Harvesting Milk Crop

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Factors affecting milk production

- Milk synthesis is dependent on:
  - no. secreting cells
  - blood supply
  - supply of milk precursor
  - endocrine support for lactogenesis
  - milking frequency

- No. secreting cells is dependent on:
  - genetics
  - endocrine support for mammogenesis
  - nutrition
  - disease (mastitis)
Mature equivalent = Production records have been adjusted for age at freshening, frequency of milking and season of the year at calving. Mature equivalent records estimate how much a cow would have produced if she was of mature age, calved during an average month, and were milked twice a day.

Comparison of lactation curve for different parity

- 1st lactation peak: 70-73% of peak for mature cows;
- 2nd lactation peak: 92-93% of peak for mature cows
- 1st lactation cows peak later, but are more persistent after peak

Adapted from W. Canadian DHI services
1st lactation “ 80% of mature cows
2nd lactation = 85-90% of mature cows
3rd lactation = 90-95% of mature cows
4th lactation=95-98% of mature cows
Lower than normal persistency post-peak may be due to improper nutrition of health.

In general, high post-peak persistency gives an opportunity to improve production.

Managerial Practices and Milk production

Milk Frequency
Milk Interval
Use of Hormones
Photo Period
**Effect of Increased Milking Frequency (IMF) on Milk Production**

<table>
<thead>
<tr>
<th>Milking Frequency Change</th>
<th>Increased Milk Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1X - 2X</td>
<td>13.6 lb.</td>
</tr>
<tr>
<td>2X - 3X</td>
<td>7.7 lb.</td>
</tr>
<tr>
<td>2X - 4X</td>
<td>10.8 lb.</td>
</tr>
</tbody>
</table>

**IMF: Effect of Udder Pressure on Milk Secretion**

![Graph showing the effect of udder pressure on milk secretion over hours since last milking.](chart.png)
Early Lactation IMF & Changes in milk yield

<table>
<thead>
<tr>
<th>Study</th>
<th>Times Milked</th>
<th>Length of Trt</th>
<th>“Earned Milk” Trt Diff.</th>
<th>“Free Milk” Carryover Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poole, 1982</td>
<td>3X vs. 2X</td>
<td>20 wks</td>
<td>8.8 lb/d</td>
<td>4.8 lb/d</td>
</tr>
<tr>
<td>Bar Peled et al., 1995</td>
<td>6X vs. 3X</td>
<td>6 wks</td>
<td>16.0 lb/d</td>
<td>11.2 lb/d</td>
</tr>
<tr>
<td>Sanders et al., 2000</td>
<td>6X vs. 3X</td>
<td>6 wks</td>
<td>9.0 lb/d</td>
<td>5.5 lb/d</td>
</tr>
</tbody>
</table>

~11 lbs/d ~7 lbs/d

IMF Results Depend on Timing

- IMF initiated during mid lactation
  - Increases milk production during IMF
  - Milk production declines to pre IMF level after IMF ceases
  - All extra milk is “Earned”

- IMF initiated **during early lactation**
  - Increases milk production during IMF
  - Milk production **does not** decline to pre IMF level after IMF ceases
  - A large portion of the extra milk is “Free”
IMF Milking Interval

- IMF cows milked before and after the normal 2X milking
- ~2 ½ hours between 2 AM and 2 PM milkings
- 8 ½ hours between AM and PM milkings

Profitability
- 8 cents/cow/day at 3 lb response
- 32 cents/cow/day at 6 lb response
Endocrine Support of Established Lactation; Photoperiod Effects

Photoperiod (length of time cattle are exposed to light)

• affects lactation yield

• 18hr light/ 6hr dark (long day-length) is best for maximum yields during lactation

Endocrine Support of Established Lactation Photoperiod Effects

• Long day-length suppresses melatonin (from pineal gland)
  • melatonin apparently regulates (suppresses?)
  • IGF-1 release from liver
  • IGF-1 increases milk synthesis
  • long day-length allows greater IGF-1 stimulation of milk synthesis
    (~ 5 lbs/cow/day = ~ 7 %)
Photoperiod Management of Dairy Cattle

Cows exposed to long days, i.e. 16 to 18 hours of light and a 6 to 8 hour period of darkness, daily milk production increases an average of 2 liters/cow (4.4 lb/day).

Effect of bST on milk yield and feed intake

<table>
<thead>
<tr>
<th>Location</th>
<th>Increase in Milk Yield</th>
<th>Increase in Feed Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>8.3%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Cornell University</td>
<td>11.5%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Missouri/Monsanto</td>
<td>21.8%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Utah/Utah State U.</td>
<td>14.6%</td>
<td>5.3%</td>
</tr>
<tr>
<td>France</td>
<td>17.8%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Germany</td>
<td>16.6%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>18.5%</td>
<td>7.1%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>19.2%</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

10-15%  6%
Milk from rbST-Treated Cow vs Conventional Milk

Endocrine Support of Established Lactation; Photoperiod Effects

- Milk yield and DMI (dry matter intake) are elevated in response to long day-length (18hr light/6hr dark)
- Milk yield and DMI are further elevated in response to long day-length + bST (additive effect)
Take Home Messages

• **Increasing peak and persistency**
  - Taking care of transition period, health and nutrition
  - Increase milk frequency overall
  - Increase milk frequency early postpartum
  - Use of galactopoietic hormone: bST
  - Photoperiod: 16 hr light; 8 hr dark