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Real hot. Real fast.

Being new to the Wisconsin area, my first question to locals was “How are the summers?”. An answer of “Oh, not bad in the shade” tells me that heat stress is a problem that herds in the area experience. Cows have a temperature and humidity at which they are most comfortable, or their thermal neutral zone. This zone is where a cow does not have to expend any of her body reserves to keeping herself warm or keeping herself cool. The temperature humidity index (THI) is a calculated value that considers both the temperature and the humidity of the environment. Considering both values is a more accurate way of quantifying what the effect of the environment is actually having on your cows. In general, cows will start to experience heat stress when the temperature is around 72° F with 50% humidity, or a THI of 68. However, high producing cows generate more heat and can experience heat stress at temperatures as low as 65° F making them one of the most susceptible domestic species.

Heat stress can affect the cow in multiple ways ranging from mild to severe. Heat stress is just that, a stressor on the cow, and a cow that is under stress will not be able to achieve her production potential. For example, similar to you and I, the warmer it gets, the less a cow wants to eat. Research has consistently shown that heat stressed cows will eat less and change their feeding patterns, both of which will decrease the amount of milk produced. Even cows under mild heat stress (THI of 68) can yield 2.5 lb/head/day less in milk production, and those losses only go up as the cow becomes more stressed. Research has also shown that heat stressed cows have more days open and lower pregnancy rates because their body is focused on staying cool instead of getting pregnant. To put it into perspective, a 2019 Foundation for Food and Agriculture Research study found that the U.S. dairy industry experiences \$1.5 billion in losses annually to heat stress. So, the question is, how can you reduce these losses on your operation?

There are several management and nutritional strategies that can help mitigate the effect of heat stress. First and foremost, use THI as an indicator instead of your own feeling of comfort in the barn. To me, a 70° F day sounds perfect, but I also don't have a fermentation vat inside my body and a fur coat. Drinking water is an easy way to bring down the internal temperature of the cow, and it is also important to remember that milk is also 87% water. Cows need water to make milk! Water should be always readily available to the cow. There should be 2.5-3.5 inches per head at the trough, at least 2 watering locations in a pen, troughs should have a refill rate of 3-5 gal/min and be cleaned regularly. Next, when considering heat abatement, it is important to have a quick physics lesson on the 4 modes of energy transfer: radiation, conduction, evaporation, and convection. Radiation is the loss or gain of heat from the sun or other bodies. Conduction is the loss or gain of heat from touch. Evaporation is the loss of heat through the phase change of water to vapor. Convection is the loss or gain of heat from the surrounding air. Different strategies remove heat with these modes in mind. Shade is provided to remove direct radiation from the sun. Air exchange removes heat and moisture, and different velocities can be used to maximize convective cooling. Evaporative cooling is used by adding water to overheated animals and removes heat by allowing the water to dry from their backs. If using low-pressure sprinklers, water must be cycled on and off to ensure that water is not being wasted and cows are actually being cooled. The water itself is not what is cooling the cows, the water evaporating off their skin is. These strategies are most effective at the feedbunk and in the holding pen.

Fans are a simple way of removing heat, but they need to be maintained and mounted correctly. Fans need to be cleaned and checked for slipped belts or corroded louvers to reach full capacity. If fans are not mounted correctly airflow may not actually reach the cow, therefore a tilt of 15-20° from vertical is suggested. It is important to make sure you can feel the airflow at the cow level whether this is standing or lying in the stalls. Increasing the air velocity flowing across a cow can also help mitigate heat. An example given by University of Minnesota extension shows that when the THI is 75 (moderate heat stress level) and a fan is at an airspeed of 3 mph, a cow producing 100 lbs/day would still experience mild heat stress. Increasing that airspeed to 10 mph



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would put her back in her thermal neutral zone. A handheld digital anemometer can be purchased at Walmart for only \$30.

Adjusting your ration and feeding strategies can also help mitigate heat stress. Cows spend more energy on non-productive body functions like panting. Maintenance requirements are increased due to higher temperatures by 7-25%. The increased maintenance demand coupled with lower dry matter intake accounts for the substantially less milk production with heat stressed cows. Feeding high quality forages can help reduce heat produced during fermentation and will also help increase dry matter intake. Adding a fat supplement of mostly saturated free fatty acids will increase the energy density of the diet if high quality forages isn't an option. Feeding cows earlier or later in the day when it is cooler can also give cows more time to ingest fresh feed before the increased THI will cause a cessation in appetite. Feeding multiple times per day can also help to stimulate intakes and keep feed fresh.

In conclusion, dairy cows can get real hot, real fast. Cows are happiest at a THI of under 68 and there are several management strategies that can be used to keep her body in a thermal neutral zone that follow the 4 modes of energy transfer. Shade, water, and air movement can all help remove heat from the cow to keep her cool. There are also ration and feeding adjustments that can allow the feed to work for your cows instead of against them during the hot summer months. Take these considerations and recommendations into account to improve your herds performance in the coming hot weeks.

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