for mastitis
Claw health

Breeding value of 1st cases
• 1st, 2nd and 3rd lactation

Value depends on:
• Total number of cases
• Cost of treatments
• Extra work

• Relatively small changes compared to 2008/2011
• Relatively small differences between conv. and organic

"Conformation" traits

Approach (same as in 2008)
• Estimated by a group of producers/breeders
• Saved work in a herd of 70 cows (converted to current herd size)
• Improvement of +1 point for all traits

Estimates of saved work - minutes per day
• Body 0 min. saved/day
• Feet & Legs 10 min. saved/day
• Udder 15 min. saved/day
• Milking speed 10 min. saved/day
• Temperament 5 min. saved/day
Conformation results

- No breed differences in saved work
- No difference between conventional and organic
- Labour costs is different per country (they were similar in 2008)
- Increase in labour cost is largest in DNK – therefore increase in values of conformation traits are largest for JER

Fertility assumptions

Factors of importance:

- AI Costs:
  - 21.44 €/AI average (lower in DNK – higher in SWE, FIN)
  - Extra 11 €/AI for sexed semen
  - Costs related to sire selection excluded
- Work (for AI and heat surveillance)
Fertility Results
Better fertility
- Less AI costs (only IFL)
- More calvings/year (more heifer and bull calves born)

Conventional compared to Classic scenario:
- In conv./organic cows room for more beef crosses
- In conv./organic AI costs are larger

In organic compared to conventional:
- Lower value because beef production is not so profitable

Calving traits (maternal and direct)
Stillbirth
- Extra work, costs of destruction
- Number of surviving heifer and bull calves
- Note: Direct effect of genetic improvement is only 50% for beef crosses

Calving ease
- With or without veterinary assistance (changed distribution)
- Extra work
- Note: Direct effect of genetic improvement is only 50% for beef crosses
Calving traits – maternal and direct Value, €/pct change (HOL)

<table>
<thead>
<tr>
<th>HOL</th>
<th>2008</th>
<th>Classic</th>
<th>Conv. maternal</th>
<th>Organic maternal</th>
<th>Conv. direct</th>
<th>Org. direct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stillbirth, 1st</td>
<td>1.915</td>
<td>1.637</td>
<td>1.613</td>
<td>1.395</td>
<td>1.613</td>
<td>1.395</td>
</tr>
<tr>
<td>Stillbirth, later</td>
<td>3.095</td>
<td>3.642</td>
<td>3.918</td>
<td>3.048</td>
<td>2.548</td>
<td>2.010</td>
</tr>
<tr>
<td>Calving ease, 1st</td>
<td>10.99</td>
<td>5.63</td>
<td>5.63</td>
<td>5.85</td>
<td>5.63</td>
<td>5.85</td>
</tr>
<tr>
<td>Calving ease, later</td>
<td>14.86</td>
<td>15.03</td>
<td>26.58</td>
<td>28.00</td>
<td>15.67</td>
<td>16.58</td>
</tr>
</tbody>
</table>

Lower replacement rate:
- Fewer 1st calvings – smaller number/average cow – lower value
- More later calvings – larger number/average cow – higher value

Young Stock survival Value, €/pct change (RDC)

<table>
<thead>
<tr>
<th>RDC</th>
<th>2008</th>
<th>Classic</th>
<th>Conv.</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival heifers 2-30 days</td>
<td>3.40</td>
<td>2.52</td>
<td>3.30</td>
<td>3.19</td>
</tr>
<tr>
<td>Survival heifers 31-458 days</td>
<td>4.06</td>
<td>3.26</td>
<td>3.66</td>
<td>3.77</td>
</tr>
<tr>
<td>Survival bulls 2-30 days</td>
<td>1.89</td>
<td>2.70</td>
<td>1.92</td>
<td>1.44</td>
</tr>
<tr>
<td>Survival bulls 31-184 days</td>
<td>2.96</td>
<td>2.93</td>
<td>2.10</td>
<td>1.76</td>
</tr>
</tbody>
</table>

- 2008-Classic: Value of surplus heifers lower – value beef production higher
- Conv. heifer: Every survived heifer makes room for an extra beef cross
- Conv. Bull calf: Only 50% of gen. improvement is expressed for crosses
- Organic: Beef production is not so profitable
**Longevity**

**Approach:**
Changing culling rate/replacement rate

**Effect**
- Increased longevity: More older cows – with more diseases but higher yield level
- Fewer heifer calving – lower stillbirth rate – less difficult
- Lower number of calvings per year – less heifer and bull calves born

**Most longevity value redistributed to other traits**

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**Summary**

Single trait economic values calculated for:
- Conventional and Organic scenario
- 7 country x breed situations

Next step:
- Converting to values per index unit