UF-Gainesville Beef Cattle News Corner

Hair coat characteristics and heat exchange in beef cattle

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Importance of heat stress

It is well known that a good environment is important for high production levels when it comes to livestock and a bad environment could lead to lower productivity by not allowing the true genetic potential of the animal to be expressed. The environmental challenge presented to beef cattle in Florida is related to the heat, insects and humidity of the long summers. Heat stress is a major cause of economic loss for beef cattle producers in tropical and subtropical environments, including Florida. To cope with harsh environmental conditions, many producers have introduced the more heat tolerant *Bos Indicus* breeds into their herds, however this has not solved all our heat stress problems.

Heat Exchange

The ability of an animal to regulate its body temperature in extreme environmental conditions determines its thermotolerance and this ability is influenced by many factors such as body weight, fat composition, hair coat properties, sweat glands, and respiratory capabilities (Collier, 2015).

Heat is absorbed and lost through a few modes of heat exchange, which are grouped into two categories: sensible and latent. Sensible heat exchange includes conduction, convection, and radiation, all of which rely on a temperature gradient (difference in temperature between the animal and the environment). Conduction is the heat transfer through direct contact with another surface. For cattle, this exchange would occur between the animal's hooves or body (when lying down) and the ground. If the ground is cooler than the animal, heat is lost and transferred to the ground and vice versa. However, since the surface area of the cow that is in contact with the ground is relatively small, this type of heat exchange does not account for much of the overall heat exchanged. Convection occurs when air flows over the animal and radiation is the heat exchanged between the sun and the animal. The impact the latter two have on the animal depends on the outside temperature. If the outside temperature is higher than the animal temperature, the animal will absorb heat instead of eliminating it.

Latent heat exchange is the type we will focus on, as it is regulated by the animal's body in response to the environment. The two major forms of latent heat exchange are sweating and panting. Sweating is the primary method cattle use to regulate body temperature, while panting occurs only when heat loads become too high to control with sweating alone. When the ambient temperature exceeds 86°F, sweating accounts for 85% of the total heat loss and panting is responsible for the rest (Collier, 2015). Heat loss by sweating is accomplished through evaporation. Sweat carries heat from the body with it when it is excreted, leaving the animal

cooler. Wind and relative humidity greatly impact the rate of evaporation, ultimately impacting body temperature regulation. Wind penetrates the hair, allowing the sweat to evaporate easier as it is released from the hair. Additionally, as relative humidity decreases evaporation rate will increase, cooling the cow more efficiently. Panting eliminates heat by carrying heat from the core of the body and expelling it with moisture and air.

Hair Coat

One important factor influencing the ability of a cow to remove heat from the body is the type of hair the animal has. Previous research done on dairy cows has shown that coat thickness, hair density, hair length, and hair diameter impact an animal's ability to regulate body temperature in high heat environments (Naskar, 2012). Hair insulates the body by trapping air next to the skin, making convection less efficient by not allowing air to flow over the skin surface. More importantly, long and thick hair traps sweat. Sweat trapped in hair cannot evaporate as easily, leaving the animal with the heat contained in the sweat. Coat color also plays an important role with lighter color animals absorbing less heat than dark colored animals, allowing them to remain cooler throughout the day.

Current research on Florida beef cattle

As stated in a previous article, researchers in the Department of Animals Sciences at the University of Florida are working towards developing selection strategies to improve heat tolerance, while conserving the high production, reproduction, and quality traits we are striving for in the beef cattle industry. Hair coat is one of the many factors we are examining in great detail. Length and thickness of hair varies considerably not only between breeds but also within breeds. This variation suggests that selection for a coat advantageous for improved thermotolerance in our cattle is possible. Our research group recorded hair coat color, coat scores and daily body temperatures at 5-min intervals over a 5-day period on approximately 725 Brangus two-year old heifers from the Seminole Tribe of Florida during summer 2016. A repeated measures model was used to investigate the effect of the coat score on body temperature. The coat was scored (**Figure 1**) as excessively smooth (score 1, n = 526), fairly smooth (score 2, n = 189) or long coat (score 3, n= 7). The fairly smooth and long coat classes were combined into one due to the small number of long coat scores. The coat score had a significant effect on body temperature, where cows with excessively smooth coat had lower body temperatures throughout the 3 days of continuous body temperature measurements (**Figure 2**) indicating that coat type plays an important role in the control of body temperature. A slick dense coat provides a greater resistance to heat transfer to the skin and therefore reduces the heat gain from the environment when the animals is in sunlight.

