

ABSTRACTS
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1 The effect of early calf weaning followed by ryegrass (*Lolium multiflorum* Lam.) grazing on performance of fall-born calves in Florida. J. D. Arthington*¹ and R. S. Kalmbacher¹, ¹University of Florida, Range Cattle Research and Education Center, Ona.

The objective of this study was to investigate the effectiveness of grazing fall-born, early weaned calves on annual ryegrass in Florida. Jumbo ryegrass was seeded at a rate of 16.8 kg/ha on November 21, 2002. Two grades of land were compared, 1) a Pomona fine sand (sandy, siliceous, gypthermic, Arenic Alaquod), which graded into a lower, wetter Popash mucky fine sand (loamy, siliceous, gypthermic Typic Umbraquefs) (Sloping), and 2) a level well-drained Pamona fine sand (Level). The Sloping grade was included to assess the effect of soil moisture on ryegrass yield, whereas during wetter winters the higher land might yield better and likewise during dryer winters the lower land might yield better. Nitrogen was applied (56 kg/ha) at emergence followed by an application of complete fertilizer (25-5-15; 336 kg/ha) 84 d after seeding. Brahman-crossbred calves were randomly assigned to one of two treatments; early weaned (EW, n = 35) and normal weaned (NW, n = 38). Calves were similar in age and body weight at the time of EW (January 3, 2002; average age = 88 2.2 d and average BW = 95 11.9 kg). Early weaned calves were maintained on ryegrass pastures for 122 d at a rate of 10.7 calves/ha and were provided supplemental grain (14% CP) at a rate of 1.0% BW daily. Normal-weaned calves remained with their dams in the mature cowherd. Available ryegrass and IVOMD and CP concentration was determined at 28-d intervals. Available forage was initially higher (P < 0.05) for Sloping vs Level pastures during January and February (471 vs 85 and 508 vs 46 kg/ha for Sloping and Level pastures in January and February, respectively). Pasture grade did not impact forage quality. Forage CP and IVOMD was highest in January, declining over the entire grazing period (81.3 and 56.2% IVOMD and 34.0 and 17.2% CP for January and May, respectively). Land grade did not impact calf performance. Calf ADG was lower (P < 0.05) for EW than NW calves (0.61 vs 0.86 kg/d). At the stocking rates used in this study early-weaned calves, grazing ryegrass, did not perform as well as normal-weaned calves. Although variability was high, overall forage quality and availability was similar when ryegrass was grown on a Level vs Sloping land grade.

Key Words: Early Weaning, Calves, Ryegrass

2 Performance of early-weaned calves grazing stargrass (*Cynodon nlemfuensis*) and Atraspaspalum (*Paspalum atratum*) pastures during summer. J. M. B. Vendramini*¹, J. D. Arthington², L. E. Sollenberger¹, R. S. Kalmbacher², and P. Mislevy², ¹University of Florida, Department of Agronomy, ²University of Florida, Range Cattle Research and Education Center.

Early calf weaning is an effective strategy for increasing conception rates of first-calf beef heifers, but few studies have evaluated feeding management options for the calf. This study compared the performance of early-weaned calves grazing stargrass (SG) and atraspaspalum (AP) pastures. All calves received concentrate supplement (16% CP) at a rate of 1.0 % of body weight daily. Calves were weaned on 2 January 2002 at an average age of 84 d and were maintained on annual ryegrass (*Lolium multiflorum*) pasture until 24 April 2002, when they were moved to experimental pastures where they remained until 19 July 2002. Calves were stratified by sex and randomly allocated to SG and AP pastures. There were four replicates per treatment, with six calves per experimental unit. Pasture size was 0.5 and 0.4 ha for SG and AP, respectively. Each pasture was subdivided into four paddocks for rotational stocking. Calves grazed each paddock for 7 d. Calf BW was recorded on 28-d intervals. Herbage mass was measured every 14 d within the paddock that the calves were about to enter. Forage grab samples were also collected and analyzed for CP and IVOMD. There were significant (P < 0.01, SEM = 0.01) differences in ADG for calves grazing SG (0.59 kg) and AP (0.44 kg). Gain per hectare was not different, but tended (P = 0.17; SEM = 16) to be greater (598 kg) on SG than on AP pastures (562 kg). Average herbage mass was greater (P < 0.01, SEM = 0.2) for SG (3.9 tons/ha) than for AP (2.6 tons/ha). Likewise, IVOMD (56.1 vs. 53.8%; P < 0.10, SEM = 0.71) and CP concentration (11.9 vs. 10.4%; P < 0.01, SEM = 0.24) were greater for SG than for AP. At the stocking rates used in this study, SG was a better alternative than AP for early-weaned calves because of higher forage mass, CP, and IVOMD leading to superior calf ADG.

Key Words: Early Weaned Calves, Stargrass, Atraspaspalum

3 Cool season forage-based beef cattle finishing systems. R. B. Pugh*, D. O. Onks, J. D. Gresham, H. D. Loveday, and C. J. Richards, *University of Tennessee, Knoxville TN.*

In two consecutive years, 42 weaned beef calves (305.3 ± 2.0 kg) were used to compare 2 forage-based finishing systems. Each yr calves were stratified by sex and weight before being randomly allotted to system. Each replication consisted of 3 steers and 3 heifers. Each system consisted of fall, winter and spring grazing periods. System 1 (CSP+A) consisted of calves grazing cool season pasture in the fall and spring (0.20-ha/calf) and winter annual pasture (0.20-ha/calf; 3 replications). System 2 (CSP+SH) consisted of calves supplemented with soybean hulls at 1% BW (4 replications) while grazing cool season pasture in the fall and spring (0.20-ha/calf) and stockpiled cool season pasture in the winter (0.40 ha/calf). Calves grazed the same pastures in fall and spring, but separate winter pastures. Hay was fed to both systems when adequate pasture was not available. Initial and final weights for each period were the average of two consecutive days weights. Calves were weighed and supplement adjusted at 28-d intervals. At the onset and completion of each grazing period, ultrasound was used to determine ribeye area and rib fat. After 306 and 284 d (yr 1 and 2, respectively) calves were harvested and carcass data collected. CSP+SH calves gained 0.58 kg/d more ($P < 0.01$) than CSP+A calves (0.40 and 0.98 kg/d, respectively), which resulted in 171 kg more weight gain during the experiment. This resulted in CSP+SH calves being heavier ($P < 0.01$) than CSP+A calves at harvest (595.31 and 424.61 kg, respectively). CSP+SH calves received an average of 1159 kg/calf (DM basis) of soybean hulls throughout the experiment. Final ultrasound measurements indicated that CSP+SH calves had a larger ($P < 0.01$) ribeye area and thicker ($P < 0.01$) rib fat than CSP+A calves (41.5 and 27.8 cm²; 0.97 and 0.31 cm, respectively). CSP+A calves averaged a 1.4 yield grade and average standard quality grade, while CSP+SH calves had a higher ($P < 0.01$) yield grade (2.8) and quality grade (low choice). The CSP+SH system resulted in greater gains with higher quality carcasses than CSP+A.

Key Words: Calves, Grazing Systems, Stock Piling

4 The use of stockpiled limpograss as a winter forage supplement for beef cows in south Florida. T. E. Anton*¹, J. D. Arthington¹, and F. M. Pate¹, ¹*University of Florida, Range Cattle Research and Education Center, Ona.*

Stockpiled limpograss (*Hemarthria altissima*) was evaluated as a winter forage supplement for fall-calving beef cows grazing established bahiagrass (*Paspalum notatum*) in south-central Florida. Cow and calf production data and an enterprise budget for cost-benefit analysis were examined over two consecutive production cycles. Two grazing systems ($n=2$ replications/system; $n=40$ cows/replication) were utilized, consisting of; 1) 0.73 ha of bahiagrass/cow with supplemental winter hay (Control), or 2) 0.61 ha of bahiagrass with 0.30 ha of stockpiled limpograss/cow. Each replicate consisted of six pastures utilized in a modified rotation. All cows were provided a molasses supplement (16% CP; 2.27 kg/hd daily) from the beginning of November through mid-April. Control cows consumed 633 kg of hay/cow annually. No significant differences in cow body weight change, pregnancy rate, or calf

6 Heritability of measures of body density and their relationship to backfat thickness and loin eye area in swine. Z.B. Johnson*¹ and R.A. Nugent, III², ¹*University of Arkansas, Fayetteville,* ²*The Pork Group, Rogers, AR.*

The objective of this study was to estimate heritability of measures of body density and their relationships to backfat thickness (BF) and loin eye area (LEA) in Landrace, Yorkshire, Duroc, and Hampshire breeds of swine. Data consisted of performance test records collected in a commercial swine operation from 1992 to 1999. Boars from 60% of the litters were culled at weaning based on a maternal breeding value of the dam. Remaining boars and all females were grown to 100 d of age ($n = 15,594, 55,497, 12,267,$ and $9,782$ for Landrace, Yorkshire, Duroc, and Hampshire, respectively). At this time all pigs were weighed (WT100) and selected for performance testing based on a combination of maternal and performance indexes which differed by breed. All pigs were weighed at the end of the 77-d performance test (WT177); and BF, LEA, and body length (LEN) were measured. Two measures of

weaning weight were detected. Three scenarios were examined for the cost-benefit analysis of the two grazing systems; 1) a 36 ha, 40 cow stockpiled limpograss system, 2) a 36 ha, 50 cow supplemental hay system, and 3) a 29 ha, 40 cow supplemental hay system. The budgeting analysis assumes that all inputs are constant allowing only variation in the system type, amount of pasture, and herd size. Scenarios 1 and 2 allow for comparison of stocking rates using a constant land base, while scenarios 1 and 3 allow comparison of a constant herd size. The only cost difference between scenarios 1 and 3 is the establishment and maintenance of the pasture, and hay purchase. Returns are identical in the two systems. The cost-benefit analysis indicates that a \$115/ton hay price is needed for the two systems to be comparable. Below this price, stockpiled limpograss is more costly without any additional benefit. Within scenarios 1 and 2, there are additional differences in costs and revenue due to herd size. Accounting for these differences, the analysis shows a breakeven hay price of \$70/ton before the use of stockpiled limpograss becomes cost-effective. Cow and calf production data do not differ among the treatments examined in this study. The cost of limpograss establishment and maintenance may make its use less desirable, from a financial perspective, compared to winter hay feeding.

Key Words: Limpograss, Supplement, Economics

5 Evaluation of perennial eastern gamagrass regrowth. M.S.H. Mashingo*¹, D.W. Kellogg¹, W.K. Coblenz¹, and K.S. Anschutz¹, ¹*Department of Animal Science, University of Arkansas.*

Eastern gamagrass (*EGG*; *Tripsacum dactyloides*) regrowth was evaluated for 2 yr at the University of Arkansas Forage Research Farm in Fayetteville. Regrowth was clipped at 4, 6, 8, and 10 wk after the first hay harvest during both 2001 and 2002. Measurements for EGG height and dry matter (DM) yield were taken, and tillers were counted. Chemical concentration of clipped samples was determined for neutral detergent fiber (NDF), acid detergent fiber (ADF), and crude protein (CP). The plant height for wk 4 to 10 ranged from 100.3 to 190.25 cm and 136.91 to 213.6 cm for yr 1 and 2, respectively. However, the DM yield and tillers of EGG regrowth for yr 2 were less ($P < 0.05$) compared to yr 1. The DM yield increased from 1339 to 6671 kg/ha, and from 2012 to 5232 kg/ha between 4 and 10 wk of regrowth for yr 1 and 2, respectively. Tilling density was higher during yr 1 (10.75 to 432.3 tillers/ft²) than for yr 2 (5.4 to 206.5 tillers/m²) for EGG clipped after 4 and 10 wk of regrowth. The NDF increased from 61.0 to 71.4 % for regrowth clipped after 4 and 10 wk during yr 1. However, there was no such trend during yr 2. The highest NDF concentration was 68.9 % for the EGG regrowth clipped after wk 6. After 10 wk, NDF was 67.9%. The NDF for yr 2 was higher at early stages of regrowth compared to yr 1. Crude protein concentration for yr 1 decreased over time from 16.1 to 7.8% between the 4- and 10-wk clippings, respectively. There were year effects, but optimum time of second cutting for EGG is 6 to 8 wk if nutritive quality is considered. However, yield continues to increase through at least 10 wk of regrowth.

Key Words: Gamma Grass, Regrowth, Nutritive Value

Breeding and Genetics

body density were calculated: $BMI = WT177(kg)/LEN(m^2)$ and $DENSITY = WT177(kg)/LEN(cm)$. For each breed, genetic parameters were estimated using an animal model with litter effects and multiple-trait DFREML procedures. A series of three-trait models including WT100 and combinations of two other traits in each analysis was conducted. Fixed effects included contemporary group and age as a covariate. Estimates of h^2 of LEN, DENSITY and BMI were low to moderate (0.12 to 0.32 for LEN, 0.22 to 0.34 for DENSITY, and 0.15 to 0.26 for BMI). Estimates of h^2 of LEA (0.22 to 0.35) and BF (0.30 to 0.49) were larger implying that direct selection for LEA and BF would be more effective than indirect selection using any of the measures of body density. Genetic correlations between LEA and DENSITY ranged from 0.44 to 0.54 and between LEA and BMI ranged from 0.44 to 0.50. Genetic correlations between BF and DENSITY ranged from 0.37 to 0.67 and between BF and BMI ranged from 0.56 to 0.68. These r_g are high enough to

indicate that improvement in LEA and BF could be accomplished using a measure of body density involving length and weight.

Key Words: Body Density, Length, Pigs

7 Milk production in four divergent biological types grazing common bermudagrass or endophyte infected tall fescue. B.A. Sandelin*¹, A.H. Brown¹, M.A. Brown², Z.B. Johnson¹, and R.T. Baublits¹, ¹*Department of Animal Science, University of Arkansas, Fayetteville*, ²*Grazinglands Research Laboratory, El Reno, OK*.

Milk yield and quality were measured on four divergent biological types resulting from Angus, Brahman, and reciprocal cross cows grazing either common bermudagrass or endophyte-infected tall fescue. Data were collected over a 4 yr period to evaluate the effect of biological type and forage on milk production traits. The growth curve parameters of mature weight (A) and rate of maturing (k) were estimated for 121 cows using the growth curve model as described by Brody. Cows were assigned to one of four biological types: genetic potential for large mature size-late maturing (LL, A > 570 kg, k < 0.047 %, n = 35), large mature size-early maturing (LE, A > 570 kg, k > 0.047 %, n = 19), small mature size-late maturing (SL, A < 570 kg, k < 0.047 %, n = 25), and small mature size-early maturing (SE, A < 570 kg, k > 0.047 %, n = 42). Milk yield was estimated by milking machine, and milk fat, protein, and somatic cell counts were evaluated in a commercial laboratory. Monthly measurements were made beginning on d 61 of lactation and continued monthly for five months. Data were averaged over month within year, and also reported as monthly estimates averaged over year. Data were analyzed by the GLM procedure of SAS. Included in the final models for milk yield and quality traits were the independent variables of forage, biological type, biological type x forage and residual error. Somatic cell counts were transformed using natural logarithms prior to analysis. Biological type was a significant (P < 0.10) source of variation for average milk yield, average milk protein and average somatic cell count. Forage was a significant source of variation for average milk production and average butterfat percentage (P < 0.05). The cows grazing bermudagrass had higher (P < 0.01) milk yields and butterfat percentage than their counterparts grazing endophyte-infected fescue. These results suggest that biological type and forage have varying effects on milk production traits.

Key Words: Biological Type, Forage, Milk Production

8 Fit of standard lactation curve models to milk production records of dairy buffaloes using different interval yields. E.B. Flores*¹, D.W. Kellogg¹, A.H. Brown¹, Z.B. Johnson¹, and A. Mauromoustakos², ¹*Department of Animal Science University of Arkansas*, ²*Department of Agricultural Statistics University of Arkansas*.

Daily milk records of riverine buffaloes from the Philippines were analyzed with general linear model to determine effects of parity, season and age at calving on total milk yield (TMY). Average lactation yields of first, second and third parity buffaloes were fitted with four standard models of the lactation curve by non-linear regression using daily, 10d, 15d, and 30d interval yields. Models fitted were Wood's gamma function, inverse polynomial, four-parameter and five-parameter quadratic polynomial. Goodness of fit was assessed by R², RMSE, correlation between actual and predicted yield, mean residuals, autocorrelation and bias in predicting TMY. Parity and season of calving affected TMY (P < 0.001) but days in milk (DIM) and peak yield accounted for the largest percentage of variation in TMY. All four standard models fitted the average lactation records well regardless of intervals used with small biases. However, when individual lactation records were fitted with the five-parameter polynomial model, R² ranged from good to poor. Mean R² values from fitting the model using daily, 10d, 15d and 30d intervals were 0.51, 0.48, 0.46 and 0.41 for respectively. Use of 30d intervals resulted in poorer fit (P < 0.05) than other intervals due to larger residuals in the rising phase of lactation, but bias in predicting TMY was not different between 15d and 30d intervals. There was no significant difference in fit of the model between 15d and 10d intervals thus, it may be better to use 15d in milk recording scheme. Herd, season of calving, DIM, peak and TMY (P < 0.05) affected the shape of the lactation curve.

