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

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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 ^{o} F and 72-77^{o} F respectively. Max. and Min. daily RH 80 % and 50% respectively.
- Winter (December – March) – Moderately cool (rainy). Max. and Min. daily Temp. 64^{0} F and 45^{0} F respectively.

Israeli Dairy Farming System

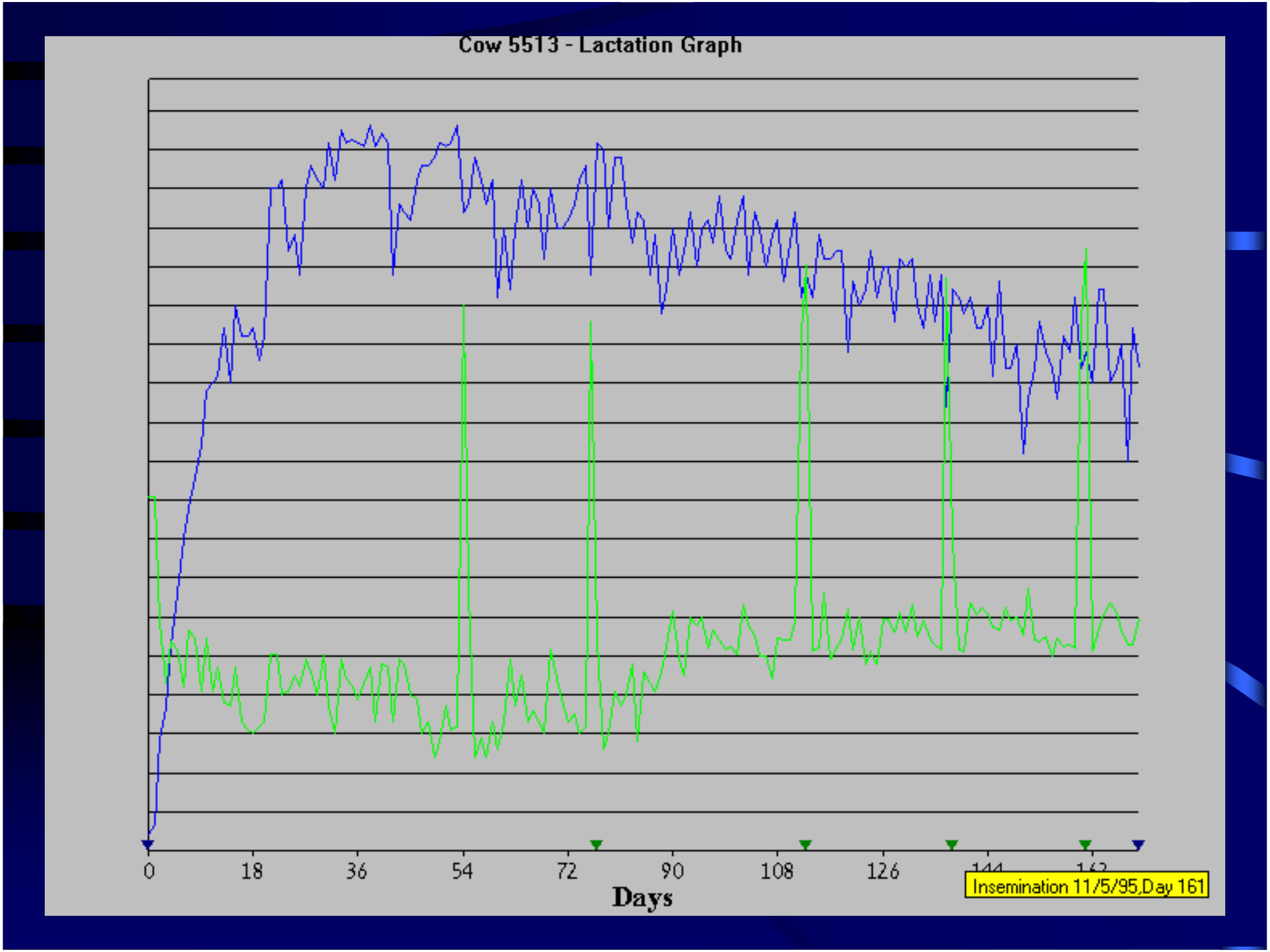
- 115,000 *Israeli-Holstein*-breed cows
- 1,000 dairy farms
- Farms distributed mostly in the coast and in the hot valleys
- DHI data 2008 (90% of the Israel dairy herd):
  - 11,460 kg (305 d), 25,200 lb.
  - 3.71% fat
  - 3.20% protein

