Reproductive management of high yielding dairy herds in hot climate
the case of Israel

Israel Flamenbaum, Ph. D
israflam@inter.net.il

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Israel climate

- **Israel climate** - Sub -Tropical Dry.

- **Summer** (June – October) – hot and humid (no rains). Max. and Min. daily Temp. 90-95°F and 72-77°F respectively. Max. and Min. daily RH 80 % and 50% respectively.

- **Winter** (December – March) – Moderately cool (rainy). Max. and Min. daily Temp. 64°F and 45°F respectively.
Israeli Dairy Farming System

- **115,000** *Israeli-Holstein*-breed cows
- **1,000** dairy farms
- Farms distributed mostly in the coast and in the hot valleys
- **DHI data 2008** (90% of the Israel dairy herd):
  - 11,460 kg (305 d), 25,200 lb.
  - 3.71% fat
  - 3.20% protein
Characteristics of Israeli dairy sector

• Cows in total confinement in open shelters (80% “loose house” and 30% “free stalls”)
• Relatively large herds
• TMR as dominant feeding system
• Diets low in roughage, high in by products
• Intensive control of health, productive and reproductive traits
• Intensive use of cooling systems to overcome summer’s heat stress
Heat detection and AI service

- All Israeli cows are AI
- All inseminations performed by an “inseminator” from Israeli AI cooperative “SION”
- Almost all dairy hers in Israel use “electronic controlled” milking equipment, mostly Israeli made
- The indicators for heat are activity measurements through:
  - “Leg-tags” (AFIMILK),  - “Neck-tags” (SCR)
- Most of Israeli cows are inseminated based mostly on electronic detection
- No “TAI” is routinely used in Israeli herds
Trends in milk production and conception rate in the Israeli herd 1995 - 2008

![Graph showing trends in milk production and conception rate from 1995 to 2008.](image)
High productivity does not impair conception rate

<table>
<thead>
<tr>
<th></th>
<th>Lowest third</th>
<th>Highest third</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean 305 d yield, Lb.</td>
<td>25,300</td>
<td>29,800</td>
</tr>
<tr>
<td>% pregnant to first AI</td>
<td>32.9</td>
<td>34.5</td>
</tr>
<tr>
<td>% open &gt;150 DIM</td>
<td>38.6</td>
<td>38.7</td>
</tr>
</tbody>
</table>

*** Fertility was not affected by high yield! ***

Oded Nir 2009, Hachaklait
Economical losses due to low summer fertility

- Seasonality in the distribution of calving
- Prolongation of the “calving interval”
- Increase in “Obligatory” culling
Distribution of calving in the Israeli herd

- Month: 0, 2, 4, 6, 8, 10, 12
- Calving (%): 0, 4, 8, 12, 8, 4, 0

Graph shows the distribution of calving over the months, with a peak in the 8th month and a low in the 6th month.
Can we improve summer fertility through cooling and improved management?
Cooling cows in Israel

- **System** – a combination of wetting and forced ventilation
- **Sites** -
  - “Holding Pen”
  - “Feeding line”
  - “Resting area”
- **Time** – June to October
Cooling in the holding pen
Cooling in feeding line
Cooling in feeding line (oscillating fans)
Ventilating the resting area
Effect of cooling intensity on cow’s performance
4 consecutive years
(treatments)

• ‘Minimal’ (5 herds)
  Just wetting before milking

• ‘Moderate’ (4 herds)
  Cooling in ‘Holding pen’ only
  6 cooling periods, 45 min. each, 4.5 hr/day

• ‘Intensive’ (5 herds)
  Cooling in ‘Holding pen’ + ‘Feeding line’
  10 cooling periods, 45 min. each, 7.5 hr/day
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Minimal</th>
<th>Moderate</th>
<th>Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>16.7 c</td>
<td>34.5 b</td>
<td>33.8 b</td>
</tr>
<tr>
<td></td>
<td>(222)</td>
<td>(172)</td>
<td>(572)</td>
</tr>
<tr>
<td>Winter</td>
<td>43.5 a</td>
<td>45.8 a</td>
<td>46.6 a</td>
</tr>
<tr>
<td></td>
<td>(618)</td>
<td>(267)</td>
<td>(684)</td>
</tr>
</tbody>
</table>

