

Managing Heat Stress Episodes in Confined Cattle



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KEYWORDS

- Heat stress • Cattle management • Environmental conditions • Animal welfare
- Shade

KEY POINTS

- Cattle fed high-energy grain-based diets are at risk of succumbing to heat stress during heat waves incurring substantial economic loss.
- Deaths from heat stress are greater after several days of high temperatures, high humidity with low air movement, and only limited nighttime cooling.
- Respiratory rate, panting score, and behavioral changes are useful indicators of heat stress in feedlot cattle.
- Manipulating management of nutrition and feeding practices during heat stress events can reduce losses.
- Developing management plans for managing heat stress events proactively rather than relying on crisis management during an event is paramount.

INTRODUCTION

Feedlot cattle consuming large amounts of feed and gaining rapidly generate significant amounts of metabolic heat. There are four ways cattle can dissipate heat from the body to the environment: (1) conduction, (2) convection, (3) radiation, and (4) evaporation (sweating and respiration).^{1,2} The first three mechanisms require a temperature gradient from the animal to the environment; that is, the air around the animal is cooler than the temperature of the animal. At high ambient temperatures that approach or exceed the body temperature, the first three mechanisms are not effective, and the animal must rely on evaporative cooling.^{3,4} However, if the relative humidity is also high, evaporative cooling is diminished.^{3–5}

Diurnal ambient temperature patterns are also important. An animal can endure high ambient temperatures if heat gain during the daytime hours is balanced with heat loss during the nighttime hours. If nighttime ambient temperatures remain high, especially if

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the relative humidity is also high, there is no time for recovery. In fact, nighttime temperature may be more important than daytime temperature in determining health and production.⁴

The impact of acute heat stress on livestock is well documented. Chronic, low-grade heat stress that occurs over several weeks to months in southern states is not well characterized. Chronic heat stress does not always show outward clinical signs but has the same potential as acute heat stress to impact the immune system and production. Climate change has the potential to extend impacts of chronic heat stress to more northern states.

ECONOMIC IMPACT

Failure to dissipate heat in summer results in an accumulation of heat within the body and predisposes the animal to heat stress,^{6,7} which may result in mortality, production loss, and substantial economic loss. Mader and colleagues⁸ estimated losses from mortality and lost performance as a result of heat stress events to average between \$4000 and \$5000 for each animal that dies.

Since the turn of the century significant heat waves have been occurring almost annually in the Midwest and Plain states, with documented cattle losses up to 5000 head for each event.^{1,9,10} In Australia, in 1991, a total of 2681 feedlot cattle reportedly died in a feedlot in Southern Queensland and in 2000, a total of 1255 feedlot cattle were lost in a southern New South Wales feedlot.^{11,12} Overall economic losses from deaths and reduced performance from two events are estimated at US\$28 million and US\$40 million in Nebraska and Iowa, respectively.^{2,13} In the summer of 2011, more than 10,000 head of cattle perished across five states as a result of heat stress.¹⁴ The economic loss from reduced dry matter intake and decreased production is much higher than the direct financial loss from cattle mortality and is likely to exceed 5 to 10 times that of the death loss.¹⁴

Today there is an expectation that animals in confined animal feeding operations are provided not only food and water but a suitable place to live in comfort. Loss of healthy animals is unacceptable even in adverse conditions. Developing management plans for managing heat stress events proactively rather than relying on crisis management during an event is paramount.

Factors Contributing to Heat Stress in Feedlot Cattle

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:

- High ongoing minimum and maximum ambient temperatures
- A recent rain event
- High and ongoing relative humidity
- Absence of cloud cover with a high solar radiation level
- Low, or the absence of, air movement over an extended period (4–5 days)
- Sudden change to adverse climatic conditions (lack of an adaptation period)

Feedlot deaths have been greatest after several days of high temperatures, high humidity with low air movement where there has been only limited nighttime cooling.² Feedlot mortality is highest in *Bos Taurus* breeds, 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.²

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