RESPONSE OF *BOS TAURUS* CATTLE TO FESCUE TOXICOSIS AND HEAT STRESS COMPARING DIFFERENCES BY REGION AND BREED

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ABSTRACT

Two studies were performed to determine response differences in heat-sensitive and –tolerant *Bos taurus* cattle to heat stress and fescue toxicosis in controlled and field environments. Romosinuano (RO), a tropically adapted heat-tolerant breed, and Angus (ANG), a temperately adapted heat-sensitive breed were used to represent these groups. In the field study, ANG from Missouri (MO: n = 10: 468 ± 11 Kg BW) and Oklahoma (OK: n = 11: 490 ± 9 Kg BW), and eleven RO from Florida (352 ± 6 Kg BW) were used. Animals were monitored on 16 random days from June through August of 2009 on endophyte-free tall fescue pasture at the University of Missouri Beef South Farm. During this time, respiration rate (RR) was measured at 0800 and 1500 h, and ruminal temperature (T_{rum}) was monitored hourly as an indication of core body temperature using a calibrated telemetric temperature transmitter (SmartStock, Pawnee, OK). Data was divided into two periods. Period 1 (P1) consisted of 9 monitored days spread throughout the first 11 days (T_a range = 19.8 to 34.3°C) while Period 2 (P2) contained 7 monitored days spread throughout the last 27 measured days (T_a range = 15.5 to 33.4°C). There were no significant differences between the two Angus groups with any comparison ($P > 0.05$), leading to the combination into a single Angus group (ANG).

Breed differences were found between ANG and RO ($P < 0.05$) steers where RR and T_{rum} were higher ($P < 0.05$) for ANG than RO throughout the entire summer period. Slopes of RR to T_a from P1 to P2 decreased ($P < 0.05$) ANG and RO, respectively. Slopes of T_{rum} to T_a also decreased ($P < 0.05$) from P1 to P2 for ANG, however there was no significant decrease from P1 to P2 for RO. Although Romosinuano have a lower respiration rate and ruminal temperature than Angus, they share a similar pattern of respiration rate adaptation from early to late summer periods.

In the controlled environment study, we tested whether or not cattle raised for generations on endophyte-infected tall fescue (E+) have an acquired tolerance to fescue toxicosis. Additionally, we tested if heat-tolerant cattle breeds may also be subject to higher tolerance to the toxins. This can be tested using the same cattle breed from different US regions where tall fescue (*Festuca arundinacea)* is present (Missouri) or absent (Oklahoma) as well as heat-tolerant *Bos taurus* cattle (Romosinuano). Angus steers from Missouri (MO ANG; n = 10; 513.6 ± 13.6 Kg BW) and Oklahoma (OK ANG; n = 10; 552.8 ± 12.0 Kg BW), as well as Romosinuano cattle (RO; n = 10; 395.1 ± 8.4 Kg BW) were used to represent these different groups. Animals were fed a diet containing either E+ (30 µg ergovaline/Kg BW/ day) or uninfected (E-) tall fescue seed in the Brody Environmental Center at the University of Missouri. Both breeds were maintained at 19 to 22°C (TN) through Day 8, followed by 2 weeks of cycling heat stress (HS; 26 to 36°C) for Angus and (HS; 30 to 40°C) for RO. Feed intake (FI), respiration rate (RR), and both skin and rectal temperatures were measured daily. No significant ($P > 0.05$) body temperature differences occurred between ANG cattle groups at any ambient temperature. For

MO and OK ANG, FI change from pretreatment level at TN was significantly ($P < 0.05$) greater for E+ (-2.1 kg) compared to E- animals (-0.3 kg). During HS, both ANG groups exhibited a significant ($P < 0.05$) FI reduction with OK ANG averaging a 3.43 kg greater reduction compared to MO ANG. In addition, E+ cattle averaged a 3.3 kg greater decrease in FI compared to E- animals ($P < 0.05$). When MO and OK ANG groups were combined into ANG, no treatment differences occurred aside from prolactin (PRL), alkaline phosphatase (ALP), and sweat rate which proved that they at least had fescue toxicosis. In contrast, we saw significant differences in FI for RO where E+ animals ate 3.57 kg less than their E- counterparts. Also ALP, sweat rate, and ear skin temperature decreased for RO on E+ diets when compared to those on E-. Finally, RR for RO on E+ treatment was lower ($P < 0.05$) than those on E- treatment, which could be attributed to the significantly lowered feed intake causing the metabolism of E+ animals to be decreased compared with animals on E- diets. Although there appear to be large differences in feed intake response to heat stress that are related to region of origin, there are no differences in the fescue toxicosis response. In addition, RO seem to be affected by E+ in terms of FI more severely than ANG, which could explain their lack of thermoregulatory response however more research must be done. (USDA Agreement No. 58-6227-3-016.)