IANR NebGuide
University of Nebraska Lincoln
Published by University of Nebraska–Lincoln Extension, Institute of Agriculture and Natural Resources
Know how. Know now.

G1409
(Revised September 2007)

Managing Feedlot Heat Stress

Terry Mader, Extension Beef Specialist
Dee Griffin, Extension Feedlot Veterinarian
LeRoy Hahn, Research Collaborator, US MARC

This NebGuide presents recommendations designed to help feedlots manage cattle during times of heat stress.

Cattle do not handle heat stress as well as humans. The thermocomfort zone varies greatly among beef cattle. Young animals have a narrow comfort zone between 45 and 80°F. The comfort zone of feedlot cattle and mature cows will range from 0°F or below in the winter to around 75°F in the summer, depending on body condition, hair coat length, coat color and plane of nutrition. This wide comfort zone allows cattle to thrive under diverse climatic conditions with little or no need for shelter or protection. However, *Bos taurus* cattle have difficulty coping with temperatures above 90°F when fed high energy feedlot diets. This is particularly true with above-average humidity or below-average wind speed, when cattle have had little or no chance to adapt to excessive heat load.

Evaluate the Potential for a Heat Stress Emergency

To the extent possible, anticipate the crisis so you can obtain maximum benefit from your plan. Evaluate both the previous history of heat stress events and the potential for one at your location.

Key elements to be evaluated are:

1. The normal annual rainfall in your area. High rainfall areas are more susceptible to having high humidity, particularly if wet weather continues into the summer months.
2. Long-term weather forecast of hotter than normal conditions which should signal early activation of a heat stress management plan. The greatest probability of heat stress is between early July and mid-August.
3. Obstruction to air flow in cattle pens. Wind breaks and other air flow obstructions will create calm air flow up to 10 feet downwind for every one foot in height. A windbreak 10 feet high can obstruct air flow 100 feet downwind.
4. Availability of water for watering cattle and wetting down cattle or pens. Cattle can consume one to two gallons of water per hour under normal environmental conditions. Watering space and water flow to watering troughs also should be evaluated to ensure cattle are protected from dehydration.

Develop a Heat Stress Management Plan

Below are some considerations for a heat stress plan. The first items listed are more easily accomplished and may significantly improve the performance of cattle during times of heat stress. These should be done when the possibility exists of heat stress reaching the upper critical limits of cattle.

Have ample water available. On days that temperatures exceed 80°F, cattle may need more than two gallons of water per 100 pounds of body weight. Consuming water is the quickest and most efficient method to reduce body temperature. Water prevents dehydration and allows heat to be dissipated through evaporative cooling (sweating) and urination. Provide extra watering tanks, if needed. This should be done in advance of anticipated use so cattle become accustomed to multiple water sources. Providing up to three inches of linear waterer space per animal can be lifesaving in feedyards and ensures that cattle can get water when needed. Keeping waterers clean encourages water consumption. Weekly scheduled waterer cleaning also improves the likelihood of finding malfunctioning waterers.

Avoid handling cattle if possible. Processing cattle can elevate body temperature 1/2 to 3 1/2°F, depending on cattle temperature and processing time. During heat stress periods, if cattle must be handled, do it in the morning prior to 8 a.m. if possible, and absolutely not after 10 a.m. unless shaded facilities are available. While it may seem to make sense to work cattle after sundown, wait until the cattle have had at least six hours of night cooling before working. Dissipation of body heat is needed at night and allows cattle to deal more effectively with heat stress the following day. Work with packers to schedule shipping cattle at night or at least early morning. Try to load early enough so that all cattle arrive at the packing plant before 7 a.m. Most pack-

ers have sprinklers and can keep the cattle comfortable. If cattle arrive with body temperature elevated above what would normally be expected, carcass defects, such as dark cutters, may result.

Cattle that must be handled during hot days should spend no more than 30 minutes in the handling facility (processing or hospital area). Avoid cattle bunching. Most cattle working facilities have very poor air movement causing cattle to gain body heat while they are in these areas. A 30-minute time limit minimizes heat gain and allows the body core temperature to return to normal quicker. Arrange to have shade or sprinklers in those areas. Tubing (one-half- to three-fourth-inch diameter line) equipped with spray nozzles placed overhead will improve the cooling in handling and holding areas.

