

What Dairy Managers Need to Know About Heat Stress

Dennis V. Armstrong
Department of Animal Sciences
University of Arizona
Tucson, Arizona

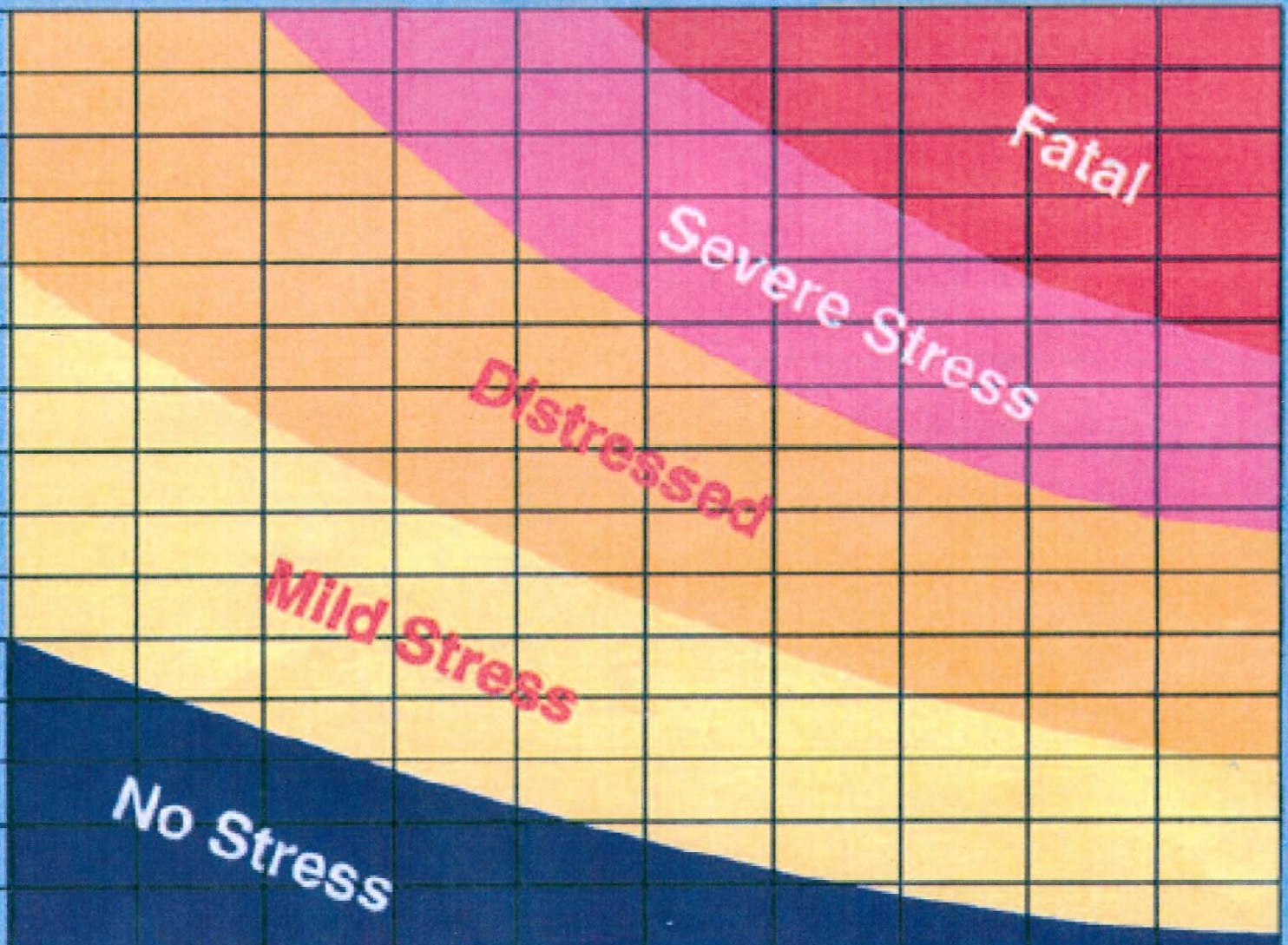




We know that dairy cattle have become more heat sensitive as average milk yield has increased.

F °C

16 46.7
13 45.0
10 43.3
07 41.7
04 40.0
01 38.3
3 36.7
5 35.0
2 33.3
9 31.7
6 30.0
3 28.3
0 26.7
7 25.0
4 23.3
1 21.7



**We know that heat stress is a major
cause of production losses in the dairy
industry**

- Milk**
- Reproduction**
- Replacement cost**

We know that dairy cattle have become more heat sensitive as average milk yield has increased.

