KemTRACE® CHROMIUM
Essential to you and your operation.

MINIMIZE THE IMPACT OF HEAT STRESS

Heat stress can compromise feedlot cattle performance in many different ways — reductions in feed intake, growth and efficiency are commonly reported in heat-stressed cattle.[1]

With an estimated total annual economic losses from heat stress in finishing cattle at $282 million,[2] the economic impact of a heat stress event cannot be overstated.

The economic loss from reduced dry matter intake and decreased production is much higher than the direct financial loss from cattle mortality — estimated to exceed 5-10 times that of the death loss.[3]

ECONOMIC LOSSES FROM HEAT STRESS EVENTS

KEMIN®

FACTORS CONTRIBUTING TO HEAT STRESS

Heat stress events causing mortality in feedlot cattle have certain environmental characteristics in common. Predominant are a combination of two or more of the following:[4]

- High ongoing minimum and maximum ambient temperatures
- Recent rain event
- Absence of cloud cover with a high solar radiation level
- Low or no air movement over an extended period (4-5 days)
- High and ongoing relative humidity
- Sudden change to adverse climatic conditions (lack of an adaptation period)

Feedlot deaths have been greatest after several days of high temperatures and high humidity with low air movement and only limited nighttime cooling.[5] Feedlot mortality is highest in cattle that are nearing finished weight and higher performing cattle. Newly arrived cattle, sick cattle and transported and handled animals (in ascending order of risk) are also predisposed.[5]

Impact of temperature and humidity

Heat production increases with digestion and metabolism. This is known as heat increment. Heat increment is thought of as energy that must be dissipated. This is not really a problem under thermoneutral or cold environmental conditions. However, under high heat load, when the animal's ability to dissipate body heat is impaired, additional body heat may be detrimental to the animal's well-being. The beef cattle temperature-humidity chart (Figure 1) demonstrates the risk level in planning cattle handling during the summer months.[6] Cattle producers need to be aware of the risk of heat stress based on the weather forecast. **The animal's core temperature peaks approximately two hours after the environmental temperature peaks and takes 4-6 hours to lower back to normal temperature.[6]**

Relative humidity (%)

TEMPERATURE (°F)	30	35	40	45	50	55	60	65	70	75	80	85
100	84	85	86	87	88	90	91	92	93	94	95	97
98	83	84	85	86	87	88	89	90	91	93	94	95
96	81	82	83	85	86	87	88	89	90	91	92	93
94	80	81	82	83	84	85	86	87	88	89	90	91
92	79	80	81	82	83	84	85	85	86	87	88	89
90	78	79	79	80	81	82	83	84	85	86	86	87
88	76	77	78	79	80	81	81	82	83	84	85	86
86	75	76	77	78	78	79	80	81	81	82	83	84
84	74	75	75	76	77	78	78	79	80	80	81	82
82	73	73	74	75	75	76	77	77	78	79	79	80
80	72	72	73	73	74	75	75	76	76	77	78	78
78	70	71	71	72	73	73	74	74	75	78	76	76
76	69	70	70	71	71	72	72	73	73	74	72	75

EMERGENCY > 84
DANGER 79-83
ALERT 75-78
NORMAL < 75

Temperature-humidity index (THI)

Figure 1: *Cattle temperature-humidity index chart[6]*

Heat stress and leaky gut syndrome[7]

Understanding the animal's biological response to a heat stress event is critical to understanding the impact it could have on performance. Diversion of blood flow to skin and extremities occurs as the animal attempts to maximize radiant heat dissipation. The coordinated vasoconstriction in intestinal tissues results in:[7]

- Decreased nutrient and oxygen delivery to immune cells
- Increased reactive oxygen species (ROS) due to hypoxia
- Reduced nutrient uptake
- Greater rumen and intestinal osmolarity in the intestinal lumen

Leaky Gut Syndrome (LGS) can broadly be defined as the inability of the intestinal barrier to prevent unwanted molecules inside the intestine from entering into the body (Figure 2). LGS results in increased intestinal permeability, which allows foreign substances to enter the body, and this stimulates an immune response that includes inflammation.

Activating the immune system

In order to combat an immune challenge, an active immune system in a Holstein steer requires more than **2,000 kilocalories in a 24-hour period.** The glucose meant for economically relevant tissues will instead be used to support this immune function, reducing total production and profitability.[8]

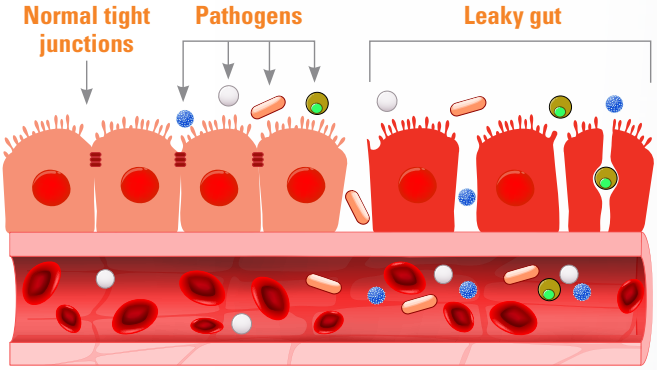

Figure 2: *Healthy gut versus Leaky Gut Syndrome*

Role of chromium

Chromium helps improve glucose use and reduces the negative impacts of stress for increased cellular energy and function. Immune cells (specifically macrophages and neutrophils) are insulin sensitive, and proper insulin signaling is necessary for leukocyte function.[9-11]

Impact of chromium on immunity

Feedlot cattle are often faced with immune challenges demanding an increase in energy efficiency to prevent sickness. Research conducted at Texas Tech University suggests that supplementing the diet with chromium propionate enhances performance and immunity responses in receiving cattle (Table 1).[12] Treatment costs for a sick animal can cost upwards of $50 U.S. dollars per head in addition to the loss in performance and carcass quality.[13]

Table 1: *Chromium performance and morbidity*

	Chromium inclusion level, ppb			Chromium improvement	
	0	300	Linear contrast (*P*-value)	0 vs. 300 gain	%
Initial body weight, lbs.	509.3	507.1	0.29	-	-
Final body weight, lbs.	703.3	720.9	0.08	17.6*	2.5
Average daily gain, lbs.	3.46	3.84	0.03	0.38**	11.0
Dry matter intake, lbs./d	14.70	15.52	0.12	0.82*	5.6
Gain to feed	0.237	0.247	0.05	0.01*	4.2
Cattle treated at least once, %	25.85	7.48	0.07	18.37**	71.1

*A chromium effect ($P \leq 0.14$) was detected. **A chromium effect ($P \leq 0.05$) was detected.

THE BOTTOM LINE

Heat can be a major stressor on cattle. Energy that's expended to compensate for the impact of stress decreases the amount of energy available for productive purposes, including daily gain, immune system efficiency and muscle production. Chromium potentiates the action of insulin, which ultimately allows more glucose availability at the cellular level. Additional glucose is used by the animal in a hierarchical manner to help reduce the energy demand from stress events, such as difficult pen conditions and/or high ambient temperatures, to provide needed energy for productive purposes.

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