Key Words: Buffaloes, Lactation Curve, Milk Yield

9 Postpartum maternal behavior in six breed groups of beef cows. A.H. Brown, Jr.*¹, Z.B. Johnson¹, J.A. Hornsby¹, B.A. Sandelin¹, R.T. Baublits¹, and E.B. Flores¹, ¹*Department of Animal Science, University of Arkansas*.

The objective of this study was to determine the effects of year, breed, age of dam, sex of calf, and sire of calf on postpartum maternal behavior score (MBS) in six breed groups of beef cows. Postpartum MBS were determined on 5,366 births involving the progeny of 156 sires used in the purebred herds of the University of Arkansas Agricultural Experiment Station over a 26 yr period. Scores were assigned as the handler obtained birth weight, tattooed, and ear tagged each calf. In most cases the handler intervened after the calf had stood and nursed. Postpartum behavior scores were: 1 = very aggressive, 2 = very attentive, remained in close proximity with mild aggression, 3 = remained in close proximity but showed no aggression, 4 = showed little interest in calf with the presence of the handler. Breed groups scored were: Angus (n = 2211), Charolais (n = 515), Hereford (n = 748), Polled Hereford (n = 1021), Red Poll (n = 344), and Heritage Angus (n = 481). Data were analyzed using methods of least squares analysis of variance with unequal subclass numbers. The model used in the analysis included terms for an overall mean, year, sex of calf, age of dam, breed, sire of calf, sex x age of dam, sex x breed, age of dam x breed, and error. Interactions were found to be nonsignificant and were deleted from the model. Year, age of dam, breed, and sire of calf were important (P < 0.05) sources of variation in MBS. Three-year-old cows had the greatest (P < 0.001) mean MBS (2.5), conversely ten-year-old cows had the lowest mean MBS (2.1). Two- and four-year old cows had lesser (P < 0.05) MBS than three-year-old-cows (2.4, 2.3 vs 2.5, respectively). Hereford, Polled Hereford, Red Poll, Heritage Angus, and Charolais did not differ (P > 0.05) in mean MBS. Likewise, Angus, Heritage Angus, Charolais, and Hereford did not differ (P > 0.05) in mean MBS. These results suggest that age-of-dam, sire-of-calf, and breed should be considered when evaluating maternal behavior in selection programs.

Key Words: Beef Cattle, Breed, Maternal Behavior

10 Genetic characterization of American Milking Devon Cattle. R. K. Splan*¹, ¹*Virginia Polytechnic Institute and State University, Blacksburg, VA*.

The American Milking Devon is currently found on the critical list of the American Livestock Breeds Conservancy, indicating fewer than 200 registrations annually. It is a triple-purpose breed well adapted to low-input management schemes and harsh environments, and represents a valuable potential genetic resource for sustainable agriculture. Herdbook records of 1310 cattle were utilized for the genetic characterization of the breed, and a census of owners revealed that the current breeding population consists of 611 cattle (119 bulls and 492 cows). Average inbreeding in the current breeding population is 4.37%, but this figure is undoubtedly underestimated, due to incomplete pedigree data. Individual inbreeding coefficients were generally higher in cows than in bulls, with maximal inbreeding levels of 42.75% and 26.56% for cows and bulls, respectively. Average mean kinship was .0324, with individual mean kinships ranging from .0112 to .0558 for bulls, and from .0008 to .0528 for cows. The current breeding population can be traced to 133 founders (55 male, 78 female), with most foundation animals are represented by less than 100 living descendants, and a only small number of founders (four bulls, five cows) are found in the pedigrees of more than 400 cattle currently in the breeding population. All animals trace to one of five foundation sires through their paternal line of descent. One foundation bull in particular is found in nearly half the current sires available in the breed. The current number of founder genome equivalents in the American Milking Devon is 15.41, with potential founder genome equivalents of 57.41, indicating that equalization of founder animals may slow the loss of genetic diversity without having to introduce new stock or grade up cattle. Efforts to characterize the American Milking Devon population genetically and offer technical assistance to breeders will assist in maintenance of sufficient genetic diversity in the breed.

Key Words: Inbreeding, Founder Contributions, Mean Kinship

11 Molecular genetic mapping of imprinted QTL for gestation length in *Bos taurus* x *Bos indicus* cross cattle produced by embryo transfer. Ikhide Imumorin^{*1,4}, Dirk-Jan De Koning², James Sanders¹, Scott Davis¹, Johan van Arendonk², JongJoo Kim^{1,3}, and Jeremy Taylor¹, ¹Texas A&M University, College Station, TX USA, ²Wageningen University, Wageningen, The Netherlands, ³University of Liege, Liege, Belgium, ⁴Valdosta State University, Valdosta, GA.

A genome-wide search of quantitative trait loci (QTL) affecting gestation length (GESL) in beef cattle was undertaken using 614 F2 and backcross Angus x Brahman cattle according to the standard line-cross regression interval mapping procedure combined with a model modified to estimate parent-of-origin (imprinting) effects. The study was done with a crossbred cattle population produced by surrogate dams using multiple ovulation and embryo transfer (MOET) and a sex-averaged map based on 414 microsatellite DNA markers spanning 2645 cM or 95% of the bovine genome. Results did not show any significant genome-wide Mendelian QTL effects but revealed two maternally expressed QTLs of modest effects on chromosomes 11 and 16 influencing GESL ($P < 0.01$), and the estimated additive effects showed increases of 4.4 days and 4.1 days respectively. Although little is known of imprinted genes in cattle, the putative conservation of imprinting on Bta11 was supported by correspondence to imprinted homologues in human and mouse genomes and point to the existence of imprinted genes in these regions that may influence GESL. We hypothesize further that the use of recipient dams genetically unrelated to the calves in the MOET program, may exert influences that modify gene expression during fetal development with possible concomitant effects on the physiological signals for the onset of parturition.

Key Words: Genomic Imprinting, Imprinted QTL, Gestation Length

12 Reproductive and maternal performance of F1 Brahman-, Senepol-, and Tuli-Angus cows bred to Charolais bulls as 3- to 8-yr-olds. D. G. Riley^{*1}, C. C. Chase, Jr.¹, T. A. Olson², A. C. Hammond³, and S. W. Coleman¹, ¹USDA, ARS, STARS, Brooksville, FL, ²University of Florida, Gainesville, ³USDA, ARS, SAA, Athens, GA.

Reproductive and maternal performance of 3- to 8-yr-old crossbred cows ($n = 126$) sired by Brahman (B), Senepol (S), and Tuli (T) bulls and out of Angus cows were compared. Cows were born in 1993 and 1994; they were exposed to Angus bulls for their first calves. After their first calves were born, they were exposed to Charolais bulls to calve in the spring of each year (1996 to 2001; $n = 640$). Model effects included (when significant) year, cow age, calf age at weaning, and breed. Random effects were sire of cow within breed and cow within both sire and breed. Birth weight of calves from S crossbreds (38.4 kg) was heavier ($P < 0.05$) than that of calves from B and T crossbreds, 34.9 and 35.9 kg, respectively (SE = 0.9 kg). Weaning weight, hip height, and body condition score of calves born to B crossbreds (268.9 \pm 4.0 kg, 114.7 \pm 0.6 cm, and 6.3 \pm 0.04) were greater ($P < 0.05$) than that of calves born to S (245.0 \pm 4.2 kg, 111.6 \pm 0.7 cm, 6.1 \pm 0.04) and T (233.4 \pm 4.0 kg,

110.4 \pm 0.7 cm, and 6.2 \pm 0.04) crossbred cows. Brahman crossbreds had a higher ($P < 0.01$) percentage of unassisted births (98.7 \pm 2.3%) than did T crossbreds (91.7 \pm 2.2%). Senepol crossbreds had lower ($P < 0.05$) calf crop born and weaned (76.9 \pm 3.3%, 70.2 \pm 3.8%) than B (89.0 \pm 3.0%, 86.1 \pm 3.7%) and T (94.7 \pm 3.0%, 86.5 \pm 3.5%) crossbred cows. Calf survival to weaning was 96.2 \pm 2.1%, 91.2 \pm 2.4%, and 91.1 \pm 1.8% for B, S, and T crossbreds, respectively. A significant breed \times year interaction for calf crop born and weaned was evidenced by lower ($P < 0.001$) calf crop born and weaned means for S crossbreds in 1998, 1999, and 2001, and lower ($P < 0.001$) calf crop born and weaned for B crossbred cows in 1999. Weaning weight per cow exposed for B, S, and T crossbreds was 223.0 \pm 8.5, 162.8 \pm 9.2, and 197.1 \pm 7.7 kg; all means differed ($P < 0.05$). Performance of T, but not S, crossbred cows was similar to B crossbreds except for lower calf survival rate and weaning weight.

Key Words: Brahman, Senepol, Tuli

13 Evaluation of F1 cows sired by Brahman, Boran, and Tuli for reproductive and maternal performance. K.L. Key^{*1}, A.E. Ducoing², J.O. Sanders¹, and D.K. Lunt¹, ¹Texas A&M University, College Station, ²Universidad Nacional Autonoma de Mexico.

Birth weight (BW) ($n=846$) and weaning weight (WW) ($n=792$) of their calves, calving rate (CR) ($n=966$), weaning rate (WR) ($n=960$), and cow's weight at palpation (PW) ($n=1,124$) were evaluated from 1994 to 2001 in 143 F1 cows sired by Brahman (B), Boran (Bo), and Tuli (T) bulls and out of Hereford and Angus cows. The fixed effects of sire breed of dam, dam breed of dam, and calf's birth year/age of dam and the random effects of dam's sire within sire breed and dam within dam's sire within sire breed were included in the model used to evaluate CR, WR, and PW. The additional effect of calf's gender was added to the previous model to evaluate BW and WW. All two-way interactions were tested for significance. Calf's birth year/age of dam was important for all variables ($P < 0.05$). Adjusted means for BW for calves out of cows by B, Bo, and T sires were 35.53 \pm 0.31, 34.78 \pm 0.48, and 35.49 \pm 0.41 kg, respectively, and were not different ($P > 0.05$). Adjusted WW means of calves out of B, Bo, and T sired cows were 229.6 \pm 2.3, 214.6 \pm 3.0, and 200.4 \pm 2.5 kg, respectively. Calves out of B sired cows were heavier ($P < 0.05$) than those out of Bo and T sired cows. Calves out of Bo sired cows were heavier ($P < 0.05$) than those out of T sired cows. Male calves had higher values ($P < 0.05$) than females for both BW and WW. CR adjusted means for B, Bo, and T sire breeds were 0.863 \pm 0.016, 0.927 \pm 0.020, and 0.890 \pm 0.017. The Bo sire group mean was higher ($P < 0.05$) than the B sire group. The adjusted means for WR were 0.808 \pm 0.019, 0.874 \pm 0.024, and 0.837 \pm 0.020 for B, Bo, and T sire breeds, and no differences ($P > 0.05$) were found among them. Adjusted means for PW in mature cows (8 and 7 years of age, respectively, for the cows born in 1992 and 1993) were 600.7 \pm 7.4, 513.7 \pm 9.7, and 512.9 \pm 8.2 kg for B, Bo, and T sired groups, with cows sired by B heavier ($P < 0.05$) than cows sired by the other breeds.

Key Words: Brahman, Boran, Tuli

Extension

14 RE-Cycle: recipe for waste-free swine production. T van Kempen^{*1}, J Koger¹, P Burnette¹, D Ali¹, J Spivey¹, A Wossink¹, A Fassbender², and P Loeffler³, ¹North Carolina State University, ²ThermoEnergy, ³Sam Houston State University.

A novel swine production system was developed that has the potential to be profitable while substantially reducing waste. At the basis is a modified housing design. Instead of urine and feces mixing in a pit, they are collected separately using an inclined conveyor belt placed in the pit. With the belt sloped 4%, urine (1.5 \pm 0.4 l per pig per day, data for 80 grower pigs) runs off the belt into a collection gutter, which takes it out of the building into a closed storage container. Subsequently, ammonia is extracted by chemisorption using a zinc-sulfate column. Efficiency of ammonia extraction was 99.7% when the column is first used, decreasing to 90% as the column became saturated, at which time the column is regenerated and ammonia is recovered. This ammonia is then processed into ammonium sulfate fertilizer. Feces are passively dried on the belt and are harvested at 6 am each day at 54 \pm 9% dry matter.

On a dry matter basis, 17 \pm 2% of feed consumed was harvested as feces. Cross-contamination of the urine and feces was estimated at less than 1% based on mineral profiles. As a result of separating urine and feces, ammonia emission was 1.0 \pm 0.2 kg per pig place per year. Dried feces can be converted to green energy using a steam reforming gasifier. Feasibility tests carried out in conjunction with MTCI (MD) and EPI (ID) showed that fecal material performed well as a gasifier feedstock. Tests with a gasifier built by BK Technologies (CO) yielded a product gas with 28% H₂, 25% CO, 23% alkanes, 11% N₂, and 12% CO₂. This product gas can be used for the production of electricity or for chemical synthesis of diesel or ethanol. Ash derived from gasification contains approximately 11.5% Ca and 13% P. The solubility of these minerals at pH 2 was 79 \pm 0.2 and 85 \pm 0.6%, respectively. Digestibility for P in vivo was 88 \pm 2.7% of that of dicalcium phosphate. Thus, this ash may be used as a feed ingredient in pig diets. In summary, the RE-Cycle

system addresses environmental concerns that face the swine industry while supplying green, or renewable, energy.

Key Words: Swine, Manure, Belt

15 Growth performance in weanling pigs fed diets with elevated copper levels from two copper sources. A. F. Harper*¹, W. A. Selby¹, C. M. Wood¹, M. J. Estienne¹, J. P. Fontenot¹, and L. A. Kuehn¹, ¹*Virginia Polytechnic Institute and State University.*

Crossbred weanling pigs (n = 210, 18 to 27 d of age) were used in a growth experiment to determine response to elevated dietary copper from an organic copper complex (BioPlex[®] copper, Alltech Inc., Nicholasville, KY) or copper sulfate. Pigs were assigned from groups based on weight, ancestry and sex to five dietary treatments including: a diet with no added copper beyond that provided in the trace mineral premix (control), a diet with 100 ppm added copper from BioPlex (BP-100), a diet with 200 ppm added copper from BioPlex (BP-200), a diet with 100 ppm added copper from copper sulfate (CS-100), and a diet with 200 ppm added copper from copper sulfate (CS-200). Each of nine treatment replications consisted of two pens assigned to the control diet and 1 pen assigned to each elevated copper treatment. Four pigs were housed in each pen except for one replication with three pigs per pen. Diet complexity and nutrient density were adjusted in three phases over the 5-wk trial. Feed and water were available ad libitum. During wk 1 post-weaning, pigs fed elevated dietary copper grew faster and more efficiently than those fed the control diet (P < 0.04). During wk 1 ADG was 167, 208, 189, 172, and 219 g (SD = 41) and gain/feed was 0.58, 0.67, 0.60, 0.62, and 0.70 (SD = 0.1) for the control, BP-100, BP-200, CS-100, and CS-200 treatments, respectively. There was a copper source by dietary level interaction (P < 0.04) during wk 1 in which the greater copper response for ADG and gain/feed with the BP source was with 100 ppm added copper but the greater response with the CS source was with 200 ppm added copper. By the end of the 5-wk trial, there were no significant responses (P > 0.08) to elevated dietary copper. Mean ADG for the total 5-wk period was 454, 484, 468, 463, and 460 g (SD = 43) and gain/feed was 0.59, 0.61, 0.60, 0.61, and 0.58 (SD = 0.03) for the control, BP-100, BP-200, CS-100, and CS-200 treatments, respectively. Elevating dietary copper was effective in promoting growth in pigs during the first wk after weaning and a lower level (100 ppm) was more effective from the BP copper source than from the CS source. However, for the overall 5-wk trial, performance was similar across treatment groups.

