Extension
UNIVERSITY OF WISCONSIN–MADISON

Animal Handling During Heat Stress

As summer temperatures rise, dairy cows are at greater risk for heat stress. Heat stressed dairy cows suffer from reduced dry matter intake, leading to reduced milk production. Farmers may also see reduced fertility or loss of a pregnancy and increased metabolic and lameness issues. Combating heat stress in the herd requires an action plan to prevent heat stress and address heat stress-related issues.

Temperature Humidity Index

Cattle aim to maintain their internal core body temperature within a narrow range. To regulate body temperature, they exchange heat with their environments, both gaining and losing heat. The air temperature and relative humidity surrounding the animals are important factors affecting cows' ability to lose heat. A commonly used term within the dairy industry, Temperature Humidity Index (**THI, below**), combines both air temperature and relative humidity to approximate the level of heat stress cattle experience. The chart is color-coded according to categories of heat stress ranging from mild (*lightly shaded*) to severe (*darkly shaded*) for lactating dairy cows.

Important caveats to keep in mind about THI:

1. If cattle are housed with direct sun exposure, for example on pasture or in open lots, THI does not account for the effects of solar radiation, which contributes further to heat stress. The same goes for calves in outdoor hutches.
2. THI must be estimated using the microclimate surrounding the animals, for example in their home pen or in the parlor, not the outside weather conditions.
3. The THI cutoff of 72, and more recently 68, was based on when studies have found lactating dairy cows to show reductions in milk production. Keep in mind cattle of all ages can experience negative effects on animal welfare, even at lower THI values.
4. Lastly, individual animals can respond differently, within the same environments. This is why it is important to look for animal-based signs of heat stress and not rely solely on THI.

Despite these limitations, the THI chart can be a useful tool to help plan activities around times when you anticipate cattle to experience heat stress.

Cows' Signs of Heat Stress

Even when planning ahead, sometimes when cattle are handled, the level of heat stress they experience can worsen. This is because greater activity levels increase the production of body heat.

Air Temperature (°F)	Relative Humidity (%)																				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
65	61	61	62	62	62	62	62	62	63	63	63	63	63	64	64	64	64	64	65	65	65
70	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68	69	69	69	70	70
75	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
80	68	69	69	70	70	71	72	72	73	73	74	74	75	76	76	77	78	78	79	79	80
85	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
90	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	90
95	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
100	77	78	79	80	82	83	84	85	86	87	88	90	91	92	93	94	95	97	98	99	100
105	79	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101	102	104	105
110	81	83	84	86	87	89	90	91	93	94	96	97	99	100	101	103	104	106	107	109	110

Written by Aerica Bjurstrom, Sarah Grotjan, Jennifer Van Os, & Amanda Young. Reviewed by Tina Kohlman and Sandra Stuttgen. July, 2020.

When working animals, look for signs of heat stress they may exhibit. A clear indicator of severe heat stress is panting. Look for animals breathing with their mouths wide open, tongues out, drooling, or a combination of these signs.

Before severe panting begins, cattle will show elevated respiration (breathing) rates. The respiratory rate for adult cattle at rest ranges from 25 to 50 breaths per minute. As the breathing rate increases the cattle will begin to demonstrate an effort to breathe as they use their respiration to cool themselves. This effort may be seen as their rib cage rises and falls while they are standing and their body begins to rock. A rule of thumb to identify heat stress in lactating cows is 60 breaths per minute or 1 breath per second. When you notice cows breathing that quickly or even faster, this is an indication they are struggling to cope adequately with the heat, and additional cooling would be beneficial. By the time panting occurs, cows breathe at an average of 100 breaths per minute.

For more information on how to recognize signs of heat stress, see the fact sheet Heat Stress Abatement in Dairy Facilities.

Cooling Techniques

When cattle breathe faster, pant, and sweat, they lose moisture. This needs to be replenished by increasing water intake. Therefore, it is critical the animals have access to a plentiful supply of clean drinking water.

If cattle show signs of heat stress while being handled you can provide emergency relief using a combination of methods.

Provide the following strategies when cattle begin to show signs of heat stress:

1. Ensure the animals have access to shade if they are located in direct sunlight. Otherwise, they will continue to gain heat from solar radiation, exacerbating heat stress.
2. Soak them directly with water, for example, using a hose. Apply approximately a gallon of water to thoroughly soak the animal to the skin, starting along their shoulders and backs, allowing some water to drip down their sides. This cools cows through a combination of evaporation and fluid convection (dripping water). You should observe a rapid reduction in respiration rate within minutes of applying the water. Likewise, a rectal thermometer should show a reduction in body temperature after 15 minutes. If needed, repeat the soaking within 15 minutes or less after the initial soaking until the signs of heat stress are reduced.
3. Lastly, combine the soaking with high-speed air, either by taking advantage of natural air movement from wind or by positioning the animal under a fan or in a shaded breeze. This enhances the cooling effect from soaking by assisting with evaporation. If combining soaking with high-speed air, re-wet the animals sooner, since they will dry faster.

For more information on everyday strategies for keeping cows cool in your facilities, see the fact sheet Heat Stress Abatement in Dairy Facilities.

