

The effect of elevated ambient temperature on ruminal temperatures of beef cows.

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STORY IN BRIEF

Mature Angus cows ($n = 10$) were administered temperature recording boluses to determine the effect of elevated ambient temperature on ruminal temperature (**RuT**). Ruminal and ambient temperatures were recorded on June 7, 2009, January 22, 2010, and June 9 and 19, 2010 in Stillwater, OK. Days with a maximum ambient temperature exceeding 34°C (ELEVATED) or less than 31°C (CONTROL) were selected for RuT analyses. During the ELEVATED day, RuT was greater ($38.76 \pm 0.09^{\circ}\text{C}$) compared with CONTROL days ($38.02 \pm 0.09^{\circ}\text{C}$). Ruminal temperature was similar on CONTROL days. Increased RuT may be a useful tool to determine heat stress in cattle during periods of elevated ambient temperature.

Key Words: beef cows, heat stress, ruminal temperature

INTRODUCTION

Core body temperature can be used to predict important physiological events in beef cows. Ruminal temperature (RuT) is an effective measure of core body temperature (Hicks et al., 2001) and can be used to identify heat stress, estrus, parturition, and health status. Heat stress can alter endocrine functions and performance of dairy cattle (Collier et al., 1982; Lewis et al., 1984). Core body temperature can be efficiently measured with RuT boluses. The use of RuT for the prediction of physiological events can be influenced by environmental and behavior factors. The objective of this study was to determine the effect of elevated ambient temperature on RuT in beef cows.

MATERIALS AND METHODS

Mature Angus cows ($n = 10$; 499 ± 48 kg), with a body condition score of 4 to 5 were used to determine the effect of elevated ambient temperature on RuT. The experiment was conducted from June 2009 to July 2010 at the Range Cow Research Center in Stillwater. Cows were managed in a drylot with ad libitum hay and water. Cows were administered rumen temperature boluses (SmartStock LLC, Pawnee, OK) via a balling gun prior to the trial. Temperature boluses were programmed to transmit RuT, bolus ID, date and time every hour. Ruminal temperatures were recorded for the same cows during one day with a maximum daily temperature exceeding 34°C (ELEVATED) and on three days when the maximum ambient temperature was less than 31°C (CONTROL). Data were included for cows that were not in estrus and had at least 14 RuT readings per day. Ambient temperature and relative humidity were collected hourly (www.agweather.mesonet.org) and ranged from 18 to 35°C and 40 to 93% , respectively. Data was analyzed using the MIXED procedure (SAS Institute INC., Cary, NC) with day and hour as the fixed effects and cow as the repeated measure.

RESULTS AND DISCUSSION

Ambient temperatures during the experimental days are depicted in Figure 1. Ambient temperatures during 1200 to 2300 h were similar on June 6, 2009 and June 9, 2010, and greater on June 19, 2010. Ambient temperature on January 22, 2010 was less compared with the other 3 days. There was a day x hour effect ($P < 0.0001$) on RuT. Ruminal temperature of ELEVATED cows during the day in June 19, 2010 ($38.76 \pm 0.09^\circ\text{C}$) was greater ($P < 0.0001$) compared with CONTROL days (June 7, 2009, January 22, 2010 and June 9, 2010: 38.02 ± 0.09 , 38.02 ± 0.09 , $37.92 \pm 0.1^\circ\text{C}$, respectively; Figure 2). Ruminal temperatures on CONTROL days were not different ($P > 0.22$). Ruminal temperatures were similar on all days from 0 h to 0900 h. After 1200 h, RuT in ELEVATED cows was greater compared with CONTROL cows. The decline in RuT of cows at 1200 h on June 7, 2009 and June 9, 2010 was probably associated with water consumption (Boehmer et al., 2009). Increases in RuT on June 19, 2010 are similar to increases in rectal temperature in dairy cows exposed to heat stress (Roman-Ponce et al., 1978; Collier et al., 1982). Our results determine that exposure of cows to elevated ambient temperature causes increased RuT of beef cows.

