Abstracts

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BREEDING AND GENETICS

1 Heterosis for reproduction of Romosinuano-Angus cows in Arkansas. *D. G. Riley[*1], S. W. Coleman[2], C. C. Chase, Jr.[3], and J. M. Burke[4], [1]Texas A&M AgriLife Research, College Station, [2]USDA ARS, El Reno, OK, [3]USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE, [4]USDA-ARS, Booneville, AR*

Purebred and crossbred Romosinuano and Angus cows (n = 145) were evaluated in Arkansas from 2005 through 2012 for calving and weaning rate (n = 666), calving interval (n = 400), and conception day within breeding season (n = 547). Purebred Romosinuano and Angus, and reciprocal F_1 cows were transported from Florida before their 3rd birthday. Some local Angus cows were included. Cows were exposed to Brahman, Angus, and Romosinuano bulls as 3-yr-olds, and to Angus, Romosinuano, or primarily Charolais thereafter. Animal was a random effect in all analyses. Fixed effects included sire and dam breed of the cow, year, age, and interactions. Calving and weaning rate were assumed binomially-distributed and analyzed after application of a logit link function. Calving and weaning rates of Angus cows (0.75 ± 0.03 and 0.65 ± 0.04) were less ($P < 0.05$) than the other breed groups (calving rate for those ranged from 0.88 ± 0.03 for Romosinuano to 0.93 ± 0.04 Romosinuano-sired F_1 cows; weaning rate: 0.81 ± 0.03 for Angus-sired F_1 cows to 0.89 ± 0.05 for Romosinuano-sired F_1 cows). Romosinuano cows conceived later in the breeding season (25.2 ± 2.3 d) than other breed groups, which ranged from 16.9 ± 3.1 to 17.3 ± 1.8 d after beginning the breeding season. No breed group differences in calving interval were detected ($P = 0.84$). Heterosis estimates were 0.09 ± 0.03, 0.12 ± 0.04, and –3.7 ± 1.2 for calving and weaning rate, and conception day within season, respectively. Direct Romosinuano effects were favorable for calving and weaning rate (0.14 ± 0.05 and 0.23 ± 0.06; $P < 0.003$), but unfavorable for conception day (8.7 ± 2.87 d; $P = 0.003$). Forage type grazed in the previous breeding season was a significant effect in subsequent analyses of a subset (n = 580): calving and weaning rates were 0.97 ± 0.02 and 0.93 ± 0.03 for bermudagrass, 0.94 ± 0.02 and 0.88 ± 0.03 for endophyte-free, and 0.85 ± 0.03 and 0.78 ± 0.04 for endophyte-infected fescue, resepctively. Forage effect was not detected for conception day in season or for calving interval ($P > 0.7$). No interaction of breed group with previous season forage type was detected for any trait ($P > 0.21$). Estimates of heterosis for reproductive rates were larger than expected for *Bos taurus* crosses, and suggest crossbreeding advantage of tropically-adapted breeds such as Romosinuano in fescue regions.

Keywords: Angus, heterosis, reproductive rate, Romosinuano

2 Birth weight, calving rate, and weaning rate in second generation reciprocal Brahman-Angus crosses. *J. K. Bohac[*1], A. D. Herring[2], D. G. Riley[2], and J. O. Sanders[3], [1]Texas A&M University, College Station[2]Texas A&M AgriLife Research, College Station, [3]Texas A&M University, Department of Animal Science, College Station*

Calving rate, weaning rate, and calf birth weight were evaluated from 1995 to 2014 in Brahman and Angus straightbred and crossbred F_1 and F_2 generation females (n=1477). The objective of these analyses was to compare dam breed groups in Brahman-Angus crosses. Breed groups evaluated were Brahman (B), Angus (A), F_1 Brahman-sired cows (BA), F_2 cows sired by BA and out of BA dams (BABA), and F_2 cows sired by Angus-sired (AB) F_1 bulls and out of BA dams (ABBA). Birth weight was evaluated using general linear model analyses that included breed group of dam, calf sex, amount *Bos indicus* in the sire, and the interaction of dam breed with the amount of *Bos indicus* in the sire and the sex of the calf. Table 1 shows the least squares means of the birth weight relative to the amount of *Bos indicus* in the sire and out of the F_2 ABBA and BABA cows. Among the F_2 cows, generally, as the amount of *Bos indicus* in the sire increased, the birth weight of the calf increased, with male calves weighing more than the females. One exception is the ABBA cows bred to bulls that had a quarter *Bos indicus* blood, in which the female calves weighed an average of 1.6 kg more than the males. Calving rate and weaning rate were evaluated using general linear model analyses that included dam breed. ABBA and BABA had similar calving rates (0.866 ± .03 and 0.867 ± .03 respectively), but the ABBA had a weaning rate of 0.812 ± 0.03 while BABA had a weaning rate of 0.759 ± 0.04. These data illustrate that the breeding of an F_2Brahman-Angus cow may influence the birth weight of her progeny, as well as their weaning rate.

Table 1. Least squares means of birth weight of calves out of F_2 Brahman-Angus cows by amount *Bos indicus*in sire.

Dam Breed	Amount *Bos indicus* in sire	Heifer calf birth weight (kg)	Bull calf birth weight, kg
ABBA	0	31.1 ± .87	34.0 ± .95
BABA	0	33.7 ± 1.90	35.4 ± 1.44
ABBA	0.25	37.4 ± 1.55	35.8 ± 1.70
BABA	0.25	37.0 ± 1.49	40.5 ± 1.39
ABBA	0.5	37.4 ± 1.0	39.3 ± 1.0
BABA	0.5	37.3 ± 1.44	39.8 ± .98

Keywords: birth weight, Brahman, reciprocal cross

3 Growth performance of calves from two lines of Angus cows separated by frame size in Alabama. *K. Nadarajah[*1], D. L. Kuhlers[1], G. L. Thompson[2,3], C. Norris[3], and H. D. Harkins[3], [1]Auburn University, Auburn, AL, [2]Alabama Cooperative Extension System, Auburn, [3]Tennessee Valley Research and Extension Center (TVREC), Belle Mina, AL*

The objective was to evaluate performance of calves born to cows from two distinct-lines, namely, small-to-medium frame (SM) and medium-to-large frame (ML). In 2006, Angus cows and heifers that were ready for breeding were assigned to respective lines as base-population. Cows were mated in single-sire breeding groups using two bulls/line. Each year, few cows were culled and selected replacement heifers based on their frame size were added. Out of 439 calves weaned, 283

were born to base-population and 156 were born to replacement cows. Calf performance-traits [birth-weight (BWT), 205-d weight (205ADJW), ADG, hip-height (HHT) and calf-frame-score (CFS)] were analyzed using MIXED model procedure in SAS for all-data, and separately for subsets of calves born to base-population and replacement cows. Mixed-linear-model included fixed effects of weaning-year, line, sex of calf and their interactions with age of cow as covariates while bulls were nested within-lines. LS means for BWT of calves born to ML cows were heavier ($P < 0.001$) than calves born to SM cows (42.9 ± 0.6 vs. 38.8 ± 0.4 kg) from all-data and for calves born to base-population (45.2 ± 1.1 vs. 40.1 ± 0.5 kg) and replacement (40.1 ± 0.7 vs. 36.3 ± 0.5 kg) cows, respectively. Least squares means of calves for 205ADJW from all data (ML = 228.4 ± 3.1 vs. SM = 223.6 ± 1.7 kg) and for ADG (ML = 904 ± 14 vs. SM = 900 ± 8 g) did not differ. However, LS means for 205ADJW of calves born to base-population cows were different ($P < 0.0001$) but not for calves from replacement cows. Significant line differences were observed for ADG of calves born to base-population ($P < 0.01$) and to replacement cows ($P < 0.05$). Line means for HHT of calves from all-data (ML = 111.3 ± 0.5 cm vs. SM = 109.5 ± 0.3 cm) were significantly different ($P < 0.05$) and similar differences were observed for calves out of base-population and replacement cows. Line differences ($P < 0.001$) were observed for CFS of calves born to cows in base-population (ML = 5.1 ± 0.1 vs. SM = 4.5 ± 0.1), for all data, but was not significant for calves born to replacement cows. Influence of sex of calf was significant ($P < 0.001$) for all calf traits across years, born to base-population and replacement cows except for 205ADJW and ADG of calves born to replacement cows. Effects of cow age were significant for all calf traits ($P < 0.05$) except quadratic effect was not significant for calves born to replacement cows. Selection for smaller frame size did not affect 205ADJW and ADG of calves in this study.

Keywords: calf growth, frame-size, selection

4 Assessment of genetic variation in fecal egg counts for multiple species of internal parasites in growing crossbred Bos indicus-Bos taurus cattle. *L. Ngere*[*1]*, D. G. Riley*[1]*, A. D. Herring*[1]*, J. O. Sanders*[1]*, and T. M. Craig*[2]*, [1]Texas A&M University, Department of Animal Science, College Station, [2]Texas A&M University, Department of Veterinary Pathobiology, College Station*

Efforts to augment beef production world-wide often include the use of crossbred *Bos indicus-Bos taurus* cattle. Introduction of non-native cattle with high growth potential in challenging environments has failed in many instances because of lack of adaptation, including susceptibility to parasites and/or infectious diseases. The objective of this study was to assess genetic variation in fecal egg count (number of eggs per gram) and the associations of fecal egg count with other traits in growing crossbred Nelore-Angus cattle. Records of 201 F_2 and F_3 ½ Nelore ½ Angus steers in feedlot conditions (14 mo of age) in a genomics resource population in Central Texas consisted of fecal egg count, birth weight, weaning temperament score, body weight, and exit velocity that were collected in 2012 and 2013. Helminth egg counts were determined from fecal samples from steers in feedlot before treatment with an anthelmintic product. Antibody titers in response to bovine viral diarrhea virus (BVDV) challenge were collected on the yearling steers following vaccination to bovine respiratory disease viral pathogens; this was done subsequent to fecal egg count determination. Animal models were used to analyze fecal egg count. Year was a fixed effect and animal was a random effect. The association of fecal egg count with birth weight, weaning weight, weaning temperament score, body weight, temperature, exit velocity, and BVDV antibody titer were assessed by modeling each in distinct analyses as a linear covariate. Species of internal parasites found were 64% *Cooperia*, 19% *Haemonchus*, 8% *Ostertagia* and 9% *Oesophagostomum*. Year explained substantial variation in fecal egg count ($P = 0.001$). No investigated covariate was important in the different models ($P > 0.05$). Subsequently, sire (n = 13) was evaluated as a fixed effect (sires with less than 3 steers with records were excluded). One sire family had significantly less ($P < 0.05$) fecal egg counts (37.15 ± 0.10) than the 3 sire families with the greatest fecal egg counts (74.13 ± 0.10 to 114.81 ± 0.20). These results suggest the presence of genetic variation for fecal egg count. No exploitable relationship of fecal egg count with other phenotypes was detected.

Keywords: Bovine Viral Diarrhea, fecal egg count, sire family

5 Detection of the prosaposin gene in different breeds of goats. *A. Robertson Byers*[*] *and M. Worku, North Carolina Agricultural and Technical State University, Greensboro*

The objectives of this study were to identify the gene encoding prosaposin in goats and to determine expression in the blood using cross-hybridizing primers. Lysosomal storage disorder is a genetic disease that results from lysosomal dysfunction and has an association with Prosaposin. This disease has been observed in diverse species. Prosaposin is important in development and maintenance of the nervous system in man. In man, prosaposin and its proteins have been studied, but not much information is available for goats. In this study, specific prosaposin primers were used to amplify regions of goat genomic DNA. Blood samples were collected on FTA cards at North Carolina A &T State University farm from Alpine, Spanish, Boer, SpanishXBoer goats and from Holstein Friesian cows. DNA was isolated and the prosaposin gene amplified using PCR and primers from the human, pig and rat Prosaposin gene sequences. Amplified products were commercially sequenced (Eurofin/MWGOperon) and analyzed using NCBI BLAST, BLAT and OmegaClustalW tools. Bands of approximately 1,353 bp, 1,078 bp, 610 bp and 500 bp were detected in the blood of 3 goat breeds using human prosaposin primers. An 872 bp amplified product was detected in the blood of 4 goat breeds using specific primers to rat PSAP. Pig prosaposin specific primers detected 4 bands at approximately 700 bp, 600 bp, 500 bp, and 400 bp in 2 goat breeds. Prosaposin was detected in the cow genome. Transcription of goat prosaposin was evaluated using goat cDNA as template and human and rat specific PSAP primers. Amplified transcripts were heterogeneous in size and varied from 234 to 1000 bp. Alignment of the amplified goat prosaposin sequences to the human and cow genome using BLAST tool showed percent

identity of 91% with the human genome and up to 77% with the cow genome. The BLAT tool identified 2 goat prosaposin genomic alignments on the human chromosome 10 with an identity of 100%. Using OmegaClustalW, the percent identity of the amplified goat prosaposin sequences to the human prosaposin and cow sequences were 38.7% and 37.87%, respectively. The gene encoding prosaposin is present in the goat and cow genome. Cross-reactive reagents for studies of goat prosaposin were identified which will aid in understanding the biology and conservation of this gene. The amplified prosaposin sequences from genomic DNA had similarity to genes, transcripts and regulatory regions in other vertebrates. These studies will aid in understanding the biology of prosaposin production among breeds and for selection of healthy animals.

Keywords: DNA, gene, goat, prosaposin, sequences

EXTENSION I

6 Management education through YouTube. *B. M. Freking*, Oklahoma State University, Ada*

Bringing management education to producers through YouTube builds upon the success of the Meat Goat video series to include production and financial risk management topics for beef cattle and forages. Individual YouTube channels highlighting risk management and general management educational videos for beef cattle and forages will be showcased. Cattle and forage production rank 1st and 3rdin Oklahoma with a value of $1.7 billion and $510 million respectively. Oklahoma State University (OSU) provides many educational opportunities for producers to learn a wide variety of production and financial risk management practices. Typically these opportunities require producers attend meetings or workshops at a prescribed date and time. Some educational programs such as the OSU Cow/Calf Boot Camp are limited in the number of participants and only occur annually. Therefore, some producers may not be able to attend these educational events. By creating video presentations of various production and risk management topics and having those videos available on dedicated websites and YouTube channels this project will allow producers to learn risk management principles and strategies on their own schedule. Producers will also be able to choose program areas. Evidence of this demand can be found in the success of the OSU Meat Goat YouTube channel. The OSU Meat Goat channel was created with the help of a Risk Management Educational grant. Since its creation in November 2013 the 25 videos have had well over 40,000 views from producers in the U.S. and across the globe. This project plans to take this concept a step further by actually videoing the educational presentations and demonstrations and having these videos available for viewing by producers at any time. This will be done with the use of websites and YouTube. This project is an expansion of two successful extension programs, the OSU Cow/Calf and Meat Goat Boot Camps.

Keywords: cattle, forages, YouTube

7 Delivering beef cattle Extension programming through YouTube. *B. B. Karisch[1], J. A. Parish[2], and T. J. Braud*[1], [1]Mississippi State University, Mississippi State, [2]North Mississippi Research and Extension Center, Prairie Research Unit, Prairie*

Extension specialists are constantly exploring new ways to share information with beef cattle producers. A YouTube channel was launched in December 2012 by the Mississippi State University Extension Service (MSU-ES). This YouTube channel (MSUBeefCattle) is accessible online at www.youtube.com/user/MSUBeefCattle. Since inception, a total of 116 videos were posted on the website through September 15, 2014. Videos were produced by an extension beef cattle specialist using Camtasia Studio 8 software (TechSmith Corporation, Okemos, MI) and included a common introduction and ending branding them with the MSU-ES and MSUcares logos and including the tag line “Education for the Beef Cattle Industry – On Demand”. The only exceptions to this common production and branding approach were the feeder calf board sale lot videos, which were produced by the MSU-ES Center for Technology Outreach. The YouTube Analytics feature of the channel manager dashboard was used to access video view and engagement information. This information was assessed over the lifetime of the channel through September 15, 2014. The MSUBeefCattle YouTube channel amassed 30,641 video views; 77,314 minutes watched; 33 subscribers; 20 likes; 8 shares; and 6 favorites added. The 2 most popular videos in terms of number of views were “Freeze Branding Beef Cattle” and “Bull Semen Storage and Handling”, with 7,197 and 5,400 views, respectively. Of the top 10 videos for estimated minutes watched, the top 3 videos for average percentage of video viewed were: 1) Mineral and Vitamin Feeding Management, 65%; 2) Freeze Branding Beef Cattle, 61%; and 3) Beef Cattle Crossbreeding Systems, 60%. Male viewers accounted for 75.8% of MSUBeefCattle YouTube channel viewership. By geography, the United States was the leading viewer location with 59% of the views and 63% of the estimated minutes watched. The top 5 viewer locations in descending order of percentage of views were Canada, United Kingdom, India, and Australia. A total of 170 countries were represented in the channel viewership, but the countries not specifically mentioned here each accounted for less than 2% of the views. Within the viewership in the United States, the majority of the views came from Mississippi (15%) followed by Texas (9.8%), California (6.4%), Georgia (3.8%), and Tennessee (3.6%). Initial analysis appears that this program delivery method is well received and utilized by clientele.

Keywords: beef cattle, Extension, Youtube

8 The ability of the Animal Science blog to transfer information. *T. R. Troxel[1] and M. S. Gadberry*[2], [1]University of Arkansas, Little Rock, [2]Department of Animal Science, University of Arkansas, Little Rock*

The objective was to determine the educational reach of the University of Arkansas, Animal Science Extension blog. The blog was published using WordPress and was launched November 2011. The blog homepage provided up-to-date information to Arkansas livestock/forage producers. Additional

menu items, linking viewers with web content, included 300 d of grazing, 4H livestock, beef cattle, E-newsletters and videos, events, forages, horses, market news, poultry and sheep and goats. As of August 2014 there were 341 blog followers. The timeframe used for the data analysis was November 2011 thru August 2014 (34 mo). During this period there were 29,349 views, averaging 863 ± 600.21 (mean ± SD) per month and 28.4 ± 19.50 per day. The number views by season (spring, summer, autumn and winter) were not different ($P > 0.10$). The number of monthly views for the first 8 mo (November 2011 thru June 2012) averaged 41.1 ± 55.46 but increased ($P < 0.001$) to 1,844 in July 2012. The increase in views (July 2012) was probably due to a severe drought and the need of livestock producers for drought information. Viewership, thereafter, averaged 1,116.2 ± 447.82 per month. The menu items receiving the most clicks were beef cattle (n = 790), 300 d grazing (n = 421), forages (n = 405), sheep and goats (n = 353), 4H livestock (n = 347), market news (n = 344), horses (n = 209), poultry (n = 154). The top 5 countries with the most views were United States (n = 21,391), Canada (n = 284), India (n = 203), United Kingdom (n = 120) and Brazil (n = 71). The month with the most and least views was May 2013 (n = 2,621) and December 2011 and April 2012 (n = 1), respectively. Although the blog was primarily used to communicate information to livestock producers, 48 reader comments were received. Comments requesting information or asking a question were answered. Rapid up-to-date electronic communication is becoming more important to extension clientele. The Animal Science blog appeared to be successful in transferring the latest information in a timely manner to Arkansas livestock/forage producers.

Keywords: blog, contacts, Extension

9 The Southeast Cattle Advisor: Utilizing mobile application and social media to improve risk management. *R. L. Stewart, Jr.*[*1], *R. C. Lacy*[2], *D. Hancock*[1], *G. C. Lamb*[3], *N. DiLorenzo*[3], *D. E. Mayo*[4], *B. Beer*[5], *and J. B. Elmore*[6], [1]*The University of Georgia, Athens,* [2]*University of Georgia, Tifton,* [3]*North Florida Research and Education Center, Marianna,* [4]*University of Florida, Extension, Marianna,* [5]*University of Clemson Extension, Lancaster, SC,* [6]*Alabama Cooperative Extension System, Auburn*

This integrated educational program leveraged mobile technology, social media and regional experts with state and local meetings to help beef cattle producers more effectively manage risk. This project built on the established program known as the Southeast Cattle Advisor. The project was a collaborative effort between the Extension services of the University of Florida, Clemson University, Auburn University, the University of Georgia, and the Southern Risk Management Education Center. The first goal of the project was to redevelop the website (SECattleAdvisor.com) to improve navigation and provide periodic blogs on market outlooks, risk management, and production information. Additionally, a mobile website was developed to serve as a decision aid for developing estrus synchronization programs for beef cattle (EstrusSynch.com). This website is accessible by computer or any device with mobile network connection (3G, 4G, or WiFi). Also, the group developed a social media page on Facebook. This page is synchronized with the main SE Cattle Advisor webpage to help direct visitors to the website for additional information. Through September 2014, the page has 346 “likes”. Finally, each state conducted a series of meetings to educate cattle producers on price, financial, and production risk (reproduction and nutrition) associated with the breeding season. Throughout the 4 states, 798 participants attended a workshop or local meeting either in person or remotely online. These sessions were also archived and made available for later viewing on the website. As a result of this program, the producers and agricultural professionals continue to access the website. From November 2013 through September 2014, the website averages 100 page views a day for a total of 34,500 page views. These views were represented by 35% returning visitors and 65% new visitors. From the webpage, 322 users have subscribed to a monthly electronic newsletter. On average, 45.5% of subscribers open their newsletter and 9.0% follow links within the newsletter to the website. The industry average is 18.6 and 2.5%, respectively. The Southeast Cattle Advisor continues to be an effective integrated educational program to disseminate information. In the future, the program will build on the current format to employ more technologies to help beef cattle producers.

Keywords: beef cattle, mobile application, risk management, website

10 Use of a clicker-based response tool for enhancing Extension programming in beef cattle production systems. *M. K. Mullenix*[*1], *G. L. Thompson*[2], *J. B. Elmore*[2], *and J. M. Johnson*[1], [1]*Auburn University, Auburn, AL,* [2]*Alabama Cooperative Extension System, Auburn*

An increasing number of Extension specialists in the Alabama Cooperative Extension System utilize clicker-based response systems (Turning Technologies, LLC, Youngstown, OH) for collecting data in educational programs. In 2014, the Beef Cattle Systems Extension program evaluated the use of clickers in 3 separate meetings to 1) determine the knowledge base of participants in a new program for novice cattle producers and in a commodity group setting; and 2) collect information on perceived needs for future beef-related programming in Alabama. Participants in the novice cattle producer program (n = 26) and commodity group meeting (n = 68) were asked a series of questions to collect basic background information regarding their cattle operations. Forage quality and animal nutritional information was presented at each meeting, and the audiences were given topic-specific questions before the topic in question was discussed. The majority (57%) of producers participating in the novice cattlemen program had 1 to 5 yr of experience in the cattle business, whereas most (75%) of the participants at the commodity group meeting had more than 20 yr of experience. More than 50% of the respondents in each setting answered the content-specific questions correctly, indicating a relatively high degree of basic knowledge. The response system was also used to survey an audience at a regional beef-forage update meeting (n = 33) regarding future program needs in Extension. Given the changing generation of Extension professionals and clientele in Ala-

bama, this survey was designed to collect base information on methods of traditional and technology-based programmatic delivery. Respondents indicated that they would be willing to attend more Extension programs that use experiment station field-based tours or on-farm demonstrations (62%) as a way to learn the latest information related to beef and forage production. The majority of the group (61%) also indicated that they would prefer to receive beef-related educational updates and advertisements for future programs by e-mail. Finally, producers indicated that they would be more willing to use social media (29%) or a webinar (32%) as alternative sources for information and updates. Results from these meetings illustrate that the use of a clicker-based polling system is an effective and efficient means of determining target audience knowledge level and educational needs, and defining future methods for Extension program delivery.

Keywords: audience engagement, beef cattle, clicker response systems

11 Mud, horseduds & soapsuds: Encouraging youth responsibility for animal disaster preparedness. *N. L. Walker[*1], R. McConnico[2], and M. Mirza[2], [1]Louisiana State University Agricultural Center, Baton Rouge, [2]Louisiana State University School of Veterinary Medicine, Baton Rouge*

Results from the 2009 Federal Emergency Management Agency (FEMA) Personal Preparedness report stated that 60% of Americans plan to rely on emergency personnel following a disaster. The report also states that while 44% of respondents have a household emergency plan, only a fraction of respondents indicated having a plan for livestock or household pets. In an attempt to stress that preparedness is a shared responsibility Louisiana State University (LSU) Agricultural Center extension specialists and professionals from the LSU School of Veterinary Medicine collaborated to conduct a program called Mud, HorseDuds & Soapsuds. Mud, Horseduds & Soapsuds is a l h educational seminar where 4-Hers are given the opportunity to practice hands on technical disaster related skills as well as learn the importance of creating a disaster plan that includes family pets and livestock. 4-Hers from across the state are encouraged to participate in 4-H University, which is a week-long conference that allows 4-Hers to practice life skills acquired throughout their 4-H career, provides statewide networking opportunities, and a chance to experience college life. 4-H University is composed of competitive and non-competitive components. Participants from across the state compete in more than 40 events reflecting projects they were active in during their 4-H career and attend non-competitive learning seminars for a total of 7 h of interactive instruction held at LSU. During the non-competitive educational component of 4-H University, participants practice technical skills required to "rescue" horses from typical disaster situations and create a disaster plan to implement in their homes. Evaluations regarding the willingness of participants to create a disaster plan that included animals in their care were increased following participation (2.3 ± 0.6 vs. 4.05 ± 0.7). Increases in the post-test scores compared with the pre-test scores indicate that there was a change in perceived participant knowledge after participating in the program. Partnering with the LSU School of Veterinary Medicine continues to provide expertise and additional opportunities to teach technical skills. After participating in the workshop, 100% of youth participants indicated they had a desire to create a disaster plan that includes their pets/horses. Louisiana is affected by natural disasters on a regular basis making programs like Mud, Horseduds & Soapsuds essential to encourage youth to take responsibility for the animals in their care.

Keywords: disaster preparedness, livestock, youth

12 The 2013-14 Georgia Bull Evaluation Program: Education through investment. *J. R. Segers[*1], J. Duggin[2], R. L. Stewart, Jr.[3], R. E. Silcox[3], and P. T. Cannon[1], [1]The University of Georgia, Tifton, [2]The University of Georgia, Calhoun, [3]The University of Georgia, Athens*

The Georgia Bull Evaluation Program is an educational program that utilizes an investment and reward system to convey livestock selection, nutrition, and management education to beef cattle producers across 4 states. The program is held 2 times per year at 2 locations dependent on age of the bulls (September 1 to November 30 tested at Calhoun Bull Evaluation Center, Calhoun, GA; December 1 to February 28 tested at Tifton Bull Evaluation Center, Irwinville, GA). Consignors are required to pay a nomination and testing fee to cover the cost of bull development. At each location, bulls are received 21 d before the initiation of the test, and acclimated to a common diet. At 28 d intervals BW is collected and used to calculate ADG, G:F, and body weight per day of age (WDA). Carcass ultrasound data, and beginning and ending hip height are also collected. Bulls are tested for 112 d. At the end of the test, those bulls that are in approximately the top two-thirds of each breed based on an index of ADG and WDA, and meet all standards for health and breeding soundness, are eligible for the sale. A sale catalog listing all pertinent information including performance data is prepared and distributed. At the Calhoun location, 39 consignors entered 152 bulls on test. At the 12/6/13 sale, 155 people registered with 68 actual buyers from 5 states purchasing the 92 bulls that sold for a total of $262,500. At the Tifton location, 34 consignors entered 128 bulls on test. At the 3/05/14 sale, 169 people registered with 59 actual buyers from 3 states purchasing the 88 bulls that sold for a total of $315,100. Consignors learned the value of placing selection pressure on economically important traits, as well as, the importance of marketing cattle with both outstanding pedigrees and demonstrated ability to gain and maintain longevity in production.

Keywords: beef cattle, bulls, extension

13 The Georgia Heifer Evaluation and Reproductive Development Program. *J. Duggin[*], The University of Georgia, Calhoun*

The Heifer Evaluation and Reproductive Development (HERD) program is an educational program that allows Georgia beef producers to consign weaned commercial and reg-

istered heifers to be developed as replacements according to best management practices. The HERD program is coordinated by participant producers, the Georgia Cattlemen's Association and the University of Georgia. The University of Georgia's Extension Service, Department of Animal and Dairy Sciences and College of Veterinary Medicine have evaluated, developed, and bred yearling beef heifers for 14 consecutive years at the Tifton and Calhoun locations. Since the inception of the program in 2000, heifers (n = 5,401) have been evaluated for disposition, reproductive tract score (RTS), pelvic area, structure and performance. The program requires a minimum pelvic area of 140cm^2 and RTS of 2 or greater (1 to 5 scale) 30 d before breeding, and a chute exit disposition score of 3 or less (1 to 5 scale). Consignors are required to precondition their heifers before delivery. Fall-born (1 September to 30 November) and winter-born (1 December to 28 February) heifers are delivered to Tifton and Calhoun, respectively, at 10 to 12 mo of age. Heifers are offered ad-libitum water and hay, and offered a hand-fed supplemental ration to achieve 0.68 to 0.79 kg ADG. All heifers maintained through the program are artificially inseminated to calving ease bulls. Currently, the 14-d CIDR-PG Fixed-Timed AI (TAI) estrus synchronization protocol is used, and heifers are subsequently pasture exposed for a 45 d minimum. Heifers confirmed open by ultrasound are not sale eligible. Since inception, HERD entries averaged 170.7cm^2 for pelvic area, 1.4 for disposition and 99% received RTS of 2 or greater. Heifers identified with deformed tracts or existing pregnancy upon RTS examination are removed from the program. Also, since 2010 AI and pasture exposed heifers have sold for a gross average $1,763.80 and $1,647.30, respectively, at HERD managed auctions. Eligible sale entries (n = 3,420) for the history of the program grossed $4.34 million. This program developed over 200 replacements meeting protocol standards in the 2013-2014 evaluation year. The 2014 gross value for heifers (n = 178) sold at HERD auctions grossed $408,300. The Georgia HERD program continues to serve as an excellent educational program for heifer development and improve the likelihood of retaining successful replacements into the breeding herd.

Keywords: beef, heifer, reproduction

14 Development and implementation of an advanced, multi-session extension training program in beef cattle production. *J. D. Rhinehart*[*1], *J. B. Neel*[2], *D. Kirkpatrick*[2], *G. E. Bates*[2], *A. Griffith*[2], *and L. Strickland*[2], [1]*University of Tennessee, Spring Hill,* [2]*University of Tennessee, Knoxville*

The Tennessee (TN) Advanced Master Beef Producer (Adv. MBP) program was developed to build on the educational foundation created by the original Tennessee Master Beef Producer (MBP) program. The objectives were to continue advancing the knowledge of TN beef cattle producers while maintaining flexibility and efficient delivery at the county level. To accomplish this goal, county agents were instructed to provide instruction in seven of ten major disciplines each year: 1) Reproduction; 2) Genetics; 3) Marketing and Management; 4) Health; 5) Forages; 6) Nutrition; 7) Handling Facilities, Fencing and Transportation; 8) End Product; 9) Production Economics & Budgeting, and 10) Industry Issues. Specialists created pre-packaged, advanced training modules under each discipline. These modules were in the form of either PowerPoint presentations or scripts and instructions for conducting hands-on demonstrations. For additional flexibility, agents were able to substitute current educational programs (e.g., field days and demonstrations) in place of the pre-packaged training modules. After the curriculum was developed, 3 in-service trainings were conducted across the state, reaching 51 county agents in the first year, with the objective of teaching agents to deliver the programming themselves. Each in-service lasted 3 d with specialist presenting the pre-packaged materials for each discipline area. Surveys were conducted to determine the efficacy of the trainings. Overall, agents ranked the trainings as Excellent (24%), Good (63%), Fair (13%) or Poor. When asked to rank their comfort level (Excellent, Good, Fair or Poor) in delivering each discipline training themselves, agents were more comfortable presenting the "Beef Quality Assurance" (46% Excellent & Good) and "End Product" (33% Excellent and Good) modules. Agents were least comfortable delivering the "Nutrition" (18% Excellent & Good) and "Forages" (23% Excellent & Good) modules. The program was adopted at the rate of 632 producers from 49 of 95 counties in the first 6 mo of availability. The TN Adv. MBP program was efficiently transferred from state specialist to county agents and successfully delivered in the early adoption phase.

Keywords: beef cattle production, Extension programming, producer education

15 A hands-on ranch management workshop for cattle producers in the Tennessee Valley region of Alabama. *G. L. Thompson*[1], *L. L. Jury*[2], *M. K. Mullenix*[*3], *J. B. Gladney*[1], *S. P. Rodning*[3], *B. S. Glover*[1], *and L. H. Robinson*[1], [1]*Alabama Cooperative Extension System, Auburn, AL,* [2]*Micro Technologies, Amarillo, TX,* [3]*Auburn University, Auburn, AL*

With the increasing accessibility of educational information through the internet and other technological resources, there is need to provide applied educational experiences for clientele that illustrate how to implement recommended management practices on farms and ranches. The Practical Ranch Management Workshop was developed to provide a 1 d, interactive, hands-on approach for teaching basic forage, nutrition, health, and identification practices to cattle producers in Northern Alabama. Program participants (n = 50) were divided into groups and rotated between a series of educational stations. During the morning, the program was separated into 5 topic-area stations. Participants were given 28 min at each station before rotating to a new topic. Topic areas discussed included how to take a soil and forage sample, herd health, beef cattle identification methods, forage establishment, grazing management, understanding animal nutrient requirements and supplementation for brood cows. At each station, participants were allowed to handle display materials and practice the method being discussed when applicable. In the afternoon, participants were divided into 2 groups and given the opportunity to practice pulling a calf using a dummy model provided by the Auburn University College of Veterinary Medicine or freeze branding a live calf under the supervision

of the topic instructors. A post-meeting survey was conducted and included a comparison of the participants' knowledge before and after the workshop (scale of 1 = very low and 5 = very high). Survey respondents (n = 43) indicated a mean knowledge increase from 2.6 (± 0.20 SD) before the meeting to 4.1(± 0.16 SD) after the workshop. In total, 100% of the participants stated that the information was easy to understand and practical for their operations. Respondents also noted that the hands-on approach and station rotation design made them feel more comfortable asking questions in a group setting, and gave the workshop a total economic impact value of $25,455. The program required heavy dependence on volunteers to provide educational information and logistical support for the workshop. A collaborative effort between extension educators, NRCS, state and local veterinarians enabled program content delivery. Total program cost-recovery was achieved through extramural support from the Alabama Cattlemen's Association and registration fees. The results of this workshop indicate that a hands-on approach to delivering beef cattle management information is a successful model for future programming in this region.

Keywords: beef cattle, Extension, hands-on learning

16 Hands-on workshops improve producers understanding of soils and temporary fencing in the Carolinas. *P. M. Kennedy*[*1]*, M. H. Poore*[1]*, J. G. Andrae*[2]*, M. Burns*[3]*, A. D. Shaeffer*[1]*, S. R. Freeman*[1]*, and J. R. Rogers*[1]*, [1]North Carolina State University, Raleigh, [2]Clemson University, Clemson, SC, [3]Clemson University, Pendleton, SC*

In 2013 a series of 5 hands-on workshops were held across the state of North Carolina to address limitations of base forages bermudagrass (*Cynodon dactylon*) and tall fescue (*Lolium arundinaceum*), pasture ecology, alternative forages (with a focus on summer annuals), and temporary fencing. Due to positive responses from participants, further training was in high demand. A summer 2014 series of these hands-on workshops was conducted at 7 on-farm sites (series A) as well as two 3-d long events based out of Clemson and NC State University (series B) with funding from the Southern Risk Management Education Center. Total workshop registration was 404 with 183 evaluations completed. Participants were 82% male and 18% female with 42% being under the age of 50. The total number of hectares of pasture owned by participants was 4,273 with 2,512 ha as hay, 6,015 brood cows, 2,743 stocker/yearling cattle, and 287 bulls. Post workshop responses indicated that 100% of attendees had increased understanding of pasture ecosystems, temporary fencing systems, and would recommend the workshop to a friend. Ninety-nine percent of participants indicated a better understanding of base forages, how alternative forages can improve cattle performance, the role soil health plays in pasture productivity, and had their expectations met in this training. As a result of this workshop, 98% of attendees indicated they plan to improve their grazing management and increase their use of temporary fencing. Series B workshops were intended to be more in-depth and catered to specific needs of the group. Pastureland owned was 2082 ha of pasture with 565 ha as hay. Attendees owned 2,196 brood cows, 541 stockers/yearling cattle, and a total of 113 bulls. Participants completed an evaluation at the conclusion of the workshop (n = 39) where they indicated their satisfaction with (scale of 1 = not satisfied to 4 = very satisfied, mean ± SD): instructors' knowledge (3.97 ± 0.16), workshop environment (3.95 ± 0.22), and overall quality (3.97 ± 0.16). All participants had an improved understanding of complex pasture ecosystems, allocating pasture to cattle, how to use temporary fencing, soil function and health, the principles of grazing management, native warm-season grasses, and economic considerations for pastures. Continued workshop participation indicates that education in these areas is needed and will continue in the Carolinas.

Keywords: hands-on workshop, soil health, temporary fencing

EXTENSION II

17 Determination of knowledge gained following an animal handling and control training workshop. *M. R. Russell*[*1]*, T. R. Troxel*[1]*, M. L. Looper*[2]*, J. Cater*[1]*, B. Kutz*[2]*, and B. Chumbley*[3]*, [1]University of Arkansas, Little Rock, [2]University of Arkansas, Fayetteville, [3]Eastern New Mexico University, Portales*

Animal control officers have long been tasked with determining health and wellbeing of animals. Many of these individuals do not possess the health and wellbeing knowledge of the various farm animal species. An animal handling and control workshop was designed to provide learning opportunities for animal control officers in Arkansas. The objective was to determine health and wellbeing knowledge gained for farm animals by animal control officers. There were 5 species of livestock presented: dairy and beef cattle, horse, goats, and sheep. Each species session was taught by faculty from the University of Arkansas, Division of Agriculture's Department of Animal Science. All sessions included healthy behavior, unhealthy symptoms, proper movement, and handling of each species. Fifteen animal control officers participated in the 3 h workshop. Each session was 20 min in duration. To determine knowledge before the workshop, a pre-test was administered to each participant. An identical post-test was given to participants at the completion of the workshop. Each test consisted of photos of each species and 1 question: "What are things you might look for in a (species) that would indicate that it is not in good health?" Participants had the option of providing 3 criteria per animal. Additionally, participants were asked to define the flight zone and point of balance for each animal. In the dairy species, participants increased their pre-test/posttest scores 54% (P = 0.01); knowledge was increased 25% in beef cattle but was not significant (P = 0.4); knowledge gained increased for horses by 50% (P = 0.02); and goats and sheep increased in pre-test/posttest knowledge by 50 (P = 0.03) and 45% (P = 0.07), respectively. There was an increase in knowledge gained on the final 2 questions, defining flight zone (92%, P = 0.01) and point of balance (53%, P = 0.01). Overall, participants showed a 54% increase (P = 0.02) in livestock

knowledge. The hands on discussion allowed participants the opportunity to ask questions more freely. Given the verbal feedback from the participants, it seems the hands on training was the major factor contributing to the increase in knowledge. These data will be used to develop more training for the animal control officers.

Keywords: animal welfare, control officers, farm animals

18 Feedback regarding animal handling training for Department of Animal Science faculty, staff and students at the University of Arkansas. *M. L. Thomas[*1], J. S. Newberry[1], and M. L. Looper[2], [1]Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville, [2]University of Arkansas, Fayetteville*

Objectives were to determine Department of Animal Science faculty, staff and student impressions and feedback regarding the value received from an animal handling training session. Training was based on multimedia instruction utilizing a slide presentation with embedded videos followed by discussion. A majority of the videos were produced by the National Beef Quality Assurance program. Training was provided at 3 locations in Arkansas. An electronic survey (10 questions) was prepared using SurveyMonkey and emailed to 45 on-campus (Fayetteville) and 19 off-campus (Hope and Batesville Research Stations) faculty, staff and students. Emails announcing the survey were sent August 26, September 3 and September 8, 2014, respectively; survey was closed September 9. Overall response rate was 69% (n = 44) with 73 (n = 33) and 58% (n = 11) of on-campus and off-campus personnel responding, respectively. On-campus participants were comprised of 58% staff, 27% faculty and 21% students; participants could select more than one category. A majority (58%) of on-campus personnel surveyed had been employed with the Department for at least 8 yr; 12% had been with the Department for less than 1 yr. Most (55%) off-campus participants were staff with 37% identified as faculty; 45% had been employed for 8 yr or more while 36% had been at their current job for less than 1 yr. Both on- and off-campus participants reported 'assigning the most experienced handler to bring in cattle from the pasture' was a new concept learned during the training. Current facility limitations were considered the greatest impediment of change in current handling practices for on- (34%) as well as off-campus (27%) survey respondents. Eighty-two percent of all personnel surveyed responded there would be no change in their current animal handling techniques if observed or videoed. Participants reported hands-on demonstrations of handling techniques would have added value to the training (58 and 55% for on- and off-campus respondents, respectively). On-campus respondents (21%) stated animal handling training was needed every year while 36% of off-campus participants reported training was needed yearly. These data will be used to develop and enhance future animal handling trainings in Arkansas.

Keywords: animal handling, survey, training

19 Saving for a wintery day: Three seasons of workshops to promote managed grazing of stockpiled tall fescue. *S. R. Freeman[*], M. H. Poore, A. D. Shaeffer, and J. T. Green, North Carolina State University, Raleigh*

In the Piedmont and mountain regions of North Carolina, tall fescue (*Festuca arundinacea*) is the main forage used on pastures. Much of the pastureland is continuously stocked, with little thought going towards managing this valuable resource. The lack of thoughtful management may result in reduced yields and cause negative environmental impacts. To stimulate interest in pastureland management a series of on-farm demonstration workshops were conducted from 2009 to 2011 to promote the stockpiling and efficient utilization of late summer fescue growth for winter grazing. Working with county Extension Agents, 21 farms were selected in 12 NC counties representing 176 ha of fescue. A total of 32 workshops were conducted over the 3-yr period to demonstrate the benefits of managed grazing coupled with stockpiled fescue. Workshops were open to the public and publicized by local Extension Agents. Measurements of forage quantity, quality, and botanical composition were made at each site over the course of each growing season. Host producers tracked time spent moving fences and feeding their cattle, fertilizer applications, and feed and equipment costs for the grazing period. Over the 3 growing seasons, area grazed for the workshops per farm was 5.9 ha (± 2.8) and herd size varied from 6 to 90 animals, but averaged 20.5 ±10.2 standard animal units (SAU) where SAU = 544 kg BW. Mean DM yield was 2,856 kg/ha (± 405). Forage available for grazing was about 50% fescue with the remainder being other cool-season grasses or broadleaf weeds. Fescue endophyte infection rate averaged 89% (±13%). Fresh forage had greater CP and TDN and reduced ADF contents than did hay fed at the same sites (14.6% CP, 67.8% TDN, and 31.3% ADF *vs.* 10.8% CP, 59.3% TDN, and 41.0% ADF for fresh forage and hay, respectively; $P < 0.01$). Grazing stockpiled forage typically began around December 15 and ended in mid-February to cover a period of 63d. Producers attained an average of 209 SAU grazing d/ha (±86) and the cost per SAU per day was $1.41 with a range of $0.22 to $2.84. Estimated costs for feeding hay during the same period of time and for the same herds was $2.51/SAU/d. Managed grazing therefore offered the producers an opportunity to save about $1.10/SAU/day of grazing as compared with feeding hay and provided a higher plain of nutrition.

