SHUR-GAIN
NUTRIFAX
Nutrition News and Information Update

MANAGING HEAT STRESS IN BEEF CATTLE

Dennis Lunn, Ruminant Nutritionist
Shur-Gain, Nutreco Canada Inc.

MANAGING HEAT STRESS IN BEEF CATTLE

Dennis Lunn, Ruminant Nutritionist
Shur-Gain, Nutreco Canada Inc.

Heat stress can have a significant impact on the production and health of beef cattle. In feedlot animals heat can reduce feed intake and daily gains while in cow/calf herds poorer reproductive performance can occur. During periods of extreme heat stress mortality can even occur. Through proper management, the effects of heat stress can be reduced, ultimately improving animal performance.

The upper critical temperature can vary for beef cattle. For younger cattle it is about 80 °F (27 °C) whereas in feedlot cattle and mature cows their upper comfort zone is about 75 °F (24 °C). Animals can start experiencing heat stress when they are above this temperature. Heat stress occurs when the animal cannot dissipate heat from their body. There are many factors that can cause heat stress. Some of these include:

- High air temperature
- High air humidity
- Low air movement
- Thermal radiation load

If any of these conditions are present cattle can start experiencing heat stress. Heat stress risk can be estimated by determining the Temperature Humidity Index (appendix 1). By looking at temperature and humidity, you can determine the severity of heat stress for cattle. Animal factors such as age, hair colour and length will also impact how susceptible cattle are to heat stress. Heavy finishing cattle with a dark hair coat are generally the first animals to be affected by heat stress. These animals are also at most risk for heat stress mortality.

Effects and Signs of Heat Stress in Beef Cattle:

Cattle primarily lose excess heat through breathing and panting, rather than sweating. Cattle only sweat about 10% of what humans do. Cattle exhibiting mild signs of heat stress will have shallow, rapid breathing. Animals experiencing severe heat stress may exhibit increased open mouth panting with increased salivation. With extreme heat stress, breathing will become shallow and weak, the animal may collapse, slip into a coma and die shortly afterwards.

Cattle will position their body to minimize exposure to the sun. Cattle will also tend to group together during heat stress situations as they move to the coolest area or seek the shade provided by other animals. Cattle will also stand up to expose more surface area to dissipate heat and crowd water troughs to drink more water.

During heat stress cattle will have reduced feed intake and with severe heat stress dry matter intake (DMI) can decrease by up to 50%.

Table 1. The Effect of DMI at Differing Temperatures

Temperature °F	Expected DMI (% compared to 68 °F)
68	100.0
86	93.5
95	91.7
104	56.0

With a decrease in DMI, animal performance will suffer. Average daily gains (ADG) will be reduced in heat stress cattle. Poorer feed efficiencies can also occur. Research at Texas Tech University has shown that reducing heat stress improved animal performance.

Table 2. Performance of Heat Stressed Feedlot Heifers With and Without Shade

	Shade	Control	P-Value
# of Heifers	84	81	
Initial Body Weight, lb	783	784	0.69
Body Weight at day 121, lb	1,247	1,222	0.04
ADG, lb	3.86	3.59	0.05
DMI, lb	21.6	21.0	0.01
Feed:Gain	5.64	5.81	0.29

Texas Tech University

In beef cows reproductive performance can be affected. Research from Oklahoma State University showed a significant reduction in pregnancy % in heat stressed cows.

Table 3. Effects of Heat Stress on Reproduction in Beef Cows

	Control	Moderate Heat Stress	Severe Heat Stress
Daytime Temp (°F)	71	97	98
Nighttime Temp (°F)	71	91	91
Relative Humidity %	25	27	40
Pregnancy, %	83	64	50

Biggers, 1986; Oklahoma State University

It is thought that the increase in body temperature (due to heat stress) in beef cows may result in an unfavorable environment for embryo survival. In breeding bulls, heat stress can result in lower sperm motility and sperm concentration. Sperm counts may take as long as 8 weeks to return to normal levels after a bull experiences heat stress. This may partially explain why reproduction can be poorer during both the summer and into early fall.

Immune function can also be impaired in heat stressed cattle making them more susceptible to disease or other health-related issues.

Strategies for Reducing Heat Stress in Beef Cattle

There are many on-farm management practices that can be used to reduce the severity of heat stress in beef cattle. Some of these include:

Water Availability and Supply:

Supplying cool, fresh, clean water is the most critical component to keeping cattle cool during hot weather. Water is important in regulating body temperature. Cattle drinking more water during hot weather are more likely to maintain normal body temperatures. Water requirements for heat stressed cattle can increase by up to 2x compared with non-heat stressed animals.

Table 4. Water Requirements for Beef Cattle

Animal	Intake in Liters for Temperature	
	14.4 °C	32.2 °C
Feeders & Replacements 2-6 months	25.0	48.1
Feeders & Replacements 7-11 months	29.9	56.8
Feeders & Replacements 12 months and older	40.9	78.0
Lactating Cows	54.9	61.3
Herd Bulls	40.9	78.0

NRC for Beef Cattle, 2000

Increasing water consumption during hot weather will also improve DMI. Higher water intake will increase urine production and subsequently increase losses of some minerals (sodium, potassium and magnesium). Higher levels of these minerals should be provided in the diet to compensate for this loss. During normal weather conditions there should be a minimum of 2 water troughs per pen with 0.1 to 0.2 m^2/25 head of water surface area available. During hot weather additional water bowls and troughs should be available to allow for higher water intakes. Wetting down cattle is another option for keeping cattle cool.

