The effect of shade on GPS collar-recorded temperature and grazing behaviour of heifers during summer in the Barkly Tableland, Northern Territory

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There are substantial areas in northern Australia where large numbers of cattle graze open grassland where the distances between water points are large, there is very little shade, and temperatures are very high (>40ºC) during the summer months. A research project investigating the effectiveness of providing shade for reducing calf mortality due to exposure in the treeless Mitchell grass plains of the Barkly Tableland, Northern Territory has commenced. This paper presents preliminary results from a pilot study which involved pregnant heifers being fitted with GPS collars to describe the effect of shade on collar-recorded temperature and frequency of fixes near water (where the shade was also located).

One hundred and fifty pregnant purebred Wagyu heifers that were predicted to calve between October and December 2019 were randomly allocated, with even numbers in each paddock, to either a paddock that had one feedlot-grade shade structure (50m x 25m in size) installed within 500 m of each water point (SHADE) or not (CONT). On day 70, 2 of the 75 heifers from each paddock were randomly selected and each fitted with a Lotek LiteTrack Iridium 420 GPS tracking collar that was scheduled to provide a GPS location and the ambient temperature at the time of capturing the location every 60 minutes. Data was transmitted via satellite in real time and was accessed via the Lotek online dashboard. Both paddocks were relatively treeless with cracking clay soils supporting productive Mitchell and Flinders grasslands and were assessed as being similar in production potential. The paddocks were almost square in shape and similar in area, approximately 56km^2 each. Paddocks were equally well-watered with 7 water points strategically located throughout each paddock with watering points approximately 5km apart. The largest distance from water in either paddock was 4km.

The dataset contained 8,729 observations, each with valid GPS location and temperature records. Therefore, each GPS collar contributed an average of 23.7 observations per day. Using QGIS GIS software, GPS positions were categorised as either within 500m of water or not. GPS location data were summarised by generating daily counts for each collar of GPS locations within 500m of water and total number of GPS locations recorded over a single day and between 10am and 3pm. GPS collar-recorded temperatures were summarised by averaging all records for each collar across a single day, together with a subset between the hottest period between 10am and 3pm. Differences in mean temperatures for average GPS collar-recorded temperature were compared using a MANOVA. Differences in frequency of GPS locations within 500m of water for treatments were compared using a Poisson regression model. All analyses were performed using Stata/IC, version 16. The results of these analyses are presented in Table 1.

Treatment	Daily		Between 10am and 3pm	
	Average GPS collar-recorded temperature (ºC)	% of daily GPS locations within 500m of water	Average GPS collar-recorded temperature (ºC)	% of daily GPS locations within 500m of water
CONT	31.6±0.04	35.5±1.1	41.2±0.05	29.2±1.5
SHADE	31.7±0.04	35.5±1.1	40.6±0.05	26.8±1.4
Diff.	0.1±0.06	0.1±1.6	-0.5±0.07	-2.5±2.1
P-value	0.11	0.97	<0.001	0.24

Table 1. Comparison of mean (± SE) GPS collar-recorded temperature and percentage of GPS location within 500m of water per day, and between 10am and 3pm.

These results suggest that the provision of shade near watering points does not have a large impact on the average GPS collar-recorded temperature or time spent near the shade for heifers during summer when considered across an entire day (Table 1). However, when analyses were performed on a subset of data recorded between 10am and 3pm, the daily average collar-recorded temperature for SHADE was 0.5ºC lower than for CONT (P<0.001). This is not easily explained as there was no evidence of heifers spending more time resting in the installed shade near water. The limitations in the design of this pilot study, such as small sample size and the available natural shade not being accounted for, are noted. This research is ongoing with a comparison of calf loss rates of particular interest, coupled with additional collars to be deployed and an assessment of the available natural shade in paddocks using satellite imagery planned.

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