Production and Heat Output

Since 1950, heat production per cow has increased an average of 30 MJ or 28,000 Btu/day in the Holstein breed

This requires reevaluating the relationship between ambient temperature, milk yield and thermal stress level in cattle

We believe that current estimates of heat load, such as the Temperature Humidity Index (THI), are underestimating the effects of heat stress on dairy cattle

Current management strategies do not sufficiently address the acute phase of the heat stress response in cattle.

We know that acclimation to heat stress is composed of acute and chronic stages but we know very little about the regulation of those stages

Acclimation is Biphasic

Short term heat acclimation
(STHA)

Long term heat acclimation
(LTHA)

How is metabolism
integrated?

Missouri Study

48 lb of milk per day had an average
BTU of 4900 per hour

72 lb of milk per day had an average
BTU of 6400 per hour

100-150 lb of milk per day average ???

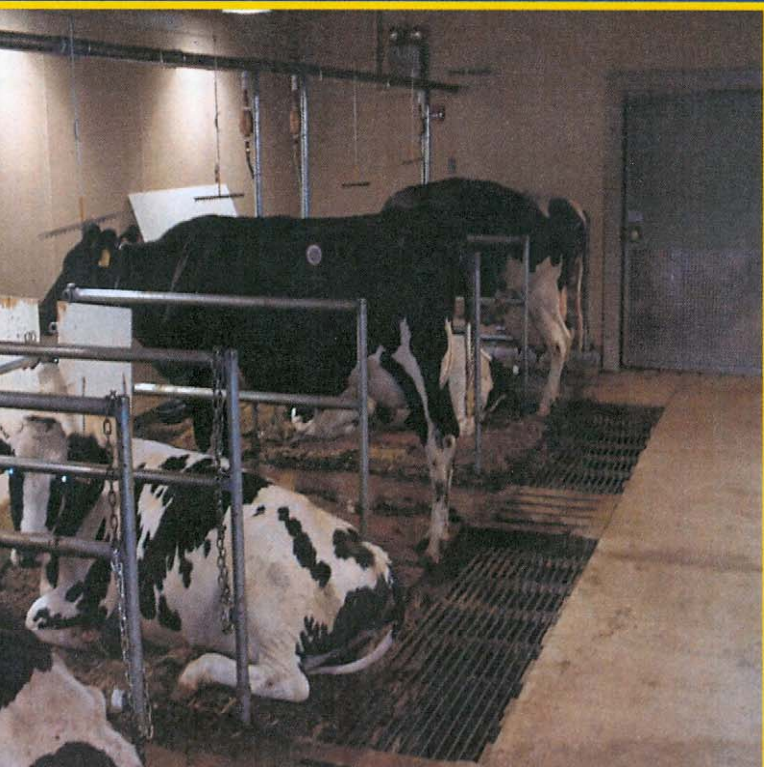
Dr. Berman

Hebrew University – Israel

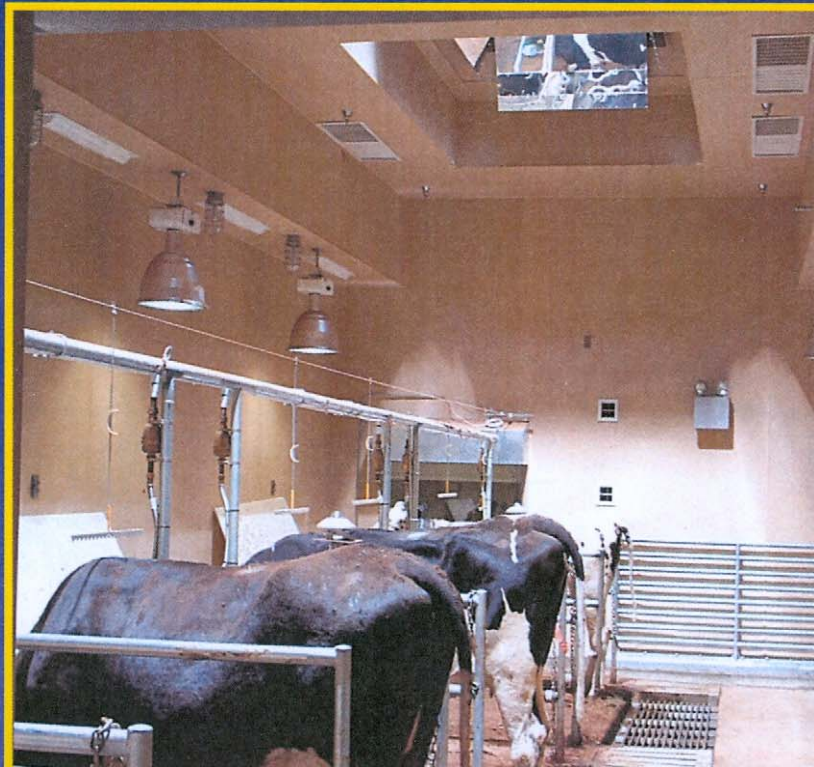
Cows producing over 99 lb of milk per day have a higher thermal stress of 9°F when compared to 77 lb cows.

