Heat Stress in Feedlot Cattle

Introduction

Heat stress is a recurring issue for most areas where cattle feeding occurs. Proper planning can provide effective mitigation strategies and minimize death loss during heat events.

When temperatures heat up during the summer, cattle feeders need to assess and manage the heat stress that their feedlot cattle may experience. Unlike pastured cattle that have the ability to seek shade and water and air movement to cool themselves, feedlot cattle experience radiant heat from dirt or concrete surfaces. To reduce the risk to feedlot cattle, feedlot operators should have a plan for performance loss due to decreased efficiency and feed intake, in addition to a plan to prevent death due to heat. At temperatures above 80° F cattle endure physiologic stress abating their heat load. Although cattle at this temperature are not at risk of dying, they will have an increased maintenance requirement to cope with the heat. Typically, pastured cattle are not as susceptible to heat stress as feedlot cattle, so this type of planning is not required for pastured cattle.

Compared to other animals, cattle cannot dissipate their heat load very effectively at high temperatures. Initially, cattle rely on sweating as their primary method to maintain core body temperatures. However, at high temperatures (>90° F) accompanied by solar radiation, their large body surface area begins accumulating more heat than can be dispersed by perspiration. At this point, cattle switch to respiration (panting) to cool themselves. Peripheral circulation is restricted and cattle will show evidence of heat stress.

Because cattle do not dissipate heat effectively, they accumulate a heat load during the day and dissipate heat at night when it is cooler. During extreme weather conditions, when sufficient cooling doesn't occur during the night, cattle will accumulate heat that they cannot disperse. Therefore, a temperature-humidity index (THI) alone may not predict cattle heat stress because it does not account for accumulated heat load. Another short fall of THI is that it does not account for solar radiation and wind speed which can also affect heat load of cattle. The USDA Agricultural Research Service (USDA-ARS) and the National Oceanic & Atmospheric Administration (NOAA) have developed a heat stress forecast map, including temperature, humidity, wind speed, and cloud cover to more accurately predict heat stress for cattle. The USDA-ARS and NOAA heat stress forecast is available at **www.ars.usda.gov/plains-area/clay-center-ne/marc/docs/heat-stress/main/**.

Producers should evaluate feedlot cattle daily, especially during July and August, for evidence of heat stress. Special attention should be paid to cattle with increased risk of heat stress including heavy cattle, black or dark-hided cattle, and respiratory-compromised animals. Heavy cattle cannot handle heat stress as well as lighter weight cattle; increased fat deposition prevent cattle from regulating their heat effectively. Solar radiation is a critical component that can lead to death loss from heat stress. Typically, more black-hided cattle die during heat waves than cattle that are lighter colored. Since cattle rely on respiration as a method to manage heat, respiratory function is important. Cattle that had severe respiratory disease early in the feeding period will have decreased ability to regulate their heat load.

Recognizing Heat Stress

As the heat load increases, cattle will display increased levels of heat stress. Initial indicators of heat stress (stage 1) include a slightly elevated breathing rate, restless attitude, and increased time standing. During stage 2 the respiratory rate will remain increased and cattle may begin to drool. Most of the animals will be standing and restless,

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and cattle may begin to group together. As heat-stressed cattle move into stage 3, respiratory rates will increase and excessive drooling and/or foaming will be evident (Figure 1). At stage 4 of heat stress open mouth breathing begins and drooling decreases. Cattle in stage 5 of heat stress will have increased respiratory effort including an abdominal effort and protruding of the tongue (Figure 2). The final stage of heat stress (stage 6) includes labored breathing with the head down; severely affected animals will isolate themselves from the herd. Calves in stages 5 and 6 are at increased risk of death from heat stress if they do not receive relief. Calves should be cooled down slowly by spraying with cool water and providing shade. Do not stress calves by trying to move or restrain. Although cooled some calves may die from organ failure days later after recovering from the initial heat stress.

Figure 1. Stage 3 heat stress. *Photo courtesy of G. Dewell.*

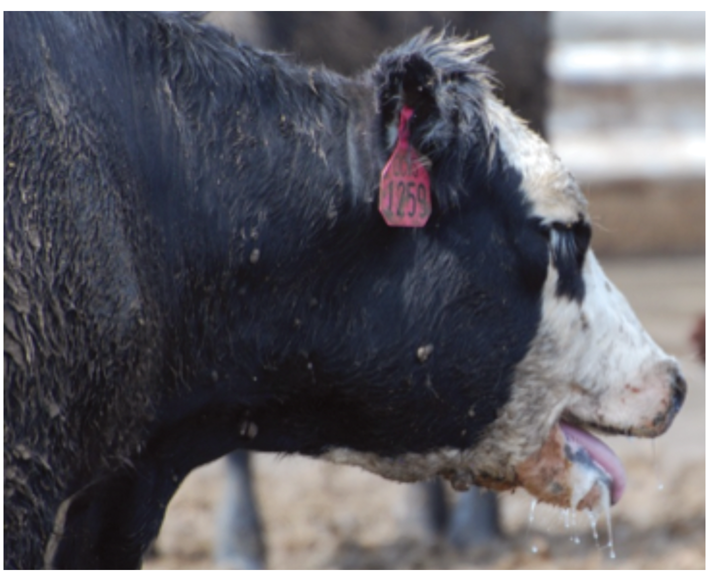
Figure 2. Stage 5 heat stress. *Photo courtesy of G. Dewell.*