Characteristics of Israeli dairy sector

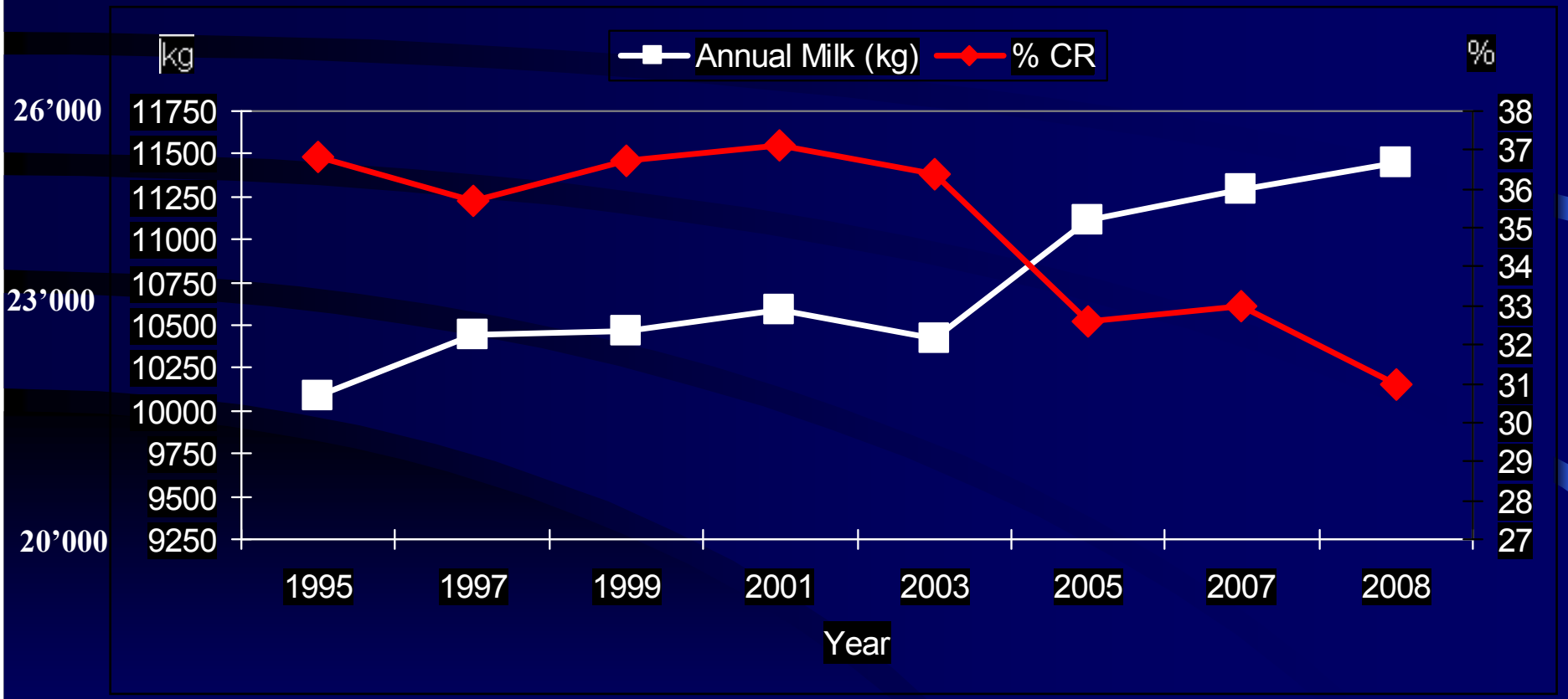
- Cows in total confinement in open shelters (80% “loose house” and 30% “free stalls”)
- Relatively large herds
- TMR as dominant feeding system
- Diets low in roughage, high in by products
- Intensive control of health, productive and reproductive traits
- Intensive use of cooling systems to overcome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


Cow 5513 - Lactation Graph
0
18
36
54
72
90
108
126
Days
Insemination 11/5/95,Day 161