Keywords: managed grazing, stockpiled fescue, workshops

20 Evaluation of four summer annuals for southeastern forage finished beef production systems: Animal performance, carcass traits, and valuation. *A. M. Stelzleni[*], R. L. Stewart, Jr., and D. Hancock, The University of Georgia, Athens*

The objective of this research was to evaluate and compare the suitability of 4 warm-season annual forages for Southeastern forage-finished beef production systems. Sixteen 0.81-ha pastures were blocked by previous land management strategy and randomly assigned to 1 of 4 forage treatments including: Brown mid-rib sorghum sudangrass (BMR), sorghum sudan-

grass (SS), pearl millet (PM), or pearl millet plus crabgrass (PMCG). Additionally, 32, previously stockered, British-cross beef steers (437±20 kg) were blocked by body weight and randomly assigned to 1 of the 16 pastures for forage finishing. Pastures were split into 2 paddocks and rotationally grazed utilizing put and take heifers, as need, to manage forage growth. Body weight and body composition (via ultrasound) were measured on d 0, 34, and 70. At a target BW of 499-kg steers were slaughtered under Federal Inspection. Twenty-four hours post-mortem carcass quality and yield data were collected and used to determine final value and break-even pricing. Data were analyzed using Proc Mixed (SAS v9.4). Pasture was considered the experimental unit and steer was considered the observational unit with steer within pasture by block as the random term. When applicable the forage type by day interaction was evaluated. Forage type did not influence ($P > 0.05$) ADG, BW, or ultrasound traits for LM area, intramuscular fat, 12th-rib fat thickness, or rump fat thickness; however, BW and all ultrasound traits increased ($P < 0.03$) as time on forage increased. Evaluating carcasses, forage type was not a significant factor ($P > 0.05$) for shrunk BW, HCW, dressing percent, LM area, LM area/100 kg BW, KPH, 12th-rib fat thickness, or calculated USDA yield grade. Additionally, carcass quality traits of marbling score, overall maturity, subjective lean and fat color, and objective L* and a* were not different ($P > 0.05$) between treatments. However, marbling scores for PM and SS were numerically greater (small degree) than BMR and PMCG (slight degree). There was no difference in starting value, carcass value, carcass value difference, premium required, percent premium required, or carcass breakeven pricing; however, PM and SS numerically had greater carcass value, educed premiums required for breakeven and lower breakeven pricing. These data show that BMR, SS, PM, or PMCG can be used in summer beef forage finishing systems in the Southeast, but, economic incentives could favor forage finishing beef on PM or SS.

Keywords: beef, forage-finished, grass-finished

21 Prevalence of shiga-toxin producing *Escherichia coli* on beef cattle farms in eastern Arkansas. *T. Breckenridge*, D. Kennedy, D. Gilmore, S. E. Choi, M. Yarbrough, S. Pulley, and H. Kaur, Arkansas State University, Jonesboro*

Sixty-five million U.S. citizens become ill from foodborne bacteria annually; 73,000 of these bacterial illnesses are caused by Shiga-toxin producing *Escherichia coli* (STEC) O157:H7. Cattle are a reservoir of STEC; therefore, STEC contamination of beef is a significant food safety concern in the U.S. On-farm STEC control measures may reduce the incidence of contamination in processing facilities. The objective of this study was to determine prevalence of 0157:H7 and non-O157:H7 STEC on beef cattle farms in eastern Arkansas, and to possibly identify farm management and/or environmental conditions associated with STEC prevalence in cattle. Rectal swab samples (10 cows per farm) were collected on 16 farms during July - Sept 2013 (average daily temp. = 24.2 ° C) and 18 farms during Sept-Nov 2012 (average daily temp. = 16.4 ° C). In this study, the prevalence of STEC on cattle farms was determined using cultural methods and agglutination tests. Triplicate samples (rectal swabs, soil, and water) were collected from each farm. Following enrichment, samples were streaked onto selective and differential media. Colonies were chosen based on characteristic appearance, confirmed as *E. coli* by positive indole and negative citrate tests, and confirmed as 0157:H7 or as other STEC using latex agglutination tests. Every farm had at least 1 animal that tested positive for non-O157:H7. The proportion of cattle testing positive for O157:H7 at each farm ranged from 0 to 100%. Prevalence for O157:H7 was increased ($P < 0.05$) for summer vs. fall (61.1% vs. 38.9%). In contrast, prevalence of non-0157:H7 was increased ($P < 0.05$) for fall vs. summer (76.6%. vs. 23.4%). Some form of STEC was detected in environmental samples (soil or water) on 94% of the farms. These data indicate that the prevalence of STEC is widespread in beef cattle herds located in eastern Arkansas, and STEC prevalence was different in cattle sampled during the summer as compared with those sampled in the fall.

Keywords: beef cattle, *Escherichia. coli*, O157:H7, shig-toxin

GRADUATE STUDENT COMPETITION I

22 Grass finishing systems for lambs born in fall and winter. *E. Smyth*[*1,2], J. M. Burke[1], M. Acharya[2], J. E. Miller[3], and K. P. Coffey[2], [1]USDA-ARS, Booneville, AR, [2]University of Arkansas, Fayetteville, [3]Louisiana State University, Baton Rouge*

There is a need to reduce off-farm inputs, including feed supplements and fertilizer. The objective was to examine performance of grass-finished or minimally supplemented lambs on mixed grass pastures in the southeastern US. Katahdin lambs born in October (fall) and February (winter) were weaned in January 2014 (80 ± 1.5 d) and May 2014 (95 ± 1.4 d), respectively. Lambs were blocked by gender (fall included both genders; winter included only ram lambs) and randomly assigned to receive no supplement (NON) or grain supplement (SUP; soyhull pellets, wheat midd pellets, corn gluten pellets, cracked corn, dried distillers grain; 15% CP) of 0.5% BW/d adjusted every 14 d (n = 20/treatment; 2 grazing reps/treatment). Lambs were rotationally grazed on predominantly grass pasture (tall fescue, vetch, bermudagrass, and(or) sericea lespedeza depending on seasonal growth; forage quality was determined). Fecal egg counts (FEC), BW, and packed cell volume (PCV) were determined every 14 d and analyzed by repeated measures in a mixed model with pen as the experimental unit. Target BW was 36 to 41 kg for ewes and 41 to 50 kg for rams. Winter lambs were removed from treatments after 56 d due to poor forage quality and loss of body condition. In fall-born lambs, ADG was greater for SUP than NON rams (184 ± 4.9 > 149 ± 5.5 g/d; $P = 0.0067$), but did not differ among ewes (118 = 113 ± 5.2 g/d; treatment x sex x day, $P < 0.001$). The ADG of winter lambs was greater for SUP than NON (44 > 11 ± 9.5 g/d; $P = 0.02$). The FEC tended to be lower in SUP than NON ($P < 0.06$) in the fall lambs, but PCV was not different ($P = 0.25$). The FEC of winter lambs was similar between treatments, but PCV was increased in SUP compared with NON

lambs (27.0 > 25.5 ± 0.4%; *P*= 0.015). Modest supplementation led to greater gains and there tended to be an advantage in management of gastrointestinal nematodes.

Keywords: average daily gain, grass-finished, sheep

23 Effect of supplemental sericea lespedeza leaf meal pellets on health and productivity of grazing goats. *T. N. Hamilton[*1], T. H. Terrill[1], D. S. Kommuru[1], A. Rivers[1], J. A. Mosjidis[2], J. E. Miller[3], and J. M. Burke[4], [1]Fort Valley State University, Fort Valley, GA, [2]Auburn University, Auburn, AL, [3]Louisiana State University, Baton Rouge, [4]USDA-ARS, Booneville, AR*

Feeding supplemental sericea lespedeza (SL; *Lespedeza cuneata*) leaf meal pellets can reduce the effects of infection with gastrointestinal nematodes (GIN) and coccidia (*Eimeria*spp.) in sheep and goats, but effects on nutritional status of parasitized small ruminants are unclear. A 7-wk grazing study (July-August, 2014) was completed at Fort Valley State University in Fort Valley, GA, comparing yearling goats (Spanish, 14 mo old, 66.2 ± 8.1 kg, intact males, n = 11-12/treatment) supplemented with SL pellets or commercial feed pellets at 1.5% of BW. Animal BW was measured at the start and end of the trial using an electronic scale, and fecal and blood samples were taken from individual animals weekly to determine fecal egg count (FEC) and fecal oocyst count (FOC), and packed cell volume (PCV), respectively. The data were analyzed as repeated measures using SAS, with FEC and FOC data log transformed ln(FEC + 1) to normalize the data. Goats supplemented with SL leaf meal pellets had reduced ($P < 0.05$) FEC and FOC than those given control pellets during wk 4 to 7 of the trial, and the SL-supplemented goats gained more body weight than control animals (123 ± 57 and 84 ± 57 g per day, respectively). Feeding supplemental SL pellets at 1.5% of body weight (Approximately 35% of daily intake) on pasture may be a viable strategy for improving health and productivity of yearling goats.

Keywords: gastrointestinal nematodes, goats, sericea lespedeza

24 The effect of CorPet a mushroom derived probiotic on gene expression in goat blood. *K. A. Ekwemalor*, E. K. Asiamah, S. Adjei-Fremah, H. Ismail, and M. Worku, North Carolina Agricultural and Technical State University, Greensboro*

The objective of this study was to evaluate the impact of an oral drench of commercial probiotic CorPet (Mycology Research Laboratory, San Francisco, CA) from the mushroom *Coriolus versicolor* on gene expression in goat blood. Goat farming is an increasing industry in the United States, but nematode infestation is a major obstacle. Gastrointestinal nematodes have developed resistance to chemical anthelmintics resulting in the need for alternative control strategies. CorPet is a mushroom-based feed that is being used as a probiotic in horses. However, little is known about its effect in goats. Five female Boer and Spanish goats were drenched with either a hot extract of CorPet, a cold extract of CorPet and a control group of goats was drenched with 10 mL of sterile water for 8 wk. Blood was collected at wk 1 and 8. Neutrophils were isolated from whole blood using differential centrifugation and hypotonic lysis of red blood cells. Isolated neutrophils were used for RNA isolation using Trizol (Sigma-Aldrich, St Louis, MO), RNA integrity number (RIN >7) was determined using Bioanalyzer (Agilent) and was converted to cDNA using the RETROscript kit (Ambion, Grand Island, NY). The human Toll-like Receptor (TLR) signaling pathway RT^2 Profiler PCR Array (Qiagen, Valencia, CA) was used to profile the expression of 84 genes to TLR-mediated signal transduction and innate immunity. The Livak method was used to calculate the fold change in transcription using water as control. The house keeping gene GAPDH was used to normalize the data. Plasma was extracted from whole blood for cytokine assay. Pro-inflammatory cytokine levels were evaluated using the Human Inflammation ELISA kit (Signosis Inc, Santa Clara, CA). In neutrophils isolated from goats that received CorPet 60-80% of the genes were up regulated. In neutrophils from goats receiving water 24% of the genes were up regulated. Corpet treatment was associated with increased expression of TLR 6, chemokine CCL2, cytokine IL6 and effectors TAB1 and ECSIT. Five out of 8 pro-inflammatory cytokine were secreted in plasma from all goats. Treatments with CorPet increased the concentration of GCSF (3 fold), GMCSF (2 fold), IFNr (3 fold), IP10 (49 fold) and Rantes (7 fold). Administration of CorPet to goat impacted transcription and translation of genes important in combating inflammation. Its use as a probiotic in goats may help stimulate innate immunity.

Keywords: CorPet, cytokines, goat

25 Artificial insulation of goat carcasses to improve tenderness. *K. L. Basinger[*1,2], J. K. Apple[1], J. D. Caldwell[2], B. C. Shanks[2], T. M. Johnson[1], J. W. Yancey[1], L. S. Wilbers[2], G. R. Pettig[2], K. M. Jones[2], E. A. Backes[1], and A. N. Young[1], [1]Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville, [2]Department of Agriculture and Environmental Sciences, Lincoln University, Jefferson City, MO*

Due to lack of subcutaneous adipose tissue, goat carcasses are particularly subject to cold shortening and subsequent tenderness issues when rapidly chilled in a cooler. Therefore, the research objective was to compare LM tenderness resulting from the postmortem application of artificial insulation to goat carcasses. Intact male Kiko × Boer crossbred goats (n = 12; 43 ± 4.4 kg body weight) were transported approximately 450 km (4.5 h) from Lincoln University's Carver Farm to the University of Arkansas abattoir, and slaughtered after overnight lairage with water, beginning at 0800. At approximately 30 min postmortem, alternating carcasses were designated to 1 of 2 treatments: 1) control or 2) artificial insulation. For artificial insulation, 2 layers of Duck Brand Bubble Wrap (30.5-cm width; Duck Brand. 2014. Shur Tech Brands, LLC. Avon, OH) was secured to each carcass with Duck Brand clear packaging tape. Thermal sensors were securely inserted approximately 0.64 cm deep in the LM, caudal to the 13th rib. Carcass temperature was monitored at 0, 1, 2, 3, 6, 12, 24, and 48 h after slaughter. At 48 h, carcasses were fabricated and the LM was excised from each carcass and stored at -20°C for subsequent cooking loss, Warner-Bratzler shear force (WBSF), sarcomere

length, and myofibril fragmentation index (MFI) determination. Data were analyzed using the PROC MIXED of SAS with the experimental unit being carcass. Temperatures of the LM were greater ($P < 0.05$) in the LM of artificially insulated carcasses at each time post mortem (time x treatment interaction; $P < 0.001$). Interestingly, the temperature at 12 h postmortem in artificially insulated carcasses was similar to the LM temperature of non-insulated carcasses at 3 h postmortem. Body and carcass weights, dressing percentage, and LM area did not differ ($P > 0.05$). Additionally LM sarcomere length, as well as cooking loss percentage, MFI, and WBSF did not differ ($P > 0.05$) between treatments. Therefore, the application of artificial insulation effectively elevated LM temperatures during chilling but may not alter the tenderness of the goat LM.

Keywords: artificial insulation, goat, tenderness

26 In vitro effects of water extracts of sericea lespedeza on goat blood. *E. K. Asiamah*, K. A. Ekwemalor, S. Adjei-Fremah, M. Worku, and H. Ismail, North Carolina Agricultural and Technical State University, Greensboro*

This study was conducted to evaluate the effect of a water extract of sericea Lespedeza (SL) on gene activation in goat blood. Sericea lespedeza, a high tannin containing legume has been shown to be a useful component of feed for control of gastrointestinal nematodes in goats. The in vitro effects of Serecia Lespedeza water extract on transcription and on formation of prostaglandin E2 (PGE2) in response to exposure to bacterial Lipopolysaccharide (LPS), Peptidoglycan (PGN) and Nystatin (NYS) was assessed in goat blood. Blood was collected from 4 BoerX Spanish goats at North Carolina A&T State University farm. Whole blood was incubated with 100ng/mL of Sericea Lespeza (SL) in the presence and absence of Lipopolysaccharide (LPS), Peptidoglycan (PGN) or Nystatin (NYS). Whole blood was also incubated with 100ng/mL LPS, PGN or NYS alone. Samples incubated with PBS served as negative controls. Following incubation plasma was removed from the cell pellet and stored at -80°C. To assess gene transcription, the cell pellet was used for isolation of total RNA using Trizol(Sigma). The concentration and purity of isolated RNA was determined with the nanodrop spectrophotometer. To assess gene translation the concentration of PGE2, a prostaglandin involved in regulation of inflammation was assessed in plasma from treated and control samples using a commercial ELISA (Cayman). When compared with blood incubated with PBS, treatment of blood with LPS, PGN, SL and NYS increased transcription by 234, 85, 100 and 14% respectively. Reduced transcription was observed when samples were co-incubated with SL and LPS or with SL and PGN simultaneously (58% and 11% respectively). However, transcription increased (159%) when blood was incubated with NYS and SL together. When compared with blood incubated with PBS, treatment of blood with microbial cell wall components LPS, PGN and NYS increased PGE2 concentration by 350, 250 and 107% respectively compared with SL alone (68%). The levels of PGE2 were deceased following concomitant exposure with SL and LPS, PGN or NYS by 174, 152 and 181% respectively. Sericea decreased the prostaglandin concentartions in goat blood when combined with LPS, PGN and Nystatin. The results demonstrate that in goat blood, SL is involved in cell activation by direct interaction and modulates the response to bacterial cell wall components. Thus, SL may aid in regulating inflammation by modulating cell activation at the RNA and protein level.

Keywords: prostaglandin, serecia lespedeza, transcription

27 Effect of protein supplementation and forage allowance on heifer growth and reproduction. *S. E. Lyons*[1], M. H. Poore[1], D. H. Poole[1], S. R. Freeman[1], A. D. Shaeffer[1], P. M. Kennedy[1], M. L. Alley[2], and M. E. Drewnowski[3], [1]North Carolina State University, Raleigh, [2]Zoetis, Cary, NC, [3]University of Nebraska-Lincoln, Lincoln*

Stockpiled tall fescue can be adequate winter forage for beef cattle, though unsupplemented replacement heifers on stockpiled systems have shown inadequate performance during the months before breeding. This 3-yr study investigated 2 potential ways to improve first service conception in replacement heifers following winter grazing of endophyte-infected tall fescue: Increasing forage allocation from a “normal” allocation of forage (Norm) to 125% of “normal” (E), and offering a free choice supplement with ruminally-degradable protein tub (RDP) verses a basic mineral supplement (M). Treatments were arranged in a 2x2 factorial and were administered for 8 wk from early November to early January. Heifers were fed fescue hay only for 1 wk before breeding in late January. Main and interaction effects between the 2 treatments were determined. Angus and Angus-Simmental cattle averaging 272 kg were separated based on body weight into groups of 5, and each group included 1 or 2 “put-and-take” animals. Groups were randomly assigned to 1 of 4 plots within a replication and were allowed 1 wk for adaptation to the pasture. Each year, pastures were fertilized with 56 kg/ha N in early September. Pastures were 68% fescue (54% infected). Blood urea nitrogen concentrations were greater for the RDP treatment groups when tubs were provided ($P < 0.001$) and were not different when tubs were not provided ($P > 0.05$). Total supplement intake was greater for RDP than M ($P < 0.0001$). Forage utilization efficiency was greater for Norm than E ($P < 0.0001$), evidence that the E group received more forage. Main effects of both treatments on average daily gain and overall body weight gain were significant ($P < 0.0001$; 0.36 kg/d and 19.88 kg overall for M, 0.47 kg/d and 26.53 kg overall for RDP, 0.36 kg/d and 19.92 kg overall for Norm, 0.47 kg/d and 26.50 kg overall for E). There was an interaction effect of the 2 treatments on change in body condition scores (BCS; $P < 0.05$; 0.12, 0.10, 0.18, and 0.31 for NormM, NormRDP, EM, and ERDP, respectively). Heifers were synchronized with the Co-synch+7d CIDR protocol and artificially inseminated (AI) in late January followed by bull exposure. All heifers were checked for pregnancy by ultrasonography at 35 and 90 d post AI. Overall, feeding a protein supplement or providing extra forage increased body bweight gain and interacted to increase BCS ($P < 0.05$) but did not have an effect on reproductive development or conception rates ($P > 0.05$).

Keywords: heifer development, stockpiled fescue, supplementation

28 Impact of milk production level on beef cow-calf productivity in Tennessee. *S. R. Edwards*[*1] and J. T. Mulliniks[2], [1]University of Tennessee, Knoxville, [2]University of Tennessee, Crossville*

Currently, the beef cattle industry tends to focus on selecting production traits with the purpose of maximizing cow-calf performance. One such trait is milking ability, which is considered the primary influence on weaning weight of the calf, but it can also have a negative effect on the reproduction and cost of production of the cow. Therefore, the objective of this study was to determine the effect of actual milk yield on reproductive performance, blood metabolites, and calf performance in beef cows in Tennessee. Data were collected from 121, three- to nine-year-old Angus sired beef cows from 3 research centers across Tennessee. On approximately d 58 and 129 postpartum, 24-h milk production was measured with a modified weigh-suckle-weigh technique using a milking machine. Subsamples of milk were collected for analysis of milk components. Milk yield data were then used to classify cows on actual milk yield as High (12 kg/d), Moderate (9 kg/d), or Low (7 kg/d). Cow BW and BCS were collected weekly through breeding. Calf BW was recorded at birth, mid-weight for an adjusted 55-d, and weaning weight for an adjusted 205-d. Data was analyzed with the MIXED procedure of SAS with cow as the experimental unit. At d 58 and 129 of postpartum, milk yields were different ($P < 0.001$) among the treatment groups with High milk cows milking the greatest and Low milk cows milking the least. Milk fat, protein, solids-non-fat, and somatic cell count at both milk dates were not influenced ($P > 0.07$) by milk production groups. However, milk lactose (%) did increase ($P < 0.05$) with increasing level of milk production for both milk dates. Cow BW and BCS throughout the duration of this experiment were not different ($P > 0.40$) among milk production groups. Pregnancy rates were not different ($P = 0.86$) across the individual milk treatments. Even with the increased levels of milk production, calf BW at 55-d of age ($P = 0.30$) and 205-d of age ($P = 0.54$) were not influenced by milk production level of their dams. Results from this study indicate that increased milking ability in beef cows do not result in increased cow-calf productivity as seen by the lack of difference in calf weaning weight. Thus, selection for milk production in this given production setting could be discounted to decrease to nutrient demands of lactation and maintain or increase productivity.

Keywords: beef cattle, calf performance, milk production

29 Intensified cow/calf production system in the southern great plains incorporating wheat pasture, semi-confinement and native rangeland. *J. R. Cole*[*], A. L. McGee, S. K. Linneen, C. L. Bayliff, J. G. Warren, G. W. Horn, and D. L. Lalman, Oklahoma State University, Stillwater*

Decreasing acres of grazing land, increasing demand for red meat and escalating cattle prices encourage more intensified beef cattle production systems. The objective of this experiment was to economically decrease land area per unit of production by incorporating cropland and semi-confinement into a fall-calving operation. Angus and Angus x Herford cows (n = 82; BW = 528 ± 70 kg; BCS = 5 ± 0.9) were allotted randomly by BW and age into 2 forage system treatments: extensive (EXT) or intensive (INT). Cows assigned to the EXT treatment grazed native rangeland year-around with access to 5.4 ha per cow/calf pair. Starting December 9, cows assigned to the INT system were fed prairie hay in a dry lot. During this time, INT cows had access to 0.4 ha of wheat pasture per cow/calf unit 12 h/wk (3 d/wk, 4h/d.) Beginning March 27, cows and calves were given ad libitum access to wheat pasture. Following the 41 d graze-out period, INT cows were moved to native rangeland with a stocking rate of 3.2 ha per cow/calf pair until weaning. Cow weight and BCS, calf weight, land area and cow carrying cost were measured throughout the experiment. Data were analyzed using the MIXED procedure of SAS. Pasture group was the experimental unit and the model included treatment, calf gender (when appropriate) and the interaction as fixed effects. During the limit grazing winter period EXT system cows lost substantially more body weight and body condition compared with INT system cows ($P < 0.01$). As expected calves grazing wheat pasture gained more weight than calves grazing native range ($P = 0.02$). This trend continued as INT system cattle where allowed continuous access to wheat pasture ($P < 0.01$). In early summer when both treatment groups grazed native rangeland, EXT system calves gained 10.5 kg ($P < 0.01$) more body weight than INT system calves. At weaning, INT system calves tend to weigh 30 kg (P = .08) more in comparison with EXT calves. The annual cow cost was $86.32 greater for INT system cows. However, it was estimated calf revenue at the time of weaning was $69.56 more for INT calves. Excessive body condition of INT cows suggests opportunity to further limit caloric intake by increasing stocking rate or reducing winter and spring forage access. This should lead to reduced costs and further reduce land requirement for the INT system.

Keywords: graze-out, semi-confinement, wheat pasture

30 Canola and calves: An integrated crop-livestock farming system for producing canola and stocker calves in the Southeast. *S. H. Ingram*[*], S. L. Dillard, R. L. Stewart, Jr., and D. Hancock, The University of Georgia, Athens*

Research was conducted to compare and establish appropriate grazing management strategies that optimize stocker calf production and the agronomic performance of canola. Nine 0.66-ha paddocks were blocked by previous tillage history and randomly assigned to 1 of 4 treatments including: Canola lightly grazed to Harper and Berkenkamp (1975) growth stage (GS) 3.0, (CEG), canola grazed to GS 3.1 (CLG), canola-no graze (CNG), and winter wheat grazed until jointing Feekes GS 6, (WW). Additionally, 18 Angus steers (248± 19 kg) were blocked by body weight and randomly assigned to 1 of 9 paddocks for grazing. The paddocks were divided into 2 subpaddocks and rotationally stocked utilizing put and take steers to manage crop growth. Leaf area index (LAI), and Near Difference Vegetation Indices (NDVI) were non-destructively assessed using a handheld CropCircle remote sensing device and a LI-COR LAI-2200 Plant Canopy Analyzer for each pad-

dock every 2 wk. At this same time, destructive samples were collected by hand to 2.5 cm stubble in 3 randomly located 0.1 m² areas in each paddock to assess herbage biomass yield. Herbage biomass was measured weekly in all paddocks using a rising plate meter (RPM) at approximately 40 random locations along a randomly located transect. Body weights for stocker calves were measured on d 0 and 49. Data were analyzed using Proc Mixed (SAS v9.4). Experimental unit was paddock and steer was observational unit with steer within paddock by block as the random term. Grazing treatment did not influence ($P > 0.05$) herbage biomass yield, LAI, ADG and seed oil content .Grazing treatment did influence ($P < 0.05$) GS with CLG being the highest and CNG being the lowest. NDVI was influenced ($P < 0.05$) by treatment with CLG being the greatest and CNG being the least. Seed yield was also influenced ($P < 0.05$) by treatment with CLG having the least yield, and CEG having the greatest yield. These data show that implementation of appropriate grazing management strategies can optimize stocker calf production and not compromise seed yield and oil content of the canola.

Keywords: canola, calves, dual-Purpose

31 Utilization of canola and sunflower meals as replacements for soybean meal in a corn silage-based stocker operation. *J. M. Lourenço*, M. A. Froetschel, and R. L. Stewart, Jr., The University of Georgia, Athens*

Two experiments were conducted to evaluate 3 stocker diets composed mainly of corn silage. In the first experiment, diets were fed to 276 steers and heifers (initial BW = 285 ± 9.7 kg) for 3 yr. In the second experiment, these diets were subjected to in vitro digestion for 5 distinct lengths: 0, 6, 12, 24, and 48 h, to evaluate IVDMD, production of fermentation end products, and transformations in dietary energy. On a DM basis, the diets were composed of: 1) 74% corn silage, 15.2% ground ear corn, and 10.8% soybean meal (SBM); 2) 74.4% corn silage, 9.8% ground ear corn, and 15.8% canola meal (CAN); 3) 74.5% corn silage, 9.8% ground ear corn, and 15.7% sunflower meal (SUN). Exp. 1 was analyzed using a completely randomized design with 3 treatments and 9 pens, with pens as experimental units. Fermentation bottles (n = 40) were considered the experimental units in Exp. 2. Results from the first experiment showed that DMI was similar across all treatments ($P = 0.167$), whereas, ADG was greatest ($P = 0.007$) for animals fed either SBM or CAN, followed by the animals fed SUN (1.29, 1.28, and 1.20 kg/d, respectively). Final BW was superior for SBM and CAN, followed by SUN ($P = 0.009$). Both CAN and SUN significantly reduced daily feeding cost per animal in comparison with SBM ($P < 0.001$). Data from the second experiment revealed that total VFA production was similar for all treatments ($P = 0.185$); however, greater molar proportions of propionate were observed for SBM and CAN ($P = 0.02$). Additionally, IVDMD was greatest for SBM ($P < 0.001$). Regression analysis of fermentation traits over time showed that concentration of CH_4 increased linearly ($P = 0.01$) while all other traits followed a quadratic trend ($P \leq 0.02$). Through the use of a bomb calorimeter, the dietary energy converted into VFA, microorganisms, and $CH_4$was determined. This approach was able to detect virtually all the transformations that energy went through. It detected an average of 97% of the conversions in digestible energy over time. In summary, results from these 2 experiments showed that although SBM had greater IVDMD, stocker animals fed this diet had similar performance compared with the animals fed CAN. Furthermore, animals receiving CAN had decreased daily feeding cost, which makes this treatment an economically viable option for beef producers.

Keywords: canola meal, stockers, sunflower meal

32 Effects of replacing corn with wet brewers grains on growth performance and trace mineral consumption of beef heifers provided medium-quality tall fescue hay. *L. F. Artioli* and P. Moriel, North Carolina State University - Mountain Research Station, Waynesville*

The objective of this study was to evaluate growth performance and trace minerals consumption of beef heifers fed medium-quality hay and increasing levels of wet brewers grains (WBG) replacing ground corn (CN). At 14 d post-weaning (d 0), Angus beef heifers (n = 27; 218 ± 3 kg; 225 ± 23 d of age) were stratified BW, and randomly assigned into 1 of 9 drylot pens (3 heifers/pen). Treatments were randomly assigned to pens (3 pens/treatment), and consisted of heifers receiving a 42-d period of daily supplementation with 100% CN (9% CP and 89% TDN; DM basis), 50% CN plus 50% WBG (CNWBG; 19% CP and 81% TDN; DM basis), or 100% WBG (29% CP and 72% TDN; DM basis). Supplement offer was adjusted on d 0 and 21 to provide equal daily amounts of supplemental TDN (0.7% of BW), whereas free-choice access to ground tall fescue hay (10% CP and 54% TDN; DM basis) and complete mineral mix were provided from d 0 to 42. Body weights were obtained every 21 d after 16 h of feed and water withdrawal. Data were analyzed using PROC MIXED procedure of SAS, with pen(treatment) as random effect. Average daily gain from d 0 to 42 did not differ ($P = 0.65$) between CNWBG and WBG heifers, and tended ($P \leq 0.08$) to be least for CN heifers (1.0, 1.0 and 0.7 ± 0.08 kg/d, respectively). On d 42, CNWBG and WBG heifers were heavier ($P \leq 0.02$) than CN heifers (260, 256 and 247 ± 3 kg/d, respectively). Hay and total DMI (% of BW) were least ($P \leq 0.03$) for heifers fed WBG vs. CN and CNWBG in 3 of 6 wk. Hence, G:F was similar ($P = 0.63$) between CNWBG and WBG heifers, but least ($P \leq 0.004$) for CN heifers (0.22, 0.23 and 0.16, respectively). Mineral salt intake was greatest ($P \leq 0.04$) for WBG, least for CNWBG, and intermediate for CN heifers (0.12, 0.08 and 0.10 ± 0.007 kg/d, respectively). Total Zn, Cu, Mn and Mo intake were greatest ($P \leq 0.05$) for WBG heifers, whereas Se and Co intake were least ($P \leq 0.05$) for CNWBG heifers, and similar ($P = 0.05$) between CN and WBG heifers. Overall, replacing corn with wet brewers grains improved growth performance, feed efficiency and trace minerals consumption of beef heifers fed medium-quality tall fescue hay.

Keywords: brewers grain, fescue, heifers

33 Precision-feeding dairy heifers a high rumen undegradable protein diet with differing forage to concentrate ratios. Effects on protein utilization and N efficiency. *L. E. Bowen* and G. Lascano, Clemson University, Clemson, SC*

The objective of this experiment was to determine the effects of feeding a high rumen undegradable protein (RUP) diet when dietary fiber level is manipulated within differing forage to concentrate ratios (F:C) on protein utilization of precision fed dairy heifers. Six rumen cannulated Holstein heifers (556.7 ± 31.8 kg body weight) were randomly assigned to 2 levels of concentrate, HC (45% forage) and LC (60% forage) and to a forage type sequence [100% oat hay and silage OA, 0% wheat straw WS (Low fiber; LF); 83% OA, 17% WS (Medium fiber; MF); and 67% OA, 33% WS (High fiber; HF)] within forage level administered according to a split-plot 3 × 3 Latin square design (21-d period). Similar N intake (1.70 g N/kg BW $^{0.75}$) and RUP (55% of CP) were provided accordingly. All dependent variables were analyzed using the PROC MIXED procedure of SAS. Heifers fed HC had similar apparent total tract organic matter (OMD), neutral detergent fiber (NDF), and hemicellulose apparent digestibility (AD) to those fed LC diets. Acid detergent fiber (ADF) and hemicellulose apparent digestibilities were greater (P < 0.01) as WS levels increased. Acid detergent fiber AD interacted quadratically (P = 0.01); increasing for heifers fed LC and decreasing for HC diets. Dry matter (DM) AD tended to decrease linearly (P = 0.09) with addition of dietary fiber. Acid detergent lignin (ADL) AD in LC-fed heifers (P = 0.11) tended to be greater than HC-fed heifers and tended to increase with addition of WS (P = 0.07). Nitrogen intake and AD were similar between F:C or with increasing levels of WS. Mean ruminal fluid pH was 6.42 among F:C rations. Urine excretion was similar among F:C, resulting in decreased total manure output by HC-fed heifers as compared with LC-fed heifers. Water intake was greater for LC-fed heifers as well as for diets with low levels of dietary fiber. Apparent digestibility coefficients were affected differently as dietary fiber was added through the addition of WS in the diet, suggesting that RUP can be beneficial to nutrient utilization as dietary fiber is manipulated in precision fed dairy heifers.

Keywords: digestibility, fiber, heifers, rumen undegradable protein

34 Effect of inclusion of post-extraction algal residue on nutrient utilization and carcass performance in finishing steers. *J. C. Morrill*, J. E. Sawyer, S. B. Smith, J. R. Baber, and T. A. Wickersham, Texas A&M University, College Station*

An experiment was conducted to determine effects of post-extraction algal residue (PEAR) inclusion on nutrient utilization and carcass characteristics in finishing steers. Eighteen Angus x Hereford steers (initial BW = 549 ± 38.8 kg) were randomly assigned to 1 of 3 treatments: PEAR hand-mixed into the diet at 1.0 kg OM/d (PEAR), 1.0 kg OM/d glucose infused ruminally (GR) or abomasally (GA). Infused steers were fitted with ruminal cannulae, allowing continuous infusion of glucose via anchored infusion lines. The basal diet consisted of 90% concentrate and 10% chopped prairie grass hay. The concentrate portion was comprised of dry rolled corn (47%), ground milo (20%), cottonseed hulls (15%), molasses (7.5%), cottonseed meal (6%), vitamin/mineral premix (2.5%), urea (1%), and limestone (1%). Steers were adapted to housing and basal diet for 5 d; subsequently, treatments were applied until harvest. Intake and digestion were determined from d 33 to 37. Steers were harvested on d 38 to 40; carcass measurements were collected 2 d post-harvest. Greater DMI was observed for PEAR (13.0 kg/d) than GR (10.3 kg/d; P < 0.05); DMI for steers receiving GA (11.2 kg/d) was intermediate and not different from either PEAR or GR (P = 0.14). Intake of DE was similar among treatments (P = 0.45) and averaged 36 Mcal/d. Digestion of GE was 72.9, 82.6, and 80.9% for PEAR, GA, and GR, respectively (P < 0.01). Digestion of NDF was substantially less (55.7%) for PEAR than GA (75.4%) and GR (75.0%; P < 0.01). No measurable NDF was added to the diet by inclusion of PEAR; thus, effects on NDF digestion are indirect. Rate of passage may have increased due to increased DMI or increased sodium consumption with PEAR inclusion. Steers fed PEAR had greater marbling scores (520) than GA (463) and GR (452; P = 0.01). Accordingly, USDA Quality Grade was greater for PEAR than GA and GR (P = 0.01; 340, 321, and 317, respectively). Additional marbling precursors potentially resulted from increased intake of oleic acid (18:1) impacting insulin-glucose homeostasis or differences in ruminal fermentation allowing escape of starch from the rumen, thus contributing to post-ruminal glucose absorption. There was no difference in USDA Yield Grade or HCW between treatments (P ≥ 0.66). Diet utilization was impacted by PEAR while slightly improving carcass quality; however, further investigation is necessary to determine consumer acceptance of beef from PEAR-fed steers.

Keywords: intake, marbeling**,** post-extraction algal residue

GRADUATE STUDENT COMPETITION II

35 Effects of treating sorghum wet distillers grains with solubles with fibrolytic enzymes on nutrient digestibility and performance in finishing beef steers. *C. L. Brauer*[1,2], J. C. MacDonald[3], N. A. Cole[4], F. T. McCollum[1], and J. S. Jennings[1], [1]Texas A & M AgriLife Research and Extension Center, Amarillo, [2]West Texas A & M University, Canyon, [3]University of Nebraska, Lincoln, [4]USDA-ARS, Bushland, TX*

Two experiments were conducted to determine the effects of treating sorghum wet distillers grains with solubles (SWDG) with an enzyme, or enzyme-buffer combination on diet digestibility and feedlot performance. Experimental treatments are; 1) untreated SWDG (control), 2) addition of an enzyme complex to SWDG (enzyme); and 3) addition of enzyme complex and limestone buffer to SWDG (E+B). Sorghum WDG was included at 45% (DM basis) of the finishing diet. The enzyme complex was a proprietary blend containing both exogenous and endogenous fibrolytic enzymes, and added at rate of 6 L/ton of SWDG (DM basis). In experiment 1, six crossbred steers (initial BW = 577 kg) were used to evaluate digest-

ibility characteristics. Data were analyzed using PROC GLM of SAS. No differences (P > 0.28) in DMI, or digestibility of DM, OM, NDF and starch between treatments were detected. Cattle fed E + B treatment tended (P = 0.07) to have a higher ruminal pH than control or enzyme fed steers. In experiment 2, 54 beef steers (initial BW = 370 ± 9 kg) were used in a finishing study to evaluate performance and carcass characteristics. Data were analyzed using PROC MIXED of SAS. Dry matter intake was not different for enzyme (P = 0.35) or E + B (P = 0.15) fed cattle compared with the control throughout the feeding period. No other effects on performance were detected during the feeding period between enzyme versus control fed cattle or E + B versus control fed cattle (P > 0.35 and 0.32, respectively). Standard carcass measurements did not differ (P > 0.43) between enzyme and control fed cattle or between E + B and control fed cattle. However, E + B cattle had less rib fat (P = 0.09) and graded lower (P = 0.03). Furthermore, the E + B fed cattle had significantly (P = 0.05) larger REA than control fed cattle. Conclusively, while treating SWDGS with a buffered fibrolytic enzyme complex had positive effects on NDF digestibility, no corresponding improvements in cattle performance were detected.

Keywords: cattle, fibrolytic enzymes, neutral detergean fiber digestibility, sorghum wet distiller's grains with solubles

36 The effects of supplementing ruminal bypass unsaturated fatty acids on marbling in early-weaned steers. *K. S. Mangrum*[*1], *G. Tuttle*[1], *S. K. Duckett*[1], *G. S. Sell*[1], *C. R. Krehbiel*[2], *and N. M. Long*[1], [1]*Clemson University, Clemson, SC,* [2]*Oklahoma State University, Stillwater*

The objective of this study was to determine if supplementation with Megalac-R, ruminal bypass unsaturated fatty acids (FA), improved marbling in early-weaned steers. All steers (Angus, n = 23 and Angus × Hereford, n = 24) were weaned at 150 ± 5 d of age. Steers were blocked by BW and breed then randomly assigned to either control (CON; 1.5 kg of corn gluten feed (CGF), n = 23) or isocaloric supplementation containing 200 mg of Megalac-R in 1.06 kg of CGF (EFA, n = 24) for 110 d (fed 5 d/wk). All steers had ad libitum access to pastures throughout treatment. Steer BW and blood samples were collected at 0, 55, and 110 d of supplementation, and real-time ultrasound measurements were collected at d 110. Following treatment, steers were transported to Oklahoma State University for finishing and subsequent harvesting at a commercial plant. All data were analyzed using PROC MIXED procedure of SAS either as a repeated measures or ANOVA depending on parameters. There were no significant changes in BW from beginning of treatment to slaughter due to treatment. Ultrasound data showed that EFA steers tended (P = 0.08) to have more intramuscular fat than CON at d 110. Serum concentrations of FA showed a treatment × day interaction (P < 0.02) for 16:0, 18:0, 18:1*c*-9, 18:2, 20:4 and total FA. These specific FA concentrations slightly increased in CON steers, but there was a more pronounced increase in the concentration of these FA across the supplementation period in EFA steers. Serum triglyceride and cholesterol concentrations were increased (P < 0.01) on d 55 and 110 in EFA steers compared with CON steers. Serum leptin concentration in EFA steers was greater (P < 0.01) than CON steers at d 110. After slaughter, yield grades of the EFA carcasses were greater (P = 0.04) than CON carcasses. Marbling scores of the EFA carcasses tended (P = 0.09) to be higher than CON carcasses. There was a tendency (P = 0.09) for the percentage of total lipids to increase for EFA steaks compared with CON. There was also a tendency (P = 0.06) for EFA to have a greater percentage of 20-30 µm adipocytes in their intramuscular depot than CON. The results of this study may indicate that supplementation of unsaturated FA can positively impact marbling deposition in early-weaned steers.

Keywords: early-weaning, marbling, ruminal bypass fat

37 Associations among stress response of male calves, single nucleotide polymorphisms of heat shock protein 70, and anabolic steroids. *L. Meyer*[*1], *S. Tabler*[2], *M. L. Looper*[1], *J. M. Burke*[2], *and C. F. Rosenkrans, Jr.*[1], [1]*University of Arkansas, Fayetteville,* [2]*USDA-ARS, Booneville, AR*

Transportation and sale barns can be stressful events for calves. Heat shock proteins act as molecular chaperones and are involved with steroid hormone signal transduction. We hypothesized that single nucleotide polymorphisms (SNP) within heat shock protein 70 (HSP70) gene have an effect on calf stress response. Weaned crossbred male calves (n = 80; ~ 250 kg) were randomly assigned (d 0) to one of the following treatments: intact bulls (n = 20), banded bulls (n = 20), banded bulls with an androgenic implant (Revalor G; n = 20) and banded bulls with an estrogenic implant (Ralgro; n = 20). On d 14, calves were transported approximately 26 km to a local auction barn and penned for 24 h. Blood samples were collected on d 13, 14, 15, and 16. Genomic DNA was extracted from buffy coat samples and genotyped at HSP70 SNP: C895D, A1125C, G1128T, and C1204T. After d 16, bull calves were banded. Dependent variables were concentrations of prolactin and cortisol, ratio of prolactin to cortisol, and calf body weight gain during the stress period. Effects of genotype, treatment, day, and their interactions were analyzed by ANOVA. Concentrations of prolactin varied (P < 0.05) by day (60, 88, 102, and 37 ng/mL, SE = 9; respectively for d 13, 14, 15, and 16). Three-way interaction of day, C895D genotype, and treatment also affected (P < 0.05) prolactin concentrations. Calves that were heterozygous at SNP C895D and treated with estrogenic implants had the greatest prolactin concentration on d 15. Day also affected (P < 0.01) cortisol concentrations (26, 39, 36, and 33 ng/mL, SE = 2; respectively for d 13, 14, 15, and 16). Cortisol concentrations tended (P < 0.1) to be affected by an interaction between C895D genotype and treatment. Ratio of prolactin to cortisol was affected by the interaction (P < 0.05) of treatment by day, and a 3-way interaction among treatment, day, and genotype at A1125C. Bulls that were homozygous adenine at SNP A1125C on d 13 had the greatest (P < 0.05) prolactin:cortisol. Body weight gain during the 16 d trial tended (P< 0.1) to be affected by A1125C genotype. Our results suggest prolactin to cortisol ratio may serve as a sensitive indicator of animal stress response and is associated with HSP70 genotypes.