Environmental/Metabolic Chambers

Heat Stress



Heat Stress + Solar Radiation



**When do you need to cool
heat-stressed cows?**

**When there are 24-48 hours of stress
above THI 72?**

**When there are more than 8-9 hours per
day above THI 72?**

Management Strategies



Minimize heat gain
Maximize heat loss

We do not yet understand regulating controls of insensible heat loss during thermal stress of cattle



Acclimation

Understanding metabolic integration
during acclimation to thermal stress
has high potential return on investment

Somatotropin, Prolactin, Thyroid
hormones, Mineralcorticoids,
Glucocorticoids and possibly Insulin
are involved

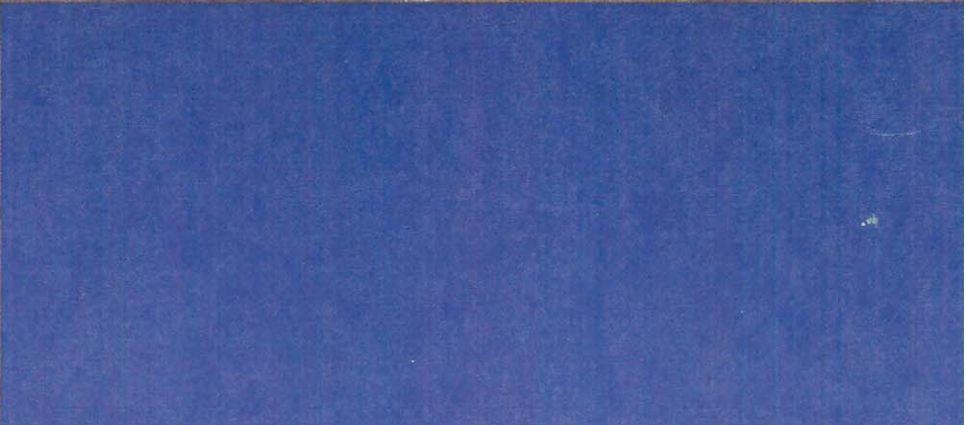
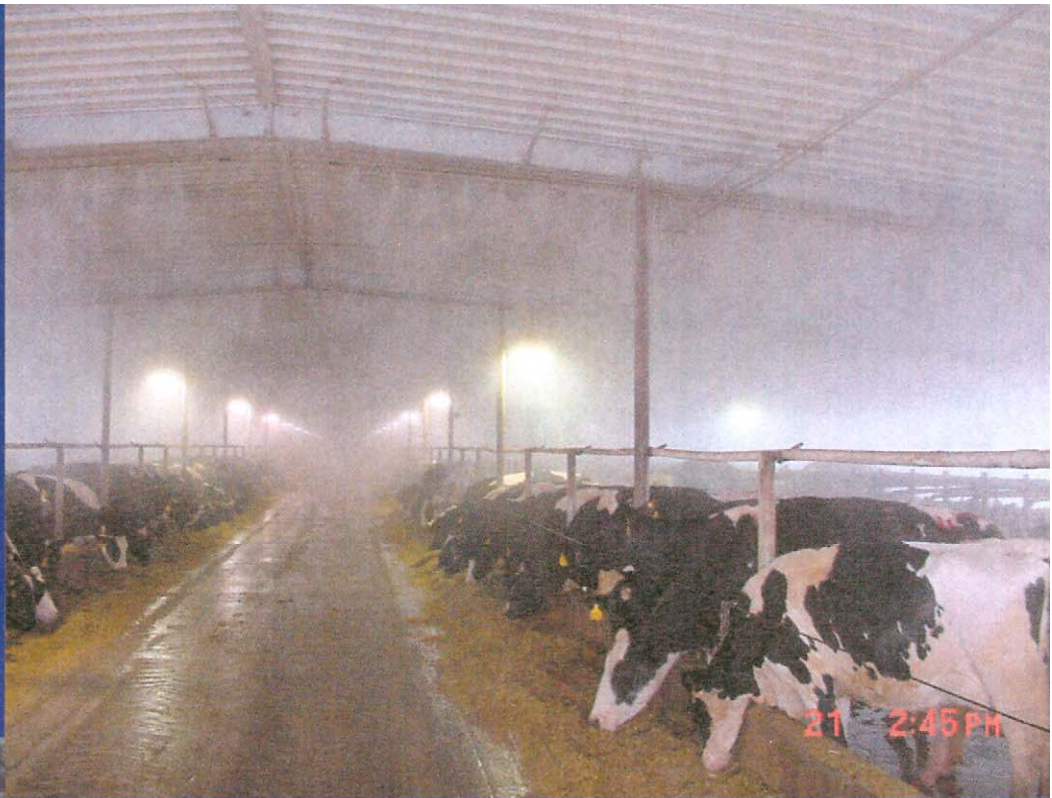
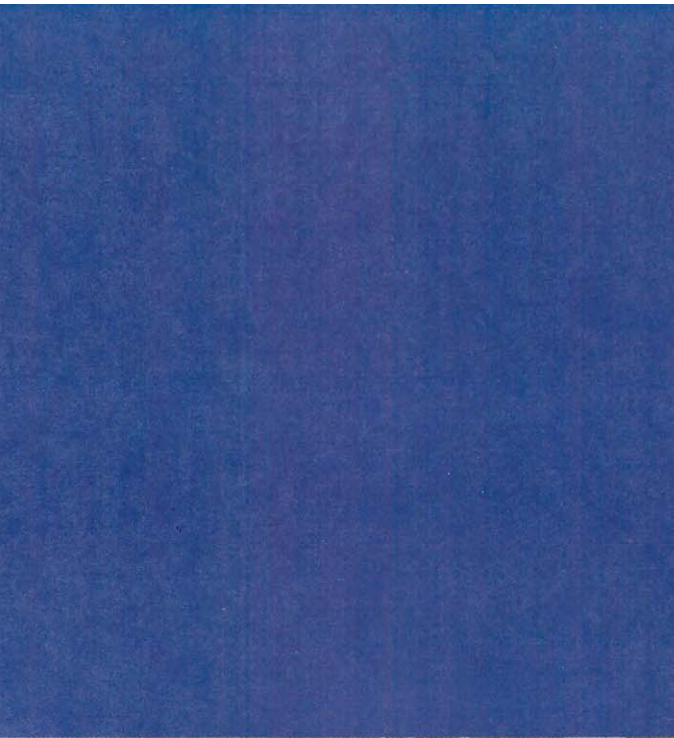
**If you can see your shadow,
spend more money!!!**