Key Words: Pigs, Copper, Performance

16 The Kentucky "Master Cattleman" program. R. Burris*, L. Anderson, J. Bicudo, D. Bullock, J. Henning, J. Johns, G. Lacefield, L. Meyer, B. Mikel, and P. Scharko, *University of Kentucky.*

The Kentucky "Master Cattleman" program is a multi-disciplinary Extension education program for cattle producers which is delivered by the University of Kentucky. It is funded with a grant of \$249,000 from state tobacco settlement monies through the Kentucky Beef Network. Extension associates were hired to coordinate the development and delivery of the program and to develop graphics and presentations. Subject matter specialists were responsible for content of the program. A pilot program was conducted in one multi-county area in 2000 with 35 producers and 3 areas in 2001 with 105 producers. It was re-worked and expanded to 12 multi-county groups of 420 cattle producers in 2002. Eleven 4-hr training sessions were developed complete with instructional CD's and notebooks for support material. These sessions consisted of (1) management skills, (2) forages, (3) nutrition, (4) facilities and animal behavior, (5) environmental stewardship and industry issues, (6) genetics, (7) reproduction, (8) herd health, (9) end product, (10) marketing and profitability, and (11) an optional "hands-on" session for each group. Program delivery has been through Extension specialists or other Extension personnel which received training by specialists. This program will be expanded to 15 multi-county locations across Kentucky in 2003 based on additional producer interest.

Key Words: Extension, Beef, Training

17 Using a value-added study tour and workshop to develop county based Integrated Resource Management programs. K. D. Bullock*, L. H. Anderson, W. R. Burris, J. C. Henning, P. B. Scharko, W. B. Mikel, D. W. Shepherd, J. Akers, J. Hunter, and A. Smith, *University of Kentucky.*

Beef cattle Integrated Resource Management (IRM) is a large part of many states' beef producer educational program. How IRM is incorporated into a state's program is varied from state to state. In Kentucky, the IRM program is primarily an educational program that is focused on empowering producers with the tools necessary to make a difference in the cattle industry nationally, statewide, locally and at home. One program that is used for this purpose is a Value-added Study Tour. This is a multi-tiered program that begins with a commitment by the county agriculture agent to participate in an eleven day intensive in-service training on all aspects of beef cattle production. At the completion of the training the agent distributes a beef production survey in their county to collect baseline information on the dynamics of the county's beef herd and practices used. The agent then selects two potential or existing beef leaders within the county to participate in the tour and workshop. Additionally, the Family and Consumer Sciences agent from each county is invited to participate and is offered an in-service training on the basics of beef production and terminology. The number of county teams for each tour is limited to twelve to ensure good communication and some individual attention. Extension faculty from Animal Sciences, Agronomy, Ag Economics, Ag Engineering and Vet Sciences actively participate in the tour and workshop. The tour portion of the program is centered around value-added concepts, that includes working examples of delivery from farm to plate. The workshop portion is designed to get the county groups working together to improve the beef industry as a whole and within to develop a customized IRM program for their respective counties. The county programs are focused on the needs identified in the base-line survey. Forty two county teams have participated in this tour and workshop. Over 75% of those counties have developed county IRM programs that are focused on improving the profitability of the county's beef producers. Additionally, the Kentucky Cattlemen's Association adopted the ideas developed at the first two study tours to develop their plan for enhancing the state's beef production through the tobacco settlement funds.

Key Words: Beef, Integrated Resource Management, Educational Program

18 The Louisiana Calf-to-Carcass Program: Influence of sire breed. H. D. Chapman, J. E. Devillier*, and D. E. Franke, *Louisiana State University Agricultural Center.*

The Louisiana Calf-to-Carcass Program was initiated in 1991 and is administered by the LSU Agricultural Center Cooperative Extensive Service. A total of 1,533 fall weaned feeder steers were processed through the program from 1992 to 1998. Steers were assembled at three locations within the state for shipment to a commercial feedlot. Upon arrival at each location, steers were identified, weighed, assigned a feeder calf grade, and breed of sire recorded. Of interest in this report is the influence of breed of sire on feedlot and carcass traits. Sire breeds represented were Angus, Hereford, Simmental, Limousin, Gelbvieh, Braunvieh, Charolais, Brahman, Beefmaster, Brangus, and Braford. Because of small numbers of steers sired by several of the sire breeds, steers were grouped into British- (24%), European- (44%), and American-sired (24%) groups (8% unknown). Growth and carcass traits were analyzed with a linear fixed model that included year, location, and breed group of sire. Interactions were not important. Averages for all steers were 268 kg for initial weight, 1.4 kg/d for average daily gain, 347 kg for carcass weight, 84.8 cm sq for ribeye area, 1.1 cm for fat thickness, average Slight for marbling score, and 2.7 for yield grade. Sire breed group influenced (P < .01) variation in ribeye area, fat thickness, yield grade and marbling score. European-sired steers had 4.5 and 3.6 cm sq greater ribeye area (P < .01), .46 and .49 lower yield grade (P < .01), and .25 and .31 cm less fat thickness (P < .01) than American- and British-sired steers, respectively. British-sired steers had 15 and 14 higher marbling score points (P < .01) than American- and European-sired steers, respectively. These data suggest European sires produced higher yielding carcasses and British sires produced higher quality carcasses. Overall, yield traits appear acceptable but carcass quality is below industry standards.

Key Words: Beef Cattle, Sire Breeds, Carcass Traits

19 Using advanced reproductive technology to determine estrus in estrous-synchronized beef heifers. T.W. Wilson*¹, J.E. Rossi², and M.E. Pence², ¹University of Georgia, Statesboro, ²University of Georgia, Tifton.

In an effort to utilize advanced estrous-detection technology at the University of Georgia's Heifer Evaluation and Reproductive Development (HERD) program, the computerized estrous-detection tool HeatWatch[®] (HW) was utilized. Yearling heifers were fed to reach 65% of their mature weight at 15 mo, estrus was synchronized using a melengestrol acetate (MGA[®])/Lutalyse[®] protocol, and were bred by AI. Heifers were divided into two groups and were bred 2 d apart to facilitate efficient use of labor at breeding (Group 1, n=87; Group 2, n=86). Transmitters were applied to heifers immediately after receiving an injection of Lutalyse and data were recorded for the duration of the AI breeding season. Standing heat reports were printed twice daily to identify heifers that had exhibited signs of estrus. Group 1 had 58 (66.7%) heifers determined in estrus by HW and confirmed pregnant from 1st service AI, with 52 (59.8%) of these heifers bred by h 120. A total of 11 (12.6%) heifers were detected and bred on 2nd service AI by HW. Group 1 had a total of 69 (79.3%) heifers confirmed pregnant by AI. Fourteen (16.1%) heifers were detected in estrus by HW but did not settle to AI, and 4 (4.6%) heifers were not detected by HW in estrus. Group 2 had fewer heifers (47; 54.7%) detected in estrus by HW and a lower synchronization rate (40; 46.5%) by h 120 compared to Group 1. Eight (9.3%) heifers were detected in estrus and bred on 2nd service AI by HW. Group 2 had a total of 55 (64%) heifers confirmed pregnant by AI that were detected in estrus by HW. Twenty-one (24.4%) heifers determined in estrus by HW were not pregnant to AI, and 3 (3.5%) heifers were not detected in estrus. In Group 2, 7 (8.1%) heifers were determined in estrus and bred from visual observation without detection by HW, with 4 (4.7%) settling to AI. These results of this demonstration indicate that the computerized estrous-detection tool HeatWatch[®] is a useful tool that can be used to detect estrus in estrous-synchronized beef heifers.

Key Words: Estrous detection, Heifers, Artificial Insemination

20 Effect of Brahman-influence on cattle grazing fescue pastures. R. Burris*, L. Anderson, D. Bullock, P. Scharko, and J. Randolph, University of Kentucky.

Forty Angus-based cows with varying amounts (0, 3/16 or 3/8) of Brahman breeding were allotted to either low (<5%) or high (>95%) endophyte infected fescue pastures. Objectives of the 3-year trial were to study the effect of Brahman breeding on (1) cow-calf performance on fescue pastures and (2) feedlot performance of calves with varying levels of Brahman-influence. Cows were bred to Hereford bulls which were rotated among the two pasture groups at weekly intervals during the breeding season. Pregnancy rates tended to be higher for cows on low endophyte (LE) pastures but did not differ (P<.10). Cows of 3/8 Brahman breeding tended to calve later (avg. birthdate March 17 vs. March 6) than those with no Brahman breeding. Actual weaning wt was higher (P<.05) for calves on LE with no Brahman-breeding than for all calves on high endophyte (HE) pasture, with calves of Brahman breeding on LE being intermediate. Adjusted weaning wts (AWW) were lower (P<.05) for HE than LE calves. Calves on HE pasture from 0 Brahman cows had lower AWW (P<.10) than calves from 3/8 Brahman cows (227 vs. 243 kg). Steer calves from the resultant matings did not differ (P<.10) in feedlot performance or carcass characteristics.

Key Words: Brahman, Fescue, Endophyte

21 Survey of production and marketing practices of cattle producers in the Southeastern United States. J.E. Rossi*¹, M.E. Pence, and R.C. Lacy, ¹University of Georgia, Tifton.

A survey was completed by 293 beef cattle producers from 17 states at the Sunbelt Agricultural Exposition at Moultrie, GA on October 16, 17, and 18, 2001. Questions were asked pertaining to herd size, production practices, and marketing strategies. Producers operations were divided into categories by herd size, which was identified by the number of breeding-aged females (less than 25, 25 to 75, 76 to 199, and 200 or more). Producers operations were primarily cow/calf (77%) with fewer than 200 breeding-aged females. A controlled breeding season was used by 67% of producers and did not differ (P > 0.68) by herd size. Producers that individually identified cows was greater (P < 0.01)

for producers with 76 to 199 (82%) and > 200 (93%) breeding-aged females compared with 63 and 67% for producers with <25 and 25 to 75 breeding-aged females; respectively. Percentage of producers that vaccinated for respiratory diseases was greater (P < 0.01) for producers with > 200 breeding-aged females (89%), and similar (P > .05) for producers with < 25 (60%), 25 to 75 (53%), and 76 to 199 (69%) breeding aged females. Most producers (58%) marketed cattle a few at a time at an auction barn and did not differ (P = 0.08) among herd sizes. The percentage of producers retaining ownership of calves throughout the backgrounding and finishing phase was greater (P < 0.01) for producers that had greater than 200 breeding-aged females (3, 3, 9, and 28% for producers with <25, 25 to 75, 76 to 199, and > 200 breeding-aged females; respectively). Approximately one-third of producers surveyed are not using recommended management practices such as individual identification, a controlled breeding season, and completion of pre-condition procedures. Omission of these management practices will limit profitability in value-based production systems that require cattle to be produced to exact specifications.

Key Words: Survey, Cattle, Marketing

22 Overview of West Nile Virus in horses in Tennessee. O. F. Harper*, F. Hopkins, and E. L. Tipton, The University of Tennessee.

West Nile Virus (WNV), an encephalitis, is a new viral disease that first appeared in the United States in 1999. It can infect birds, humans and horses. WNV is transmitted by mosquitoes from wild birds to non-infected birds, humans and horses. Humans and horses are incidental but dead-end hosts. In three years, West Nile Virus has spread from the East coast to the West coast. A multi-faceted Extension program was initiated in 2001 to educate and keep Extension agents, horse owners, agribusiness leaders and the general public abreast of the current status of WNV in horses in Tennessee. WNV was first diagnosed in Tennessee in 2001 in wild birds and one horse. As of mid-October 2002, 109 horses and more than 760 birds have been diagnosed positive for WNV in the state. Thirty horses have died or have been euthanized. Six human deaths have also occurred from WNV. There is no treatment for WNV. The USDA has conditionally approved a WNV vaccine for horses. A five-point Extension program was developed in 2002 for Tennessee horse owners: 1) Do not panic; 2) Be aware of clinical signs of WNV so horses can be monitored and tested; 3) Consider vaccinating in consultation with your veterinarian; 4) Eliminate mosquito breeding areas around horses; and 5) Use labeled, effective insecticides on horses and facilities. Extension agents have been kept updated on the WNV situation by periodic e-mails noting the county location of WNV-positive birds and horses and by articles in the Department of Animal Science Update, an in-house, monthly publication. A WNV Webpage was developed as a part of the Department of Animal Science Website at <http://www.agriculture.utk.edu/ansci>. More than 10,000 brochures about the WNV facts for horse owners have been distributed to 56 county Extension offices, the Tennessee Department of Agriculture and the USDA Veterinary Service in Tennessee. Other farm animal owners have expressed concern about WNV. While other farm animals may become infected by mosquitoes, there is no current evidence that they become clinically sick or have a role in the proliferation of WNV.

Key Words: Equine, West Nile Virus, Tennessee

23 Impact of a new livestock program for youth in Worth County, Georgia. H.M. Harris*¹, W.R. Getz², and T.E. Cary¹, ¹University of Georgia, Sylvester, GA, ²Fort Valley State University, Fort Valley, GA.

Local extension programming is affected by change. A positive response brings vitality to extension efforts. Youth livestock projects most often involve cattle, swine, sheep and horses. At one time Worth County was a hotbed for market hog projects. With reduced availability of feeder pigs, prices becoming excessive, and expenses of other livestock projects continuing to escalate, the extension coordinator took a chance and organized a market goat program. Results have been positive. We illustrate the outcome, discuss lessons learned, and provide implementation guidelines resulting from steps into the unknown. Goats are small and easy to match with the size of the participant. They require a small amount of space and provide a meaningful livestock experience in a short time. They can be fed and cared-for without expensive facilities or equipment. Cost of animals and feed is relatively low. The

program began in 1999 with 4 exhibitors and 6 goats. It has grown to involve 33 exhibitors and 52 goats, and now represents a significant portion of all market goats and participants at the Georgia National Fair live and carcass show. Success indicators include: 1) number of program participants, 2) location of goats in suburban backyards as well as rural areas, 3) strong parental involvement while egos are kept in check, 4) involvement of a diverse clientele of various income brackets and cultural backgrounds, 5) placing in the top bracket of local and state shows using goats from commercial herds, and 6) returns on investment being reasonable. Georgia does not yet have a statewide 4-H market goat program. The agents in Worth County took bold steps to use this animal as a tool in youth development and adult education. Critical program elements include: 1) availability of good quality commercial goats, 2) reasonable and affordable prices, 3) insistence that parents be involved, 4) clinics for instruction and practice, and 5) active involvement of extension staff.

Key Words: Extension Programs, Market Goats, Youth

24 Determining the value of preconditioned feeder cattle. T.R. Troxel*, *University of Arkansas Cooperative Extension Service, Little Rock, AR.*

The objective of this study was to evaluate the health performance of preconditioned feeder cattle. To qualify for the preconditioned sale, cattle were weaned 45 d prior to the sale, dewormed and vaccinated for blackleg, IBR, BVD, PI3, BRSV, *Pasteurella haemolytica* and *Haemophilus somnus* 2 to 4 wk before weaning (killed vaccines). Calves were revaccinated at weaning (modified live vaccines). Bulls were castrated and all cattle were dehorned or tipped. Seventeen buyers that purchased 656 hd. Eighty-one percent of the buyers, which purchased 88% of the cattle, were surveyed. Ninety percent of the feeder cattle were transported the same day of the sale. The cattle were hauled an average of 94 ± 105.6 km, and 82% of the cattle were unloaded into a dry lot. Thirty-two percent of the buyers said they commingled the preconditioned calves with calves not preconditioned. One-third of the buyers did not treat any calves for sickness during the first two-week period after the sale whereas 66% of the buyers did. Thirty-four calves (6%) were treated for sickness during this period. Seventy-one percent of the buyers, that treated calves, treated only one or two head. One calf died of pneumonia during the first two weeks following the sale (0.2% death loss). During the second two-week period following the sale, 90% of the buyers did not treat any cattle for sickness and no calves died. Overall, 70% of the buyers reported that the preconditioned calves had less sickness than normal sale barn cattle, but 20% reported about the same sickness. Fifty-five percent of the buyers believed the preconditioned calves took to feed and water faster than sale barn cattle. When comparing ($P < 0.01$) the actual morbidity (6%) and mortality (0.2%) rates to expected morbidity (23%) and mortality (3.2%) rates, a 226 kg preconditioned calf was worth \$50 more than a "normal" sale barn calf. It was concluded that the majority of the buyers were very pleased with the cattle purchased at this sale.

