DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

April 2017

Beef Cattle Research Update

United States Department of Agriculture, University of Arkansas, and County Governments Cooperating

What's Inside

Arkansas Is Our Campus

Visit our web site at:
http://www.uaex.edu

Nutritional and Management Considerations for Beef Cattle Experiencing Stress-Induced Inflammation

Cooke, R. F. Eastern Oregon Agricultural Research Center, Oregon State University, Burns, *Professional Animal Scientist* 2017.33:1-11 (February 2017)

"Stress response" is commonly defined as the sum of all reactions of an individual to factors that potentially influence its homeostasis. The foundation for this concept emerged more than 70 years ago, when stress was first employed in the medical community by Hans Selye, who also proposed that an organism responds similarly to different types of stressors in an effort to maintain homeostasis.

Beef cattle are inevitably exposed to stress during their productive lives. These include psychologic, physiologic and physical stressors associated with management procedures currently practiced within beef production systems. A classic example occurs during transfer of beef calves from cow-calf ranches to commercial feedlots, when cattle are exposed to several stressors within a short period of time. These include weaning, commingling with different animals and exposure to novel environments (psychologic stressors), injury, thermal stress, fatigue, feed and water deprivation during road transport (physical stress), as well as the resultant disruption in endocrine or neuroendocrine function (physiologic stress) characterized by activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system.

The combination of some or all of the aforementioned stressors has been shown to directly decrease cattle performance and increase risk to bovine respiratory disease complex. Such economical losses include, besides cattle mortality, costs associated with wasted feed resources, purchase of pharmaceuticals and decreased performance of morbid cattle. Hence, strategies that prevent stress-related health disorders elicited by routine cattle management procedures are warranted to promote beef cattle welfare and productivity.

- Research has shown that stressors associated with transporting beef cattle from the ranch of origin to feedlots stimulate inflammatory and acute-phase proteins (APP) reactions that are detrimental to performance and health of cattle during feedlot receiving. Our group also reported that nutrient restriction is a major contributor to the APP response and decreased feedlot receiving performance detected in cattle transported for long distances, whereas these outcomes might be aggravated in cattle with excitable temperament.

- Based on this knowledge, our research group investigated several management strategies to decrease the stress-induced APP responses during feedlot receiving. Inclusion of rest stops during transport, preconditioning essential fatty acids (EFA) supplementation and nonsteroidal anti-inflammatory drug (NSAID) administration are methods to decrease the stress-induced APP response during feedlot receiving, whereas EFA and meloxicam administration enhanced cattle receiving performance. Nevertheless, the adoption of one or more of the aforementioned methods will depend on the management scheme of the operation, but they are expected to enhance health, production efficiency and cattle welfare within beef production systems.

Effects of Injectable Castration Regimen on Beef Bull Calves

Ball, J. et al. University of Arkansas, Division of Agriculture, Department of Animal Science

Arkansas Animal Science Department Report, Arkansas Agricultural Experiment Station Research Series 638:9-10 (December 2016)

Husbandry practices in the beef industry that are associated with pain, discomfort and distress include castration, dehorning and branding. It has been estimated there are approximately 15 million castration procedures performed in the United States annually to reduce aggressiveness and sexual activity, prevent unwanted breeding and improve the quality of meat. In Arkansas, only 17 percent of male calves sold in livestock auctions weighing between 300 and 550 pounds were already castrated; and of the bulls placed on feed in feedlots in 2008, roughly 91 percent were castrated, predominantly by band castration (64 percent) or surgical castration (19 percent). Economically, castration post-weaning affects profitability by decreasing average daily gain and increasing susceptibility to bovine respiratory disease. Currently, no commercially available injection sterilization method exists for beef cattle in the United States, although there has been a zinc solution utilized in other species. An injectable sterilization method could be an alternative castration method that could potentially reduce pain, stress and performance loss and minimize the prevalence of bovine respiratory disease. Therefore, this research project was designed to evaluate an injectable zinc solution at three dosage levels for the efficacy of castration in beef bull calves prior to weaning on weight gain, testosterone production and testicle atrophy.

- Thirty-one bull calves were allocated to treatments by body weight (average BW = 284 ± 55 pounds) and birthdate. Twenty-seven bull calves were allocated to three injectable castration treatments reflecting three levels of dosage concentration of a zinc-based solution and administered as 1 milliliter (1 cc equivalent) of zinc solution to each testicle. Two bull calves were castrated using a surgical technique while two bull calves were left intact until the termination of the study at weaning.

- Calves were weighed with no further shrink on 28-day intervals and weaned from dams on September 30. At each subsequent 28-day interim weight collection and at the end of the study on October 3, calves were bled via jugular venipuncture to determine serum testosterone. On the same day, the thicknesses of the right testicle and scrotum were measured.

- There were no effects of castration or castration method on body weight or preweaning average daily gain. Over the course of the experiment, mean average daily gain was nearly or slightly above 2 pounds per day for the initial two 28-day intervals (1.95 ± 0.15 and 2.01 ± 0.18 pound per day, for periods 1 and 2, respectively), yet declined to 1.63 ± 0.17 pound per day in period 3 and to 0.33 ± 0.15 pound per day in the final period before weaning. The decline in performance during the late summer is due to seasonal deterioration in forage quality and was not related to treatments imposed. Bodyweight at weaning averaged 445 ± 30 pounds.

