The effect of parasitic diseases on fertility and the economy of dairy herds

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CEVA Turkey Symposium
## Parasitic diseases on dairy cattle

**Caused for:**
- Internal or external parasites

**Impair:**
- Health
- **Reproduction**
- Growth
- Productivity

<table>
<thead>
<tr>
<th>Internal:</th>
<th>External:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundworms</td>
<td>Mites</td>
</tr>
<tr>
<td>Tapeworms</td>
<td>Lice</td>
</tr>
<tr>
<td>Flukes</td>
<td>Ticks</td>
</tr>
<tr>
<td>Protozoa</td>
<td>Flies and Mosquitoes</td>
</tr>
</tbody>
</table>
Economics of reproduction

**Economic net return:** Strongly associated to reproductive performance

↑ **Reproductive performance:**
Most efficient part of lactation curve
Ferguson and Galligan, 1999

↓ **Costs of replacement and mortality**
Galvao et al., 2013

↑ **On-farm replacements**
Giordano et al., 2012

↓ **Relative reproductive costs**
Giordano et al., 2012
21-d Pregnancy Rate (PR): Best single index of reproductive performance
Ferguson and Galligan, 1999

Rate at which eligible cows become pregnant in successive 21-d periods

Integrates many other parameters that indicate reproductive performance

Managers of modern US commercial dairy herds use 21-d PR index
Economic impact of reproductive programmes: Difficult to assess

Series of recent simulation studies: Provide interesting clues and further direction

Giordano et al., 2011: Partial budgeting, DSS
Giordano et al., 2012: Daily Markov chains, DSS
Cabrera, 2012: Markov-Chain, DSS
Kalantari and Cabrera, 2012: Markov-Chain, DSS
Giordano et al., 2013: Decision theory
Galvao et al., 2013: Monte Carlo
The economic value of improving reproductive performance

![Graph showing the relationship between 21-day pregnancy rate and net return gain over 10% 21-d PR (US$/cow per year). The graph includes data points and a trend line, with different symbols representing studies by Cabrera, 2012; Galvao et al., 2013; Giordano et al., 2012; Giordano et al., 2011; and Kalantari and Cabrera, 2012.](image-url)
PR vs. milk, feed, and IOFC ($/cow.yr)

11,000 kg/cow.yr

13,600 kg/cow.yr

Cabrera, 2012
PR vs. calf sales ($/cow.yr)

Return ($/cow.yr) =
- 0.0352 (21-d PR)^2
+ 2.8476 (21-d PR)
+ 18.93  (R^2=0.996)

♀ Calf value = $100

Between $3 and $1 per 1% increase 21-d PR

Study  ♀ Calf value, $  Gain, $/1% 21-d PR
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Galvao et al., 2013  $140  $1 to $3*
Giordano et al., 2012  $90  $2 to $1
## PR vs. replacement supply

21-d PR → Selective culling

Souza et al., 2013

<table>
<thead>
<tr>
<th>21d-PR, % (different reproductive programs)</th>
<th>Replacement balance (per 1,000 cow herd) when breeding cutoff was at 300 DIM</th>
<th>NEW breeding cutoff to balance the heifer supply and demand, DIM</th>
<th>Approximated net return change compared to 300 DIM breeding cutoff, $/cow.yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>-14</td>
<td>310</td>
<td>-5</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>15</td>
<td>281</td>
<td>+5</td>
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<tr>
<td>17</td>
<td>20</td>
<td>270</td>
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<td>18</td>
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<td>19</td>
<td>40</td>
<td>240</td>
<td>+8</td>
</tr>
<tr>
<td>20</td>
<td>48</td>
<td>235</td>
<td>+9</td>
</tr>
</tbody>
</table>

From Giordano et al., 2012
PR vs. replacement & mortality costs

Daily hazard for culling (non-pregnant cows)

Lactations

Days after calving

0.8%
0.6%
0.4%
0.2%
0.0%

0 100 200 300 400 500 600 700

Lower Costs
$/cow.yr
⇧1% 21-d PR

$4 to $1
Cabrera, 2012

$4 to $3
Giordano et al., 2012

$27 to $4
Galvao et al., 2013

Data from De Vries et al., 2010

Pregnant = Less risk than non-pregnant (e.g., 75% less risk)

Mortality = Proportion of culling risk (e.g., 17% of that risk)
PR vs. reproductive costs

- PR (no investment) → Decrease Reproductive costs
- PR may require Increase investments
- Depends on investments vs. PR
- Seems to be inconsistent among studies