Trends in milk production and conception rate in the Israeli herd 1995 - 2008

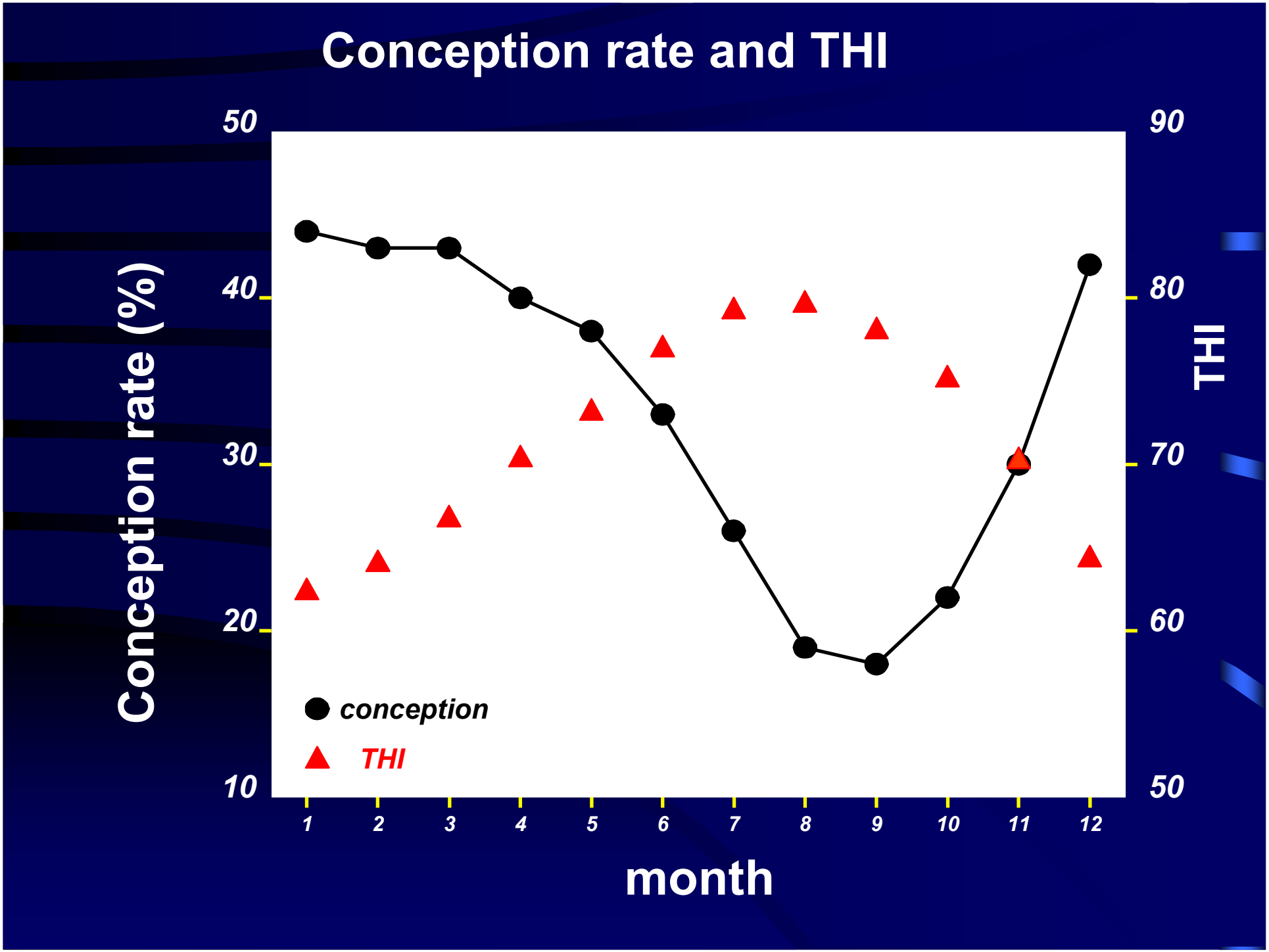


High productivity does not impair conception rate

	Lowest third	Highest third
Mean 305 d yield, Lb.	**25,300**	**29,800**
% pregnant to first **AI**	**32.9**	**34.5**
% open >150 **DIM**	**38.6**	**38.7**