Exit Lane Soakers



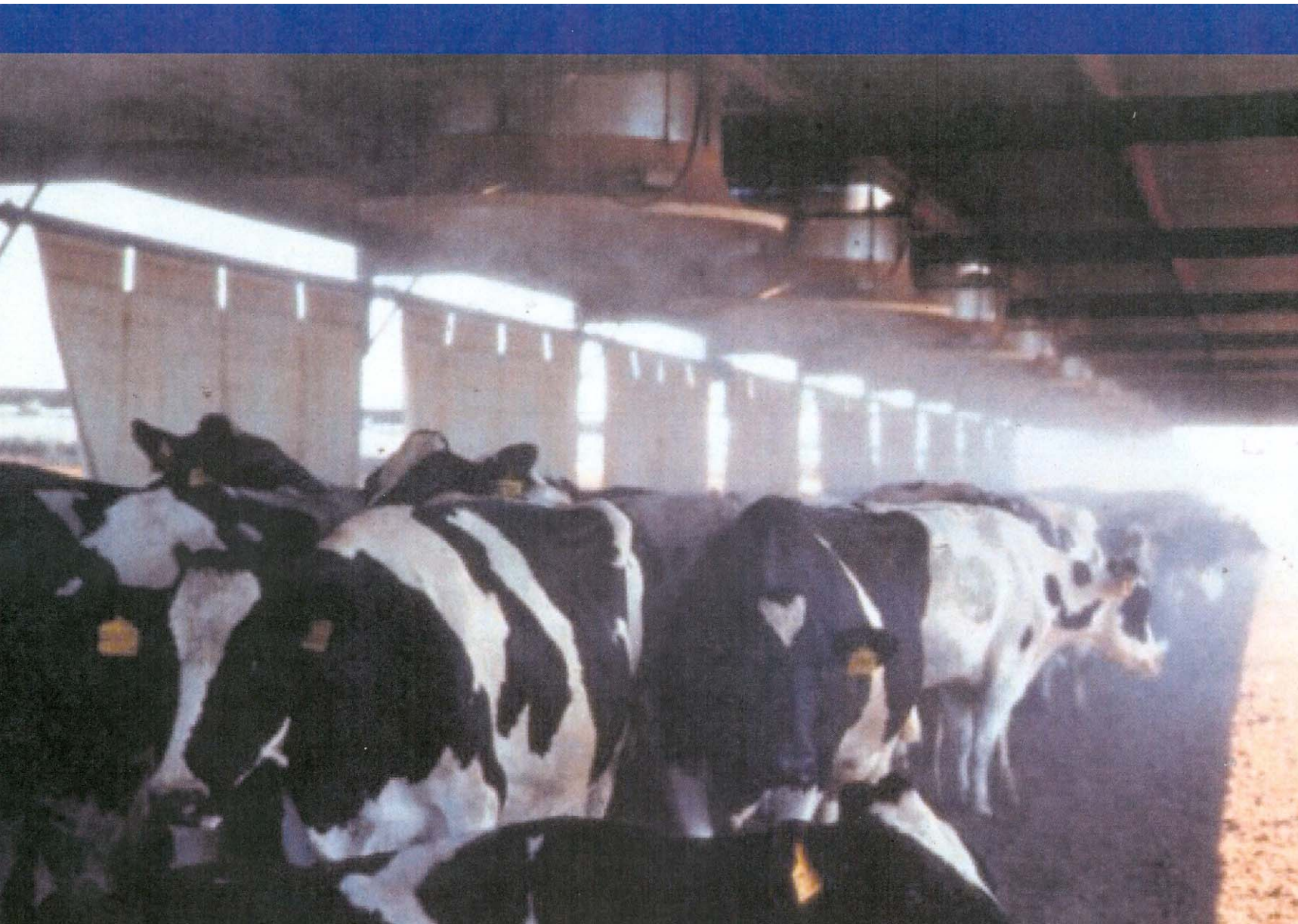


Desert Dairy Industry (Saudi Arabia)

