The Economic Value of a Dairy Cow

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What is the cow value?
What the cow value means?

Discounted future net return of a cow
Compared to a replacement

Net return of a cow minus net return of a replacement
Includes the replacement transaction cost

General interpretation
• Positive cow value = keep
• Negative cow value = replace
Important factors
Variables with large impact

Cow expected milk production
• This lactation
• Future lactations

Replacement
Expected genetic gain
Why to worry about the cow value?
Critical economic implications

Optimal management
Keep or replace

Crucial decisions
Breed or not breed

Important information
• Value of pregnancy
• Cost of pregnancy loss
• Cost of a day open
How to calculate the cow value?
Markov chains to simulate herd dynamics

Cabrera, 2012
Data required for model

Evaluated cow

Current state
• Lactation (PAR)
• Months after calving (MIM)
• Pregnancy (MIP)

Expected milk production
• Rest current lactation
• Next lactations
Data required for model
Replacement heifer

Genetic improvement
• Expected productivity gain with the replacement
Data required for model

Herd level

Milk production
- Rolling herd average
- Butterfat content

21-d pregnancy rate
Percentage of cows becoming pregnant every 21 days
Data required for model
Herd level

**Herd turnover ratio**
Percentage of animals leaving the herd

**Reproductive replacement**
- Last month to breed non-pregnant cows
- Milk threshold to replace do-not-breed cows
Data required for model
Herd level

Body weight
- Within a lactation
- Between lactations

Pregnancy loss
Abortion of pregnant cows between 35 days and end of gestation
Data required for model
Farm data, economic variables

Milk price
Feed cost
Reproductive cost
Replacement cost
Salvage value
Calf value
Interest rate
Economic net return
Expected future net returns

Cow Value = $625
The value of a new pregnancy
How much more when a cow becomes pregnant?

**Difference in cow value:**
- Cow becoming pregnant
- Cow remaining non-pregnant

Vs.
The cost of a pregnancy loss
How much less when a cow aborts?

Difference in cow value:
• Cow being pregnant
• Cow losing pregnancy

Vs.
# Model illustration

## Herd baseline data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd turnover ratio, %/year</td>
<td>35</td>
</tr>
<tr>
<td>Rolling herd average, kg/cow per year</td>
<td>10,896</td>
</tr>
<tr>
<td>21-d pregnancy rate, %</td>
<td>18</td>
</tr>
<tr>
<td>Reproduction cost, $/cow per month</td>
<td>20</td>
</tr>
<tr>
<td>Last MIM to breed a cow</td>
<td>10</td>
</tr>
<tr>
<td>Milk threshold, kg/cow per day</td>
<td>22.7</td>
</tr>
<tr>
<td>Pregnancy loss after 35 d pregnant, %</td>
<td>22.6</td>
</tr>
<tr>
<td>Average cow body weight, kg</td>
<td>593</td>
</tr>
</tbody>
</table>
## Model illustration

### Herd baseline data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Replacement cost, $/cow</td>
<td>1,300</td>
</tr>
<tr>
<td>Salvage value, $/kg live weight</td>
<td>0.84</td>
</tr>
<tr>
<td>Calf value, $/calf</td>
<td>100</td>
</tr>
<tr>
<td>Milk price, $/kg</td>
<td>0.35</td>
</tr>
<tr>
<td>Milk butterfat, %</td>
<td>3.5</td>
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<tr>
<td>Feed cost for lactating cows, $/kg dry matter diet</td>
<td>0.22</td>
</tr>
<tr>
<td>Feed cost for dry cows, $/kg dry matter diet</td>
<td>0.18</td>
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<tr>
<td>Interest rate, %/year</td>
<td>6</td>
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</tbody>
</table>

Cabrera, 2012
Model illustration
Average cow and replacement

Open cow value
• Decreases
• Becomes negative

Pregnant cow value
• Higher than open
• U-shaped
• Similar value at calving

Overall cow value
• Increases to 3\textsuperscript{rd} or 4\textsuperscript{th} lactation
## Model illustration