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

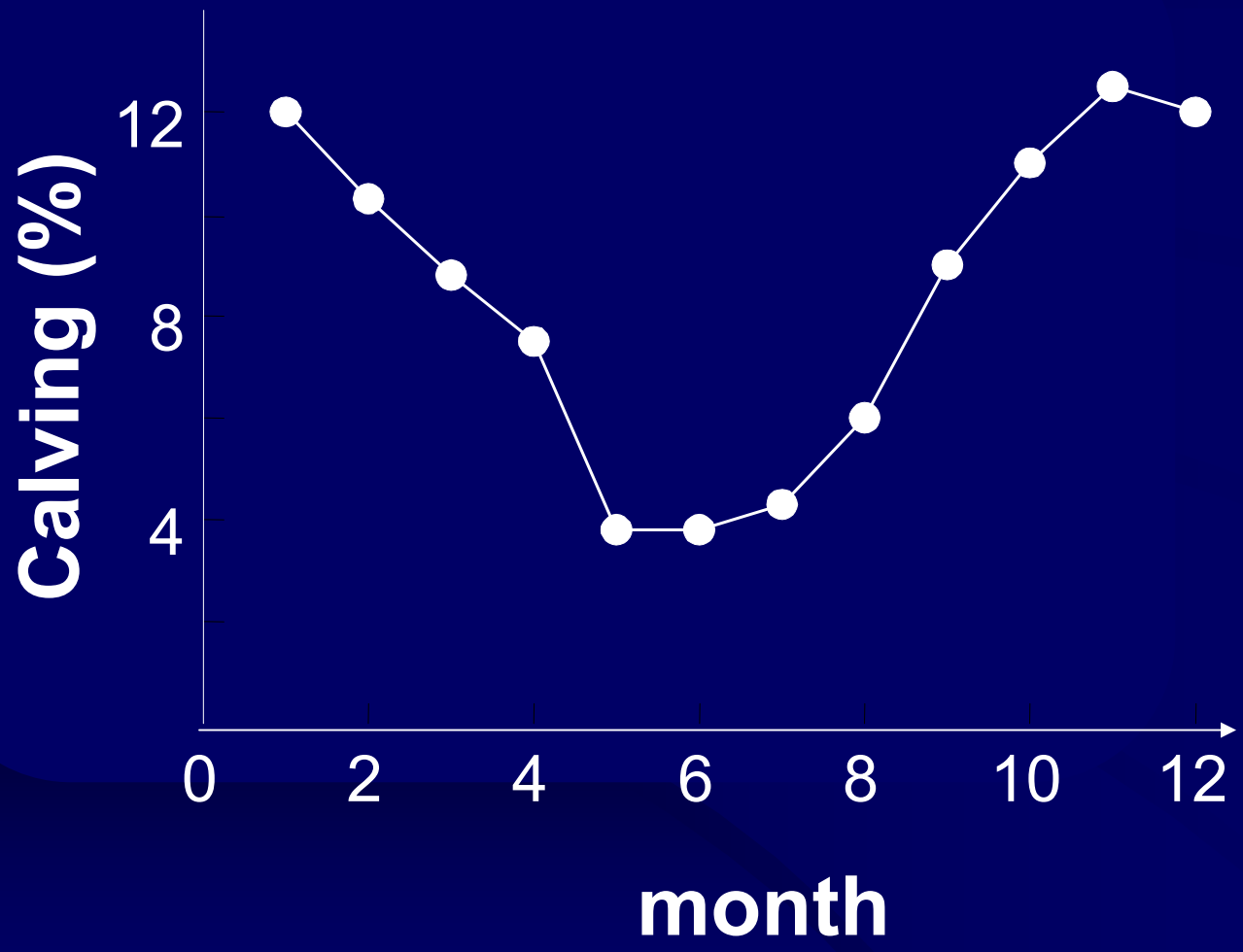
Oded Nir 2009, Hachaklait


Conception rate and THI
Conception rate (%)
50
40
30
20
10
90
80
70
60
50
THI
conception
THI
1
2
3
4
5
6
7
8
9
10
11
12
month

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



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

Conception rate - Adult Cows (inseminations)

Treatment	Minimal	Moderate	Intensive
Summer	16.7 c (222)	34.5 b (172)	33.8 b (572)
Winter	43.5 a (618)	45.8 a (267)	46.6 a (684)

