Reducing Excessive Heat Load in Feedlot Cattle

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Introduction

Animal welfare is a major concern within animal production industries, particularly those with intensive production systems such as with feedlot cattle. Meat and Livestock Australia (MLA) recommend the use of sprinklers on feedlot cattle in hot weather in combination with other measures, such as providing shade and adequate water (MLA, 2006). During hot weather, cattle not adapted to hot climates suffer from excessive heat load leading to heat stress (Gaughan *et al.*, 2008). Nienaber and Hahn (2007) investigated ways to adapt current production systems in the face of a predicted rise in global temperatures. Gaughan *et al.* (2008) looked at the timing of sprinkling on feedlot cattle while Mader *et al.* (2007) focused on the effectiveness of using sprinklers on cattle and the feedlot surface.

Discussion

Through an examination of available literature, Neinaber and Hahn (2007) characterised the sources, responses to, and management of heat stress in cattle. They found that the most devastating heat waves (in terms of cattle deaths) generally occur in early summer before animals are acclimatised to the warmer temperatures. Relatively fewer deaths occur in late summer, possibly as a result of acclimatisation. Hahn (1995a) noted that most cattle deaths from heat stress occur at night or early morning when conditions are not as severe as at midday and early afternoon, when temperatures peak. Prolonged periods of heat stress will suppress appetite and reduce weight gain and cattle condition (Gaughan *et al.*, 2008; Mader *et al.*, 2007). High-performance animals, such as dairy cattle and fast-growing beef cattle, are more susceptible to adverse environmental conditions due to higher metabolic demands to maintain milk or muscle production (Nienaber & Hahn, 2007).

Sprinkling maximises the amount of heat removed from the animal through evaporative cooling at a reduced water cost to the animal itself. In addition, the ambient air temperature is lowered in the area immediately surrounding the animal, increasing the heat gradient and increasing the effectiveness of non-evaporative cooling mechanisms. Gaughan *et al.* (2008) used a controlled-climate facility to compare the effects of sprinkling cattle as temperatures increased in the morning (0600 to 1400 hours) and during the evening (1400 to 2200 hours). Mader *et al.* (2007) conducted a similar experiment in an outdoor feedlot, with water being applied from 2m above the floors of sprinkled pens every 1.5 hours between 1000 and 1730 hours each day. A second experiment was also carried out, wetting only the feedlot surface during the morning (1000 to 1200 hours) or the afternoon (1400 to 1600 hours).

To achieve adequate heat loss when sprinkling, droplets must wet the hides of the animals as accumulation of water in the hair may increase the humidity around the animal and reduce effective heat loss. High-pressure irrigation-type sprinklers can improve inexpensive wetting of animals, especially when coupled with fans to increase air movement (Nienaber & Hahn, 2007). However, cooled animals have limited ability to adapt to warm conditions and may become reliant on sprinkling to keep cool even in milder conditions. Cessation of sprinkling during the day on hot days may increase the heat load in cattle, even though ambient temperature and humidity may be decreasing (Gaughan *et al.*, 2008; Mader *et al.*, 2007).

Gaughan *et al.* (2008) conclude that cooling cattle after peak ambient conditions have been reached until early evening was beneficial, but recommend some alternate form of heat alleviation during the hottest part of the day. They noted that inadequate night-time cooling in day-cooled animals lead to a decreased recovery and impaired ability to cope with heat the following day. Nienaber and Hahn (2007) believe that the night-time recovery period is essential for cattle survival during periods of prolonged heat stress. Cattle require about 3-4 days after the onset of a heat challenge to fully recover from the effects of the additional heat load (Hahn, 1995b).

Mader *et al.* (2007) found that sprinkling both the feedlot surface and the cattle improves the microclimate around the cattle. While sprinkling raised the relative humidity, it decreased the temperature-humidity index due to the cooling effect of the sprinkling. Periodic wetting of the feedlot surface can provide heat-stress relief for animals by reducing feedlot surface temperature. Research conducted by Kendall *et al.* (2007) on dairy cattle found similar results in cattle sprinkled before afternoon milking. Both Gaughan *et al.* (2008) and Mader *et al.* (2007) noted the benefits in cooling cattle during the night as opposed to during daylight hours. While sprinkling heat-stressed feedlot cattle improved performance in hot, dry conditions, it may be detrimental in conditions where the humidity is such that is restricts evaporation and thus evaporative cooling. In these situations, alternate methods of cooling must be considered.

Not only can sprinkling feedlot cattle reduce the heat load on them but, if used effectively, it also has the potential to improve other feedlot conditions. Sprinkling can reduce the amount of dust produced by cattle movements in dry conditions (Mader *et al*., 2007), as well as reducing insect avoidance behaviours and thus irritation for the cattle (Kendall *et al*., 2007). As these are some of the concerns in any intensive animal production unit, this may be an added incentive to install sprinkler systems in cattle feedlots. However, sprinkling cattle must be carefully monitored to ensure that it is not increasing the humidity in the feedlot. It is also important that excess water is readily drained, as damp surfaces can contribute to pad moisture and ammonia levels within the feedlot, both of which can lead to problems with cattle health (MLA, 2006).

Conclusion

Intensive production systems must be carefully managed to reduce animal welfare concerns and maximise productivity. Production losses due to excessive heat load are a major concern, particularly in feedlot cattle. Sprinkling either the feedlot surface or the cattle, in addition to providing adequate shade, is an effective method of reducing heat stress in cattle. Sprinkling cattle is particularly effective once daytime temperature has peaked, allowing cattle to cool sufficiently and recover overnight. Sprinkling cattle has the added benefits of reducing dust in feedlots and deterring insect pests.

References

Gaughan, J.B., Mader, T.L., Holt, S.M. (2008) Cooling and feeding strategies to reduce heat load of grain-fed beef cattle in intensive housing. *Livestock Science* 113: 226-233.

Hahn, G.L. (1995a) Environmental influences on feed intake and performance of feedlot cattle. Proceedings Symposium, Intake by Feedlot Cattle. Oklahoma Agricultural Experimental Station, Stillwater, Oklahoma. p.207.

Hahn, G.L. (1995b) Global warming and potential impacts on cattle and swine in tropical and temperate areas. In: Proceedings, First Brazilian Congress on Biometeorology, 4-6 September 1995, Jaboticabal, SP, Brazil.

Kendall, P.E., Verkerk, G.A., Webster, J.R., Tucker, C.B. (2007) Sprinklers and shade cool cows and reduce insect avoidance behaviour in pasture-based dairy systems. *Journal of Dairy Science* 90 **(**8**)**: 3671-3680.

Mader, T.L., Davis, M.S., Gaughan, J.B. (2007) Effect of sprinkling on feedlot microclimate and cattle behaviour, *International Journal of Biometeorology* 51: 541-551.

Meat and Livestock Australia (2006) Heat Load in Feedlot Cattle, Meat and Livestock Australia Limited.

Nienaber J.A., Hahn, G.L (2007) Livestock production system management responses to thermal challenges. *International Journal of Biometeorology* 52: 140-157.