$/cow.yr 1% 21-d PR

-$4  
+$4

The Wisconsin-Cornell Dairy Repro$ Tool could be used for farm-specific assessments

http://DairyMGT.info/Tools
Interbreeding interval interval vs. net return

Net return gain by changing interbreeding interval, US$/cow per year

Change in interbreeding interval (weeks)

8 to 7
7 to 6
6 to 5
5 to 4

Presynch-Ovsynch + Ovsynch

Adapted from Giordano et al., 2013
Anoestrus and parasitic diseases

- Anoestrus is a major problem in the tropics and subtropics, where inadequate nutrition, high ambient temperature, high parasite burdens and disease exacerbate the problem. FAO (www.fao.org)

- Anoestrus therefore decreases the herd’s PR

- Economic loss can be expected between $30 to $10/cow per year for each 1 percentage point decrease in 21-d PR
Worms and fertility

• Fertility rates in adult cows can be improved by worm treatments (mydairyvet.com)

• Elimination of parasites around calving can be associated with improved transition period (improved energy balance) and therefore improved fertility (norbrook.com)

• Remember that every 1 percentage 21-d PR would mean as much as $30 or $10 per cow per year
The value of a cow and reproduction

Important relationship for decision-making

Opportunities for cow-level reproductive management. E.g.,

High value cow ➔ more inseminations
High value cow ➔ better care (parasites)
Low value cow ➔ lower quality semen

Associated economic values could be used to enhance the value of reproductive programs. E.g.,

The value of a new pregnancy
The cost of a pregnancy loss
The cost of an additional day open
The value of a cow

Long-term expected net return of a cow compared with that of an imminent replacement

Critical factors

- Cow’s productivity level in relation to herd mates
- Replacement’s genetic improvement in relation to herd mates
- Cow’s current conditions
  - Lactation
  - Days after calving
  - Pregnancy status
The value of a cow

Days after second calving

- Value of a new pregnancy (e.g., US$ 222 (628-406)
- Cost of a pregnancy loss (e.g., US$323 (488-165)
- Cost of a day open (e.g., US$5.2 (704-549)/(120-90)
- Effect of 10% increased productivity in future lactations
Cost of abortion because of parasites

*Neospora caninum* is a protozoal parasite that appears to cause abortions, sporadically in the middle of gestation (4-5 months), although they can occur anywhere from about 3 months onward ([Virginia Tech Extension](#)).

**Trichomoniasis.** Another protozoan parasite known as *Tritrichomonas foetus* causes uterine infection and abortions, which may be accompanied by discharge of pus ([NSW Australia](#)).
The cost of a pregnancy loss

The tool Economic Value of a Dairy Cow can be used to calculate the cost of a pregnancy loss, value of a new pregnancy, or cost per day open.

Changes to $71 if aborted
So, a loss of $436
The value of a new pregnancy
The cost of a pregnancy loss

<table>
<thead>
<tr>
<th>Months in pregnancy</th>
<th>1st Lactation</th>
<th>2nd Lactation</th>
<th>3rd Lactation</th>
<th>4th Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$170</td>
<td>$170</td>
<td>$170</td>
<td>$170</td>
</tr>
<tr>
<td>2</td>
<td>$353</td>
<td>$353</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>$718</td>
<td>$718</td>
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</tr>
<tr>
<td>5</td>
<td>$900</td>
<td>$900</td>
<td>$900</td>
<td>$900</td>
</tr>
</tbody>
</table>

Legend:
- ● 1st Lactation
- ◼ 2nd Lactation
- ■ 3rd Lactation
- ▲ 4th Lactation
The cost of a pregnancy loss
Depends on many other factors

Higher loss when

- Cow’s higher productivity
- Herd’s low 21-d PR
- Higher milk price
- Higher replacement cost
Conclusions

• Reproductive efficiency has a large economic impact on dairy cattle production

• Parasitic diseases impair, directly or indirectly, fertility of dairy cows

• Therefore, parasitic diseases appear to have an important economic impact on dairy cow fertility

• No study has quantified the actual impact of parasitic diseases on dairy cow fertility
Conclusions

• Studies indicate some parasitic diseases increase the risk of abortion in mid gestation.

• Abortions happening between 4 and 6 months in pregnancy cost between $350 and $500 for an average cow.

• Parasitic diseases also decrease the overall herd fertility and consequently the 21-d PR.

• Every 1 percentage point lower 21-d PR can be associated with $30 to $10/cow per year less net return.
Thanks