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

Milk production

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

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 I Israel (Based on herd book data 2008)

S:W ratio	No Herds	%
< 0.90	209	34%
0.91 – 0.95	269	44%
> 0.96	134	22%

Flamenbaum & Ezra 2009, Jerusalem Dairy Conference (in Hebrew)

Effect of production level on S:W ratios of Milk and CR - 2005

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

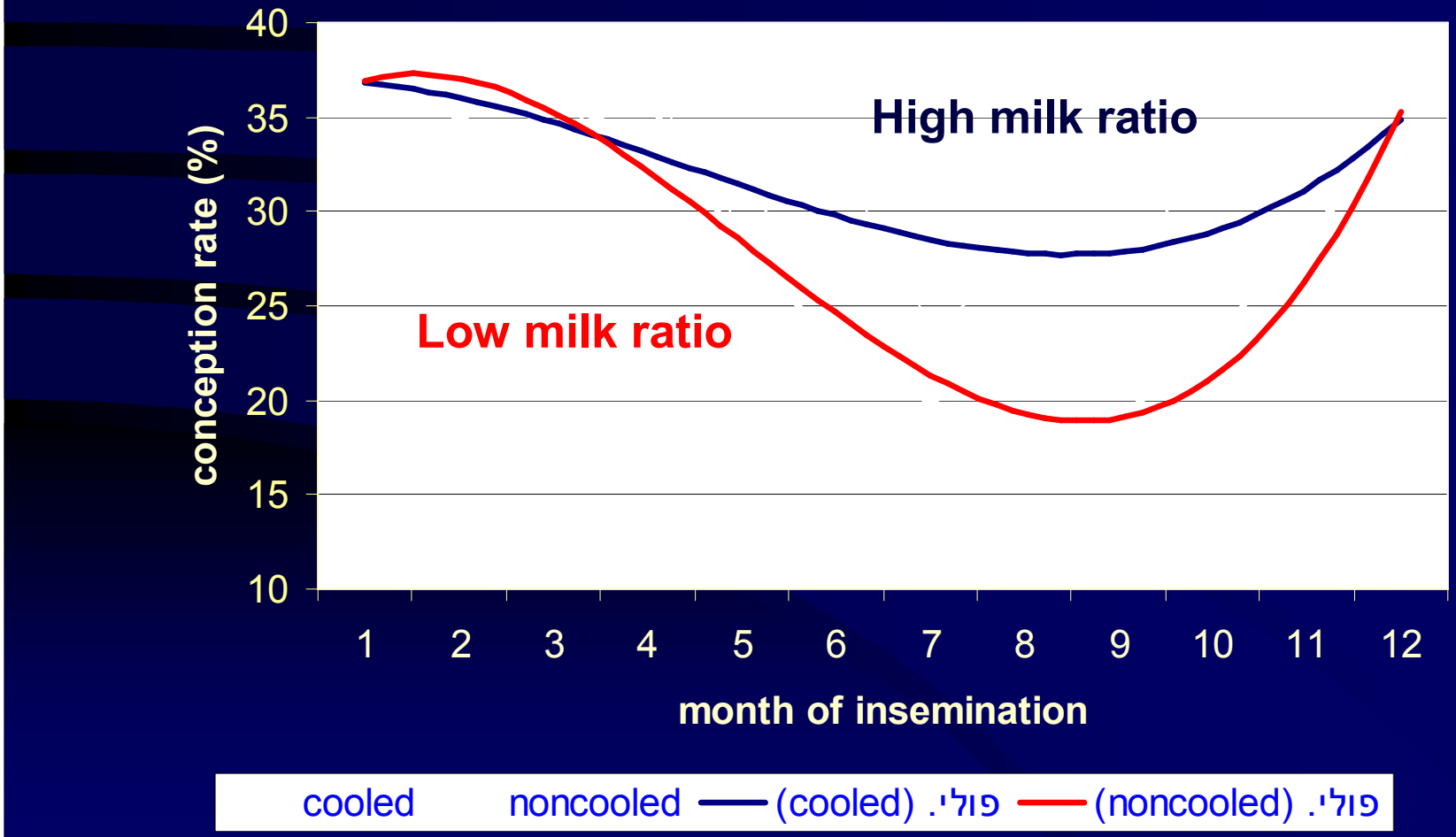
Flamenbaum & Ezra (2007), J. Dairy Sci. Vol. 90, (Suppl. 1): 753