Herd size – 40,000+

– Milk sold per cow per year

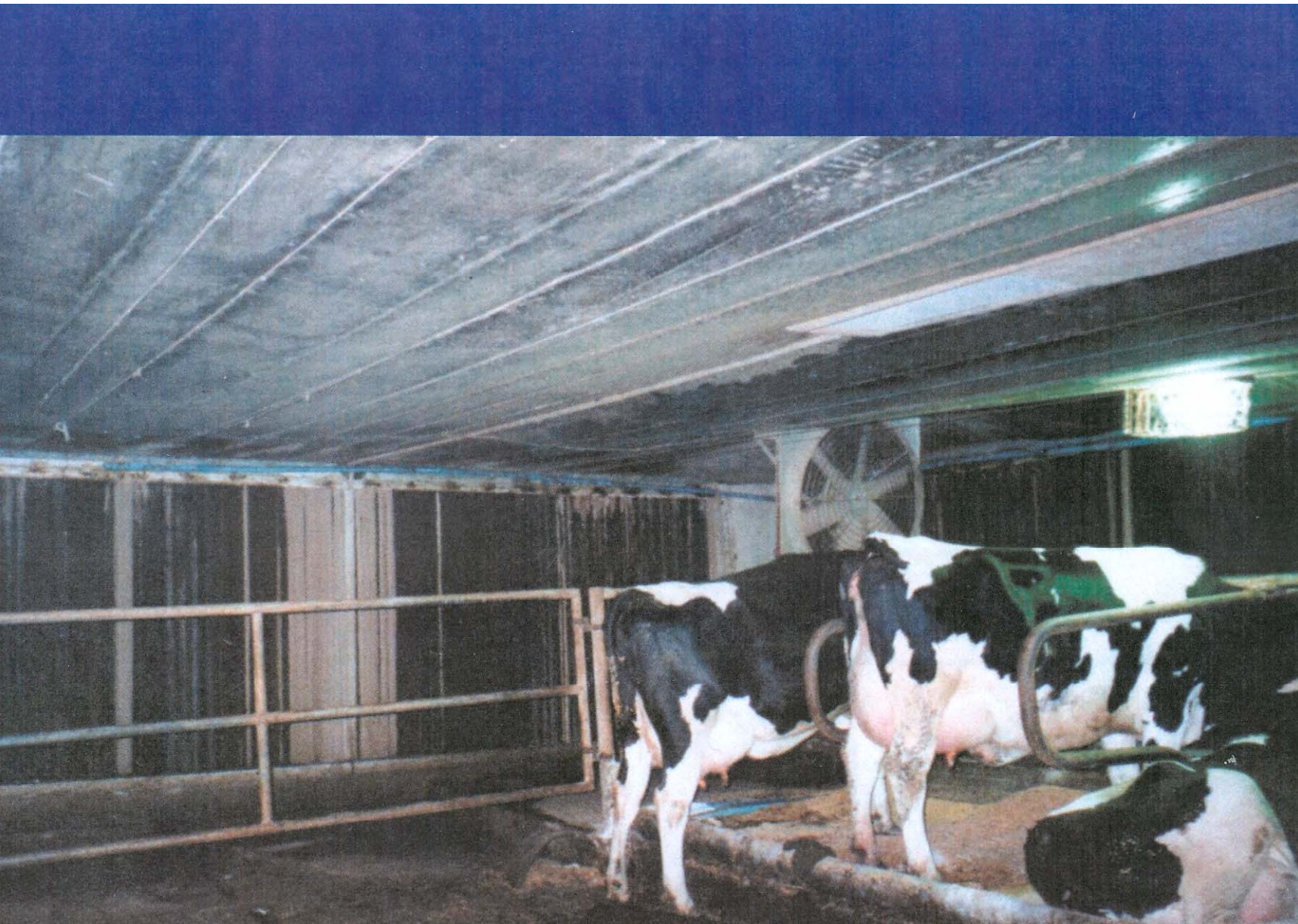
- 1998 – 22,000**
- 2005 – 29,000**



Tropical Dairy Industry (Thailand)

Peak milk yields over 100 lb per day

Calving interval of 13.8 months



**2005 University of Arizona/
Kansas State University/
Monsanto Trial**

40 Dairy Farms in 24 States

**Looked at cooling methods and thermal
heat stress on dry and lactating cows**