### Herd statistics

<table>
<thead>
<tr>
<th>Economic values, $/cow per year</th>
<th>Herd structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk sales revenue</td>
<td>Days in milk</td>
</tr>
<tr>
<td>3,834</td>
<td>224</td>
</tr>
<tr>
<td>Feed cost</td>
<td>Days to conception</td>
</tr>
<tr>
<td>1,522</td>
<td>122</td>
</tr>
<tr>
<td>Calf sales revenue</td>
<td>Percent of pregnant</td>
</tr>
<tr>
<td>96</td>
<td>52</td>
</tr>
<tr>
<td>Non-reproductive culling cost</td>
<td>Reproductive culling, %</td>
</tr>
<tr>
<td>197</td>
<td>8</td>
</tr>
<tr>
<td>Mortality cost</td>
<td>Percent of 1\textsuperscript{st} parity cows</td>
</tr>
<tr>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>Reproductive culling cost</td>
<td>Percent of 2\textsuperscript{nd} parity cows</td>
</tr>
<tr>
<td>58</td>
<td>27</td>
</tr>
<tr>
<td>Reproductive cost</td>
<td>Percent of 3\textsuperscript{rd} parity cows</td>
</tr>
<tr>
<td>80</td>
<td>15</td>
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</table>
### Model illustration

The value of a new pregnancy, $\$\

<table>
<thead>
<tr>
<th>PAR</th>
<th>MIM</th>
<th>Cow value</th>
<th>Milk</th>
<th>Feed</th>
<th>Repro.</th>
<th>Non-Repro.</th>
<th>Mortality</th>
<th>Calf</th>
<th>Repro. cost</th>
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<tr>
<td>1</td>
<td>4</td>
<td>151</td>
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<td>5</td>
<td>29</td>
<td>45</td>
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<tr>
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<td>6</td>
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<td>8</td>
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<td>3</td>
<td>4</td>
<td>202</td>
<td>46</td>
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<td>43</td>
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<td>9</td>
<td>26</td>
<td>49</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>215</td>
<td>39</td>
<td>-25</td>
<td>69</td>
<td>50</td>
<td>9</td>
<td>27</td>
<td>47</td>
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<td>3</td>
<td>8</td>
<td>203</td>
<td>-9</td>
<td>-29</td>
<td>108</td>
<td>53</td>
<td>10</td>
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<tr>
<td>5</td>
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<tr>
<td>5</td>
<td>6</td>
<td>203</td>
<td>25</td>
<td>-22</td>
<td>60</td>
<td>57</td>
<td>11</td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>186</td>
<td>-24</td>
<td>-25</td>
<td>94</td>
<td>61</td>
<td>12</td>
<td>26</td>
<td>44</td>
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</tbody>
</table>
Model illustration
The impact of expected milk productivity

Cow MIM = 8 and MIP = 2

<table>
<thead>
<tr>
<th>Rest lact.</th>
<th>Next lact.</th>
<th>1st lact.</th>
<th>2nd lact.</th>
<th>3rd lact</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>120</td>
<td>2,458</td>
<td>2,038</td>
<td>2,002</td>
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<tr>
<td>120</td>
<td>100</td>
<td>1,045</td>
<td>877</td>
<td>829</td>
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<tr>
<td>120</td>
<td>80</td>
<td>-380</td>
<td>-284</td>
<td>-345</td>
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<tr>
<td>100</td>
<td>120</td>
<td>1,891</td>
<td>1,499</td>
<td>1,477</td>
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<tr>
<td>100</td>
<td>100</td>
<td>479</td>
<td>338</td>
<td>304</td>
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<tr>
<td>100</td>
<td>80</td>
<td>-934</td>
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<tr>
<td>80</td>
<td>120</td>
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<td>961</td>
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<tr>
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<td>100</td>
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<tr>
<td>80</td>
<td>80</td>
<td>-1,501</td>
<td>-1,361</td>
<td>-1,395</td>
</tr>
</tbody>
</table>

Graph showing the impact of expected milk productivity with different lactations.
Model illustration

The impact of genetic gain with a replacement

Replacement genetic gain
- Cow value is $211 lower for every 1% expected milk productivity of replacement
Decision support system
Perform your own calculations

Cow value is farm specific
Every farm is different

Farm conditions change dynamically
Cow value and cow net return change

Market conditions change permanently
 Might impact decisions

User-friendly application
Easy to use, still robust
The economic value of a dairy cow
Freely and openly available

