

# Welfare benefits of providing shade to feedlot cattle



# Optimising welfare of feedlot cattle

Livestock care is fundamental to the success and sustainability of every feedlot. Australia's red meat customers and consumers both domestically and overseas, seek reassurance that livestock are cared for humanely and ethically.

## What does animal welfare mean?

Animal welfare is often described through the five freedoms, which means an animal's life is:

1. Free from hunger, thirst and malnutrition
2. Free from thermal and physical discomfort
3. Free from pain, injury and disease
4. Expresses normal behaviour
5. Free from fear and distress.

The five freedoms is an outcome-based system with provisions outlining the husbandry necessary to promote the five freedoms (Table 1). In addition to the five freedoms, any outcome-based working protocol for the evaluation of animal welfare must include chronic indices of failure to cope with physical and emotional challenges.<sup>20</sup>

**Table 1: Five freedoms of animal welfare**

Freedom	Provisions
Freedom from thirst, hunger and malnutrition	By ready access to a diet to maintain full health and vigour
Freedom from thermal and physical discomfort	By providing a suitable environment including shelter and a comfortable resting area
Freedom from pain, injury and disease	By prevention or rapid diagnosis and treatment
Freedom from fear and distress	By ensuring conditions which avoid mental suffering
Freedom to express normal behaviour	By providing sufficient space, proper facilities and the company of the animal's own kind

## Benefits of providing shade

Best-practice shade adoption has many benefits for feedlot cattle regardless of breed and geographical location.

Based on the five freedoms and consideration of peer-reviewed literature, providing shade to feedlot cattle during periods of excessive heat can:

- improve freedom of choice for normal shade seeking behaviour of feedlot cattle
- alleviate possible thirst and dehydration
- mitigate possible thermal discomfort
- reduce possible pain and disease
- decrease possible fear and distress.

# Understanding thermal regulation and shade seeking behaviour

Cattle will naturally seek shade on hotter days. If there is no shade available, cattle can use other strategies to reduce their body's heat load, such as panting or reducing feed intake. However, these alternative strategies can divert energy away from growth and maintaining good health.

## Thermal regulation

Animals are often subject to variation in environmental temperature and respond through thermoregulatory mechanisms. Thermal regulation balances heat gain/production with heat losses to the surrounding environment in an attempt to maintain thermal neutrality.

Thermal regulation can occur through either changes in their physiology (panting, reducing feed intake) or behavioural mechanisms (seeking shade). Behavioural thermoregulation offers an effective means of controlling body temperature and maximises time allocated to activities such as feeding.

## How to determine if cattle are heat stressed

An easy way to determine if cattle are heat stressed is by observing their panting – cattle that breathe with their mouths open are heat stressed.

When cattle are at rest in their pens, the first sign of heat stress is open-mouth breathing followed by tongue extension. The further the tongue is extended, the greater the heat load of the animal.

## Impacts of heat stress on feedlot cattle

Excessive heat load in feedlot cattle during the summer months can result in:

- significant production losses
- animal welfare considerations.

High body heat loads can develop in feedlot cattle when a combination of local environmental conditions and animal factors exceed the animal's ability to dissipate body heat. Initially it will lead to a reduction in feed intake and therefore production losses.

However, with severe or prolonged elevations in body temperature, tissue organ damage can result, and in some instances large numbers of feedlot cattle have been lost during these extreme weather conditions.

Some cattle breeds are genetically more heat tolerant than others. However, heat tolerance is also behavioural. For example, cattle may deal with lack of shade by grazing and walking in the cool of the day or at night, and by using good airflow to help evaporation.

Cattle will seek shade when it's available regardless of whether their breed is adapted to hotter climates (*Bos indicus*) or southern breeds (*Bos taurus*), and even in mild climatic conditions.<sup>15,8,4,5</sup>

Shade helps reduce heat loading from the sun, especially for dark-coloured animals that readily absorb heat. In the absence of adequate shade, animals will try to find any form of shade such as a fence post or another animal's shadow.

## Responses to shade

The provision of shade in feedlot pens can provide cattle with an option to escape extreme heat events, or regulate their physiology to minimise their body's thermal regulation effort.

