**Increased Milking Frequency**

By

*Allison Fitzgerald, Ehrin Annen, Lance Baumgard and Matt VanBaale*

**Milk Frequency Summary:**
1. Increased milking frequency (IMF) in early lactation *primes* the mammary gland and induces a carry-over effect throughout the entire lactation.
2. **Cows and heifers** may respond differently to IMF.
3. Increased milking frequency may have beneficial effects on SCC.
4. **Weather and heat abatement** strategies impact the effects of IMF.
5. The combined effect of bST and IMF in early lactation is not known.

**Introduction**

Low milk price and other financial pressures have required dairy producers to find ways to increase milk yield while minimizing expenses. Traditionally, dairies have milked cows two (2X) or three times daily (3X) however, some producers are currently milking cows four times daily (4X) during early lactation, followed by 2X or 3X milking thereafter. Producers implementing such practices have reported higher peak milk yields and greater 305-day productions. It has been suggested that milking fresh cows 4X for 21 days postpartum supports a “carry-over” effect when animals return to a 2X-milking regime. Currently, the mechanism by which this occurs is not known. Some hypotheses are: 1) an increase in the activity of milk-secreting cells (increased milk synthesis), 2) an increase in the number of milk-secreting cells (mammary growth), 3) a decrease in intramammary pressure resulting in increased milk synthesis, 4) a change in hormone concentrations, or 5) any combination of the aforementioned.

**Milk Response**

There are two primary considerations surrounding the effects of IMF: 1) the enhanced milk yield due to increased milking frequency is a fixed response within parity in lbs/milk/day and 2) increased milking frequency in early lactation stimulates a carry-over effect throughout lactation (Bar-Peled et al., 1995; Erdman and Varner, 1995; Table 2.).

**Table 1. Milk yield response to different milking frequencies compiled from 44 research articles.**

<table>
<thead>
<tr>
<th>Milking Frequency</th>
<th>Number of Studies</th>
<th>Milk Yield (lb/d/cow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2X versus 3X</td>
<td>40</td>
<td>7.7</td>
</tr>
<tr>
<td>2X versus 4X</td>
<td>4</td>
<td>10.8</td>
</tr>
</tbody>
</table>

Adapted from Erdman and Varner, 1995.

Under typical IMF conditions, a cow producing 80 or 90 lbs/day when milked 2X, will increase by approximately 8.0 pounds/day when she is milked 3X (Erdman and Varner, 1995). Thus, high and low producers will increase production by the same increment (i.e. fixed response). However, there appears to be an effect of parity since
milk response between heifers and cows varies. A study by D.A. Poole in 1982, reported a difference in lactation yields between heifers and cows milked 3X (heifers = 10,738 vs. cows = 14,267 lbs) and 2X (heifers = 9,875 vs. cows = 12,526 lbs). Cattle were milked under different milking frequencies utilizing unequal milking intervals throughout lactation (Table 2; Poole et al., 1982).

Table 2. Difference in milk yield between 2X and 3X in heifers and cows for different stages of lactation.

<table>
<thead>
<tr>
<th>Cows (stage of lactation)</th>
<th>Difference in Milk Yield (3X-2X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-20 weeks</td>
<td>1351 lbs</td>
</tr>
<tr>
<td>21-30 weeks</td>
<td>255 lbs</td>
</tr>
<tr>
<td>305-d lactation</td>
<td>1741 lbs</td>
</tr>
<tr>
<td>Heifers (stage of lactation)</td>
<td></td>
</tr>
<tr>
<td>1-20 weeks</td>
<td>669 lbs</td>
</tr>
<tr>
<td>21-30 weeks</td>
<td>91 lbs</td>
</tr>
<tr>
<td>305-d lactation</td>
<td>843 lbs</td>
</tr>
</tbody>
</table>

Adapted from D.A. Poole, 1982.

**Milking Frequency - 2X, 3X, 4X, and 6X**

Most experiments have compared 2X vs. 3X and unfortunately not many have compared 4X milking. Researchers are currently evaluating what the cause(s) are that elicit a carry-over effect observed throughout lactation from early postpartum IMF. Dahl and coworkers (2001) evaluated the effects of 2X versus 4X and reported a significant increase in milk yield. An economic analysis of IMF was recently presented at the Arizona Dairy Production Conference in Phoenix, October 16, 2003 (Table 3).

Table 3. Milk response and economic benefit from milking fresh cows 4X for 21 days postpartum.

<table>
<thead>
<tr>
<th>Costs to Consider</th>
<th>Potential Milk Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 lb</td>
</tr>
<tr>
<td>Labor(^a)</td>
<td>$0.11</td>
</tr>
<tr>
<td>Feed(^b)</td>
<td>0.09</td>
</tr>
<tr>
<td>Supplies(^c)</td>
<td>0.05</td>
</tr>
<tr>
<td>Milk revenue(^d)</td>
<td>0.33</td>
</tr>
<tr>
<td>Marginal profit/cow(^e)</td>
<td>0.08</td>
</tr>
<tr>
<td>Marginal profit/farm(^f)</td>
<td><strong>$2,928</strong></td>
</tr>
</tbody>
</table>

\(^a\)Labor cost: $10/hour, 4 hours/cow/lactation.
\(^b\)Dry matter: $.06; 0.5 lb DM for each pound of milk increase.
\(^c\)Cost for supplies for an extra 42 milkings distributed over entire 305-day lactation.
\(^d\)Milk at $11.00/cwt
\(^e\)Estimate is for each day of a typical 305-day lactation.
\(^f\)Calculated from profit/cow for 305-day lactation for 120 cow herd.