Keywords: cortisol, genotype, prolactin, stress

38 Serial use of Estrotect estrous detection patches as a reproductive management tool. *A. J. Davis*, T. D. Lester, E. A. Backes, and R. W. Rorie, Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville*

Objective was to determine if Estrotect estrous detection patches can be used as a simple, cost-effective reproductive management tool to identify cyclic animals before breeding, distinguish between cows or heifers conceiving to AI versus natural service, and determine seasonal pregnancy rate after bull removal. A secondary objective was to determine if altering timing of gonadotropin releasing hormone (GnRH) treatment in a 14-d progesterone-Select Synch synchronization protocol could reduce labor costs without reducing protocol effectiveness. Angus-based cows (n = 149) and heifers (n = 81) were used in this study. Cows had a mean BW of 494.8 ± 64.3 kg, BCS of 5.5 ± 0.9, and were 57 ± 12.8 d postpartum. Heifers averaged 405.1 ± 12.7 d of age, with a mean BW of 282.1 ± 2.7 kg and BCS of 5.4 ± 0.5. Patches were adhered to heifers and scored weekly over a 4 wk period to determine cyclic status pre-breeding. Cyclic status of all heifers was confirmed via ultrasonography at patch removal. Compared with cyclic status determined via ultrasonography, Chi-square analysis indicated estrous detection patches correctly identified 79% (42/53) of cyclic and 86% (24/28) of non-cyclic heifers (P < 0.01). Patches were adhered to heifers and cows and scored weekly for 4 wk, as described previously, to determine AI and seasonal pregnancy rates upon bull removal. Compared with pregnancy data determined via ultrasonography, estrous detection patches were 96 (23/24) and 98% (79/81) accurate in identifying heifers and cows pregnant by AI, respectively. Estrous detection patches were 76% (45/59) accurate in identifying pregnant heifers and 87% (109/125) accurate in identifying pregnant cows at the end of the breeding season (P < 0.01). Data indicates that accuracy of estrous detection patches in predicting pregnancy depends upon the herd cycling normally. Estrous was synchronized in lactating cows using a progesterone controlled internal drug release (CIDR)-Select Synch protocol where timing of GnRH administration occurred at time of CIDR removal (d 14; GnRH+0) or 24 h later (d 15; GnRH+1). In both treatments, prostaglandin F2alpha was given 7 d after GnRH. Estrous response, [63 (46/73) and 63% (48/76)], and AI pregnancy rates, [76 (35/46) and 77% (36/47)], were similar (P > 0.1), regardless of timing of GnRH treatment. Data indicates comparable estrous response and AI pregnancy rates can be achieved with treatment of GnRH at CIDR removal, thereby reducing labor costs and animal handling.

Keywords: estrous detection patch, estrous synchronization, reproductive management

39 Impact of progesterone supplementation on pregnancy rates following timed artificial insemination or embryo transfer in beef cattle consuming endophyte-infected fescue. *J. C. Mackey*, J. M. Lection, A. M. Tyson, M. H. Poore, and D. H. Poole, North Carolina State University, Raleigh*

Tall fescue (*Festuca arundinacea*) is a commonly utilized forage in the southeastern United States. Most fescue is infected with a fungal endophyte (*Neotyphodium coenophialum*) that produces ergot alkaloids, hindering reproductive success in cattle by decreasing pregnancy rates and suppressing plasma progesterone (P4) concentrations. Pregnancy success requires progesterone; therefore, the objective of this study was to determine if progesterone supplementation following timed artificial insemination (TAI) or embryo transfer (ET) increases pregnancy rates of cattle consuming endophyte-infected tall fescue. Nulliparous and multiparous cattle were maintained on endophyte-infected pasture and hay. Cattle were synchronized using the standard CO-Synch +CIDR protocol. In the TAI group, cows (n = 95) and heifers (n = 49) were observed for estrus and artificially inseminated by a trained inseminator with bull semen of known fertility. Ten days following AI, cattle were randomly assigned to either receive a blank CIDR or progesterone CIDR. Cattle in the ET group, (n = 88), received a freshly collected or a frozen embryo on d 7 post-ovulation. Cattle receiving embryos were randomly assigned either a CIDR blank (no P4) or CIDR (P4). Pregnancy was determined by ultrasonography 30 d post insemination or 21 d post-embryo transfer. Embryo length and width were measured to calculate embryo area. All experiments were analyzed using a PROC MIXED model, examining the effects of treatment, age, BCS, sire and inseminator and their interactions. Statistical significance was determined at P < 0.05. Progesterone supplementation increased pregnancy rates in ET cattle (P < 0.05) compared with controls (84.6% vs. 60.1%, respectfully). However, no difference (P < 0.05) in pregnancy rates was observed in heifers (41.67 % P4 vs. 41.67% controls) or postpartum cows (44.68% P4 vs. 38.76% controls) following timed AI. In ET cattle, supplemental progesterone improved pregnancy rates (P < 0.05) in cattle greater than 7 yr old compared with controls (98.7% vs. 57.2%, respectfully) and increased (P < 0.05) embryo retention in cattle receiving a frozen embryo (96.7% P4 vs. 59.7% control); but was not observed with fresh embryos. Pregnancy rates were not affected (P < 0.05) by animal weight, days postpartum, or breed. Additional progesterone did not affect embryonic development, however embryo area was greater in nulliparous compared with multiparous cattle at 30 d post TAI (P < 0.05). Continuous progesterone supplementation throughout maternal recognition of pregnancy significantly increased pregnancy rates in cattle receiving embryos, but not following timed insemination in cattle consuming endophyte-infected tall fescue.

Keywords: embryo transfer, fescue toxicity, progesterone supplementation

40 Effects of toxic tall fescue on bovine semen cryopreservation. *C. R. Burnett*, S. M. Calcatera, M. A. Dimmick, W. C. Bridges, and S. L. Pratt, Clemson University, Clemson, SC*

In spite of the positive agronomic traits that make tall fescue a desirable forage, reduced fertility rates are reported for beef cattle grazing pasture containing the ergot alkaloid-producing endophyte, *Neotyphodium coenophialum*. The objective of this study was to assess the influence of toxic tall fescue consumption on semen cryopreservation of bulls grazing toxic Kentucky 31 (KY31) compared with a novel endophyte cultivar, Texoma Max Q II (NE). Yearling Angus bulls (n = 24), having passed a breeding soundness exam and exhibiting ≥ 30 cm scrotal cir-

cumference (SC), were blocked based on body weight (BW), body condition score (BCS), and SC. Bulls were allotted to 1 of 2 treatments (TRT), grazing KY31 or NE, for 112 d. On d 112, all bulls were placed on NE pasture to the end of test (d 168) to evaluate recovery from grazing KY31. Semen samples were collected by electro-ejaculation on d 28, 84, 112, 140, and 168 and evaluated using a computerized sperm quality analyzer. Semen was extended to 30 x 10^6 motile sperm/mL at 32° C, cooled to room temperature, and packaged in 0.5 mL French straws. Straws were refrigerated overnight, frozen horizontally in nitrogen vapor 16 to 20 h later, thawed 48 h post-freezing, and subjected to computerized sperm quality analysis. Post-thaw data were analyzed using ANOVA to test effects of TRT, day, and TRT by day interactions, followed by the appropriate t-tests using a significance level of 0.05. Progressive motility was decreased in KY31 vs. NE (P = 0.0002). There were significant TRT by day interactions for concentration (P = 0.03), percent motility (P = 0.01), total motile sperm per dose (P = 0.0004), and total progressive motile sperm per dose (P = 0.006). The KY31 TRT was significantly less than NE for concentration on d 84; for percent motility on d 28, 84, and 168; for total motile sperm per dose on d 28, 84, and 168; and for total progressive motile sperm per dose on d 28 and 84. These data demonstrate that grazing KY31 negatively impacts semen cryopreservation. Further, these data suggest that there is a residual negative impact from grazing KY31 following removal from toxic pasture.

Keywords: endophyte, semen freezing, tall fescue

41 Endogenous cortisol, luteinizing hormone (LH), and testosterone secretion and GnRH-induced LH and testosterone secretion in prenatally stressed sexually mature Brahman bulls. *B. P. Littlejohn[*1,2], M. C. Roberts[1,2], M. N. Bedenbaugh[1], A. W. Lewis[2], D. A. Neuendorff[2], D. G. Riley[1,3], J. A. Carroll[4], R. C. Vann[5], M. Amstalden[1], T. H. Welsh, Jr.[1,3], and R. D. Randel[2], [1]Texas A&M University Department of Animal Science, College Station, [2]Texas A&M AgriLife Research, Overton, [3]Texas A&M AgriLife Research, College Station, [4]USDA-ARS, Livestock Issues Research Unit, Lubbock, [5]MAFES - Brown Loam Experiment Station, Mississippi State University, Raymond*

The purpose of this experiment was to determine the effects of prenatal transportation stress (PNS) on LH, testosterone, and cortisol secretion before and after GnRH stimulation in sexually mature Brahman bulls. Forty-eight of 96 Brahman cows were stressed at 5 stages of gestation, and bulls from this calf crop were electroejaculated every 2 wk beginning at a scrotal circumference of 24 cm through sexual maturity (SM; i.e., 500 million sperm/ejaculate). The initial 11 control and 12 PNS bulls to reach SM were selected to study. Within 7 to 21 d after reaching SM, blood samples were collected via jugular cannulas at 15-min intervals for 6 h. Exogenous GnRH was administered intravenously (10 ng/kg BW) and collection continued at 15-min intervals for 8 h. Serum concentrations of LH, testosterone, and cortisol were determined by RIA. Data were analyzed using a fixed effect model including treatment. Endocrine profiles were analyzed using repeated measures ANOVA. Incidence of endogenous LH pulses and testosterone responses were analyzed by chi-square. The following were analyzed for the 4-h period immediately preceding GnRH administration: amplitude and maximum concentration of LH pulses and testosterone response; baseline concentration of LH and testosterone; average LH, testosterone, and cortisol in the h before GnRH; LH, testosterone, and cortisol area under the curve (AUC); and LH, testosterone, and cortisol profiles. In the 6-h period following GnRH administration, amplitude and maximum concentration of the GnRH-induced LH and testosterone response, duration of the GnRH-induced LH response, LH and testosterone AUC, as well as LH and testosterone profiles were compared. More PNS (10 of 11) than control (3 of 12) bulls exhibited an endogenous LH pulse (P < 0.01). More PNS bulls exhibited an endogenous testosterone response (9 of 11; P = 0.02) than control bulls (4 of 12). In the h preceding GnRH administration, testosterone tended to be greater (P = 0.07) in PNS (1.46 ± 0.30 ng/mL) than control (0.68 ± 0.28 ng/mL) bulls, and cortisol was less (P < 0.01) in PNS (4.00 ± 0.91 ng/mL) than control (7.8 ± 0.87 ng/mL) bulls. No other characteristic associated with the release of LH, testosterone, or cortisol secretion before GnRH administration differed between groups (P > 0.1). Bulls responded similarly to exogenous GnRH, except for the longer duration of GnRH-induced LH release (P = 0.02) in PNS (268 ± 18 min) than control (207 ± 16 min) bulls. Prenatal transportation stress affected secretion of endogenous LH, testosterone, and cortisol and exogenously-induced LH and testosterone secretion in SM Brahman bulls.

Keywords: bulls, cortisol, gonadotropin-releasing hormone, luteinizing hormone, prenatal stress, testosterone

42 Transcription of Toll-like receptor 2 (TLR2) in bovine blood in response to microbial and plant derived molecular patterns. *S. Adjei-Fremah[*], E. K. Asiamah, K. A. Ekwemalor, H. Ismail, and M. Worku, North Carolina Agricultural and Technical State University, Greensboro*

The effects of a water extract of Sericea lespedeza (SL; a high tannin plant), bacterial lipopolysaccharide (LPS) from gram negative bacteria, nystatin (NYS), and peptidoglycan (PGN; both from gram positive bacteria) on transcription of Toll-like receptor (TLR) 2 in bovine blood was investigated. Toll-like receptors are pattern recognition receptors that recognize highly conserved structural motifs known as pathogen-associated microbial pattern and initiates host innate immunity. Whole blood collected from 5 Holstein Friesian cows were treated with 100 ng/mL each of PGN, LPS, NYS or SL either individually or in pairwise combinations. Phosphate buffer saline (PBS) treatment served as control. Samples were incubated at 37°C, with 85% humidity and 5% CO_2 for 15 min. Total RNA was isolated using Trizol on pelleted cells, RNA integrity number (RIN) was determined with Bioanalyzer and samples with RIN >7 for each treatment were pooled together and used for cDNA synthesis. Commercially sequenced specific primers were used to amplify TLR2 transcripts using real time PCR. The House keeping gene GAPDH was used as an internal control. Fold change in transcript abundance was calculated using the Livak method with samples maintained in PBS serving as control. Agarose gel electrophoresis and ethidium bromide staining of products was also used to confirm amplification in PBS sam-

ples. The TLR2 transcript was detected in bovine blood and the transcript abundance ranged from 0.3 to 2.5 fold. Samples exposed to individual treatment LPS, PGN, NYS or SL had decreased transcript abundance 0.3-, 0.5-, 0.4- and 0.6-fold, respectively. Exposure to SL in combination with PGN resulted in 1.5-fold change in TLR2 transcript abundance. Nystatin and peptidoglycan co-exposure increased transcription the most by 2.5 fold. This data trend suggests that TLR2 transcription in cattle is variably responsive to different bacteria cell wall components stimulation. Cell wall components of gram-positive bacteria increased transcription of TLR2 which increased further in the presence of SL. The lipid raft inhibiting function of NYS may contribute to TLR2 transcription. The effect of SL on TLR2 expression in response to microbial products may offer an avenue for the exploitation of plant-derived tannins to regulate inflammatory response and enhance bovine innate immune response.

Keywords: blood, bovine, leukocyte, *Sericea lespedeza*, toll-like receptor expression

43 Toll-like receptor expression and activity in the bovine corpus luteum. *A. M. Tyson*[*1], *H. A. Faircloth*[1], *M. D'Annibale-Tolhurst*[1], *J. Chang*[1], *P. W. Farin*[1], *I. M. Sheldon*[2], *J. E. Gadsby*[1], *and D. H. Poole*[1], *[1]North Carolina State University, Raleigh, [2]Swansea University, Singleton Park, Swansea, United Kingdom*

Understanding of the mechanisms controlling the reproductive cycle will maximize the sustainability of today's animal industry. The corpus luteum (CL) is a transient endocrine organ that forms after ovulation, controls the reproductive cycle, and is required for maintenance of pregnancy. Toll-like receptors (TLR) are found in a variety of tissues and mediate the immune response by recruiting cytokines during inflammatory-like processes. Previous studies have demonstrated the role of immune cells within the CL. However, the mechanisms regulating the cellular interactions within the CL remain largely unknown; therefore, the objectives of this project are to examine TLR expression during the CL lifespan and in cultured luteal cells treated with TLR ligands. Bovine CL at various stages of luteal development (stage I, d 1 to 4; stage II, d 5 to 10; stage III, d 11 to 17; stage IV, d 18 to 21, and CL of pregnancy) were collected at a local abattoir. Luteal tissue was immediately frozen in liquid nitrogen for RNA analysis. Polymerase chain reaction (PCR) was used to detect *TLR1-TLR4*, *TLR7-TLR8*, and *TLR10*, TLR4 signaling components (*MD2* and *CD14*), *CD45* (a marker for leukocytes), and cytokine (*TNF, IFNG, IL6, IL12* and *TGFB1*) mRNA expression. In addition, luteal cells from stage III CL (n = 3) were dissociated and cultured with TLR4 and TLR1/TLR2 ligands to evaluate TLR role in luteal function via quantitative PCR. Preliminary data, using semi-quantitative PCR analysis, revealed differential expression in TLR across CL stages. Expression of *TLR1*, *TLR2*, *TLR4*, and *TLR6* mRNA was greatest in stage IV compared with other stages ($P < 0.05$). Progesterone concentrations measured via radioimmunoassay were decreased ($P < 0.05$) at stage IV reflecting an inverse profile of TLR expression. Expression of *MD2*, *CD14* and *CD45* was greatest at stage III compared with other stages ($P < 0.05$). There was a significant reduction in *CD14* and *CD45* expression from stage III to stage IV ($P < 0.001$). Proinflammatory cytokine, *TNF, IFNG*, and *IL12*, expression was greatest in stage IV CL compared with other stages ($P < 0.05$), whereas *IL6* expression was significantly greater in early CL. Interestingly, no significant differences were observed in cytokine expression in cultured luteal cells. These results may be attributed to other cell types within the heterogeneous population of the CL providing the inflammatory response seen during luteolysis. Ultimately, these data contribute to understanding the cellular and molecular actions of Toll-like receptors and their role in luteal function and regression.

Keywords: bovine corpus luteum, toll-like Receptors

44 Steroid-dependent regulation of bovine oviductal epithelial cells: A transcriptomal analysis. *K. L. Cerny*[*], *E. M. Garrett, L. Anderson, and P. Bridges, University of Kentucky, Lexington*

Reproductive success depends on a functional oviduct for gamete storage, maturation, fertilization, and early embryonic development. The ovarian-derived sex steroids estrogen and progesterone have been found to influence cell proliferation, differentiation and functionality of the oviduct. The objective of this study was to investigate steroidal regulation of oviductal epithelial cell function by using the Bovine Gene 1.0 ST array (Affymetrix Inc., CA) for transcriptional profiling. Our overall goals were to increase our understanding of known epithelial cell processes critical for fertility, and to identify novel genes and biochemical processes for future analysis. Normally cycling Angus heifers were assigned to either luteal phase (LP, high progesterone, n = 3) or follicular phase (FP, high estradiol, n = 3) groups. Heifers in the LP group were killed between d 11 and 12 after ovulation. Heifers in the FP group were treated with 25 mg $PGF_{2\alpha}$ (Lutalyse, Pfizer, NY) at 20:00 h on d 6 after ovulation and killed 36 h later. Cycle stage was confirmed by ultrasonography and oviducts were collected within 20 min after slaughter. Epithelial cells were isolated from the ampulla and isthmus and total RNA extracted and purified using TRIzol and RNeasy columns, respectively. RNA integrity numbers were greater than 9.2 for all samples. Following microarray hybridization, the resulting dataset was analyzed using Partek Genomics Suite 6.6 (Partek Inc., MO). Robust multi-array average, quantile normalization, and Median Polish were applied for GeneChip background correction, log base2 transformation, conversion of expression values and probeset summarization. Statistical 1-way anova using Benjamini-hochberg multiple testing correction for false discovery rate and pairwise comparison of FP versus LP ampulla epithelial cells revealed 972 genes significantly up-regulated and 597 genes significantly down-regulated (adjusted $P < 0.05$). FP versus LP isthmus epithelial cell analysis revealed 946 genes significantly up-regulated and 817 genes significantly down-regulated (adjusted $P < 0.05$). Furthermore, 47 miRNA were found to be differentially expressed between FP and LP in both the ampulla and isthmus (adjusted $P < 0.01$). Differentially expressed gene lists were also subjected to gene ontology classification and pathway analysis using Fischer's exact test to determine significant pathways. Up-regulated genes from both ampulla

and isthmus were found to be involved in cholesterol biosynthesis and cell cycle pathways, while down-regulated genes were found in numerous inflammatory response pathways ($P < 0.05$). These results illustrate dynamic hormonal regulation of the oviductal epithelium and may reveal the identity of novel, specific genes affecting fertility in cattle.

Keywords: heifer, oviduct

45 Effects of maternal nutrient restriction on bovine fetal growth during mid-gestation. *R. K. Taylor*, C. T. LeMaster, K. S. Mangrum, and N. M. Long, Clemson University, Clemson, SC*

Primiparous Angus-cross cows (n = 22) were synchronized using a Co-Synch+CIDR protocol and inseminated with sexed semen from a single Angus sire. Animals were fed at 1.3 x [Control (CON)] or 0.55 x [Nutrient Restricted (NR)] of maintenance energy and protein requirements based on BW (NRC 1996). Animals were blocked into groups by BCS and BW and fed CON (n = 8) d 30-190; NR (n = 7) d 30 to 110 followed by CON d 110 to 190; or CON (n = 7) d 30 to 110 followed by NR d 110 to 190. Cows were slaughtered on d 190 of gestation, when fetal measurements and samples were taken for analysis. Fetal weights tended to be reduced (P = 0.07) in NR/CON and CON/NR vs. CON/CON cattle (9.05 ± 0.48, 8.91 ± 0.48 vs. 10.34 ± 0.45 kg, respectively). Empty fetal weights were reduced (P = 0.03) in NR/CON and CON/NR vs. CON/CON cattle (7.21 ± 0.39, 7.18 ± 0.39 vs. 8.50 ± 0.36 kg, respectively). Abdominal and thoracic circumferences were reduced (P = 0.01 and P = 0.03, respectively) in NR/CON and CON/NR vs. CON/CON cattle (43.50 ± 0.96, 43.92 ± 0.96 vs. 47.25 ± 0.89 cm and 97.26 ± 4.66, 100.95 ± 4.66 vs. 106.46 ± 4.36 cm, respectively). Brain weight as a percent of empty fetal weight was increased ($P < 0.001$) in NR/CON and CON/NR vs. CON/CON cattle (1.379 ± 0.033, 1.443 ± 0.033 vs. 1.211 ± 0.031 %, respectively). Fetal pancreas weight as a percent of empty fetal weight was reduced (P = 0.04) in CON/NR vs. CON/CON cattle (0.062 ± 0.004 vs. 0.079 ± 0.004 %) while NR/CON values (0.069 ± 0.004 %) were intermediate. Fetal perirenal adipose as a percent of empty fetal weight was increased (P = 0.003) in NR/CON and CON/NR vs. CON/CON cattle (0.432 ± 0.012, 0.441 ± 0.012 vs. 0.377 ± 0.012 %, respectively). The data show that maternal nutrient restriction during early or mid gestation causes asymmetrical fetal growth restriction, regardless if the restriction is preceded or followed by a period of non-restriction.

Keywords: fetal growth, fetal programming, undernutrition

46 The effects of late gestation maternal nutrient restriction with or without protein supplementation on endocrine regulation of newborn and postnatal beef calves. *C. T. LeMaster*, R. K. Taylor, K. S. Mangrum, E. R. Ricks, and N. M. Long, Clemson University, Clemson, SC*

A study was conducted to evaluate late gestation maternal nutrient restriction with or without protein supplementation on endocrine regulation in newborn beef calves. This study utilized multiparous cows (3 and 4 yr of age, n = 57) randomly assigned to 1 of 3 treatments for the last 100 d of gestation. The control (n = 19) cows were fed to increase BCS while the nutrient restricted (NR, n = 19) and nutrient restricted with protein supplement (NRS, n = 19) cows were fed to lose 1.2 ± 0.2 BCS during the last 100 d of gestation. Control cows were allowed ad libitum access to a tall fescue/crabgrass paddock and when grazing became insufficient, ad libitum hay was provided along with 1.3 kg of corn gluten feed 5 d/wk. Tall fescue paddocks were strip grazed to limit forage availability for NR and NRS. The NRS treatment were individually penned and fed 0.45 kg of soybean meal 3 d/wk. As forage became dormant the nutrient restricted paddocks received limited fescue hay. After parturition cow/calf pairs were moved to 1 common pasture and received ad libitum silage and 1.8 kg of high concentrate feed. Calves from NR dams weighed less at parturition and the NRS calves were intermediate to control calves (33.4 ± 1.2, 35.0 ± 1.3 and 37.2 ± 1.3 kg respectively; P = 0.04,). Maternal nutrient restriction regardless of supplementation reduced cow plasma glucose and insulin concentrations during the late gestation (69 ± 2, 68 ± 2 and 80 ± 2 mg/dL; $P < 0.0001$ and 1.19 ± 0.07, 1.22 ± 0.07, and 1.50 ± 0.7 ng/mL; P = 0.005 NR, NRS, and control, respectively). Plasma glucose concentrations of unsuckled calves at parturition was reduced (P = 0.037) in NR and NRS calves compared with control (67.7 ± 6.5, 60.1 ± 6.9 and 83.7 ± 6.1 mg/dL, respectively). At parturition, control and NRS calves had increased (P = 0.0037) plasma leptin concentrations compared with NR calves while calf plasma cortisol concentrations were greater for the nutrient restricted groups than the control (trt x day P = 0.0135). This research demonstrates that late gestation nutrient restriction reduces postnatal calf birth weight, plasma glucose and leads to reduced plasma leptin. Maternal protein supplementation appears to alleviate effects of late gestation nutrient restriction.

Keywords: late gestation, newborn calves, nutrient restriction

47 Plane of nutrition during the preweaned period influences the pathophysiological responses to a combined intranasal bovine herpesvirus-1 and intratracheal Mannheimia haemolytica challenge in post-weaned Holstein calves. *K. P. Sharon*[1], Y. L. Liang[1], N. C. Burdick Sanchez[2], J. A. Carroll[2], and M. A. Ballou[1], [1]Texas Tech University, Department of Animal and Food Sciences, Lubbock, [2]USDA-ARS, Livestock Issues Research Unit, Lubbock, TX*

The objective was to determine whether previous plane of milk replacer nutrition (PON) influences the pathophysiological responses to a combined viral-bacterial respiratory challenge. Thirty Holstein calves (1 d of age) were assigned to treatments in a 2 x 3 factorial arrangement with preweaned PON and intratracheal dose of *Mannheimia haemolytica* as the main effects (n = 5 treatment). Calves were fed either a low (LPN; n = 15) or a high plane of nutrition (HPN; n = 15) from birth through weaning. Two-thirds of the calves did not receive adequate colostrum, ≤5.2 g/dL total serum protein upon arrival. Calves fed the LPN were fed 445 g DM/d of milk replacer until weaning, and the HPN calves were fed 830 g DM/d of milk replacer during the first 10 d and 1,080 g from d 11 until weaning. Calf

starter and water were offered ad libitum. Calves were step-down weaned at 54 d. Calves were moved into an enclosed barn at 70 d. Indwelling rectal temperature (RT) probes and jugular catheters were inserted at 80 d. All calves were challenged with 1.5x10^8 PFU/mL/nostril of bovine herpesvirus-1 (BHV-1) at 81 d. Calves were challenged with 10^6, 10^7, or 10^8 CFU of *M. haemolytica* at 84 d. Blood samples were collected every 6 h after the BHV-1 challenge, then every 30 min from -2 to 8 h, and 12, 18, 24, 36, 48, 96, 144, and 240 h relative to the the *M. haemolytica* challenge. A linear, mixed model with the fixed effects of PON, *M. haemolytica* dose, time, and their interactions was fitted using the Mixed procedure of SAS. Body weights at 70d were different ($P \leq 0.001$) between LPN and HPN (62.2 vs. 81.2 ± 2.67 kg, respectively). Although HPN consumed more calf starter ($P \leq 0.001$) throughout the respiratory challenge, there were no differences ($P > 0.424$) in ADG or when starter intake was expressed per kg $BW^{0.75}$. The neutrophil:lymphocyte ratio was greater ($P \leq 0.001$) among LPN than HPN after the BHV-1 (1.14 vs. 0.66 ± 0.084) and *M. haemolytica* (1.51 vs. 0.95 ± 0.069) challenges. There was a PON x *M. haemolytica* interaction ($P \leq 0.001$) on RT, whereas the 10^8 *M. haemolytica* dose caused the greatest rise in RT among HPN calves, but the least among LPN calves. These data demonstrate that calves previously fed a LPN had a more severe pathophysiological response to a combined viral-bacterial respiratory challenge.

Keywords: health, plane of nutrition, respiratory

GRADUATE STUDENT COMPETITION III

48 Use of statistical process control procedures to identify deviations in feeding behavior patterns preceding an acute spontaneous BRD outbreak. *K. S. Jackson*[*1], *G. E. Carstens*[1], *L. O. Tedeschi*[1], *Y. Fu*[1], *A. Banerjee*[1], *W. E. Pinchak*[2], *and J. Wall*[1], [1]*Texas A&M University, College Station,* [2]*Texas A&M Agrilife Research, Vernon*

Bovine respiratory disease (BRD) remains the most costly disease in beef cattle. Deviations in behavioral patterns associated with consumption of feed are among the earliest indicators of the onset of disease in cattle. The objective of this study was to determine if statistical process control (SPC) analysis of feeding behavior traits could be used to predict morbidity events in growing bulls. The study was conducted with 201 commercial seedstock bulls representing 5 breeds that were housed in a facility equipped with GrowSafe feed bunks at the Genetic Development Center in Navasota, TX. All bulls were vaccinated against standard viral and bacterial pathogens before and upon arrival. Bulls were weighed at 14-d intervals and daily DM intake and feeding behavior measured daily using a GrowSafe system. Time to bunk (TTB) was measured for each bull as the difference in time (min) from delivery of feed to the 1st feeding bout (FB) event. Bulls were checked twice daily for clinical signs of illness throughout the trial. During a 4-d period beginning on d 33 of the trial the average feed intake declined for 4 consecutive days and metaphylaxis therapy (Tulathromycin; Draxxin) was administered to all bulls for the treatment of BRD on d 37 of the trial. For the analysis, individual feed intakes and behaviors were evaluated for individual animals using the cumulative sum procedure (CUSUM) to identify those animals that experienced deviations in behavior before the BRD outbreak. Of the 201 bulls, 70% were identified as having deviations in intake preceding or on the day of the metaphylaxis therapy. The CUSUM analysis of FB duration, FB frequency, head down time, and TTB identified 58%, 36%, 63%, and 39% respectively of the animals that also experienced deviations in intake. Of the animals identified by intake alone, 82% can be identified by at least 1 of the behavioral indicators. The average date of detection for animals that deviated in intake was 2 d before the metaphylaxis therapy. Feeding bout duration, FB frequency, head down time, and TTB preceded intake by 4.4, 5.7, 2.9, and 2.0 d, respectively. These results indicate that SPC could detect deviations in feeding behavior before a change in intake do to an acute spontaneous BRD outbreak. Results from this study also demonstrate the potential value of electronic behavior-monitoring systems for accurate preclinical detection of BRD in feedlot cattle.

Keywords: bovine respiratory disease, morbidity, statistical process control

49 Evaluation of long-acting eprinomectin or a combination of moxidectin and oxfendazole on post-weaning heifer growth and fecal egg counts. *E. A. Backes*[*], *J. G. Powell, E. B. Kegley, J. A. Hornsby, J. L. Reynolds, K. S. Anschutz, D. L. Galloway, and W. L. Galyen, Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville*

Parasite burdens in beef cattle have been reported to decrease animal appetite, feed efficiency, ADG, and total gain performance and have been reported to flourish in the Southern states. The objective was to evaluate the effects of anthelmintic therapy on performance in Fall-born beef heifer calves treated, at the recommended dose, 14 d post-weaning. Eighty-three Fall-born Angus crossbred heifer calves were processed 14 d before treatment to determine BW and fecal egg counts (FEC). Heifers were stratified by BW, d of age, and FEC and were allocated randomly to 1 of 3 anthelmintic treatments consisting of 1) control (n = 28; no anthelmintic administered; **CON**); 2) moxidectin/oxfendazole combination (n = 28; **COMBO**); or 3) long-acting eprinomectin (n = 27; **LR**) on June 2, 2014. Heifers grazed in treatment groups on predominately tall fescue pastures and were fed daily at 1% BW of a corn gluten supplement. Body weight, BCS, and FEC were taken on d 0, 14, 28, and 84. Hair coat shedding scores were taken on d 0, 14, 28, 56, and 84. Data were analyzed using the PROC MIXED of SAS, with heifer being the experimental unit. Body weight and BCS did not differ ($P \geq 0.46$) between treatments on d 0, 14, 28; however, were greater ($P \leq 0.03$) on d 84 for LR treated heifers compared with COMBO and CON heifers. Heifer ADG was similar ($P = 0.99$) from d 0 to 14 for all treatments; however, was greater ($P \leq 0.02$) for LR treated heifers compared with other treatments from d 14 to 28, 28 to 84, as well as overall (d 0 to 84). Fecal egg counts did not differ ($P \geq 0.16$) on d -14 or 0, but were greater ($P < 0.01$) for CON

heifers on d 14, 28, and 84 compared with COMBO and LR treatments. Hair coat shedding scores did not differ ($P \geq 0.38$) between treatments on any observation d. Therefore, anthelmintic therapy positively impacted heifer BW, ADG, BCS, and FEC compared with untreated beef heifers.

Keywords: anthelmintic, long-acting eprinomectin, moxidectin/oxfendazole

50 Effects of Ralgro implants administered at branding on growth performance of steer calves through weaning. *C. L. Bayliff*[*1], *M. D. Redden*[1], *J. R. Cole*[1], *A. L. McGee*[1], *C. Stansberry*[1], *D. L. Lalman*[1], *M. E. Corrigan*[2], *and W. Burdett*[2], [1]*Oklahoma State University, Stillwater,* [2]*Merck Animal Health, DeSoto, KS*

Previous studies have shown that Ralgro implants administered at 30 to 90 d of age increase weaning weight in suckling steer calves by 11 kg (Mader et al., 1985) and 10.4 kg (Gill et al., 1986). However, these and other peer reviewed research results from experiments conducted in the U.S. were completed nearly 3 decades ago. Beef cattle genetics in the U.S. have changed dramatically during this time period. Specifically, aggressive selection for growth, milk yield, and muscling has occurred since 1985. Consequently, it is possible that the response to anabolic implant compounds may have changed as well. The objective of this experiment was to determine the impact of a Ralgro implant administered at 30 to 90 d of age on suckling phase growth rate and weaning weight. A total of 154 suckling steer calves weighing 115 ± 23 kg at branding (approximately 30 to 90 d of age) from 2 locations were used. Two hundred nine cow/calf pairs grazed primarily bermudagrass pastures near Valiant, OK at the Mac Lindley Research Station while 106 cow/calf pairs grazed primarily native grass rangeland at the Crosstimbers Research Station near Stillwater, OK. Cows and calves were sired by Angus bulls. Within location, steer calves were stratified by dam age, then randomly assigned to two experimental treatments; implanted with Ralgro (77 animals), and no implant (98 animals). The steers were weighed at the time of branding/implanting and again at weaning 134 d later. Implanted steers gained 9.1 kg more ($P < 0.01$) body weight between the branding and weaning dates compared with non-implanted steers. This resulted in a tendency ($P = 0.07$) for a 4% increase in weaning weight and an 8% increase ($P < 0.01$) in 134-d body weight gain. Ralgro growth promoting implants remain an effective and economical method to increase performance of suckling steer calves and the response is similar to research results published in the 1980s.

Keywords: anabolic implants, average daily gain, steer calf performance

51 Impact of between-animal variation in performance, carcass-quality and feed efficiency on profitability of Brangus steers. *K. S. Jackson*[*], *G. E. Carstens, A. G. Cupples, D. S. Hale, M. L. Jenks, J. R. Johnson, and R. K. Miller, Texas A&M University, College Station*

The objectives of this study were to evaluate the between-animal variation in net revenue (NR) due to performance, feed efficiency, and carcass-quality traits, and to examine the sensitivity of changing feed and carcass prices to the proportion of between-animal variation in NR. Growth and individual DMI were measured in Brangus steers (n = 84) fed a high-grain diet (3.05 Mcal ME/kg MD) for 98 d. Residual feed intake (RFI) was computed as actual minus expected DMI from linear regression of DMI on ADG and BW $^{0.75}$. Steers were transported to a commercial feedlot where they were housed for 152 d and harvested. Feed costs were based on actual DMI during the feed-intake measurement period, and CVDS model-predicted DMI adjusted for RFI. RFI was positively correlated with DMI, feed cost, quality grade, and yield grade (0.85, 0.85, 0.24, and 0.33), and negatively correlated with G:F, and NR (-0.67, and -0.42 respectively). NR was calculated as carcass value minus feeder calf, yardage, transportation, processing, feed, and interest costs. Steers were classified as low, medium or high (±0.5 SD) NR to examine effects of NR group on performance, carcass-quality, and feed efficiency. NR (mean ± SD) was $241 ± 124 per animal and positively correlated with ADG, G:F, HCW, and carcass value (0.56, 0.77, 0.53, and 0.74 respectively), and negatively correlated with RFI (-0.42). High NR steers gained 16.5% faster, had 21.4% higher G:F, and 9.5% heavier carcass weights. RFI was -0.4 and 0.36 kg/d for high and low NR steers. Stepwise regression was used to quantify the amount of variance attributed to performance, feed efficiency, and carcass-quality. The NR model using RFI accounted for 90% of the variation in NR with performance, carcass-quality, and feed efficiency explaining 32, 21, and 36%, respectively. Comparison of regression models estimating NR at various ration-cost scenarios ($265, $315, $365, and $451/ton) revealed that the proportion of total model variance (R^2) attributed to feed efficiency increased (1 to 55% for $265 and $415 respectively), while R^2 attributed to performance decreased (84 to 16%); at various dressed beef price scenarios ($215, $245, $275, and $305/ton) the proportion of total variance attributed to feed efficiency decreased (37 to 24% for $215 and $305 respectively), while that attributed to performance increased (20 to 50%).Results demonstrate that substantial variation in NR can be attributed to individual animal variances in performance, feed efficiency and carcass-quality of feedlot steers.

Keywords: revenue efficiency

52 Establishing relaxin as a novel adipokine affecting adipose tissue remodeling in pigs. *M. M. Roberts*[*1], *J. Bartosh*[1], *A. K. McNeel*[2], *and T. D. Brandebourg*[1], [1]*Auburn University, Auburn, AL,* [2]*USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE*

Relaxin (RLN) exerts potent inhibitory action on collagen production and has recently gained attention as a potential antifibrotic agent in non-reproductive tissues. Interestingly, using real-time PCR, we have observed RLN expression in both primary pig preadipocytes and human LS14 preadipocytes. To determine if adipocyte-derived RLN could be an important local regulator of adipose tissue (AT) function, we used primary cultures of pig preadipocytes (n = 9) or AT from lean and obese

Mangalica pigs (n = 12) as model systems. Real-time PCR was used to examine RLN expression and determine the presence of the putative RLN receptor, RXFP1 in differentiating primary cultures of pig preadipocytes and in pig AT. RNAseq was used to examine if differentiating pig preadipocytes respond to exogenous RLN. To facilitate gene expression studies, total RNA was extracted using a 2-step purification protocol whereby initial extraction was followed by spin column purification. Analysis via capillary electrophoresis indicated that all RNA samples had RIN values above 9. Real-time PCR values for target genes were normalized to *S15* with fold-change relative to baseline calculated by the Pfaffl method. RNAseq was performed on samples using Poly (A) selection with 50bp paired end sequencing and 50 million reads per sample. Tophat was used for mapping and alignment. Trimmed Mean of M-values (TMM) normalization was used for quantification. Multiple testing correction was handled using z-tests to calculate statistically significant differentially expressed genes with a FDR correction of 0.05 according to the Benjamini-Hochberg procedure. Real-time PCR indicated RLN mRNA expression was detectable in porcine preadipocytes and RLN expression was up-regulated 3.6-fold during adipogenesis ($P < 0.05$) while RLN mRNA expression was 2.4-fold greater in AT of obese versus lean Mangalica pigs ($P < 0.05$). The secretion of bioactive RLN by porcine adipose tissue was confirmed using a highly sensitive bioassay. Furthermore, porcine adipose tissue expressed mRNA for RXFP1. Importantly, addition of RLN to differentiating cultures of pig preadipocytes stimulated adipogenesis as measured morphologically and by assessment of marker gene expression. Finally RNAseq analysis revealed that a total of 2,643 genes were differentially expressed between differentiating cultures of pig preadipocytes that had been treated with RLN versus differentiating cultures that had not ($P < 0.05$). In summary, these data demonstrate that porcine adipose tissue synthesizes RLN, cells of adipose tissue express the RLN receptor, and exposing adipose tissue to exogenous RLN elicits an adipogenic response.

Keywords: adipogenesis, adipose tissue, relaxin

53 Effects of alkaline electrically oxidized water on pork loin enhancement. *M. Rigdon* and A. M. Stelzleni, The University of Georgia, Athens*

The objective of this project was to compare the effects of a novel enhancement solution to a control and common salt and phosphate solution. Sixty-four pork loins were randomly assigned to 1 of 4 treatments (enhanced to 110% of green weight): no enhancement (CON), alkaline electrically oxidized water (EOH), EOH with 2.5% potassium lactate (EOK), and industry standard (0.35% sodium tri-polyphosphate, 0.14% sodium chloride, 2.5% potassium lactate; IS). After enhancement loins were allowed to rest for 15 min. Approximately 8-cm was removed from the anterior portion of the loin, then 7 chops (2.54-cm) for water analysis, followed by 7 chops for shelf life color analysis were cut, and randomly assigned to 0, 5, 10, 15, 20, 25, or 30 d. Water chops were weighed, hung for 24 h, and then reweighed for drip loss. Water chops were then vacuum packaged and stored in cool (1±1°C) dark storage until their respective sample day. Chops were removed from packaging and weighed to obtain expressible juice due to vacuum packaging. Subsequently, two 5 g samples were taken from each chop and analyzed for expressible juice due to gravimetric force. Resulting samples were placed in an oven at 105°C for 24 h to measure bound moisture. Chops designated for shelf life were vacuum packaged and placed in simulated retail display (2 ± 2°C). On the respective sample day objective and subjective color scores were recorded. Data were analyzed using Proc Mixed (SAS v9.4) as a completely randomized split-plot design. Loin within treatment by rep was considered the random term. Water loss due to free drip was greater ($P < 0.01$) for EOH treated chops and followed EOH > EOK > IS = CON. Water lost to expressible juice was greater ($P < 0.01$) for EOH treated chops, while CON and EOK were similar ($P > 0.05$) and IS lost ($P < 0.01$) the least amount of water. Control and EOH chops lost more water ($P < 0.05$) during drying than EOK and IS. Overall, objective color showed EOH and EOK chops were less red and had more metmyoglobin formation than IS or CON. Despite its alkaline nature (pH ≈ 11.5) EOH did not retain water comparable with CON and IS. Furthermore, EOH exhibited a detrimental effect on color when compared with CON and IS.

Keywords: electrolyzed water, enhancement, pork

MEATS

54 Timing of exposure to high-concentrate diets vs. pasture on carcass traits and meat quality of steers. *B. M. Koch*, G. Volpi Lagreca, M. Alende, J. G. Andrae, and S. K. Duckett, Clemson University, Clemson, SC*

Forty Angus steers (278 ± 21.4 kg) were used to evaluate the effect of feeding strategy during stockering (P1) and finishing (P3) phases on carcass characteristics, and meat quality. Steers were randomly assigned to 2 feeding treatments during P1 (111 d): high-concentrate diet (cracked corn, corn silage, and soybean meal) or high-quality pasture (winter annuals, alfalfa, and non-toxic fescue). Phase 2 consisted of 98 d where all steers grazed high-quality pastures. At the start of P3 (until 568 kg BW), each group from P1 was randomly divided into 2 groups that received either a high-concentrate ration or grazing high-quality pastures. Interactions were statistically significant for ribeye area, skeletal maturity, yield grade, and the ratio of PUFA n-6/PUFA n-3 ($P < 0.028$). Overall ADG and HCW did not differ in P1 ($P > 0.43$) whereas cattle receiving high-concentrate ration in P3 had greater overall ADG and HCW ($P < 0.001$). The high-concentrate diet in P3 resulted in greater fat deposition at the 12th-rib, KPH, and marbling score ($P < 0.0495$) than the pasture grazing diet. Marbling score was also increased by high-concentrate diet in P1 ($P = 0.0033$). Longissimus muscle L* score was not different among treatments ($P > 0.171$). Longissimus muscle b* was lower for high-concentrate fed steers in both phases ($P < 0.028$), whereas longissimus muscle a*, and subcutaneous L*, a*, and b* scores were not different between P1 ($P > 0.11$) feeding treatments, but were greater for cattle grazing high-quality forage in P3 ($P <$

0.029). Fat cell size for both intramuscular and subcutaneous adipocytes were larger for cattle consuming the high-concentrate diet in P3 ($P < 0.0033$), whereas P1 did not change cell size ($P > 0.05$). Moisture and total lipids did not differ between treatments, while P3 did produce greater crude protein from steers grazing high-quality forage ($P = 0.003$). Both SFA and PUFA did not differ among treatments, whereas MUFA were decreased for steers grazing high-quality forage ($P = 0.0055$) and PUFA n-6 was less ($P = 0.0099$) for steers that grazed high-quality forage during P1. Feeding high-concentrate diets in both phases resulted in lower PUFA n-3 ($P < 0.0005$). Therefore, exposure to high-concentrate diets alters beef quality and composition. Similar quality composition may be achieved with either early or late exposure to high-concentrate diets.

