# UF-Gainesville Beef Cattle News Corner

## Finding the genetic basis for thermotolerance in beef cattle

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**Background and significance**

Climatic stress is a major limiting factor of production efficiency in beef cattle in tropical and subtropical environments and this stress is expected to increase due to climate change. More than half of the cattle in the world are maintained in hot and humid environments, including about 40% of beef cows in the US. Substantial differences in thermal tolerance exist among breeds and among animals within breeds indicative of opportunities for selective improvement. For example, *Bos indicus* cattle exhibit increased natural resistance to many environmental stressors relative to *Bos taurus,* but tend to have slower growth and lower fertility and meat quality as they have not been as intensively selected for these traits as specialized *Bos taurus* breeds. Heat stress has significant impact on US and global livestock industries, and the prospect of global climate change will only intensify it. Economic losses from heat stress in the US beef industry were estimated to average $369 million (St-Pierre et al., 2003). Selection focused on production that ignores adaptability results in beef animals with high metabolic heat production without significant changes in their ability to lose heat, making them more sensitive to heat stress. We will address this challenge by developing selection strategies that improve thermal tolerance in concert with production, reproduction and product quality in indicine-influenced beef cattle populations that predominate in hot and humid regions of the US and globally. These US regions contain approximately 50% of beef cow-calf producers and 40% of beef cows, for which a substantial fraction are *Bos indicus* influenced (Morrison, 2005).

Development and use of population specific genomic tools in selection and management to improve thermal adaptation in concert with all other economically important traits represents an energy-efficient strategy to meet the challenges of global climate change and improve sustainability and profitability of beef industry in Florida and other hot and humid regions of the US.

**Preliminary data and results**

An exploratory study was conducted at the University of Florida (UF) Beef Research Unit in summer 2015 to demonstrate the feasibility of using iButtons devices (**Figure 1**) to record vaginal temperature over a period of 5 consecutive days and assess the phenotypic variation in thermal tolerance in Brahman, Angus and Brahman x Angus crossbred cattle using the UF multibreed population. Vaginal temperature was measured at 5-min intervals for 5 days on approximately 200 cows which ranged in breed composition from 100% Brahman to 100% Angus. Air temperature and relative humidity were recorded continuously in the pastures using a HOBO recording device (Onset, Cape Cod, MA).

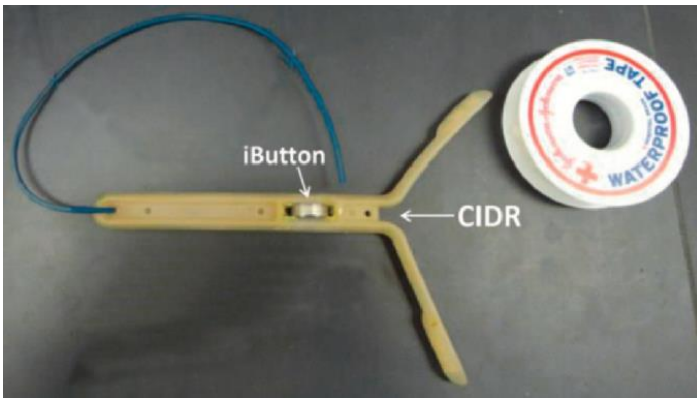


**Figure 1.** Device used to measure vaginal temperature. The iButton was placed in a groove into the CIDR and secured with surgical adhesive tape. The CIDR was then loaded into an applicator for insertion into the vagina.

**Figure 2** shows the pattern of hourly variation in vaginal temperature during summer of 2015. Brahman cattle (dark blue) maintained a lower and more uniform vaginal temperature throughout the 24h-day while all other cows of different breed composition show a significantly greater increase ($P<0.05$) in vaginal temperature during the hot afternoon hours.

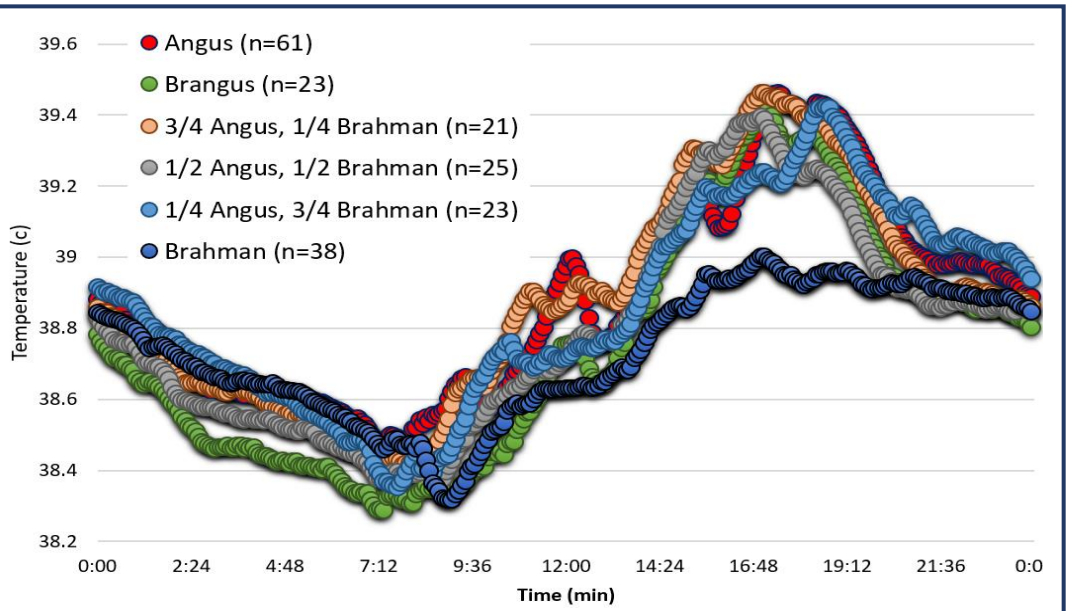


**Figure 2.** Daily variation in vaginal temperature in UF cows of different breed composition presented as average temperature over a 5-day period for each breed group.

## Current and future research

**Heat stress is a principal factor limiting production of animal protein in subtropical and tropical regions, and its impact is expected to increase dramatically. Development of effective strategies to mitigate effects of heat stress on production efficiency and reproductive function are imperative for enhancing productivity of the US livestock industry and securing global food**

**supplies.** Although swine, poultry and dairy cattle are more severely affected by heat stress than beef cattle, their confinement and intensive production systems make climate control via housing design and management interventions feasible. Beef cattle, particularly those in the cow-calf segment, are typically reared in extensive systems with limited opportunities for controlling environmental stress. Genetic improvement of thermal tolerance is one of few feasible strategies for ensuring adequate and sustainable production of beef protein in an increasingly hotter world. Selection focused on production that ignores adaptability results in beef animals with high metabolic heat production without significant changes in their ability to lose heat, making them more sensitive to heat stress. The long-term goal of our research group is to address this challenge by developing the tools needed to implement a selection strategy that improve thermal tolerance in concert with production, reproduction and product quality in indicine-influenced beef cattle populations that predominate in hot and humid regions of the US and globally.