A recent study by Hale et al. (2003), utilized 31 Holstein cows milked either 2X throughout lactation, 4X (starting day 1 postpartum) through 21 days postpartum, or 4X (starting day 4 postpartum) through 21 days postpartum. The objectives were to determine early lactation milking frequency response, carry-over effects, and effects on mammary growth and hormones responsible. Cows milked 4X beginning on day 1
postpartum produced 19.4 lbs/day more milk than those milked 2X during early lactation. Similarly, cows milked 4X beginning on day 3 postpartum through day 21 produced 10.6 lbs/day more milk than the 2X group. Milk yield for both groups converged at day 252 in milk.

Minimal research has been done on milking cows 6X. Bar-Peled et al. (1995) compared 3X and 6X milking for 21 days postpartum. Compared to the 3X group, cows milked 6X produced 16.1 lbs/day (77.7 vs. 93.7 lb/day) more milk up to 6 weeks in lactation and 11.2 lb/day (82.3 vs. 93.5 lb/d) more from weeks 7 through 18. Another study reported an increase in milk yield and a carry-over effect when cows were milked 6X versus 3X for 42 days postpartum (Sanders et al., 2000). Milk responses observed for 2X, 3X, 4X and 6X milking frequencies are compiled in Figure 1.

Figure 1. Milk yield responses to 2X vs. 4X (Hale et al., 2003) and 3X vs. 6X (Bar Peled et al., 1995) milking in early lactation.

Unequal Milking Interval

When increasing milking frequency, the ability to milk all of the cows in one shift can be a challenge. Limitations or questions to consider when increasing the milking frequency are: 1) is your parlor at full capacity, 2) what is cow throughput, and 3) can throughput be increased without sacrificing milk quality. Researchers evaluating milking frequency have used unequal milking intervals to compensate for the aforementioned challenges (Schmidt and Trimberger et al., 1962; Hale et al., 2003). Hale et al. (2003) employed a 4-8 hour milking interval in the 4X treatment and still obtained benefits from IMF. Implementing a protocol to increase milking frequency in fresh cows will be dependant upon parlor capacity, cow throughput and associated costs for increased milking frequency (i.e. electricity, equipment etc.).

Somatic Cell Count and Milk Composition

The majority of the research indicates that with increased milking frequency, somatic cell count (SCC) is either unaffected or decreased. In theory, an increase in udder emptying should decrease SCC and improve overall udder health. Sanders et al. (2000) reported no significant differences in SCC for cows milked 6X versus 3X for 42 days postpartum. Smith et al. (2002) compiling performance records representing approximately 10,600 cows per year (1998-2000) observed an overall decrease in SCC when cows were milked 3X versus 2X. No effect on SCC was observed between groups milked either 2X or 4X (Hale et al., 2003).

As for milk components, milk fat and protein are typically reduced as milking frequency increases. Smith et al., (2002) and Erdman and Varner, (1995) reported that
protein and fat percentages were lower when cows were milked 3X vs. 2X. Cows milked 2X versus 4X in early lactation had decreased protein percentages from weeks 4 – 44, but no effects on fat were detected (Hale et al., 2003).

**Considerations When Increasing Milking Frequency**

**Walking distance** recommendations from John Smith and co-workers (2002) suggest the following maximum walking distances to the parlor under dry lot conditions for different milking frequencies to minimize feet and leg stress are:

- 2X – 1,000 ft.
- 3X – 700 ft.
- 4X – 500 ft.

**Holding pens** exert the greatest stress to dairy cattle on the dairy, as it becomes humid from crowding, udder washing and ambient temperature. Cows being cooled in the holding pen increased milk yield by 1.7 lb/day (Wiersma and Armstrong, 1983). Minimizing time spent in holding pens will decrease pre-milking stressors and support the potential milk yield increase for 4X or 6X milking.

**Cow throughput** must be considered when planning to increase the number of cows entering the parlor in one shift. As mentioned above, current parlor capacity, cow throughput, number of milkers, and wash time will be considerations for increasing milking frequency. Throughput is typically a function of:

- Number of stalls in parlor X 4.5 = cows milked per hour (CPH)
- # of cows being milked = CPH X length of milking shift

**Water** availability upon exiting the parlor is crucial to maximize feed intake and milk yield. Dairy cattle may increase water intake by 50% under periods of heat stress (Jones and Stallings, 1999).

- Adequate **feed** and **feeding times**. Schedule feeding times upon cows exiting the parlor. This may minimize cows heading for the shade versus the feedbunk.
- **Shade** and **cooling**. Supplying the lactating dairy cow with shade and cooling is pertinent. With sweltering temperatures and little or no cooling at night during summer months, cattle will expend energy to cool down.
- The Arizona and New Mexico environment may be a deciding factor when calculating revenue received from IMF.

**Conclusion**

More research is needed to establish the number of days increased milking frequency should be employed. Furthermore, profitability of increasing peak yields and the subsequent carry-over effect should be determined. The mechanism by which increased milking frequency increases peak milk yield and a carry-over effect throughout the entire lactation is still under investigation.
References