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

S:W milk ratio	Lowest 24	Highest 24
Winter milk production (Kg/d)	86.9	87.3
Summer milk production (Kg/d)	75.7	85.6
S:W milk ratio	0.87	0.98
Conception rate Winter (%)	36	40
Conception rate Summer (%)	19	27
Conception rate % S:W ratio	0.53	0.68

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.

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

Flamenbaum & Ezra - Hoard's Dairyman- August 10, 2009

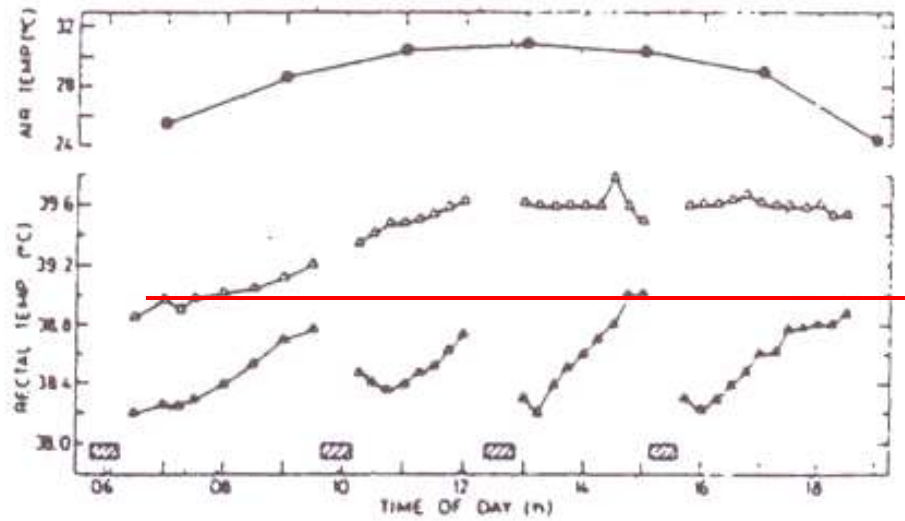
Is it possible obtaining “winter CR” in summer ?

Conception Rate (%) and pregnancy rate (%) of cooled and Non cooled cows in summer

Group	Intensively cooled	Non cooled
Conception Rate (%)		
First AI	59 a	17 b
All AI	57 a	20 b
Pregnancy Rate (%)		
At 90 d	44 a	14 b
At 120 d	59 a	31 b
At 150 d	73 a	31 b

Wolfenson et al, JDS 71:3497 (1988)