Key Words: Precondition, Morbidity, Mortality

25 Assessment of timing of castration and other factors that affect performance of calves in a 45-day conditioning program. J.B. Neel*, A.E. Fisher, W.W. Gill, C.D. Lane, Jr., B.D. Sims, and M.D. Davis, *University of Tennessee, Knoxville.*

Cattle that were part of an existing study, comparing the performance of steers of differing body types in a conditioning program, were weighed and assigned a body condition score (BCS), a castration score (CS), a hair score (HS) and were graded either large frame (LF) or medium frame (MF) at the onset of the study. They were weighed and assigned a BCS, a CS and a HS again at day 45. The BCS system is a 1-9 scale, with 1 being thin and 9 being obese. The CS system is a 1-2 scale with a castration score 1 (CS1) being a calf castrated prior to purchase while a castration score 2 (CS2) is a calf castrated after purchase. The HS system is a 1-5 scale with 1 being a healthy coat appearance with no detectable problems and 5 being a clearly dead, brittle hair coat with discoloration. Of the 122 steers assessed, 97 were classified CS1 and 25 were classified CS2. Weight and gain data were analyzed using the MIXED procedure of SAS and differences were determined at $P < 0.05$. The CORR procedure of SAS was used to establish valid correlations at $P < 0.05$. There were no differences in initial weights of CS1 and CS2 steers. Castration score 1 calves gained 0.2 kg per day more than CS2 calves. The LF CS1 calves gained more than any other group. A valid

positive correlation was found between end weight and ADG, end weight and end BCS, end weight and BCS increase, ADG and BCS increase and BCS increase and HS decrease. A valid negative correlation was found between CS and ADG, end weight and end HS, end BCS and end HS and BCS increase and end HS. Timing of castration has a significant impact on future productivity of feeder calves. The HS system may be a valid indicator of nutritional status and subsequent performance.

Table 1.

	Initial Weight (kg)	ADG (kg)
LF	272 _A	1.16 _A
MF	255 _B	1.08 _A
CS1	264 _A	1.22 _A
CS2	264 _A	1.02 _B
LF CS1	273 _A	1.33 _A
LF CS2	271 _{AB}	1.00 _B
MF CS1	255 _C	1.12 _B
MF CS2	256 _{BC}	1.05 _B

Key Words: Feeder Calves, Castration, Hair Score

26 Effect of frame size and supplementation on performance of newly received beef steers. W.W. Gill*¹, J.B. Neel¹, C.D. Lane, Jr.¹, A.E. Fisher¹, T.M. Steen², B.D. Sims¹, M.D. Davis¹, and C.J. Richards¹, ¹*University of Tennessee, Knoxville,* ²*Tennessee Farmers Cooperative.*

Steers (141) were purchased from three sale barns over a 14-day period (day -14 to day 0) and fed a commercial receiving ration plus hay for a minimum of 8 days before initiating the experiment. After weighing on d-0, 128 steers were blocked by frame size and randomly allotted to treatment. Large frame (LF) cattle were typical of Continental/English crossbreds and medium frame (MF) cattle were typical of English breeds. Throughout the experiment, steers had free choice access to medium quality grass hay and received one of two supplemental treatments at 1% of initial body weight. Supplemental treatments consisted of a 14% CP highly digestible fiber based commercial supplement (DF) or a 1:1 mixture of an 18% CP DF and whole shelled corn (DFC), to make the diets isonitrogenous. Steers were weighed on days 0, 21 and 45 with period 1 (P1) as days 0-21 and period 2 (P2) as days 22-45. Nine steers and their respective measures were removed from study due to death or illness. Supplemental cost of gain (COG) was calculated by dividing total supplement cost by total gain. All data were analyzed using the MIXED procedure of SAS and differences were determined at $P < 0.05$. The LF pens had a higher morbidity/mortality rate than MF pens (12% vs. 3%, respectively). Initially, there was no difference in treatment weights, but LF steers were heavier than MF steers. Large frame steers gained more weight than MF steers during P2 and the entire experiment. Steers on DF gained more weight than DFC steers during the P1 and entire experiment. There were no differences in COG throughout the experiment. These data indicate that frame size and ration formulation affect performance of newly weaned cattle.

Table 1.

	Initial Weight (kg)	ADG (kg/d)	P1ADG (kg/d)	P2ADG (kg/d)	COG (\$/kg)	P1COG (\$/kg)	P2COG (\$/kg)
LF	273 _A	1.3 _A	1.5 _A	1.1 _A	0.31 _A	0.28 _A	0.41 _A
MF	255 _B	1.1 _B	1.3 _A	0.9 _A	0.35 _A	0.32 _A	0.47 _A
DF	266 _A	1.3 _A	1.6 _A	1.0 _A	0.34 _A	0.30 _A	0.50 _A
DFC	262 _A	1.1 _B	1.2 _B	1.0 _A	0.33 _A	0.30 _A	0.39 _A
LF DF	276 _A	1.4 _A	1.7 _A	1.0 _A	0.34 _{AB}	0.27 _A	0.52 _A
LF DFC	270 _A	1.2 _A	1.3 _A	1.2 _A	0.30 _B	0.29 _A	0.31 _A
MF DF	256 _B	1.2 _A	1.4 _A	1.0 _A	0.35 _A	0.32 _A	0.47 _A
MF DFC	255 _B	1.0 _B	1.2 _B	0.8 _A	0.35 _A	0.31 _A	0.48 _A

Key Words: Feeder Calves, Body Type, Supplementation

27 Effects of age at first calving and age within contemporary group on calving intervals in beef cattle. J. A. Parish*¹ and M. S. Andrews¹, ¹University of Arkansas Cooperative Extension Service.

Early age at first calving has been shown to increase the overall lifetime efficiency of a beef cow. However, many beef cattle producers manage heifers to first calve at 30 months or older instead of as 2-yr olds. In addition, many producers select heifers born earlier in the calving season as replacements since these cattle often reach heavier weights than younger contemporaries by breeding time. The objectives of the present study were to determine the effects of age at first calving and birth date within the calving season on first calving interval, second calving interval, and mature calving interval defined as the average of the third and subsequent calving intervals. Data were collected from 437 calving records spanning an 11-yr period from 1991 to 2001 at Harmony Meadows Ranch in Bee Branch, AR. Salers and Salers x Angus crossbred heifers were born at Harmony Meadows Ranch, retained as replacements, and managed under uniform conditions. Natural mating was used within controlled breeding seasons. First calving interval was longer ($P < 0.01$) in heifers that first calved at 24 months of age or less (410 ± 9 d) than in heifers that calved at 25 to 30 months of age (379 ± 9 d) or greater than 30 months of age (378 ± 10 d). No significant differences were found in second calving interval, mature calving interval, adjusted 205-d calf weaning wt, or adjusted 205-d calf wt / cow wt among these groups. There were no significant differences for age at first calving, first calving interval, or mature calving interval among heifers born in the first 30 d of the calving season, the second 30 d of the calving season, or beyond 60 d into the calving season. Second calving interval was longer ($P < 0.01$) in heifers (444 ± 15 d) born in the first 30 d than heifers born in the second 30 d (368 ± 10 d) of the calving season. These results indicate that managing heifers to calve at earlier ages may increase first calving intervals without negatively impacting subsequent calving intervals.

Key Words: Cow-calf Management, Calving Interval, Age at First Calving

28 Mineral problem provides opportunity to develop Extension model for partnerships in Tennessee. W.W. Gill*, A.E. Fisher, C.D. Lane, Jr., D.K. Joines, and J.B. Neel, University of Tennessee, Knoxville.

Over the years, progressive beef producers in Montgomery County, Tennessee observed brood cows not shedding winter hair coats and experiencing decreased reproductive rates. Extension agents and beef specialists were consulted to analyze the problem. The problem was first believed to be the result of consuming the tall fescue endophyte, *Neotyphodium coenophialum*. Since the visual symptoms (rough hair coats) were indicative of a copper (Cu) deficiency, forage analyses were made to determine mineral levels, primarily Cu and Cu antagonists (sulfur (S), iron, molybdenum (Mb)). With the help of the University of Tennessee Forage Testing Lab and the Tennessee Farmers Cooperative, a commercial laboratory conducted the mineral analysis. In 1999, 11 forage samples were collected and Cu, S and Mb averaged 6.4 PPM, 0.31% and 1.1 PPM, respectively. Twenty forage samples were taken in 2000 and Cu and S averaged 6.9 PPM and 0.25%, respectively. A grant was secured to collect forage samples over a 2-year period in order to determine if the mineral imbalance was a statewide problem. Extension agents were asked to collect 1-2 forage samples from a suspect herd in their county. In 2001, 182 forage samples were gathered from 47 counties and experiment stations. The data were reported at county meetings and field days in every region of the state. Over \$4000 was raised to support forage and blood analysis in 2002. In 2002, 72 counties and experiment stations submitted 419 forage samples. The FREQ procedure of SAS with chi-square analysis was used to determine if a yearly difference exists between the total number of samples and the number of county/experiment stations. In 2002, more samples ($P < 0.01$) were submitted from more county/experiment stations ($P < 0.03$). The interest of this program increased from 2001 to 2002 primarily because every sector played a key role in conducting the project. The cooperation between Extension agents, specialists and industry generated data that is very important and timely to the beef industry in Tennessee.

Key Words: Extension, Partnerships, Minerals, Beef Cattle

29 Mineral study reveals imbalances in Tennessee forage systems. A.E. Fisher*, W.W. Gill, C.D. Lane, Jr., D.K. Joines, J.B. Neel, and C.J. Richards, University of Tennessee, Knoxville.

A 2-year study was conducted to determine the mineral levels of Tennessee (TN) forage systems and if seasonal differences exist. Since tall fescue is the predominate forage used for pasture and hay production in TN, Extension agents across the state were asked to collect 1-2 tall fescue samples from their county in the spring and fall. These samples were taken during the first 10 days of May and August. Of the samples collected, 50 per season were determined to be from the same farm in spring 2001 (S1), fall 2001 (F1) and spring 2002 (S2). They were ground and sent to a commercial laboratory for analysis via a standard ICP analyzer system. Additionally, 15 samples from F1 and 15 samples from S2 were selected randomly for selenium (Se) analysis. All data were analyzed using the MIXED and FREQ procedures of SAS and differences were determined at $P < 0.05$. The means and associated standard errors are listed in Table 1. Copper (Cu) was marginally deficient or deficient in 74%, 84% and 100% of samples in S1, F1 and S2, respectively. Sulfur (S) was classified antagonistic to Cu in 80%, 92% and 94% of samples in S1, F1 and S2, respectively. Zinc was marginally deficient or deficient in 92%, 68% and 90% of samples in S1, F1 and S2, respectively. Potassium was classified antagonistic to magnesium in 24%, 30% and 38% of samples in S1, F1 and S2, respectively. Copper decreased across seasons while S was the highest in F1 and was higher in S2 than S1. Selenium was lower in S2 than F1.

Table 1.

	Spring Mean	2001 SE	Fall Mean	2001 SE	Spring Mean	2002 SE
Calcium, %	0.48 _B	0.02	0.55 _A	0.02	0.47 _B	0.02
Phosphorus, %	0.33 _B	0.01	0.38 _A	0.01	0.38 _A	0.01
Sodium, %	0.00 _B	0.00	0.00 _B	0.00	0.02 _A	0.00
Magnesium, %	0.21 _C	0.01	0.31 _A	0.01	0.24 _B	0.01
Potassium, %	2.65 _A	0.09	2.67 _A	0.09	2.82 _A	0.08
Sulfur, %	0.24 _C	0.01	0.31 _A	0.01	0.28 _B	0.01
Manganese, ppm	99.74 _{AB}	7.28	110.88 _A	7.28	88.48 _B	7.14
Copper, ppm	8.56 _A	0.34	6.92 _B	0.34	5.31 _C	0.33
Zinc, ppm	22.68 _A	2.89	28.14 _A	2.89	24.10 _A	2.83
Selenium, ppm	.	.	0.077 _A	0.006	0.053 _B	0.006

Key Words: Forage Minerals, Copper, Sulfur

30 Serum copper and selenium levels of selected Tennessee cattle. C.D. Lane, Jr.*¹, A.E. Fisher¹, W.W. Gill¹, J.B. Neel¹, R.B. Wilson², F.M. Hopkins¹, and F.D. Kirkpatrick, ¹University of Tennessee, Knoxville, ²C.E. Kord Animal Disease Diagnostic Laboratory.

Recent work in Tennessee (TN) has shown mineral deficiencies and imbalances in TN forages. These imbalances have been low copper (Cu), high sulfur (S) levels in spring and fall, as well as low magnesium, high potassium levels in the spring. Limited analysis has also shown low forage selenium (Se) levels. Little information is known about the blood mineral status of TN cowherds or if and to what extent a link exists between forage and animal mineral levels. Bulls brought in for the University of Tennessee Central Bull Test were weighed, assigned a hair score (HS), had body temperature (BT) measured and randomly selected to have blood drawn. Ninety bulls received in July were classified Senior and 63 bulls received in September were classified as Junior. The HS system is a 1-5 scale with 1 being a healthy coat appearance with no detectable problems and 5 being a clearly dead, brittle hair coat with discoloration. Blood serum samples were analyzed for Cu and Se (only for Senior bulls) levels by the state diagnostic laboratory. All data were analyzed using the MIXED procedure of SAS and differences were determined at $P < 0.05$. The data are listed in Table 1. The CORR procedure of SAS was used to establish valid correlations at $P < 0.05$. A valid positive correlation was found between BT and HS, BT and weight and weight and blood Se. A valid negative correlation was found between weight and blood Cu while BT and blood Cu tended ($P = 0.12$) to be negatively valid. The differences in weight, BT and HS between Senior and Junior bulls are related to age and possibly more to seasonal variation. It is recognized that serum mineral analyses are of limited value in assessing total mineral status, however the differences noted in this study warrant consideration and point toward the need for additional assessment.

Table 1.

	Senior Bulls			Junior Bulls		
	Mean	SE	Range	Mean	SE	Range
Weight, kg	365 _A	5	256-464	310 _B	6	196-428
BT, °C	40.1 _A	0.1	38.8-41.8	39.2 _B	0.1	38.6-40.6
HS	1.9 _A	0.1	1-5	1.3 _B	0.1	1-2
Copper, ppm	0.54 _A	0.02	0.32-0.78	0.56 _A	0.02	0.35-1.15
Selenium, ppm	0.09	0.03	0.03-0.19	.	.	.

Key Words: Beef Cattle, Serum, Copper

31 Evaluation of blood mineral levels of beef cows and heifers. M.S. Gadberry*¹, T.R. Troxel¹, and G.V. Davis¹, ¹University of Arkansas, Cooperative Extension Service.

The objective of this study was to evaluate serum mineral and whole blood Se levels to determine the occurrence of mineral deficiencies in AR beef cattle. Each herd was provided a free choice mineral supplement. Blood samples were collected from mature cows (22 farms) and replacement heifers (5 farms). Cow and heifer samples were not collected from the same farms. An average of 13 cows and 12 heifers were sampled per farm, representing 17% of the cows and 74% of the heifers. Fifty-nine heifer samples were analyzed for Ca, P, Na, K, Mg, Fe, Zn, Cu, and

Se; and 106 cow samples were evaluated for all listed minerals except for Cu (n=316) and Se (n=350). Michigan State University suggested blood levels were used to categorize samples as below adequate, adequate, or excessive. Chi-square analysis was used to determine if heifer or cow samples differed in category. Mineral levels of heifers versus cows were analyzed using farm as the experimental unit and animal within farm as the model error term. Serum Cu averaged 0.72 0.07 and 0.67 0.03 ppm for heifers and cows and did not differ (P = 0.51). Blood Se averaged 0.13 0.02 and 0.11 0.01 ppm for heifers and cows and did not differ (P = 0.46). The percent farms with heifers or cows that was adequate (80% and 54.6%) or below adequate (20% and 45.4%) for Cu was not different (P = 0.30). The percent farms with heifers or cows adequate (20% and 36.4%) or below adequate (80% and 63.6%) for Se was not different (P = 0.48). Farm averages for heifers and cows were adequate for Na and Mg and excessive for K. Calcium and P were adequate on all heifer farms but below adequate on 8.3% cow farms; however, percent heifer and cow farms adequate or below adequate were similar (P = 0.51). Zinc was adequate for all farms. Producers should provide mineral supplements containing adequate trace mineral levels and monitor and adjust intake of free choice supplements to ensure consumption.

Key Words: Beef Cattle, Copper, Selenium

Graduate Student Paper Competition

32 Exogenous γ -glutamyl cycle compound supplementation to *in vitro* maturation medium and effects on subsequent *in vitro* fertilization, culture, and viability of porcine oocytes and embryos. B. D. Whitaker*¹ and J. W. Knight¹, ¹Virginia Polytechnic Institute and State University, Blacksburg VA/USA.