### ***Bos taurus* cattle**

Studies have shown that, in beef and dairy cattle in natural grazing environments, shade utilisation increases with:

- increasing air temperature
- solar radiation
- temperature humidity index.<sup>15,9,19</sup>

Multiple studies have demonstrated the strong biological drive of *Bos taurus* cattle to seek shade and escape thermal discomfort:

- Dairy cattle provided with increased shade allocation under pasture situations during summer spent twice as much time under shade (25% vs 50%) and showed less aggressive interactions.<sup>16</sup>
- For feedlot steers provided with 100% solar block polyvinyl shade cloth (21.6 m<sup>2</sup>/head; 50% of pen area) spent 80%–96% of their time under shade for normal and emergency thresholds of the temperature-humidity index, respectively.<sup>6</sup>
- Under non-heatwave conditions, on average 50% of feedlot steers were under 70% solar block shade cloth (2.0 to 4.7 m<sup>2</sup>/head) in a summer feedlot experiment in south east Queensland.
- Under heatwave conditions, on average 90% of cattle accessed shade.<sup>18</sup>
- Numerous scientific papers have reported the benefit of shade for decreasing respiration rate, panting score or productivity in *Bos taurus* cattle.<sup>6,10,11,13,14,18,12</sup>

### ***Bos indicus* cattle**

*Bos indicus* cattle also benefit from shade for productivity and animal welfare. Studies with Brahman cross cattle with access to 3.3 to 4.0 m<sup>2</sup>/head of roofed shade had:

- reduced stress hormones
- reduced respiration rate
- improved hydration
- greater feed intake, gain and efficiency.<sup>1,2,3,17</sup>

## Animal health

Mortality has been prevented in severe heatwaves through provision of shade. A survey in the USA of 36 farmer-feeders (9,830 head) reported that 35 pens with shade had a mortality of 0.2% whereas 46 pens without shade had a mortality of 4.8%.<sup>7</sup> Similar observations have been made in the Australian feedlot industry.

Observational evidence from Australian lot feeders indicates cattle that experience bouts of excessive heat load are more susceptible to:

- bovine respiratory disease after a heat stress event
- feed intake variation.

## Putting it all together

- shade lowers respiration rate, panting score and stress hormones in feedlot cattle
- shade alleviates dehydration of cattle
- both *Bos taurus* and *Bos indicus* cattle can respond to shade
- shade alleviates mortality, fear and distress during heat wave conditions
- shade improves feedlot performance.

## Management strategies to optimise welfare with shade

Moisture accumulation under shade can occur as shade seeking is normal behaviour for feedlot cattle.

To limit moisture accumulation and optimise welfare a variety of shade and/or engineering designs are recommended in the *MLA Beef cattle feedlots: design and construction manual*, such as:

- retractable shade designs
- separate panel designs
- corrugated iron strip design with spaces to encourage drying
- centre square designs with gaps to encourage drying
- longitudinal shade rows in the north to south direction
- correct inclination of shade to encourage drying in morning sun
- covered housing systems
- increased shade allocation to allow the cattle space to spread out
- correct shade height
- correct positioning of water troughs away from shade.

Providing shade at an appropriate density for the class of cattle allows animals to spread out, and for wind movement to encourage convection cooling and pen floor drying. Lot feeders should maintain appropriate pen cleaning intervals and surface maintenance in shaded pens.

## Ongoing research

MLA is supporting ongoing research on the animal welfare benefits of shade in southern regions of Australia. This includes determining the year-round animal welfare and production effects of conventional shade systems. Novel designs are also being explored including dual purpose shade-shelter structures that may offer some beneficial protection during rain events. Results of these projects will be available in 2021.