2005 University of Arizona/ Kansas State University/ Monsanto Trial

Results:

- Shaded cows produced more milk and remained cooler than non-shaded cows.**

2005 University of Arizona/ Kansas State University/ Monsanto Trial

Results:

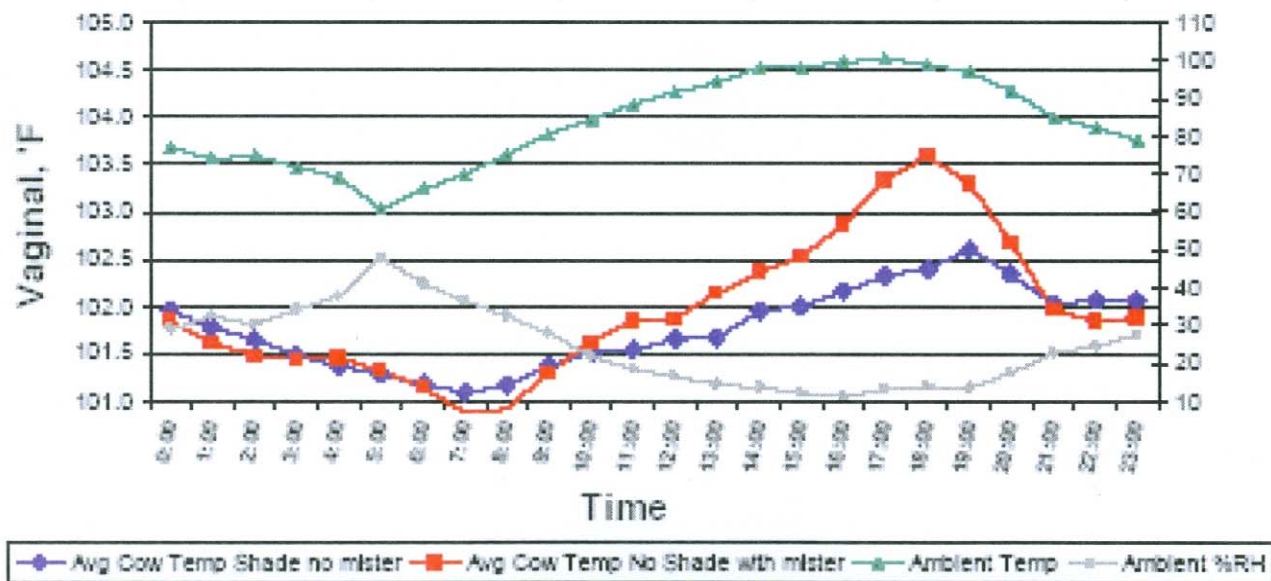
- Shade alone maintained lower body temperatures than misters alone.**

