Customising dry period length in dairy cows: consequences for energy balance and yield over multiple lactations

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This presentation

- WHYDRY project: effect of dry period length on the energy balance and health of dairy cows (2010-2014)
Why a dry period?

Advice to farmers: dry period of 6 till 8 weeks...
.... to maximize milk yield in the next lactation.

... related with maximal renewal of mammary secretory cell population (Capuco et al., 1997)

Why no or a short dry period?

• Less ration– and group transitions
• Improved energy balance in early lactation (due to less milk)
• Improved metabolic status and potential for improved fertility

(Grummer and Rastani, 2004; Annen et al., 2005; Rastani et al., 2005)
Experimental design

**WHYDRY (2010-2014)**
- 168 cows (all parities)
- 3 dry period lengths: 0, 30, and 60 days
- 2 lactations
- Used drying–off protocol:
  - 7 d before drying off: dry cow ration
  - 4 d before drying off: once daily milking
  - at drying off: dry cow antibiotics

**Customised Dry Period (2013-2017)**
- 130 cows (all parities)
- 2 dry period lengths: 0 and 30 days
- 1 lactation
- Used drying–off protocol:
  - 7 d before drying off: dry cow ration
  - 4 d before drying off: once daily milking
  - at drying off: NO dry cow antibiotics

Both experiments are paralleled with a network of dairy farmers (N = 11 and 16 Dutch dairy farms, resp.)
(Short and) No dry period costs milk

Fig 1. Milk production for cows with conventional (60d), short (30d) or no dry period (N=167).

Less milk postcalving, but:
- Extra milk precalving
- Greater fat and protein %
- No effect on lactation persistency

Dry period length: $P<0.01$

(Van Knegsel et al., 2014; Chen et al., 2016)
Fig 2. Energy balance for cows with conventional (60d), short (30d) or no dry period (N=167)

Post calving: Dry period: $P<0.01$;

(Van Knegsel et al., 2014)
Energy balance effects reflected in plasma values

**Fig 3.** Plasma **NEFA** (a) and **glucose** (b) concentration for cows with conventional (60d), short (30d) or no dry period (N=92).

Post calving: Dry period: $P<0.01$

(Chen et al., 2015a)
0 days dry: ’ ovulate earlier post calving (23 vs. 28 vs. 29 d) ’ had more regular cycles (Chen et al., 2015b)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dry period length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 days</td>
</tr>
<tr>
<td>Normal resumption of ovarian cyclicity (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>53.2 (25/47)(^a)</td>
</tr>
<tr>
<td>Abnormal resumption of ovarian cyclicity:</td>
<td></td>
</tr>
<tr>
<td>Type I: late ovulation or anovulation (%)</td>
<td>2.1 (1/47)</td>
</tr>
<tr>
<td>Type II: long luteal phase (%)</td>
<td>44.7 (21/47)</td>
</tr>
<tr>
<td>Type III: cessation of cyclicity (%)</td>
<td>0.0 (0/47)</td>
</tr>
</tbody>
</table>
Intercalving interval is shorter for cows with no/short dry period

(Kok et al., in review)

Table 2. Milk production and intercalving interval of second parity cows from 16 commercial farms with a shortened/no dry period management strategy.

<table>
<thead>
<tr>
<th>Dry period</th>
<th>Conventional</th>
<th>Short</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPCM&lt;sup&gt;3&lt;/sup&gt;</td>
<td>FPCM&lt;sup&gt;3&lt;/sup&gt;</td>
<td>FPCM&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>305-d milk yield (kg/d)</td>
<td>30.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>23.8&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Effective lactation yield (kg/d)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>25.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>24.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22.4&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Intercalving interval (d)</td>
<td>385&lt;sup&gt;a&lt;/sup&gt;</td>
<td>368&lt;sup&gt;b&lt;/sup&gt;</td>
<td>359&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup>Effective lactation yield = milk yield from 60 d before calving to 60 d before next calving (in kg/d), i.e. lactation yield corrected for milk yield before calving and differences in intercalving interval.
Effect of short/no dry period over multiple lactations

Three possible scenarios?

Aim: Assess the impact of dry period length on yield over multiple lactations

2nd time no/short DP: lower/similar/greater yield
Methods – Analysis

- 16 farms, 2007-2015: milk records, dry-off dates
- 1420 lactations with known DPL and previous DPL
  - No 0-2 wk (89% 0 days)
  - Short 3-5 wk
  - Conventional 6-8 wk
  - Long 9-12 wk

➢ Assess impact of current DPL and previous DPL
  ➢ Additional yield in 60 days precalving
  ➢ 305-d yield
Results – Additional yield during the 60 d before calving

- When previous DP is omitted: additional yield during 60d before current calving is reduced.
### Results – 305-d yield

<table>
<thead>
<tr>
<th>Previous dry period length</th>
<th>305-d yield (kg FPCM/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>a</td>
</tr>
<tr>
<td>Short</td>
<td>a</td>
</tr>
<tr>
<td>Conventional</td>
<td>b</td>
</tr>
<tr>
<td>Long</td>
<td>ab</td>
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</table>

Currently no dry period

- No effect when previous DP was short, conventional or long (data not shown)
- Increased yield after 2\(^{nd}\) time no dry period, compared with 1\(^{st}\) time no dry period.
Effect of previous DPL in case of no DP

Milk losses are similar, but timing is different.
What are the consequences for EB in the 2\textsuperscript{nd} lactation?

