SOME EFFECTS OF SHADE ON ZEBU CROSS CATTLE IN A FEEDLOT

M.R. CLARKE[A], *M.R. JEFFERY*[B] *AND A.M. KELLY*[A]

[A]Queensland Dept of Primary Industries, PO Box 102, Toowoomba, Qld. 4350
[B]Queensland Dept of Primary Industries, Brigalow Research Station, MS 586, Theodore, Qld. 4719

SUMMARY

The comparative performance of shaded and unshaded Zebu cross steers was studied in a Queensland feedlot from January to May 1992. The provision of shade gave no significant ($P > 0.05$) advantage in liveweight gain (182 *v*. 177 kg), feed conversion ratio (9.4 *v*. 9.8 kg of fresh feed/kg liveweight gain), carcase weight, dressing percentage, P8 rump fat, eye muscle area, saleable meat yield, meat colour, fat colour, fat content, marbling or ultimate pH to the shaded group compared to the unshaded group. At no time did steers exhibit open-mouth breathing or aberrant behaviour. A significant ($P < 0.05$) relationship was found between rectal temperature and dry bulb temperature ($r^2 = 0.60$) but not between rectal temperature and wet bulb temperature. Although the slopes were the same in the relationship of rectal temperature against dry bulb temperature for the treatments, the unshaded steers had significantly ($P < 0.05$) higher rectal temperature than shaded steers for any particular dry bulb temperature. The equations were; $y = 37.95 + 0.036x$ and $y = 38.09 + 0.036x$ for shaded and unshaded respectively, where y is rectal temperature and x dry bulb temperature in °C.

Keywords: feedlot, climate, heat stress, shade, genotype.

INTRODUCTION

Finishing of beef cattle in feedlots in Australia is increasing in popularity, mostly as a result of expansion of the north Asian beef market. Because of proximity to store cattle, grain and abattoirs, more than half of these feedlots are in Queensland, where the summers can be hot and humid.

Cattle gain heat from metabolic activity and the environment, and lose it by convection, radiation, conduction and evaporation. A thermal balance exists when the heat gained equals the heat lost (Gates 1968). The 2 important factors affecting the ability to thermoregulate in overheated situations are breed and the nature of the climatic challenge. Zebu derived breeds are more heat tolerant than other breeds (Finch 1985). Air temperature, solar radiation, relative humidity and wind speed are the important climatic variables (Gates 1968).

A number of researchers in the United States have reported the benefits of providing shade to British breed feedlot cattle in hot environments in terms of higher liveweight gain, better feed conversion, lower respiration rate and lower rectal temperature (Garret *et al.* 1960; Hahn 1985).

Australian feedlots are at lower latitudes and altitudes than American feedlots and have higher heat loads (Fell and Clarke 1993). British breed cattle predominate in Australian feedlots because the export market specifications demand these breeds, rather than the more heat tolerant Zebu derived breeds (Clarke 1993).

This experiment examined the response to the provision of shade in a Queensland feedlot using Zebu cross steers.

MATERIALS AND METHODS

In January 1992 at Brigalow Research Station, Theodore, central Queensland, 36 two year old Brahman cross steers (50% Brahman, 50% Shorthorn) weighing (mean ± sd) 466 ± 1.39 kg were stratified into 6 groups based on their fasted liveweight and randomly allocated to 2 treatments; shaded and unshaded. The treatments were replicated 3 times with yards forming the experimental units and 6 steers/yard treated as samples within each pen.

Shade was achieved by the suspension of knitted shade cloth at 3.75 m above the feedlot pad to provide 10 m^2/beast. A rotation system was employed to minimise yard effectsand steers were fed (75% barley, 10% hay, 15% additives) to appetite twice daily in open troughs for 127 days from 6 January 1992 to meet the specifications of the short-fed Japanese export market.

Rectal temperature and liveweight were recorded weekly at 1400 hours. Daily air temperature at steer height in the shaded yards (beneath the shade) and unshaded yards was recorded in the feedlot at 1500 hours. Location of animals in yards, and incidence of open-mouth breathing and aberrant behaviour were recorded at 0730 and 1500 hours. Fresh feed intake of each group was recorded daily as total feed fed less that refused, on a fresh feed basis.

Individual hot carcase weight, subcutaneous fat depth at the P8 rump site, eye muscle area at the 10th

rib, saleable meat yield using a prediction equation (R.F. Thornton, pers. comm.), fat colour and meat colour of a striploin sample using a Minolta CR200 Chromameter, fat content of the striploin steak using Soxhlet extraction, marbling using the Japanese grading system (Anon. 1988) and ultimate pH of the striploin steak were recorded for all carcases.

The animal production data were analysed by analysis of variance with the statistical model including terms for replicates and the effect of shading. Differences were considered to be significant at the 5% probability level. The relationship between rectal temperature and air temperature was tested using regression analysis with the effect of shading included as a factor.

