Cow Own Worth (COW) Index

Margaret Kelleher PhD
The COW index = Cow Own Worth

Designed to represent more closely the future phenotypic (actual) performance of dairy females

A new system to rank females on predicted profit potential
Economic Breeding Index (EBI)

Life timeline

EBI identifies most profitable bulls and cows for breeding dairy replacements
Table 1. Economic values and % emphasis of the various traits in the EBI formula.

<table>
<thead>
<tr>
<th>Sub-Index</th>
<th>Trait</th>
<th>Economic Weight</th>
<th>Trait Emphasis</th>
<th>Overall Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>Milk</td>
<td>-€0.09</td>
<td>10.6%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Fat</td>
<td>€1.04</td>
<td>3.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protein</td>
<td>€6.64</td>
<td>18.9%</td>
<td></td>
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<tr>
<td><strong>Fertility</strong></td>
<td>Calving Interval</td>
<td>-€12.43</td>
<td>24.0%</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>Survival</td>
<td>€12.01</td>
<td>10.9%</td>
<td></td>
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<tr>
<td><strong>Calving</strong></td>
<td>Direct Calving Difficulty</td>
<td>-€3.52</td>
<td>2.8%</td>
<td>9%</td>
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<tr>
<td></td>
<td>Maternal Calving Difficulty</td>
<td>-€1.73</td>
<td>1.3%</td>
<td></td>
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<tr>
<td></td>
<td>Gestation Length</td>
<td>-€7.49</td>
<td>4.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calf Mortality</td>
<td>-€2.58</td>
<td>1.0%</td>
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<tr>
<td><strong>Beef</strong></td>
<td>Cull Cow Weight</td>
<td>€0.15</td>
<td>0.7%</td>
<td></td>
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<tr>
<td></td>
<td>Carcass Weight</td>
<td>€1.38</td>
<td>5.1%</td>
<td>9%</td>
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<tr>
<td></td>
<td>Carcass Conformation</td>
<td>€10.32</td>
<td>1.7%</td>
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</tr>
<tr>
<td></td>
<td>Carcase Fat</td>
<td>-€11.71</td>
<td>1.1%</td>
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<tr>
<td><strong>Maintenance</strong></td>
<td>Cull Cow Weight</td>
<td>-€1.65</td>
<td>7.2%</td>
<td>7%</td>
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<tr>
<td><strong>Management</strong></td>
<td>Milking Time</td>
<td>-€0.25</td>
<td>2.1%</td>
<td>4%</td>
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<tr>
<td></td>
<td>Milking Temperament</td>
<td>€33.69</td>
<td>1.9%</td>
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<tr>
<td><strong>Health</strong></td>
<td>Lameness</td>
<td>-€54.26</td>
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<tr>
<td></td>
<td>SCC</td>
<td>-€43.49</td>
<td>1.8%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Mastitis</td>
<td>-€77.10</td>
<td>0.8%</td>
<td></td>
</tr>
</tbody>
</table>
Genetic trend in EBI

Profit per lactation (€)

Year of birth

Average EBI
Average milk sub-index
Average fertility sub-index

Phenotypic performance

Calving Interval (days)

- 2009: 401
- 2010: 402
- 2011: 403
- 2012: 397
- 2013: 394
- 2014: 396
- 2015: 392
Phenotypic performance

- Genetic gain materialising into phenotypic gains

- BUT......

“Sometimes my best cow on paper doesn’t perform like my best cow!”
Cow Own Worth (COW)
Expected profit from:

Current Lactation
- Milk
- Health
- Management
- Maintenance
- Fertility (calving date)

Future Lactations
- Milk
- Health
- Beef
- Calving
- Management
- Maintenance
- Fertility
- Descendants

Net Culling Cost
- Cull cow value
- Replacement cost

+ predictions on fertility, survival and SCC performance
Current lactation profit

Genetics effects

Crossbreeding effects

Age of cow

Calving date

Individual effects

Current Lactation

- Milk
- Health
- Management
- Maintenance

Current milk price

Current lactation profit
Current lactation profit

Actual calving date

- Feb
- Mar
- Apr
- May

Costs per calving month MDSM

Current Lactation

- Fertility (calving date)
Expected profit from:

**Current Lactation**
- Milk
- Health
- Management
- Maintenance
- Fertility (calving date)

**Net Culling Cost**
- Cull cow value
- Replacement cost

**Future Lactations**
- Milk
- Health
- Beef
- Calving
- Management
- Maintenance
- Fertility
- Descendants

+ Predictions on fertility, survival and SCC performance
Future lactations profit

Future Lactations

- Milk
- Heath
- Beef
- Calving
- Management
- Maintenance
- Fertility
- Descendants

+ predictions on fertility, survival and SCC performance
Future lactations profit

- Genetics effects
- Crossbreeding effects
- Age of cow
- Calving date
- Individual effects

