UF-Gainesville Beef Cattle News Corner

Thermotolerance and feed efficiency in Brahman influenced cattle

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More than half of the cattle in the world are maintained in tropical environments and about 40% of beef cows in the US are in hot and humid areas. Climatic stress is a major limiting factors of production efficiency in these areas and is expected to become even more of a limitation due to climate changes. Beef cattle when exposed to environmental high temperature and humidity, exhibit significant declines in feed intake, growth, fertility and welfare. Selection to increase productivity disregarding the genotype by environment interaction is likely to increase susceptibility to climatic stress. This makes the quest for heat-tolerant cattle with increased efficiency of production and reproduction increasingly important. One long-term goal of our research is to develop the knowledge and tools the cattle industry will use to increase tolerance to heat stress, while simultaneously allowing for increased efficiency of production, reproduction, and meat quality.

Two years ago, a group of researchers listed on this article with Dr. Nicolas DiLorenzo as the main investigator were fortunate to receive funding from the Florida Beef Cattle Enhancement Fund to start addressing this issue. The funded proposal “What is the link between feed efficiency, reproduction competence and heat tolerance in Brahman influenced cattle?” had the objective to investigate the relationship between feed efficiency, reproduction competence, and heat tolerance in Brahman influenced cattle. In this article, we present a small aspect of this research focusing on our findings relative to thermotolerance and feed efficiency.

For the last 5-6 years we had the privilege to collaborate with the Seminole Tribe of Florida which is one of the largest commercial Brangus cattle producers. This collaboration allowed us to measure their replacement heifers (approximately 800 head every year) for several traits related to thermotolerance. One of these measurements was the core body temperature over 5 continuous days while on pasture, during the hottest part of the summer. There is quite a bit of variation in how cattle respond to heat and humidity in the summer and this is evident in their body temperature: some cattle are able to maintain a lower body temperature throughout the day, while others get pretty hot. To identify extreme animals which would be classified as thermotolerant and non-thermotolerant, we calculated the increase in body temperature from the coolest part of the day (based on environmental temperature and humidity recorded on the same pasture where the heifers were monitored, usually around 7am in the morning) to the hottest part of the day. Based on this difference, we selected 27 two-year old Brangus heifers: 13 with high values (non-thermotolerant with more than one degree Celsius increase in their body temperature throughout the day) and 14 with low values

(thermotolerant, with almost no change in body temperature throughout the day). **Figure 1** shows the 2 selected groups, and the increase in body temperature for either the non-thermotolerant (red dots) averaging a 1.2°C increase and the thermotolerant (blue dots) averaging a 0.2°C increase in body temperature (almost no change throughout the day).

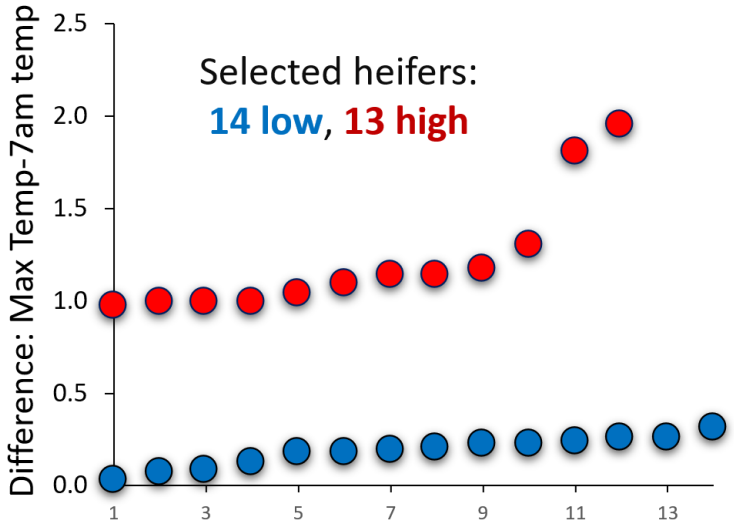

Figure 1. *Increase in body temperature (°C, from the coolest part of the day to the hottest part of the day) for 13 non-thermotolerant heifers (red dots, averaging a 1.2°C increase in body temperature) 14 thermotolerant heifers (blue dots, averaging a 0.2°C increase in body temperature - almost no change throughout the day).*

All 27 heifers were transported to the UF-North Florida Research and Education Center and allocated to the feed efficiency facility. Full body weight and dry matter intake were measured over the 42 d of the feeding phase to calculate average daily gain (ADG), residual feed intake (RFI), dry matter intake (DMI) as a percentage of the body weight, and gain:feed (G:F) ratio. At the end of the feed efficiency trial, heifers returned to the Seminole Tribe as female replacements. **Table 1** shows a summary of the feed efficiency trial and more details will be presented by the other researchers in future articles. However, the most exciting result of this preliminary study was that heifers previously classified as thermotolerant had decreased RFI (indicating improved feed efficiency), when compared with heifers classified as not thermotolerant. The residual feed intake (RFI) shows a difference of 5.7 lb of DM/d between the least efficient (not thermotolerant) and the most efficient phenotypes (thermotolerant). Heifers classified as thermotolerant consumed 3.8% of their BW, while not thermotolerant heifers consumed 4.4% of their BW. This represents a reduction of 14% in feed intake as % of BW, without any effect on average daily gain.

	Thermotolerant	Not Thermotolerant	P-value
Max. temp – 7am temp, ◦C	**0.19**	**1.2**	**<0.001**
Initial BW, lb	908	847	0.03
Final BW[1], lb	1007	1016	0.42
DMI, lb/d	37.1	40.3	0.20
DMI, % of BW	**3.8**	**4.4**	**0.01**
ADG, lb	3.1	3.2	0.81
G:F	0.08	0.08	0.65
RFI, lb	**-2.9**	**2.8**	**0.01**

[1]Variable covariate adjusted (Initial BW, P ≤ 0.05).

Table 1. *Summary of the feed efficiency trial for the 2 groups of heifers: thermotolerant and not thermotolerant (based on the increase in body temperature during hot days of the summer). Heifers classified as thermotolerant consumed 3.8% of their BW, while not thermotolerant heifers consumed 4.4% of their BW. This represents a reduction of 14% in feed intake as % of BW, without any effect on average daily gain. The resulting feed efficiency expressed as residual feed intake (RFI) shows a difference of 5.7 lb of DM/d between the least efficient (not thermotolerant) and the most efficient phenotypes (thermotolerant).*

These are very exciting results suggesting heifers that were previously classified as thermotolerant based on no or very small increase in body temperature, had decreased RFI, indicating an improvement in feed efficiency (less feed consumed to achieve the same rate of weigh gained). Indicators of feed efficiency such as RFI can be used to promote large improvements in the cowherd efficiency by reducing maintenance costs while maintaining growth performance. In this particular study, selecting for thermotolerant heifers can lead to a reduction in feed intake of 5.7 lb of DM/d without affecting average daily gain. Larger studies will need to be performed to confirm these findings and our team is following up on this research.