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



39 C

102.2 F

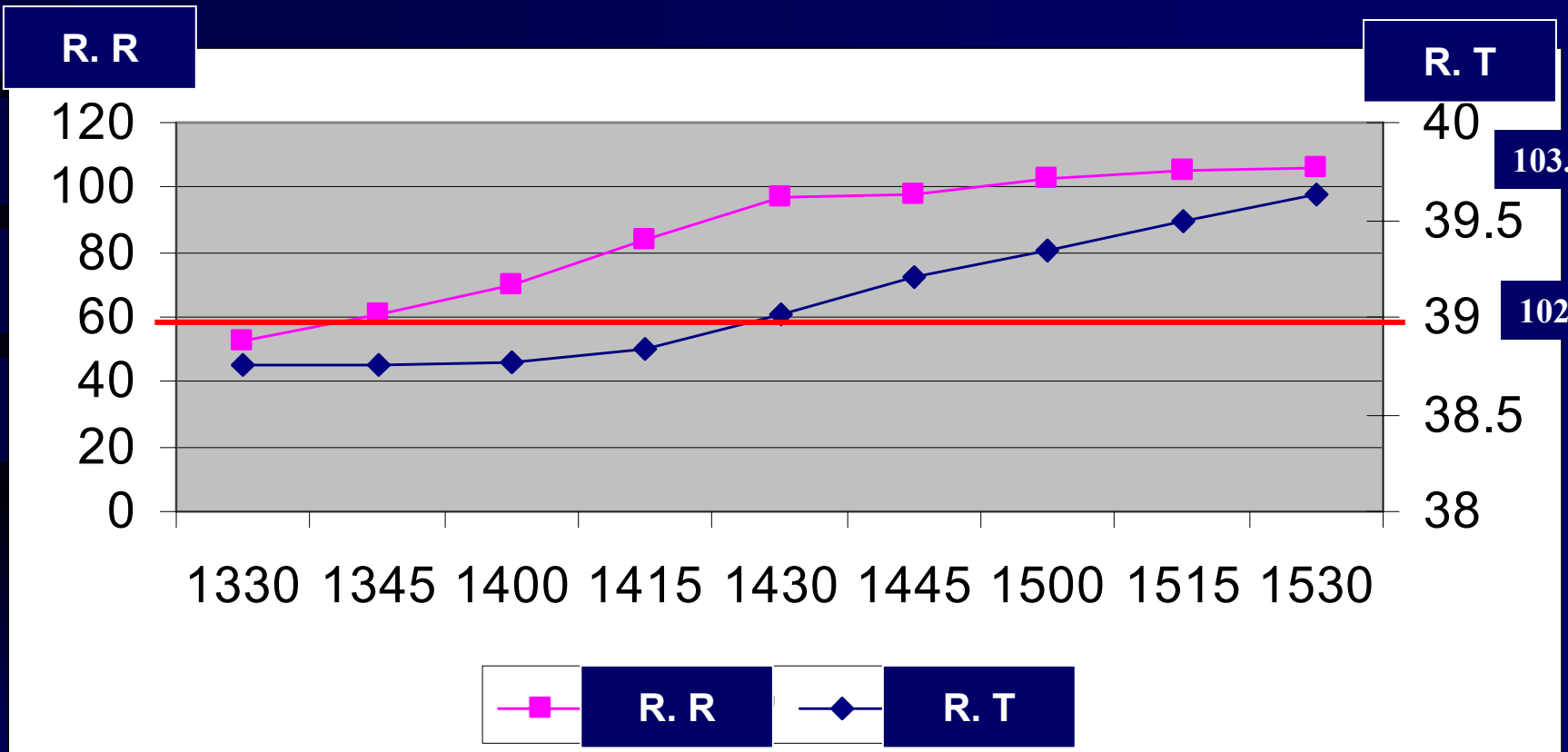
Figure 4. Daytime changes in rectal temperature (temp) when cows were kept in the shade or kept in the shade and cooled five times per day for 30 min; △, shaded only; ▲, shaded and cooled five times per day.

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

Flamenbaum et al 1986, JDS 69:314

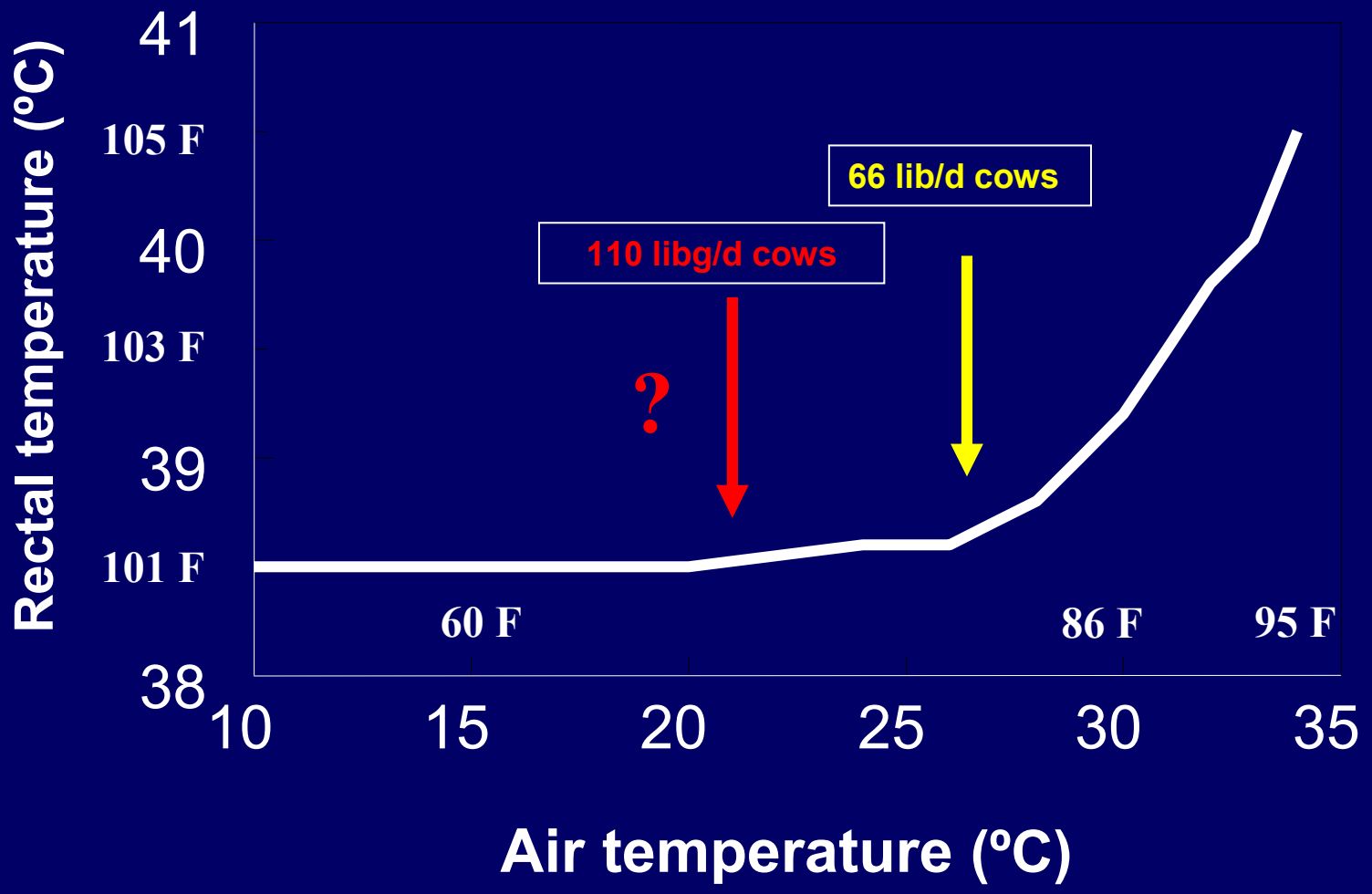
Respiration Rate (RR/min) and Rectal Temperature (RT),C, in 45 kg/d cow in a typical summer day in Israel