- There were no differences in scrotal thickness, growth performance or testosterone concentrations regardless of the dosage concentration of zinc. The injectable castration method resulted in serum testosterone concentrations similar to calves that had been surgically castrated.

Forage Nutritive Value and Steer Responses to Grazing Intensity and Seed-Head Suppression of Endophyte-Free Tall Fescue in Mixed Pastures

Goff, B. M. et al., University of Kentucky, Dow AgroSciences, and University of Tennessee

Professional Animal Scientist 31:120-129 (April 2015)

Tall fescue is a cool-season perennial grass used as a forage on approximately 14 million hectares in the humid east. Tall fescue is persistent and productive, but cattle production and thriftiness is low because of toxic ergot alkaloids produced by a fungal endophyte that infects most plants of tall fescue. Cattle that consume endophyte-infected tall fescue can undergo a toxicosis that causes cattle to exhibit poor weight gain, rough hair coats during the summer months, elevated core body temperatures and reduced serum prolactin concentrations.

Removal of fescue seed heads can be an effective strategy for reducing dosage of alkaloids by grazing animals because ergot alkaloid concentrations are greater in seeds than other plant parts and cattle readily consume seed heads. Seed heads can be removed by mowing, but this is generally ineffective if done during seed maturation because cattle selectively graze seed heads over a short period during early seed development. Research demonstrated that the plant growth regulator mefluidide inhibits floral development of cool-season perennial grasses to maintain vegetative stands and improve nutritive value, but mefluidide was not licensed for forages.

- A two-year grazing experiment was conducted with 8- to 10-month-old steers on pastures of endophyte-free tall fescue in mixture with other grasses to assess the effect of seed-head suppression of fescue on steer performance and forage nutritive values. Twelve 1.0-hectare pastures were sprayed twice with glyphosate (5 liters per hectare) and no-till planted with endophyte-free Kentucky 31 tall fescue on March 19 with 28 kilograms of pure live seed per hectare.

- Two grazing intensities (light and moderate) and two rates of herbicide application were arranged as a 2 × 2 factorial with three replications. Herbicide treatments consisted of Chaparral {Dow AgroSciences, Indianapolis, Indiana; 62.13 percent aminopyralid [4-amino-3,6-dichloro-2-pyridinecarboxylic acid] and 9.45 percent metsulfuron-methyl [methyl 2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino] sulfonyl]benzoate]} applied at 0 or 140 grams per hectare (metsulfuron: 13.2 grams per hectare, aminopyralid: 87.0 grams per hectare) on April 7 and March 19. Control pastures received Milestone (DowAgroscience LLC, Indianapolis, Indiana; 40.6 percent aminopyralid) at 220 grams per hectare (aminopyralid: 89.3 grams per hectare) on the same dates.

- Chemical seed-head suppression improved forage nutritive value and increased steer average daily gain (ADG) on pastures that contain 60 to 70 percent endophyte-free tall fescue in mixture with orchardgrass and other grasses. The ADG with seed-head suppression was 19 percent greater than without suppression. This suggests that enhancement of forage quality through suppression of lower-quality reproductive tissues will benefit calf performance, but the alleviation of toxic seed heads from endophyte-infected tall fescue could have a greater influence on steer performance.

Evaluation of the Influence of Prenatal Transportation Stress on GnRH-Stimulated Luteinizing Hormone and Testosterone Secretion in Sexually Mature Brahman Bulls

Littlejohn, B. P. et al., Texas A&M University, USDA-ARS, and Mississippi State University

Journal of Animal Science 95:129-138 (February 2017)

Stress experienced by a dam during gestation may program the progeny's postnatal endocrine function. Subjecting pregnant rats to electric tail shocks resulted in offspring with increased plasma corticosterone. Prenatal stress (i.e., exposure of pregnant rats to restraint and light stress) has been associated with decreased testosterone in fetal male rats. In a cow-calf production setting, gestating cows may be exposed to

natural or managerial stressors, such as predation, handling, restraint or transportation. Transportation is a stressor for pregnant Brahman cows as indicated by increased body temperature as well as increased systemic concentrations of cortisol and glucose. Prenatally stressed suckling Brahman calves are more temperamental and exhibit elevated serum concentrations of cortisol compared with controls. In bulls, endogenous cortisol appeared to have a negative regulatory influence on episodic and induced secretion of testosterone. Based on these reports, we hypothesized that a prenatal stressor such as transportation would negatively affect exogenous GnRH-induced secretion of LH and testosterone in sexually mature bulls.

- Brahman cows (n = 96; 48 were stressed by transportation at five stages of gestation and 48 were controls) produced a calf crop of 85 calves. All bulls (n = 46) from this calf crop were electroejaculated every two weeks beginning at a scrotal circumference of 24 centimeters until sexual maturity (SM; i.e., 500 million sperm perejaculate). The initial 11 control and 12 prenatal transportation stress (PNS) bulls to reach SM were selected for the experiment.
- All bulls responded similarly to exogenous gonadotropin-releasing hormone (GnRH), indicating no influence of PNS on luteinzing hormone (LH) or testosterone response to GnRH. More PNS (9 of 11) than control (3 of 12) bulls exhibited an endogenous pre-GnRH LH pulse, and more PNS (9 of 11) than control bulls (4 of 12) exhibited a pre-GnRH testosterone response to LH.
- Results from this study indicate that PNS did not affect pituitary responsiveness to GnRH or testicular responsiveness to GnRH-induced LH secretion.

Articles were edited for length and style.

Michael Looper
Department Head - Animal Science