2005 University of Arizona/ Kansas State University/ Monsanto Trial

Washington

Compare Dry Cow Open Lot
8/4/05-8/7/05

No Misters with Shades
With Misters, No Shades



2005 University of Arizona/ Kansas State University/ Monsanto Trial

Results:

- Soakers on the exit lane from the parlor extends cooling benefit of parlor cooling.**

2005 University of Arizona/ Kansas State University/ Monsanto Trial

Results:

- There is a benefit of holding pen cooling if the system is properly installed, maintained and operated**

Nutritional Management of Heat Stress

Increase slightly NDF & ADF to minimize risk of ruminal acidosis

Addition of fat in high fiber diets

Clean water below 85°F

Feed in the early morning or late evening hours because peak heat production in cows occurs 3-4 hours

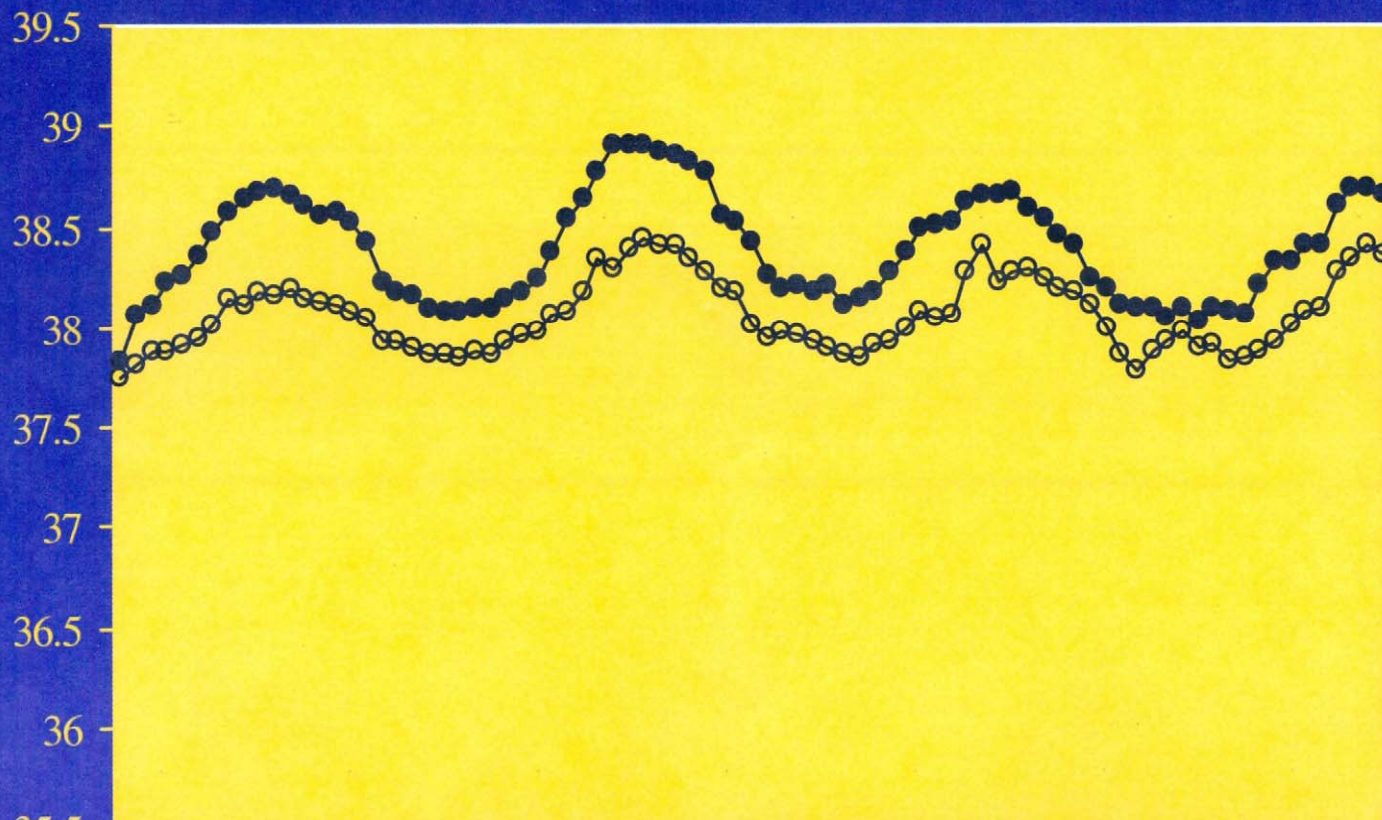
Treatments

Twelve multiparous Holstein cows producing an average of 31 kg/d and balanced for parity and stage of lactation were randomly assigned to either 0 g encapsulated niacin/d (C) or 12 g niacin/d (NASHURE™®) (Trt) and were exposed to environmental temperature patterns.