Keywords: beef, grazing, high-concentrate

55 Carcass characteristics and meat quality of steers fed high-concentrate diets at an early backgrounding phase or at finishing. *C. S. Maglietti[1], M. L. Testa[1], M. J. Cimminelli[2,3], A. Pordomingo[4], and E. Pavan[*1], [1]Instituto Nacional de Tecnología Agropecuaria, Balcarce, Argentina, [2]Universidad Nacional de Mar del Plata, Facultad de Ciencias Agrarias, Balcarce, Argentina, [3]Comisión de Investigaciones Científicas de la Prov. de Buenos Aires, Balcarce, Argentina, [4]Instituto Nacional de Tecnología Agropecuaria, Anguil, Argentina*

To study the effect of feeding high-concentrate diets (CONC) on carcass traits and meat quality as compared with a pasture diet (PAST) on early backgrounding phase (Phase-1; d 0 to d 74, starting 35 d after weaning) or at finishing (Phase-3; d178 to body weight end point of 470 kg BW), 40 Angus steers (217 ± 2.2 kg BW) were randomly assigned to 1 of 4 treatment combinations (PP, PAST and PAST on Phase-1 and Phase-3, respectively; PC, PAST and CONC; CP, CONC and PAST; CC, CONC and CONC). After the early backgrounding phase (d 75 to d 178; Phase-2) all steers grazed an annual-ryegrass pasture (21 ± 7% CP, 38 ± 6% NDF). High-concentrate diets (13% CP) contained 67 and 72% (DM basis) of cracked corn on Phas-1 and Phase-3, respectively. At slaughter carcass characteristics were collected and, 24h ostmortem, left rib sections (10^{th} to 12^{th} ribs) were removed and fabricated into 2.54 cm thick steaks. Steaks were vacuum packaged for proximate analysis (12^{th} rib) and for WBSF determination (11^{th} to 10^{th} ribs) after being aged for 3, 7, or 14 d at 4°C. Steaks were stored at -20°C until analysis. Data were analyzed under a complete randomized design with a 2×2 factorial arrangement; aging periods were included as repeated measurements for WBSF analysis; correlations between variables were analyzed. In Phase-3, HCW and REA were greater in CONC than in PAST ($P < 0.001$), but were not affected by Phase-1 ($P = 0.915$). Subcutaneous fat thickness (FT) was greater in CC (8.8 mm) and least in PP and CP (3.3 mm), being intermediate in PC (6.6 mm; $P = 0.052$). Total *longissimus* muscle (LM) lipid content did not differ among treatments (3.0 ± 0.2%; $P > 0.35$). Both pH@3h and pH@24h (LM pH at 3 and 24 h postmortem) were greater for PAST than for CONC in Phase-1 and Phase-3 ($P < 0.05$). Temp@3h (LM temperature at 3 h postmortem) was lowest in PP and highest in PC, CP was lower than CC ($P < 0.001$). In Phase-3, WBSF was lower, and glycolytic potential and sarcomere length were greater ($P < 0.001$), for CONC than for PAST; no differences were observed in Phase-1 ($P > 0.20$). WBSF was reduced by aging ($P < 0.001$). At all aging periods, WBSF was negatively correlated with FT ($P < 0.01$), temp@3h ($P < 0.05$) and sarcomere length ($P < 0.07$), and positively with pH@3h ($P < 0.05$). No major effects of early backgrounding diet were observed, whereas finishing diet affected several carcass traits and WBSF. Greater WBSF in beef from pasture finished carcasses could be attributed to a less carcass fat thickness.

Keywords: chilling rate, pasture, shear force

56 Supplementation of glycerol or fructose via drinking water to enhance marbling deposition and meat quality in finishing cattle. *G. Volpi Lagreca[*1], M. Alende[1], A. C. Fluck[2], and S. K. Duckett[1], [1]Clemson University, Clemson, SC, [2]Universidade Federal de Pelotas, Pelotas, Brazil*

Thirty six Angus-cross steers (665 ± 28.0 kg initial BW) were used to assess the impact of glycerin or high fructose corn syrup administration via drinking water on meat quality and marbling deposition. Steers were blocked by BW, allocated in pens (4 animals/pen) and each pen within block was randomly assigned to 1 of 3 treatments: 1) control, regular drinking water (CON), 2) 43 g of crude glycerin per liter of drinking water (GLYC), or 3) 43 g of high fructose corn syrup per liter of drinking water (HFCS). Steers were fed a high (88%) concentrate diet and allowed ad libitum access to supplementation treatments during 25 d before slaughter. Data were analyzed with PROC GLM (SAS). Water intake was similar ($P > 0.05$; 38.2 $L \cdot animal^{-1} \cdot d^{-1}$) between treatments. Fat thickness as measured by ultrasound did not differ ($P > 0.05$; 13.8 mm) between treatments. Supplementation of drinking water with GLYC or HFCS did not alter ($P > 0.05$) hot carcass weight (408.4 kg), dressing percentage (61.9%), ribeye area (84.9 cm^2), fat thickness (15 mm) and KPH (2.8%). Marbling score was similar among treatments ($P > 0.05$; $modest^0$) and carcasses graded 92% Choice in all treatments. *Longissimus* muscle and subcutaneous fat color (L*, a* and b*) were not affected ($P > 0.05$) by treatment. Total lipid and total fatty acid content of the LM did not differ ($P > 0.05$; 5.9% and 4.7%, respectively) among treatments. Fatty acid composition of the LM was similar ($P > 0.05$) between treatments. Warner Bratzler shear force was not affected ($P > 0.05$, 2.68 kg) by treatments. Intramuscular mean adipocyte diameter was greater ($P = 0.0389$) for steers offered HFCS compared with GLYC (51.2 vs. 47.0 µm) with CON being intermediate. The expression of fatty acid synthase was up-regulated ($P < 0.05$) by both HFCS and GLYC. Overall, HFCS or GLYC supplementation via drinking water did not alter carcass or meat quality variables but did alter the size of intramuscular adipocytes and the expression of fatty acid synthase. These results would indicate that longer supplementation times or higher substrate levels may be needed in order to obtain differences in marbling.

Keywords: beef, glycerol, fructose, lipogenesis, marbling

57 Effects of animal age, pasture or feedlot finishing and

postmortem aging of Angus steers in central Argentina: I. Performance, carcass traits, and tenderness and color of the longissimus dorsi muscle (LM). *A. Pordomingo[*1], A. Pordomingo[2], E. Pavan[3], and S. K. Duckett[4], [1]INTA, Anguil, Argentina, [2]Instituto Nacional de Tecnología Agropecuaria, Anguil, Argentina, [3]Instituto Nacional de Tecnología Agropecuaria, Balcarce, Argentina, [4]Clemson University, Clemson, SC*

This study evaluated the effects of pasture or feedlot finishing, animal age at slaughter (2 or 3 yr old) on carcass traits, and postmortem aging of beef during 3 or 14 d on tenderness and color (L*, a* and b*) of LM of steers. Forty eight Angus steers (24 6-mo old calves; 150 ± 15.6 kg) and 24 18-mo old stockers; 266 ± 16.3 kg) were used. Treatments included controlled-gain backgrounding on pasture and pasture or feedlot finishing to reach similar final body weights within 2 age groups (440 and 550 kg for 2- and 3-yr old, respectively), and a minimum 8 mm backfat thickness (BFT). Finishing phase took 120 d and consisted in small-grain winter and alfalfa for pasture finishing, or a 90% concentrate diet for feedlot finishing. Feedlot steers had the highest ($P < 0.001$) average daily gain (ADG) during the finishing period. Dressing percentage was greater for feedlot compared with pasture finished ($P < 0.001$; 61.5 vs 58.5%, respectively). Ribeye area (REA) was greater for 3-yr old compared with 2-yr old steers ($P = 0.002$; 64.5 vs 59.0 cm^2respectively). Feedlot finishing resulted in greater BFT compared with pasture ($P < 0.001$; 10.0 vs. 8.3 mm) and for the 3-yr old steers ($P < 0.001$; 9.9 vs 8.4 mm). Warner-Bratzler shear force (WBS) was greater for pasture finished compared with feedlot ($P = 0.031$; 31.3 vs 28.6N). No effects of animal age in WBS were detected ($P > 0.05$). Postmortem aging time reduced WBS ($P = 0.001$; 33.4 vs. 26.4N for 3 and 14 d, respectively). Effects were detected for LM L* which was lower for pasture compared with feedlot ($P < 0.001$; 39.5 vs 41.8 respectively) and for 3-yr old steers compared with 2-yr old ones ($P = 0.004$; 40.1 vs 41.3 respectively). Pasture finished and 2-yr old steers showed greater ($P < 0.05$) LM a* value compared with feedlot and 3-yr olds. Pasture finished steers had the highest ($P < 0.001$) LM b* value compared with feedlot. No interaction between age, feeding strategies and postmortem aging were detected in this study.

Keywords: aging beef, feedlot finishing, pasture finishing, tenderness

58 Effects of animal age, pasture or feedlot finishing and postmortem aging of Angus steers in central Argentina: II. Proximate composition and fatty acid profile of longissimus dorsi muscle (LM). *A. Pordomingo[*1], A. Pordomingo[2], E. Pavan[3], and S. K. Duckett[4], [1]INTA, Anguil, Argentina, [2]Instituto Nacional de Tecnología Agropecuaria, Anguil, Argentina, [3]Instituto Nacional de Tecnología Agropecuaria, Balcarce, Argentina, [4]Clemson University, Clemson, SC*

This study evaluated the effects of feeding strategy (pasture or feedlot finishing), and animal age at harvest (2 or 3 yr old) and postmortem aging of beef during 3 or 14 d on proximate composition and fatty acids of LM of steers. Forty-eight Angus steers 24 6-mo old calves (150 ± 15.6 kg) and 24 18-mo old stockers (266 ± 16.3 kg) were used. Treatments included controlled-gain backgrounding on pasture followed by pasture or feedlot finishing to reach similar harvest weights within 2 age groups (440 and 550 kg for 2- and 3 yr of age, respectively), and a minimum of 8 mm for back-fat thickness. No effects due to postmortem aging ($P > 0.05$) were detected for all variables measured. Beef from pasture-finished steers had lower dry matter ($P < 0.001$; 26.5 vs 27.7% respectively) and greater pH and ash ($P < 0.001$) compared with feedlot finished. Three-year old steers had greater LM dry matter ($P < 0.001$; 28.2 vs 26.0% respectively) and decreased ash ($P < 0.001$; 3.5 vs 3.9% respectively) compared with 2 yr olds. No effects were detected for LM crude protein and cook loss ($P > 0.05$). Total intramuscular (IM) lipids, MUFA concentration and n6/n3 ratios were lower ($P < 0.05$), and PUFA and CLA were greater ($P < 0.05$) for pasture-finished animals compared with feedlot finished. Interactions between feeding strategies were detected for age and feeding system ($P < 0.024$) for LM n-3 PUFA. Pasture finished had the higher n-3 PUFA compared with feedlot ($P < 0.001$; 2.35 vs 1.45% respectively), but the difference between pasture and feedlot was lower for 3 yr old steers. The 2-yr old steers showed lower ($P < 0.05$) total IM lipids, MUFA, CLA and n6/n3 ratios and greater PUFA, n-6 PUFA and PUFA/SFA ratio in LM than 3-yr old steers ($P < 0.05$). Postmortem aging did not affect ($P > 0.10$) the lipid profile.

Keywords: fatty acids, finishing feedlot, finishing pasture

59 Determining the prevalence and antimicrobial susceptibility of *salmonella* serovars isolated from U.S. retail ground pork. *P. R. Broadway[*1], J. C. Brooks[2], D. F. Mollenkopf[3], M. A. Calle[2], G. H. Loneragan[2], M. F. Miller[2], J. A. Carroll[4], and T. E. Wittum[3], [1]Texas Tech University, Wolfforth, [2]Texas Tech University, Lubbock, [3]Ohio State University, Columbus, [4]USDA-ARS, Livestock Issues Research Unit, Lubbock*

Salmonella is a foodborne pathogen that may be associated with meat products and can cause disease or death in humans. The first objective of this study was to determine the overall prevalence of *Salmonella* in ground pork in stores in the United States over 3 seasons and 4 regions. Both case-ready and store-ground packages were obtained throughout the study. The package types collected were overwrap, chub, modified atmosphere packaging (MAP) and other (plastic or wax paper wrapped). Because these package types represent different production systems and are subject to different microbiological government regulation and testing methodologies, both USDA-FSIS and FDA *Salmonella* isolation protocols were used. Another objective of the study was to determine the serotypes and antimicrobial resistance profiles of the isolates found. Ground pork aliquots were subjected to real-time PCR isolation. Recovered isolates were then serotyped and minimum inhibitory concentration analysis (MIC) to 15 antimicrobial compounds was determined using micro-broth dilution in accordance with the national antimicrobial resistance monitoring system (NARMS). The overall prevalence of *Salmonella* in ground pork from the 865 samples collected was 1.39%. Prevalence was not affected by package type ($P = 0.29$) or

grind location (case-ready vs. store-ground; $P = 0.17$). Season affected *Salmonella* prevalence ($P = 0.05$) with most isolates found during the fall season, and there was a tendency for region to affect *Salmonella* prevalence ($P = 0.07$). The USDA *Salmonella* isolation method was more effective at recovering isolates from packages ($P = 0.01$) in comparison with the FDA methodology and yielded a Kappa statistic of 0.26 as a measure of agreement. The serotypes isolated included: Infantis, 4,5,12:i:-, Brandenburg, Typhimurium var 5-, Seftenberg, and Johannesburg with only 2 packages containing multiple serotypes. There were no isolates resistant to antibiotics used to treat *Salmonella* infections including extended spectrum cephalosporins or flouroquinolones. The recovery of *Salmonella* from retail ground pork sampled in this study was relatively uncommon. However, *S*. Typhimurium (and its monophasic variant 4,5,12:i:-) were recovered and are known human pathogens. Therefore, strategies to further reduce or eliminate these pathogens from retail pork products are warranted.

Keywords: antimicrobial resistance, pork, salmonella

60 Sous vide beef cookery. *D. A. Griffing*[*1], *D. D. Johnson*[2], *K. Schneider*[2], *C. L. Bratcher*[1], *and C. Carr*[2], [1]*Auburn University, Auburn, AL,* [2]*University of Florida, Gainesville*

Drastic changes are expected to occur in the food service industry on January 1, 2016 as it relates to the cooking of mechanically tenderized beef due to food safety concerns. Thus, it is necessary to explore innovative methods such as sous vide cookery as possible alternatives to mechanical tenderization for tenderness enhancement. The sous vide cooking method involves cooking under vacuum in a water bath at a precise, constant temperature for a specified time period. The objective of this research was to evaluate the effect of sous vide cookery on dairy cow semitendinosus muscles (STM; IMPS # 171C). Each of the STM muscles (n = 50) was further fabricated into steaks according to the specified, randomly assigned treatment in 1 of 3 experiments comparing sous vide cooking with grilling, evaluating the effect of mechanical tenderization used in conjunction with sous vide cookery, and evaluating sous vide par-cooking as an alternative to mechanical tenderization. Experiment 1 indicated steaks sous vide cooked at 62.8°C had lower slice shear force (SSF) values ($P < 0.03$) than all other treatment steaks cooked to 51.7°C or 57.2°C and had numerically lower SSF values than grilled steaks at the same cooking temperature. Steaks sous vide cooked to 62.8°C exhibited the greatest percentage of solubilized collagen ($P \leq 0.04$). As sous vide cooking temperature increased ($P \leq 0.04$), there was a linear decrease in the moisture percentage. The 51.7°C treatments exhibited the least fat percentages ($P \leq 0.04$). Experiment 2 showed sous vide cooked, mechanically tenderized steaks had lower SSF values ($P \leq 0.01$) than intact, sous vide cooked steaks at 51.7°C and 57.2°C, and an increase in cooking loss was observed ($P \leq 0.01$) as cooking temperature increased, regardless of mechanical tenderization. The trained sensory panel evaluation for experiment 2 complemented findings for the SSF and cook loss analysis. Experiment 3 revealed steaks sous vide par-cooked at 62.8°C and finished on a grill to an internal temperature of 62.8°C had the lowest ($P \leq 0.04$) SSF values. All sous vide par-cooked treatments had a greater ($P \leq 0.04$) cooking loss percentage when compared with all grilled steak treatments. In conclusion, sous vide par-cooking could be used as an alternative to mechanical tenderization for tenderness improvement; however, cook loss is an issue.

Keywords: beef, sous vide, tenderization

PASTURES AND FORAGES

61 Seeding method and clover species for grazing calves in southern Arkansas. *P. Beck*[*1], *B. Stewart*[1], *C. Shelton*[1], *A. McWilliams*[1], *M. Sims*[1], *and J. Jennings*[2], [1]*University of Arkansas SWREC, Hope,* [2]*Department of Animal Science, University of Arkansas, Little Rock*

Eighteen 1.6-ha warm-season grass pastures at the Southwest Research and Extension Center Stocker Unit were interseeded to white (**WHT**, Trifolium repens), red (**RED**, Trifolium pratense), or subterranean (**SUB**, Trifolium subterraneum) in October, 2013 either across the entire pasture (**SOLID**) at the recommended rate (2.2, 8.9, and 22, kg/ha, respectively) or in strips (**STRIP**) at twice the recommended rate in a 3 x 2 factorial arrangement of treatments. Pastures were stocked with growing heifers (n = 5/pasture, BW = 298 ± 6.0 kg) from 21 May to 10 September. Each pasture was split into two 0.8 ha paddocks, heifers grazed paddocks on alternating weeks. Stand counts, forage mass, and diet samples were collected monthly across each pasture and heifers were weighed full at the initiation and termination of grazing. Forage data were analyzed as a repeated measures design, and animal performance was analyzed by ANOVA using PROC MIXED in SAS (SAS Inst. Inc., Cary, NC). There were no interactions ($P \geq 0.78$) between clover species and seeding method on heifer performance. Total body weight gain and ADG per heifer from RED (64 ± 3.6 and 0.58 ± 0.03 kg, respectively) were greater ($P = 0.02$) than SUB (49 ± 3.9 and 0.44 ± 0.03 kg, respectively) and tended ($P = 0.10$) to be greater than WHT (56 ± 3.2 and 0.49 ± 0.03 kg, respectively), but did not differ ($P = 0.84$) by planting method. There was a treatment by sampling date interaction ($P < 0.01$) for clover stand counts. In May, SOLID RED (62 ± 5.1%) had greater ($P = 0.02$) stand counts than STRIP RED (43 ± 5.1%); yet, in SUB (42 ± 5.1%) and WHT (36 ± 5.1%), stand counts did not differ ($P \geq 0.25$) in SOLID or STRIP. In June, SOLID RED (65 ± 5.1%) had greater ($P = 0.05$) stand counts than STRIP RED (50 ± 5.1%) and WHT SOLID (46 ± 5.1%) tended ($P = 0.07$) to have greater stand count that WHT STRIP (33 ± 5.1%); while in SUB (11 ± 5.1%), stand counts did not differ ($P = 0.25$) in SOLID or STRIP. In September, stand counts were very low (< 10%), and there was no difference ($P \geq 0.49$) between SOLID and STRIP among clover species. Strip seeding appears to be a viable alternative to achieve acceptable clover populations.

Keywords: beef cattle, clover, performance, seeding method

62 Performance of stocker cattle grazing 'Tifton 85' bermudagrass supplemented with distillers dried grains. *W. B. Smith[*1], F. M. Rouquette[1], J. L. Kerby[1], L. O. Tedeschi[2], J. L. Foster[3], J. P. Banta[4], K. C. McCuistion[5], and T. J. Machado[5], [1]Texas A&M AgriLife Research, Overton, [2]Texas A&M University, College Station, [3]Texas A&M AgriLife Research, Beeville, [4]Texas A&M AgriLife Extension, Overton, [5]Texas A&M University, Kingsville*

The vast supply of distillers dried grains (DDG) generated from ethanol production provides great opportunities for supplementation of stocker cattle. The objective of this study was to evaluate performance of stocker calves grazing 'Tifton 85' bermudagrass (*Cynodon dactylon* [L.] Pers.) and supplemented daily with varying levels of DDG. Steers [n = 48 (4 testers per pasture), 398 ± 4.4 kg initial BW, approx. 15 mo of age] were stratified by BW within source and known breed type and allocated randomly to 1 of 16 pastures (0.6 ± 0.01 ha), and pastures were allocated randomly to 1 of 4 levels of DDG supplementation for the 110-d study: 0.00, 0.25, 0.50 or 1.00% BW·animal^{-1}·d^{-1}. Animals were group-fed daily at 0800 h, and bunk space was allowed at a minimum of 38 cm/animal. Forage mass was assessed by destructive harvest of four 0.09-m^2 quadrats throughout each pasture on 21-d intervals. Steers were weighed, unshrunken, every 21 d, and grazing animals were added to each pasture based on visual and numerical assessments to maintain similar forage mass among pastures. Data were analyzed using SAS PROC MIXED. The model included the fixed effects of treatment, breed type and their interaction, and source and pasture within treatment were treated as random effects. Least-squares means were calculated for treatments and separated using pairwise *t*-tests with Tukey-Kramer adjustment. Significance was declared when $P < 0.05$. Average daily gain was less ($P < 0.05$) from steers receiving no supplement (0.76 kg·d^{-1}) compared with those offered 0.25, 0.50 or 1.00% BW daily (1.09, 1.12 and 1.26 kg·d^{-1}, respectively). Pastures in which supplement was offered at 1.00% BW were able to sustain more ($P < 0.05$) AU (363-kg steer) per ha (2.2 AU·ha^{-1}) compared with 0.00, 0.25 or 0.50% pastures (1.8, 1.8 and 1.9 AU·ha^{-1}, respectively). Gain per unit area was greatest ($P < 0.05$) from pastures offered supplement at 1.00% BW (275 kg·ha^{-1}), followed by 0.25% and 0.50% (193 and 209 kg·ha^{-1}, respectively), and least from pastures receiving no supplement (137 kg ha^{-1}). Therefore, supplementation of stocker calves with DDG may be a viable option for increased performance from high-valued stocker cattle, as well as increased stocking density, on bermudagrass pastures.

Keywords: distillers dried grains, stocker, Tifton 85 bermudagrass

63 Effect of grazing management on performance of steers grazing mixed alfalfa and bermudagrass pastures. *W. Galyen[*1], E. B. Kegley[2], J. G. Powell[2], P. Beck[3], D. S. Hubbell, III[4], T. Hess[4], T. Butler[5], and J. Rogers[5], [1]University of Arkansas, Fayetteville, [2]Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville, [3]University of Arkansas SWREC, Hope, [4]University of Arkansas Livestock and Forestry Research Station, Batesville, [5]The Samuel Roberts Noble Foundation, Ardmore, OK*

It is commonly recommended to use rotational grazing to improve persistence of legumes interseeded into bermudagrass, but impacts on animal performance are poorly understood. Steers (n = 160, BW = 251 ± 2.4 kg) grazed mixed alfalfa/bermudagrass pastures (n = 10; 1.6-ha) with either continuous grazing (CONT) or rotational grazing (ROT) management from 15 May to 7 August 2014 (84 d). Initial stocking rate was set at 10 calves/ha and rotational grazing pastures were divided into 8 paddocks with 3 d grazing (21-d rest between grazing events). Initial, final, and interim (28 d) BW were collected following a 16-h removal from feed and water. When forage allowance became limiting (forage allowance < 1 kg forage DM/kg steer BW) in CONT on 10 July, 2 randomly selected steers were removed from all pastures to maintain equal stocking rates in CONT and ROT. Data were analyzed as a completely random design with the mixed procedure of SAS (SAS Inst. Inc., Cary, NC) using pasture within treatment in the random statement. Steer BW at the end of the experiment did not differ ($P = 0.22$), but was numerically 7 kg greater for ROT (317 ± 3.6 kg) than CONT (310 ± 3.6 kg). Daily BW gains during the initial 28-d period did not differ ($P = 0.37$) and were less than expected (0.36 ± 0.06 kg/d) based on forage quality and forage mass. During the 28-d period between 12 June and 10 July, ADG of ROT (1.01 ± 0.04 kg/d) was 26% greater ($P < 0.01$) than CONT (0.81 ± 0.04 kg/d) and ADG of ROT (0.91 ± 0.05 kg/d) during the third 28-d period tended ($P = 0.10$) to be 16% greater than CONT (0.79 ± 0.05 kg/d). Over the entire experimental period, ADG of ROT (0.78 ± 0.03 kg/d) was numerically ($P = 0.14$) greater than CONT (0.70 ± 0.03 kg/d). Because stocking rates were maintained at the same level, ROT pastures provided greater forage allowance during the grazing season (>2 kg forage DM/kg steer BW) than CONT (maintained at 1 kg forage DM/kg steer BW) explaining differences in BW gain between treatments. These data indicate that at equal stocking rates, rotational grazing management can maintain greater forage allowance during the late summer compared with continuous grazing of mixed alfalfa/bermudagrass pastures during the late summer, but did not result in overall increases in animal performance.

Keywords: alfalfa, bermudagrass, grazing management, growing steers

64 Production characteristics of stockpiled 'Alicia' bermudagrass in Louisiana. *G. Scaglia[*1], G. T. Gentry[2], and J. Gurie[2], [1]LSU AgCenter, Jeanerette, [2]LSU AgCenter Dean Lee Research Station, Alexandria*

Stockpiling bermudagrass helps reduce hay feeding costs in beef cattle operations. Accuracy of nutritive value analysis of stockpiled bermudagrass by near infrared spectrophotometry (NIRS) needs to be determined. The objective of this experiment was to stockpile a bermudagrass (*Cynodon dactylon*) hybrid ('Alicia') at 2 LSU AgCenter Research Stations, Dean Lee (DLRS) and Iberia (IRS). These areas have similar soil types with little or no slopes. In August of 2 consecutive years, bermudagrass was clipped or cut for hay. Pastures were fertilized with 100 units of N per ha as urea and remained ungrazed until the beginning of the grazing period (November/December).

Approximately a month after the fertilization and until the end of the experiment (January) forage mass was determined and samples for nutritive value analyses (CP, ADF, NDF, and TDN) were collected every 15 d. Nutritive value was determined by wet chemistry and NIRS at a commercial laboratory. Weather data were obtained from weather stations located at each of the experimental sites. Data (wet chemistry results were used for statistical analyses of the nutritive value) were analyzed using PROC GLM and the effects of year, location, sampling date, and their interactions were determined. Mean separation of NIRS and wet chemistry values was performed using t-test. A year x location interaction was detected for forage mass (P = 0.01). Forage mass was greater at DLRS on yr 1 (4,451 kg DM/ha) and at IRS in yr 2 (2,399 kg DM/ha). A year effect was detected for NDF (P = 0.03) and TDN (P = 0.04). In yr 1, stockpiled bermudagrass at DLRS had greater NDF (72%) and less TDN concentration (53%) compared with IRS (64% and 59%, respectively). A quadratic response was observed for forage mass and nutritive value variables decreased linearly (P < 0.05) with sampling date. On both sites, rainfall affected the nutritive value of bermudagrass through weathering. It was visually observed that lodging increased waste. Nutritive value parameters were greater (P < 0.05) when NIRS was used. Under the conditions of the present experiment, the nutritive value of stockpiled bermudagrass was affected by weathering. Despite the low nutritive value of stockpiled bermudagrass, it could meet the nutrient requirements of an open nonlactating beef cow. These results suggest that NIRS analysis of stockpiled bermudagrass overestimates nutritive value and specific calibrations should be developed for its use in analysis of stockpiled forages.

Keywords: bermudagrass, nutritive value, stockpiled bermudagrass

65 Forage and sweet sorghum silages as alternatives to corn silage for growing cattle. *M. H. Poore*, K. R. Caffrey, M. S. Chinn, and M. W. Veal, North Carolina State University, Raleigh*

Corn silage (CS) is often used for growing cattle in the southern US, but often environmental conditions make corn production risky. Sorghums make attractive alternatives because of their greater drought tolerance, but decreased nutritive value compared with CS has limited adoption. New forage sorghum hybrids including brown midrib and brachytic traits to improve nutritive value have become available, and sweet sorghum has been bred for improved agronomic characteristics. This trial compared a BMR6 brachytic dwarf forage sorghum (FS; Alta Seed AF 7401), an improved sweet sorghum (SS; M81E) and CS as forages for growing cattle. The silages contained 31.4, 24.8, and 23.0% DM; 6.15, 6.25, and 5.20% CP; and 29.9, 27.6, and 25.3% NSC for CS, FS and SS, respectively. Forty-two head of yearling Angus and Angus cross steers (initial body weight 348 kg) were implanted with Revalor-XS and fed ad libitum through Calan gates for an 84-d growing period. Steers were fed 1 of 3 diets (balanced to 14% CP) that included 75% CS, FS or SS and, 25% of a corn and soybean meal-based concentrate. After 84 d cattle were switched to a finishing diet consisting of 15% CS and 85% concentrate. After 98 d on the finishing diet cattle were transported to PA for harvest and carcass data was collected. During the growing period steers fed FS or SS had reduced DMI (P < 0.05; 10.44, 8.70, and 9.14 kg/d) and decreased ADG (P < 0.05; 1.97, 1.65, and 1.71 kg/d) but similar G:F (0.189, 0.188, and 0.188 for CS, FS, and SS, respectively) compared with CS. During finishing steers fed the sorghum silages during growing had greater DMI (P < 0.05; 10.56, 12.15 and 11.54 kg/d), greater ADG (P < 0.05; 1.32, 1.62 and 1.60 kg/d) but similar G:F (0.125, 0.133 and 0.138 for CS, FS and SS, respectively) compared with CS. Overall, ADG, DMI and G:F during the combined periods did not differ. Steers had similar (P > 0.20) hot carcass weight (382 kg), backfat (1.32 cm), loin eye area (92.4 cm^2), and yield grade (2.73) on all treatments. Quality grade scores were higher (P < 0.05) for CS compared with FS (17.7, 16.5, 17.0 for CS, FS, and SS, respectively). Forage sorghum and sweet sorghum silages resulted in decreased DMI and ADG during the growing period but steers compensated during the finishing period resulting in similar overall performance.

Keywords: alternative forages, beef cattle, sorghum silage

66 Impact of nitrogen source and rate on yield and nutritive value of stockpiled tall fescue. *B. T. Campbell*, C. D. Teutsch, and N. T. Shireman, Virginia Tech, Blackstone*

Fall application of nitrogen (N) can affect dry matter (DM) yields in tall fescue (*Lolium arundinacea* (Schreb.) stockpiling operations. The correlation between N rate and N source on stockpiled forage yields and nutritional value has not fully been investigated. This study was designed to show the effects of both N rate and N source on nutritional quality and DM yield of fall stockpiled tall fescue. Trials were conducted on a farm located near Crewe, VA in 2012 and 2013. Seven N sources [ammonium sulfate (AS), ammonium nitrate (AN), urea + Agrotain@ 1.9L/ton (AG2], urea + Agrotain @ 3.8L/ton (AG4), urea + Agrotain @ 5.7 qt/ton (AG6), urea + Nutrisphere (NS), and urea) were applied at 0, 18.1, 36.2, and 54.3 kg plant available N/acre in mid-September. Forage was accumulated until harvesting in January. Samples were analyzed for forage quality and quantity. Data were analyzed using SAS 9.1. The experimental design was a randomized complete block with a 2 factor (N rate and N source) factorial treatment arrangement and 4 replications. Each treatment was replicated. Quantity of forage increased linearly with an increase in rate of nitrogen applied up to 80lbs of N/acre (P < 0.05). There was no difference in forage accumulation between 80 and 120lbs of N/acre (P > 0.05). Forage nutritive value and forage yield were not impacted by the source of N (P > 0.05).

Keywords: nitrogen stockpiled fescue

67 Animal performance, in vivo forage digestibility and forage intake of beef steers grazing annual ryegrass varieties differing in water soluble carbohydrate content, with and without corn supplementation. *J. G. Andrae[1], M. Alende[*1,2], S. K. Duckett[1], G. Volpi Lagreca[1,2], and A. C. Fluck[3], [1]Clemson University, Clemson, SC, [2]INTA, Anguil, Argentina, [3]Universidad Federal de Pelotas, Brazil, Pelotas, Brazil*

The objective of this study was to compare animal performance, forage intake and in vivo digestibility of annual ryegrass varieties (VAR) selected to have differential water soluble carbohydrate (WSC) content ['Lonestar', (conventional) vs 'Enhancer', (high WSC)]. Steers grazing both VAR were supplemented daily (SUPPL) with cracked corn at 0 or 0.75% BW basis. Four 2-ha paddocks (2 replicates per variety) were planted during mid-October 2013 and grazing began in mid-March 2014 due to a dry fall and abnormally cold winter. Study was a split-plot design with VAR as main plot and SUPPL as sub-plot. Twenty-four steers (324 ± 15.7 kg initial BW) were assigned to 1 of 4 paddocks (2 replicates per variety), with 6 animals per paddock. Within each paddock replicate 3 animals were supplemented (2.7 kg cracked corn/animal/d, DM basis) and 3 animals were not supplemented. SUPPL was provided individually using Calan gates (American Calan Inc., NH). Put and take stocking was utilized to maintain similar forage allowance among paddocks. Average daily gain (ADG) was calculated by BW difference between initial and final BW, using double unshrunk weights on consecutive days. Orts were measured daily. Forage analyses included WSC, crude protein, NDF and ADF. Titanium dioxide (TiO_2) was used to estimate total DM and forage intake. Animals received daily oral administration of gelatin capsules containing 10g TiO_2 during a 21-d period. Fecal grab samples were collected twice daily (150 g wet material/animal) during the last 6d of digestion period. TiO_2 concentration in feces was assessed by H_2SO_4 digestion and spectrophotometry (410 nm). Data were analyzed with Proc Glimmix (SAS), in a model including VAR and SUPPL, with paddock as random. Forage composition did not differ between VAR for any of the variables analyzed (P = 0.84, P = 0.37, P = 0.15 and P = 0.18, for WSC, NDF, ADF and CP, respectively). No differences due to VAR or SUPPL were found in final weight (P = 0.77 and P = 0.33, for VAR and SUPPL, respectively) or ADG (P = 0.76 and P = 0.47, for VAR and SUPPL, respectively), which were 484 ± 19.6 kg and 1.66 ± 0.144 kg/d, respectively. Additionally, no differences due to VAR and SUPPL were found in forage intake, total dry matter intake or in vivo digestibility (P = 0.07). Under conditions of this study, no differences in forage composition, animal performance or forage digestibility were detected between the high sugar ryegrass variety and a conventional check variety.

Keywords: beef cattle, ryegrass, supplementation,

68 Supplementing soybean hulls to stocker cattle grazing wheat during periods of high N prices. *J. T. Biermacher[*], J. Rogers, C. A. Moffet, and R. Reuter, The Samuel Roberts Noble Foundation, Inc., Ardmore, OK*

Between 1959 and 2009 there were 6 significant spikes in the price of nitrogen fertilizer (N) above the long-term trend, and the most significant was the 150 percent increase between 1972 and 1974. Typically, spikes lasted between 2 and 4 yr and reverted back to, or below, trend levels. Farmers responded to price spikes by reducing the quantity of N they used, leading to reduced yields and net returns, especially during periods of favorable growing conditions. One management option to deal with high N price is to reduce N use and supplement cattle with purchased feed. Data from a 4-yr wheat grazing study were used to determine how the system performs when supplemental soybean hulls are used as a substitute for N fertilizer. Four systems were evaluated, including the conventional practice of applying 168 kg N ha^{-1} (N168); a reduced application of 56 kg N·ha^{-1} (N56); a 56 kg N·ha^{-1} application plus access to soybean hulls at a rate of 0.75% of BW·d^{-1} (N56+SBH); and a 168 kg N·ha^{-1} application plus access to soybean hull pellets at a rate 0.75% of BW·d^{-1} (N168+SBH). Value of gain estimates were calculated for each system using Oklahoma City prices for cattle based on observed placement and market weights and dates incurred for each year and treatment of the study. Base-case prices of \$0.99 and \$0.24·kg^{-1} for N (as urea) and soybean hulls, respectively, were used. Estimates of net return were calculated for a number of price scenarios for N and soybean hulls. Gain·ha^{-1} and net return were subjected to an analysis of variance model with management system as a fixed effect and year as a random effect; pasture within year was the experimental unit. Average total body weight gain (P < 0.0001) by system was 769, 626, 779, and 828 kg·ha^{-1}, respectively. For the base-case market scenario, the greatest (P < 0.0001) net return of \$1,191·ha^{-1} was generated with the conventional system (N168). For a 100 percent N price spike scenario (price of N = \$1.98·kg^{-1}), the breakeven price of soybean hulls for the N56+SBH system relative to the N56 system was equal to \$0.23 kg^{-1}, suggesting that it would be economical for farmers who reduce the quantity of N on their pastures to supplement stocker cattle with soybean hulls if they are priced < \$230·Mg^{-1} (\$210·ton^{-1}).

Keywords: cattle, nitrogen, supplement

PHYSIOLOGY

69 Effect of lipid sources, lysophospholipids and organic acids on the performance of broilers fed wheat–based diets. *G. D. V. Polycarpo[*1], P. D. A. P. Ribeiro[1], J. C. Dadalt[1], L. F. D'Abreu[1], T. C. Lagassi[1], K. D. S. Andrade[1], M. F. D. C. Burbarelli[1], C. D. P. Carão[1], C. E. B. Merseguel[1], V. C. Cruz-Polycarpo[2], and R. D. Albuquerque[1], [1]University of São Paulo - USP, Pirassununga, Brazil, [2]São Paulo State University - UNESP, Dracena, Brazil*

The non-starch polysaccharides (NSP) of wheat such as pentosanas affect the digestion of lipids in the intestine of chickens. As previously reported by some researches, the NSP impair mainly the digestion of saturated lipid sources. One of the reasons is associated with the proliferation of undesirable microorganisms in the intestinal lumen, causing deconjugation of endogenous bile salts. Thus, the aim of this study

was to evaluate wheat-based diets with different lipid sources supplemented or not with lysophopholipids and organic acids on performance of broilers. Male Cobb chicks were allotted in a completely randomized design featuring a 2x2x2 factorial arrangement: soybean oil or beef tallow and suplemented with or without lysophospholipids and organic acids, with 8 replications of 12 birds per experimental unit. The diets were provided ad libitum with similar energy and amino acid levels. The lysophospholipids were composed mainly of lysolecithins, which is an emulsifier produced from enzymatic enrichment of soybean lecithin by the enzyme phospholipase A_2 activity. The composition of organic acids was: lactic (40%), acetic (7%) and butyric acid (1%). No interactions ($P > 0.05$) were observed in 42-d-old broilers for body weight gain (WG), feed intake (FI), feed:gain ratio (F:G) and viability (VB). The diets with soybean oil increased WG (2774.5 g *vs.* 2695.2 g, $P < 0.0001$) and improved F:G (1.6697 *vs.* 1.7056, $P < 0.0001$) compared with diets containing beef tallow. The inclusion of organic acids increased WG (2760.53 g *vs.* 2709.21 g, $P = 0.0082$). The lysophospholipids did not affect broiler performance. FI and VB were not influenced by treatments. It can be inferred that the fatty acid profile of the lipid sources strongly influences the performance of broiler chickens fed wheat-based diets, however, there is no interaction with feed-additives tested. Organic acids improve the weight gain, whereas the lysophospholipids have no effect on the performance.

Keywords: beef tallow, lysolecithin, soybean oil

70 Exposure to lipopolysaccharide in utero alters preweaning growth performance of calves. *P. A. Lancaster[*1], J. A. Carroll[2], and N. C. Burdick Sanchez[2], [1]UF/IFAS Range Cattle Research and Education Center, Ona, FL, [2]USDA-ARS, Livestock Issues Research Unit, Lubbock*

This study was designed to determine the effect of prenatal lipopolysaccharide (LPS) exposure on the postnatal growth performance of calves. Pregnant crossbred cows (n = 50) were separated into prenatal stress (PNS; n = 25; administered 0.1 µg/kg BW LPS subcutaneously) and saline groups (Cont; n = 25) based on expected calving date. Cows were managed as a single group on bahiagrass pasture with hay and molasses supplement from November through March. Cows calved from mid-October through December. Vaginal temperature probes were inserted 2-d before LPS injection (September 25, 2013) to monitor change in body temperature. Date and body weight of calves were recorded at birth and weaning in July. Day of gestation for LPS injection was computed using calving date and length of gestation of 283 d. For calves, 205-d adjusted weaning weight was calculated. Cow vaginal temperature data were analyzed using the MIXED procedure of SAS for repeated measures with fixed effects of treatment, hour, treatment by hour interaction, and baseline as a covariate. Calf growth data were analyzed using MIXED procedure of SAS with fixed effects of treatment, gender, and treatment by gender interaction. There was a treatment by hour interaction for change in vaginal temperature of cows post injection. Cows administered LPS had greater ($P = 0.01$) change in vaginal temperature for the first 6h post injection than cows administered saline (0.48 vs. 0.06 ± 0.005 °C, respectively). There was no difference in day of gestation when the injection was administered between PNS and Cont cows (231.2 and 235.9 ± 3.9 d, respectively). PNS and Cont calves had similar ($P = 0.18$) birth weight (34.6 and 32.5 ± 1.1 kg, respectively), but male calves were heavier ($P = 0.03$) than females (35.3 vs. 31.8 ± 1.1 kg, respectively). There was a treatment and gender effect for 205-d adjusted weaning weight. PNS calves had greater ($P = 0.02$) weaning weight than Cont calves (215.3 vs. 201.7 ± 4.0 kg, respectively). Additionally, male calves had greater ($P = 0.02$) weaning weight than female calves (215.5 vs. 201.5 ± 4.2 kg, respectively). These results suggest that pre-weaning growth of calves is affected by a single prenatal exposure to LPS, and that male and female calves respond similarly.

Keywords: growth, lipopolysaccharide, prenatal stress

71 Altered postnatal acute phase response in heifers exposed to lipopolysaccharide in utero. *J. A. Carroll[*1], N. C. Burdick Sanchez[1], K. P. Sharon[2], J. D. Arthington[3], and P. A. Lancaster[3], [1]USDA-ARS, Livestock Issues Research Unit, Lubbock, [2]Texas Tech University, Lubbock, [3]UF/IFAS, Range Cattle Research and Education Center, Ona, FL*

The objective of this study was to determine the effect of prenatal lipopolysaccharide (LPS) exposure on the postnatal acute phase response (APR) to LPS challenge in heifer calves. Pregnant crossbred cows (n = 50) were separated into prenatal stress (PNS; n = 25; administered 0.1 µg/kg BW LPS subcutaneously at 233 ± 19 d of gestation) and saline groups (Cont; n = 25). From these treatments, all heifer calves (n = 12 PNS and 11 Cont) were identified at weaning (238 ± 15 d of age) to subsequently receive an LPS challenge. On d 0 heifers were fitted with indwelling jugular catheters and vaginal temperature (VT) recording devices and were moved into individual pens. On d 1, heifers were challenged intravenously with LPS (0.5 µg/kg BW) at 0 h (1000h). Sickness behavior scores (SBS) were recorded and whole blood samples were collected at 30-min intervals from -2 to 8 h and again at 24 h relative to the LPS challenge. Serum was isolated and stored at -80°C until analyzed for cytokine concentrations. Data were analyzed using the MIXED procedure of SAS specific for repeated measures. There was a treatment x time interaction ($P < 0.001$) for the change in VT (relative to 0 h) such that the change in VT was greater in Cont than PNS from 150 to 250 min ($P \leq 0.05$), yet it was greater in PNS than Cont from 355 to 440 min and from 570 to 1145 min ($P \leq 0.05$). The change in VT (relative to 0h) was greater ($P < 0.001$) in PNS heifers (0.360 ± 0.001°C) compared with Cont heifers (0.104 ± 0.001°C). There was also a treatment x time interaction ($P = 0.02$) for SBS such that scores were greater in Cont than PNS at 0.5h ($P = 0.04$), yet were greater in PNS than Cont from 2.5 to 4 h post-LPS ($P \leq 0.05$). Concentrations of the cytokines interferon-γ and tumor necrosis factor-α were not affected by treatment ($P \geq 0.33$), but were affected by time ($P < 0.001$). There was a tendency ($P = 0.06$) for a treatment x time interaction for concentrations of interleukin-6 (IL-6). Specifically, IL-6 concentrations were greater in PNS than Cont heifers from 5.5 to 6h and from 6.5 to 8h post-challenge ($P \leq 0.05$). This resulted in an overall time ($P < 0.001$) and treatment ($P < 0.001$) effect

with PNS heifers having greater IL-6 (4511 ± 134 pg/mL) than Cont heifers (3788 ± 119 pg/mL). These results demonstrate that a single exposure to LPS during gestation can alter the postnatal APR to LPS in heifer calves.