Flamenbaum and Ezra, 2003, J. Dairy Sci. 86: (Suppl. 1) 19.
### Milk production

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Minimal</th>
<th>Moderate</th>
<th>Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>77.0</td>
<td>87.5</td>
<td>88.0</td>
</tr>
<tr>
<td>Winter</td>
<td>85.0</td>
<td>91.0</td>
<td>89.3</td>
</tr>
<tr>
<td>Differ. (kg/d)</td>
<td>7.9c</td>
<td>3.5b</td>
<td>1.3a</td>
</tr>
<tr>
<td>Ratio S:w</td>
<td>90.7%</td>
<td>96.1%</td>
<td>98.5%</td>
</tr>
</tbody>
</table>

Flamenbaum and Ezra, 2003, J. Dairy Sci. 86: (Suppl. 1) 19.
The “Summer to Winter ratio” report

A tool for monitoring on farm cooling efficiency

- An “Excel” program based on “Israeli Herd book” data
- Compares Summer (Jul-Sep) to Winter (Jan-Mar)
- Compares milk production, milk components, milk quality and reproductive traits
- Analyzes each dairy farm annually
- Compares each farm to its “relative group”
- Compares each farm’s results to the previous 4 years
- $S:W$ ratio close or above 1.0, means farm dealing good with summer heat
### Variation in S:W ratio between herds in Israel (Based on herd book data 2008)

<table>
<thead>
<tr>
<th>S:W ratio</th>
<th>No Herds</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.90</td>
<td>209</td>
<td>34%</td>
</tr>
<tr>
<td>0.91 – 0.95</td>
<td>269</td>
<td>44%</td>
</tr>
<tr>
<td>&gt; 0.96</td>
<td>134</td>
<td>22%</td>
</tr>
</tbody>
</table>

Flamenbaum & Ezra 2009, Jerusalem Dairy Conference (in Hebrew)
## Effect of production level on S:W ratios of Milk and CR - 2005

<table>
<thead>
<tr>
<th>Production level</th>
<th>High (25%)</th>
<th>Medium (50%)</th>
<th>Low (25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average winter production (lb/d)</td>
<td>77.5</td>
<td>78.3</td>
<td>77.1</td>
</tr>
<tr>
<td>Average summer production (lb/d)</td>
<td>77.5</td>
<td>72.8</td>
<td>66.4</td>
</tr>
<tr>
<td>Milk ratio</td>
<td>1.00</td>
<td>0.93</td>
<td>0.86</td>
</tr>
<tr>
<td>Winter CR (%)</td>
<td>41</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Summer CR (%)</td>
<td>26</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>CR ratio</td>
<td>0.63</td>
<td>0.51</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Comparison of productive and reproductive traits of High and Low S:W dairy farms

<table>
<thead>
<tr>
<th>S:W milk ratio</th>
<th>Lowest 24</th>
<th>Highest 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter milk production (Kg/d)</td>
<td>86.9</td>
<td>87.3</td>
</tr>
<tr>
<td>Summer milk production (Kg/d)</td>
<td>75.7</td>
<td>85.6</td>
</tr>
<tr>
<td>S:W milk ratio</td>
<td>0.87</td>
<td>0.98</td>
</tr>
<tr>
<td>Conception rate Winter (%)</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>Conception rate Summer (%)</td>
<td>19</td>
<td>27</td>
</tr>
<tr>
<td>Conception rate % S:W ratio</td>
<td>0.53</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Flamenbaum & Ezra - Hoard’s Dairyman - August 10, 2009
Conception rate by month of insemination in intensive and moderately cooled cows in Israel
Intensive cooling cows in summer can increase herd fertility:

- By 10 percentage points, the conception rate of summer inseminated cows
- By 4-5 percentage points, the average annual conception rate
### Average 305d Milk, ECM, Milk fat and Milk protein, for herds with high and low S:W ratio.

<table>
<thead>
<tr>
<th></th>
<th>24 Low S : W ratio</th>
<th>24 High S : W ratio</th>
<th>Difference (lib)</th>
<th>Added production (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (lib)</td>
<td>24,960</td>
<td>26,440</td>
<td>1,480</td>
<td>6.0%</td>
</tr>
<tr>
<td>ECM (lib)</td>
<td>24,380</td>
<td>25,975</td>
<td>1,600</td>
<td>6.5%</td>
</tr>
<tr>
<td>Economical Corrected Milk</td>
<td>24,380</td>
<td>25,975</td>
<td>1,600</td>
<td>6.5%</td>
</tr>
<tr>
<td>Milk fat (lib)</td>
<td>884</td>
<td>946</td>
<td>60</td>
<td>6.8%</td>
</tr>
<tr>
<td>Milk protein (lib)</td>
<td>794</td>
<td>847</td>
<td>54</td>
<td>6.8%</td>
</tr>
</tbody>
</table>

