What does climate change mean for heat stress in the Canadian dairy industry?

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The dairy industry continues to invest in research to expand our understanding of thermal conditions inside and outside dairy barns in current and future climates. Here are some of the latest findings from research on the climatic conditions in dairy barns across Canada.

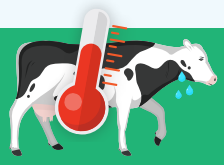
Heat stress: a growing concern for the Canadian dairy industry

High temperature and humidity impacts the health, welfare, and productivity of dairy cattle.

Heat stress occurs when environmental pressures exceed the heat dissipation capacity of the cow. This results in an increase in body temperature which triggers a set of physiological reactions that are necessary for the survival of the animal but harmful to its performance. The entire herd can be impacted by heat stress. The heat tolerance of animals varies depending on their physiological status and health status.

The temperature humidity index (THI) is an index that combines the effects of ambient temperature and relative humidity on animals.

A THI of 68 is often used as a threshold for heat stress although it is associated with a reduction in the amount of milk produced.



However, milk components are more sensitive to heat and therefore may be impacted at lower THIs. In addition to losses in performance, several behavioral adaptations including an increase in respiratory rate, time spent lying down, grouping as well as reductions in the quantity of food ingested can be observed in response to heat stress.

Climate change & thermal conditions in dairy barns

Researchers from Agriculture and Agri-Food Canada, University of Windsor, University of Waterloo, Laval University and the Ontario Ministry of Agriculture, Food and Rural Affairs evaluated dynamics of THI in the past and in future projections. They used this information to understand historical climate change trends and model projections about heat stress conditions in the future under several global emission scenarios.

Key Points

- **Exposure to heat is increasing due to climate change** and heat stress will continue to challenge the Canadian dairy industry if no adaptation strategies are put in place on dairy farms.
- **To maintain the health and welfare of cattle,** dairy farmers need to consider strategies to adapt to elevated temperatures and humidity.
- **Consider operating recirculating fans more in the evening and night,** to help animals dissipate accumulated heat as barns may not cool adequately at night, particularly when the wind speed is low.
- **Cool your parlour and holding area:** milking parlours were found to have a higher temperature-humidity index than the rest of the barn during milking times.

The researchers also measured climatic conditions and heat stress at representative dairy farms across a range of climatic regions.

The farms were located in Alberta, Ontario, Quebec and Nova Scotia and included facilities with different barn ventilation and cooling systems. Barns were equipped with temperature and humidity sensors and the THI was calculated to look at the in-barn thermal environment that cows experienced.

9 dairy farms across **4** provinces

What did they find about climate change trends?

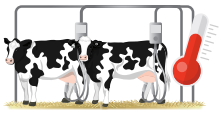
- Projections from climate models predict warmer summers
- More warm days, less cool nights
- Longer heat waves
- **Climate change models project an increase in the number of days of in barn heat stress conditions at all locations across Canada**

What did they find about thermal conditions in dairy barns?

The researchers found that all barns in the study routinely exceeded heat stress thresholds, however the contribution of temperature and relative humidity were different depending on the location of the farm. In western Canada, humidity was lower and decreased as temperature increased, compared with eastern Canada where relative humidity increased with temperature.

The impact of barn design:

Barn design influenced how fast the barns cooled down in the evening. Mechanically ventilated and insulated barns cooled faster at night compared to naturally ventilated barns. One naturally ventilated barn was found to be warmer due to its fabric roof which increased direct solar heat gain.



Heat in the parlour:

The results showed that THI in the parlour holding area was higher than in the stall area. The heat, humidity and congregation of cows means that cows are exposed to higher THI during 2 or 3 milking times per day in a barn with a parlour.

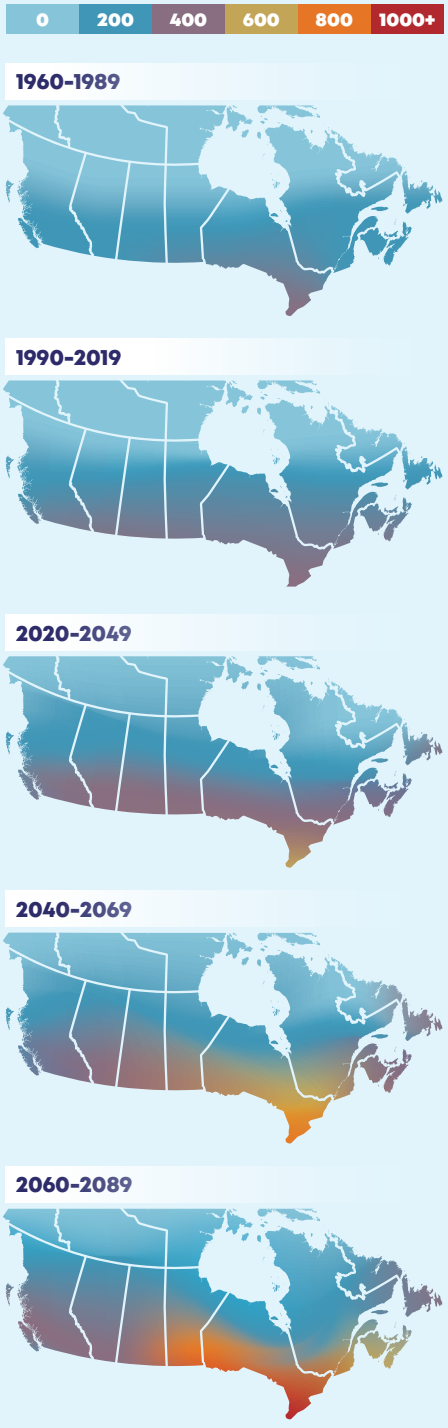
What about fans?

All barns studied, except one, were equipped with air recirculation fans. Although these fans do not have direct effects on the THI of the barn, the air movement created by them helps the cows dissipate heat to the environment. Additionally, a ventilation system that combines exhaust fans and curtain walls could provide a way to increase air exchange and improve cooling at night, when wind speeds are low. At one of the farms, the fans were turned on at a relatively high temperature, meaning they turned off at night, even if the THI in the barn exceeded the heat stress threshold. It is important to determine the thresholds at which fans must be activated in order to avoid the consequences of thermal stress.

From these results, it can be concluded that:

- **Canadian dairy farmers need to consider strategies to minimize the impacts of heat stress in their herd.**
- **It is important to adapt recommendations on heat stress to the barn design.**

THI Load (a measure of heat intensity over time) for 30-year periods in the historical record and projections to 2089 for a moderate global emission pathway. Historical observations and future projections indicate the largest increases in the magnitude and duration of heat stress occur in Ontario, while central Alberta and Newfoundland have the least expected change.



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