Managing Heat Stress

The water requirement for cattle increases during heat stress as cattle lose water from increased respiration and perspiration. Water consumption is the quickest method for cattle to reduce their core body temperature. During times of heat stress, water consumption will be greater than times of typical metabolic requirements. Access to adequate water sources is critical to managing heat stress and water resources must be carefully managed. The rule of thumb is that cattle need three inches of linear water space per head during the summer. If existing water tanks are not enough, extra water tanks should be introduced prior to extreme heat events so that cattle become accustomed to them. It is important to allow for extra water space because some cattle will dominate a single tank and prevent other cattle access to this critical resource (Figure 3). Rate of water delivery is also important. The water supply should be able to deliver 1.1 percent of body weight of the cattle per hour. A 1,000 pound animal needs about 1.5 gallons of water per hour. In addition, water tanks need to be kept clean to encourage cattle to consume adequate water.

Heat production from feed intake peaks four to six hours after feeding. Therefore, heat production in cattle fed in the morning will peak in the middle of the day when environmental temperatures are also elevated. To alleviate some of the heat load from feed, cattle should receive a least 70 precent of their feed in the late afternoon or evening, two to four hours after peak ambient temperature. Ration modifications may also be needed. Changing the ration has been controversial, but research indicates that lowering the energy content of the diet will decrease the heat load. The general recommendation is to reduce the diet energy content by five to seven percent during high temperatures.

Working cattle will also elevate their body temperature. For this reason, cattle should not be worked at all during times of extreme heat. They should only be worked in the early morning when it is going to be hot. Nor should cattle should wait in processing areas longer than 30 minutes when it is hot. During a heat event, when the heat index is between 90 and 100 degrees, do not work cattle in the evening, even if it has cooled off. Cattle's core temperature peaks two hours after the peak environmental temperature. And it takes at least six hours for cattle to dissipate their heat load. Therefore, if the day's peak temperature occurred at 4:00 p.m. cattle will not have recovered from that heat load until after 12:00 a.m. (midnight) and it will be later than that before cattle have fully recovered from the entire day's heat load.

Shade can be critical in determining whether cattle die during extreme heat events, especially for dark-hided cattle. For adequate cooling, plan for 20 to 40 square feet of shade per animal and a height of at least 8 feet tall to allow sufficient air movement under the shade. If the shade structure has an east-west orientation, then the ground under the shade will remain cooler during the day. However, if mud is an issue then a north-south orientation will increase drying as the shade moves across the ground during the day. For drying to occur the cattle will need to follow the shade onto hot ground.

Figure 3. Steer blocking water tank to cool head. *Photo courtesy of G. Dewell.*

Increasing the air flow can help cattle cope with extreme heat events since evaporative cooling, whether from perspiration or respiration, is improved with air movement. Wind speed has been shown to be associated with ability of cattle to regulate their heat load. Although wind speed cannot be influenced, feedlots can increase the cattle's exposure to air movement. For example, if pens have permanent wind breaks for winter weather protection, consider constructing temporary wind breaks for winter use so that air movement is not impeded during the summer. Removing tall vegetation within 150 feet of feedlot pens will also improve air movement. Tall, earthen mounds will also allow cattle more exposure to air movement. Feedlot managers should assess their feedlot and know which pens have poor air movement due to physical structures or low lying areas and then avoid using these pens for cattle that will be approaching slaughter weights in mid to late summer.

Another factor that feedlots can address is fly control. Biting flies annoy and stress cattle. If biting flies are numerous, cattle will often bunch up, which can limit their ability to cool. Minimizing breeding areas for flies and applying insecticides early in summer to decrease fly populations prior to heat stress times is worthwhile.

Pen management with sprinklers and bedding can mitigate heat stress. Sprinklers can be used to increase evaporative cooling and can reduce ground temperature. For best results, sprinklers should thoroughly wet the animal and not just put a mist in the air to cool the animal. If cattle hides are not soaked, then the mist may actually settle on the hair and trap the heat, making the cattle even hotter. Before installing a misting system be sure the water supply is adequate enough to provide drinking water and sprinklers. Drinking water is more critical than a sprinkler system, so make sure that adequate water resources are before installing sprinklers. When installed, sprinklers should be operated intermittently to avoid mud and increased humidity. They should be placed away from feed bunks and water tanks as shy or unaccustomed cattle may reduce the feed or water intake to avoid them.

Cattle need to be introduced to sprinklers prior to extreme heat. Those not used to sprinklers will try to avoid the spray before becoming acclimated. Additionally, sprinklers need to be used before cattle are in extreme stress. Thermal shock from cold water can kill cattle that are extremely stressed. Once sprinklers are utilized, they need to be continued until the heat event is over and cattle can manage on their own.

Another consideration to reduce heat is to use light colored bedding such as straw or corn stalks to provide cooler areas within the pen and reduce radiant energy absorption.

Summary

To reduce the damage caused by heat stress, feedlots need to monitor environmental temperatures throughout the summer. When the heat index is above 90° F, cattle will be under heat stress. In addition, hot weather following precipitation can dramatically increase the potential for a heat event. If overnight temperatures are above 70° F cattle will have increased heat stress because of a retained heat load. During times of increased heat stress, cattle should be observed closely to identify if additional strategies need to be implemented. For best results, feedlots need to monitor for heat stress and implement strategies to minimize impact on cattle to prevent severe death from heat stress.

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