Keywords: acute phase response, lipopolysaccharide, prenatal stress

72 In utero exposure to lipopolysaccharide alters the postnatal metabolic response in heifers. *N. C. Burdick Sanchez[*1], J. A. Carroll[1], K. P. Sharon[2], J. D. Arthington[3], and P. A. Lancaster[3], [1]USDA-ARS, Livestock Issues Research Unit, Lubbock, [2]Texas Tech University, Lubbock, [3]UF/IFAS, Range Cattle Research and Education Center, Ona, FL*

This study was designed to determine the effect of prenatal lipopolysaccharide (LPS) exposure on the postnatal metabolic response to LPS challenge in heifers. Pregnant crossbred cows (n = 50) were separated into prenatal stress (PNS; n = 25; administered 0.1 µg/kg BW LPS subcutaneously 233±15d of gestation) and saline groups (Cont; n = 25). From these treatments, all heifer calves (n = 12 PNS and 11 Cont) were identified at weaning (238 ± 15 d of age) to subsequently receive an LPS challenge. On d 0 heifers were fitted with indwelling jugular catheters and were moved into individual pens. On d 1, heifers (fed at 0600 h) were challenged intravenously with LPS (0.5 µg/kg BW) at 0 h (1000 h). Blood samples were collected at 30-min intervals from -2 to 8 h and again at 24 h relative to the LPS challenge. Serum was isolated and stored at -80°C until analyzed for cortisol, glucose, NEFA, and blood urea nitrogen (BUN) concentrations. Data were analyzed using the MIXED procedure of SAS specific for repeated measures. There was a treatment x time interaction ($P < 0.001$) for cortisol such that PNS heifers had greater cortisol from 4 to 6.5 h post-challenge ($P < 0.001$). There was a treatment x time interaction ($P = 0.04$) for serum glucose such that glucose was greater ($P = 0.01$) in PNS than Cont heifers at 0.5 h but was greater in Cont than PNS heifers at 2, 4.5, and 7 h post-challenge. This resulted in overall time ($P < 0.001$) and treatment ($P = 0.001$) effects such that Cont heifers had greater (68.6 ± 1.1 mg/dL) glucose concentrations than PNS heifers (63.4 ± 1.0 mg/dL). There was a tendency ($P = 0.10$) for a treatment x time interaction for serum NEFA such that NEFA was greater in Cont than PNS heifers at -2, -1.5, and 7h relative to the challenge ($P \leq 0.02$). Also, there were time ($P < 0.001$) and treatment effects ($P = 0.002$) for NEFA with Cont heifers having greater NEFA (0.30 ± 0.01 mmol/L) than PNS heifers (0.20 ± 0.01 mmol/L). Serum BUN was affected by a treatment x time interaction ($P = 0.002$). Concentrations of BUN were greater in PNS heifers from -1.5 to -1h, 1 to 2h, at 4h, and from 5 to 24h relative to the challenge. Additionally, BUN concentrations were affected by time ($P < 0.001$) and treatment ($P < 0.001$) such that PNS heifers had greater BUN (12.1 ± 0.1 mg/dL) than Cont heifers (9.5 ± 0.2 mg/dL). These results demonstrate that the postnatal metabolic response can be significantly altered with a single exposure to LPS in utero.

Keywords: lipopolysaccharide, metabolism, prenatal stress

73 Effect of increased systemic concentrations of urea nitrogen in crossbred heifers on in vitro fertilization (IVF). *C. C. Chase, Jr.[*1], O. L. Asmundson[2], R. A. Cushman[1], H. C. Freetly[1], A. K. McNeel[1], E. C. Wright-Johnson[1], G. A. Perry[3], D. D. Sypherd[1], and J. R. Miles[1], [1]USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE, [2]South Dakota State University, Brookings, [3]South Dakota State University; Department of Animal Sciences, Brookings*

Increased levels of dietary N and hence systemic concentrations of urea-N have been shown to have a deleterious effect on reproduction. The objective of this study was to determine the effect of feeding pubertal crossbred heifers diets with moderate (M-N; 64.8% corn silage, 30.0% alfalfa hay-chopped, 5.0% corn, and 0.2% salt; 2.2% N) or high (H-N; 64.3% corn silage, 29.8% alfalfa hay-chopped, 5.0% soybean meal, 0.7% urea, and 0.2% salt; 3.0% N) levels of N on IVF. From a pool of 150 heifers, 30 heifers (15 M-N and 15 H-N) were used in this study. Heifers were fed treatment diets for at least 90 d. Heifers were synchronized using $PGF_{2\alpha}$ and sacrificed over 2 d; on d 4 of the estrous cycle. Twenty-six heifers (n = 12 M-N and n = 14 H-N) were at the appropriate stage of the estrous cycle. Ovaries were collected and transported to the laboratory. The IVF procedures and media were as described (P.J. Hansen's Laboratory, IVP Protocol). Cumulus-oocyte complexes (COC) from follicles less than 8 mm in diameter, were cultured in maturation medium (5% CO_2; 38.5°C) for 24 h. Matured COC were fertilized using thawed frozen semen from a crossbred bull that was purified using Percoll separation procedures. Motile spermatozoa were added to COC in fertilization medium at a final concentration of 1 x 10^6 spermatozoa/mL. About 24 h later, presumptive zygotes were placed in microdrops of development medium under oil, and cultured (5% CO_2; 5% O_2; 38.5°C). On d 3 and 8 after fertilization, cleavage and blastocyst development, respectively, were assessed. Data were analyzed using the MIXED procedure of SAS and the model included the effects of collection day, treatment, and the interaction. Contemporary heifers fed H-N had greater plasma urea-N concentrations than heifers fed M-N (11.0 vs. 6.2 ± 0.17 mg/dL, respectively). Neither collection day nor the interaction differed ($P > 0.2$). Likewise, treatment (M-N vs. H-N) did not affect ($P > 0.3$) the number of COCs collected per heifer (12.0 ± 2.20 vs. 14.7 ± 2.04), oocytes that cleaved (9.3 ± 2.02 vs. 11.9 ± 1.87), and developed to blastocysts (3.0 ± 0.97 vs. 4.4 ± 0.90). Additionally, there were no treatment differences ($P > 0.9$) in the percentage of COC per heifer that cleaved (76.0 ± 4.21 vs. 75.9 ± 3.89%) or that developed to blastocysts (27.7 ± 5.25 vs. 27.5 ± 4.85%). Inclusion of a high N level in the diet to growing pubertal heifers did not negatively impact oocyte competence.

Keywords: diet protein, heifers, in vitro fertilization

74 Evaluation of hair cortisol in beef cattle of divergent temperaments. *R. C. Vann[*1], S. T. Willard[2], M. Robinson[2], A. W. Lewis[3], T. H. Welsh, Jr.[4], and R. D. Randel[3], [1]MAFES - Brown Loam Experiment Station, Mississippi State University, Raymond, [2]Department Animal and Dairy Sciences, Mississippi State University, Mississippi State, [3]Texas A&M AgriLife Research, Overton, [4]Department of Animal Science, Texas A&M University, College Station*

The objective of this research project was to evaluate the relationships among hair and serum cortisol concentrations and cattle disposition. Spring born (n = 101) crossbred beef heifers (7 to 8 mo. of age) were evaluated for temperament preweaning and at weaning by pen score (PS; 1 = calm and 5 = excitable), exit velocity (EV; m/sec) and temperament score [TS = (PS + EV)/2]. One experienced evaluator determined PS for all calves. In addition, calves were weighed and a blood sample collected by jugular venipucture for evaluation of serum cortisol concentrations pre-weaning and at weaning. At weaning, hair samples were collected over the shoulder, rib and hip areas (7.6 cm x 12.7 cm clipped area) for evaluation of hair cortisol concentrations. Heifers were classified as calm, intermediate or temperamental based on separation of one-half standard deviation from the mean TS. Serum concentrations of cortisol were determined by RIA. Hair samples were washed with isopropanol and dried overnight, and were ground using a Retsch mixer mill 200MM at 25 Hz for 10 min, sonicated in methanol and incubated 8 h at room temperature on a multitube vortex. The supernatant was removed and allowed to dry under a stream of atmospheric air. Samples were reconstituted with phosphate buffered saline before quantification of cortisol using Salimetrics cortisol EIA assay. Data were analyzed using PROC CORR and PROC GLM of SAS. Serum cortisol at weaning was positively correlated with TS pre-weaning r = 0.45 and at weaning r = 0.51 ($P < 0.001$). Serum cortisol was not significantly correlated with hair cortisol at the 3 locations (rib, hip, shoulder). Hair cortisol at the shoulder and average hair cortisol (average of rib, hip and shoulder) were positively correlated with TS at weaning only r = 0.24 ($P = 0.01$) and r = 0.21 ($P = 0.03$), respectively. Hair cortisol at the rib was positively correlated with hair cortisol at the shoulder r = 0.57 ($P < 0.001$) and hip r = 0.57 ($P < 0.001$). Hair cortisol at the shoulder was positively correlated with hair cortisol at the hip r = 0.36 ($P < 0.001$). Serum cortisol at weaning was greater in temperamental heifers compared with calm ($P < 0.005$). In this study serum cortisol had positive moderate correlations with TS pre-weaning and at weaning and was a better predictor of temperament assessment than hair cortisol concentrations from either the shoulder, rib or hip areas at weaning.

Keywords: beef cattle, disposition, cortisol

75 Influence of prolactin single nucleotide polymorphisms and anabolic steroid type on stress response of beef calves. *P. Dias Morse[*1], S. Tabler[2], M. L. Looper[1], J. M. Burke[2], and C. F. Rosenkrans, Jr.[1], [1]University of Arkansas, Fayetteville, [2]USDA-ARS, Booneville, AR*

The objective of this study was to determine whether anabolic steroid implants interact with prolactin genotype in calf response to relocation stress. Weaned crossbred bull calves (n = 80; ~250 kg) were randomly assigned to the following treatments: intact bulls (n = 20), banded bulls (n = 20), banded bulls with an androgenic implant (Revalor G; n = 20), and banded bulls with an estrogenic implant, (Ralgro; n = 20). On d 14, calves were transported approximately 26 km to a local auction barn and penned for 24 h. Blood samples were collected on d 13, 14, 15, and 16 (d 0 = day of implant) to assess serum prolactin and cortisol concentrations. Genomic DNA, harvested from buffy coat samples, was analyzed for single nucleotide polymorphisms (SNP) using the MassARRAY system. Calves were genotyped at 2 enhanced-region (C1286T and A1128G) and 1 coding sequence (G6398A) SNP of the bovine prolactin gene. Dependent variables were circulating concentrations of prolactin and cortisol, ratio of prolactin to cortisol, and calf body weight gain during the stress period. Main effects of genotype, treatment, day, and their interactions were analyzed by ANOVA. Concentrations of prolactin varied ($P < 0.05$) by day (62, 89, 109, and 38 ng/mL, SE = 11; respectively for d 13, 14, 15, and 16). Two-way interactions (day*A1128G and day*G6398A) also affected ($P < 0.05$) prolactin concentrations. Day also affected ($P < 0.01$) cortisol concentrations (27, 40, 36, and 33 ng/mL, SE = 2; respectively for d 13, 14, 15, and 16). Cortisol concentrations tended ($P < 0.1$) to be affected by genotype and treatment. Ratio of prolactin to cortisol was affected by the interaction ($P < 0.05$) of treatment by day, and a tendency ($P < 0.1$) for an A1128G genotype by day effect. Bulls on d 13 had the greatest ($P < 0.05$) prolactin:cortisol, and calves that were AA genotype at A1128G had the largest ($P < 0.05$) prolactin:cortisol on d 13. Body weight gain during the 16 d stress trial was not affected by treatment, genotype, or their interactions. Serum prolactin and cortisol and their ratio were associated with stress response of calves. Prolactin genotype may be useful in selecting animals that are less susceptible to relocation stress.

Keywords: cortisol, genotype, prolactin, stress

76 Microarray studies in high and low RFI cattle reveal a potential role for inflammation within the arcuate nucleus in regulating feed efficiency. *K. N. Purvis[*1], C. Foradori[1], A. K. McNeel[2], L. A. Kriese-Anderson[1], and T. D. Brandebourg[1], [1]Auburn University, Auburn, AL, [2]USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE*

Residual feed intake (RFI) is a heritable feed efficiency measure. Mechanisms underlying variation in feed efficiency are poorly understood. To address this issue, divergent cohorts consisting of high (High) and low (Low) RFI individuals were identified by assessing RFI in Angus-sired steers during a 70 d feeding trial. Microarray studies were then conducted on hypothalamic tissue RNA samples harvested from High and Low RFI steers. Carcass and growth data were analyzed using a mixed model with RFI level (Low, High) as the independent variable. The lsmeans for RFI were -1.25 and 1.51 for the Low and High cohorts ($P < 0.0001$). Dry matter intake was greater for the High individuals vs. the Low steers ($P < .0001$) while on test BW gain was not different between the 2 groups ($P < 0.73$). Of the 24,000+ probes included on the Affymetrix Bovine Genome Array, 891 were found to be significantly different ($P < 0.05$) between high and low RFI. These results were verified using real-time PCR to assess the expression of 12 genes identified as being differentially expressed in the arcuate nucleus of High and Low steers. Consistent with the microarray results, target gene expression analysis indicated mRNA expression of *actin gamma-2* (*ACTG2)*, chemokine (C-C motif) ligand 2 *(CCL2)*, Chorionic gonadotropin alpha *(CGA)*, calponin 1 (*CNN1)*, *CXC* motif ligand *1 (CXCL1)*, desmin (*DES)*, periostin (*POSTN)*, collagen type XIII alpha 1

(*COL13A)*, myosin heavy chain 11 (*MYTH11)*, SIX homeobox 1 (*SIX)*, smoothelin (*SMTN)*, and tropomyosin 2 beta (*TPM2)* was les in Low steers than High steers ($P < 0.05$) validating differences detected by microarray. Ingenuity Pathway Analysis software revealed that the pathways most heavily represented in the differentially expressed genes were consistent with the known functions of the central nervous system, specifically; increased cellular movement, cell-to-cell communication and cellular development were highly significant ($P = 1.34x10^{-24}$, $9.54x10^{-20}$,$3.14x10^{-17}$, respectively). In terms of canonical pathways, dendritic cell maturation and interleukin signaling ($P = 3.56x10^{-6}$ and $5.24x10^{-6}$, respectively) were identified as activated in High vs. Low steers. Likewise, mRNA for the proinflammatory cytokine genes, tumor necrosis factor alpha (*TNFα)* and interleukin-6 (*IL-6)* was greater in the arcuate nucleus of High vs. Low steers as measured by real-time PCR ($P < 0.01$). These data support the hypothesis that differences in hypothalamic gene expression underlie variation in feed efficiency in steers while higher inflammatory activation in otherwise healthy steers contributes to a higher RFI phenotype.

Keywords: inflammation, residual feed intake, steer

RUMINANT ANIMAL PRODUCTION I

77 In vitro and in situ degradation of alkali treated sorghum wet distillers grains alone or in combination with corn stalks to increase their nutritive value. *W. W. Gentry[*1,2], C. P. Weiss[1,2], C. L. Brauer[2], F. T. McCollum[2], N. A. Cole[3], and J. S. Jennings[2], [1]West Texas A&M University, Canyon, [2]Texas A&M AgriLife Research and Extension Center, Amarillo, [3]USDA-ARS, Bushland, TX*

This experiment was conducted to evaluate the effect of alkali treatment on in vitro and in situ digestibility of fiber sources. An in vitro and in situ experiment were conducted to determine the effects of treating sorghum WDG with solubles (SWDG) and corn stalks (CS) with calcium hydroxide on in vitro volatile fatty acid concentrations and methane production (Exp. 1), and in situ DM, OM, and NDF disappearance (Exp. 2). Treatments were arranged in a 2 x 4 factorial. Individual ingredient treatments include untreated SWDG, calcium hydroxide treated SWDG (2.67 % DMB), untreated CS, or calcium hydroxide treated CS (6.5 % DMB). Combination treatments include 2 parts SWDG: 1 part CS blend (both untreated), 2 parts SWDG: 1 part CS (both treated), 2 parts SWDG: 1 part CS (SWDG treated, CS untreated) and 2 parts SWDG: 1 part CS (SWDG untreated, CS treated). Treated ingredients were stored in containers for 7 d before blends were prepared. Two ruminally cannulated steers were adapted for 14 d to a finishing diet. In Exp. 1 in vitro incubation of the 8 treatments were conducted using an Ankom System. Bottles with 1.4 g of substrate and 150 mL of inoculum from both steers were incubated for 24 h at 39°C. In Exp. 2 treatment substrate was ruminally incubated for 0, 6, 12, 24, 36, and 48 h in triplicate. Data were analyzed using PROC MIXED of SAS. Alkali treatment of SWDG increased ($P < 0.01$) percent methane and CO2 in vitro. However, treatment of CS decreased percent CO_2 ($P < 0.05$) and tended to decrease ($P = 0.08$) methane compared with control in vitro. Alkali treatment of SWDG increased ($P < 0.01$) in situ DM digestibility compared with untreated SWDG (59.1 vs 52.7 ± 2.3%, respectively). No differences ($P = 0.46$) were determined between alkali treated and untreated CS (34.8 vs 36.6 ± 2.3%, respectively). Alkali treatment of SWDG and CS did not affect ($P = 0.91$ and 0.46, respectively) %NDF after the 48 h incubation period.

Keywords: calcium hydroxide, corn stalks, sorghum distillers grains

78 Effects of an injectable hay additive on hay quality and feeding preference of mature beef cows. *J. D. Rivera[*1], R. W. Lemus[2], J. A. White[2], and P. J. Slusher[1], [1]Mississippi State University, South Mississippi Branch Experiment Station, Poplarville, [2]Mississippi State University, Plant and Soil Sciences, Mississippi State*

Two studies were conducted to evaluate the use of an injectable hay additive on hay quality, and feed preference by mature beef cows. In Exp. 1, twelve round hay bales (bahiagrass) weighing approximately 385 ± 22.9 kg were allotted to 1 of 2 treatments: injection of a high protein hay additive at 8 mL/kg of hay (INJ), or no treatment (NONE). Hay samples were collected (six core samples per bale), before injection and at 4, 10, or 22 d post injection. Samples were subsequently analyzed for quality using NIR technology. Additionally, 4 bales (2 from each treatment) were weighed, sampled and placed in 2 large pastures where beef cows (n = 35, block 1 and 2; n = 42 block 3) had free choice access to the bales, and after 4 d, refusals were measured. Feed intake data were analyzed as a mixed model, with fixed effects of treatment, and random effects of block; quality data were analyzed as a mixed model with fixed effects of treatment, time, and any interactions, with block being a random effect. A time x treatment interaction ($P = 0.04$) was noted for ADF, with bales injected with additive decreasing in ADF in pre and post injection. No other statistical differences ($P > 0.10$) were noted for any other quality variable (NDF, CP, Ca, and P). Cows showed no preference between bales not injected and bales injected with additive ($P > 0.10$). In Exp. 2, 4 rates of treatment (0, 8, 16, or 24 mL of additive treatment per kilogram of hay) were hand mixed into loose hay to determine if increased levels of additive might improve quality. Following a 72 h period, grab samples were obtained, dried, ground and subsequently analyzed for quality variables using NIR technology. Data were analyzed as a linear model with fixed effects of treatment and orthogonal polynomials were used to determine response curve. A linear response ($P < 0.01$) was noted for all quality variables with forage quality increasing as level of additive increased. Results suggest that injection of a hay additive at recommended levels did not affect quality parameters, or feeding preference; however increasing the amount and/or method the additive was applied seemed to increase forage quality.

Keywords: beef cows, forage quality, hay additive

79 Effects of prepartum mineral supplement source on

composition of colostrum and milk in Brangus (BN) and Angus (AN) cows. *D. M. Price[1], J. M. Guevara[2], C. R. Trcalek[2], K. K. Arellano[3], D. M. Irsik[*2], D. O. Rae[2], M. J. Hersom[1], and J. V. Yelich[1], [1]University of Florida, Gainesville, [2]College of Veterinary Medicine, University of Florida, Gainesville, [3]University of Florida, Montrerde*

Effect of prepartum mineral supplement source on cow colostrum and milk composition was evaluated in mature pregnant AN (n = 20) and BN (n = 20) cows, which were allotted to 2 mineral supplements containing either inorganic (ING) or organic (ORG) trace minerals in a 2 x 2 factorial design. Mineral supplementation began approximately 90 d before expected parturition and continued through weaning. Colostrum (before calves suckling) and milk (30 d post-parturition) samples were collected by hand-milking and frozen at -20 °C for eventual mineral and milk composition analysis. Colostrum analysis (percentage basis) included fat, total protein, total solids, lactose, as-fed ash, moisture, and DM, and somatic cell count (SCC). Centrifuged colostrum was analyzed for trace minerals (Co, Cu, Fe, Mn, Mo, Se and Zn). Milk analysis (percentage basis) included fat, true protein, total solids, and lactose, plus milk urea nitrogen (MUN) and SCC. Data were analyzed using PROC GLM of SAS for treatment and breed effects. Treatment and breed did not affect ($P > 0.05$) colostrum fat (5.06 ± 0.42 %), total protein (16.67 ± 0.44 %), lactose (2.97 ± 0.08 %), DM (4.38 ± 0.13 %) or SCC (7.4 ± 1.0 X 10^6 cells/mL). Colostrum total solids were greater ($P \leq 0.05$) for AN (27.10 ± 0.89 %) than BN (24.56 ± 0.86 %). The BN (75.44 ± 0.89 %) had greater ($P \leq 0.05$) colostrum moisture than AN (72.89 ± 0.86 %). Colostrum as-fed ash tended ($P = 0.07$) to be greater for AN (1.15 ± 0.03 %) than BN (1.06 ± 0.03 %). Colostrum had no detectable concentrations of Co, Cu, Fe, Mn, or Mo. However, Zn was greater ($P > 0.05$) for AN (90.80 ± 2.15 µg/g) than BN (79.30 ± 2.15 µg/g). A treatment by breed interaction ($P = 0.03$) was observed for selenium colostrum (AN-ORG, 0.86 ± 0.06; BN-ING, 0.88 ± 0.06; AN-ING, 0.74 ± 0.07; BN-ORG, 0.72 ± 0.07 µg/g). Treatment and breed did not affect ($P > 0.05$) milk fat (1.98 ± 0.23 %), true protein (3.07 ± 0.06 %), total solids (10.89 ± 0.24 %), lactose (5.11 ± 0.06 %) and SCC (3.2 ± 1.7 X 10^5 cells/mL). The MUN was greater ($P = 0.02$) for BN (12.12 mg/dL) than AN (9.40 ± 0.75 mg/dL). Results indicate breed had more effect on colostrum and milk composition than prepartum mineral supplement treatment.

Keywords: colostrum, composition, minerals

80 Effects of prepartum mineral supplement source on cow colostrum and neonatal calf serum immunoglobulin concentration. *D. M. Price[*1], J. M. Guevara[2], C. R. Trcalek[2], K. K. Arellano[3], D. M. Irsik[2], M. J. Hersom[1], J. V. Yelich[1], and D. O. Rae[2], [1]University of Florida, Gainesville, [2]College of Veterinary Medicine University of Florida, Gainesville, [3]University of Florida, Montrerde*

The objective of this study was to examine the effects of prepartum mineral supplement on neonatal calf serum and colostral immunoglobulin (Ig). Mature pregnant Angus (n = 20) and Brangus (n = 20) cows were allotted to 2 mineral supplements containing either inorganic (ING, salt sulfates) or organic (ORG, chelated complexes) trace minerals in a 2 x 2 factorial design. Cow mineral supplementation started approximately 90 d before expected parturition and continued to weaning. At parturition, colostrum was collected by hand-milking before calves suckled. Calf serum was collected at 0 (pre-suckling), 12, and 24 h and 30 d of age. Calf serum and colostrum samples were frozen at -20 °C until quantification of concentrations of IgG, IgM, and IgA which were determined by single radial immunodiffusion. Total Ig (TIg) concentrations for calf serum and colostrum were calculated by summing all Ig concentrations. Data were analyzed using PROC GLM of SAS for each sample time with treatment and breed as fixed effects. Colostrum Igs were not affected by breed ($P \geq 0.05$), or treatment ($P \geq 0.05$); mean concentrations were 11,112 ± 491, 415 ± 30, 536 ± 41, and 12,063 ± 515 mg/dL for IgG, IgM, IgA and TIg, respectively. At 0 h, calf serum had no detectable IgG, IgM, and IgA values. Calf serum IgG and IgM concentrations at 12 h and 24 h were not affected ($P \geq 0.05$) by treatment or breed. However, ORG calves had greater IgA concentrations than ING calves at 12 ($P = 0.04$; ORG = 287.9 mg/dL, ING = 202.8 mg/dL) and 24 h ($P = 0.03$; ORG = 290.3 mg/dL, ING = 195.2 mg/dL). Treatment had no effect ($P > 0.05$) on 12 h calf TIg concentrations; but at 24 h, ORG calves tended to have greater ($P = 0.06$) TIgs than ING calves. There was no breed effect or interaction for TIgs at 12 ($P > 0.05$) or 24 h ($P > 0.05$). At 30 d of age, ORG calves (1653 mg/dL) had greater ($P = 0.04$) IgG concentrations than ING (1,273 mg/dL) calves. Organic mineral supplementation provided to gestating cows increased calf Ig concentrations after birth and at 30 d of age. Enhanced Ig concentrations may provide calves greater protection from infectious disease agents during vulnerable periods in their life.

Keywords: immunoglobulins, mineral, prepartum

81 Evaluation of hair coat shedding and cow/calf performance of two sources of Angus cattle under Florida subtropical conditions. *J. D. Arthington[*] and J. M. B. Vendramini, UF/IFAS, Range Cattle Research and Education Center, Ona, FL*

Results from a study comparing production traits and adaptability attributes of embryo-derived Angus genetics sourced from Florida (local-source) and Kansas (outside-source) herds were previously published (J. Anim. Sci. 2011. 89:2265). The local-source herd was primarily a closed herd with selection criteria placed mainly on female longevity, while the outside-source herd was comprised of modern Angus genetics. Females from that study (n = 16 and 10 from local- and outside-sources, respectively) were used in the current study to evaluate hair coat shedding and performance of cow/calf pairs over 3 consecutive year. At the start of the study, cows were 5 to 7 yr of age. Within year, cows were exposed to a common Angus sire over a 90-d breeding season beginning in early January. In each of 3 yr, cow/calf pairs were evaluated for BW, cow BCS (1 to 9 scale; 1 = emaciated and 9 = obese), and hair coat score (1 to 5 scale; 1 = slick, short coat and 5 = full winter coat) in March, April, May, and June. In March only, cow milk production was estimated using the calf weigh-suckle-weigh technique. Data were analyzed using the mixed

procedure of SAS with cow(source x year) as the random effect. Calf BW in March and ADG over the 90-d evaluation period (adjusted for sex) was greater ($P \leq 0.005$) for outside- vs. local-source dams (105 vs. 93 kg, SEM = 3.2 and 0.86 vs. 0.77 kg/d, SEM = 0.027, respectively). Cow BW did not differ between sources ($P \geq 0.18$) in March or April; however, cow BCS was less for outside- vs. local-source dams in both March and April (3.3 vs. 4.3, SEM = 0.16 and 4.1 vs. 4.9, SEM =0.19, respectively). Local-sourced dams had slicker hair coat scores ($P \leq 0.04$) in the early spring (March and April; 3.0 vs. 3.7, SEM = 0.23 and 2.3 vs. 2.9, SEM = 0.22, respectively), but similar hair coat scores in May and June (mean = 1.8 and 1.3, respectively) compared with outside-source dams. Outside-source dams had 74% greater ($P < 0.001$) milk production compared with local-sourced dams (4.90 vs. 2.81 kg/d, respectively; SEM = 0.449). These results suggest that cows from the local-sourced herd, selected primarily for longevity traits in Florida, have slicker spring hair coats and produce less milk compared with the outside-source herd, which is more representative of modern Angus genetics used throughout the industry.

Keywords: Angus, calf, cow, hair coat

82 Effectiveness, reproducibility, and repeatability of estimating beef cattle age via dentition. *T. F. Best*[*1], J. A. Parish[1], R. C. Vann[2], and J. D. Rivera[3], [1]North Mississippi Research and Extension Center, Prairie Research Unit, Prairie, MS, [2]MAFES-Brown Loam, Mississippi State University, Raymond, [3]Coastal Research and Extension Center, White Sand Unit, Poplarville, MS*

Information is lacking regarding the use of dentition for estimating animal age in modern cattle populations within the U.S. The objectives of this study were to assess the effectiveness, reproducibility, and repeatability of dental evaluation for estimating cattle age. Three independent trained technicians observed teeth and gums of crossbred beef cows and heifers (n = 400) aged 1.5 to 20 yr at the North Mississippi Research and Extension Center Prairie Research Unit in Prairie, MS to estimate animal age. Four weeks later, a subset (n = 383) of these cattle were evaluated again by the same observers. Actual cattle ages were determined via birth records. The GLM and CORR procedures in SAS were used for data analyses. Cattle were classified by actual age as: <5 yr (YOUNG), 6 to 10 yr (MIDDLE), and >11 yr (OLD). There was a BCS x age group interaction ($P < 0.01$) in explaining the difference of estimated and actual age. Cattle age overestimation increased as BCS exceeded 6 in YOUNG cattle. Cattle age was overestimated in MIDDLE cattle assigned a BCS of 4 and underestimated at BCS 5 through 9 with underestimation of age increasing beyond a BCS of 7. Underestimation of cattle ages by greater than 1 yr occurred in OLD cattle with BCS 4 or less and 6 or more. Individual animal age was both underestimated and overestimated as much as 9.5 yr. Across all observers and observation dates, 95.7%, 81.5%, and 62.1%, respectively, of YOUNG, MIDDLE, and OLD cattle age estimates were within 2 yr of actual ages. Observers agreed on greater than 9 out of 10 age estimates within 1 yr in YOUNG cattle and 8 out of 10 age estimates within 3 yr in MIDDLE and OLD cattle. Very strong positive ($P < 0.01$) inter-observer correlations occurred when scoring YOUNG cattle at the second observation event, with all correlations being 0.93739 or greater. Results suggest that cattle age estimation by way of dental assessment is more reproducible than repeatable. Observers can be very consistent with one another in reproducing age estimations in YOUNG cattle via the dental examination method. These results should be coupled with economic valuations of cattle age and dental condition when using dental-based age estimates for cattle production and marketing decisions.

Keywords: age, dentition, teeth

83 Benchmarking beef quality assurance defect rates in market cows sold at public auctions in Mississippi. *J. A. Parish* and T. F. Best, North Mississippi Research and Extension Center, Prairie Research Unit, Prairie, MS*

Current benchmarks for incidence of Beef Quality Assurance defects are lacking in Southeast U.S. market cow populations. The objective of this study was to quantify incidence rates of various Beef Quality Assurance defects in market cows sold at public auctions in Mississippi. Trained observers attended weekly public livestock auctions in Mississippi during spring and summer 2014 and recorded the following information on market cows sold (n = 2,389): BCS, horn presence and length, udder score, teat score, number and location of lumps, presence of excessive hair, presence of excessive mud, stale appearance, sick appearance, number of injuries, type of injuries, eye score, locomotion score, temperament score, number of brands, location of brands, presence of screw claw, and presence of long toes. Cows with a BCS < 4 accounted for 10.3% of the observations. Horned cows represented 9.8% of the cattle sold, and horn length was > 12.7 cm in 6.5% of the horned cattle. Cows with loose or very loose udder attachments were 7.2 and 3.1%, of the sample, respectively. Teat size was rated as large or very large in 4.4 and 1.6% of the cows, respectively. Incidence rates were as follows: excessive hair (4.6%), excessive mud (0.8%), injury (4.0%), lumps, (1.6%), stale appearance (0.5%), sick appearance (0.1%), and long toes (1.8%). Temperament was rated as very nervous or extremely aggressive in 4.8 and 5.6% of the cows, respectively. Single brands were observed on 8.8% of the cows; whereas 1.0% of the cows had multiple brands. Cases of cancer eye in which the bony tissue around the eye was affected or the eye was prolapsed were 0.3% and 0.4%, respectively. Relative to information reported for Western U.S. market cow populations, lesser defect rates in Mississippi market cows were observed for BCS < 4, brand presence, and sick appearance; but greater rate of foot abnormalities in Mississippi market cows was documented. The information gleaned from this project can be used to focus Beef Quality Assurance training efforts to address defects of greatest concern and relative incidence. Future calculation of price differentials associated with these defects will provide economic justifications that help prioritize improvement efforts.

Keywords: Beef Quality Assurance, cattle market, market cow

84 Performance and activity of fall-born calves weaned in the morning or evening. *T. S. Begley*[*1], *J. T. Richeson*[1], *J. G. Powell*[2], *S. L. Roberts*[1], *B. C. Shanks*[3], *J. D. Caldwell*[3], *and E. A. Bailey*[1], [1]*Department of Agricultural Sciences, West Texas A&M University, Canyon,* [2]*Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville,* [3]*Department of Agriculture and Environmental Sciences, Lincoln University, Jefferson City, MO*

Fall-born crossbred calves (n = 96; initial BW = 199 ± 30 kg) were blocked by sex, stratified by body weight, and assigned randomly to morning (AM) or evening (PM) weaning and subjected to a 21-d ranch-of-origin preconditioning period. Weaning times were targeted to be within 2 h of sunrise and 2 h before sunset. Calves were weaned at 241 ± 14 d of age, and placed into *Cynodon dactylon* pastures (13.8% CP, 36% ADF) according to treatment (n = 3 pastures·treatment^{-1}·sex^{-1}). Calves were allowed access to self-fed mineral, but not supplemented during preconditioning. Calves received vaccinations against viral and clostridial pathogens at the time of weaning and were revaccinated 14 d later. No calves were treated for illness during the course of this experiment. Cow-calf pairs were sorted 7 d before weaning (d -7) to prevent confounding on the day of weaning by imposing additional handling on PM calves. On d -7, steer calves (n = 48) were restrained in a squeeze chute and fitted with 3-axis accelerometers on the metatarsus of the rear left leg. The 3-axis accelerometers continuously recorded step count, standing and lying duration, lying bouts, and motion index. Calves were weighed on d 0, 14, and 21. Body weight at weaning and shipping did not differ ($P \geq 0.47$) between treatments. Body weight change during the first 14 d of preconditioning was greater ($P = 0.01$) for PM calves than AM calves, but did not differ between d 14 and 21 ($P = 0.13$). Preconditioning average daily body weight gain (d 0 to 21) was similar ($P = 0.28$) between AM and PM groups. Treatments did not differ ($P \geq 0.45$) in the proportion of time spent standing or lying or the number of lying bouts per day, during preconditioning. However, timing of weaning did impact the number of steps taken (treatment x date; $P = 0.01$) per day; AM calves had a greater step count ($P < 0.01$) the day of weaning (d 0). Conversely, PM calves had a greater ($P \leq 0.04$) step count on d 2 and 3. During preconditioning and under conditions of the experiment, weaning in the evening had a transient improvement in calf performance and decreased step count on the day of weaning when compared with morning weaning.

Keywords: beef cattle, behavior, preconditioning, weaning

85 Increasing the metabolizable protein supply enhanced growth performance and led to variable results on innate and humoral immune response of preconditioning beef steers. *P. Moriel*[*1], *L. F. Artioli*[1], *M. H. Poore*[2], *D. H. Poole*[2], *R. Marques*[3], *and R. F. Cooke*[4], [1]*North Carolina State University - Mountain Research Station, Waynesville,* [2]*North Carolina State University, Raleigh,* [3]*Oregon State University, Burns,* [4]*Oregon State University - EOARC Burns, Burns*

We evaluated the effects of metabolizable protein (MP) supply on growth performance, and measurements of innate and humoral immune response of beef steers following vaccination. Angus steers (n = 36; 231 ± 21 kg; 184 ± 18 d) were weaned on d 0, stratified by body weight and age on d 7, and randomly assigned into 1 of 18 drylot pens (2 steers/pen). Treatments were assigned to pens (6 pens/treatment), and consisted of isocaloric, corn silage-based diets formulated to provide 85, 100 or 115% of the daily MP requirements of a beef steer gaining 1.1 kg/d. Diets were provided at 2.1% of BW (DM basis) from d 7 to 49. Steers received a preconditioning vaccination protocol on d 21 and 35. Blood samples were collected from jugular vein on d 0, 21, 22, 24, 28, 35, 36, 37, 42 and 49 to determine the plasma concentrations of haptoglobin (Hp) and ceruloplasmin (Cp), and serum titers against Bovine Viral Diarrhea Virus-1b (BVDV1b) and Infectious Bovine Rhinotracheitis (IBR). Body weight did not differ ($P \geq 0.18$) from d 0 to 35, but was greatest ($P \leq 0.05$) for 115MP, least for 85MP, and intermediate ($P \geq 0.21$) for 100MP steers on d 49 (297, 278, and 290 ± 7 kg, respectively). From d 7 to 49, 100MP and 115MP steers had similar ADG ($P = 0.13$), but both had greater ($P < 0.001$) ADG than 85MP steers (1.20, 1.35 and 0.83 ± 0.068 kg/d, respectively). A treatment x time effect was not detected ($P = 0.46$) for plasma Hp concentrations. Plasma Cp concentrations were least ($P \leq 0.08$) for 115MP steers on d 28, 42 and 49, but similar ($P \geq 0.66$) between 85MP and 100MP steers on d 28 and 42. Treatment and treatment x time effects were not detected ($P \geq 0.42$) for positive seroconversion to BVDV1b and IBR, and serum titers against IBR. However, serum titers against BVDV1b were greatest ($P \leq 0.02$) for 115MP steers, and similar ($P = 0.37$) between 85MP and 100MP steers on d 49 (5.8, 3.7 and 3.0 ± 0.60 base 2 log, respectively). In summary, increasing the metabolizable protein supply to preconditioning beef steers enhanced the growth performance and serum titers against BVDV1b, but did not affect plasma haptoglobin concentrations, positive seroconversion to BVDV1b and IBR, and serum titers against IBR.

Keywords: immune, preconditioning, protein, steers,

86 Effect of crude protein levels and metaphylaxis during the stocker receiving phase on feedlot and carcass performance. *T. J. Braud*[*], *B. B. Karisch, D. R. Smith, C. L. Huston, and S. G. Genova, Mississippi State University, Mississippi State*

Newly received stocker calves typically have low feed intake and are at risk for bovine respiratory disease (BRD). The objectives of this study were to evaluate the effects of: 1) metaphylactic antibiotic administration (none or Excede on arrival); and 2) receiving diet crude protein levels (12% or 18% CP) for calves received into a stocker system on finishing and carcass performance. For the stocker phase, steers (n = 244) were stratified by body weight and randomly assigned to 20 pens. Treatments were randomly assigned to pen in a 2x2 factorial study design. During the stocker phase 176 calves (72%) were treated for BRD and 32 calves (13%) died. In the 60 d stocker study, metaphylactic treatment was associated with reduced morbidity (RR = 0.4, $P < 0.001$) and calves receiving 18% CP gained an additional 0.19 kg/d ($P = 0.0008$). A subset of steers (n = 76, average BW = 302 ± 16.7 kg), with a minimum BW of 227 kg and 19 animals/treatment, were sent

to Tri County Steer Carcass Futurity in Lewis, IA. Cattle were finished to a target of 1 cm backfat, and harvested in 2 groups. Ractopamine hydrochloride was fed to the 2nd harvest group for 28 d. Continuous outcomes were tested using generalized linear mixed models accounting for clustering by pen. Treatment effects on feedyard morbidity and mortality were not tested as only 2 calves (2.6%) were treated for BRD. There was no effect of receiving CP level on feedlot or carcass performance. Cattle receiving metaphylactic treatment gained an additional 0.10 kg/d (P = 0.04), and produced 13.2 kg heavier carcasses (P = 0.003). Cattle treated for BRD in the stocker phase gained an additional 0.10 kg/d (P = 0.04, n = 43), produced 10.5 kg heavier carcasses (P = 0.02) and had 0.22 cm greater fat thickness (P = 0.005). For every additional 1 kg of BW at the end of the stocker phase, HCW increased by 0.35 kg (P < 0.0001), and LM area was increased by 0.07 cm^2 (P = 0.0007). Logistic regression was used to test factors associated with yield grade and quality grade accounting for clustering by pen. Neither treatment was associated with quality grade (P > 0.30). Cattle not receiving metaphylaxis had 4.6 greater odds for having a yield grade of 1 or 2 (P = 0.03). Health and management during the stocker phase can impact feedlot and carcass performance.

Keywords: beef cattle, bovine respiratory disease, metaphylaxis

RUMINANT ANIMAL PRODUCTION II

87 Effects of excess dietary sulfur on growth performance, sulfhemoglobin concentrations, and tissue mineral concentrations in growing-finishing beef cattle. *J. Hawley, E. B. Kegley*, J. L. Reynolds, D. L. Galloway, and J. A. Hornsby, Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville*

A study was conducted to evaluate the effects of excess dietary S on BW gain, feed conversion, sulfhemoglobin concentrations, and plasma, liver, and *longissimus* muscle (LM) mineral concentrations in growing-finishing cattle. Twenty beef steers (initial BW = 279 ± 60.4 kg) were blocked by BW and assigned randomly to 1) no additional S (~ 0.15% S) or 2) high S (0.40% S; as Na_2SO_4). Steers grazed fall pastures (n = 6; 3-4 steers/pasture) and were offered corn and soybean meal supplements (1.8 kg/d) for a 114-d growing phase. Steers were moved to feedlot pens (n = 16; 1 to 2 steers/pen), remained on prior dietary treatments, and received corn and soybean meal rations for a 123-d finishing phase. Animal feed intake was measured during the finishing phase. Body weight and blood samples were collected every 28 d. Liver samples were collected immediately postmortem. Longissimus muscle samples were collected from 2.54-cm-thick steaks obtained from rib sections aged 14 d at 4°C before fabrication. Steers were slaughtered at an average BW of 565 ± 38.4 kg. Dietary S did not affect ADG during the growing phase (P = 0.52). During the finishing phase, however, steers fed 0.40% S tended to have less ADG (P = 0.07) and less DMI (P < 0.001) than steers that did not receive additional S. Finishing phase G:F did not differ (P = 0.30) between dietary S levels. Dietary S tended (P = 0.15) to affect the incidence of bloat. Steers fed 0.40% S were 0.55 (95% confidence interval = [0.24, 1.26]) times more likely to experience bloat. While sulfhemoglobin concentrations remained within normal limits throughout the study, a treatment × day interaction (P < 0.01) was observed. Dietary S did not affect plasma Zn concentrations (P = 0.42). Although steers maintained normal plasma Cu concentrations throughout the study, steers fed 0.40% S had decreased plasma Cu concentrations (P < 0.01). Dietary S did not affect the majority of liver mineral concentrations (P ≥ 0.24), however, steers fed 0.40% S had greater liver Ca (P < 0.05) concentrations. While dietary S did not affect the majority of LM mineral concentrations (P ≥ 0.35), steers fed 0.40% S tended to have reduced Cu and Ca LM mineral concentrations (P = 0.11). These results suggest that supplementing beef cattle diets with 0.40% S had no appreciable effects on steer performance, sulfhemoglobin concentrations, or plasma, liver, and LM mineral concentrations.