Change feeding patterns and consider diet changes. Shifting the feeding schedule toward evening deliveries may help hold cattle on feed and even out the consumption patterns. Delivering 70 percent or more of the daily scheduled feed two to four hours after the peak ambient temperature of the day has been reached may decrease roller coaster intake patterns often observed. Moving to a late-day feeding schedule also may minimize the sub-clinical acidosis thought to contribute to heat stress problems. Lowering the energy level has been controversial but research indicates that lowering the energy content of the diet or using a storm ration may lower the metabolic heat load on the cattle.

The following items may be more difficult to accomplish, and require more intense prior planning, labor and materials to implement. The key is to know where your potential problem areas are and focus your efforts on critical areas first.

Assess water supply and delivery capacity. Under heat stress conditions, the system needs to deliver a minimum of 1.1 percent of body weight per hour. This amounts to 11 lbs or 1.3 gallon/animal/hour for a 1,000 lb animal. However, as a safety measure, the system should deliver, at any one time, more water than actually is required. Thus, an ideal water system should be capable of delivering the amount of water required for an entire day's needs within a 4- to 8-hour period. This can be calculated from line diameter and line pressure. Always perform these calculations before installing new watering systems. Check flow rates on automatic water tanks in existing facilities. The gallons-per-minute a waterer can deliver can be estimated by using a rubber tube to divert from the waterer-input orifice (controlled by the float) into a bucket. Divert the water for 15 seconds and estimate the gallons that would have been delivered per minute. If deficiencies are identified in total supply or delivery at peak demand periods, additional supply and/or waterers must be added when temperatures are in the critical range. Alternatively, the cattle can be spread out to more pens so that the existing water supply can better serve critical needs.

Make arrangements for emergency water. Contact the local fire department or cooperative to access equipment that can deliver emergency water. Make sure livestock drinking water delivered in this manner is safe and palatable. Large volume sprinklers can be installed if water supply is adequate. Sprinklers can effectively keep cattle below their upper critical temperature by increasing evaporative cooling and lowering ground temperature. Coverage of 10 to 15 square feet per head should be adequate. Remember, water requirements can easily double when wetting pens and sprinkling cattle. Plan accordingly.

Improve air flow in pens. Windbreaks can be beneficial in the winter, but a detriment in the summer. Identify feedlot areas having limited air movement, and, if possible, consider abandoning these pens during critical heat stress. Also avoid these pens when feeding cattle that are projected to finish in summer or early fall, if possible. Identify heavy, finished cattle and newly arrived high-risk cattle in the feedlot and give their pens special attention in regard to air flow. Cut tall vegetation 150 feet back from the perimeter of the pens. If possible, consider moving these cattle to shaded pens or pens with better wind flow. Consider building earth mounds in the pens. Mounds help prevent cattle from bunching and usually will enhance cattle exposure to air movement.

Consider shade. Shades reduce exposure to solar radiation, thus reducing heat load on the animal; they do not affect air temperature. Major design considerations for shade structures are: orientation, space, height and roof construction *(Figure 1)*. The preferred orientation is east-west to keep ground under the shade cool; however, a north-south orientation, while less effective, will minimize mud build-up under a shade. With east-west orientation, a higher percentage of shadow lies under the shade structure than when a north-south orientation is used. The shade structure should provide about 20 to 40 sq. ft. per feedlot animal, recognizing that few production benefits will be realized if animals are overcrowded. Shade height should be 8 to 14 ft. keeping in mind that the higher the shade, the greater the air movement under the shade. To enhance natural ventilation in shade structures, select a site with minimal trees, other buildings,

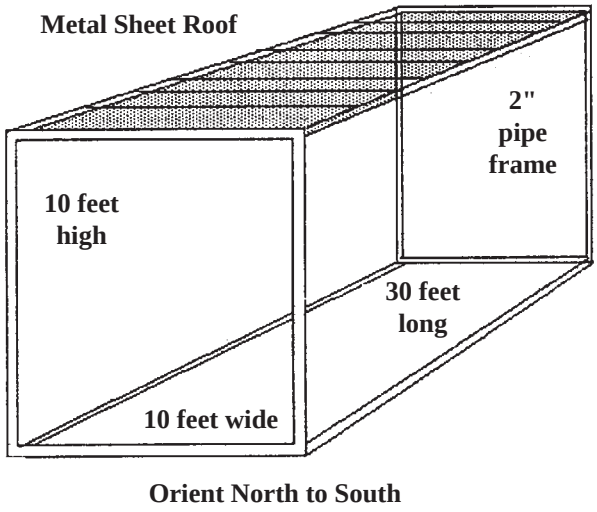

Figure 1. One box protects approximately 30 cattle.

or obstructions within at least 50 feet of all sides. Various types of roofing materials can be used for shade structures. The most effective is a reflective roof constructed of white-colored, galvanized or aluminum materials. Slats, plastic fencing, or other shade materials with less than total shading capabilities are considerably less effective. Shade structures need to be designed to handle winter snow load and wind to minimize maintenance and upkeep. Whether the benefits of shade justify the cost depends on the year and potential degree of cattle stress. Shade is a form of insurance against potential mortality losses; any performance benefits are a bonus.