High concentrations of intracellular glutathione (GSH) enhance *in vitro* production of porcine embryos. Objectives were 1) to study the effects of γ -glutamyl cycle compound supplements to the *in vitro* maturation (IVM) medium on *in vitro* fertilization (IVF) and *in vitro* culture (IVC) and 2) to evaluate embryo viability. Porcine oocytes were matured in NCSU 23 medium supplemented with either L-cysteine (3.3 mM), L-cysteamine (150 mM), L-cysteine and L-cysteamine, L-glycine (1, 2.5, or 5 mM), L-glutamate (1, 2.5, or 5 mM), L- α -aminobutyrate (3.3 mM), β -mercaptoethanol (25 mM), L-cysteine and β -mercaptoethanol, or L- α -aminobutyrate and β -mercaptoethanol. After IVM, concentrations of intracellular GSH were determined using the DTNB#GSSG reductase recycling assay. Significant (P < 0.05) increases in GSH concentrations were observed using L-cysteine (n = 42), 1.0 mM L-glutamate (n = 109), L- α -aminobutyrate (n = 57), and L- α -aminobutyrate with β -mercaptoethanol (n = 47). Oocytes matured with L- α -aminobutyrate and β -mercaptoethanol had a lower (P < 0.05) occurrence of polyspermy during IVF compared to controls and a greater percentage (P < 0.05) of embryos reaching the blastocyst stage compared to other treatment groups. For objective 2, oocytes were matured in NCSU 23 (n = 150) or NCSU 23 supplemented with L- α -aminobutyrate with β -mercaptoethanol (n = 180). Supplementation had no effect on the time of cell death. The times at which embryo mortality was greatest (P < 0.05) were between 24 to 42 h post-IVF with the greatest occurrence around 36 h. In conclusion, supplementing 3.3 mM L- α -aminobutyrate and 25 mM β -mercaptoethanol into the IVM medium increases the intracellular GSH concentrations, decreases the occurrence of polyspermy during IVF, and increases embryo development parameters during IVC but does not have an effect on cell death during embryo development. The onset of cell death appears to occur between 24 to 42 h post-IVF with the greatest occurrence around 36 h post-IVF.

Key Words: Embryo Cell Death, Glutathione, Porcine

33 Supplementing bahiagrass hay with molasses or molasses-urea with or without soybean hulls. M. J. Kostenbauder*², S. W. Coleman¹, C. C. Chase, Jr.¹, W. E. Kunkle², M. B. Hall², and F. G. Martin², ¹USDA, ARS, STARS, Brooksville, FL, ²Univ. of Fla., Gainesville.

Two experiments were conducted to evaluate the effect of molasses or molasses-urea fed with or without soybean hulls on digestibility, intake and animal performance of cattle fed bahiagrass hay (8% CP). In exp. 1, Holstein steers were fed one of six diets: 1) hay only; 2) hay plus

molasses (0.75% BW); 3) hay plus molasses-urea (3% of molasses); 4) hay plus soybean hulls (0.75% BW); 5) hay plus soybean hulls-molasses; and 6) hay plus soybean hulls-molasses-urea. Diet digestibility was increased with added molasses (P < 0.05) or soybean hulls (P < 0.01) but estimated hay and neutral detergent fiber digestibility were depressed with added molasses (P < 0.05). Neutral detergent fiber digestibility increased with added urea (P < 0.10) or soybean hulls (P < 0.05). Acid detergent fiber digestibility increased with soybean hulls supplementation (P < 0.01), decreased with molasses (P < 0.01), and was unaffected by urea supplementation. Nitrogen absorbed and retained, as a percentage of intake, were not affected by supplementation. Concentrations of plasma urea nitrogen, non-esterified fatty acid, and blood-glucose were not affected by diets. In exp. 2, the same diets as in exp. 1 were fed to 36 beef calves in Calan headgates for 43 d (6 calves/diet). Average daily gain was improved (0.2 vs. 0 kg/d; P < 0.01) with added soybean hulls, and also with urea (0.2 vs. -0.1 kg/d; P < 0.01). Plasma urea nitrogen (PUN) was higher with added soybean hulls and urea (P < 0.01 for day 20; P < 0.10 for day 43, respectively). Molasses decreased PUN concentrations at day 20 (P < 0.01). Blood-glucose was increased by added soybean hulls (P < 0.05) and urea (P < 0.10) both on day 20 and day 43. Soybean hulls can improve gains when used to supplement marginal quality hay without depressing digestibility of hay. Molasses depressed fiber digestibility, but adding urea restored digestibility and improved gains.

Key Words: Soybean Hulls, Molasses-urea, Bahiagrass Hay

34 Effect of supplementation on nutrient digestion and retention by steers consuming bermudagrass hay. A.S. Webb*, B.J. Rude, and D.G. St. Louis, ¹Mississippi State University.

Cattle consuming low quality forage often need supplementary energy. The objective of this study was to evaluate digestibility of nutrients and retention of protein and energy when supplementing corn or soybean hulls to cattle fed low-quality bermudagrass hay. Twelve steers (184 ± 14.2 kg BW) were fed in metabolism crates for 11 d. Steers were randomly assigned to three treatment groups: 1) Bermudagrass hay only (control); 2) Corn supplemented to bermudagrass hay (corn); 3) Soybean hulls supplemented to bermudagrass hay (hulls). Soybean meal was added to meet NRC protein requirements based on dietary ME content. Corn was supplemented at 0.5 % BW and soybean hulls were supplemented at 1.0 % BW. Steers were allowed *ad libitum* access to hay and consumed respective supplements once daily. Forage intake was similar (P > 0.05) for all treatments ranging between 2.06 and 2.37 kg/d (1.15 and 1.32 % BW/d). Total DMI was increased (P < 0.01) when steers were supplemented with hulls (2.37 % BW/d) compared to steers receiving control or corn diets (1.31 and 1.66 % BW/d, respectively). Both DM and OM digestibility were increased (P < 0.05) when corn

or hulls were fed (70 and 70 % for DM; 71 and 72 % for OM, respectively) compared to control (58 and 59 %, respectively). Digestibility of fiber portions were not different ($P > 0.05$) with control, corn and hulls ranging between 65 and 74 %; 64 and 74 %; 66 and 73 % for NDF, ADF and hemicellulose, respectively. Protein digestibility differed ($P < 0.05$) between steers receiving control (54 %) and those supplemented with corn or hulls (70 and 64 %, respectively). Energy digestibility differed ($P < 0.05$) between steers receiving control (57 %) and those supplemented with corn or hulls (70 and 70 %, respectively). Steers receiving hulls retained more ($P < 0.01$) protein (0.92 kcal/d) than those receiving corn (0.27 kcal/d), which retained more protein than those receiving control (-0.37 kcal/d). Steers receiving hulls retained more ($P < 0.01$) energy (14.0 Mcal/d) than those receiving corn (9.8 Mcal/d), which retained more energy than those receiving control (6.3 Mcal/d). These data indicate that hulls allow more efficient nutrient utilization compared to corn as a supplement for cattle fed lower quality forages such as bermudagrass.

Key Words: Bovine, Digestibility, Supplementation

35 Effect of forage vs. concentrate feeding with or without antioxidants on carcass characteristics, fatty acid composition, and quality of Uruguayan beef. C.E. Realini¹, S.K. Duckett¹, G.W. Brito², M. Dalla Rizza², and D. De Mattos², ¹Animal and Dairy Science Department, The University of Georgia, Athens, ²National Institute of Agricultural Research, Uruguay.

Thirty Hereford steers were finished either on grass (GRASS, n=10) or concentrates (CONC, n=20) to determine dietary and antioxidant treatment effects on fatty acid composition, shelflife, and meat quality of Uruguayan beef. Half of the steers finished on concentrates were supplemented with 1000 I.U. vitamin E head-1d-1 (VITE). Postmortem vitamin C (VITC) was added to ground beef (1% w/v:) displayed for 8 d at 2C. CONC carcasses had greater ($P < 0.05$) carcass weight, conformation, degree of finishing, fat depth, and ribeye area than GRASS. GRASS carcasses showed darker ($P < 0.05$) longissimus color and yellow ($P < 0.05$) fat at 24 h postmortem than CONC. Initial Warner-Bratzler shear force values were similar ($P > 0.05$) between GRASS and CONC beef. However, GRASS beef had lower ($P < 0.05$) WBS values at 7 and 14 d postmortem. Longissimus a-tocopherol levels were greater ($P > 0.01$) for GRASS and CONC-VITE compared to CONC. Ground beef from VITE had the lowest TBARS values, while samples from GRASS had the lowest lipid stability with numerically higher TBARS levels than other treatments. VITC treatment did not ($P > 0.05$) reduce lipid oxidation. Steaks from GRASS and VITE had similar ($P > 0.05$) TBARS values, which were lower ($P < 0.05$) than steaks from CONC during 21 d of display. VITE supplementation of CONC cattle had no effect ($P > 0.05$) on color stability of ground beef or steaks. a* (redness) values were higher when VITC was added to ground beef. Longissimus fatty acid content of CONC was twofold greater ($P < 0.01$) than GRASS. The percentages of 14:0, 16:0 and 18:1 fatty acids were higher ($P < 0.01$) in the intramuscular fat of CONC, while GRASS showed greater ($P < 0.01$) proportions of 18:0, 18:2, 18:3, 20:4, 20:5, and 22:5. Total conjugated linoleic acid (CLA) and CLA isomer c9t11 were higher ($P < 0.01$) for GRASS than CONC. VITE supplementation of CONC increased lipid stability of ground beef and steaks, but was unable to improve color stability; whereas VITC addition to ground beef increased color stability without altering lipid oxidation. Finishing cattle on grass enhanced the unsaturated fatty acid profile of intramuscular fat in beef including CLA and omega-3 fatty acids.

Key Words: Beef, Grass-fed, Antioxidants

36 Effect of oil source with or without fish oil addition on ruminal biohydrogenation and conjugated linoleic acid (CLA) production in beef cattle fed finishing diets. B Jacob¹, S K Duckett¹, J R Sackmann¹, M H Gillis¹, C E Realini¹, K R Smith¹, A Parks¹, and R Eggleston¹, ¹University of Georgia, Athens.

Four Hereford steers, caulated in the proximal duodenum were used to determine the effect of oil source (canola vs corn oil) with or without fish oil addition, on the ruminal biohydrogenation (BH) of C18 unsaturated fatty acids and outflow of conjugated linoleic acid (CLA) and trans C18:1 fatty acids at the duodenum. Steers were fed one of the four treatment diets in a 2x2 factorial arrangement of treatments (4% canola oil or corn oil; 0 or 1% fish oil), in a 4x4 Latin Square design. Steers were fed the basal finishing diet once daily, which contained 12%

grass, hay and 88% concentrate. Chromic oxide was fed as an external marker to quantify fatty acid flow. Data were analyzed with animal, period, oil source, fish oil and oil source*fish oil interaction in the model. Addition of canola oil increased ($P < 0.05$) BH of oleic and linolenic acids and decreased ($P < 0.05$) linoleic acid BH compared to corn oil. Fish oil addition reduced ($P < 0.05$) oleic acid BH but did not alter ($P < 0.05$) BH of linoleic and linolenic acids. Overall BH of unsaturated 18C fatty acids was reduced ($P < 0.05$) with fish oil addition and remained similar ($P < 0.05$) between oil sources. Trans-11 octadecenoic acid flow (g/d) was greater ($P < 0.05$) for diets containing corn oil than canola; however trans-11 C18:1 did not differ ($P < 0.05$) between oil sources with addition of fish oil. Flow of trans-9, -10 and -12 octadecenoic acids was higher ($P < 0.05$) with fish oil addition. Diets containing canola oil increased ($P < 0.05$) flow of cis-9 trans-11 isomer of CLA compared to corn oil. Addition of fish oil increased ($P < 0.05$) flow of cis-9 trans-11 isomer of CLA. Other CLA isomers (trans10 cis12, cis11 trans13) were also increased ($P < 0.05$) with fish oil addition. Flow of omega-3 fatty acids was greater ($P < 0.05$) when fish oil was added. Supplementing canola oil in finishing diets increased the flow of cis-9 trans-11 isomer of CLA at the duodenum by 54% over corn oil. Addition of fish oil reduced oleic acid overall BH, and increased cis-9 trans-11 flow by 92%.

Key Words: Beef, Fish Oil, Conjugated Linoleic Acid

37 Measuring carcass composition of goat kids fed three dietary concentrations of copper. C. E. Hopkins², S. G. Solaiman¹, and C. R. Kerth², ¹Tuskegee University, ²Auburn University.

Fifteen Spanish x Boer mix goat kids (21.3 ± 0.7 kg initial BW), were used to determine the effect of high dietary copper (Cu) on carcass composition and to develop regression equations for predicting carcass composition. Animals were housed in individual pens, stratified by BW and randomly assigned to three different treatments consisting of control (no supplemental Cu); 100 mg Cu/d; and 200 mg Cu/d from Cu sulfate. Animals were fed *ad libitum* twice a day a 70:30 grain: hay diet. At harvest, dressing percentage (DP), hot carcass weight (HCW), kidney and pelvic fat (KPF), backfat thickness over the 12th rib (BF), and ribeye area (REA) were collected and used as independent variables in developing regression equations. The left side of 12 carcasses and the 9-10-11th rib section of 15 carcasses were dissected into separable lean, fat and bone portions. Lean portions were analyzed for moisture, fat, protein, and ash. The moisture percent of 9-10-11th rib section increased (L, $P = 0.03$) and fat percent decreased (L, $P = 0.02$) as Cu supplementation increased in the diet. Protein and ash percent of the 9-10-11th rib section tended to increase (L, $P = 0.09$ and L, $P = 0.06$, respectively), as Cu increased in the diet. Carcass protein measured using one half the whole body increased (L, $P = 0.01$) as Cu supplementation increased. Percentages of fat, ash, and moisture in the 9-10-11th rib section were correlated ($P < 0.05$) with fat, ash, and moisture percentages of one half the whole body ($r = 0.70, 0.71, \text{ and } 0.88$, respectively). Carcass measurements (DP, HCW, KPF, BF, and REA) could not predict whole body composition ($P > 0.05$). These results indicate that supplemental Cu fed to goat kids can alter carcass composition and composition measurements of the 9-10-11th rib section are useful for predicting carcass composition.

Key Words: Carcass Composition, Copper, Goat Kids

38 Dexamethasone effects on leptin concentrations in stallions, mares, and geldings. J.A. Cartmill¹, D.L. Thompson, Jr.¹, W.A. Storer¹, and N.K. Huff¹, ¹Louisiana State University Agricultural Center, Baton Rouge.

We previously reported that leptin concentrations in geldings and mares increased following multiple injections of dexamethasone (DEX). The purpose of Exp. 1 was to determine if multiple injections of DEX altered plasma leptin in stallions. The objective of Exp. 2 was to determine if age, sex, and body condition altered the response in leptin concentrations to a single injection of DEX. In Exp. 1, nine light horse stallions were randomly assigned to receive either DEX in oil (125 µg/kg BW; n = 5) or oil (n = 4) i.m. daily for 5 d. In Exp. 2, 10 stallions, 10 mares, and 10 geldings were assigned a body condition score (BCS) and received a single i.m. injection of DEX (125 µg/kg BW) once on d 0. Ultrasound measurements of fat thickness (FT) from four different sites (tailhead, rump, back, and withers) were collected on d -4 and 14. In Exp. 1, plasma leptin, glucose, and insulin were increased ($P < 0.01$) by

DEX. During the period of 12-h sampling, plasma leptin and insulin peaked each afternoon and decreased each morning. This pattern of secretion appeared to be diurnal but may have been related to the feeding of concentrate only in the morning. Concentrations of IGF-1 were altered ($P < 0.01$) by treatment, being lower on d 3, 4, 5, and greater on d 14 in the DEX group. In Exp. 2, concentrations of leptin in response to DEX were greater ($P < 0.01$) in mares and geldings relative to stallions. Body condition score, FT over the withers, and sex best fit ($R^2 = 0.65$) the stepwise regression model for pre-DEX leptin concentrations. Body condition score, FT over the back, and sex best fit ($R^2 = 0.75$) the stepwise regression model for maximum leptin response after DEX. In conclusion, stallions responded to multiple injections of DEX with increased leptin, insulin, and glucose concentrations. Further, estimates of fatness (BCS and FT) correlate with resting as well as DEX-stimulated leptin concentrations, however the low leptin concentrations in stallions are not fully explained by their degree of fatness.

Key Words: Horse, Sex, Leptin

39 Feeding supranutritional concentrations of vitamin D₃ and restricting dietary phosphorus effects on pork quality. T.R. Bonner*, C.R. Kerth, W.F. Owsley, W.R. Jones, and L.T. Frobish, *Auburn University*.

