Is Heat Stress a Problem for Sheep in Ontario?

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I don't know about you, but I don't really think of Canada as a hot country. I think of our summers as being too short with a few hot spells that usually happen in July. When I hear about climate change, I am concerned, but more about other places in the world. But what about our sheep? Do they get heat stressed?

What is heat stress for sheep?

Heat stress is when core body temperature rises because of outside temperature. Sheep are considered to be a heat tolerant species, but not all breeds and individual animals have the same heat tolerance. Most of the breeds in Ontario are temperate breeds which perform the best and are most comfortable when temperatures are between 5 and 25 degrees Celsius.

When sheep are heat stressed, their respiration rate increases, they drink more water, they stop eating, their heart rate increases, they sweat, and they pant. These are natural body processes to bring core body temperature down, similar to what we notice ourselves. Adequate water and not moving sheep under heat stress will generally avoid distress. Although sheep adapt to heat and can tolerate heat stress events, there are production consequences to heat stress.

How does heat stress affect production?

Heat stress during mating

In the ram, the scrotum is the cooling system which keeps the testicles about 4°C cooler than body temperature. When rams experience heat stress and the scrotum is not cool enough, the number of abnormal sperm increase, sperm motility and sperm numbers decrease. The production of sperm takes time and sperm that are already developed at the time of heat stress will be normal. But by two weeks after heat stress, ewes don't get pregnant. Then, it can be 8 weeks or the time that it takes for sperm to develop before the ram will be fertile again.

It is clear from several studies that ewes experiencing heat stress between -7 and +7 days of breeding results in failure to conceive, shorter estrus and embryo loss. Ewes experiencing heat stress in this timeframe have been shown to be 12-26 times more likely to have embryo loss than ewes that are not heat stressed.

Heat stress during pregnancy

Heat stress during pregnancy results in lower birth weights and increased lamb mortality. The reported studies used heat stress treatments over several weeks with lamb birth weights lowered by 20-35% and survival rates dropping by as much as 30%. Fortunately, in Ontario, our heat stress events are shorter than those studied.

Heat stress during lactation

Lactating ewes are more sensitive to heat stress than ewes in late gestation due to the amount of heat created by milk production. Short periods of heat stress can cause milk yield to decrease by 15-20%, as well as cause changes to the composition of the milk. For dairy producers, it is important to note that there is also an adverse effect on coagulation properties and an increase in the bacterial load which can affect cheese production.

Heat stress – growing lambs

In general, as respiration, water consumption and sweating increase, feed intake and feed conversion are reduced. Polli et al 2019, compared feedlot lambs grown for 70 days with 15 days of heat stress (average temperatures of 23.4C) and those with 4 days of heat stress (average temperatures of 14.9C). This increase in heat stress was not enough to cause a change in dry matter intake relative to body weight but the lambs with less heat stress used the feed more efficiently.

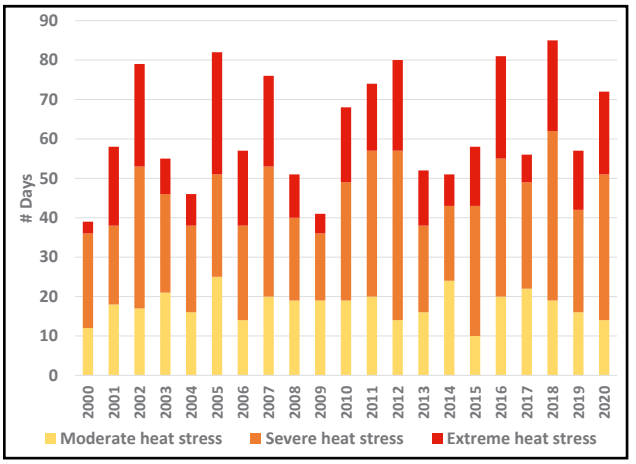
Heat Stress - Meat quality

Heat stress prior to slaughter can increase the chance of dark and tougher meat with less water holding capacity. Zhang et al 2020, speculates that this is more likely when the animals are not well adapted to heat stress along with the severity and duration of the heat stress.

How often do we have days of heat stress?

Using a temperature and humidity equation to estimate heat stress as suggested by researchers, Marai et al. 2007, figure 1 shows the difference between the number of days per year with moderate, severe and extreme heat stress between 2000 and 2020. The climate data was collected in Mount Forest which isn't the hottest area in Southern Ontario so the number of heat stress days may be different in your area.