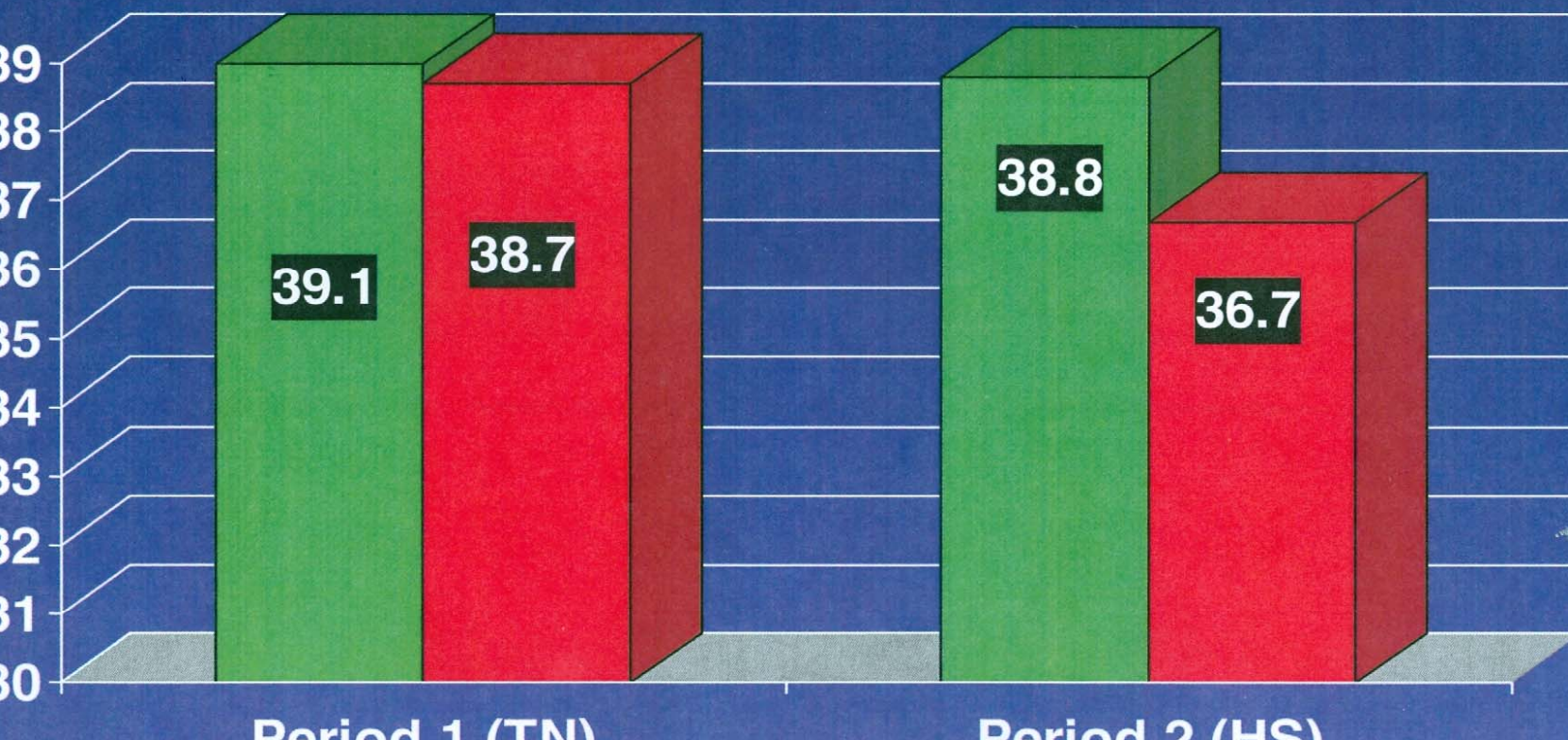
Trt 1-THI never exceeded 72

Trt 2-THI exceeded 72 12 hours per day

Effect of Niacin (NIASHURE) on Vaginal Temperature in Lactating Dairy Cattle Subjected to Acute Heat Stress



Crude Fiber Intakes for Cows During Periods 1 and 2



Average Daily Milk Yield for Cows During Period 1 and 2

Control Trt