Yorkshire-cross pigs ($n = 50$) were assigned to one of five experimental finishing diets to determine the effects of high levels of vitamin D₃ with or without phosphorus fed for 10 or 50 days prior to slaughter on carcass and meat quality traits. The diets were 1) a standard finishing (SF) diet which served as the control (CON); 2) a SF diet with 70,000 IU/kg supplemental vitamin D₃ fed for 50 days prior to slaughter (50); 3) a SF diet with 70,000 IU/kg supplemental vitamin D₃ fed for 10 days prior to slaughter (10); 4) a SF diet with 70,000 IU/kg supplemental vitamin D₃ without supplemental phosphorus fed for 50 days prior to slaughter (50-P); and 5) a SF diet with 70,000 IU/kg supplemental vitamin D₃ without supplemental phosphorus fed for 10 days prior to slaughter (10-P). Animals fed the 50-P diet tended to have a lower pH across all times (0.5, 1, 2, 3, 4, and 24 h) postmortem compared to CON and 50 diet ($P = 0.10$). Diets did not affect objective color, marbling, or firmness/wetness scores measured at the 10th rib in the longissimus muscle ($P > 0.05$). There were no differences among diets for hot carcass weight; fat thickness along the mid-line measured at the first rib, last rib, and last lumbar vertebrae; muscle score; and loin eye area measured at the 10th rib ($P > 0.05$). Hunter color measurements taken at the 10th rib on the longissimus muscle did not differ ($P > 0.05$) among diets. Percent drip loss was not different among diets at 7 days or 10 days postmortem ($P > 0.05$). These data indicate that feeding high levels of vitamin D₃ and restricting phosphorus may lower pH values in pigs fed these diets for 50 days but do not affect other pork quality measures.

Key Words: Vitamin D₃, Pork Quality, Phosphorus

40 Timing effects of second GnRH administration on AI pregnancy rate in an Ovsynch protocol in postpartum crossbred beef cattle. H.K. Baitis*¹, W.D. Whittier¹, A. Garcia¹, and J.M. DeJarnette², ¹*Large Animal Clinical Science, Virginia Polytechnic Institute and State University, Blacksburg, VA*, ²*Select Sires Inc., Plain City, OH 43064*.

Fixed-time artificial insemination (TAI) after GnRH-PGF₂α-GnRH treatments (Ovsynch) is a protocol used to achieve acceptable pregnancy rates in cattle without estrus detection. However, up to 30% of

the synchronized animals display premature estrus. The objective of this experiment was to determine if varying the interval from PGF₂α to the second GnRH administration in an Ovsynch protocol would alter conception rates in crossbred beef cows. Postpartum beef cows ($n = 310$) were subjected to the synchronization programs. Cows were managed in commercial cow/calf operations at four locations. Cows were injected (im) with 50 μg of GnRH on day 0 and PGF₂α (25 mg dinoprost) on day 7. Animals were randomly allotted to receive a second dose of GnRH either 36 h ($n = 155$) or 48 h ($n = 154$) following PGF₂α administration and were artificially inseminated 12-16 h later without estrous detection. Data were analyzed using Chi square and Proc GLM (SAS) procedures. Pregnancy rates were 48% and 47% when GnRH was administered 36 or 48 h respectively. There was no significant effect of the timing of second GnRH administration on pregnancy rates as determined by trans-rectal ultrasonography 72-77 d post TAI ($p = .95$). However, there was a significant difference in pregnancy rates associated with location ($p > 0.001$). In conclusion, a second GnRH can be administered 36 or 48 h following PGF₂α in an Ovsynch synchronization protocol without detrimental effects on pregnancy rates. If estrous detection were employed, a 36 h interval from PGF₂α to second GnRH injection would be expected to decrease the number of cows requiring premature insemination.

Key Words: Synchronization, GnRH, Postpartum

41 Estrus Induction and Synchronization in Seasonally Anestrous Does in south Texas. M. A. Lerma*¹ and R. L. Stanko^{1,2}, ¹*Texas A&M University-Kingsville, Kingsville, TX*, ²*Texas A&M University Agricultural Research Station, Beeville, TX*.

Meat goats are considered seasonal breeders showing increased breeding activity as day length decreases. The ability to induce does to exhibit estrous cycles year-round should result in increased meat goat production. The objective of this experiment was to induce and synchronize estrus in seasonally anestrous Spanish (S) and Boer X Spanish (BX) does. The experiment began at time of summer solstice (June 21), was conducted in Kingsville, TX (27.4° N), and utilized S ($n = 22$) and BX ($n = 26$) does. Does were bled weekly to determine estrous cyclicity for 3 wk prior to initiation of the experiment. On d 0, does were blocked by age, breed, and production status, and allocated to one of four 14-d treatments. Treatments were: 1) .25 mg/hd/d of Melengesterol Acetate (MGA $n = 12$), 2) male exposure (ME $n = 12$), 3) MGA and ME (MGA+ME, $n = 12$), and 4) no MGA or ME (CON, $n = 12$). On d 15, MGA and MGA+ME does, and ME and CON does, were combined into two separate groups. Two fertile bucks equipped with marking harnesses were introduced into each group for a 40-d breeding season. During the breeding season estrus behavior was monitored daily. Does were bled twice weekly for serum progesterone (P₄) determination, from d 15 to 65. Mean number of d to first elevated P₄ was greater ($P < .05$) in CON does (12.3 ± .9) compared to all other does (MGA 7.6 ± .6, MGA+ME 7.0 ± 0.0, ME 7.0 ± 0.0). Mean number of d to conception were greater ($P = .05$) for CON (20.4 ± 3.1) compared to MGA (11.4 ± 3.1) and MGA+ME (11.7 ± 2.02), but similar ($P > .1$) to ME (19.5 ± 2.7). Pregnancy rates (100%, 83%, 100%, 100%) were similar ($P > .1$) between MGA, MGA+ME, ME, and CON does, respectively. Does which consumed MGA (MGA and MGA+ME) had fewer d ($P < .001$) to estrus than does which did not consume MGA (3.0 ± .2 vs. 10 ± 0.7, respectively). Independently, MGA and ME are effective methods to induce estrous cyclicity in anestrous does. Synchronized estrus, as a result of feeding MGA, may increase production through a concentrated kidding season and uniform kid crop.

Key Words: Goat, Melangesterol Acetate, Seasonality

Meats

42 Color stability of summer sausage displayed in light of varying intensity. A.M. Jydegaard², P.L. Dawson¹, H.J.S. Nielsen², and J.C. Acton*¹, ¹*Clemson University*, ²*The Technical University of Denmark*.

Four light intensities ranging from 61.3 to 294.8 ft-c were evaluated for effects on surface color attributes of slices of summer sausage vacuum-packaged in a high oxygen transmission rate film. Color attributes in the CIE L*a*b* and CIE L*C*h* color spaces were determined. During display at 21C, CIE C* (chroma) and CIE a* (redness) decreased ($P < 0.001$) and CIE h* (hue) increased ($P < 0.001$) with increasing dis-

play time in all lighting intensities. Plotting first order rate constants of the color attributes against the reciprocal of light intensity indicated an Arrhenius-type reaction rate fit. This finding confirmed that the Arrhenius concept for reaction dependency on temperature is also valid for dependency on light intensity, another form of energy affecting surface color stability of summer sausage.

Key Words: Surface Color, Sausage, Light Intensity

43 Effect of rumen-protected conjugated linoleic acid (CLA) or linoleic acid on leptin and CLA content of bovine adipose depots. M.H. Gillis^{*1}, S.K. Duckett¹, J.R. Sackmann¹, and D.H. Keisler², ¹University of Georgia, Athens, ²University of Missouri, Columbia.

Thirty-six Angus-cross heifers (366 kg) were used to determine effects of dietary lipid sources on serum and adipose tissue leptin levels and fatty acid composition of intramuscular (IM), perianal (PA), and subcutaneous (SQ) lipid depots. Lipid was supplied to diets as either corn oil or rumen-protected conjugated linoleic acid (CLA) salt for two specific treatment periods of either 32 or 60 d. Following an initial feeding period of 56 d, heifers were fed one of three dietary treatments: 1) basal ration containing 88% concentrate and 12% grass hay (CON), 2) basal ration plus 4% corn oil (OIL), or 3) basal ration plus 2% rumen-protected CLA salt (CLA), containing 31% CLA-60. Circulating leptin levels were not affected ($P > 0.05$) by dietary treatment at any time during the trial. However, leptin concentration in adipose tissue was greater ($P < 0.05$) for heifers fed OIL compared to either CON or CLA diets, which were similar ($P > 0.05$). The cis-9, trans-11 CLA isomer and total CLA content was lowest ($P < 0.05$) in IM adipose tissue compared to PA and SQ, which did not differ ($P > 0.05$). The trans-10, cis-12 CLA concentration was highest ($P < 0.05$) for animals fed CLA and OIL diets for 60 d and lowest ($P < 0.05$) for CON, regardless of time on dietary treatment. CLA supplemented heifers had greater ($P < 0.05$) total CLA content than either CON or OIL fed. Adipose tissue concentration of C18:1 trans-11 was lower ($P < 0.05$) for CON than OIL or CLA, which were similar ($P > 0.05$). Percentages of C18:1 trans-10 were lowest ($P < 0.05$) in IM lipid compared to PA and SQ, which did not differ ($P > 0.05$). The ratio of cis-9, trans-11 to C18:1 trans-11 was higher ($P < 0.05$) for animals fed 60 d compared to 32 d, but did not differ ($P > 0.05$) between adipose depots. Feeding rumen-protected CLA increased total CLA isomers by 22%. IM lipid contained the lowest ($P < 0.05$) percentage of cis-9, trans-11 CLA, total CLA, C18:1 cis-9, C18:1 trans-10, and C18:1 trans-11. Based upon cis-9, trans-11 to C18:1 trans-11 ratio in duodenal digesta of steers fed similar diets and tissue ratio for this study, we estimate the percentage of cis-9, trans-11 resulting from desaturation of C18:1 trans-11 in adipose tissue at approximately 86%.

Key Words: CLA, Leptin, Beef Cattle

44 Carcass characteristics, fat color, and tenderness of beef finished on concentrate or forage. C.R. Kerth^{*}, Auburn University.

Charlais-Angus crossbred steers were fed one of three finishing diets to determine the effects of concentrate-finishing and forage-finishing on carcass characteristics, trimmed and untrimmed fat color, and loin and rib cooking losses and Warner-Bratzler shear force (WBSF) values. When the steers ($n = 30$) reached about 340 kg, they were randomly assigned to finishing systems consisting of rye grass only for 178 d (RG), rye grass for 125 days followed by 98 days of a high-concentrate, feedlot-type diet (RGC), or a high-concentrate diet for 82 days (CON). Steers from the RGC and CON groups were slaughtered when estimated backfat thickness reached 1.0 cm and steers from the RG group were slaughtered when the amount of rye grass present was not sufficient to maintain the animals. Steers finished on RG had lower ($P < 0.01$) hot carcass weight, actual 12th rib fat thickness, adjusted 12th rib fat thickness, ribeye area, and kidney, pelvic and heart fat compared to steers finished

on either RGC or CON, which did not differ ($P > 0.10$). Finishing system did not affect ($P > 0.2$) marbling, which averaged high slight in all three treatments. Subcutaneous rib and loin fat color (measured by L*, a*, and b*) in all three finishing systems was more white, and less red and yellow when the fat was trimmed to 0.3 cm compared to the untrimmed fat ($P < 0.01$). Regardless of trim level, RGC steers had fat that was more yellow than fat from CON steers but less yellow than fat from RG steers (as measured by b*, $P < 0.05$). Longissimus muscle cooking losses were not affected ($P > 0.7$) by finishing system in either the rib or loin. Loin longissimus muscle WBSF values from RGC and CON systems were similar ($P > 0.10$) and both were lower ($P < 0.05$) compared to longissimus muscle from RG steers. Warner-Bratzler shear values of longissimus muscle from the rib section did not differ among the three finishing systems ($P > 0.05$). These data indicate that steers finished on rye grass have similar quality grades as steers finished on grain, but have more yellow fat and muscle that may be less tender.

Key Words: Grass-fed Beef, Fat Color, Tenderness

45 Effects of biological type and forage feeding on carcass characteristics, fatty acid profiles, and sensory attributes of beef cattle. R. T. Baublits^{*1}, A. H. Brown, Jr.¹, F. W. Pohlman¹, C. J. Richards⁴, H. D. Loveday⁴, D. O. Onks³, Z. B. Johnson¹, C. A. Wells², R. E. Morrow², and B. A. Sandelin¹, ¹University of Arkansas, Fayetteville, AR, ²National Center for Appropriate Technology, Fayetteville, AR, ³University of Tennessee, Springhill, TN, ⁴University of Tennessee, Knoxville, TN.

The effects of biological type across different forage-based feeding systems were analyzed to determine differences in carcass quality, chemical composition, and sensory attributes. Small-framed/intermediate-maturing (SI), medium-framed/intermediate-maturing (MI), and large-framed/intermediate-maturing (LI) calves ($n = 53$) were randomly chosen and stratified across either orchardgrass/clover pasture with soyhull supplementation (O), fescue grass/clover pasture with soyhull supplementation (F), or fescue grass pasture overseeded with wheat and millet with no supplementation for the control (C). Effects for hot carcass weight showed that the F and O cattle were heavier ($P < 0.05$) than C. The F and O cattle had larger ($P < 0.05$) loin eye areas than C, but did not differ ($P > 0.05$). Control cattle (C) had less ($P < 0.05$) back fat and lower ($P < 0.05$) quality grades than F or O cattle, whereas F and O cattle did not differ ($P > 0.05$). The LI cattle were heavier ($P < 0.05$) and had larger ($P < 0.05$) loin eyes than SI, whereas SI, MI, and LI did not differ ($P > 0.05$) in terms of back fat or quality grade. The C carcasses had higher ($P < 0.05$) adipose L* values, lower ($P < 0.05$) adipose a* values, and lower ($P < 0.05$) adipose b* values than F or O. Percent total lipid was lower ($P < 0.05$), and percent moisture was higher ($P < 0.05$) for C compared to F and O. No differences were exhibited between biological types for percent total lipids or percent moisture ($P > 0.05$). The C steaks contained higher ($P < 0.05$) linolenic acid concentrations than F or O, and there were no differences ($P > 0.05$) between treatments for conjugated linolenic acid. Sensory evaluation revealed no differences ($P > 0.05$) between treatments or biological types for sensory characteristics. These results suggest that biological type may not influence quality grade for cattle supplemented with soyhulls on forage, and that supplementation can improve carcass quality without drastically altering the fatty acid profile of grass-fed cattle.

Key Words: Biological Type, Beef Cattle, Forage Feeding

Physiology

46 Some hematological and biochemical alterations of experimentally infected rabbits by *Pasteurella multocida*. Osama Abd-Alla^{*1}, Hesham El-Shewy¹, Hamdy Fetaih², and Fatma Yousef³, ¹Department of Clinical Pathology, College of Vet Med, Suez Canal Univ, Ismailia, EGYPT, ²Department of Pathology, College of Vet Med, Suez Canal Univ, Ismailia, EGYPT, ³Animal Health Institute, Giza, Egypt.

New Zealand rabbits (1 to 1.5 kg BW) were assigned to 5 groups of 5 rabbits each. First group was kept as control, and the other 4 groups were inoculated intranasally by 0.8, 0.4, 0.2, or 0.1 ml $\times 10^7$ CFU/mL/rabbit of *Pasteurella multocida*, respectively. Infected groups were examined after 2, 4, 7, and 21 d. Depression, sneezing, conjunctivitis, loss of appetite, and nervousness were noticed in all infected animals. At 2 and 4

d after infection, thrombocytopenia (175 ± 8.8 and 137 ± 4.1 vs $329 \pm 3.8 \times 10^3$ /mL), leukopenia (6.1 ± 0.39 and 7.1 ± 0.11 vs $9.3 \pm 0.25 \times 10^3$ /mL); ($P < 0.01$), and normocytic, normochromic anemia were observed. At 7 and 21 d postinfection, thrombocytosis (383 ± 19.2 and $687 \pm 46.4 \times 10^3$ /mL vs $329 \pm 3.8 \times 10^3$ /mL), leucocytosis (10.7 ± 0.34 and $10.65 \pm 0.45 \times 10^3$ /mL vs $9.3 \pm 0.25 \times 10^3$ /mL); ($P < 0.01$) mainly due to neutrophilia; and microcytic, hypochromic anemia were observed. Serum biochemical analysis of all infected groups showed elevation ($P < 0.01$) of transaminases; AST (82 ± 1.4 , 86 ± 1.7 , 125 ± 10.9 and 54.5 ± 1.6 vs 51 ± 4.2 U/I) and ALT (124 ± 1.8 , 79 ± 1.8 , 95 ± 5.2 and 66.8 ± 2.1 vs 64 ± 1.8 U/I), respectively with hyperbilirubinemia and hypoglycemia. Also, there were decreased ($P < 0.01$) albumin/globulin ratios (1.89 ± 0.11 , 1.79 ± 0.12 , 0.93 ± 0.15 and 0.87 ± 0.15 vs 3.2

± 0.23) due to hyperglobulinemia and hypoalbuminemia. Furthermore, there were increases ($P < 0.01$) in blood urea nitrogen (27.4 ± 0.93 , 18.1 ± 0.43 , 21 ± 0.7 and 21.4 ± 0.58 vs 15.5 ± 0.29 mg/dL, uric acid (4.58 ± 0.26 , 4.2 ± 0.09 , 4.9 ± 0.67 and 4.6 ± 0.25 vs 2.63 ± 0.23 mg/dL, and creatinine (1.9 ± 0.22 , 1.7 ± 0.18 , 1.48 ± 0.16 and 1.8 ± 0.03 vs 0.97 ± 0.08 mg/dL) in addition to hypocalcemia and hyperphosphatemia.