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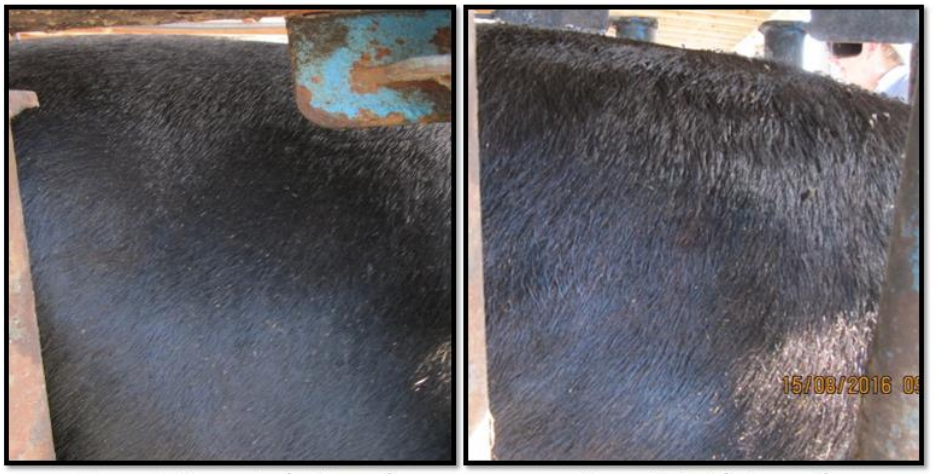

Figure 1. These pictures represent the two predominant coat scores in our study. Heifers with a coat score 2 have longer, thicker hair compared to the short, smooth coat of a coat score 1.

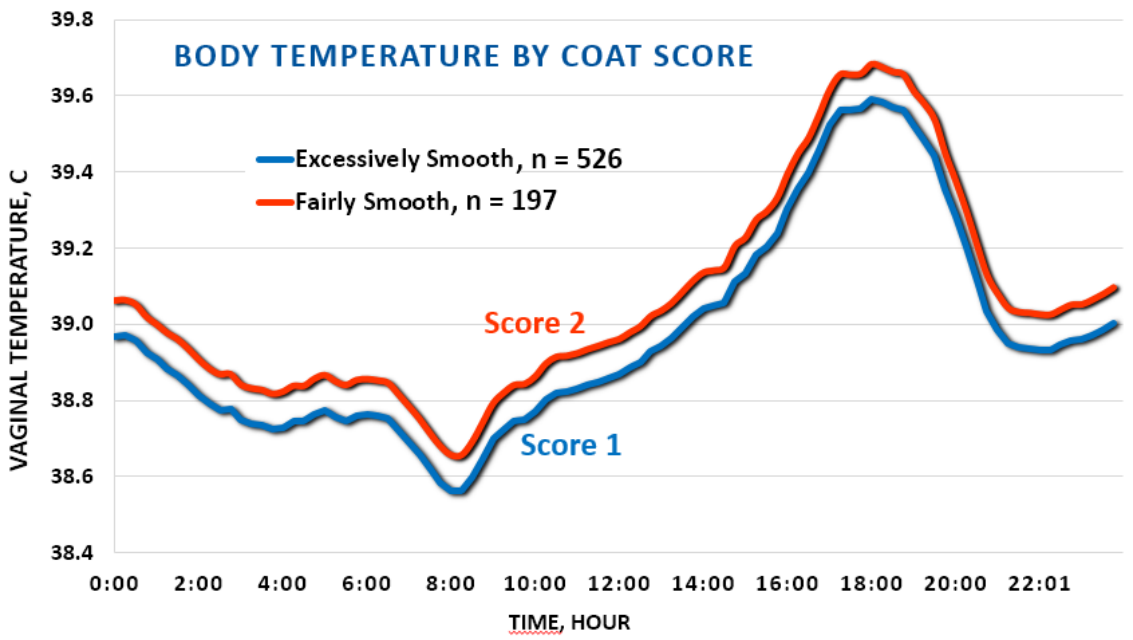

Figure 2. This graph shows the average vaginal temperatures of heifers with coat scores of 1 (blue line) and 2 (orange line) over the course of a day (average of 4 consecutive days for each coat score group). On average, animals with a coat score of 2 were hotter than those with a coat score of 1 throughout the entire day. This emphasizes the impact hair coat has on temperature regulation for cattle.