\textbf{Milk yield} and \textbf{Energy balance} for cows with conventional (60d), short (30d) or no dry period (0d) in the 2\textsuperscript{nd} lactation after implementation of dry period length treatments (WHYDRY).

(Chen et al., 2016)
Conclusion and perspectives

No dry period:
- significant effects on EB and milk yield
- repeated no DP: similar milk losses, different timing, less beneficial for EB?

Short dry period (30d):
- beneficial for EB, limited (no?) reduction in milk yield
- repeated short DP: similar milk losses

New focus: Customised dry period
- Is the optimal dry period length depended on individual cow characteristics? (parity, body condition, udder health status, genotype, ...)?
Optimal dry period length depends on age?

- Data from 16 commercial farms
- Short DP: -1 kg/d
- No DP: -3 kg/d – parity 2 cows
  -2 kg/d – parity >2 cows

(Kok et al., 2016)
Optimal dry period length depends on BCS?

Shortening or omitting the dry period has no effect on the energy balance and milk yield after calving in fat cows (BCS > 3.5 before calving).

Currently: development of a **decision support tool** to optimize DPL for energy balance and milk yield for individual cows.

- evaluate a customised dry period for **longevity**, and **economic** and **environmental consequences**
Thank you for your attention
Optimal dry period length depends on somatic cell count?

Omitting the dry period increases SCC in cows which had a SCC elevation in the previous lactation.

(Van Hoeij et al., Accepted)
Difference between young and old cows

Table 1. Milk production (FPCM; kg) whole lactation, young and old cows,

<table>
<thead>
<tr>
<th>Dry period length</th>
<th>0 days</th>
<th>30 days</th>
<th>60 days</th>
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<tbody>
<tr>
<td><strong>Total milk production, parity 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week: -8 till 0</td>
<td>1081</td>
<td>447</td>
<td>0</td>
</tr>
<tr>
<td>week: 0 till 44</td>
<td>8083</td>
<td>10451</td>
<td>11110</td>
</tr>
<tr>
<td><strong>Total: week -8 till 44</strong></td>
<td><strong>9164</strong></td>
<td><strong>10898</strong></td>
<td><strong>11110</strong></td>
</tr>
<tr>
<td><strong>Total milk production, parity &gt; 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week: -8 till 0</td>
<td>797</td>
<td>442</td>
<td>0</td>
</tr>
<tr>
<td>week: 0 till 44</td>
<td>8804</td>
<td>9883</td>
<td>10775</td>
</tr>
<tr>
<td><strong>Total: week -8 till 44</strong></td>
<td><strong>9601</strong></td>
<td><strong>10325</strong></td>
<td><strong>10775</strong></td>
</tr>
</tbody>
</table>
No dry period increases somatic cell count

Fig 6. Somatic cell count in milk of cows with conventional (60 d), short (30 d) or no dry period (N=167).

What is the cause for increase in SCC: omitting the dry period or omitting the antibiotics?
Is increase in SCC related with reduced mammary health, less milk or altered regeneration profile in the mammary cells?

Mastitis incidence, week 0-14:
0 days: 12 (10/56 cows);
30 days: 8 (8/55 cows);
60 days: 10 (9/56 cows)

Post calving: Dry period length: $P<0.01$;
Ration: $P=0.95$
Lower IgG in colostrum

DPL; $P<0.01$

(Mayasari et al., 2015)
Timing of colostrum secretion makes the difference

- Total colostral IgG is not different between 0 and 60 days dry
- Timing of secretion is different!

(Baumrucker et al., 2014)
Lower plasma antibodies in first weeks, later no effect

- Calves received colostrum of their own mother (2 x 2 ltr in first 24 hrs);
- Calves were immunized with model antigens (KLH and HuSa) in week 6 and 10
- No effect on calf growth first 12 weeks

KLH: Keyhole Limpet Hemocyanin
HuSA: Human Serum Albumin
DPL: Dry Period Length

(Mayasari et al., 2015)
Conclusions WHYDRY

**Short dry period**
- Limited reduction in milk yield
- Improvement of the energy balance
- No effect on: SCC, colostrum, calves, persistency
- Shortening the DP for 2 subsequent lactations is possible!

**No dry period**
- Strong reduction in milk yield, no effect on persistency
- Large improvement of the energy balance and metabolic health
- Greater SCC, lower colostrum quality
- Risk that cows are not persistent enough
- Option for selected group of cows.