Tasks Requiring Animal Movement

The THI chart is an important consideration when moving cattle. To prevent cattle losses during handling, refer to the THI chart to determine the likelihood of heat stress during high temperature and humidity conditions.

Remember, however, dairy animals can experience discomfort and poor welfare associated with heat stress in milder weather, before production losses set in.

To prevent added heat stress, handle animals during the early morning hours before the temperature rises into the risky THI level. Limit the length of time animals spend in headlocks or other handling equipment where their stress from confinement may exaggerate the heat stress conditions. When THI is 72 or higher, consider postponing animal handling related tasks which can be performed during cooler weather. An animal's internal temperature peaks approximately two hours after the environmental temperature peaks and it takes the animal four to six hours to lower their temperature back to normal. If possible, the evening hours should be left for the animals to cool down and not used for handling unless it is necessary.

Cattle will eat more and show reproductive activity during the cooler evenings. If possible, do not interfere with their comfort during this time.

Use caution while vaccinating cattle during high THI levels. A normal reaction to a vaccine is a mild fever (increase in core body temperature by one or two degrees). Vaccine induced heat stroke may occur when this elevated core body

temperature coincides with high THI levels. To prevent the possibility of induced heat stroke, vaccinate extremely early in the morning. This practice enables the cattle to have their immune response to the vaccine under control before the ambient temperature starts to rise. Another option is to vaccinate cattle in the evening, six hours after the peak daytime temperature. Using this option, the normal vaccine reaction (increase of one or two degrees of the cattle's internal temperature) will occur during the cooler evening hours.

Extra care should be taken if the evening temperatures do not drop below 70°F as the cattle have no chance to recover before another day of heat and humidity. The longer the heat stretch lasts, the more stressful it is on the cattle.

When animals become nervous and stressed, their core body temperature naturally rises. At all times, remember to use low-stress handling techniques to keep their core body temperature down. Move cattle slowly, calmly, and short distances, if possible. Plan ahead and avoid any unnecessary movements or stressful handling.

Make note of any compromised cattle. Cattle which are sick, lame, heavy, weak, recently calved, or newly purchased are all at high risk for heat stress. Watch these cattle closely for signs of heat stress and take extra precautions to cool them down if needed.

Check and clean waterers to ensure cattle have adequate clean water. Check hoses, pumps, floats, and all parts of the water supply system to make sure water is available at all times. In the summer heat, cattle water intake increases, and many cattle may drink at the same time. Check to make sure the refill rate is adequate, enabling all cattle to drink. To ensure adequate access to water, consider adding additional, temporary tanks, if needed.

Cattle will congregate around the waterer to capture evaporative cooling coming off the water. This leads to manure build up and flies around the waterers. Remove manure build up around water tanks and locate the tanks in a high, dry area. If puddling occurs at the base of the water tank, move the water tank to higher ground.

Transporting Animals

During hot and humid weather, the temperature inside the trailer is much higher than the outside temperature. Avoid transporting cattle in moderate to severe THI conditions. Monitor the weather forecast and plan accordingly. If possible, postpone transport until cooler and less humid weather arrives.

Additionally, the high temperatures and humidity of summer can result in severe stress. Remember to check the weather before loading cattle and along the way. This will help ensure a safe and uneventful trip.

Checklist Hot Weather Factors *(Source: Beef Quality Assurance)*

1. Extreme heat conditions exist when temperature and humidity are at levels in which they create a heat index greater than or equal to 100ºF. Heat index levels 100ºF or greater pose a significant health risk to stressed cattle. Avoid transporting cattle in extreme heat conditions.
2. Avoid hauling and handling cattle between 11:00 am and 4:00 pm, which is most often the hottest time of the day. If cattle must be hauled at times of high temperature and humidity, **avoid stopping**. If stopping along the way is absolutely necessary. Make stop durations as short as possible.
    a. Stop during cooler parts of the day, if at all possible.
    b. Pick shaded areas to park if you have to stop.
3. Consider placing fewer cattle on the trailer during hot weather.
4. Handle cattle gently and patiently during extreme heat conditions. When cattle are stressed in extreme heat conditions, they are more likely to become non-ambulatory, sick, and possibly die.
5. Haul animals fit to transport. Fitness for transport is determined by multiple considerations including the health, mobility, and body condition score (BCS) of the animal. Do not transfer cattle with BCS score less than 2 non-ambulatory animals or those with severe mobility issues and animals appearing exhausted, dehydrated, or otherwise health impaired.

Special Needs of Non-Ambulatory Cows

Increased temperatures cause a chain reaction of events, compromising a dairy cow's ability to tolerate heat stress. One of the first changes we may see is less time resting. When a cow lies down, its internal temperature increases.

Cows tend to stand to regulate their internal temperature. Increasing standing time puts additional stress on their feet, which in turn leads to an increased possibility of lameness. Compared to healthy counterparts, lame cows have increased susceptibility of falling and injuring themselves.

Assessment of a Down Cow

If a cow is down, it is important to assess the situation to determine the best outcome for the animal before addressing it. What caused the cow to fall? If the cow fell due to an environmental issue such as slippery floors or a tripping hazard, rectify that situation so other cows and people can pass through the area safely.