RESULTS

Overall, there was no significant advantage in liveweight gain, daily feed intake, feed conversion ratio or meat quality measurements to the shaded group compared to the unshaded group (Table 1). During February, the percentage of steers which used the shade was 41 and 70% at 0730 and 1500 hours respectively.

Table 1. The comparative performance and meat quality of shaded and unshaded feedlot steers

	Shaded	Unshaded	LSD (P = 0.05)
Liveweight gain (kg)	182	177	22.4
Daily feed intake (kg)	13.5	13.7	1.81
Feed conversion (kg fresh feed/kg liveweight gain)	9.4	9.8	0.86
Carcase weight (kg)	352	351	14.0
Dressing percentage (%)	54	54	1.1
P8 rump fat (mm)	24.9	21.3	4.38
Eye muscle area (cm2)	72.4	72.3	5.75
Saleable meat yield (kg)	233	234	9.9
Meat colour	35	35	1.5
Fat colour	11.2	11.9	1.39
Fat content (%)	3.5	4.3	0.99
Marbling	2.16	2.44	0.465
Ultimate pH	5.54	5.54	0.014

No significant ($P < 0.05$) differences were observed between treatment means

At no time did any steers exhibit open-mouth breathing or aberrant behaviour even though daily air temperature regularly exceeded 35°C (Figure 1). Mean rectal temperature for shaded and unshaded steers was 39.1 and 39.3°C respectively.

A significant relationship was found between rectal temperature and dry bulb temperature ($r^2 = 0.60$) but not between rectal temperature and wet bulb temperature. Although the slopes were the same in the relationship of rectal temperature against dry bulb temperature for the treatments, unshaded steers had significantly higher rectal temperatures than shaded steers for any particular dry bulb temperature. Equations were $y = 37.95 + 0.036x$ and $y = 38.09 + 0.036x$ for shaded and unshaded respectively, where y is rectal temperature and x dry bulb temperature.

DISCUSSION

Shade reduced the rectal temperature in the Zebu cross steers although the mean rectal temperature in unshaded steers was not unacceptably high (39.3°C). Blood *et al.* (1979) suggested that the first observable clinical reactions to hyperthermia occur above 39.5°C and Beede (pers. comm.) reported 38.5 to 39.3°C as an acceptable range of rectal temperature for cattle.

Although shade reduced rectal temperature, it gave little benefit in terms of liveweight gain, feed conversion efficiency and carcase quality.

Use of shade by Zebu cross steers in this experiment was less than that observed for Hereford steers in the same feedlot in January *1994* which used the shade at the rate of 98% at 1506 hours (Clarke, unpublished).

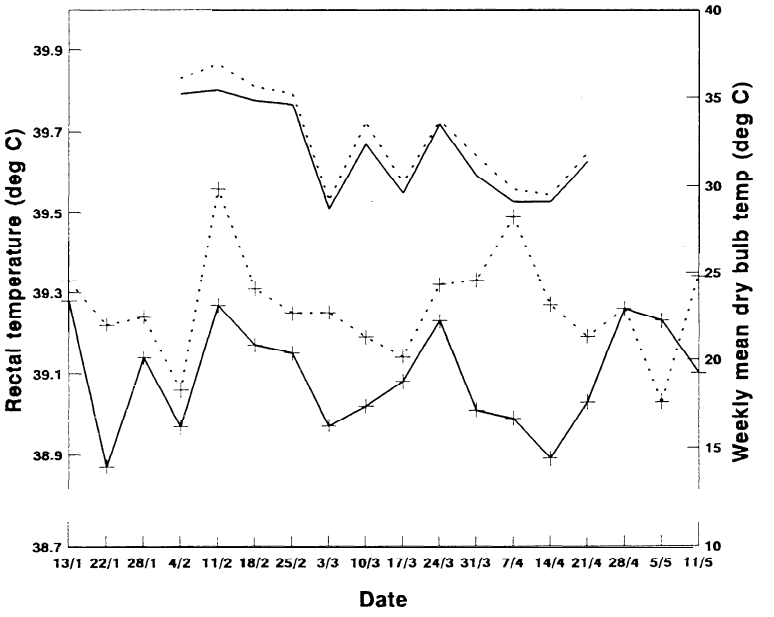

Figure 1. Effect of shade on air dry-bulb temperature (solid line for shaded and broken line for unshaded), and rectal temperature (solid line with cross points for shaded and broken line with cross points for unshaded) of Zebu cross feedlot steers

Acceptable rectal temperature and absence of aberrant behaviour suggest that Zebu cross steers similar to those in this experiment under similar climatic conditions are unlikely to suffer from excessive heat load. This finding is supported by the comparative breed studies of Finch (1985) but contrasts with results with British breeds from southern regions of the United States (Garret *et al.* 1960; Hahn 1985).

Research needs to be continued on the effect of excessive heat load on beef production and cattle welfare in Australian feedlots, especially with British and European breeds.

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