Keywords: cattle, production, sulfur

88 Effect of residual feed intake classification on energy metabolism in growing heifers. *T. P. Vining*[1], P. A. Lancaster[1], N. DiLorenzo[2], H. Monaco[1], S. Cross[2], and G. C. Lamb[2], [1]Range Cattle Research and Education Center, Ona, FL, [2]North Florida Research and Education Center, Marianna*

Residual feed intake (RFI) is a trait used in selection programs to improve feed efficiency. The objective of this study was to determine energy expenditure in low and high RFI heifers. Angus crossbred heifers (n = 45; initial BW = 345 ± 35 kg) were fed a high roughage growing diet (ME = 2.17 Mcal/kg DM) for 70 d. Feed intake was recorded daily using the GrowSafe feed intake system and BW was recorded every 14 d. Residual feed intake was calculated as the residual from the regression of DMI on mid-test $BW^{0.75}$ and ADG (R^2 = 0.31). Heifers were separated into low, medium, and high RFI groups based on 0.5 SD from the mean (0.00 ± 1.85 kg/d). Low (n = 8) and high (n = 8) RFI heifers were selected to determine heat production at 3 levels of intake: ad libitum, 1.0X maintenance, and 0.5X maintenance. Oxygen consumption and heart rate were recorded simultaneously for 30 min in the morning and afternoon at each feeding level to compute oxygen pulse (O2P; oxygen/heart beat). Heart rate was also measured continuously for 48 h. Daily heat production (HP) was then calculated as the product of O2P, average 48-h heart rate, 1440 min/d, and 4.90 kcal/L oxygen. The natural logarithm of HP was regressed on metabolizable energy intake to calculate metabolizable energy required for maintenance (MEm) and fasting HP (FHP). Efficiencies of ME used for maintenance (km) and growth (kr) were calculated from FHP, ad libitum retained energy, and MEm. Data were analyzed using the MIXED procedure of SAS with the fixed effect of RFI group. During the RFI measurement period, low RFI heifers consumed 31% less (P < 0.01) DM and had 47% greater (P < 0.01) G:F than high RFI heifers, even though final BW and ADG were similar. During the HP measurement period, ad libitum intake did not differ between low and high RFI heifers. High RFI heifers had less (P < 0.01)

MEm (90.9 vs. 110.6 ± 6.2 kcal/kg$^{0.75}$) and FHP (69.0 vs. 80.9 ± 2.8 kcal/kg$^{0.75}$) than low RFI heifers. There was no difference in km (0.738 and 0.736 ± 0.03) and kr (0.641 and 0.611 ± 0.08) between RFI groups. These data indicate that selection for more feed efficient low RFI heifers may not lead to improved energy efficiency in growing heifers.

Keywords: energy expenditure, heifers, residual feed intake

89 Developing heifers on stockpiled, dormant native forages delays gain without altering reproductive performance. *S. R. Edwards*[*1], *J. D. Rhinehart*[2], *R. L. Nave*[3], *and J. T. Mulliniks*[3], [1]*University of Tennessee, Knoxville,* [2]*University of Tennessee, Spring Hill,* [3]*University of Tennessee, Crossville*

Stockpiling forages for winter grazing is an economical alternative to feeding harvested feedstuffs. However, developing heifers on stockpiled forages may have a negative impact on productivity due to restricted growth during a crucial developmental period. Therefore, the objective of this experiment was to determine growth and reproductive performance of developing yearling heifers grazing stockpiled forages. Spring-born, crossbred heifers (n = 105) were stratified by BW to 1 of 3 stockpiled forage types (n = 7 replicates/treatment) at weaning: (1) endophyte-infected tall fescue (TF), (2) big bluestem and indiangrass combination (BI), or (3) switchgrass (SG). Grazing stockpiled forage pastures was initiated in January and terminated at the onset of a 60-d breeding season in April. Heifers were fed twice per week at a rate of 0.18 kg·heifer^{-1}·d^{-1} of CP. Body weights and BCS were recorded ever 28-d of the study. All heifers were maintained together before and after the grazing period on tall fescue pastures. Heifer BW were taken monthly from initiation of grazing until breeding and again at overall pregnancy detection in September. Pregnancy detection occurred 30 d after timed AI and again in September of every year. Initial BW in January were not different (P = 0.83; 328, 327, and 330 ± 4 kg for BI, TF, and SG; respectively) among forage types. However, ADG for January to February and February to March were decreased (P < 0.01) in heifers grazing BI and SG pastures. From March to April, ADG was not different (P = 0.78) among forage types. However, from April until September, heifers grazing the low-quality native dormant forage pastures compensated and outgained (P < 0.05) heifers developed on stockpiled tall fescue pastures. Overall, heifers developed on TF pastures did have greater (P < 0.01; 423, 438, and 413 ± 5 kg for BI, TF, and SG; respectively) BW at pregnancy detection (September) than BI and SG pastures. Even with restricted growth in BI and SG heifers, timed AI pregnancy rates were 67, 51, and 56% for TF, BI, and SG heifers (P = 0.32), respectively. In addition, overall pregnancy rates were 90, 89, 92% for TF, BI, and SG heifers (P = 0.83), respectively. Results from this study indicate that stockpiling native warm-season forages for winter grazing of yearling beef heifers restricts growth without decreasing reproductive performance.

Keywords: heifers, reproduction, stockpiled forages

90 Effects of offering cows mineral containing Altosid IGR on growth of beef calves. *T. D. Harrison*[*] *and E. Felton, Division of Animal and Nutritional Sciences, West Virginia University, Morgantown*

Flies can reduce productivity in cattle by way of disease transmission or stress. The objective of this study was to determine the effect of offering beef cows free-choice mineral containing Altosid IGR on the growth of calves before weaning. Cow-calf pairs were randomly assigned to 1 of 3 treatments and grazed for 64 d. Treatments included 1). non-medicated mineral without fly control, 2). non-medicated mineral with fly tags (both cows and calves) and 3). medicated mineral containing Altosid IGR (2,880 g/ton Chlorteracyline, 90.80 g/ton, S-Methoprene). Body weights were collected on d 1, 28 and 64 and BW gains reported on d 1 to 28 (period1), 28 to 64 (period2) and overall. Facial fly counts were taken at the beginning (d 2, 3), middle (d 31, 32) and end of the trial (d 63). Fly traps were utilized to collect representative fly types (flesh, face, house, horn, stable and blow) on d 9, 16, 31, 37, 44, 58 and 64. Mineral intake was similar between treatments (81.65kg/d). All data were analyzed using the GLM procedures of SAS. There were no treatment effects on calf ADG period1 (1.13 kg/d; P = 0.93), period2 (1.06 kg/d; P = 0.28) and overall (1.09 kg/d; P = 0.19). There were no treatment effects on cow ADG during period1 (-0.41 kg/d; P = 0.13) or period2 (-0.29 kg/d; P = 0.35). However, there was a trend (P = 0.08) for a treatment effect on cow ADG overall. Cows on treatment 2 lost more BW than the other 2 treatments. Numerically, cows offered mineral with Altosid IGR lost the least amount of BW. There were no treatment effects on cow and calf facial fly counts on d 2 (P = 0.16; P = 0.50), 31 (P = 0.49; P = 0.13) and 63 (P = 0.73; P = 0.27), respectively. However, there were treatment effects on cow-facial-counts on day 32 (P = <0.01) and calf-facial-counts on d 3 (P = 0.02) and 32 (P = 0.01). There were no treatment effects (P > 0.11) on fly type found on fly traps. In this study, overall fly load was relatively low throughout the grazing period. Although there were no direct effects of offering cows medicated Altosid IGR mineral on calf performance, fly induced stress on cows with calves may have been reduced, as they had less weight loss during this study.

Keywords: Altosid IGR, beef cattle, flies

91 Validation of skin biomarkers for copper deficiency in beef cattle. *J. G. Carter*[1], *J. Haffner*[1], *J. Carlton*[1], *S. Cui*[1], *J. D. West*[2], *and W. W. Gill*[*1], [1]*Middle Tennessee State University, Murfreesboro,* [2]*Vanderbilt University, Nashville, TN*

Copper deficiency is one of the most common micronutrient problems in beef cattle, which could cause multiple health consequences such as poor reproductive performance. Currently, there exists no reliable test for detecting copper deficiency aside from a liver biopsy, which is an inconvenient procedure. We previously used gene expression arrays in an unbiased discovery approach to identify genes whose expression correlate with moderate copper deficiency in beef cattle using both skin and blood samples. The training cohort used a

group of 15 Angus crossbred heifers (12 to 14 mo).For a validation cohort, we collected hair coat scores (1 to 5 scale), skin samples, blood samples, and liver biopsies from a group of Angus crossbred cows (n = 15) at the Middle Tennessee State University Beef Unit. Blood and liver samples were sent to a commercial laboratory for mineral analysis. RNA was isolated from blood samples and homogenized skin samples flash frozen by liquid nitrogen. Copper deficiency in these animals was at worst moderate, but liver copper concentrations were not significantly correlated with either serum copper concentrations or hair coat scores. Liver copper correlated weakly with serum selenium, cobalt, and zinc (P = 0.07, 0.02, and 0.09, respectively, by z-correlation test), possibly indicating a supplementation effect. Quantitative reverse transcriptase PCR was used on blood and skin RNA in the validation cohort to quantify expression of genes identified as copper-responsive from the training cohort. Our results fell into 3 categories: I) Genes that correlated well with copper concentrations in both the training and validation cohorts, II) Genes that correlated well with copper concentrations in the training cohort, but with coat score (and not copper concentrations) in the validation cohort, and III) Genes that correlated with copper concentrations in the training cohort, but with different metals in the validation cohort. These results suggest that some of the genes identified in the training cohort were more related to general mineral deficiency rather than copper deficiency specifically (set II) or to copper deficiency at an earlier time, as apparent in coat condition (set III). However, the existence of a class of genes with close correlation to liver copper deficiency, especially when combined in a regression model, in both training and validation cohorts supports the creation of a simple skin test for copper deficiency with high sensitivity and specificity. This would be useful in the detection of mild to moderate copper deficiency found in well managed herds.

Keywords: copper deficiency biomarker

92 Associations among cytochrome P450 3A28 polymorphisms, anabolic steroids, and stress response of calves. *M. A. Sales*[*1], *S. Tabler*[2], *M. L. Looper*[1], *J. M. Burke*[2], *and C. F. Rosenkrans, Jr.*[1], [1]*University of Arkansas, Fayetteville,* [2]*USDA-ARS, Booneville, AR*

Previous work identified associations between cattle performance and single nucleotide polymorphisms (SNP) in cytochrome P450 3A28 (CYP3A28). Our objective was to evaluate the interactive effects of CYP3A28 SNP genotype and anabolic implants on calf stress response. On d 0, calves were randomly assigned to 1 of 4 treatments: 1) intact bulls (n = 20), 2) banded bulls (n = 20), 3) banded bulls with an androgenic implant (Revalor-G; n = 20), and 4) banded bulls with an estrogenic implant (Ralgro; n = 20). On d 14, calves were transported approximately 26 km to a local auction barn and penned for 24 h. Whole blood was collected from weaned, crossbred male calves (n = 80; BW ~ 250 kg) at 4 time points (d 13, 14, 15, and 16) from onset of implant treatments. Genomic DNA was isolated from buffy coat and genotyped for 2 SNP (T78G and C979G) in CYP3A28. Prolactin, cortisol, prolactin:cortisol, and calf BW gain during the stress period were the dependent variables. Concentrations of prolactin varied (P < 0.05) by day (55, 85, 96, and 32 ng/mL, SE = 16; respectively for d 13, 14, 15, and 16). Day also affected (P < 0.05) cortisol concentrations (23, 37, 32, and 30 ng/mL, SE = 3; respectively for d 13, 14, 15, and 16). Cortisol tended (P < 0.1) to be affected by genotype and treatment. Ratio of prolactin to cortisol was affected by an interaction (P < 0.05) of treatment by day, and the 3-way interaction (P < 0.05) of treatment by day by genotype at C979G. Bulls on d 13 had the greatest (P < 0.05) prolactin:cortisol, and for the 3-way interaction, bulls with CC genotype at C979G on d 13 had the greatest (P < 0.05) prolactin:cortisol. Calf BW varied during the stress period; however, treatment, genotype, and their interaction were not significant sources of variation. Our findings confirm biological responses to management strategies, in this case steroid implants, interact with genetic composition and collectively impact calf stress response. Ratio of prolactin and cortisol may serve as a sensitive indicator of animal stress response.

Keywords: cytochrome P450, prolactin:cortisol, stress

93 Withdrawn

SMALL RUMINANT PRODUCTION I

94 Effects of method of determining heat energy:heart rate of confined and grazing Boer goats. *M. E. Brassard*[1,2], *R. Puchala*[*2], *T. A. Gipson*[2], *T. Sahlu*[2], *and A. L. Goetsch*[2], [1]*Universite Laval, Quebec City, QC, Canada,* [2]*American Institute for Goat Research, Langston University, Langston, OK*

Heat energy (HE) of 11 yearling Boer goat wethers (43.4±1.4 kg) consuming fresh Sudangrass ad libitum while confined in 1.2 × 1.2 m pens (Conf) or grazing a 0.8-ha pasture (G) was determined in a crossover from heart rate (HR) measured over 24 h and the ratio of HE to HR (HE:HR) estimated 2 ways. The BARN method involved a prior period in metabolism cages with head-boxes of an indirect calorimetry system measuring oxygen production and emission of carbon dioxide and methane for 24 h (i.e., 96 individual measurements) while consuming a moderate quality grass hay. The SPOT method entailed a portable face mask system measuring oxygen consumption and carbon dioxide production for 5 min while standing near grazing and confinement areas at 08:00, 12:00, 16:00, and 2000 h, after 30 min of adaptation. With both methods, HR, HE, and HE relative to $BW^{0.75}$ (HEMBW) were greater (P < 0.01) for G vs. Conf. There was no difference (P > 0.05) between methods for Conf in HR (76.4 and 70.0 beats/min; SE = 2.68), HE (8.4 and 7.9 MJ/d; SE = 0.20), HEMBW (485 and 455 kJ/kg $BW^{0.75}$; SE = 10.7), or HE:HR (6.420 and 6.573 kJ/kg $BW^{0.75}$ per heart beat for BARN and SPOT, respectively; SE = 0.1939). For G, HR (100.9 and 92.5 beats/min; SE = 2.35; P <0.01), HE (11.2 and 9.7 MJ/d; SE = 0.38; P < 0.01), HEMBW (646 and 566 kJ/kg $BW^{0.75}$; SE = 17.4; P < 0.01), and HE:HR (6.335 and 6.114 kJ/kg $BW^{0.75}$ per heart beat/min; SE = 0.1540; P = 0.046) were greater for BARN vs. SPOT (P < 0.01). There was a treatment × time interaction (P < 0.01) in HR, HE, and HEMBW with SPOT, as well as a trend (P = 0.100) in HE:HR.

Accordingly, greater (P < 0.01) HE was observed at 1600 vs. 0800 and 1200 h (Conf: 7.5, 7.6, 8.2, and 7.9; G: 9.2, 8.9, 10.7, and 10.3 MJ/d at 0800, 1200, 1600, and 2000 h, respectively; SE = 0.33), HE:HR tended to be also greatest at 1600 vs. 0800 and 1200 h (Conf: 6.390, 6.643, 6.847, and 6.375; G: 5.988, 5.795, 6.562, and 6.158 kJ/kg $BW^{0.75}$ per heart beat at 0800, 1200, 1600, and 2000 h, respectively; SE = 0.2299). In conclusion, though HE:HR differed between methods, the relatively small magnitude (i.e., 4.7%) indicates that both could be used to estimate HE based on HR in grazing or confined settings; however, multiple measurements would be beneficial with SPOT to address potential differences among times of the day.

Keywords: activity, energy, goats

95 Effects of creep feeding on weaning weight and market value of meat goat kids. *R. Browning, Jr.*[*1], *R. V. Lourençon*[2], *J. L. Groves*[1], *D. Garcia*[3], *L. Wang*[1], *and A. Aldridge*[1], [1]*Tennessee State University, Nashville,* [2]*Universidade Estadual Paulista, Botucatu, Brazil,* [3]*USDA-AMS, Montgomery, AL*

Research reports on the effect of creep feeding in meat goat kids are scarce. Spring-kidding does (n = 140) and their kids (n = 187) representing various straightbred and crossbred genotypes were divided into 2 groups to evaluate the impact of creep feeding on preweaning kid performance. One-half of the does were placed in pastures with creep feed (CF) provided. Kids for the other doe group were not creep fed (NC). There were 2 replicates per treatment. Kids were sired by Kiko, Myotonic, Savanna, and Spanish bucks. Genotype, litter type, sex, and age of kids were balanced between creep groups. Creep feeding began when kids were 30 d old and ended when kids were weaned at 90 d of age. Pelleted, non-medicated 16% CP creep feed was provided daily for ad libitum consumption. Feed offerings and orts were recorded daily. Dams grazed pasture unsupplemented. Kids were weighed at the start and end of the creep period. A USDA grader scored each kid for conformation at weaning. Market value was assigned to each kid based on body weight and conformation using the USDA local market report for the first sale date after weaning. Mixed models were used to evaluate kid performance with fixed terms including creep group, sire breed, dam breed, dam age, litter size, sex, and interactions. Least squares means were separated by Tukey test. Kid body weights were similar at 30 d (P > 0.1) for CF and NC (6.92 vs 7.32 ± 0.35 kg). The creep group by sex interaction affected (P < 0.05) 30- to 90-d ADG and 90-d weaning weight. For bucklings, CF had greater (P < 0.01) values than NC for ADG (181 vs 150 ± 6.6 g/d) and weaning weight (18.1 vs 16.2 kg). In doelings, CF and NC did not differ (P > 0.8) for ADG (132 vs 127 ± 6.7 g/d) or weaning weight (14.2 vs 14.1 ± 0.35 kg). Conformation score did not differ (P > 0.6) between CF and NC (2.33 vs 2.31 ± 0.07). Kid market value was higher (P < 0.05) for CF than for NC ($57.58 vs 52.98 ± 1.94). For CF kids, total feed cost was $2.99/kid and the cost added body weight was $1.76/kg across sex. Preliminary results suggest that creep feeding improved for the preweaning growth of bucklings but not for doelings.

Keywords: creep feeding, meat goats, weaning weight

96 Effects of supplemental concentrate level and forage source on intake and digestion by growing and yearling Boer goat wethers and evaluation of a method of predicting negative feedstuff associative effects. *A. T. Dolebo*[1,2], *R. Puchala*[1], *T. A. Gipson*[1], *L. J. Dawson*[1,3], *T. Sahlu*[1], *and A. L. Goetsch*[*1], [1]*American Institute for Goat Research, Langston University, Langston, OK,* [2]*Southern Agricultural Research Institute, Hawassa, Ethiopia,* [3]*Center of Veterinary Health Sciences, Oklahoma State University, Stillwater*

Negative associative effects between supplemental concentrate and forage were investigated with 12 growing (24 kg BW; SE = 0.48) and 12 yearling (47 kg; SE = 1.0 kg) Boer wethers in 8 simultaneous 3 × 3 Latin squares, 4 with each animal type. Treatments in the different squares were 0, 15, 30, and 45 g/kg $BW^{0.75}$ (DM) of supplemental concentrate (primarily ground corn), and in periods within squares 3 sources of grass hay were consumed ad libitum (A: 5% CP, 79% NDF, and 13% ADL; B: 8% CP, 71% NDF, and 9% ADL; C: 12% CP, 69% NDF, and 12% ADL). Forage intake in g/kg $BW^{0.75}$ was similar between animal types (34.9 and 30.8 for growing wethers and yearlings; SE = 1.96), greatest (P < 0.05) among forages for B (29.7, 42.9, and 25.9 for A, B, and C, respectively; SE = 3.92), and ranked (P < 0.05) 0 and 15 > 30 > 45 g/kg $BW^{0.75}$ of concentrate (48.5, 41.8, 25.9, and 15.2; SE = 2.77). There was an interaction (P = 0.026) in forage intake in g/d between animal type and level of supplementation (458, 449, 345, and 199 for growing wethers and 810, 730, 383, and 221 for yearlings with 0, 15, 30, and 45 g/kg $BW^{0.75}$; SE = 59.1). There also was an animal type by concentrate level interaction (P = 0.021) in NDF digestibility (57.3, 60.6, 61.4, and 58.4% for growing wethers and 56.6, 62.9, 56.8, and 30.0% for yearlings with 0, 15, 30, and 45 g/kg $BW^{0.75}$ of concentrate; SE = 3.41). Based on NDF digestibility without concentrate, the decrease in basal forage NDF digestibility in yearlings given 45 g/kg $BW^{0.75}$ of concentrate was substantial compared with moderate effects of 45 g/kg $BW^{0.75}$ with growing wethers and 30 g/kg $BW^{0.75}$ with yearlings. A method of a web-based nutrient requirement calculation system at www2.luresext.edu/goats/research/suppconc.html for goats predicted a much greater decrease in forage intake with the lowest level of supplementation than occurred, suggesting need to increase the dietary concentrate level below which no negative associate effects are assumed. Considering that this method projects change in basal forage intake to also account for decreases in forage digestion to ultimately address supplementation effects on intake of ME, predictions with the moderate and high levels of supplementation were reasonable.

Keywords: associative effects, feed intake, goats

97 Enhancing the fatty acid composition of lamb via oral oil supplementation. *S. K. Duckett*[*1], *R. Arnoni*[2], *G. Volpi Lagreca*[1], *and M. Alende*[1], [1]*Clemson University, Clemson, SC,* [2]*Universidade Federal de Pelotas, Pelotas, Brazil*

Research was conducted to examine the efficacy of oil supplementation via bottle-feeding to bypass ruminal biohydrogenation on finished lamb fatty acid composition. Fifteen Southdown wether lambs were weaned at 1.5 mo of age and

bottle-fed twice daily for 30 d. Bottle-feeding treatments were: 1) coconut oil (73% C12:0 + C14:0; CO), 2) flaxseed oil (57% C18:3; FO) or 3) Provinal (Tersus Pharmaceuticals, 45% C16:1, PO). The oils were added to commercial milk replacer (Sav-A-Lam; 32% total lipid) on an isocaloric basis and fed according to manufacturer's recommendations. The amount of oil was increased from 1 g·animal^{-1}·d^{-1} to 3 g·animal^{-1}·d^{-1} on a weekly basis. At the end of the bottle-feeding, lambs were weaned and grazed on alfalfa pastures to a live weight endpoint of 35 kg. At harvest, several muscles (longissimus, semitendinosus, semimembranosus, triceps brachii, psoas major, gluteus medius) and subcutaneous adipose tissues were collected for proximate and fatty acid composition. Data were analyzed with oil treatment, tissue and 2-way interaction in the model. All interactions between oil treatment and tissues were non-significant. Supplementation of FO and PO increased (P < 0.01) palmitoleic (C16:1) acid concentration in all tissues compared with CO. Linoleic (C18:2) acid concentration was increased (P < 0.05) in all tissues for FO and PO compared with CO. Conjugated linoleic acid, cis-9 trans-11 isomer, tended to be greater (P = 0.08) in all tissues for FO than PO. The ratio of omega-6 to omega-3 fatty acids was less (P < 0.05) for FO than PO due to differences in linoleic acid content. Total fatty acid content of the tissues tended to be less (P = 0.08) for PO than FO. Muscle and adipose tissues differed (P < 0.05) in fatty acid composition with muscle tissues containing more polyunsaturated fatty acids than adipose tissue. All muscle and adipose tissues had omega-6 to omega-3 fatty acid ratios of 4:1 or less, which is the level recommended by health professionals. All muscle tissues had less than 3 g of total fatty acids per 100 g of tissue, which would qualify these cuts for extra-lean nutrient labeling in the marketplace. Overall, results show that supplementation of unique oils during a 30-d bottle feeding period can alter fatty acid composition of tissues that is maintained throughout finishing.

Keywords: fatty acid, lamb, oil supplementation

98 Grazing/browsing behavior and distribution patterns of meat goats confined in small plots. *U. Karki*, D. Jenkins, N. K. Gurung, W. H. McElhenney, and A. S. Kumi, Tuskegee University, Tuskegee, AL*

Understanding grazing/browsing behavior and distribution patterns of goats is very important to develop the suitable grazing facilities to enhance the sustainable land management. However, there is not much information available on how goats behave, especially when they are confined in small plots. Objectives of this research were to 1) determine the distribution patterns and grazing/browsing behavior of meat goats confined in small plots and 2) relate the distribution patterns and grazing/browsing behavior of goats with weather conditions and available forages. The study was conducted at the research facility of Tuskegee University, Alabama within a 2-acre plot with 5 virtual zones: Zone 1 was dominated with tall fescue and hairy vetch, and consisted of artificial shelter, tree shade, water supply, and mineral supplement; Zone 2 was dominated with briar; Zone 3 consisted of tall fescue and few browse; Zone 4 basically had tall fescue, and some browse; and Zone 5 dominated with browse species. Diurnal distribution patterns and grazing/browsing behavior of goats were observed for 2 consecutive days in March, April, May, and July 2014. Diurnal behavior was classified into 4 categories: grazing, browsing, lying, and loafing. Similarly, diurnal observation period was divided into morning (dawn to 1100 h), midday (1100 to 1400 h), and afternoon (1400 h to dusk). Height of the ground vegetation was measured and available forage biomass was determined before bringing goats to the study plots. Before- and after-grazing vegetation change was monitored with the photographic technique. Grazing was the dominant behavior of goats when weather was favorable and they were in zones with plenty of ground vegetation, but limited amount of browse species. However, browsing was the dominant behavior in zones with abundant browse species**.** When it was raining and goats were out of shelter, browsing was the dominant behavior. Irrespective of observation date and time, goats remained mostly in the zone where shelter, shade, watering facility, and mineral supplement were located. Weather conditions, available vegetation, and the location of facilities influenced the behavior and distribution patterns of goats. These findings can be very helpful for goat farmers in Alabama and other states with similar production conditions to improve pastures and grazing facilities for better land utilization and resource management.

Keywords: Alabama, browse, diurnal behavior, photographic technique, vegetation change, weather

99 Effects of mixing different breeds to evaluate electric fence strand additions to barbwire fence to contain meat goat does. *Y. Tsukahara*[1], T. A. Gipson[1], J. Hayes[1], R. Puchala[1], M. E. Brassard[1,2], T. Sahlu[1], and A. L. Goetsch[1], [1]American Institute for Goat Research, Langston University, Langston, OK, [2]Universite Laval, Quebec City, QC, Canada*

Eighty Boer (3.9 yr of age, 56.3 kg) and 80 Spanish does (3.5 yr, 37.6 kg) were used to evaluate conditions of an accurate and repeatable method being developed to test efficacy of various electric fence strand additions to barb wire fence for cattle to contain goats, particularly a method of grouping does as a single breed (SGL) or combined (COM). Five 2.4 × 3.7 m evaluation pens had 1 side of barb wire strands at 30, 56, 81, 107, and 132 cm from the ground. Fence treatments (FT) chosen to vary hindrance to exit were electrified strands (6 kV) at 15 and 43 (LH), 15 and 23 (LM), 15 (L), 23 (M), and 43 cm (H). During 5 wk of adaptation, does were exposed to evaluation pens with or without electric strands to avoid unacceptably high and low pen exits. Then breeds were divided into 2 replication sets per grouping; each of the 5 pens held 4 does for 1-h exposure to FT while observing behavior visually and with video surveillance. Data were analyzed with the GLIMMIX of SAS. There were significant main effects of grouping, FT, and their interactions (P < 0.01) in the percentage of does exiting pens (0.0, 50.0, 50.0, 75.0, and 87.5% with Boer COM, 0.0, 12.5, 12.5, 62.5, and 50.0% with Boer SGL, 25.0, 87.5, 100.0,

100.0, and 100.0% with Spanish COM, and 75.0, 100.0, 62.5, 62.5, and 100.0% with Spanish SGL for LH, LM, H, L, and M, respectively) and exiting without being shocked (0.0, 25.0, 25.0, 62.5, and 75.0% with Boer COM, 0.0, 0.0, 0.0, 37.5, and 12.5% with Boer SGL, 12.5, 75.0, 62.5, 87.5, and 75.0% with Spanish COM, 62.5, 100.0, 37.5, 62.5, and 75.0% with Spanish SGL, respectively). In summary, COM decreased exit by Spanish does with LH and had no effect with Boer, whereas COM increased exit by Boer with LM and H. Similarly, COM increased exit without shock by Boer with M and decreased values for Spanish with LH. In conclusion, evaluation pens with 1 electric strand (M and L) resulted in greater exit rate than other pens regardless of grouping treatment. Spanish does exited evaluation pens more than did Boer; however, presence of one breed (COM) affected behavior of the other with some FT and needs to be considered when evaluating effectiveness of various electric strand additions.

Keywords: behavior, fence, goats

100 Impact of different stocking rates of goats under loblolly pine plantation on changes on occurrence of understory vegetation and animal productivity. *I. M. Howard*, A. S. Kumi, N. K. Gurung, B. R. Min, A. W. Elliott, R. Davis, U. Karki, and W. H. McElhenney, Tuskegee University, Tuskegee, AL*

Objectives were to determine the changes in percent occurrence of different understory vegetation as well as litter, bare ground and pine needles and productivity of goats with varying stocking rates under loblolly pine plantation. A randomized complete block design study was used on an 11-yr old loblolly pine plantation in Epes, Alabama from July, 2011 to October, 2011. Thirty-six Kiko crossbred male goat kids of 4 to 5 mo of age were assigned to 4 treatments; low (4 goats/acre), medium (8 goats/acre), and high (12 goats/acre) and each treatment was replicated 3 times. Changes in understory vegetation occurrence were determined to a height of 153 cm or less. The understory vegetation category included grasses, forbs, and young trees. The "others" category included litter, bare ground and pine needles. Average daily gain (ADG) and blood urea nitrogen (BUN) were monitored for the grazing period. There was a linear decrease ($P < 0.05$) in percent occurrence of grass and forbs with increasing stocking rates as grazing season progressed. In young tress, there were no significant differences ($P > 0.05$) between treatments. The "others" category increased linearly ($P < 0.05$) with stocking rates. There were no significant differences ($P > 0.05$) on ADG and BUN among treatments. These results indicate that the long-term effects of different stocking rates need to be evaluated further before any inferences can be drawn.

Keywords: animal productivity, goats, pine silvopasture, species composition

101 Health, performance, and carcass characteristics of pen-fed vs. pasture-raised meat goats. *S. Schoenian*[1], J. Semler[2], D. Gordon[3], M. B. Bennett[4], and D. O'Brien[5], [1]University of Maryland, Keedysville, [2]University of Maryland, Boonsboro, [3]University of Maryland, Derwood, [4]West Virginia University, Martinsburg, [5]Virginia State University, Petersburg*

The health, performance, and carcass characteristics of pen-fed vs. pasture-raised goats were compared in consecutive years at the Western Maryland Research & Education Center. In both years, 30 Kiko bucklings, sourced from single farms, were randomly allocated to 2 treatment groups: PEN vs. PASTURE. The PEN (n = 15) goats were housed in a zero-grazing pen (4.9 m^2) and limit-fed alfalfa-orchardgrass hay and whole barley. The PASTURE (n = 15) goats grazed alongside the bucks in the Western Maryland Pasture-Based Meat Goat Performance Test. They were rotationally grazed among six 0.8-ha paddocks composed of various cool and warm season forages. In 2013, the PASTURE goats did not receive supplemental feed. In 2014, the PASTURE goats were supplemented with 341 g of soybean hulls per head per day during the second half of the study. After an adjustment period, the goats consumed their respective diets for 84 d. They were handled every fourteen days to determine BW, FAMACHA, BCS, coat condition, dag, and fecal consistency scores. Individual fecal samples were collected bi-weekly. At the end of the feeding period, the bucks were transported to Waynesboro, PA for same day slaughter. The carcasses were deboned and separated into portions of fat, lean, and bone. Throughout most of the 2013 study, the PEN goats had heavier BW ($P < 0.001$),

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Table 1. Changes in percent occurrence of understory vegetation and others (less than 153 cm) under loblolly pine plantation with varying stocking rates of goats in July and October, 2011

Vegetation	Control		Low		Medium		High		Level of Significance
Categories/Treatments	July	Oct.	July	Oct.	July	Oct.	July	Oct.	
Grasses	23.6	21.8	34.2	30.8	31.3	23.9	25.1	18.5	
% change in occurrence	-7.6		-9.9		-23.6		-25.9		Linear
Forbs	25.6	18.9	19.9	10.2	23.9	3.5	18.2	4.6	
% change in occurrence	-26.2		-48.7		-85.4		-75.3		Linear
Young trees	10.6	6.7	7.3	3.1	7.6	1.6	30.1	1.1	
% change in occurrence	+36.8		-57.5		-78.9		-96.3		NS
Others	40.2	52.6	38.6	55.9	37.2	71.06	26.6	75.8	
% change in occurrence	+30.8		+44.8		+90.9		+185.0		Linear

decreased FAMACHA $P < 0.001$) scores, and reduced fecal egg counts ($P < 0.01$). None of the PEN goats required deworming, whereas 27 treatments were administered to the PASTURE goats. The PEN goats had heavier hot ($P < 0.0001$) and cold ($P < 0.0001$) carcass weights and greater dressing percentages ($P < 0.0001$). Their carcasses had a greater percentage of fat ($P < 0.0001$) and lean ($P < 0.0001$) and a decreased percentage of bone ($P < 0.001$). Their rib eye ($P < 0.001$) and leg circumference ($P < 0.001$) measurements were larger. Similar results were observed in 2014. The PEN goats had heavier BW ($P < 0.002$), decreased FAMACHA scores ($P < 0.0001$) and reduced fecal egg counts ($P < 0.02$). None of the PEN goats required deworming, whereas 6 treatments were administered to the PASTURE goats. The PEN goats had heavier hot ($P < 0.001$) and cold carcass ($P < 0.001$) weights and greater dressing percentages ($P < 0.01$). Their carcasses had a greater percentage of fat ($P < 0.001$) and lean ($P < 0.001$) and a reduced percentage of bone ($P < 0.001$). Their rib eye ($P < 0.002$) and leg circumference ($P < 0.01$) measurements were larger. While pen-feeding improved the health, performance, and carcass characteristics of meat goats in these studies, the economics of pen-feeding will vary by year and farm.

Keywords: goats, pasture, pen

102 Effects of using ground woody plants in lamb feedlot diets on growth performance and wool and carcass characteristics. *J. L. Glasscock[*1], T. R. Whitney[1], J. R. Roper[1], A. R. Holmes[1], S. G. Marrs[1], and J. T. Sawyer[2], [1]Texas A&M AgriLife Research, San Angelo, [2]Tarleton State University, Department of Animal Science and Veterinary Technology, Stephenville, TX*

Effects of using ground woody plants in Rambouillet wether lamb (n = 48) feedlot diets on growth and wool and carcass characteristics were evaluated. In a randomized design study with 2 feeding periods [Period 1 = fed a 70% concentrate (consisting mainly of 40% dried distillers grains with solubles, DDGS; 21.7% sorghum grain) diet from d 0 to 28 d; Period 2 = fed an 86% concentrate (consisting mainly of 40% DDGS and 37.5% sorghum grain) diet from d 29 to 57]. Lambs were individually fed 6 diets that differed only by roughage source: cottonseed hulls (CSH; control) or ground wood consisting of either redberry (RED), blueberry (BLUE), or one-seed juniper (ONE), eastern red cedar (ERC), or mesquite (MESQ). Using ground wood vs. CSH as the roughage source did not affect ($P > 0.17$) BW at the end of Period 1 or 2 (Period 1: 41.6, 39.8, 40.6, 40.6, 37.7, 39.9 kg; Period 2: 50.1, 46.8, 47.5, 48.7, 45.5, 46.2 kg for CSH, RED, BLUE, ONE, ERC, and MESQ, respectively), even though ADG during the 57-d trial was greater for lambs fed CSH vs. lambs fed RED, ERC, or MESQ (0.31vs. 0.23, 0.23, 0.22 kg/d, respectively; $P = 0.007$). During Period 1, DMI was greater ($P < 0.001$) for lambs fed CSH vs. lambs fed RED, ONE, ERC, or MESQ, but lambs had similar DMI ($P = 0.20$) during Period 2. Lamb G:F did not differ ($P > 0.80$) during the trial (0.18, 0.17, 0.17, 0.17, 0.17, 0.16 kg/kg for CSH, RED, BLUE, ONE, ERC, and MESQ, respectively). Lamb HCW was less ($P = 0.02$) for lambs fed ERC or MESQ vs. CNTL but lambs had similar ($P > 0.09$) LM area, back fat thickness, leg circumference, and body wall. No differences ($P = 0.38$) were observed in lamb grease fleece weight. Current projections suggest that ground woody plants priced at $120/dry ton can be sustainably sold for a profit. Considering that CSH are currently priced in most markets above $150/ton, results indicated that ground woody products are viable and economical roughage feed ingredients, even if lambs require additional days on feed.

Keywords: feedlot, lamb, roughage

103 Effects of level and length of water restriction on body weight, feed intake, and plasma osmolality of Katahdin sheep and Boer and Spanish goat wethers. *M. Urge[*1,2], R. Puchala[2], T. A. Gipson[2], T. Sahlu[2], and A. L. Goetsch[2], [1]School of Animal and Range Sciences, Haramaya University, Dire Dawa, Ethiopia, [2]American Institute for Goat Research, Langston University, Langston, OK*

Thirty-six yearling Katahdin sheep and Boer and Spanish goat wethers were subjected to 2 water restriction treatments to develop a simple method of evaluating resilience to water restriction. Moderate quality grass hay was consumed ad libitum with supplemental concentrate at 0.5% BW. Baseline values over 2 wk with ad libitum water intake, used as covariates, were 26.9, 33.6, and 20.5 kg BW (SE = 0.90), 489, 812, and 491 g/d total DMI (SE = 33.2), and 969, 1,714, and 926 g/d water intake (SE = 100.3) for Boer, Katahdin, and Spanish, respectively. Then availability was decreased by 10% of average baseline intake by individual animals every 1 (1X) or 2 wk (2X) to a minimum of 40%, but the level of 40% for 1X also was 2 wk. Restriction phase data were analyzed with a mixed model considering animal type, restriction treatment, and restriction level as a repeated measure. There was an interaction ($P = 0.001$) in BW between restriction treatment and level, with less loss at early stages of restriction and more later for 1X vs. 2X regardless of animal type (26.3, 25.9, 25.3, 24.7, 24.6, and 23.6 kg for 2X and 26.6, 26.4, 25.3, 25.3, 24.0, and 23.0 kg for 1X with 90, 80, 70, 60, 50, and 40% levels, respectively (SE = 0.343). Restriction level and animal type interacted ($P < 0.05$) in total DMI, with the magnitude of change ranking Katahdin, Boer, and Spanish from greatest to least (605, 600, 505, 547, 434, and 354 g/d for Katahdin, 564, 552, 486, 495, 453, and 394 g/d for Boer, and 540, 527, 435, 466, 456, and 398 g/d for Spanish, respectively, as level of restriction increased; SE = 25.8). There was an interaction ($P < 0.05$) in plasma osmolality (mean of samples at 0700 h before feed and water were offered and at 1300 h) between restriction treatment and level, with greater change over time for 1X vs. 2X (310, 311, 311, 314, 316, and 314 mosmol for 2X and 310, 309, 309, 312, 317, and 319 mosmol for 1X as level of restriction increased, respectively; SE = 1.2). In summary, BW and osmolality suggest less appropriateness of 1X than 2X for evaluating resilience of sheep and goats to water restriction, but also that more than 2 wk at set levels would be necessary for stable conditions, and changes with stepwise decreases in water availability imply potential to lessen the number of steps and a lowest level greater than 40%.

Keywords: goats, sheep, water

104 Energy supplementation of purebred and crossbred hair sheep lambs grazing stockpiled fescue. *S. Wildeus*[*1] *and C. D. Teutsch*[2]*, [1]Virginia State University, Petersburg, [2]Virginia Tech, Blackstone*

The experiment evaluated growth and gastrointestinal parasites in purebred St. Croix (STX) and Barbados Blackbelly (BB), and Dorset x STX and Dorset x BB crossbred lambs supplemented with corn or soy hull while grazing fescue pasture in Fall. Thirty-six, 6-mo old purebred BB and STX, and Dorset x BB and Dorset x STX ram lambs were allocated to 3 treatment groups balanced by breed type: pasture only; pasture plus cracked corn (8.2% CP; 81.4% TDN), and pasture plus soybean hull (9.3% CP; 61.3% TDN). Lambs grazed as a single group predominantly Max-Q fescue pasture (mean CP: 10.2%; mean TDN: 62.5%) starting the first of October, and were moved to a new pasture strip at 6-10 d intervals. Supplement was fed daily at 2% BW in individual feeding stations (Calan gates), but occasional incomplete consumption resulted in effective supplementation rates of 1.74% and 1.96% BW for corn and soybean hull. Body weight, fecal egg counts and FAMACHA anemia score (scale 1 to 5; increasing with paleness) were recorded at 14-d intervals and the experiment terminated after 77 d. Animals with FAMACHA of >3 were dewormed with moxidectin. Data were analyzed in a model with diet, breed type and breed within type as main effects. Fecal egg counts were analyzed after log transformation. Final BW and ADG were greater ($P < 0.01$) in crossbred than purebred lambs (34.8 kg and 134 g/d vs. 29.3 kg and 100 g/d, respectively). Within breed type, final BW was greater ($P < 0.05$) in STX than BB, and in Dorset x BB than Dorset x STX. Soybean hull-supplemented lambs had greater ($P < 0.05$) final BW and ADG than corn-supplemented lambs, which were greater ($P < 0.05$) than pasture-only lambs (36.0 kg and 157 g/d; 32.7 kg and 108 g/d; 27.3 kg and 86 g/d; respectively). FAMACHA tended ($P = 0.07$) to be less in purebred than crossbred lambs, and 3 crossbred lambs were dewormed at the beginning and an additional lamb on d 56; no purebred lambs were dewormed. Fecal egg counts were not different ($P > 0.1$) between purebred and crossbred lambs (1,324 and 1,677 eggs/g) or affected by supplementation. It is not clear if differences in ADG between between supplement types were related to the reduced intake of the corn, but results indicated that soybean hull supplementation improved growth performance of lambs on stockpiled pasture.

Keywords: crossbreeding, hair sheep, supplementation

105 Effect of breed and sex on gain and fecal egg count of meat goat kids grazed on fescue pastures. *F. Bebe*[*] *and K. M. Andries, Kentucky State University, Frankfort*

Control of intestinal parasites is an increasing expense to goat producers. A study was conducted in late spring and summer to determine the effect of breed and sex on growth, body conditioning score (BCS) and fecal egg counts (FEC) in meat goat kids grazed on fescue (*Festuca arundinacea)* pastures. Thirty-six (2 to 3 mo old) animals [15 Spanish, 15 Savannahs and 6 Boer (12 bucks; 24 dams)] were rotated on different fescue pastures every 2 to 3 wk (April to June, 2014). Body weights and eye color scores were taken and FEC were determined at the end of the approximately 90 d grazing period using the modified McMasters procedure. Data were analyzed using PROC MIXED in SAS. There was no significant effect of breed or sex for total average daily gain (0.21 ± 0.06 kg/d), BCS (1.88 ± 0.25) and FEC (3,992.2 ± 3,336.5). The interaction of breed and sex was also not significant ($P > 0.9$). These data indicate that under good rotational management there is no impact of sex or breed on animal growth or parasite loads. The limitations of the size of this data set suggest that more research should be conducted to verify that this effect is correct.

