

Thermal stress – a hot topic!

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Over the past few years, we have begun to feel the effects of climate change. Experts say that we can expect to see more extreme temperatures and weather events, which will inevitably have an impact on the condition of our dairy cows.

What is thermal stress?

While animals have the ability to adapt to temperature fluctuations, they are most comfortable within a specific temperature range called the thermoneutral zone. Beyond the limits of that zone, animals are required to expend energy to maintain a constant body temperature. This is where thermal stress comes into play. Experts generally agree that the thermoneutral zone for mature cattle is between 5 and 20°C, and between 15 and 25°C for calves.

Ambient humidity levels also have an effect on thermal stress. As the air becomes more humid, the thermoneutral zone shrinks and this is particularly true in the Quebec climate.

Heat stress

Heat stress used to be considered as significant when the Temperature-Humidity Index (THI) reached 72, which corresponds to a temperature of 23°C at 75-per-cent relative humidity. However, recent studies indicate that an average THI of 68 (22°C at 45-per-cent relative humidity) would be a more appropriate threshold in view of current levels of milk production. Moreover, negative effects are observed as soon as the THI during the night remains at 65 or over.

How do I know if my cows are suffering from thermal stress?

For producers, the most immediate and reliable indicator of thermal stress is the respiratory rate.

How does thermal stress affect cows?

Firstly, feed intake may decrease by 30 to 40 per cent, depending on the severity and the duration of the stress. This generally leads to a number of possible side effects:

- A 20- to 35-per-cent decline in milk production
- A 0.03- to 0.07-kg/d decrease in milk protein content
- A 0.01- to 0.07-kg/d decrease in milk fat content
- A 10-per-cent decrease in conception rates.

Notably, the negative effects of thermal stress on milk production can persist for up to two months after the event.

What about dry cows?

Dry cows are often overlooked in periods of thermal stress. However, the long-term effects are considerable for them as well.

For example, their dry matter intake will decrease, which can cause weight loss during the pre-partum period, in addition to excessive weight loss after calving.

Cooling dry cows is reported to promote the growth of epithelial cells in the udder and reduce cell death, which lessens the drop in milk yield. It can also increase the production of lymphocytes and enhance neutrocyte activity, thus boosting their immune system as compared to dry cows that have experienced significant thermal stress.

Furthermore, thermal stress suffered at any time during the dry-off period will result in a shorter gestation period.

Even unborn heifers are affected

The calf mortality rate at birth has been found to increase when dams have suffered from thermal stress in late pregnancy. Conversely, keeping cows cool during the dry-off period has a positive effect on calf weight at birth, at weaning and at puberty.

In-utero heat stress affects a heifer's future reproductive performance, in addition to her milk production and her long-term capacity to regulate body

temperature. So the repercussions continue for many years, until the cow is well into production.

In conclusion

Thermal stress is a real problem that has been around for a long time and that we need to address. Climate change trends indicate that extreme

temperature variations will be increasingly frequent and that the number of days where heat stress poses a risk will rise accordingly. In modern dairy operations, the consequences can be significant in terms of cow well-being and milk production. Fortunately, there are a number of options available to minimize heat stress.

What can I do to minimize heat stress?

- Provide sufficient water and make sure water troughs are accessible and competition is minimal.
- Reduce sun exposure by providing shade.
- Make sure your cows have proper ventilation. Air circulation allows heat to dissipate from the surface of the animals' bodies. Though your barn may be equipped with a good ventilation system, it is also important to make sure that the air is directed on the animals. Under Quebec conditions, optimal wind speed should be kept at 7 km/h (400 ft./min).



- Lastly, misters or sprinklers can be added, but this option must be used in combination with adequate ventilation to dry the animals. Sprinklers help promote the exchange of heat between the animal's skin and the water. However, a damp hair coat in hot conditions can have the opposite effect, meaning that the layer of water mixed in the hair can create a greenhouse effect on the surface of a cow's body and increase her body temperature. It is also important that udders stay dry to reduce the risk of contaminating the teats.



Table 1: Physiological effects on cows

Thermal stress	THI	Respiratory rate breaths per minute (BPM)	Rectal temperature °C
Mild	68-71	>60	>38,5
Moderate	72-79	• >75	• >39
Severe	80-89	>85	>40
Very severe	90-98	120-140	>41