Key Words: Hematological, Biochemical, *Pasteurella multocida*

47 Interaction of ergotamine with liver cytochrome P450 3A4 in rats. A. S. Moubarak*, H. X. Wang, Z. B. Johnson, and C. F. Rosenkrans, Jr., *University of Arkansas, Fayetteville.*

This study was conducted to investigate the effect of ergotamine (ET) on the induction of cytochrome P450 3A4 (CYP 3A4) and comparative effects in vivo and in vitro. Sprague-Dawley rats (BW ~ 250 g) were treated via i.p. injection daily for 4 d as follows: Control (0.5 ml of only corn oil); Dexamethasone treatment (100 mM of dexamethasone in corn oil); and Ergotamine treatment (100mM of ET in corn oil). Liver tissues were collected from each group ($n = 5$) and their corresponding liver microsomes were prepared. Cytochrome P450 3A4 activity was evaluated using ET and its isomers as substrates in medium containing liver microsomes and NADPH at 37°C for 30 min. The disappearance of the substrate and the appearance of the metabolites were measured by HPLC. Liver microsomes from rats pretreated with dexamethasone, a specific inducer of CYP 3A4, were more ($P < 0.01$) active than microsomes from the control animals in the biotransformation of ET (32.1 and 7.0 nM/min, respectively; SE = 4.83) or ET-isomer (21.6 and 4.7 nM/min, respectively SE = 1.70) into its corresponding ET metabolites (M1 and M2) and ET isomer metabolites (M1-iso and M2-iso). The ergotamine treatment produced no increase ($P > 0.05$) in activity of CYP 3A4 when compared to the control group for ET (5.2 vs 7.0 nM ET/min; SE = 4.83) or ET isomer (1.5 vs 4.7 nM ET isomer/min; SE = 1.70). When ketoconazole was used as specific inhibitor of CYP 3A4, ET metabolism was inhibited in a dose dependent fashion reaching a maximum at an inhibitor to substrate ratio of greater than one and LD50 at 2.0 nM of ketoconazole. The data presented in this study suggest that although the ergot alkaloid ergotamine and its isomer are ideal substrates for the isozyme CYP 3A4, these compounds have no effect on the induction of CYP 3A4 after 4 d of treatment.

Key Words: Ergotamine, CYP 3A4, Liver Microsomes

48 Effects of administration of ergotamine tartrate to simulate fescue toxicosis on fertility of yearling beef bulls. F. N. Schrick¹, J. C. Waller*¹, J. L. Edwards¹, M. D. Davis¹, H. E. Blackmon¹, F. N. Scenna¹, N. R. Rohrbach¹, A. M. Saxton¹, H. S. Adair², and F. M. Hopkins², ¹Department of Animal Science, ²Department of Large Animal Clinical Sciences, University of Tennessee, Knoxville..

Sixteen bulls were used to investigate effects of administration of ergotamine tartrate (ET) on semen characteristics, fertilization potential, and endocrine profiles. Bulls were allotted to treatments by weight (~ 350 kg), hip height, scrotal circumference, and age (~ 270 d). Bulls allotted to a diet of cracked corn, corn silage, and soybean meal served as controls (CON, $n = 8$). Daily topdressing of the diet with 40 µg/kg body weight of ET was provided to the treatment group (ET, $n = 8$). To maintain the dosage of 40 µg/kg BW throughout the experimental period (November 15 through June 26), amount of ET administered was altered as BW increased. Blood samples, BW, scrotal circumference (SC) and rectal temperatures (RT) were collected every 2 wk. Semen samples were obtained every 60 d for determination of motility and morphology. During May and June, testicular core temperatures were measured by scrotal thermography immediately before electroejaculation. Semen from two bulls per treatment with similar scrotal circumferences was extended and returned to the laboratory for further assessment. Comparisons between ET and CON for in vitro fertilization (IVF) measures were determined using PROC FREQ procedure. All other variables were analyzed by the Mixed procedure. Administration of ET increased RT (39.3 ± 0.05 °C) compared to CON bulls (39.1 ± 0.05 °C; $P = 0.02$); however, prolactin did not differ ($P = 0.10$). Neither SC ($P = 0.68$) nor testosterone ($P = 0.17$) differed throughout the experimental period between groups. Sperm motility and morphology were similar between ET and CON ($P = 0.83$; $P = 0.51$, respectively). However, bulls exposed to ET had lower testicular core temperatures (31.4 ± 0.3 °C) compared to CON bulls (33.0 ± 0.3 °C; $P = 0.004$). Cleavage rate of oocytes

cultured with semen from bulls fed ET was reduced compared to CON (51 vs. 69%, respectively; $P = 0.001$). In conclusion, extended exposure of bulls to ergotamine tartrate appears to reduce fertilization ability of sperm. This was possibly through a vasoconstrictive action as evidenced by the reduction in testicular core temperature.

Key Words: Fescue Toxicosis, Bull, Fertility

49 Comparison of testicular and epididymal sperm content in Angus, Brahman, and Romosinuano bulls. J.W. Koch^{1,2,3}, S.R. Tatman³, C.C. Chase, Jr.⁴, T.H. Welsh, Jr.², and R.D. Randel*³, ¹Prairie View A&M University, Prairie View, TX, ²Texas Agricultural Experiment Station, College Station, ³Overton, ⁴USDA, ARS, STARS, Brooksville, FL.

Excessive heat can be detrimental to spermatogenesis in bulls. The objective was to determine if testicular and epididymal sperm content and daily sperm production (DSP) of tropically-adapted *Bos taurus* (Romosinuano, R; $n = 10$) is more similar to that of temperate *Bos taurus* (Angus, A; $n = 7$) or tropically-adapted *Bos indicus* (Brahman, B; $n = 8$) bulls. Sperm content was determined via microscopy in homogenates of testicular parenchyma and epididymal sections from each sexually mature bull. Romosinuano had greater ($P \leq 0.01$) testicular sperm content/g of parenchyma and DSP/g than A with B bulls being intermediate (sperm content/g, 73.8 ± 3.4 vs 56.9 ± 4.4 and $64.6 \pm 3.8 \times 10^6$, respectively; DSP/g, 13.9 ± 0.6 vs 10.7 ± 0.8 and $12.2 \pm 0.7 \times 10^6$, respectively). Brahman had greater ($P \leq 0.001$) testicular sperm content and DSP than R and A bulls which were similar (sperm content, 41.6 ± 3.4 vs 28.5 ± 3.0 and $20.6 \pm 3.9 \times 10^9$, respectively; DSP, 7.8 ± 0.6 vs 5.4 ± 0.6 and $3.9 \pm 0.7 \times 10^9$, respectively). Brahman bulls had greater ($P \leq 0.01$) total caput sperm content than R and A bulls which were similar (6.0 ± 0.5 vs 3.7 ± 0.5 and $3.4 \pm 0.6 \times 10^9$, respectively). Brahman also had greater ($P \leq 0.01$) corpus sperm content/g than R but both breeds were greater ($P \leq 0.01$) than A bulls (650.9 ± 44.8 vs 381.9 ± 40.1 vs $179.6 \pm 51.8 \times 10^6$, respectively). Brahman had greater ($P \leq 0.01$) total corpus sperm content than R and A bulls (1662.3 ± 91.0 vs 427.4 ± 81.4 and $219.5 \pm 105.1 \times 10^6$, respectively). Romosinuano had greater ($P \leq 0.01$) cauda sperm content/g than B and A bulls (1915.3 ± 134.8 vs 1307.9 ± 150.8 and $852 \pm 174.1 \times 10^6$, respectively). Brahman and R had greater ($P \leq 0.01$) total cauda sperm content than A bulls (7.0 ± 0.8 and 6.9 ± 0.7 vs $2.8 \pm 0.9 \times 10^9$, respectively). We conclude that testicular and epididymal sperm content and DSP of tropically-adapted *Bos taurus* bulls are more similar to tropically-adapted *Bos indicus* bulls than to temperate *Bos taurus* bulls raised in the subtropics.

Key Words: Testis, Epididymis, Bulls

50 Evaluating the relationship between environmental temperature and physiological temperatures in hair sheep rams in the tropics. O.T. Isles*, R.W. Godfrey, R.E. Dodson, and A.J. Weis, *University of the Virgin Islands, Agricultural Experiment Station, St. Croix.*

This study was conducted to determine the relationship between the environmental temperature and physiological temperatures of St. Croix White (STX; $n = 3$) and Barbados Blackbelly (BB; $n = 3$) hair sheep rams in the tropics. Rams were paired across breed by BW, scrotal circumference, and age. Each pair of rams was evaluated once during a 3-wk period for 48 h. Environmental data collected included temperature and relative humidity, which were used to calculate temperature-humidity index (THI). Physiological data collected at 5-min intervals included subcutaneous, rectal, and scrotal temperatures of each ram using HOBO data loggers (Onset Corporation). Each pair of rams was placed in a pasture (0.12 ha) for the 48-h period. The mean temperature and THI during the daytime were 29.8 ± 0.05 °C and 80.6 ± 0.05 , respectively. The mean nighttime temperature and THI were 25.9 ± 0.05 °C and 76.7 ± 0.05 , respectively. Subcutaneous temperature of BB rams was higher ($P < 0.0001$) than STX rams during the day (38.9 ± 0.04 vs. 38.7 ± 0.04 °C, respectively) but there was no difference ($P > 0.10$) at night (37.5 ± 0.04 vs. 37.5 ± 0.04 °C, respectively). Rectal temperature of BB rams was higher ($P < 0.0001$) than STX rams during the day (39.3 ± 0.02 vs. 38.9 ± 0.02 °C, respectively) and night (39.5 ± 0.03 vs. 39.0 ± 0.02 °C, respectively). Scrotal temperature of BB rams was lower ($P < 0.0001$) than STX rams during the day (34.9 ± 0.04 vs. 35.4 ± 0.03 °C, respectively) and night (34.4 ± 0.05 vs. 35.4 ± 0.03 °C, respectively). Environmental temperature was positively correlated (P

< 0.0001) with subcutaneous ($r = 0.699$), rectal ($r = 0.132$) and scrotal ($r = 0.318$) temperature across breeds. These results indicate that BB rams do not have the ability to regulate body temperature as well as STX rams. This may occur because the dark hair coat of the BB is not able to reflect sunlight as well as the white hair coat of the STX. This project was supported by NIH/NIGMS/MBRS-RISE GM61325.

Key Words: Sheep, Environment, Scrotum

51 Concentrations of leptin in serum and milk from gilts fed a high- or low-energy diet during gestation. M.J. Estienne*, A.F. Harper, D.M. Kozink, and J.W. Knight, *Virginia Polytechnic Institute and State University, Blacksburg.*

Low feed intake during lactation extends the weaning-to-estrus interval, thus increasing sow non-productive days. Research is needed to determine causes and mechanisms of sub-optimal feed consumption so that interventional management strategies can be developed. Leptin, a hormone produced by adipose tissue, has been implicated in the regulation of feed intake in swine. The objective of this study was to quantify concentrations of leptin in serum and milk from gilts fed diets during gestation that differed in energy level. Beginning at 45 d of gestation and continuing throughout pregnancy, Yorkshire x Landrace gilts (185.3 ± 0.5 kg BW and 20.0 ± 0.3 mm backfat) received either a high-energy (6,882 kcal ME/d) or low-energy (5,221 kcal ME/d) diet ($n = 9$ /group). All gilts had ad libitum access to a standard diet throughout a 21-d lactation period. During gestation, gilts consuming the high-energy diet gained more BW (29.1 ± 1.7 vs. 15.4 ± 1.7 kg; $P < 0.01$) and last-rib backfat thickness (0.8 ± 0.6 vs. -1.6 ± 0.6 mm; $P < 0.01$) than gilts fed the low-energy diet; however, serum concentrations of leptin remained similar ($P = 0.35$) between groups (1.9 ± 0.2 ng/mL). Within 24 h after farrowing, gilts fed the high-energy diet had greater concentrations of leptin in serum (2.8 ± 0.3 vs. 2.0 ± 0.3 ng/mL; $P = 0.07$) and milk (57.1 ± 4.5 vs. 42.2 ± 4.5 ng/mL; $P = 0.02$) than gilts that consumed the low-energy diet; across treatments, backfat thickness and leptin levels in serum were positively correlated ($r^2 = 0.51$; $P = 0.03$). At weaning, backfat thickness (15.8 ± 0.3 vs. 14.7 ± 0.3 mm; $P = 0.03$), but not BW (186.0 ± 0.9 kg) or serum (2.0 ± 0.2 ng/mL) and milk (39.7 ± 3.1 ng/mL) concentrations of leptin ($P > 0.1$), were greater for gilts fed the high-energy diet during gestation. Gilts that were fed the low-energy diet during gestation consumed more feed (6.8 ± 0.1 vs. 6.1 ± 0.1 kg/d) during week 2 of lactation ($P = 0.06$). Our results suggest that altering the level of energy in the diet of gestating swine can influence circulating and milk concentrations of leptin, as well as feed consumption, during lactation. High concentrations of leptin in sow milk may implicate the hormone in suckling behavior and growth and development of neonatal pigs.

Key Words: Leptin, Gestation, Gilts

52 Prepubertal administration of porcine Epidermal Growth Factor increases litter size. John McGlone*¹, Deidre Anderson¹, and Vaughan Lee², ¹Texas Tech University, ²Texas Tech University Health Sciences Center, Lubbock.

Two studies were conducted to evaluate the effects of porcine Epidermal Growth Factor (pEGF) on litter size in pigs. Recombinant pEGF was generated by RT-PCR and subcloned into a bacterial vector. The recombinant pEGF molecule had 5 histidine residues that aided in protein isolation and its identity was confirmed by Western blot analysis. In the first pilot study, four prepubertal gilts were selected from each of three litters. Littermates received either 1 mg/day pEGF (equivalent to 0.03 mg mEGF biological activity) or control vehicle each day from 14 to 28 days of life. The pEGF or control solution were administered by mini-osmotic pump. Half the gilts were sacrificed at about 70 d of age for examination of ovarian development by histology. The remaining half were mated to a single sire and taken to term. The second study involved 26 or 28 gilts per treatment (82 gilts farrowing in total). Three doses of pEGF were used (0, 1 or 2 mg/d) and the pEGF was given by a single daily i.m. injection. Half the gilts received a single injection of 5 mL of P.G.600 (Intervet) at 70 days of age and half received a control injection. P.G.600 had no effects on reproductive measures and was dropped from the analyses. Linear contrasts were used to compare control with pEGF treatments (1 or 2 mg/d did not differ). In the first pilot study, gilts had morphological evidence of enhanced follicular development and had 3.33 more pigs born alive when treated with pEGF compared with gilts in the control treatment. In the second study, both

doses of pEGF increased ($P = 0.05$) total numbers of pigs born per litter. Control pigs had 10.1, while each pEGF treatment produced 12.2 pigs born per litter (SE = 0.83). Gilts treated with pEGF also tended ($P = 0.08$) to wean 1.5 more pigs per litter than control litters. Days to onset of puberty, piglet preweaning survival and body weights at 21 days were not different among treatments ($P > 0.15$). In conclusion, pEGF can increase litter size in gilts when administered to the prepubertal gilt.