Keywords: average daily gain, breed, fecal egg count, fescue, sex

106 Effect of breed type, supplementation and sex in rotationally-grazed hair and wool x hair sheep lambs: Growth and gastrointestinal parasites. *S. Wildeus*[*1]*, J. Lee*[2]*, C. D. Teutsch*[3]*, and T. J. Nartea*[1]*, [1]Virginia State University, Petersburg, [2]Fort Valley State University, Fort Valley, GA, [3]Virginia Tech, Blackstone*

Terminal sire mating and by-product supplementation can be practical options to improve performance of pasture-raised hair sheep lambs. This experiment evaluated growth rates and gastrointestinal parasitism in 48, 5-mo old purebred hair (Barbados Blackbelly and St. Croix) and crossbred wool (Dorset) x hair sheep lambs of both sexes, rotationally grazing predominantly Jesup tall fescue with Max-Q endophyte pasture (6.2 to12.4% CP; 39.5 to 50.2% ADF; 52 to 59% TDN) during summer (mid-May to mid-August) with or without soybean hull (9.4% CP; 48.5% ADF; 54% TDN) supplementation. Lambs grazed as a single group and were moved to a new pasture strip at 3 to 6 d intervals based on visual appraisal of forage availability. Ram lambs were rendered sterile through induced cryptorchidism (short scrotum). Soy hull was provided at 2% of BW at individual Calan feeding stations. Body weight, fecal egg counts (FEC) were monitored at 14-d intervals and supplement adjusted at that time. The experiment ended after 90 d. No lambs were treated with anthelmintics before or during the experiment. Data were analyzed in a model with breed type (purebred vs. crossbred), supplement (pasture-only vs. pasture plus soybean hull) and sex (female vs. male) as main effects, and starting BW as a covariate. Fecal egg counts were analyzed after log conversion, but are presented as arithmetic means. Final BW and ADG were greater in crossbred than purebred lambs (29.3 vs. 27.5 kg and 108 vs. 87 g/d; $P < 0.05$), in soy hull-supplemented than pasture-only lambs (31.8 vs. 25.0 kg and 136 vs. 59 g/d; $P < 0.001$), and in male than female lambs (29.6 vs. 27.2 kg and 111 vs. 84 g/d; $P < 0.001$). Fecal egg counts at the end of the experiment were greater in crossbred vs. purebred lambs (1,760 vs. 393 eggs/g; $P < 0.001$), pasture-only vs. soybean hull-supplemented lambs (1930 vs. 223 egg/g; $P < 0.001$), and male vs. female lambs (1,195 vs. 958 eggs/g; $P < 0.05$). Results indicated that soybean hull supplementation significantly improved growth performance of lambs on pasture and also reduced FEC. Furthermore, terminal sire mating improved growth rate, but crossbred lambs had greater FEC, especially when not receiving supplement, which may have impacted growth.

Keywords: crossbreeding, hair sheep, supplementation

SMALL RUMINANT PRODUCTION II

107 Effects of protein supplementation on parasitism in grazing lambs. *C. Crawford*[*1], *D. Mata-Padrino*[1], *D. P. Belesky*[1], *E. Felton*[2], *and S. Bowdridge*[1], [1]*West Virginia University, Morgantown,* [2]*Division of Animal and Nutritional Sciences, West Virginia University, Morgantown*

Controlling gastrointestinal nematodes has become an increasing challenge resulting from reduced efficacy of anthelmintics. Previous data have indicated that supplementation of lambs with a 16% CP ration at 1% BW maintained growth comparable to dewormed lambs and lambs supplemented with fish meal had decreased fecal egg counts (FEC). The objective of this study was to determine the dietary component of fish meal responsible for reduced FEC. Winter-born Suffolk and Dorset lambs weaned at 60 d were randomly assigned to a replicate of 3 supplementation groups with 16 lambs per group. Group 1 was supplemented with corn and soybean meal, group 2 with corn, soybean meal and fish meal and group 3 with corn, soybean meal and fish oil. Protein supplementation occurred at a rate of 1% BW per head, daily and diets were manufactured to be 19% CP as-fed and 2.4% ether extract. Before grazing, lambs were housed in an elevated floor facility for 28 d and were infected with 4,000 L3 *Haemonchus contortus* larvae. After which lambs were grazed in small plots, moved every 3d and data collected biweekly included, body weight, FAMACHA score, packed cell volume (PCV) and FEC. Data were analyzed using the MIXED procedure of SAS with fixed effects of treatment, period and 2-way interactions. Analysis of hematological parameters of *H. contortus* infection indicated that group 3 (31.48 ± 0.35) had greater PCV than groups 1 (29.81 ± 0.35) and 2 (29.47 ± 0.35; $P < 0.001$), although all were within normal range. Analysis of FEC resulted in a tendency for differences between groups ($P = 0.11$). Further pairwise comparisons indicated that FEC of group 2 (519 eggs/g ± 24) was less than group 1 (684 eggs/g ± 24; $P < 0.05$) and not different than group 3 (630 eggs/g ± 24; $P = 0.15$). No differences in body weight gain were observed. These results indicate that lambs supplemented with 19% CP ration gain despite being parasitized and that supplementation including fish meal derived by-pass protein can reduce FEC in grazing lambs.

Keywords: parasites, protein, sheep

108 Influence of sericea lespedeza on relationships between gastrointestinal nematode infection and hematology, serum biochemistry, and trace minerals in lambs. *J. M. Burke*[1], *M. Acharya*[*2], *J. E. Miller*[3], *T. H. Terrill*[4], *E. Smyth*[1], *G. R. Huff*[5], *E. B. Kegley*[6], *K. P. Coffey*[2], *and C. F. Rosenkrans, Jr.*[2], [1]*USDA-ARS, Booneville, AR,* [2]*University of Arkansas, Fayetteville,* [3]*Louisiana State University, Baton Rouge,* [4]*Fort Valley State University, Fort Valley, GA,* [5]*USDA-ARS, Fayetteville, AR,* [6]*Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville*

The objective was to determine the influence of *Haemonchus contortus* infection on hematology, serum biochemistry, and serum and liver concentrations of trace minerals (TM) in lambs fed sericea lespedeza (SL). Thirty naturally infected Katahdin ram lambs weaned in May (84 ±1.5 d of age; 27.2 ± 1.1 kg) were fed 900 g of 75% alfalfa pellets (CON; n = 10) or 75 % SL pellets (n = 20) for 104 d. Diets were balanced to meet energy, protein, and meet or exceed mineral requirements for moderate body weight gain according to NRC (2007). *Haemonchus contortus* was the predominant gastrointestinal nematode (GIN; 86%). Body weight, BCS were determined, blood and feces were collected on d 28, 56, and 98 to determine serum concentrations of TM, hematological and serum chemical profiles and fecal egg counts (FEC). A liver biopsy was collected on d 104 to determine concentrations of TM. There was no effect of dietary treatment on GIN infection (based on FEC); therefore, data were analyzed as both pooled or between diets. Pearson correlation coefficients were calculated among measurements. There was a positive relationship between PCV and serum copper (0.28; $P = 0.007$), liver copper (0.49; $P = 0.006$) and liver selenium (0.49; $P = 0.006$), and a negative relationship between FEC and serum copper (-0.31; $P = 0.003$), which was attributed to the SL diet. The FEC was correlated with white blood cell count (-0.29; $P = 0.004$), neutrophils (-0.30; $P = 0.004$), red blood cell count (-0.55; $P < 0.001$), and hemoglobin (-0.56; $P < 0.001$); and PCV was correlated with red blood cell count (0.65; $P < 0.001$) and hemoglobin (0.66; $P < 0.001$). Protein metabolism or serum albumin (-0.36 and 0.47; $P < 0.001$), total protein (-0.44 and 0.41; $P < 0.001$), and creatinine (-0.36 and 0.29; $P < 0.001$ and $P = 0.005$) were related to FEC and PCV, respectively, and associated with SL feeding. Body weight was positively correlated with uric acid concentrations (0.47; $P < 0.01$). Other correlations will be presented. Differential relationships exist between GIN infection and nutrient metabolism between CON and SL fed lambs.

Keywords: biochemical, gastrointestinal nematodes, hematology, trace minerals

109 The effects of combining condensed tannin-rich diets from sericea lespedeza pellets and pine bark powder on experimentally infected goats with drug-resistant *Haemonchus contortus*, body weight gain, and carcass quality in meat goats. *C. Wright*[*1], *B. R. Min*[1], *T. H. Terrill*[2], *D. Perkins*[1], *T. Vines*[2], *W. H. McElhenney*[1], *N. K. Gurung*[1], *D. S. Kommuru*[2], *and S. Howell*[3], [1]*Tuskegee University, Tuskegee, AL,* [2]*Fort Valley State University, Fort Valley, GA,* [3]*The University of Georgia, Athens*

The objective of this study was to assess the effects of combining condensed tannin-rich diets from sericea lespedeza pellets and pine bark (PB)-mixed diets on experimentally infected goats with drug-resistant *Haemonchus contortus, body* weight gain, and carcass quality in meat goat. Twenty-four Kiko-cross meat goats (*Capra hircus;* BW = 38.6 ± 2.7 kg) were randomly assigned to 4 experimental diets: 1) 30% bermudagrass hay (BG), 2) 30% PB, 3) 30% SL, and 4) 15% SL+15% PB-mixed diets. Each treatment diet (30% DM) was mixed with remainder of each diet (70% DM) contained 70% commercial sweet feed and 30% alfalfa pellets. Animals were dewormed on d -10 and inoculated (d 0) with 5000 drug-resistant infective stage (L3) *H. contortus* larvae. Feed intake and growth were

monitored for 42 d. Blood samples were taken at the beginning and end of the trial. Fecal egg counts (FEC) were determined approximately every 2 wk. At the end of the experiment, goats were slaughtered and carcass quality was determined. Overall, there were no differences ($P > 0.10$) in DMI and BW gain among treatment diets. Mean hematocrit (packed cell volume) was similar ($P > 0.05$) among treatments, but FAMACHA scores were less ($P < 0.05$) for all treatment groups than goats fed the control diet. Animals fed PB and PB with SL had no differences for blood plasma metabolites, but less blood cholesterol, triglyceride, and alanine aminotransferase compared with those fed control and SL diets. Mean FEC was less ($P < 0.05$) for mixed (150 FEC/g), PB (708.3 FEC/g), and SL (366.7 FEC/g) than for control (1591.7 FEC/g) treatment. No differences were detected for carcass characteristics. The results indicate that ground PB and SL or its combination as a feed ingredient has the potential to reduce internal parasite infection and less cholesterol content in blood.

Keywords: condensed tannins, internal parasites, meat goats

110 In vitro effects of water extracts of sericea lespedeza on goat blood. *E. K. Asiamah*, K. A. Ekwemalor, S. Adjei-Fremah, H. Ismail, and M. Worku, North Carolina Agricultural and Technical State University, Greensboro*

This study was conducted to evaluate effect of water extract of *Sericea lespedeza* on gene activation in goat blood. *Sericea lespedeza* (SL), a high tannin containing legume, has been shown to be useful for control of gastrointestinal nematodes in goats and has a potential to be an efficient alternative treatment for bacterial infections. Tannins act systemically or by producing local effects in the gastrointestinal tract. The in vitro effects of SL water extract on transcription and formation of prostaglandin E2 (PGE2) was assessed in goat blood. Blood was collected from 4 BoerX Spanish goats at the North Carolina A & T State University Farm and incubated in 100 $ng \cdot mL^{-1}$ of SL in the presence and absence of lipopolysaccharide (LPS), peptidoglycan (PGN) or nystatin (NYS). Blood was also incubated with 100 $ng \cdot mL^{-1}$ LPS, PGN or NYS alone. Phosphate-buffered saline solution (PBS) served as negative control. Following incubation, plasma was removed from the cell pellet and stored at -80 °C. Gene transcription was assessed using total RNA extracted from the cell pellet, and gene translation was evaluated by measuring the concentration of PGE2, a protein involved in regulation of inflammation, in plasma from treated and control samples using a commercial ELISA kit. As expected, all 3 microbial cell components increased transcription, with greatest increment of 234% by LPS. Transcription from samples incubated with SL also increased by an average of 100%, and were most comparable with those of PGN at 85% and greater than NYS at 14%. Reduced transcription was observed when samples were co-incubated with SL and LPS or with SL and PGN simultaneously (58% and 11%, respectively); however, co-incubation with SL and NYS increased transcription by 159%. Compared with control, treatment of blood with the microbial cell wall components; LPS, PGN and NYS, increased PGE2 concentration by 350, 250 and 107%, respectively, and SL by 68%. The PGE2 concentration decreased following concomitant exposure to SL and LPS, PGN or NYS by 174, 152 and 181%, respectively. SL decreased the PGE2 concentrations in goat blood when combined with LPS, PGN and NYS. The results demonstrated that, at equivalent concentrations, SL, like the microbial cell wall components, is involved in cell activation by direct interaction and modulate response to some bacterial cell wall components in goat blood. Thus, SL may aid in regulating inflammation by modulating cell activation at the RNA and protein level.

Keywords: prostaglandin, transcription, translation

111 Influence of *Moringa oleifera* on fecal egg counts and packed cell volume in meat goats. *N. C. Whitley*, S. H. Oh, K. Moulton, R. Franco, S. B. Routh, D. King, C. Kyle, and J. Idassi, North Carolina A&T State University, Greensboro*

Moringa is a plant native to India that is thought to have various nutritional or health benefits. The effect of moringa on goat gastrointenstinal nematode (GIN) parasite fecal egg counts (FEC) and packed cell volume (PCV) was investigated in 3 experiments. Naturally infected Savanna and Savanna x Boer crossbred female goats were used at 167 ± 14 d of age and 18.7 ± 0.9 kg BW for Exp. 1. Female and castrated male (Exp. 2) or only female (Exp. 3) Boer and high percentage Boer crossbred goats were used. Goats were 187 ± 2.3 d of age and 25.3 ± 0.9 kg BW (Exp. 2) and 156 ± 3.2 d of age and 20.8 ± 0.3 kg BW (Exp. 3). For Exp. 1 and 2, group-housed goats were allotted to treatments of juice from fresh alfalfa (control) or moringa leaves extracted using a home type juicing machine. Animals were allotted to treatment for similar initial FEC and BW. Goats were orally dosed within 4 h of juice collection with 2.0 mL/4.5 kg (Exp. 1, n = 4 control, n = 7 moringa) or 1.5 mL/4.5 kg (n = 15/treatment). Ad libitum fresh water and a commercial 17% meat goat diet with a coccidiostat were provided. For Exp 3, goats assigned to treatments for similar initial FEC and BW were individually housed and provided with an alfalfa (control) or moringa based pellet at 2% BW daily (n = 10/treatment). The pellets were designed to be 21% CP (DM) and contained leaf meal, 17% CP commercial goat feed, dried molasses and SBM. Fecal samples were collected for FEC by modified McMaster's technique with a sensitivity of 25 epg at treatment (d 0) and d 7 (Exp. 1), d 0, 1, 4 and 7 (Exp. 2) and d 0, 7, 14 and 21 (Exp. 3). Blood samples collected via jugular vein puncture were analyzed for PCV via microhematocrit centrifugation on d 0 and 7 (Exp. 1 and 2), and d 0, 7, 14 and 21 (Exp. 3). Data were analyzed using mixed model ANOVA for repeated measures. Moringa juice and pellets did not influence FEC (3322 ± 598, 1792 ± 205, and 1336 ± 201 epg for Exp. 1, 2 and 3, respectively) or PCV (22.8 ± 0.8, 27.8 ± 0.5, and 33.6 ± 0.5% for Exp. 1, 2 and 3, respectively). No benefit of moringa was found in these studies.

Keywords: fecal egg counts, moringa, parasites

112 Effect of weaning age on parasite burdens of hair sheep lambs and ewes in an accelerated lambing system in the tropics. *R. Godfrey*, S. Joseph, L. LaPlace, and W. George, University of the Virgin Islands, St. Croix, US Virgin Islands*

The objective of this study was to evaluate the impact of weaning St. Croix White and Dorper x St. Croix White lambs at 63, 90 or 120 d of age on gastrointestinal parasite burden of ewes and lambs. St. Croix White (STX; n = 19) and Dorper x St. Croix White (DRPX; n = 27) ewes were assigned to treatment groups at lambing based on breed, age, number and sex of lambs. Treatments consisted of weaning lambs (n = 67) at 63 (n = 24), 90 (n = 21) or 120 (n = 22) d of age. At 63, 90 and 120 d of age all lambs were weighed, scored using FAMACHA system and fecal egg counts (FEC) and packed cell volume (PCV) were measured. All ewes were sampled when their lambs were 63, 90 and 120 d of age. Lambs and ewes were treated with an anthelmintic if they had a FAMACHA score of 4 or greater. Data were analyzed using GLM procedures of SAS with treatment and breed as main effects. FEC was transformed using log10(FEC + 1) before analysis. Weaning weight of lambs weaned at 120 d was heavier than lambs weaned at 90 and 63 d (17.8 ± 0.7 vs. 13.3 ± 0.7 vs. 10.5 ± 0.6 kg, respectively) across breeds. FAMACHA score was greater in DRPX than in STX lambs (2.3 ± 0.1 vs. 1.8 ± 0.1, respectively). There was no difference (P > 0.10) in PCV or FEC between DRPX and STX lambs (32.7 ± 0.4 vs. 30.7 ± 0.4 %, and 1,468 ± 214 vs. 1,518 ± 240 eggs/g, respectively). Weaning age had no effect (P > 0.10) on FAMACHA, PCV or FEC in lambs. There was no effect (P > 0.10) of breed or treatment on ewe body weight. There was no difference (P > 01.0) in FAMACHA or PCV between DRPX and STX ewes (2.7 ± 0.1 vs. 2.4 ± 0.1 and 27.9 ± 0.4 vs. 27.3 ± 0.5 %, respectively). The DRPX ewes had greater (P < 0.05) FEC than STX ewes (998 ± 175 vs. 170 ± 231 egg/g, respectively). There was no effect (P > 0.10) of weaning age on FAMACHA, PCV or FEC of ewes. Weaning hair lambs later than 63 d of age resulted in heavier lambs at weaning, but there was no effect on parasite burdens.

Keywords: gastrointestinal parasites, hair sheep, weaning

113 Efficacy of copper oxide wire particles from three sources to control *Haemonchus contortus* in lambs. *J. M. Burke*[*1], J. E. Miller[2], T. H. Terrill[3], E. Smyth[1,4], and M. Acharya[4], [1]USDA-ARS, Booneville, AR, [2]Louisiana State University, Baton Rouge, [3]Fort Valley State University, Fort Valley, GA, [4]University of Arkansas, Fayetteville*

Use of alternatives to synthetic dewormers remain of critical importance because of anthelmintic resistance and an allowable product for organic production. The objective of the experiment was to determine the efficacy of copper oxide wire particles (COWP) from 3 sources to control *H. contortus* in lambs. Naturally infected Katahdin ewe lambs that were 106 d of age (born February) and 21.7 kg were randomly assigned to receive no COWP (CON; n = 10) or 2 g COWP in a gel capsule as Copasure (COP; n = 9; Animax Ltd.), Copper Oxide – Wire Form (AUS; n = 10; Pharmplex), or Ultracruz (ULT; n = 9; Santa Cruz Animal Health). Lambs grazed bermudagrass pastures as a group and were supplemented with 227 g/lamb daily of a commercial grain mix (15% CP) and the same amount of alfalfa pellets. Blood and feces were collected on d 0 (day of COWP treatment), 7, and 14 for determination of packed cell volume (PCV) and fecal egg counts (FEC), and pooled feces were cultured on d 0, and pooled feces from each treatment on d 7 to determine gastrointestinal nematode (GIN) genera. Data were analyzed using repeated measures in a mixed model, and FEC were log transformed. The predominant GIN on d 0 was *H. contortus* (87%). The FEC were reduced in COP and AUS compared with CON (P < 0.01) lambs by d 7, and to the greatest extent in COP lambs (treatment × d, P = 0.025); ULT and CON were similar. The FEC were reduced in all lamb groups by d 14, but COP was the only source that reduced FEC relative to CON on d 14 (P = 0.004). The PCV was different (P = 0.01) on d 0 and used as a covariate thereafter. The PCV of COP was greater than CON (P = 0.004), but otherwise PCV was similar among treatments. The percentage of *H. contortus* was reduced from 89% in CON to 8% in COP feces. In these conditions, COP had greater efficacy in reducing *H. contortus* than other forms of COWP.

Keywords: copper oxide, gastrointestinal nematode, sheep

114 Relationship between preweaning performance and parent expected breeding value for meat goat kids. *K. M. Andries*, S. Harrod, and F. Bebe, Kentucky State University, Frankfort*

Meat goat production is still a growing and relatively new enterprise in the US livestock industry. There is a need for increased use of genetic evaluations by meat goat producers. The National Sheep Improvement Program has a program to calculate expected breeding values (EBV) for sheep flocks. Research in Austria has shown that the sheep growth, reproduction, and carcass traits have greatly improved through the use of EBV. To learn the effect of EBV on meat goat performance, data from the research herd at Kentucky State University was submitted to NSIP for evaluation after weaning in the summer of 2014. Data on 114 spring born kids was submitted along with previous data on all parents. Correlation coefficients were calculated between kid growth traits and the respective dam and sire EBV. Birth weight was positively correlated (P < 0.01) with dam direct, dam maternal, and sire BV for birth weight (r = 0.55, 0.57, and 0.28, respectively). Weaning weight was positively correlated (P < 0.01) with dam maternal and sire weaning weight (r = 0.31 and 0.33, respectively) and with dam direct weaning weight EBV (r = 0.35, P = 0.03). Dam and sire breeding values for birth and weaning weight had significant (P < 0.01) effects on the respective traits as well except for dam direct (P = 0.38) birth weight on birth weight. Reproductive traits are very important to goat producers as well. The EBV for number of live births and number of live kids weaned were positively (P < 0.01) correlated to the actual lifetime number of kids born alive and weaned (r = 0.54 and 0.39, respectively). These results indicate that genetic evaluation and breeding values can be a significant tool in improving meat goat performance. Additional research and evaluation is needed to learn the potential impact of breeding values on goat performance.

Keywords: breeding values, meat goat, preweaning

115 Terminal sire mating of Landrace hair sheep ewes with Dorset rams: Ewe and pre-weaning lamb performance. *S. Wildeus*, Virginia State University, Petersburg*

The experiment evaluated the effect of crossbreeding Dorset rams with Barbados Blackbelly and St. Croix hair sheep ewes on ewe reproductive performance and growth performance of lambs under fall mating. Mature Barbados Blackbelly and St. Croix hair sheep ewes (n = 119) were allocated within breed to be either mated to rams of like breed or Dorset rams in November. Ewes were synchronized with CIDR devices and initially bred by vaginal artificial insemination, followed by a 30 d natural mating period. Twelve sires (3 Dorset, 4 St. Croix, and 5 Blackbelly) were used for AI, and 3 sires of each breed in single sire groups for the cleanup mating. Ewes were managed as a single group on pasture except during mating, and were supplemented with corn/soybean meal (14% CP) during late gestation (0.5% BW) and lactation (1.5% BW). Ewes lambed on pasture and birth weights were recorded within 24 h of lambing. Lambs were not creep fed but had access to forage and supplement provided to the ewes. Lambs were weaned approximately 63 d. Pregnancy was determined on d 1 and 25 after the end of breeding using transrectal ultrasound. Overall pregnancy rate (95.8%), still born lambs (9.1%), pre-weaning lamb loss (13.1%), and litter size at birth (1.97) and weaning (1.57) were not different ($P > 0.1$) between purebred and crossbred matings. Litter birth weights ranged ($P < 0.05$) from 5.73 kg in purebred Blackbelly to 7.27 kg in Dorset x St. Croix crosses. Adjusted 60-d weaning weight and pre-weaning ADG were greater ($P < 0.05$) in crossbred (21.2 kg and 241 g/d) than purebred (17.1 kg and 186 g/d) litters, but were not different for breeds within breed type. Lamb birth weight was lighter ($P < 0.05$) in Blackbelly lambs, but not different between the other breed types. Adjusted 60-d weaning weight ranged ($P < 0.05$) from 9.3 kg in Blackbelly to 11.9 kg in Dorset x Blackbelly cross lambs. Single (3.55 kg) and twin-born lambs (3.38 kg) and were heavier ($P < 0.05$) than triplet lambs (2.79 kg). Survival to weaning was different ($P < 0.05$) between birth types, and adjusted 60-d weaning ranged ($P < 0.05$) from 8.65 kg in triplet-born to 12.10 kg in single lambs. Results indicated that terminal sire mating of land race hair sheep increased pre-weaning growth performance of lambs without adversely affecting survival to weaning.

Keywords: hair sheep, lamb performance, terminal sire

116 Effect of breed type, supplementation and sex in rotationally-grazed hair and wool x hair sheep lambs: Carcass characteristics. *J. Lee[1], S. Wildeus*[2], T. J. Nartea[2], B. Lemma[1], and B. Kouakou[1], [1]Fort Valley State University, Fort Valley, GA, [2]Virginia State University, Petersburg*

Landrace hair sheep breeds utilize moderate quality pasture well, but are slower growing and have smaller and leaner carcasses than improved hair sheep types and wool breeds. There is a need to determine whether terminal sire mating and supplementation can improve their performance. Carcass characteristics were evaluated in 47, 8-mo old purebred hair (Barbados Blackbelly and St. Croix) and crossbred wool (Dorset) x hair sheep lambs of both sexes, after rotationally grazing predominantly tall fescue pasture (6.2 to12.4% CP; 39.5 to 50.2% ADF; 52 to 59% TDN) during summer (mid-May to mid-August), with or without soy hull (9.4% CP; 48.5% ADF; 54% TDN) supplementation. Lambs grazed as a single group and were moved to a new pasture strip at 3 to 6 d intervals based on visual appraisal of forage availability. Ram lambs were rendered sterile through induced cryptorchidism (short scrotum). Soy hull was provided at 2% of BW at individual Calan feeding stations, and supplement was adjusted for increasing BW at 14 d intervals. After 90 d of grazing, lambs were harvested using standard procedures, and carcass traits were evaluated. Data were analyzed in a model with breed type (pure- vs. crossbred), supplement (pasture-only vs. pasture plus soy hull) and sex (female vs. male) as main effects, and empty BW as covariate. Pelt weight was heavier in crossbred than purebred lambs (3.59 vs. 2.65 kg; $P < 0.001$), and affected by supplementation in crossbred, but not purebred lambs (breed type x supplement interaction: $P < 0.05$). Hot carcass weight (11.2 vs 10.2 kg) and dressing percentage (43.5 vs. 39.2%) were greater ($P < 0.01$) in soy hull-supplemented than pasture-only lambs, but these characteristics were not affected by breed type or sex. Muscle pH after 24-h post-mortem was higher ($P < 0.01$) in crossbred than purebred lambs. Loin eye area was not affected ($P > 0.1$) by breed type or supplementation. Weights of rack, loin and leg cuts were greater ($P < 0.01$) in soy hull-supplemented lambs, whereas breast was heavier ($P < 0.01$) in purebred than crossbred, and flank heavier ($P < 0.01$) female than male lambs. Results indicate that supplementation rather than crossbreeding had more significant effect on carcass quality under the conditions of this experiment.

Keywords: carcass characteristics, hair sheep, rotational grazing

117 Preliminary evaluation of the effect of a mushroom (*Coriolus versicolor*) probiotic on gene expression in goat blood. *K. A. Ekwemalor*, H. Ismail, and M. Worku, North Carolina Agricultural and Technical State University, Greensboro*

Gastrointestinal parasites pose a serious threat to the global goat industry due to resistance of parasites to anthelmintic drugs. Oral administration of anthelimintics may activate genes in peripheral blood and impact goat health and production. *Coriolus versicolor* is a mushroom with immunostimulant properties used as a dietary supplement and an immunostimulant. CorPet biomass (Mycology Research Laboratories Ltd, UK) is a mushroom- (*Coriolus versicolor*) based feed that is being used as a probiotic in horses and small animals as an immunostimulant. White-rot fungi such as *Coriolus versicolor* are efficient lignin degraders and have been studied for their ability to ferment different crop residues to produce improved animal feed for ruminants such as goats. Although the impact of white rot fungi on animal feed has been studied the effect of their use as feed supplements on the animal needs further study. The objective of this study was to evaluate the effect of aqueous extracts of CorPet on gene activation in adult Boer goats infected with gastrointestinal parasites. Following initial screening for infection, goats were assigned to 3 groups of 5 (n = 15). Powdered CorPet was soaked in hot or cold water with stirring. Sterile filtered extracts were prepared. Goats were drenched daily with 10 mL of the hot (treatment I) or cold

extract (treatment II) daily for a 4 wk period, and a control group of 5 age-matched goats received sterile water (treatment III). The groups were reversed for a further 4 wk. Fecal sample and blood were collected weekly. Body weight was also determined. Total RNA was isolated using the Zyomed kit. The Nanodrop spectrophotometer was used to evaluate RNA concentration and purity. Fecal egg count, Haemonchus and coccidi were counted using a stereo microscope. There was no significant effect on fecal egg count. Treatment increased body weight (P < f 0.05). The average concentration of the different treatment groups for each week revealed some variation over time. Administration of CorPet as an oral drench may stimulate gene expression in peripheral blood. Further studies using more samples are needed to assess the impact on diversity and feed efficiency.

Keywords: anthelmintics, CorPet, immunostimulant

TEACHING AND UNDERGRADUATE EDUCATION

118 Teaching animals and society: Introducing animal science to non-majors. *J. L. Wahrmund*, Texas A&M University, Commerce*

College courses about animals are very intriguing to students who may not necessarily major in Animal Science. Instructors of Animal Science are uniquely positioned to create courses that appeal to these students. Offering these courses may increase the reach of Animal Science to those who may not otherwise investigate this field of study. At Texas A&M University-Commerce, Animals and Society provides a good example of one of these courses. In Summer 2014, the course was offered online. It is a 3-h course with no prerequisites. Of the enrolled students, 78% were not Animal Science majors. Declared majors of the 18 enrolled students were as follows: General Studies (n = 5), Animal Science (n = 4), General Agriculture (n = 3), AgriBusiness (n = 3), Agricultural Education (n = 2), and Environmental Science (n = 1). The course focused on the many ways animals and humans interact. Some topics were closely related to Animal Science. Examples of these topics include “Animals as Food” and “Animals in Research and Science.” However, other topics focused on the human-animal bond. Examples of these topics include “Animals as Pets” and “Animals as Symbols.” Other topic areas included “Animals in History,” “Animals in Prison Industries,” and “Animal Rights/ Animal Welfare,” to name a few. Assignments included writing assessments related to assigned articles, interviews with friends or family regarding their views of animals in society, and online group discussions. Anonymous evaluations at the completion of the course revealed that a majority of students felt they gained knowledge in the field of Animal Science and had a better fundamental knowledge of the philosophy, theory, and principles of Animal Science. Evaluations also indicated that 100% of students felt better prepared for an interconnected world and that the course improved their knowledge of the interconnectedness of global dynamics. This course provides a unique avenue for exposing the field of Animal Science to students with diverse backgrounds and academic interests. Plans are underway to add Animals and Society to the list of courses which satisfy the social and behavioral sciences requirements in the university core curriculum. This will further expand the reach of Animal Science and will increase awareness of agricultural animal practices to those who may not otherwise gain this knowledge. Other institutions may find benefit in adding a course such as this to their undergraduate catalogs.

Keywords: animals, society, teaching

UNDERGRADUATE STUDENT COMPETITION

119 Impact of visual, auditory, and olfactory cues on circulating concentrations of ghrelin in wethers. *M. G. Stockwell-Goering*[*1], E. Benavides[2], D. H. Keisler[3], and J. Daniel[1], [1]Department of Animal Science, Berry College, Mt. Berry, GA, [2]University of Missouri-Division of Animal Sciences, Columbia, [3]University of Missouri, Columbia*

Ghrelin is a hormone that stimulates feed intake and regulates energy homeostasis. A recent study demonstrated that peripheral ghrelin in humans increased when subjects were shown photographs of food, suggesting a link between visual cues and ghrelin concentrations. This link has also been observed in sheep, where simulated feedings at scheduled meal times resulted in an increase in ghrelin levels. The present study sought to characterize the effect that visual, auditory and olfactory cues have on circulating ghrelin levels in sheep. To do so, Katahdin wethers (age 201 ± 4.9 d; weight 35 ± 1.2 kg) were not offered feed (CONT; n = 5), offered 275 g of feed (FED; n = 5), or fitted with a muzzle and offered 275 g of feed (SHAM; n = 5) during the sampling period which was 1 h after normally scheduled daily feeding time. During the sampling period, blood samples were collected via jugular catheter every 15 min for 2.5 h. CONT samples were collected on d 1, and FED and SHAM samples were collected on d 2. The active ghrelin present in the plasma was then analyzed by radioimmunoassay. The area under the curve (AUC) representing circulating concentrations of ghrelin in CONT, FED, and SHAM treatments was determined using the trapezoidal method. One SHAM wether was an outlier using Shapiro-Wilk W Goodness-of fit test and was removed from the study. Data were tested for effect of treatment (FED, SHAM, or CONT), time, and treatment x time interaction using procedures for repeated measures with JMP Software (SAS Inst. Inc., Cary, NC). There was not a treatment or time effect (P > 0.05); however, there was a treatment x time interaction on plasma ghrelin concentrations (P = 0.0028) such that ghrelin concentrations in SHAM wethers were greater than those in CONT wethers at 15, 60, and 90 min after feeding; whereas ghrelin concentrations in SHAM wethers were greater than those in FED wethers at 30, 60, 90, and 120 min after feeding (P < 0.05). Analysis of the AUC yielded a treatment effect with a tendency toward signifi-

cance (P = 0.0866). These results support the hypothesis that plasma ghrelin concentrations in scheduled meal-fed wethers are increased by visual, auditory, and olfactory feeding cues.

Keywords: feed intake, ghrelin, wethers

120 Ovine maternal nutrient restriction from mid to late gestation decreases hepatic progesterone inactivating enzyme activity. *C. L. Gilfeather[*1], C. G. Hart[1], K. A. Vonnahme[2], and C. O. Lemley[1], [1]Mississippi State University, Mississippi State, [2]North Dakota State University, Fargo*

Previously we have shown increased concentrations of progesterone and decreased liver weight in mid to late pregnant ewes provided a nutrient restricted vs. adequate diet. This alteration in peripheral progesterone could be due to increased synthesis and/or decreased clearance of progesterone. Therefore, the objective was to examine hepatic and placental progesterone inactivating enzymes in a mid to late gestation ovine model of intrauterine growth restriction. Ewes (n = 30) were allocated to receive either 100% [adequate (ADQ; n = 14)] or 60% [restricted (RES; n = 16)] of nutrient requirements until d 130 of gestation. At slaughter both maternal and fetal livers and maternal (caruncle) and fetal (cotyledon) placentas were collected for enzyme analysis. Activity of aldo-keto reductase 1C (AKR1C) and uridine 5'-diphospho-glucurosyltransferase (UGT) were determined using specific enzyme substrates. Activities were expressed relative to mg of protein, total tissue weight, or body weight. Data were analyzed using MIXED procedure of SAS, and the model statement included nutritional plane. Activity of AKR1C in the caruncle (P > 0.60) and cotyledon (P > 0.30) were not different between RES vs. ADQ fed. Activity of UGT was not detected in the caruncle or cotyledon. Activity of AKR1C in the maternal liver was not different (P = 0.89) when expressed relative to mg of protein between RES vs. ADQ fed. However, activity of AKR1C in the maternal liver was decreased (P < 0.05) in RES vs. ADQ fed when expressed relative to total liver or maternal body weight. Activity of AKR1C in the fetal liver was not different (P > 0.35) between RES vs. ADQ fed when expressed relative to mg of protein, total liver, or fetal body weight. Activity of UGT in the maternal and fetal liver were not different (P > 0.05) between RES vs. ADQ fed when expressed relative to milligrams of protein, total liver, or maternal body weight. In conclusion, nutrient restricted dams had decreased hepatic progesterone inactivating enzyme activity, which may be responsible for the previously observed increase in peripheral concentrations of progesterone.

Keywords: ewe, pregnancy, progesterone

121 Relationship between body condition score, follicular activity and postpartum interval in Brahman females. *T. C. Rocha[*1,2], R. A. d'Orey Branco[2], R. C. Vann[3], T. H. Welsh, Jr.[4], D. A. Neuendorff[2], A. W. Lewis[2], and R. D. Randel[2], [1]Texas A&M University, College Station, [2]Texas A&M AgriLife Research, Overton, [3]MAFES-Brown Loam, Mississippi State University, Raymond, [4]Texas A&M University Department of Animal Science, College Station*

The purpose of this study was to identify the inter-relationship of body condition score (BCS), follicular activity, and postpartum interval (PPI) in Brahman females. Ultrasonography was performed on Brahman females (n = 93) at d 21 to 28 postpartum, the 2 largest follicles (> 4 mm) on both ovaries were measured (diameter in millimeters) and follicular counts (FC) were made, using the SonoSite M-Turbo with a 2 MHz L52X transducer. At that time 2 observers independently assigned a BCS (9-point scale, 0.5 increments). The PPI was calculated as the time from calving to first estrus which was detected using vasectomized bulls with chin-ball markers. Classes of PPI including short (≤ 40 d), moderate (40 d - 60 d), and long (≥ 60 d) and data were analyzed using PROC GLM of SAS. Long PPI females had decreased (P < 0.0003; 6.1 ± 0.16) BCS at 21 to 28 d postpartum than did the short (BCS = 7.1 ± 0.18) or moderate (BCS = 6.9 ± 0.15) PPI groups. The diameter of the largest follicle (FD) at 21 to 28 d postpartum for the short PPI (P < 0.014; 14.5 ± 0.56 mm) was larger than the long PPI (12.6 ± 0.51 mm), but did not differ from the moderate PPI (P = 0.16; 13.6 ± 0.48 mm). Data were also analyzed using PROC CORR, and REG of SAS. Body condition score was positively correlated with the FD (r = 0.27, P < 0.01), and the FC (r = 0.22, P = 0.04). Body condition score positively affected FD (R^2 = 0.07, P < 0.01), and FC (R^2 = 0.05, P = 0.04). Postpartum Interval was negatively correlated with BCS (r = -0.50, P < 0.01), and FD (r =-0.23, P = 0.03). As BCS increased PPI decreased (R^2 = 0.25, P < 0.01), and as FD increased PPI decreased (R^2 = 0.05, P = 0.03). These results suggest that both BCS and ovarian follicular populations in the early postpartum period may predict the duration of PPI in Brahman females.

Keywords: body condition score, follicular activity, postpartum Interval

122 Effect of level of intake and energy concentration on diet utilization and ruminal fill in beef steers. *L. N. Bierschwale[*1], T. A. Wickersham[1], L. A. Trubenbach[1], and J. E. Sawyer[2], [1]Texas A&M University, College Station, [2]Texas AgriLife Research, College Station*

Intensification of cow-calf production by limit-feeding high-energy diets could increase beef production per acre and returns to cow-calf enterprises. To determine the impact of level of intake and dietary energy concentration on digestion, 16 steers (287 kg BW) fitted with ruminal cannulae were used in a 2×2 factorial experiment. The first factor consisted of ration energy density: high-energy (Hi; 2.45 Mcal ME/kg) and low-energy (Low; 1.94 Mcal ME/kg). The second factor was level of intake 80% (80) or 120% of predicted NRC requirements (120). Intake was assigned individually based on mean treatment intake (g/kg $BW^{0.75}$) of gestating cows from a previous completed project. The experiment consisted of 14-d for adaptation to treatments, 4-d for measurement of intake and digestion, 1-d for determination of ruminal fermentation, and 1-d to determine ruminal fill. There was an energy density by intake level interaction (P = 0.05) for OM intake resulting from a smaller increase in intake for Low steers moving from 80 to 120, than the Hi steers. Organic matter intake was 11.96 and 14.93 g/kg BW for Low 80 and Low 120, respectively. Steers fed Hi had OM intakes of 9.06 and 13.71 g/kg BW for 80 and

120, respectively. An energy density by level interaction was observed for digestibility of OM ($P < 0.01$) and GE ($P = 0.02$). These interactions result from consistent digestion of Low across the 2 intakes (59 and 61% for 80 and 120, respectively) and a sizeable reduction in Hi as intake increased (69 and 61% for 80 and 120, respectively). Intake of DE was different between intake level ($P < 0.01$) and energy density ($P < 0.01$) with steers offered Low consuming 0.138 and 0.178 Mcal/kg $BW^{0.75}$ in 80 and 120, respectively. Steers fed Hi consumed 0.120 and 0.161 Mcal/kg $BW^{.75}$ for 80 and 120, respectively. Ruminal fill was greater ($P < 0.01$) in steers fed Low vs. Hi diets (4.75) vs. 3.90 kg DM and for steers consuming 80 vs. 120 ($P < 0.01$, 3.98 vs. 4.67 kg DM, respectively). Solid rate of passage was greater ($P < 0.01$) in steers offered Low (2.65) than Hi (2.20 %/h) and was not significantly different between levels of intake ($P = 0.11$). Steers responded to dietary energy density and level of intake as expected with the exception of digestion being greater with the low-energy diet than anticipated.

Keywords: cattle, energy-density, intake

123 Beta-adrenergic receptor subtype distributions differ across carcass and non-carcass tissues in feedlot steers and heifers. *B. K. Riedel*, W. C. Burson, J. O. Baggerman, B. C. Bernhard, and R. J. Rathmann, Texas Tech University, Lubbock*

Insight into the distribution of beta-adrenergic receptor (**β**-AR) subtypes across tissues in bovine is needed to more readily understand the ubiquitous influence of beta-adrenergic agonists beyond the carcass. English x Continental feedlot steers and heifers (n = 20; 10 per gender) were harvested at a commercial abattoir. Within 10 min post-mortem, 10-g biopsies of longissimus dorsi muscle (LM), heart, liver, lung, and kidney tissue were collected, placed in a sealable plastic bag, and snap frozen in liquid N. Samples were placed on dry ice, transported to Texas Tech University and frozen at -80°C for subsequent analysis. The relative mRNA and protein abundance of 3 β-AR subtypes (β_1-, β_2-, and β_3-AR) were determined by real-time quantitative PCR and western blotting, respectively. Samples were arranged in a 2 x 5 factorial with gender and tissue type serving as the factors. Data were analyzed as a completely randomized design using SPSS Statistics 22.0 (IBM; Armonk, NY) and means were separated by the LSD option. Protein could not be detected for the β_1-AR in the liver and kidney, and for the β_3-AR in the lung; consequently, these variables were removed from the analysis. No gender x tissue interactions or gender effect were detected for any variable evaluated ($P \geq 0.12$). The relative mRNA and protein abundance of the β_1-AR were differentially expressed across tissues, but were more pronounced in LM and less in the liver ($P < 0.01$). The relative mRNA and protein abundance of the β_2-AR differed across tissues, being more pronounced in the kidney, and less in the liver (mRNA) and LM (protein; $P < 0.01$). The relative mRNA abundance did not differ across tissues for the β_3-AR ($P = 0.20$). However, protein abundance did differ ($P < 0.01$), with a more pronounced concentration in the heart and less in the liver ($P < 0.01$). Within the LM, heart, liver, and lung the β_2-AR was the densest β-AR subtype present based on protein abundance ($P < 0.01$), and tended to be the greatest in the kidney ($P = 0.06$). Collectively, these data suggest that gender does not affect the distribution of β-AR subtypes; however, the relative proportion of β-AR subtypes is highly tissue dependent. Nevertheless, the β_2-AR was the most populated within each carcass and non-carcass tissue evaluated.