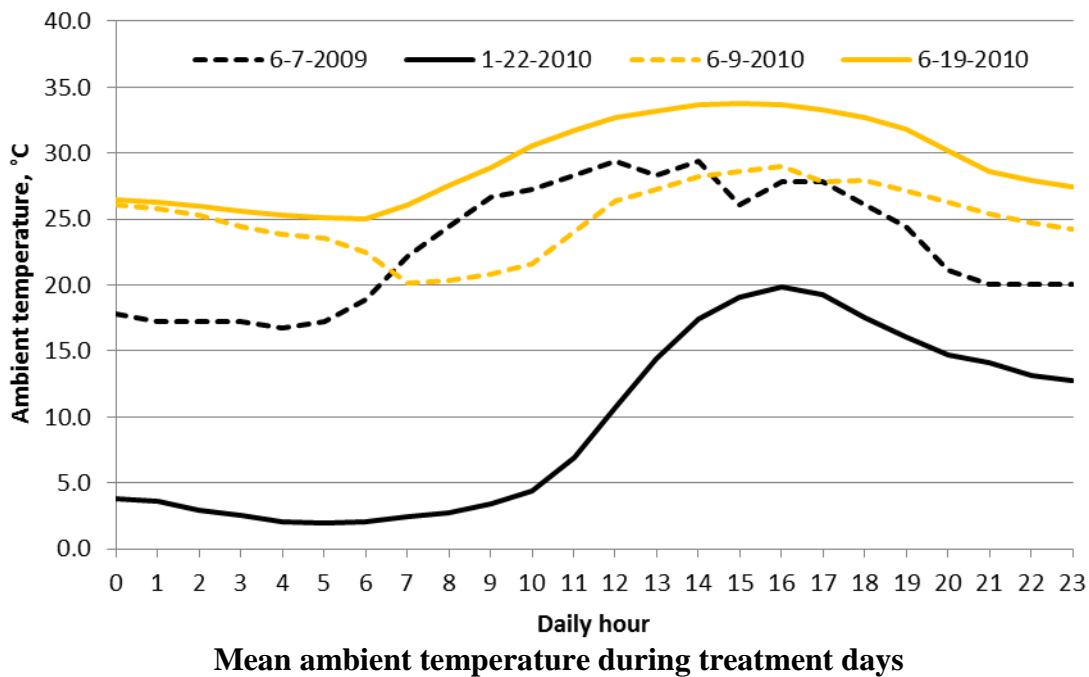
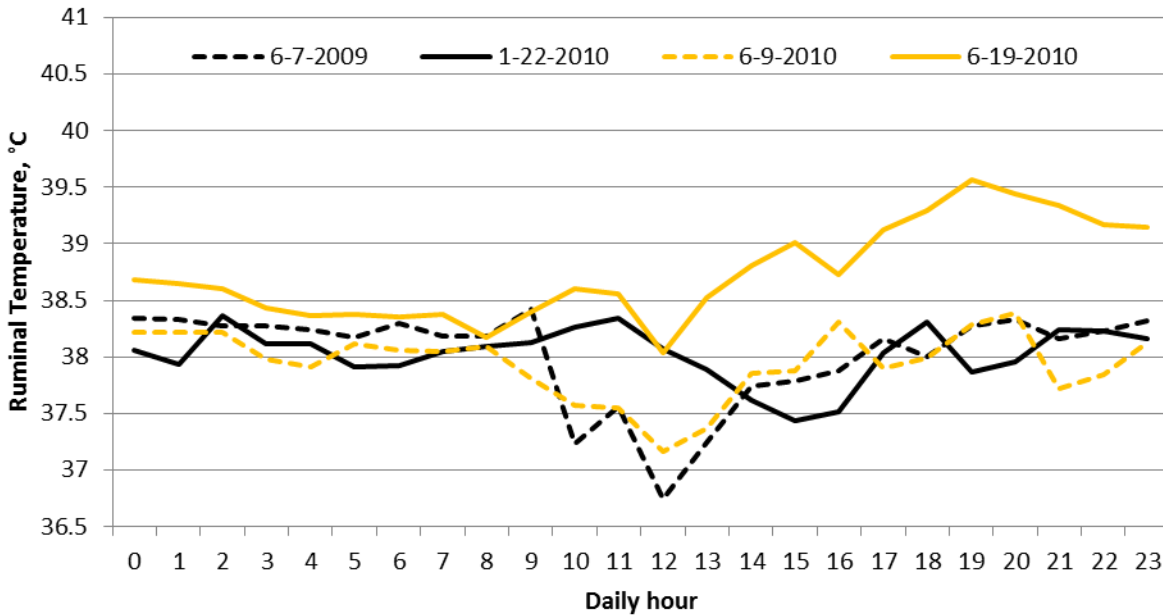


Figure 1. The relationship between ambient temperature and daily hour for experimental days.



The relationship between ruminal temperature (RuT) and daily hour during periods

Figure 2. The effect of maximal ambient temperature on ruminal temperature in beef cows.

The effect of elevated ambient temperature should be considered when developing models that use RuT to predict physiological events. Exposure of mature beef cow to ambient temperatures greater than 34°C can cause elevated RuT and demonstrates the challenge of maintaining body temperature in beef cows. Ruminal temperature may be a useful tool in the management of beef cattle. Prado-Cooper et al. (2008) and Bailey et al. (2009) found that RuT can be used for the identification of parturition and estrus in beef cows.

We conclude that an ambient temperature greater than 30°C can cause elevated RuT of beef cows. This study provides information for the development of RuT models to predict physiological events in cows.

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