Future Lactations
- Milk
- Heath
- Beef
- Calving
- Management
- Maintenance

Future milk price MDSM
Future lactations profit

EBI times
Cumulative Discounted Expression

Future Lactations

• Descendants
Future lactations profit

Actual calving date
- Feb
- Mar
- Apr
- May

Next calving date
- Feb
- Mar
- Apr
- May

Genetic effects
- EBV
- Heterosis

Future Lactations
- Fertility
+ predictions on fertility, survival and SCC performance
### Future fertility performance

#### Transition matrices

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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</thead>
<tbody>
<tr>
<td><strong>Best Genetics</strong></td>
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<tr>
<td>Proportion</td>
<td>0.14</td>
<td>0.53</td>
<td>0.22</td>
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<td>Cost (€)</td>
<td>0.00</td>
<td>0.00</td>
<td>-151.00</td>
<td>-210.00</td>
<td>-437.00</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Worst Genetics</strong></td>
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<tr>
<td>Proportion</td>
<td>0.13</td>
<td>0.39</td>
<td>0.25</td>
<td>0.15</td>
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<tr>
<td>Cost (€)</td>
<td>0.00</td>
<td>0.00</td>
<td>-151.00</td>
<td>-210.00</td>
<td>-437.00</td>
</tr>
</tbody>
</table>

**Difference of €36.71**
Fertility probability

Probability

Calving month next year

January
February
March
April
May

HIGH
LOW

ICBF.com
Expected profit from:

**Current Lactation**
- Milk
- Health
- Management
- Maintenance
- Fertility (calving date)

**Future Lactations**
- Milk
- Health
- Beef
- Calving
- Management
- Maintenance
- Fertility
- Descendants

**Net Culling Cost**
- Cull cow value
- Replacement cost

+ predictions on fertility, survival and SCC performance
Net culling cost

- Cull value
- Salvage value + Genetics\textsubscript{CWT}
- Replacement cost
- Long term replacement requirement

Net Culling Cost
Does the COW index work?

- Validation dataset (Kelleher et al., 2015)
  - 2011 genetic evaluation data
  - 2012 phenotypic data

- Pilot herds
  - 2016 spring calved herds ranked
  - Feedback
<table>
<thead>
<tr>
<th>Group</th>
<th>Milk (kg)</th>
<th>Fat (g/100g)</th>
<th>Protein (g/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COW</td>
<td>EBI</td>
<td>COW</td>
</tr>
<tr>
<td>Best (Top 25%)</td>
<td>6965 (6.17)</td>
<td>6674 (6.32)</td>
<td>4.07 (0.003)</td>
</tr>
<tr>
<td>Good</td>
<td>6695 (6.45)</td>
<td>6580 (6.38)</td>
<td>4.03 (0.003)</td>
</tr>
<tr>
<td>Poor</td>
<td>6512 (6.18)</td>
<td>6530 (6.27)</td>
<td>4.01 (0.003)</td>
</tr>
</tbody>
</table>

Results: Milk production

€360 more value per cow per lactation for cows in top 25% versus bottom 25%
Results: Crossbreeding

Breed specific heterosis effects for F1 crossbred over lifetime

**Holstein x Jersey**
- €472 more profit
- €105 per lactation assuming average lifetime 4.5 lactations

**Friesian x Jersey**
- €597 more profit
- €132 per lactation assuming average lifetime 4.5 lactations

**Holstein x Friesian**
- €245 more profit over her lifetime
- Half the extra gain in performance compared to HOxJE due to closeness of breed origin
- But does exist

**COW: NOT a crossbreeding index**

Other effects have major impact on ranking of cows in herd;

EG: Calving date Individual effect SCC penalty
In general, the higher the EBI, the higher the COW index. BUT you can see some low EBI cows performing better than higher EBI cows.
Culling: Cull cows below dotted line

Correlation between COW and EBI by month of calving

Herd size = 189

Cull cows below the dotted line
Notice a range in EBI Poorest performers on the COW scale
Do not cull on EBI

Correlation between COW and EBI by month of calving

Herd size = 189

This cow is ranked 25 out of 189 cows on COW
She is the top 15% for performance

EBI is for selecting your best animals for BREEDING
COW is for CULLING
You would cull a cow in your top 15% for performance
Summary facts about COW

- Rank dairy cows on expected profitability
- Complimentary to EBI
- More accurate for milk recorded herds
- Pregnancy diagnosis has a huge impact on a cow’s rank in the herd
- Potential to include new traits of importance
- Genomics will improve the accuracy

<table>
<thead>
<tr>
<th>Purpose</th>
<th>EBI</th>
<th>COW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeding</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Culling &amp; Purchasing</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Males</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Females</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Scale</td>
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<td>Lifetime</td>
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<td>Genetics</td>
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<td>PTA</td>
<td>✓</td>
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<td>EBV</td>
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<tr>
<td>Crossbreeding</td>
<td>X</td>
<td>✓</td>
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<tr>
<td>Individual effects</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Age</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Calving date</td>
<td>X</td>
<td>✓</td>
</tr>
</tbody>
</table>