Texas Dairy Matters

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Understand and Prevent Heat Stress in your Dairy Cattle

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Economic losses due to heat stress are estimated to be $900 million in the US dairy industry. These losses are due to reduced milk yield, decreased reproductive performance and increased culling[1]. Heat stress occurs when ambient temperatures and relative humidity (RH) increase above a certain limit making cows adapt by dissipating the excess body heat through sweating, panting, and through other mechanisms.

Heat stress in cattle is determined though the Temperature Humidity Index (THI). This index combines both ambient temperature and RH. Relative humidity is a key factor in the index formula since an environment with higher relative humidity will decrease the body heat loss of cattle through sweating. This occurs because the air might be already saturated with moisture, thus decreasing evaporation of the animal's sweat.

Milking cows experience heat stress and reduced performance at a THI $\geq$ 68. This would be equivalent to 78°F and 10% RH, or 72°F and 50% RH (Figure 1). However, there is variability in the susceptibility of cattle to heat stress. This occurs because there is variation in the amount of heat individual cows produce and dissipate. This variation depends on breed, genetics, level of production, and other factors.

Dairy Cattle Adaptations to Heat Stress: Cattle have a lower capacity to exchange heat via sweating compared with other species (e.g., horses). However, sweating is still a major mechanism to regulate body temperature and dissipate excess heat in cattle. Increased number of sweat glands, short hair, greater surface area (e.g., dewlap region of Bos indicus cattle) allow for greater body heat loss[2].

Research from Florida state showed that Holstein cattle carrying the SLICK gene are more tolerant to heat stress. These animals have a short, sleek hair coat and increased sweating

rate during times of heat stress. This results in lower respiration rate and lower vaginal and rectal temperature compared to cattle with normal hair coat. In addition, cows with the SLICK trait have a smaller decrease in milk production during heat stress compared to other cows.

Increased sweating and panting during heat stress results in increased loss of body fluids. This leads to increased water intake from cattle. During summer lactating cows can increase their water intake from 18 to over 25 gallons a day. Therefore, the importance of available fresh water for cattle during summer cannot be underestimated.

Impact on Cattle Performance and Welfare: During summer, embryo mortality increases and conception rate decreases. As a result, the pregnancy rate of the herd will considerably decrease. Milk yield could decrease over 20% in severe cases. Heat stressed cows spent more time standing which increases the risk for hoof diseases and lameness. Heat stress is considered to be an animal welfare concern in cattle. Besides the impact on cattle health, it results in modifications of cattle behavior:

- Increased water intake.
- Shifting feed intake to cooler periods.
- Increased standing time.
- Shade seeking.
- Decreased activity and movement[3].

Temperature (°F)	% Relative Humidity									
	0	10	20	30	40	50	60	70	80	90
72	64	65	66	67	67	68	69	70	70	71
74	65	66	67	68	69	70	70	71	72	73
76	66	67	68	69	70	71	72	73	74	75
78	67	68	69	70	71	73	74	75	76	77
80	68	69	70	72	73	74	75	76	78	79
82	69	70	71	73	74	75	77	78	79	81
84	70	71	73	74	75	77	78	80	81	83
86	71	72	74	75	77	78	80	81	83	84
88	72	73	75	76	78	80	81	83	85	86
90	72	74	76	78	79	81	83	85	86	88
92	73	75	77	79	81	83	85	86	88	90
94	74	76	78	80	82	84	86	88	90	92
96	75	77	79	81	83	86	88	90	92	94
98	76	78	80	83	85	87	89	91	94	96
100	77	79	82	84	86	88	91	93	95	98
102	78	80	83	85	87	90	92	95	97	100
104	79	81	84	86	89	91	94	96	99	101
106	80	82	85	88	90	93	95	98	101	103

Figure 1. Representation of the THI at which cattle experience mild to moderate (orange); moderate-severe (red); and severe (purple) heat stress.

Signs of heat stress in cattle

Mild-moderate: THI of 70-79. Cows increase respiration rate over 60 breaths/minute (BPM).

Moderate-severe: THI 80-89. Cows have >104°F of rectal temperature and >85 BPM.

Severe heat stress: THI >90. Cows have rectal temperature >106 °F and >120 BPM.

PREVENTION

Remember the principles of heat transfer: radiation, evaporation, convection and conduction. Bearing in mind these principles, herdsman can prevent heat stress:

1) Radiation: heat transferred through infrared rays. Minimize exposure to solar radiation.

2) Evaporation: conversion of water to gas. E.g., soaking cattle and letting water evaporate.

3) Convection: losing heat through air movement. E.g., use of fans.

4) Conduction: physical contact with another object. E.g., contact with cool water.

Recommendations for shades, sprinklers, and fans: Provide shade and enough drinking water to all milking cows, dry cows, and heifers. In dry lot pens, the orientation of the shades should be from north to south to allow the sun to dry up the surface. Provide between 38-48 square feet of solid shade (steel or aluminum) at a height >12 feet. Daily grooming is necessary to dry up the surface and stimulate cows to lie down.

For free-stall barns the orientation should be east/west to take advantage of the prevailing winds from the south. Clean your fans before summer begins to increase efficiency and orient them on a 30-degree angle towards the floor. Fans should provide appropriate air movement around cows at the feedbunk but especially in the stalls. Cows cannot dissipate heat as well when they are lying down compared to standing.

Use the combined effect of fans and soaking your cattle while they are waiting in the holding pen to be milked. When the ambient temperature is >87 °F soakers should be activated every 5 minutes. Providing appropriate heat abatement in the milking parlor helps your cows and employees.

References:

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