Keywords: beta-adrenergic receptor, bovine tissues, feedlot cattle

124 Effects of lactic acid and sodium metasilicate on fresh beef quality parameters. *G. A. Willhelm*, S. L. DeGeer, and C. L. Bratcher, Auburn University, Auburn, AL*

It is important to utilize antimicrobials that do not negatively impact meat quality or shelf life. The purpose of this study was to evaluate the effect of 4% (vol/vol) lactic acid (LA) and 4% (wt/vol) sodium metasilicate (SM) on meat quality throughout shelf life. Beef bottom rounds were treated with LA, SM or a control solution (CON). Beef bottom rounds were cut into $100cm^2$ pieces and treated with 10 mL of LA, SM, or CON. All samples were packaged and placed on retail display. Samples were evaluated for instrumental color (L*, a*, b*), aerobic plate counts (APC), total coliforms (TC), lactic acid bacteria (LAB), yeast and mold counts (YM), oxidative rancidity (thiobarbituric acid reactive substances, TBARS), shear force (WBS) and sensory characteristics. Samples were evaluated at d 0, 3, 6, 9, 12, and 15. Data were analyzed using SAS 9.2 PROC GLM with treatment and days of display as fixed effects. No YM were detected. APC and LAB increased over display ($P < 0.05$); however, no differences were seen in TC ($P > 0.05$). Among treatments, there were no differences in LAB or TC ($P > 0.05$), but meat treated with LA exhibited less APC than SM and CON ($P < 0.05$). a* values decreased ($P < 0.05$), while L* and b* values remained the same ($P > 0.05$) over days in display. There were no differences in any color values among treatments ($P > 0.05$). While there were no differences in TBARS values among treatments ($P > 0.05$), TBARS values increased as days of display increased ($P < 0.05$). Treatment did not show any difference for WBS or sensory characteristics as determined by a trained panel ($P > 0.05$). As days of display increased, off flavor also increased ($P < 0.05$), and differences in sustained juiciness were recorded ($P < 0.05$). No other sensory or WBS differences were observed within days of display ($P > 0.05$). As expected spoilage bacteria increased over time, resulting in lower meat quality, but neither LA nor SM had an adverse effect on shelf life when compared with CON. Meat treated with LA exhibited lower APC, which could indicate higher meat quality.

Keywords: beef, lactic acid, sensory, shelf life, sodium metasillicate

125 Impact of hydration supplements on vital signs of exercised horses during the summer. *B. L. Green* and J. L. Wahrmund, Texas A&M University, Commerce*

Dehydration in horses is concerning to equine enthusiasts, particularly during summer when increased temperatures can

cause increased water and electrolyte losses through sweat. The objective of this experiment was to compare 2 supplements on hydration status of horses after exercise in the summer. Six mature horses (mean BW = 525 ± 69 kg) were group housed with ad libitum access to pasture and were offered 0.91 kg of 14% CP pellet·horse^{-1}·d^{-1}. Horses were stratified by age and sex, and randomly divided into 3 treatment groups in a Latin square design. Treatments included control (no dietary change), ELEC (30 g of supplemental electrolyte), and WH (wet hay, 0.91 kg of hay soaked in 5 L of water). For 4 mornings leading up to and including sampling days, horses were separated and offered their assigned treatment diets. A 3-d washout period between treatments resulted in 1-wk rotations for each of the 3 treatment offerings. On d 4 of each week horses were ridden for approximately 30 min at the same time during the hottest part of the day. The maximum temperature was 37°C for wk 1, 37.8°C for wk 2, and 37.8°C for wk 3. Before and immediately following each ride rectal temperature (RT), heart rate (HR), respiratory rate (RR), and BW were recorded. Blood samples were obtained via jugular venipuncture before and after exercise for measurement of packed cell volume (PCV). Data were analyzed using the MIXED procedure of SAS. For RT, there was no treatment effect (P = 0.87); however, there was a sampling time effect (P < 0.01), where RT were 0.59°C (SEM = 0.07) greater following exercise compared with before. Similarly, there was no treatment effect (P = 0.59) for RR, however there was a sampling time effect (P < 0.01) where RR increased by 31.4 (SEM = 4.7) breaths per minute after exercise. Treatment did not impact (P = 0.60) HR, but HR increased (P < 0.01) by 8.7 (SEM = 1.0) beats per minute following exercise. Treatment did not affect (P =0.92) PCV; however, there was a sampling time effect (P < 0.01) where PCV increased by 1.22 (SEM = 0.46) percentage units after exercise. Percent BW change after exercise did not differ (P = 0.28) across treatments. Results indicate that neither ELEC nor WH significantly decreased risk of horse dehydration in the summer after 30 min of exercise.

Keywords: electrolytes, horse, hydration

126 The effect of nonstructural carbohydrate intake on heart rate variability in thoroughbred horses. *A. Gates*[*1] *and J. D. Pagan*[2], [1]*Georgetown College, Georgetown, KY,* [2]*Kentucky Equine Research, Versailles, KY*

Feeds for performance horses have traditionally contained increased levels of nonstructural carbohydrates (NSC). It is a common belief in the horse industry that these types of feeds affect behavior by causing some horses to be high-strung or excitable. Because docile behavior and tractability are key components in a wide range of equestrian disciplines, feed manufacturers have begun to manufacture horse feeds with reduced NSC levels. Few studies have measured tangible differences in behavior in horses fed low-NSC diets. Heart rate variability (HRV) records the fluctuations between successive heartbeats, thereby measuring the function of the autonomic nervous system. HRV has been successfully used to study stress and behavior in humans and other species of livestock. This study examined the effects of NSC levels on equine stress and behavior using HRV indices. Two feeds with different NSC levels (20.36% or 51.41%) were used in a 4-wk switchback study with 4 mature Thoroughbred geldings. The feeds were fed at levels calculated to supply a similar intake of digestible energy (DE), and there were no differences in body weight change in the horses when fed either diet. It was hypothesized that HRV indices would be greater with reduced NSC intake, indicating increased parasympathetic tone and a calmer demeanor. HRV data were collected using a Polar heart rate monitor and an IOS-based Heart Rate Variability Logger (Marco Altini), and analyzed using paired t-tests. There were no significant differences between low- or high-NSC diets for the mean of RR-intervals (AVNN), standard deviation of RR-intervals (SDNN), square root of the mean squared difference of successive RR intervals (rMSSD), low-frequency power (LF), high-frequency power (HF), low-to-high frequency power ratio (LFHF), and average heart rate (AvgHR). The proportion of pairs of RR intervals that differed by more than 50 ms (pNN50) were significantly greater ($P < 0.05$) for the low-NSC diet compared with the high-NSC diet. A higher pNN50 is indicative of increased parasympathetic nervous system activity that has been associated with decreased stress and a more relaxed state. This study suggests that NSC content of feed may affect behavior in horses.

Keywords: heart rate variability, horses, nonstructural carbohydrates

127 Clock gene expression is altered in adipose tissue during adipogenesis and obesity in mangalica pigs. *S. M. Campbell*[*], *K. N. Purvis, J. Bartosh, and T. D. Brandebourg, Auburn University, Auburn, AL*

Circadian rhythms are cyclical, 24-h patterns in physiological processes or behaviors. These rhythms are controlled by a central oscillator in the hypothalamus using clock genes as "gears" to keep time. Furthermore, changes in peripheral clock gene expression integrate various biochemical and physiological processes to coordinate clocks in tissues throughout the body. Importantly, clock genes have been implicated in regulating metabolism and obesity suggesting these genes may regulate adiposity. The objective of this study was to investigate the potential that clock gene expression regulates adipocyte biology in the pig by 1) determining if porcine adipose tissue expresses candidate clock genes, and by 2) determining clock gene expression using 2 model paradigms-during adipocyte differentiation and within subcutaneous adipose tissue of lean and obese Mangalica pigs. To accomplish this, pig preadipocytes were obtained from the adipose tissue of neonatal pigs and induced to differentiate in vitro. RNA was extracted from differentiating cultures on d 0 and 8 post-induction. The degree of adipogenesis was assessed by measuring lipid accumulation and *adiponectin* (*ACRP*) expression. Using real-time PCR, we show here for the first time that the clock genes *Bmal1*, *ID2*, *Npas2*, *NR1D1*, *Per1*, *Per2*, and *Per3* are expressed in both porcine preadipocytes and adipocytes. Furthermore, the expression of *Per1* and *Per2* mRNA was induced during adipogenesis (P < 0.05) while the expression of *ID2*, *Npas2*, *NR1D1*, and *Per1* was reduced (P < 0.05). We next investigated clock gene expression during conditions of excessive adiposity. To accomplish this, RNA was extracted

from subcutaneous adipose of lean and obese Mangalica pigs. Using real-time PCR, we determined that *Npas2* was increased ($P < 0.01$) and *Per2* expression decreased ($P < 0.05$) in obese pigs. These data support the hypothesis that clock genes play a role in regulating porcine adipocyte function as expression profiles of candidate clock genes were altered during fat cell differentiation and during obesity.

Keywords: adipose, clock gene, swine

SYMPOSIUM: BILL E. KUNKLE INTERDISCIPLINARY BEEF SYMPOSIUM

128 Coping with tall fescue toxicosis: Solutions and realities. *R. L. Kallenbach[*], University of Missouri, Columbia*

Beef cattle consume more tall fescue (*Lolium arundinaceum* (Schreb.) Darbysh.) than any other perennial cool-season grass in North America. Tall fescue forms a mutualistic relationship with the fungus *Neotyphodium coenophialum* [(Morgan-Jones & Gams.) Glenn, Bacon, & Hanlin comb. nov.]; these plants are often referred to as endophyte-infected. Agronomically, endophyte infection is good; endophyte infected plants resist biotic and abiotic stresses better than endophyte-free plants. However, tall fescue plants infected with wild-type strains of the endophyte produce the ergot-like alkaloids that cause tall fescue toxicosis. Several agronomic practices can eliminate or reduce the effects of tall fescue toxicosis. Renovating tall fescue fields infected with a wild-type endophyte to new cultivars infected with a novel (or non-toxic) endophyte eliminates the problem for that field. This can be a costly ($1,000 USD/ha) initial investment, though most economic analyses show it to be a good long-term investment, especially on fields with greater forage production potential. Less effective, but popular, methods of dealing with tall fescue toxicosis include adding clovers (*Trifolium* spp.) or other species to the pastures to dilute the effects of the toxins, avoiding the use of increased rates of nitrogen fertilizers, feeding supplements, and rotating cattle to warm-season forages in summer. Also, the alkaloid concentration in forage can be reduced by making it (drying) into hay. Recent research shows that animal resistance to tall fescue toxicosis is possible, though there is still much to learn about this topic. Tall fescue toxicosis is likely a reality in the beef industry for some time to come. We contend that renovation of the most productive fields to cultivars infected with a novel endophyte coupled with the prospect of using resistant livestock in scenarios where renovation is not possible will give innovative producers a competitive edge.

Keywords: beef cattle, tall fescue, toxicosis

129 Research efforts aimed at reducing the impact of fescue toxicosis on economically important production measures for beef cattle. *M. S. Gadberry[*1], J. Hawley[2], and P. Beck[3], [1]Department of Animal Science, University of Arkansas, Little Rock, [2]Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville, [3]University of Arkansas SWREC, Hope*

Productivity and persistence through adverse conditions brought widespread adoption of tall fescue (*Lolium arundinecea*) for livestock production in eastern USA. Historical estimates placed land use coverage at 14 million hectares. Notoriety of tall fescue ensued due to acute production losses. In an effort to rectify production in tall fescue based livestock systems, decades of research would begin to identify and quantify both plant and fungal (*Neotyphodium coenophialum*) contributions to production losses. Concurrently, scientist would quantify livestock production responses such as body weight change, milk production, and pregnancy status, as well as, underlying physiological responses among different bodily systems including the digestive, reproductive, immune, and endocrine system. Agronomic hypotheses tested to reduce or eliminate the effects of fescue attributed toxicity included forage substitution (endophyte-free and non-toxic, endophyte-infected fescues), compliment (interseeded legumes or utilization of complimentary forage stands to disrupt toxin intake), and seed head suppression. While alternative forage systems may appear an easy solution, it is met with several adoption limitations including the already widespread coverage of toxic fescue, persistence of alternative forage crops, 90% of US beef cow operations having less than 100 cows, 50% of farms with cattle sales being operated by individuals 55 yr of age or older, and 60% of producers surveyed indicated they had fescue but was not sure or did not believe they had production issues. In addition to modifying the forage system, scientist have also taken approaches applied directly to livestock. Treating animals directly would help overcome factors that limit adoption of forage system changes. Two forms of experimentation would address animal responses. Factorial designs, including toxic and non-toxic fescue, would be applied to examine potential alleviating effects of treatments, while basic randomized designs would focus on treatment responses restricted to the toxic fescue environment only. Treatments tested with both research designs have included non-specific binders of microbial, plant, and clay origins. Effectiveness of pharmacological compounds including dopamine agonist (Domperidone), implants, antibiotics, and anthelmentics have also been studied. Nutritional supplements have also been studied. The objective of this symposium presentation is to review research with cattle consuming a toxic fescue basal diet and alternative treatment effects on economically important production measures for beef cattle.

Keywords: cattle, fescue, review

130 Genetic resistance to the effects of grazing endophyte-infected tall fescue. *T. Smith[*1] and J. P. Cassady[2], [1]Mississippi State University, Mississippi State, [2]South Dakota State University, Brookings*

Forages are the base source of nutrition for any cow-calf operation. Forage types vary based on soil type and climate. Tall fescue (*Lolium arundinaceum*) is the most commonly used cultivated grass for grazing beef cattle in the United States.

This cool-season perennial is easily established, resistant to drought, insects and nematodes, and has the ability to withstand heavy grazing pressure. Most tall fescue varieties are infected with the endophyte fungus (*Neotyphodium coenophialum*) that is essential for the survival of the plant but detrimental to cattle performance. Ergovalines are the generally accepted toxic agents produced by the fescue endopyhte. Cattle that consume forages infected with this endophyte can develop fescue foot, fat necrosis, or fescue toxicosis. It is estimated that the beef industry loses over $500 million annually due to fescue toxicosis through heat stress, reduced body weight gain, suppressed appetite, and decreased reproductive performance. Other symptoms include a retained or rough hair coat and increased body temperature which can be detrimental when animals are located in hot and or humid environments. Different forages and forage systems, feed additives and animal management strategies have been tested through the years that would allow the use of tall fescue in beef production systems while minimizing the adverse effects. An animal genetics approach needs to identify and select animals less susceptible to the ergot alkaloids. Research in this area reports that different cattle within the same herd can respond differently when grazing tall fescue and evidence exists that breed type may also play a role in genetic tolerance to the negative effects on performance. Some studies have looked at the potential of identifying genetic markers that may assist in the selection of more resistant animals. From these studies, there is evidence that genetic variation does exist for resistance to the ergot alkaloids present when grazing endophyte-infected tall fescue. Forage management coupled with genetic selection could allow for more efficient use of tall fescue as a significant forage source in beef cattle systems. With this improvement, it would allow for more beef per acre to be produced in the U. S. with an increasing population combined with decreasing resources.

Keywords: fescue, genetic resistance

131 Physiologic effects of ergot alkaloids: What happens when excretion does not equal absorption? *J. L. Klotz*, USDA-ARS, FAPRU, Lexington, KY*

Increased persistence of tall fescue (*Lolium arundinaceum*) infested with an endophytic fungus *Epichloë coenophiala* in forage-based agriculture has led to increased effort in understanding the negative effects caused by consumption of ergot alkaloids by animals consuming this forage. Ergot alkaloids have been shown to have an extremely short plasma half-life, but this does not necessarily equate to excretion. Studies that measured alkaloids consumed and excreted have demonstrated that, in the case of ergovaline, less is excreted than is consumed. The fate of ergot alkaloids that leave circulation, but are not excreted, is not well understood. Consequently, these 'alkaloid balance studies' have led to speculation that ergovaline can bioaccumulate in the animal. Unfortunately, there are no in vivo data that indisputably support this outcome. Progress has been slowed by the fact that the fungus produces a multitude of different ergot alkaloids that can bind to a variety of different receptors. Multiple in vitro studies have shown that ergopeptine alkaloids (like ergovaline) have a persistent receptor-binding effect that results in a sustained contractile response and the consequence is the vasoconstriction associated with fescue toxicosis. If binding affinities of ergot alkaloids like ergovaline are sufficient to permit a post-absorptive accumulation, then a gradual build up may occur through chronic exposure to ergot alkaloids achieved by grazing. Myographic and mass spectrometric analyses have revealed a potential for vascular accumulation of ergot alkaloids through repetitive exposures to low concentrations. Interestingly, cattle exposed to ergot alkaloids in vivo have a consistently reduced vascular response to agonists that target receptors known to bind ergot alkaloids. If these same receptors are blocked with an antagonist, contractile response to ergopeptine alkaloids is also reduced significantly (>60% reduction). Recent experiments demonstrated that prior exposure of blood vessels to ergovaline completely abolishes the ability of the blood vessel to respond to similar alkaloids like ergotamine. This observation that alkaloid exposure interrupts the normal function of a receptor can persist 5 to 6 wk after animals have been removed from an ergot alkaloid source (and prolactin concentrations have long since returned to normal). Thus, clearance of ergot alkaloids from cattle that grazed pasture with ergot alkaloid-producing endophytes may occur in a similar gradual manner. This may or may not be detectable if only prolactin were measured. Studies that improve the understanding of how cattle process ergot alkaloids will help answer the question of whether ergot alkaloids bioaccumulate.

Keywords: bioaccumulation, cattle, ergot alkaloids

132 Does ergot alkaloids negatively impact bull semen quality and fertility? *S. L. Pratt* and J. G. Andrae, Clemson University, Clemson, SC*

The dominate, cool-season forage in the southeastern United States is the tall fescue cultivar Kentucky 31 (KY31). Kentucky 31 possesses an endophyte, which produces a family of toxins called ergot alkaloids. These toxins negatively affect the physiology of animals upon consumption. While the literature is clear that these toxins affect body weight, body temperature, blood flow and hair growth; their effect on bulls reproductive biology is not well defined. We conducted 4 experiments evaluating semen quality, and fertility of young beef bulls exposed to ergot alkaloids. In Exp. 1 bulls were fed concentrate diets with or without ergot alkaloids for 126 d. All bulls were sacrificed at the end of the 126-d feeding trial or 60 d after removal from treatment. In Exp. 2 through 4, bulls were grazed on KY31 or a novel endophyte-infected tall fescue (NE), which does not produce ergot alkaloids. Tissues obtained in Exp. 1 were subjected to end point RT-PCR and immuno-histochemistry using primers and antibodies specific for prolactin (PRL), dopamine (DRD2) and serotonin receptors (5-HT2 and 7). In all experiments, semen evaluations were conducted periodically. For Exp. 3 and 4, semen was extended and used to time AI cows to assess fertility. Semen quality did not differ in Exp. 1 for all variables examined. We identified the presence of prolactin receptor, DRD2, and 5-HT receptors in the testes, epididymis and on sperm cells. The PRL receptor mRNA abundance was decreased in testis samples due to ergot alkaloid treatment at both slaughter dates ($P < 0.05$). Using seminal fluid samples

obtained from bulls in Exp. 1 and 2 and subjecting the samples to RIA, we found that PRL is present in seminal fluid with concentrations in bulls grazing KY31 lower than those grazing NE ($P < 0.05$), but no difference in seminal fluid PRL concentrations were observed for Exp. 1. Further, bulls grazing KY31 in Exp. 2 exhibited a decrease in sperm cell morphology ($P < 0.05$) not observed in EXP1. Day 35 timed AI pregnancy rates for Exp. 3 were reduced for the KY31 treatment ($P < 0.05$); however, no difference due to treatment was observed in Exp. 4. These data tend to indicate that semen quality and fertility are altered when grazing KY31; however, these observations may be due to toxin by nutrition level interactions.

Keywords: fertility, prolactin, semen

SYMPOSIUM: DESIGN, ANALYSIS, AND EXECUTION OF QUALITY GRAZING RESEARCH SYMPOSIUM

133 Pros and cons of grazing management options in grazing studies. *G. E. Aiken*, USDA-ARS, Lexington, KY*

Grazing experiments are expensive to conduct, but necessary because they generate applicable information to livestock producers on best management practices, forage quality, animal and forage production limits, and potential toxicities. Grazing experiments should be the last step in the development of technologies (e.g., new cultivars, grazing systems, nutrient supplementation strategies) directed towards enhancing forage-based livestock production. Decisions on grazing management and stocking rates for use in grazing experiments are key to meeting research objectives and generating information that can be applied to the industry. Once a research objective is set, the initial questions to be asked are: 1) how will be the pastures be stocked, and 2) what method of grazing will be used. Experimental pastures can be stocked using a single rate; however, a range of stocking rates is preferred. Pastures can also be grazed with a fixed number of tester animals and then vary stocking rates for individual pastures using put-and-take animals to meet a targeted forage availability, pasture canopy height, leaf-to-stem ratio, etc. This is the ideal method for comparing animal performance and pasture carrying capacity among treatments under similar grazing pressures. A single fixed stocking rate can be used to have grazing pressure or herbage allowance treated as response variables, but the stocking rate should be within the range of economically optimum stocking rates. A range of replicated stocking rates for individual discrete variables (e.g., forage species/cultivar, fertilizer sources or rates, supplementation) are preferred that provide a range of forage availabilities and represent slightly excessive forage consumption with the heavier stocking rates and forage accumulation with the lighter stocking rates. A direct measure of carrying capacity is not provided, but regression slopes can be compared with evaluate treatment responses to stocking rates. Decision to use either continuous or rotational stocking is critical and can have a bearing on how applicable the results are to the industry. Certain grasses form a sod or tight canopy under heavier grazing that allow them to persist under more intensive and frequent continuous stocking. Continuous grazing is oftentimes more representative of production scenarios for these grasses. Although many grasses with upright growth habits have moderate quality and great forage potential, they are less persistent under intensive and frequent grazing and, therefore, should be rotationally stocked. Advantages and disadvantages of fixed versus variable stocking, and continuous versus rotational stocking will be presented.

Keywords: forages, grazing, livestock

134 The roles of forage management, forage quality, and forage allowance in grazing research. *F. M. Rouquette*, Texas A&M AgriLife Research, Overton*

Grazing research and experimentation are initiated for an array of rationale and objectives among which includes: 1) evaluation for forage cultivars for persistence and resultant performance traits; 2) documentation, definition, and refinement of mathematical expressions of forage-animal relationships; 3) comparison of stocking methods under varying levels of grazing intensity; 4) establishment of biological constraints that are responsive to stocking strategies; and 5) development of parameters for modeling, decision aids, and economic inferences. Nutritive value of forages establishes the boundaries and limitations for ADG. Forage sampling protocols must be attentive to measurements of nutritive value of the selected diet vs that of the entire forage canopy. Grazing intensity and stocking rates can have a greater impact on ADG than nutritive value when forage mass restricts ad libitum selection of leaf fractions. Grazing intensities also provides benchmarks for determining gain per unit land area. Within a forage quality classification and for a defined vegetational zone, grazing intensity experimentation provides for development of stocking strategies. Periodic measurements of the forage DM and animal BW allows for calculation of average forage allowance for the entire experimental period. The resultant defining of relationships between ADG and forage allowance for a specific forage class provides guidelines and boundaries for establishing grazing intensity-stocking rate management principles for pasture systems. The integrated relationship of forage quality and forage allowance defines the roles of grazing intensity and stocking strategies for sustainable soil-forage-animal-environmental prerequisites for pasture management decisions. The establishment of these gain per animal and gain per unit land area relationships for forage and pasture management are the basis for extending, educating, and demonstrating the impact of stocking strategies on economic-based decisions for clientele.

Keywords: forage allowance, forage management, forage quality, grazing research

135 Designing a grazing experiment that can reliably detect meaningful differences. *R. Reuter and C. A. Moffet, The Samuel Roberts Noble Foundation, Inc., Ardmore, OK*

Grazing trials are expensive to conduct, in terms of money, space, effort, and time. The grazing enterprise is very complex; animals, plants, soils, weather, supplements, and management all must be considered. Small-plot or in-vitro experiments cannot capture all of the relevant interactions. Therefore, grazing trials should be emphasized in agricultural research and conducted in such a way so that the resources invested result in useable information for practitioners, as well as advance the science of grazing management. Poorly designed or conducted experiments that, from the beginning, are unlikely to detect a meaningful difference among treatments under study are a waste of resources. Grazing experimental design should begin with an assessment of the hypothesis to be tested, and an estimation of the statistical power of candidate designs. All avenues of obtaining reasonable power and reducing experimental error should be considered before a methodology is selected. Major considerations are assessing Type I and II error rates, increasing denominator degrees of freedom, and reducing experimental error. For example, different experimental objectives and potential consequences of Type I or II errors may allow for selection of different acceptable α and β levels than accepted default values. Likewise, additional replication and selection of treatment combinations or experimental design can impact the F-test denominator degrees of freedom. Finally, management of variability of experimental material and careful measurement can reduce experimental errors and increase power. Technology such as automated scales and pasture sensors can reduce costs and errors while simultaneously providing data at a scale that allows for advanced analysis techniques, such as locally-weighted regression. We present a discussion of these methods along with examples of their use, and software tools that help scientists explore these design and analysis options.

Keywords: experimental design, grazing, power

136 Getting more information from your grazing research beyond cattle performance. *S. A. Gunter*[*1] *and N. A. Cole*[2], [1]*USDA-ARS, Woodward, OK,* [2]*USDA-ARS, Bushland, TX*

Research examining the nutrition of grazing ungulates can be a rewarding career, however it poses many challenges. This type of science requires the scientist to make many assumptions, deal with numerous variables across a landscape, and requires careful planning to manage these unknowns and produce a publishable experiment. The most rewarding item to researchers in this field is probably the ability to collaborate with scientists from other disciplines to research an entire system. Animal performance is a function of the soil, plant, animal, and climate interaction with one factor affecting the other. The knowledge that can be gained from studying your system with collaborating scientists is valuable beyond a quantifiable number. One area of research that has been demonstrated in recent years has been how plant structure and mass will impact instantaneous intake rate and possibly total dry matter intake (DMI). Struggles to predict DMI by grazing livestock have not been gifted with high predictive quality. The low prediction quality has probably resulted from little characterization of the sward canopy and its integration into predictive models. Further, grazing management affects the other ecological services provided by a landscape. Ecological services are often thought of as just wildlife habitat, but these services also include carbon sequestration, water infiltration and runoff, nutrient management, and food and fuel production for a growing world population. We know that ruminants are significant emitters of carbon dioxide and methane. With the current level of interest in climate change, research examining the effects of grazing management on ecological services would be as valuable an asset to producers as animal performance data alone. The only way producers will adapt sustainable grazing systems is if these systems are as profitable as other opportunities for that same land resource. In the future, producers will need data showing the effects of their production systems on other ecological services. We will need to have those data in hand, because the public will be unwilling to wait a decade for scientists to produce it.

Keywords: beef cattle, ecological services, grazing, pastures

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1967–68	G.L. Robertson	Louisiana State University
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1936–37	M.P. Jarnigan	University of Georgia
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2010	Monte Rouquette, Jr.	Texas AgriLife Research
2009	Not Given	
2008	Ronald D. Randel	Texas A&M University
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2006	Gary M. Hill	Georgia
2005	Samuel W. Coleman	USDA
2004	Don G. Ely	Kentucky
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2000	Philip Utley	Georgia
1999	Paul R. Noland	Arkansas
1998	Not Given	
1997	William G. Luce	Oklahoma
1996	Raymond W. Harvey	North Carolina
1995	Gary L. Cromwell	Kentucky
1994	George E. Mitchell, Jr.	Kentucky
1993	L.E. McDowell	Florida
1992	Joseph Fontenot	Virginia
1991	Robert Totusek	Oklahoma
1990	Virgil Hays	Kentucky
1989	Frank Baker	Arkansas
1988	Clarence B. Ammerman	Florida
1987	Lowell E. Walters	Oklahoma
1986	Lemuel Goode	North Carolina
1985	O.M. Hale	Georgia
1984	L.C. Ulberg	North Carolina
1983	C.J. Brown	Arkansas
1982	W.C. McCormick	Georgia
1981	Elliot R. Barrick	North Carolina
1980	J.A. Whatley, Jr.	Oklahoma
1979	Marvin Koger	Florida
1978	Thomas J. Marlowe	Virginia
1977	Sam Hansard	Tennessee
1976	J.C. Hillier	Oklahoma
1975	J.K. Riggs	Texas
1974	T.J. Cunha	Florida
1973	O.D. Butler	Texas
1972	George W. Litton	Virginia
1971	Ray H. Dutt	Kentucky
1970	Robert C. Carter	Virginia
1969	Henry H. Leveck	Mississippi
1968	Wesley P. Garrigus	Kentucky
1967	Byron L. Southwell	Georgia
1966	Charles S. Hobbs	Tennessee

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2011	Richard D. Coffey	University of Kentucky
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2009	Eric van Heugten	North Carolina
2008	Ted McCollum	Texas A&M University
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2006	Allen F. Harper	Virginia
2005	Glen Selk	Oklahoma State University
2004	Roger L. McCraw	North Carolina
2003	Darrh Bullock	Kentucky
2002	Warren Gill	Tennessee
2001	Walter R. Burris	Kentucky
2000	Tom R. Troxel	Arkansas
1999	George V. Davis, Jr.	Arkansas
1998	G. L. Monty Chappel	Kentucky
1997	Steven H. Umberger	Virginia
1996	Clyde D. Lane, Jr.	Tennessee
1995	John T. Johns	Kentucky
1994	David W. Freeman	Oklahoma
1993	J.R. Jones	North Carolina
1992	James B. Neel	Tennessee
1991	Keith Lusby	Oklahoma
1990	Joe Hughes	Oklahoma
1989	Henry Webster	Clemson
1988	Donald R. Gill	Oklahoma
1987	H. John Gerken, Jr.	Virginia
1986	M.K. Cook	Georgia
1985	W.G. Luce	Oklahoma
1984	Charles Cooper	Virginia
1983	C.W. Absher	Kentucky
1982	C.M. Triplett	Georgia
1981	Arden N. Huff	Virginia
1980	A.L. Eller, Jr.	Virginia

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2014[1]	Kyle Stutts	Sam Houston State University
2014[2]	Christy Bratcher	Auburn University
2013[1]	Elizabeth Wagner	Auburn University
2013[2]	M. Carey Satterfield	Texas A&M University
2012[1]	Deb VanOverbeke	Oklahoma State University
2012[2]	Surendranath Suman	University of Kentucky
2011[1]	J. Chance Brooks	Texas Tech
2011[2]	J. Chance Brooks	Texas Tech
2010[1]	Deborah L. VanOverbeke	Oklahoma State University
2010[2]	Troy J. Wistuba	Morehead State University
2009[1]	Gretchen Hilton	Oklahoma State University
2009[2]	Michael L. Looper	USDA, ARS
2008[1]	Jodi A. Sterle	Texas A&M University
2008[2]	Jeffery Escobar	Virginia Tech
2007[1]	L. Anderson	University of Kentucky
2007[2]	S-W Kim	Texas Tech University
2006[1]	Michael L. Looper	USDA, ARS
2006[2]	Scott T. Willard	Mississippi State University
2005[2]	Clinton Krehbiel	Oklahoma State University
2004[1]	M. Todd See	North Carolina State University
2004[2]	Theo Van Kempen	North Carolina State University
2003[1]	Sam Jackson	Texas Tech University
2003[2]	Tom Spencer	Texas A&M University
2002[1]	Joel Yelich	University of Florida
2002[2]	Beth Kegley	University of Arkansas
2001[1]	Shawn Ramsey	Texas A&M University
2001[2]	Jason Apple	University of Arkansas
2000[1]	Andy D. Herring	Texas Tech University
1999[2]	Chad C. Chase, Jr.	USDA, ARS
1998[1]	Markus F. Miller	Texas Tech University
1998[2]	Arthur L. Goetsch	Langston University
1997[1]	Tim Marshall	University of Florida
1996[1]	William L. Flowers	North Carolina State University
1996[2]	Markus F. Miller	Texas Tech University
1995[1]	Craig H. Wood	University of Kentucky
1995[2]	Jeffrey D. Armstrong	North Carolina State University
1994[1]	Debra K. Aaron	University of Kentucky
1994[2]	Peter J. Hansen	University of Florida
1993[1]	Kevin Pond	North Carolina State University
1993[2]	Rod Geisert	Oklahoma State University
1992[1]	David S. Buchanan	Oklahoma State University
1992[2]	James L. Sartin	Auburn University
1991[1]	W.E. Beal	VPI & SU
1991[2]	Wayne Greene	Texas A&M University
1990[1]	J.W. Mabry	University of Georgia
1990[2]	T.H. Welsh	Texas A&M University

[1]Education
[2] Research

continued

Young Animal Scientist Award Recipients continued

1989	J.W. Spears	North Carolina State University
1988	S.B. Smith	Texas A&M University
1987	D.L. Thompson, Jr.	Louisiana State Univ.
1986	G.J. Hausman	USDA, ARS, Athens, GA
1985	J.W. Savell	Texas A&M University
1984	D.R. Notter	VPI & SU
1983	T.S. Stahly	University of Kentucky
1982	D.N. Marple	Auburn University

NPB Swine Industry Award Recipients

2014	M. D. Johnson	Texas A&M University
2013	J. R. Donaldson	Mississippi State University
2012	Mark Estienne	Virginia Tech
2011	Mark Estienne	Virginia Tech
2010	Jeffery A. Carroll	ARS, USDA
2009	Eric Van Heugten	NC State University
2008	Sung Woo Kim	North Carolina State Unversity
2007	Chad O'Gormon	Texas A&M University
2006	Jeffery A. Carroll	USDA, ARS
2005	Zelpha B. Johnson	University of Arkansas
2004	Jason Apple	University of Arkansas
2003	Theo van Kempen	North Carolina State University
2002	Kim Cole	University of Arkansas
2001	G. E. Conatser	University of Tennessee
2000	Not given	
1999	Not given	
1998	Robert A. Cushman	North Carolina State University
1997	M. Todd See	North Carolina State University
1996	William L. Flowers	North Carolina State University
1995	M. Todd See	North Carolina State University
1994	Robert Dove	University of Georgia

Emerging Scholar Award

2013	Angela Mays	University of Arkansas
2013	Andrew P. Foote	University of Kentucky
2013	Julie Hicks	North Carolina State University
2011	R. S. Fry	North Carolina State University
2010	Christina Taylor-Edwards	University of Kentucky

Graduate Student Paper Award Recipients

Year	Awardee	Place of Meeting	University
2014	L. K. Mabry	Dallas	North Carolina State University
2013	P. Moriel	Orlando	University of Florida
2010	J. S. Fry	Orlando	North Carolina State University
2009	S.J. Winterholler	Atlanta	Oklahoma State University
2008	S.L. Hansen	Dallas	North Carolina State University
2007	P. Williams	Mobile	Texas A&M University-Kingsville
2006	L. R. Legleiter	Orlando	North Carolina State University
2005	M. Bowman	Little Rock	University of Arkansas
2004	E. G. Brown	Tulsa	Texas A&M University
2003	C. Realini	Mobile	University of Georgia
2002	J. A. Parish	Orlando	University of Georgia
2001	J. Montgomery	Ft. Worth	Texas Tech University
2000	M. R. Stivarious	Lexington	University of Arkansas
1999	T. E. Engle	Memphis	North Carolina State University
1998	C. Barnett	Little Rock	Univ. of Tennessee
1997	D.H. Crews, Jr.	Birmingham	Louisiana State University
1996	None Given		
1995	E.B. Kegley	New Orleans	North Carolina State University
1994	R.D. Coffey	Nashville	University of Kentucky
1993	D.K. Bishop	Tulsa	Oklahoma State University
1992	R.L. Stanko	Lexington	North Carolina State University
1991	G.A. Rohrer	Ft. Worth	Texas A&M University
1990	K.A. Meurer	Little Rock	Mississippi State Univ.
1989	G.M. Davenport	Nashville	University of Kentucky
1988	M.J. Esteinne	New Orleans	University of Georgia
1987	T.W. Burnell	Nashville	University of Kentucky
1986	M.J. Wylie	Orlando	Texas A&M University
1985	M.W. Richards	Biloxi	Clemson University
1984	J.C. Betts	Nashville	Texas A&M University
1983	J.B. Lutz	Atlanta	University of Georgia
1982	K.R. Pond	Orlando	Texas A&M University
1981	L.W. Greene	Atlanta	VPI & SU
1980	D.K. Aaron	Hot Springs	University of Kentucky
1979	T.W. Robb	New Orleans	University of Kentucky
1978	E.F. Gray	Houston	University of Kentucky
1977	T.A. Puglisi	Atlanta	University of Georgia
1976	D.L. Thomas	Mobile	Oklahoma State University
1975	J.C. Cornwell	New Orleans	Louisiana State University
1974	D.M. Hallford	Memphis	Oklahoma State University
1973	A.C. Mills	Atlanta	University of Florida
1972	C. McLellan, Jr.	Richmond	Oklahoma State University
1971	C.L. Fields	Jackonsville	University of Kentucky
1970	A.R. Bellve	Memphis	North Carolina State University
1969	W.L. Brown	Mobile	Auburn University
1968	W.E. Powell	Louisville	Auburn University
1967	F.W. Bazer	New Orleans	North Carolina State University
1966	D.G. Ely	Jackson	University of Kentucky
1965	R.D. Goodrich	Dallas	Oklahoma State University
1964	C.K. Vincent	Atlanta	North Carolina State University
1963	C.B. Ramsey	Memphis	University of Tennessee
1962	J.R. Crockett	Jacksonville	University of Florida

Undergraduate Student Paper Award Recipients

Year	Awardee	Place of Meeting	University
2014	K. M. Doran	Dallas	Berry College
2013	A. Arellano	Orlando	Texas A&M University
2010	W. N. Tapp III	Orlando	University of Arkansas
2009	C.M. Ballou	Atlanta	North Carolina State University
2008	C.R. Boldt	Dallas	Texas A&M University
2007	K. Starkey	Mobile	University of Arkansas
2006	D. Sykes	Orlando	Mississippi State University
2005	N. Burdick	Little Rock	Texas A&M University-Kingsville
2004	J. L. Roberts	Tulsa	Oklahoma State University
2003	M. Seitz	Mobile	Mississippi State Univ.
2002	B. Spader	Orlando	University of Missouri
2001	R. Horsley	Ft. Worth	Virginia Polytechnic Univ.
2000	B. Robbins	Lexington	Virginia Tech
1999	J. L. Bardugone	Memphis	Virginia Tech
1998	S. F. Flohr	Little Rock	Virginia Tech
1997	T. M. Weick	Birmingham	Louisiana State Univ.
1996	K. J. Goodson	Greensboro	Texas A&M University
1995	B. C. Bloom	New Orleans	Auburn University
1994	Beth Good	Nashville	Oklahoma State University
1993	C. J. Kirby	Tulsa	North Carolina State University

Academic Quadrathlon Winners

2014	Texas A&M University	1998	University of Kentucky
2013	Oklahoma State University	1997	Oklahoma State University
2012	Texas A&M University	1996	Oklahoma State University
2010	University of Florida	1995	Virginia Tech
2009	Univeristy of Georgia	1994	Oklahoma State University
2008	University of Kentucky	1993	Texas A&M University
2007	Texas A&M University	1992	Oklahoma State University
2006	Texas A&M University	1991	University of Kentucky
2005	North Carolina State University	1990	Virginia Tech
2004	University of Kentucky	1989	Oklahoma State University
2003	Texas A&M University	1988	Texas A&M University
2002	University of Florida	1987	University of Georgia
2001	University of Kentucky	1986	University of Georgia
2000	Texas A&M University	1985	University of Kentucky
1999	University of Kentucky	1984	Texas A&M University

AUTHOR INDEX

Please Note: Numbers following author's name indicate abstract numbers.

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2015 Emerging Young Scholar Award Winner
David S. Rosero, PhD

Nutritional value of dietary lipids in lactating sow diets.
D. S. Rosero[1,2], J. Odle[1], R. D. Boyd[1,2], and E. van Heugten[1], [1]Department of Animal Sciences, North Carolina State University, Raleigh and [2]Hanor Company, Inc., Franklin, KY*

The nutritional requirements of the modern lactating sow have increased substantially because of genetic improvements for litter size. Supplemental lipids increase caloric intake and consumption of essential fatty acids (EFA, linoleic acid and α-linolenic acid) by sows and this is important to minimize body tissue loss during lactation and to increase milk fat and milk production; thus improving litter growth and survival. However, the response to lipid supplementation may be compromised by the source of lipid because its nutritional value depends on chemical composition, peroxidation status and content of EFA. The objectives of this study were to: 1) investigate the effects of varying chemical composition and lipid peroxidation status on nutrient digestibility; and 2) to determine the impact of increasing concentrations of EFA on litter growth and survival and subsequent reproduction of sows. In Exp. 1, 85 lactating sows were assigned randomly to a 4 × 5 factorial arrangement of treatments plus a control diet without added lipid. Factors included: 1) free fatty acids (FFA) concentration (0, 18, 36, and 54%) and 2) unsaturated to saturated (U:S) fatty acid ratio (2.0, 2.8, 3.5, 4.2, and 4.9). The apparent total tract digestibility (ATTD) and DE content of added lipids were reduced as FFA concentrations increased (linear, $P<0.01$) and improved as U:S fatty acids ratio increased (quadratic, $P<0.01$). Results were used to develop a prediction equation to estimate the DE content of lipids and this was described by: DE, kcal/kg = $8,381 – 80.6 \times FFA + 0.4 \times FFA^2 + 248.8 \times U:S - 28.1 \times U:S^2 + 12.8 \times FFA \times U:S$ ($R^2 = 0.74$). In Exp. 2, the impact of lipid peroxidation on nutrient digestibility and intestinal integrity was determined using the nursery pig model. A total of 216 weaned pigs (6.5 ± 0.1 kg) were randomly allotted within weight blocks and sex and fed either a control diet (no added lipid) or diets supplemented with 6% soybean oil previously exposed to peroxidation (heated at 80°C with oxygen flow of 1 L/min) for 0, 6, 9 and 12 d. Lipid peroxidation reduced feed intake ($P<0.01$) and growth linearly ($P=0.02$). Increasing peroxidation linearly reduced the ATTD of fat and gross energy ($P<0.01$). Detrimental effects were related with increased oxidative stress (using malondialdehyde as a marker; quadratic, $P=0.04$) and reduced total antioxidant capacity (linear, $P=0.04$) in jejuna mucosa. The next experiments were designed to investigate the impact of supplemental EFA to lactation diets. In Exp. 3, 50 sows were assigned randomly to a 2 x 2 factorial arrangement of diets plus a control diet without added lipid. Factors included linoleic acid (2.1 and 3.3%) and α-linolenic acid (0.15 and 0.30%). Concentrations of EFA were obtained by adding 4% of different mixtures of canola, corn and flaxseed oils to diets. Supplemental EFA increased milk concentrations of both ($P<0.01$) linoleic and *α-linolenic acid* in a dose-response manner. Supplemental EFA during lactation did not impact growth ($P=0.89$) or survival ($P=0.31$) of progeny, but it resulted in a relevant increase in the estimated balance of EFA (computed by subtracting the amount of EFA secreted in milk from the apparently absorbed EFA). Preventing a negative balance of EFA during lactation has a positive effect in the subsequent reproduction of sows as demonstrated in Exp. 4. In this experiment a total of 480 sows (equally balanced by parity 1, and 3 to 5, P3+) were used to defined the minimum levels of EFA required by the lactating sow for optimal subsequent reproduction. Sows were assigned randomly to a 3 x 3 factorial arrangement plus a control diet without added lipid. Factors included: a) linoleic acid (2.1, 2.7 and 3.3%) and b) α-linolenic acid (0.15, 0.30 and 0.45%). The effects of linoleic acid on the subsequent reproduction of P3+ sows were influenced by the level of α-linolenic acid in the diet, highlighting the importance of the n-6:n-3 fatty acid ratio. For diets containing less than 0.45% α-linolenic acid, linoleic acid at 2.7% (and beyond) tended to improved farrowing rate ($P=0.07$) and decreased culling rate ($P=0.01$) when compared to linoleic acid at 2.1%. When linoleic acid was less than 2.7%, α-linolenic acid at 0.45% resulted in the highest farrowing rate ($P<0.01$; >95%) and the lowest culling rate ($P<0.01$; <5%). Moreover, increasing linoleic acid linearly increased the subsequent litter size ($P=0.03$). Results of this study demonstrated that lactation EFA level is directly related to subsequent reproduction level, and that this phenomenon is increasingly important with advancing sow age. In conclusion, our studies demonstrated that the nutritional value of supplemental lipids is determined by chemical composition and peroxidation status and that that provision of 100 g/d of linoleic acid to lactating sows is required to prevent negative EFA balance and optimize subsequent reproduction.

Key Words: dietary lipids, essential fatty acids, peroxidation, lactation, sows