(30C, 60% RH)



Effect of ambient temperature on rectal temperature

Of the high yielding dairy cow

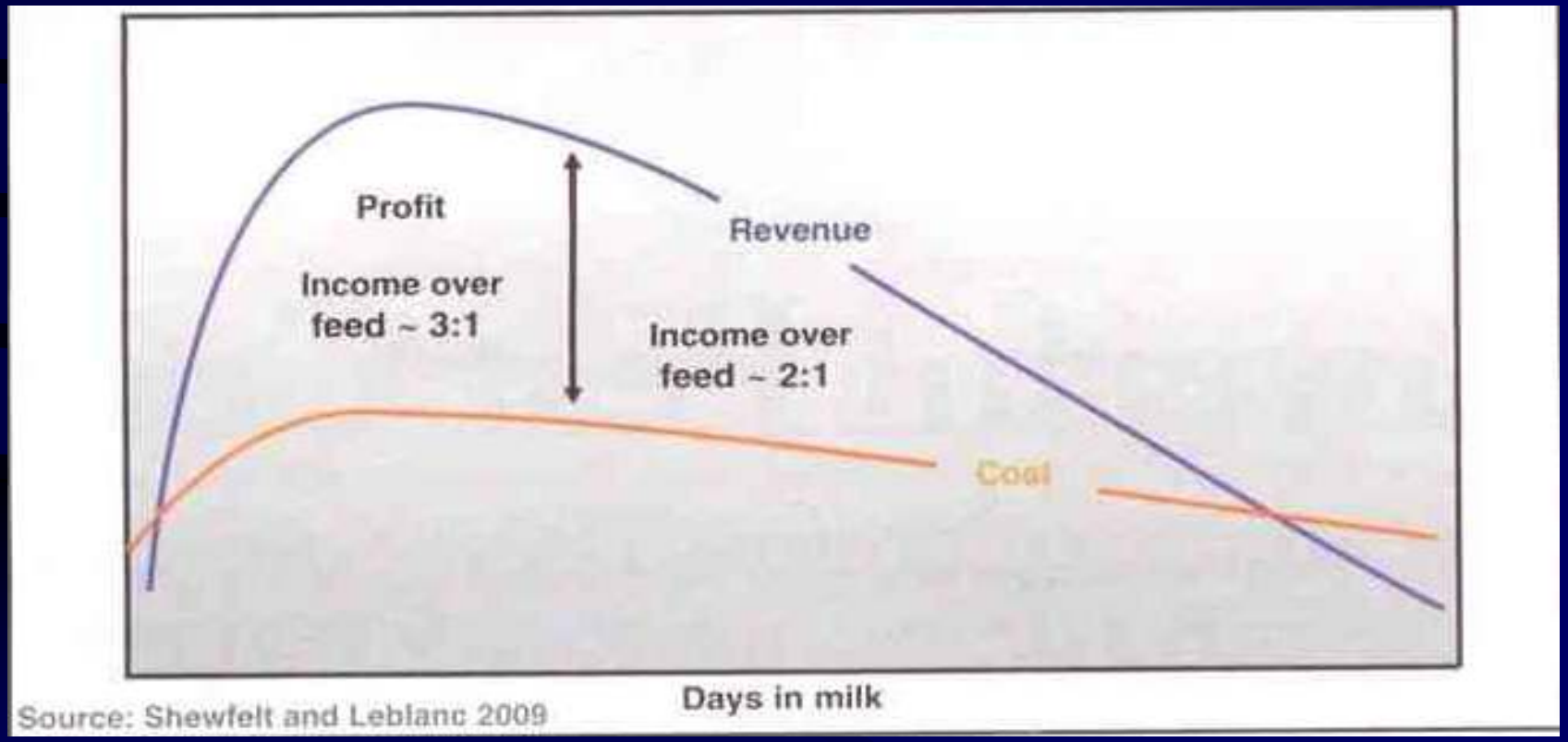


Berman et. Al 1985

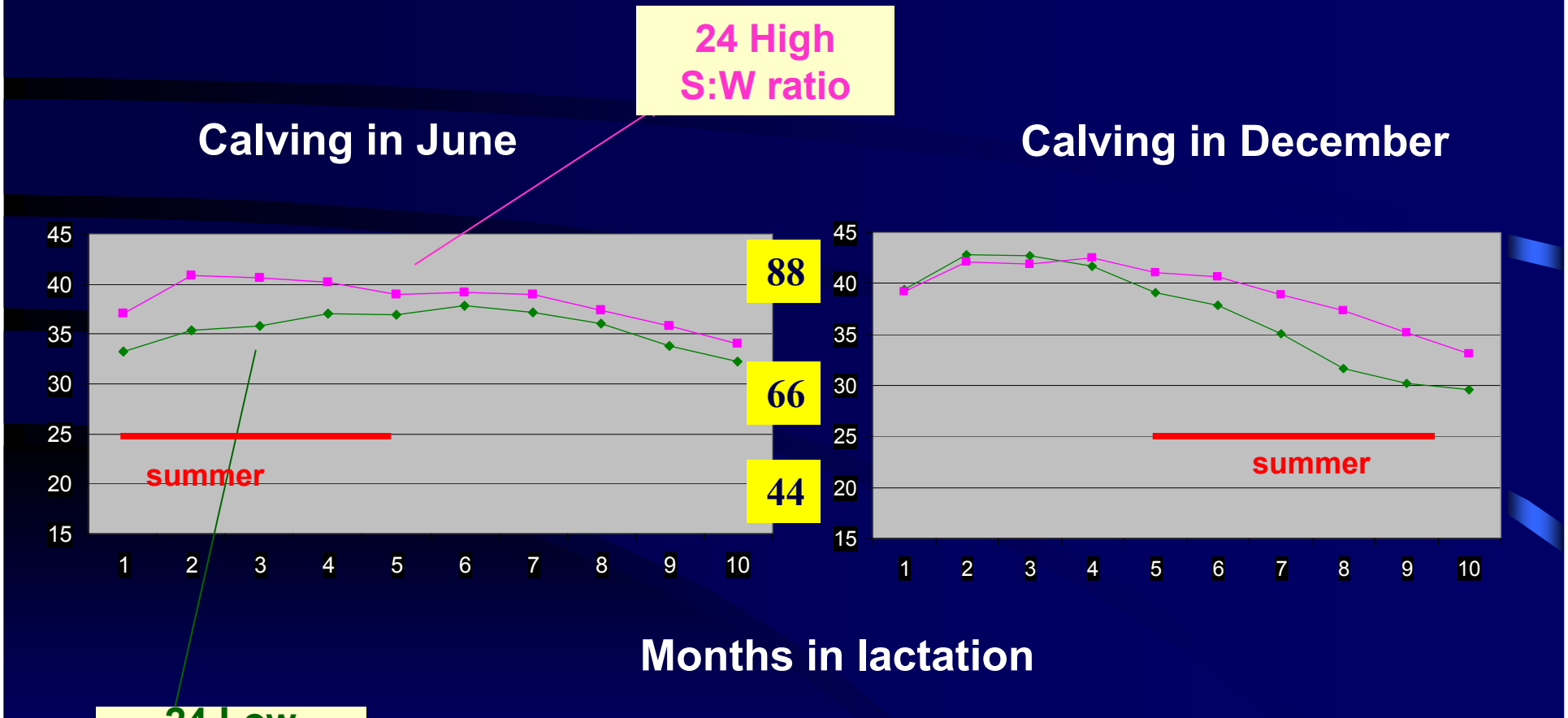
Lactation curves changed

Does it influence optimal calving intervals ?

“Textbook” lactation curve of a dairy cow



Lactation curves of intensively and moderately cooled cows calving in June and December



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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

Farm gate price (US$/CWT) →		12		14		16	
Increase annual milk production		5%	10%	5%	10%	5%	10%
Improved Feed Efficiency	5%	80	170	100	200	120	250
	10%	110	200	130	230	150	280

Thank you

Questions ?