Figure 1. Number of days of heat stress per year in Mount Forest, Ontario.



You will notice that the moderate heat stress days have stayed the same over the past two decades with a lot of variation in the number of severe or extreme days from year to year. If we compare the first decade in this century to the second it is easier to see the trend. Table 1 shows that there has been an increase of 13% in the number of days of severe and extreme heat stress in the past decade compared to the decade before.

Table 1. Number of days of heat stress per decade, Mount Forest, Ontario.

Days of Heat Stress	2000-2009	2010-2019	Change
# days moderate heat stress	181	180	0%
# days severe heat stress	248	315	27%
# days extreme heat stress	155	167	8%
Total # days heat stress	584	662	13%

This is information from the weather station at Mount Forest and it doesn't take into account all of the environmental factors influencing heat stress or the various microclimates that exist on your farm. It does point out the need to keep in mind that heat stress is gradually happening more often and can affect production.

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The best method to determine if your sheep are heat stressed is to use the panting score described by Carissa White in her article called "Helping your sheep beat the heat." Once sheep are starting to open their mouths to pant, they are experiencing moderate heat stress

What can we do about it?

Water

Sheep will drink as much as 50% more water when heat stressed. To reduce heat stress, it is important to ensure an adequate supply of water. Reducing the distance sheep need to travel to the water supply in times of severe or extreme heat stress improves their ability to adapt.

Shearing

Although wool has an insulating factor and can protect sheep from heat and sun, this is generally only useful for a short moderate heat stress event. Under longer or more severe heat stress, sheep that are shorn have lower core body temperatures, require less water and pant less than animals with their wool. Shearing creates more evaporation from the skin allowing a breeze to have a greater cooling effect.

Shade

Shade provides some protection from extra heat caused by solar radiation. Animals with shade will use less energy to thermoregulate and therefore maintain better body condition scores than sheep without shade. In the longer term, trees can be planted in or beside pasture fields. There are also cost-effective solutions that can be implemented right away such as shade cloth along fence rows or strategically placed stacks of straw. Plan pasture rotation to use fields with shade when heat stress is most likely and for the animals that are most vulnerable to heat stress production losses. It is important to ensure there is enough shade for all animals in the group to lie down to avoid piling.

In years past, recommendations have been made to avoid shade in pasture fields. Shade causes the sheep to congregate which creates compaction and loss of grass and the sheep aren't grazing when they are laying in the shade. Although those recommendations are valid, the changing weather means that practices will need to be adjusted to prevent production losses in vulnerable groups and to ensure animal wellbeing during sudden and long-lasting severe heat stress events.

Ventilation

High temperature and humidity levels negatively affect air quality and raise the risk of heat stress in barns during heat stress events. Many barns will combine natural and mechanical ventilation strategies to move maximal air and improve animal comfort. Natural cooling relies on barn side wall curtains to allow breezes through the barn and ceiling vents which allow air heated by livestock to escape. This is possible because of a process called thermal buoyancy, which explains why hot air rises. Thermal buoyancy is not always an effective means of cooling barns in summer, as the difference between barn and outside air temperature is often minimal. You may need to consider mechanical ventilation systems to improve cooling. Fans increase the speed of air that is passing over livestock, providing a cooling effect. For air flow to be able to reduce the body temperature and cool down the flock, it must generate air speeds of around 1.0 m/s to 2.0 m/s. You can check your air speeds in your barn using a handheld wind monitor. Circulation fans, like High Volume Low Speed (HVLS) large diameter fans, can improve barn temperature, but must be chosen based on individual barn design to maximize efficiency. It is important to remember that while fans provide cooling, they do not improve air quality unless they introduce outdoor air into the barn. Air turnover rates of 40-60 times per hour are recommended during hot weather for cooling purposes, as well as maintaining optimal air quality.

Conclusions:

Heat stress is something that may be affecting the performance of your sheep. To a degree, mammals including sheep, adapt to climate conditions over time. If the weather changes gradually from cooler to hotter, animals have a better chance of adapting. In the last few years, we have seen periods of rapid change from cooler temperatures to hot temperatures which can cause heat stress. The effects of heat stress can be reduced with adequate water, good ventilation, provision of shade, and avoiding sheep handling, moving, transporting or mating during hot spells or the heat of the day. To reduce potential production losses, make sure rams are not heat stressed for 8 weeks prior to the breeding season and ewes are not heat stressed for 7 days before or after being bred. **OSN**

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