Avoid Handling Cattle During Hot Weather:

Sorting and handling cattle during hot weather can increase their body temperature and heat load. If it is necessary to handle cattle during hot weather do it between midnight and 8 AM when temperatures are cooler. Do not handle cattle during the hottest part of the day.

Change Feeding Patterns and Consider Ration Changes:

Feeding cattle less in the morning and more in the evening can help keep cattle on feed and even out eating patterns. Cattle consuming more feed during the evening and night and less during the day may help reduce metabolic heat production during the hottest time of the day. Restricted feeding programs (such as slick bunk management) may also reduce metabolic heat production.

Changing the ration itself may also reduce heat stress in cattle. The heat of digestion of forages is higher than that of grains. Animals on a higher forage ration are more inclined to heat stress than animals on higher grain diets. formulate rations to include higher quality forages.

Feed additives may improve animal performance and reduce mortality during heat stress situations. Adding yeast to the diet may increase feed intake and help improve rumen function during hot weather. Feeding MGA to feedlot heifers may also reduce mortality losses due to heat stress. In an Iowa feedlot survey heifers that were fed MGA had a 3.8% mortality rate, compared to 6.2% in non-MGA fed heifers during heat stress. Forty percent of herds feeding MGA did not have any death losses (compared to 10% in non-MGA fed herds).

Improve Air Flow in Pens and Barns:

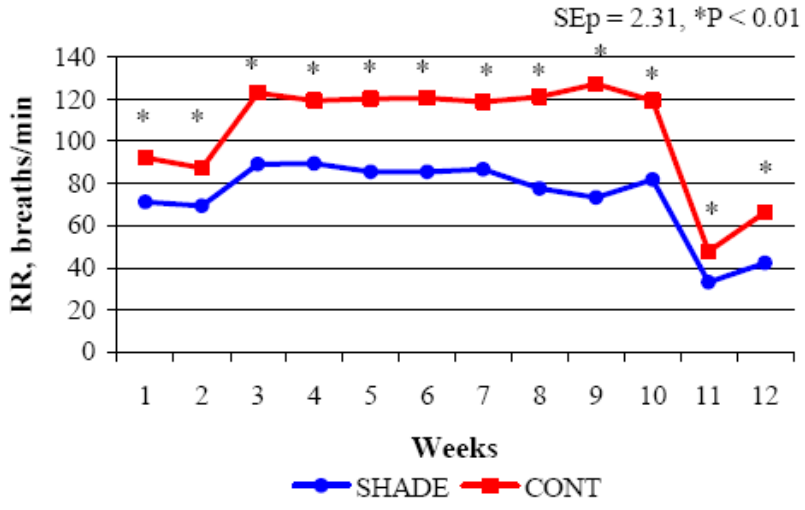
Wind breaks can be beneficial in the winter but detrimental to cattle in the summer. Increasing airflow will help keep cattle cool. House animals most susceptible to heat stress in areas with better airflow. Opening up barns and using fans to move air will improve ventilation rates and reduce heat load.

Increasing pen and truck space (if cattle are being shipped during hot weather) should also be considered. Overcrowding increases the risk for animal mortality.

Provide Shade for Cattle:

Providing shade for cattle can also help reduce heat stress. Shade reduces exposure to solar radiation, reducing heat load on the animal. Providing shade has been shown to improve ADG (see table 2) and reduce death loses (table 5) in feedlot cattle. Respiratory rates are also lower when shade is provided for cattle. Animals have less heat to dissipate when shade was provided.

Figure 1. Respiration Rates of Shaded vs. Non-Shaded Feedlot Heifers



Texas Tech University

Table 5. Mortality and Shade vs. No Shade for Feedlot Cattle During Heat Stress

	Shade	No Shade
No. of Lots	35	46
No. of Cattle	3940	5890
Shade area, sq ft/animal	24.0	0.0
% Death loss	0.2%	4.8%
% of lots with no death loss	86%	19%

Iowa State University

Trees, buildings or sunshades can be used to provide shade. These should not reduce airflow, as this is critical to keeping cattle cool. Find ways to provide temporary shade for cattle during hot weather.

Heat stress can have a significant impact on both cow/calf and feedlot animals. Feed intake, daily gains, reproductive performance and animal mortality can all be adversely affected. Through proper management, heat stress can be reduced ultimately improving animal performance.

Appendix 1. Temperature Humidity Index (THI) for Livestock

Ambient air Temp. °F	Ambient air Temp. °C	Relative Humidity (%) 20	30	40	50	60	70
100	37.8	26	29	30	31	33	34
98	36.7	26	28	29	31	32	33
96	35.6	26	27	28	30	31	32
94	34.4	26	27	28	29	31	32
92	33.3	25	26	27	28	29	30
90	32.2	25	26	26	27	28	29
88	31.1	24	24	26	27	27	28
86	30	23	24	25	26	27	27
84	28.9	22	23	24	25	26	27
82	27.8	22	23	23	24	25	26
80	26.7	21	22	23	23	24	24
78	25.6	20	21	22	23	23	24
76	24.4	19	21	21	22	22	23
Livestock Safety Index (°C)		Normal <23	Alert 24-25.5	Danger 26-28	Emergency >29		

Source: Minimizing Heat Stress in Beef Cattle, Alberta Agriculture, Food and Rural Development