[Image of economic value calculator]

**INPUTS - Edit Values in This Block**

**Evaluated Cow Variables**
- Current Lactation
- Current Months after Calving
- Current Months in Pregnancy
- Expected Milk Production Rest of Lactation, %
- Expected Milk Production Next Lactations, %

**Replacement Cow Variable**
- Expected genetic improvement, % additional milk

**Herd Production and Reproduction Variables**
- Herd Turnover Ratio, %/year
- Rolling Herd Average, lb/cow per year
- 21-d Pregnancy Rate, %
- Reproduction Cost, $/cow per month
- Last Month After Calving to Breed a Cow
- Do-not-Breed Cow Minimum Milk, lb/day
- Pregnancy Loss after 35 Days Pregnant, %
- Average Cow Body Weight, lb

**Herd Economic Variables**
- Replacement Cost, $/cow
- Salvage Value, $/lb live weight
- Calf Value, $/calf
- Milk Price, $/cwt
- Milk Butterfat, %
- Feed Cost Lactating Cows, $/lb dry matter
- Feed Cost Dry Cows, $/lb dry matter
- Interest Rate, %/year

**OUTPUTS - Interactive Results**

**Value of the Cow, $**
- 628

**Compared Against a Replacement, $**
- Milk Sales, $
- Feed Cost, $
- Calf Value, $
- Non-reproductive Cull, $
- Mortality Cost, $
- Reproductive Cull, $
- Reproduction Costs, $
- Replacement Transaction, $
- 704

**Herd Structure at Steady State**
- Days in milk
- Days to Conception
- Percent of Pregnant
- Reproductive Culling, %
- Mortality, %
- 1st Lactation, %
- 2nd Lactation, %
- > 3rd Lactation, %
- 224
- 122
- 52
- 6
- 3
- 43
- 27
- 30

**Economics of an Average Cow, $/year**
- Net Return, $
- 1998
- Milk Sales, $
- Feed Cost, $
- Calf Sales, $
- Non-Repord. Culling Cost, $
- Mortality Cost, $
- Reproductive Culling Cost, $
- Reproductive Cost, $
- 3834
- 1522
- 60
- 198
- 38
- 59
- 80
The economic value of all cows in a herd
Use the herd analysis
The economic value of a dairy cow

Where to find it

DairyMGT.info

Dairy Management UW-Extension
University of Wisconsin-Madison

Dairy Management

Dairy Management Site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly computerized decision support systems to help dairy farms improve their economic performance. Dr. Victor Cabrera focuses on model-based decision support in dairy cattle and its dairy farm production systems. Dr. Cabrera’s primary interest is to improve cost-efficiency and profitability along with environmental stewardship in dairy farms by using simulation techniques, artificial intelligence, and expert systems. Dr. Cabrera’s research and Extension programs involve interdisciplinary and participatory approaches focusing on the creation of user-friendly decision support systems. As an Extension Specialist, Dr. Cabrera works in close relationships with county-based Extension faculty, dairy producers, and related industry.

Tools

Replacing

The economic value of a dairy cow

The economic value of a dairy cow

Online Client

Users get an idea of the value of a single cow within a herd.

Replacement

The economic value of a dairy cow

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Online Client

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The economic value of a dairy cow

Online Client

Users get an idea of the value of a single cow within a herd.
Examples of uses
How the tool could help decision making

Time to replace a cow
• Cow value is negative
• Include milk expectancy
• Include genetic gain

Herd performance
• Herd demographics
• Herd net returns

The value of a:
• Pregnancy
• Day open
• Pregnancy loss

Sorted list of cow values
• Candidates for replacement
• Best performing animals
• Treatment decisions

<table>
<thead>
<tr>
<th>Cow ID</th>
<th>Cow value, $</th>
</tr>
</thead>
<tbody>
<tr>
<td>5892</td>
<td>-1,123</td>
</tr>
<tr>
<td>6344</td>
<td>-243</td>
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<tr>
<td>435</td>
<td>-10</td>
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<tr>
<td>221</td>
<td>269</td>
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<tr>
<td>5543</td>
<td>2,213</td>
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</table>
Acknowledgement

Project support

This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2010-85122-20612 from the USDA National Institute of Food and Agriculture

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Thanks