The Northeast Center for Risk Management Education

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College of Agricultural Sciences

Cooperative Extension Lancaster County

HEAT-STRESS IN DAIRY CATTLE

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Cow Comfort Zone:

1. The most comfortable range for milk production is 41 to 77 degrees Fahrenheit (see Table 2).

Causes of Increased Heat Load in Dairy Cattle:

1. Cow activity, digestion and other metabolic functions increase cows body temperature.
2. Air temperature. Increased humidity and lack of air movement intensify the problem because they reduce cows' ability to evaporate moisture and cool off (see Table 1).
3. Solar radiation. Dark cows absorb about twice as much heat as light-colored cows.

Effect of Heat Stress on Dairy Cows:

1. High producing cows are more sensitive to heat than low-producing and non-lactating cattle.
2. Increased respiration rates and panting. This increases cows' nutrient needs (see Table 2).
3. Increased loss of body fluids and minerals due to increased sweating, salivation and urination. Potassium losses increase with sweating. Sodium losses increase with urination.
4. Reduced rate of feed passage and gut motility, which reduces feed intake (see Table 2).
5. Reduced volatile fatty acid (VFA) production in the rumen, which triggers lower fat tests.
6. More acid rumen.
7. Blood flow to the skin is increased to help dissipate body heat with a resultant decrease in blood flow to internal organisms. This reduces milk secretion and decreases the absorption and transport of feed nutrients.
8. Increase body temperature, as measured by rectal temperatures.
9. Excessive body heat can damage the ovum, the embryo and sperm. High uterine temperatures can interfere with embryo implantation and trigger early embryonic death.
10. Heat stress in the last trimester of pregnancy contributes to lighter birth weights, reduced vigor in newborn calves, increased calving difficulties and all its related problems, plus a significant loss of milk production in the subsequent lactation. Thus, it is beneficial to also reduce heat stress on dry cows and late-bred heifers.
11. Lower immune response. Cows are less able to fight off mastitis and other infections.
12. Heat stroke and death in severe cases (see Table 1).

How Cows Dissipate Excess Body Heat:

1. Evaporation of body moisture is the major method (sweating, panting and saliva production, wetting by rain or sprinkling). Breezes and low humidity increase the rate of evaporation.
2. Radiation, or the emission of heat from a warm body. Blood flow to the skin is increased so more body heat can escape. Shade protects cows from radiant heat.

How Cows Dissipate Excess Body Heat (continued):

3. Convection. Breezes breakup and remove the blanket of warm air surrounding the body.
4. Conduction. Body heat is transferred to colder objects by direct contact (ie. cold rest area).

How Cows React to Heat Stress:

1. Seek shade and breezes, and opportunities to become wet, and to lie down in wet areas.
2. Reduced activity. Reluctance to walk to feed and water and less interest in displaying heats.
3. Reduced dry matter intakes, especially forages (see Table 2). The digestion of forages generates more body heat than the digestion of high energy feeds such as grains and fats.
4. Increased water intake - if it is clean, convenient and abundantly available (see Table 2).
5. Cows may prefer to stand rather than lie down, especially if stall areas are not comfortable and well ventilated. This increases the nutrient demand for maintenance and reduces blood flow to the udder.

Table 1. Temperature-Humidity Indexes (THI)

		Relative Humidity (%)									Cow's Situation
		20	30	40	50	60	70	80	90	100	
	(^{o}F)										Comfort Zone
	70	65	65	66	67	67	68	69	69	70	
T											Mild Stress
e	75	68	68	69	70	71	72	73	74	75	
m											
p	80	70	72	73	74	75	76	78	79	80	**Moderate Stress**
e											
r	85	73	75	76	78	79	81	82	84	85	
a											
t	90	76	78	79	81	83	85	86	88	90	**Severe Stress**
u											
r	95	79	81	83	85	87	89	91	93	95	
e											
	100	82	84	86	88	91	93	95	98	100	**Life in Danger**

Source: Adapted from Jay W. West, University of Georgia

Table 2. Environmental Temperatures and Their Anticipated Effects on Dairy Cattle

	Nutrient Requirements for 59.5 Lb. of Milk		Expected Intakes and Milk Yields		
Temperature	Maintenance Requirements (as % of 68 ^{o}F)	DMI Required	DMI	Water Intake	Milk Yield
(^{o}F)	(requirements)	(lb.)	(lb.)	(gal.)	(lb.)
68	100	40.1	40.1	18.0	59.5
77	104	40.6	39.0	19.5	55.1
86	111	41.7	37.3	20.9	50.7
95	120	42.8	36.8	31.7	39.7
104	132	44.5	22.5	28.0	26.5

Source: Adapted from National Research Council, 1981.