Comparison of heat stress behavior between different Canadian Bos taurus cattle breeds using unmanned aerial vehicles

Justin Mufford

Supervisor: John Church

Committee: Matt Reudnik, Mark Rakobowchuk

Heat stress is an emerging cause of mortality and production loss in Bos taurus beef cattle production in North America. As heat waves and summer temperatures are projected to increase, there is a growing need to investigate heat tolerant breeds, or adapt commonly raised breeds, for beef production. Despite the recent occurrence of extreme heat events in Canadian pastures and feedlots, there is very little heat stress research conducted in Canadian settings. The purpose of this study was to develop a non-invasive method to compare behavioral and physiological indices of heat stress between different Canadian cattle breeds. We compared respiration rates between breeds varying in coat colour while in feedlot pens, including Black Angus, Red Angus, Hereford, Simmental, Charolais, the new Canadian Speckle Park composite breed and their various cross breeds. We recorded 4K video of cattle with a UAV positioned at nadir directly overhead at a height of ~10–15 m; respiratory behavior was analyzed later using Observer XT software. The mean respiration rate in breaths per minute (BPM) for black coated cattle (110 BPM, SD = 19) and red coated cattle (105 BPM, SD = 20) was higher than white coated cattle (94 BPM, SD = 21) (ANOVA, Tukey Test; $p < 0.001$). The mean ($n = 36$) and standard deviation was calculated for each of the following weather variables throughout the data collection period: ambient air temperature, 33.8 ± 1.9 °C; black globe temperature 47.1 ± 1.6 °C, relative humidity 23.9 ± 1.4 °C; and wind speed 3.0 ± 1.6 km hr^{-1}. Prior to the data collection period, cattle were given a week to acclimate to the sound of the UAV hovering above them. Cattle exhibiting the following behaviors in response to the UAV were not included in the study: rapid head turns, sudden increase in tail flicking, and sudden bouts of fast walking. Only videos in 5 of the 18 data collection days have been analyzed and we expect that behavioral differences will be larger with a greater sample. We suggest from our data that dark-coated cattle such as Angus show heightened responses to hot temperatures due to increased absorption of solar radiation at the coat; as a result, dark-coated cattle are likely more susceptible to heat-stress related production losses than light-coated cattle (such as the newly created Canadian Speckle Park breed) under temperate summer weather conditions. We further conclude that UAVs are a novel, effective, efficient and non-invasive tool to study cattle heat stress behavior in both feedlot and pasture settings.