## References

1. Barajas, R., P. Garces, and R. A. Zinn. 2013. Interactions of shade and feeding management on feedlot performance of crossbred steers during seasonal periods of high ambient temperature. *Prof. Anim. Sci.* 29:645–651.
2. Barajas, R., B. Cervantes, J. Guerra-Liera, and A. Ramos-Suarez. 2018a. Influence of pen-shade area on feedlot performance of finishing bulls in a warm environment. *J. Anim. Sci. Vol. 96, Suppl. S3:15.*
3. Barajas, R., B. J. Cervantes, B. O. Lopez, D. Jimenez-Leyva, and L. Avendaño-Reyes. 2018b. Pen-shade and morning versus afternoon feeding on feedlot performance and respiratory rate of growing calves under hot weather. *J. Anim. Sci. Vol. 96, Suppl. S3*
4. Bennett, I.L., Finch, V.A., and C.R. Holmes. 1985. Time spend in shade and its relationship with physiological factors of thermoregulation in three breeds of cattle. *Applied Animal Behaviour Science* 13:227-236.
5. Blackshaw, J.K., Blackshaw, A.W., and T. Kusano. 1987. Cattle behaviour in a saleyard and its potential to cause bruising. *Australian Journal of Experimental Agriculture* 27:753-757.
6. Brown-Brandl, T. M., R. A. Eigenberg, J. A. Nienaber, and G. L. Hahn. 2005. Dynamic response indicators of heat stress in shaded and non-shaded feedlot cattle, Part 1: Analyses of indicators. *Biosyst. Eng.* 90:451-462.
7. Busby, D., and D. Loy. 1996. Heat stress in feedlot cattle: Producer survey results. A. S. Leaflet R1348. Iowa Agric. Exp. Stn., Iowa State Univ., Ames.
8. Daly, J.J. (1984). Cattle need shade trees. *Queensland Agricultural Journal* 109:21-24.
9. Kendall, P. E., P. P. Nielsen, J. R. Webster, G. A. Verkerk, R. P. Littlejohn, and L. R. Matthews. 2006. The effects of providing shade to lactating dairy cows in a temperate climate. *Livest. Sci.* 103:148-157.
10. Gaughan, J. B., S. M. Holt, and R. H. Pritchard. 2009. Assessment of housing systems for feedlot cattle during summer. *Prof. Anim. Sci.* 25:633–639.
11. Gaughan, J. B., S. Bonner, I. Loxton, T. L. Mader, A. Lisle, and R. Lawrence. 2010. Effect of shade on body temperature and performance of feedlot steers. *J. Anim. Sci.* 88:4056–4067.
12. Hagenmaier, J.A., C. D. Reinhardt, S. J. Bartle, and D. U. Thomson. 2016. Effect of shade on animal welfare, growth performance, and carcass characteristics in large pens of beef cattle fed a beta agonist in a commercial feedlot. *J. Anim. Sci.* 2016.94:5064–5076.
13. Mitlöhner, F. M., J. L. Morrow, J. W. Dailey, S. C. Wilson, M. L. Galyean, M. F. Miller, and J.J. McGlone. 2001. Shade and water misting effects on behavior, physiology, performance, and carcass traits of heat-stressed feedlot cattle. *J. Anim. Sci.* 79:2327-2335.
14. Mitlöhner, F. M., M. L. Gaylean, and J. J. McGlone. 2002. Shade effects on performance, carcass traits, physiology, and behaviour of heat-stressed feedlot heifers. *J. Anim. Sci.* 80:2043–2050.
15. Rovira, P and J. Velazco. 2010. The effect of artificial or natural shade on respiration rate, behaviour and performance of grazing steers, *New Zealand Journal of Agricultural Research*, 53:4, 347-353.
16. Schütz, K.E., A.R. Rogers, Y.A. Poulouin, N.R. Cox, and C. B. Tucker. 2010. The amount of shade influences the behavior and physiology of dairy cattle. *J. Dairy Sci.* 93 :125–133.
17. Ramos-Suarez, A., J. Guerra-Liera, B. Cervantes and R. Barajas. 2018. Influence of Pen-shade area on hematocrit and white blood cells of feedlot cattle during hot season. *J. Anim. Sci. Vol. 96, Suppl. S3:10.*
18. Sullivan, M.L, A. J. Cawdell-Smith, T. L. Mader, and J. B. Gaughan. 2011. Effect of shade area on performance and welfare of short-fed feedlot cattle. *J. Anim. Sci.* 2011. 89:2911–2925.
19. Tucker, C. B., A. R. Rogers, and K. E. Schütz. 2008. Effect of solar radiation on dairy cattle behaviour, use of shade and body temperature in a pasture-based system. *Appl. Anim. Behav. Sci.* 109:141-154.
20. Webster, J. 2016. Animal welfare: Freedoms, dominions and ‘a life worth living’. *Animals* 6:35.

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