If the cow fell due to an existing injury, assess its injury and any new injuries that may have occurred as a result of the fall. If the cow appears to be capable of standing, encourage her to do so on her own. Providing aid such as sand or straw bedding can provide better footing for standing. If the cow needs assistance such as hobbles, lifting apparatus, or float tank, carefully following the equipment's use guidelines and referring to the farm's animal handling protocols before moving or assisting the animal. Hitting, tail twisting, or inappropriate/incorrect use of equipment is considered abuse and is unacceptable.

If a cow is down on concrete, she must be moved within six hours to prevent pressure damage in the legs. A disabled animal should be moved to a stable surface such as a dirt/sand pack, pasture, or straw bedded pack. If a cow is moved to a location outside for recovery, always provide shade, food, and water.

Moving a Down Cow

If a cow is unable to stand and needs to be moved by equipment, it should be a coordinated effort between the equipment operator and the person or people working with the cow. The farm's animal handling protocols should be followed carefully to ensure the safety of the animal and the people working with it. A tractor bucket deep enough to hold the entire body of the cow or a sled wide enough to hold the cow without her body hanging off the surface are appropriate tools for moving a non-ambulatory animal. In both cases, a sled or bucket should be at least six to eight feet long to accommodate the length of the cow. A cow should never be dragged on any surface. Move the cow by rolling it on to the sled or bucket, never attempt to scoop the cow up with a bucket.

A cow should never be pulled or moved by her legs or head. Before rolling a cow onto the sled or bucket, her head should be secured with a halter tied to a rear leg. Once the cow is relocated to a location with good footing, allow the cow to stand with her own power. Down cows should be provided deep dry bedding and freshwater. If a cow is moved to a location outside for recovery, shade and protection from the elements should be provided.

Down Cow Care

If a cow is down for more than 12 hours, a veterinarian hould be consulted on further treatment or euthanasia. Down cows should have dry deep bedding to aid in standing. Encouraging a cow to stand should be done in short bursts and should not cause or prolong pain to the animal. Thoroughly evaluate the cow for proper diagnosis. Common reasons cows to be down are metabolic (milk fever), musculoskeletal (nerve damage, injury, hip injury, muscle/tissue damage from being down), toxic mastitis (especially common is due to heat stress), and toxic metritis.

Diagnosis and subsequent care are critical to a cow's recovery. Work with the farm's veterinarian on a treatment plan. Frequently re-evaluate the cow's progress and adjust treatment accordingly. Be sure to keep accurate records of treatment and outcome. A standard operating procedure template and guideline form can be found on nationaldairyfarm.com.

References

- Bohmanova, J., I. Misztal, and J. B. Cole. 2007. Temperature-humidity indices as indicators of milk production losses due to heat stress. J. Dairy Sci. 90:1947-1956.

- Bianca, W. 1968. Thermoregulation. In: Adaptation of domestic animals, ed. E. S. E. Hafez. Lea & Febiger, Philadelphia, PA.
- Chen, J. M., K. E. Schütz, and C. B. Tucker. 2015. Cooling cows efficiently with sprinklers: Physiological responses to water spray. J. Dairy Sci. 98:6925-6938.
- The Dairyland Initiative. 2020. https://thedairylandinitiative.vetmed.wisc.edu/home/housing-module/adult-cow-housing/ventilation-and-heat-abatement/
- Kelly, C.F. and T. E. Bond. 1971. Bioclimatic factors and their measurement. In: A guide to environmental research on animals, National Research Council. National Academies Press, Washington, DC.
- Polsky, L. and M. A. G. von Keyserlingk. 2017. Invited review: Effects of heat stress on dairy cattle welfare. J. Dairy Sci. 100:8645-8657.
- Schütz, K. E., A. R. Rogers, Y. A. Poulouin, N. R. Cox, and C. B. Tucker. 2010. The amount of shade influences the behavior and physiology of dairy cattle. J. Dairy Sci. 93:125–133.
- Silanikove, N. 2000. Effects of heat stress on the welfare of extensively managed domestic ruminants. Livest. Prod. Sci. 67:1–18.
- Tresoldi, G., K. E. Schütz, and C. B. Tucker. 2016. Assessing heat load in drylot dairy cattle: Refining on-farm sampling methodology. J. Dairy Sci. 99:8970-8980.
- Van Os, J. M. C. 2019. Considerations for cooling dairy cows with water. Vet. Clin. N. Am. 35:157-173.
- Vitali, A., M. Segnalini, L. Bertocchi, U. Bernabucci, A. Nardone, and N. Lacetera. 2009. Seasonal pattern of mortality and relationships between mortality and temperature-humidity index in dairy cows. J. Dairy Sci. 92:3781-3790.
- Webster, J. 1993. Environmental physiology and behaviour. In: Understanding the dairy cow, ed. J. Webster. Blackwell Scientific Publications, Boston, MA.
- FARM Farmers Assuring Responsible Management https://nationaldairyfarm.com/dairy-care365/
- Beef Quality Assurance (BQA) www.bqa.org