

Minimisation of heat stress to improve the welfare of feedlot cattle

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Introduction

Feedlots are a well-established, value-adding component of beef cattle production. The cattle are housed in groups in confined outdoor yards that leave them exposed to episodes of high environmental temperatures, which can exceed their ability to dissipate body heat. The ensuing heat stress has important implications for cattle welfare as well as a negative impact on health and production; in extreme cases resulting in death. This has been the drive behind several recent studies examining alternative feeding and sprinkler regimens and access to shade as ways of reducing heat stress.

Discussion

An important contributing factor to excessive heat load in feedlot cattle is their high level of metabolic heat production resulting from their high-energy diet. To determine the physiological effects of altering feeding time and/or feed consumption of cattle under both thermoneutral and hot environments, Holt et al. (2004) divided six *Bos Taurus* steers into three groups and subjected each to one of three feeding regimens; ad libitum, limited feeding or bunk management, where feed was only available from 1600 to 0800 hours. After ten days in a climate-controlled metabolism unit, the steers had five days of readjustment in a feedlot before being reallocated to a different feeding regimen. Steers that were fed ad libitum were found, telemetrically, to have the highest respiration rates and peak rectal temperatures. This diurnal peak at 1400 to 1500 hours coincided with the diurnal peak climatic temperature, whereas steers on the restricted regimens had a diurnal peak rectal temperature at 2100 to 2200 hours. These results strongly supported the hypothesis that restricted feed intake could alter the diurnal body temperature pattern and thus prevent peak metabolic heat load from coinciding with high diurnal temperatures. Based on these results it is apparent that the ability of cattle to cope with adverse hot weather can be improved by either altering bunk management practices to prevent feed being consumed in the hottest part of the day or by implementing a limit-feeding regimen. This consolidates the findings of studies by Brosh et al. (1998) and Mader et al. (2002), which established that heat stress could successfully be reduced by limiting feed intake and/or feeding duration. These alterations increase animal wellbeing without adversely affecting performance (Mader and Davis, 2004).

Another strategy to alleviate heat stress is to enhance evaporative cooling through the direct application of water. Gaughan et al. (2004) conducted a study to evaluate whether altering the duration of water sprinkling affected cattle under heat-stress conditions. Six individually housed *Bos taurus* heifers, in a climate-controlled metabolism unit, were divided into two groups; one group [WET] received sprinkling daily but the duration was altered from two hours to four hours and back to two hours over six days, while the other group [NONWET] were not sprinkled on certain days. Treatments were then swapped between groups and repeated. Results showed that sprinkling reduced rectal temperature and respiration rate during the first few days of hot weather following a thermoneutral period. Heifers that received daily sprinkling had a lower rectal temperature and respiration rate than those that did not, except on the sixth consecutive day of hot weather, when their respiration rate was greater. It was hypothesised that this was due to the reduction in sprinkling duration from four hours back to two hours combined with the maintenance of a 62% greater feed intake than NONWET heifers during this time. These results suggest that while sprinkling can be used to reduce respiration rate immediately, inconsistent cooling regimens may actually increase the susceptibility of cattle to heat stress. This emphasises the importance of keeping the timing and duration of water application consistent during periods of hot weather. These findings have important welfare implications in feedlots as cattle seldom have consistent access to sprinkling, due to factors such as crowding. Nevertheless, Mader and Davis (2004) found that sprinkling the feedlot surface still served to decrease overall heat load.

Feedlot cattle are particularly vulnerable to heat stress as they cannot move away from solar radiation (Blackshaw and Blackshaw, 1994). Brown-Brandl et al. (2005 In Press) aimed to address this problem by assessing the dynamic responses of feedlot cattle to certain environmental conditions with and without access to shade. Eight *Bos taurus* steers were housed outside in individual concrete-surfaced pens; four of these had access to shade provided by a polyvinyl 100% shade-cloth covering 50% of the pen. Over eight periods, respiration rates, daily feed intake and core body temperatures were collected and analysed using four categories of daily maximum temperature humidity index (ITH); normal (at maximum ITH<74), alert, danger and emergency (at maximum ITH=84). Shade was found to have an increasing impact on physiological responses as the ITH increased, with the largest benefits being seen in the danger and emergency categories. Access to shade was shown to lower respiration rate and core body temperature during diurnal peak temperatures, thus concurring with results of a similar study by Mitlehner et al. (2001). Additionally, respiration rate increased with increasing ITH and was therefore deemed the most reliable heat stress indicator. This knowledge can assist feedlot managers in early detection of impending heat stress, enabling a proactive rather than reactive approach to heat stress relief.

The three aforementioned studies all housed the cattle individually and therefore failed to consider the role that social and behavioural factors may play in the development and minimisation of heat stress in feedlot cattle. The studies were also limited by small sample sizes of a single sex.

Conclusion

The results of these studies demonstrate that heat stress in feedlot cattle can be significantly reduced by altering feeding time and amount, providing regular sprinkling with water and providing access to shade. Application of these findings in commercial feedlots therefore has the potential to improve both the welfare and productivity of cattle. Given that the results of these studies were not obtained under feedlot conditions there is a need for further research into heat stress in "real-life" settings, taking into account both environmental and social effects.

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