Control biting flies. Stable flies cause cattle to bunch and disrupt cooling. Removing weeds and brush within 150 feet of pens and spraying the shaded areas of buildings with a residual insecticide will help control stable flies. Minimizing shallow pools of water or muddy areas around the feedlot will aid in eliminating breeding areas for flies.

Look for clues to an impending heat stress crisis

First clue: Predicted hot weather following precipitation. It is the combined temperature and humidity that determines the severity of heat stress. Days with temperatures in the high 80s or above, following a precipitation event, can be extremely stressful, especially if the wind speed is below 5 miles per hour for extended periods.

Second clue: Monitor the upper critical temperature-humidity limits of cattle. Consider this limit has been reached when the Temperature-Humidity Index (THI) reaches 80 (e.g. 86°F at 60 percent relative humidity; see the THI chart included).

Third clue: Evening weather forecast for overnight temperatures to remain above 70°F. A potential heat stress crisis situation exists for cattle when there is little or no night cooling. Watch for days following nights in which the ambient temperature remains relatively high. Feedlot losses have been commonly reported when consecutive days with Temperature-Humidity Index values above 80°F have been tied together with nights in which the temperature stayed above 70°F.

Fourth clue: Observing cattle will tell you when they are becoming uncomfortable from heat. The cattle will start to move … walk around the pen looking for an area of the pen that is more comfortable. They will start to slobber and respiratory rate will increase above 100 breaths per minute. They will begin to elevate their head to make it easier to breathe. They will position their body to minimize their exposure to the sun; generally, this is facing the sun.

Activate emergency plans when temperatures combined with humidity are forecast to be in the critical range for livestock. During a heat wave, the first calm wind day can be lethal to cattle. If your resources are limited, focus on managing heat stress for those cattle that may be most susceptible to heat stress. This includes cattle with dark hides, cattle close to being finished, newly-arrived cattle, and cattle suffering from illness or recovering from illness.

Remember human safety

Maintaining feedlot personnel health during a heat crisis is also critical. Without optimum output from personnel, the checklist items can't be accomplished. These recommendations are for personnel doing reasonably strenuous outdoor work when temperatures are in the critical range.

- Minimize strenuous work during hotter times of the day or at least alternate between hard and light work. If personnel must do hard work, take a break by spending 10 to 20 minutes of each hour doing less strenuous work, preferably in the shade.
- Force water consumption. Drink one to two quarts of water per hour.
- A buddy system should be used to make sure adequate water is consumed, workload alternates between strenuous work with periods of light work, and early signs of heat exhaustion are detected. Signs of heat exhaustion include mood changes, emotional responses and confusion.
- If a person gets overheated, he or she should not return to strenuous work that day. Inside work or taking the rest of the day off is advisable. Failure to do this may result in the person developing heat stroke.

Heat stress management review

Post the THI table *(Table I)* and evaluate the weather forecast against the THI table every evening and morning.

- Start emergency measures when two or more days occur with little or no night cooling (temperature stays above 70°F).
- In hot weather, schedule cattle handling between midnight and 8 a.m. Never handle after 10 a.m.
- Ensure cattle have adequate water and watering space in an emergency.
- Evaluate water flow-rate and place extra waterers in each pen if needed.
- Improve air flow by reducing tall vegetation and abandoning pens with dead air spots.
- Place shade and/or sprinklers in problem pens and consider installing in all pens.
- Shift daily feed delivery schedule toward evening feeding.
- Reformulate ration to lower the energy content by 5 to 7 percent or lower total feed intake to minimize overall metabolic heat load.

Table I. Temperature Humidity Index (THI)

TEMPERATURE	Relative Humidity 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**	**75**	**76**	**76**
76°	69	70	70	71	71	72	72	73	73	74	72	**75**

THI = Tdbf - (0.55 - (0.55 x (RH / 100))) x (Tdbf – 58)

Normal <74 | Alert 75-78 | Danger 79-83 | Emergency >84

This publication has been peer reviewed.

UNL Extension publications are available online at *http://extension.unl.edu/publications.*

Index: Beef
Beef Mangement

2000, Revised September 2007