Flamenbaum & Ezra - Hoard’s Dairyman- August 10, 2009
Is it possible obtaining “winter CR” in summer?
### Conception Rate (%) and pregnancy rate (%) of cooled and Non cooled cows in summer

<table>
<thead>
<tr>
<th>Group</th>
<th>Intensively cooled</th>
<th>Non cooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conception Rate (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First AI</td>
<td>59 a</td>
<td>17 b</td>
</tr>
<tr>
<td>All AI</td>
<td>57 a</td>
<td>20 b</td>
</tr>
<tr>
<td>Pregnancy Rate (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 90 d</td>
<td>44 a</td>
<td>14 b</td>
</tr>
<tr>
<td>At 120 d</td>
<td>59 a</td>
<td>31 b</td>
</tr>
<tr>
<td>At 150 d</td>
<td>73 a</td>
<td>31 b</td>
</tr>
</tbody>
</table>

Rectal temperature of intensively cooled and non cooled cows (28 kg/d) in a typical summer day

Figure 4. Daytime changes in rectal temperature (temp) when cows were kept in the shade or kept in the shade and cooled five times per day for 30 min; △, shaded only; ▲, shaded and cooled five times per day.

Journal of Dairy Science Vol. 69, No. 12, 1986

Flamenbaum et al 1986, JDS 69:314
Respiration Rate (RR/min) and Rectal Temperature (RT), C, in 45 kg/d cow in a typical summer day in Israel (30°C, 60% RH)
Effect of ambient temperature on rectal temperature of the high yielding dairy cow

Adapted from Berman et al. 1985

Berman et. Al 1985

66 lib/d cows

110 libg/d cows

?
Lactation curves changed

Does it influence optimal calving intervals?
“Textbook” lactation curve of a dairy cow

Source: Shewfelt and Leblanc 2009
Lactation curves of intensively and moderately cooled cows calving in June and December

Calving in June

Calving in December

Months in lactation

Flamenbaum & Ezra - Hoard’s Dairyman- August 10, 2009
Can hormonal treatments improve cow’s summer fertility?
Hormonal treatments to improve cow’s summer fertility

- Manipulate blood progesterone after insemination to support pregnancy
- GNRH treatment at time of insemination to optimize timing between ovulation to insemination
- Improve egg quality through elimination of aged follicles produced under heat stress
- Implementation of timed AI and embryo transfer technologies
Conclusions (1)

- Although high yields and limiting climatic conditions, Israeli herds obtain relatively fair reproductive results.
- Intensively cooling cows in summer has the potential to completely eliminate the decline in milk production, even in high yielding herds.
Conclusions (2)

- Under experimental conditions, intensive cooling of 66 lb/d cows allowed them maintain normal body temperature during summer days and obtain conception rates similar to the winter.

- Intensive cooling of 110 lb/d cows, did not allow cows maintain normal body temperature throughout the day.

- Cows experienced 5 - 6 “stressful periods” during the day, with body temperatures above normal.
Conclusions (3)

• These “stressful periods” can probably explain why intensively cooling reduces to only an half the summer decline in conception rate.

• It appears that, obtaining “winter conception rates” in summer through intensive cooling the cows, can be achieved only when cows will maintain normal body temperature throughout the entire summer.
Conclusions (4)

- Some hormonal treatments have the potential of improving summer fertility, especially when combined with intensive cooling the cows.

- There is a need for evaluation of optimal “calving interval” of Israeli cows today, due to the change in their persistency.
Cost effectiveness of cooling cows in summer under US actual conditions (August 2009)

- 1000 cows herd
- 22,000 pounds annul production (before cooling implementation)
- Farm gate milk price – 12, 14 and 16 US$ /CWT
- Feed cost - 0.09 US$ per pound DM.
- Cooling expenses per cow/year - 36 US$/
  ( 60 US$/cow for equipment and 30 US$/year for expenses as electric power, water and manpower).
- Economical benefits are due to:
  - Increase milk production
  - Improve feed efficiency
The increase in per cow annual profit (US$), due to intensively cooling the cows in summer

<table>
<thead>
<tr>
<th>Farm gate price (US$/CWT)</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase annual milk production</td>
<td>5%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Improved Feed Efficiency</td>
<td>5%</td>
<td>80</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>110</td>
<td>200</td>
</tr>
</tbody>
</table>
Thank you

Israele Cheeses

Questions ?