Key Words: Pig, Epidermal Growth Factor, Litter size

53 Characterization of collagen degradation marker excretion during postpartum uterine involution in sows. B. A. Belstra*, W. L. Flowers, M. T. See, and W. J. Croom, *North Carolina State University, Raleigh.*

During the first three weeks postpartum, sow uteri exhibit a 90% decrease in wet weight as 0.7 to 0.9 kg of collagen is degraded during a process known as involution. Lactation lengths currently in use in the swine industry may not provide enough time to complete this vital process and may cause increased embryo mortality and reproductive failure. Our objective was to characterize the excretion of the collagen degradation markers pyridinoline and deoxypyridinoline (crosslinks) during this period. Urine samples from 21 multiparous sows that lactated for 21.3 \pm 0.3 d were collected on d 1, 4, 7, 10, 13, 16, 19 postpartum and d 6 postweaning and stored at -20°C. A colorimetric assay for creatinine (Cre) and an ELISA for crosslinks were performed. Intra and interassay CVs for both assays were < 5%. Marker data are expressed as a ratio to Cre to standardize samples for urine excretion rate. Mean crosslinks ratios increased from 74.6 ± 12.5 to 153.8 ± 14.9 nmol / mmol Cre from d 1 to 10, and then decreased to 100.6 ± 9.3 nmol / mmol Cre on d 19. Peak crosslinks ratio in each sow's excretion profile was defined as the maximum value that exceeded the mean + 1.5 S.D. Sows exhibited one of four crosslinks excretion patterns: peak on d 1 or 4 (early, $n = 3$), peak on d 7 (mid, $n = 4$), peak on d 10, 13 or 16 (late, $n = 7$), or no peak (none, $n = 7$). There was no difference ($P > 0.10$) in sow parity, pre-farrow weight, total pig birth weight, total born, born alive, number of pigs suckled, sow weaning weight, or sow lactation weight change between the peak classes (early, mid, late, none) based on GLM analysis. These data support an increase in crosslinks excretion during the involution period but also highlight variation in the timing and amplitude of the increase between sows. Relating crosslinks excretion to a physical measure of uterine involution may clarify its relationship to this process and help determine the applicability of these markers.

Key Words: Collagen, Sow, Uterine Involution

54 Enhancing feed intake during the early lactation period in sows. J. Miller*, L.A. Solis, and J.C. Laurenz, *Texas A&M University-Kingsville.*

The following was a pilot study designed to investigate the effects of a palatability-enhancing product (PEP[®] 1000; Biomim, Herzogenburg, Austria) fed before and during lactation on sow intake, sow performance, and subsequent piglet performance. Crossbred sows ($n = 11$) were selected at approximately 14 days before farrowing and assigned by weight and parity to one of two treatments. All sows were fed a standard lactation diet containing either 0 (Control; $n = 5$) or 2 kg/t PEP[®] 1000 (PEP; $n = 6$) beginning at 10 days before expected farrowing dates and continuing through weaning. Approximately 2 to 4 days before farrowing, sows were moved to farrowing crates and feed intake recorded twice daily for each sow through weaning. After farrowing (day 1), all piglets were weighed and tattooed for permanent identification. Sows and piglets were then weighed at weekly intervals. By design, treatments did not differ ($P > 0.05$) in initial sow weight (240 14 kg) or parity (3.5 0.5). In addition, supplementation with PEP did not effect the number of pigs born live (10.5 0.9), piglet birthweight (1.4 0.1 kg), or number of pigs weaned (8.5 0.7). As expected feed intake for Control sows following lactation (days 1 to 3) was low (0.7 0.3, 2.0 0.7 and 3.0 0.3 kg/day, respectively) and gradually increased ($P < 0.01$) up to day 14 of lactation (5.2 0.7 kg/day). In contrast, sows fed PEP consumed more ($P < 0.05$) feed in early lactation (1.6 0.4, 4.8 0.8, and 5.5 0.6 kg/day for days 1 to 3, respectively) and reached maximum feed intake levels much earlier than control (7.1 0.5 kg/day by day 9). Although not statistically significant ($P > 0.05$), sows supplemented with PEP had numerically less weight loss during the first two weeks following farrowing (3.5 1.9 vs. 12.1 3.3 kg for PEP vs. Control sows, respectively). In addition, there was a tendency ($P < 0.20$) for piglets from sows treated with PEP to be

heavier at days 7, 14, and 21 of age (2.5, 4.1, and 5.8 vs. 2.3, 3.8, and 5.4 kg, for PEP vs. Control piglets, respectively; SEM = 0.1 kg). Overall, these results demonstrate that supplementation of sows with PEP does improve feed intake during the early lactation period and may improve sow and piglet performance.

Key Words: Heat Stress, Intake, Palatability

55 Real-time monitoring of *Salmonella* in swine: Specificity and sensitivity of bacterial detection through the gastrointestinal tracts of juvenile and market weight pigs. S.T. Willard*¹, R.H. Bailey¹, M.L. Rybolt¹, B.S. Gandy¹, P.L. Ryan¹, and D.C. Lay², ¹Mississippi State University, Mississippi State, Mississippi, ²USDA-ARS, West Lafayette, Indiana.

We have demonstrated that *Salmonella* can be monitored non-invasively using biophotonic paradigms (*Salmonella* expressing light-emitting proteins) in living neonatal pigs. Nevertheless, questions remain concerning system sensitivity and adaptations of these methodologies for investigations of pre-harvest food safety issues in market weight (MW) pigs. The aim of this study was to quantify the relationship between the amount of bacteria present (colony forming units; CFU), photonic emissions, and the influence of tissue depth on photon detection in juvenile (3 kg) and MW (100 kg) pigs. Gastrointestinal tracts (GI) were collected post-mortem from pigs at 14 (juvenile; n = 6) and 170 (MW; n = 6) days of age, and sectioned into 4-cm segments for the small intestine (SI), large intestine (cecum: CE; colon: CO) and stomach (ST). Skin from the ventral surface of juvenile pigs was also analyzed. GI and skin sections were placed separately on 96-well plates containing varying concentrations of *Salmonella-lux* (*Salmonella anatum* engineered to express luciferase). Data were analyzed to ascertain changes in *Salmonella-lux*-induced specific photonic emissions (SPE) as detected through the GI and skin, and are reported as SPE or as a % of SPE captured. Two levels of photonic emissions were tested (High: $1.8 \pm 0.07 \times 10^6$ SPE; Low $0.84 \pm 0.05 \times 10^6$ SPE), which represented a two-fold difference in concentrations of *Salmonella-lux*. Similar recovery percentages for High and Low SPE were observed ($P > 0.10$), therefore data were pooled for each GI segment within juvenile and MW pigs. For juvenile pigs, 9.9 ± 1.1 , 8.8 ± 1.2 , 6.4 ± 0.8 and 1.5 ± 0.5 % of SPE were detectable through the SI, CO, CE and ST, respectively, and 0.98 ± 0.1 % through the skin. For MW pigs, 1.6 ± 0.13 , 1.7 ± 0.17 , 0.79 ± 0.17 and 0.08 ± 0.05 % of SPE were detectable through the SI, CO, CE and ST, respectively. The respective juvenile GI segments permitted more SPE to pass through ($P < 0.05$) than MW GI segments. System performance data indicated that quantifiable SPE specific to bacterial presence equated to 0.2 to 2×10^6 CFU depending on the GI section imaged. In summary, real-time imaging of *Salmonella* is feasible through juvenile and MW pig GI tracts. Through improved imaging technologies, this technology will enable the identification of sites within swine (*in vivo* or post-mortem) where *Salmonella* may congregate and establish pathogenicity.

Key Words: Swine, *Salmonella*, Biophotonics

56 Effect of supplemental molasses on equine salivary pH and subsequent bacterial acid production. B.C. Housewright*, E.L. Swain, J. Hamra, L.L. Pickering, H.L. Richardson, and D.B. Crenshaw, Texas A&M University - Commerce.

Dental degeneration in horses is a major concern from perspectives of health, performance, and dietary utilization. Producers spend hundreds of dollars per head annually in dental maintenance (floating teeth). Eight yearling horses including four colts and four fillies were used to determine if the addition of molasses has any effect on salivary pH and subsequent bacterial acid production. Horses were randomly assigned to two treatments, using two colts and two fillies per treatment. Treatments were: pelleted commercial feed with 14% crude protein and 6% fat (CTRL) or an identical pelleted feed with 5% added molasses (MOL). Horses were fed 1.13 kg twice daily (0800 and 1800 h). Just before feeding, 5% molasses, as fed basis, was added to the horses' rations assigned to MOL treatment. A 24-d adaptation period was allowed for horses to acclimate to specific diet treatment. Following the adaptation period, salivary samples were taken on four subsequent days. A 2-ml sample was taken from each horse using sterilized cotton swabs as a medium. Samples were taken just before feeding for a baseline measurement (BL), followed by two additional samples at 15 min and 45 min after all feed was consumed. Samples were immediately analyzed for pH and 300 μ l were plated on sterilized Snyder Test Agar, for determination of presence

of acid-producing bacteria following a 96 h incubation time. No changes ($P > 0.05$) in salivary pH were detected at 15 min or 45 min after feeding in CTRL. Salivary pH at 15 min decreased ($P < 0.05$) from BL measurement by 0.44 pH units for horses receiving MOL diet. However, pH at 45 min after feeding returned to BL levels ($P > 0.05$). Presence of acid producing bacteria was slightly higher ($P = 0.06$) for horses supplemented with molasses. Supplementation with molasses does initially decrease equine salivary pH and possibly increases the presence of acid-producing bacteria. However, pH returns to baseline levels by 45 min after feed consumption.

Key Words: Equine, Saliva, Molasses

57 The effect of cooling strategy during summer heat stress on production performance and body composition quality traits in lactating Holstein dairy cattle. H.L. Evans*^{1,2}, J. Murphy³, E. Cuadra⁴, S.T. Willard², and R.C. Vann¹, ¹Brown Loam Branch Experiment Station, Raymond, Mississippi, ²Mississippi State University, Mississippi State, Mississippi, ³Coastal Plains Branch Experiment Station, Newton, Mississippi, ⁴Alcorn State University, Alcorn State, Mississippi.

Heat stress can negatively impact physiological processes and production in lactating dairy cows. Environmental cooling strategies can alleviate some of these detrimental effects, yet the effects of cooling method on the repartitioning of fat and changes in body composition remain poorly understood. The objective of this study was to determine whether type of cooling system influences production and body composition quality traits in dairy cattle. Lactating Holstein cows (n = 96) were assigned to equal groups based on high (HMP) or low (LMP) milk production and cooling strategy as follows: HMP, Fan only (HF; n = 24); HMP, Fan and Sprinklers (HFS; n = 24); LMP, Fan only (LF; n = 24); and LMP, Fan and Sprinklers (LFS; n = 24). Following a 14-d acclimation period within groups, data were collected before milking at 14-d intervals for 86 d. Data included respiration rate (RR; breaths/min), dorsal coat temperature using infrared thermometers (DIR; °C), rectal temperature (RT; °C), body condition score (BCS) and body weight (BW). Measurements by real-time ultrasound (RTU) consisted of percent intramuscular fat (%IMF) of the Longissimus muscle at the 11, 12, and 13th ribs, back fat thickness (BF), rump fat thickness (RF), gluteus medius depth (GMD). Ambient temperature (TEMP), relative humidity (RH) and temperature-humidity index (THI) were monitored at 5-min intervals throughout the trial using remote data loggers. Mean daily TEMP, RH and THI were 25.8 ± 0.03 °C, 83.6 ± 0.13 and 75.9 ± 0.03 . Peak daily TEMP, RH and THI were 33.9 ± 0.26 °C, 51.5 ± 1.2 and 83.4 ± 0.28 . Cows in the FS groups had lower ($P < 0.05$) RT, DIR and RR than cows in the F only groups. BCS and BW change during the 86 d trial did not differ ($P > 0.10$) relative to cooling strategy, yet LMP cows gained more weight ($P < 0.03$) than HMP cows. Cooling strategy (F vs. FS) did not influence ($P > 0.10$) changes in BF, RF or GMD, yet LMP cows had higher ($P < 0.05$) BF, RF and GMD than HMP cows. Low MP cows had a higher ($P < 0.01$) %IMF than HMP cows; however the %IMF change during the 86-d trial did not differ ($P > 0.10$) relative to level of MP or cooling strategy. In summary, expected differences between HMP and LMP cows were observed in body composition traits; however cooling strategy did not influence those measures within groups.

Key Words: Intramuscular Fat, Dairy Cattle, Cooling Systems

58 The effect of 6-Methoxybenzoxazolinone (MBOA) on PMSG-induced superovulatory responses in St. Croix White ewes. T. Dickerson*¹, R. Godfrey², R. Dodson², A. Weis², and S. Willard¹, ¹Mississippi State University, Mississippi State, Mississippi, ²University of the Virgin Islands, St. Croix, USVI.

The purpose of this study was to evaluate the effectiveness of the plant metabolite 6-Methoxybenzoxazolinone (MBOA) in combination with PMSG in a superovulation program of St. Croix White ewes. Ewes (n = 44) were synchronized using an intravaginal progesterone (P4) sponge for 14 d followed by hCG administration (750 IU i.m.) 1 d after sponge removal (d 0). Ewes were assigned to one of six treatment groups as follows: Control I (n = 7) received no PMSG or MBOA; Control II (n = 7) received PMSG (1000 IU i.m.) on d -1; Low MBOA (n = 7; 0.43 mg/kg) and High MBOA (n = 7; 1.15 mg/kg) received only MBOA on d -1; Low MBOA + PMSG (n = 8) and High MBOA + PMSG (n = 8) received injections of MBOA and PMSG on d -1. The

MBOA was dissolved in 100% propylene glycol and administered i.m. A sterile ram with a crayon-marking harness detected estrus. Number of corpora lutea (CL) and follicles were counted on d 9 via laparoscopy. For all ewes, 89 % exhibited estrus post-synchrony. Interval to estrus did not differ ($P > 0.10$) between ewes receiving MBOA alone or with PMSG and non-superovulated ewes (Control I). Low MBOA and High MBOA ewes tended ($P < 0.10$) to have a longer interval to estrus, and Low MBOA + PMSG ewes had a longer interval to estrus ($P < 0.04$), than superovulated ewes (Control II). The MBOA-treated ewes (High or Low MBOA) did not differ ($P > 0.10$) in number of CL from non-superovulated ewes (Control I). Similarly, MBOA + PMSG-treated ewes (High or Low MBOA) did not differ ($P > 0.10$) in number of CL from superovulated ewes (Control II). Mean number of follicles did not differ ($P > 0.10$) in MBOA-treated ewes (High or Low MBOA) compared to non-superovulated ewes (Control I). Mean number of follicles was not different ($P > 0.10$) between High MBOA + PMSG and superovulated ewes (Control II). The Low MBOA + PMSG ewes tended to have more ($P < 0.10$) follicles than did superovulated ewes (Control II). These results indicate that MBOA did not enhance the ovulatory responses of superovulated hair sheep ewes but did alter follicular populations of the subsequent estrous cycle.

Key Words: MBOA, Sheep, Superovulation

59 Effects of prostaglandins E and F on early embryonic development in the goat. B.L. Sayre*, M.P.L. Dismann, and J.P. Tritschler, *Virginia State University, Petersburg, VA.*

Previous data indicated prostaglandin E (PGE) increased ovine embryonic hatching rate, and prostaglandin F (PGF) reduced development of rabbit, bovine, and rat embryos. The objective of this experiment was to determine the effects of PGE and PGF on embryonic development of caprine embryos. Estrus was synchronized in does ($n = 25$) with medroxyprogesterone acetate (MPA) pessaries for 12 d. Does were superovulated using 20 units of FSH. On d 6 following estrus, embryos were flushed ($n = 128$) and incubated individually in a 25 μ L droplet of TCM-199 with 25 mM HEPES and BSA (8 mg/mL) for 6 d at 38.5°C in a 5% CO₂:air atmosphere with one of the following treatments: 1) control (0.001% EtOH), 2) PGE (7 ng/mL), 3) PGF (7 ng/mL), 4) low PGE:high PGF (3.5:14 ng/mL), 5) balanced PGE:PGF (7:7 ng/mL), or 6) high PGE:low PGF (14:3.5 ng/mL). Data were analyzed with the GLM and GENMOD procedures of SAS. A majority (92.0%) of does expressed estrus after treatment with MPA pessaries and FSH during the early anestrous period (April-June). The number of ovulations (8.4) and number of embryos collected (5.1) did not decline ($P > 0.05$) as the anestrous period deepened. Treatment with PGE alone reduced ($P = 0.07$) hatching rate (1/17; 6%), whereas the hatching rates of embryos treated with PGF (9/18; 50%), low PGE:high PGF (8/16; 50%), and balanced PGE:PGF (11/18; 61%) were similar to control (6/18; 33%). In contrast, both development of morula to blastocysts and hatching rate were increased ($P < 0.05$) with high PGE:low PGF (6/6; 100% and 13/18; 72%, respectively). All other treatments did not affect ($P > 0.05$) development of morula to blastocysts. Based on the literature, PGF was expected to reduce hatching rates, and PGE was expected to increase hatching rates. In contrast, in this experiment PGE reduced embryonic hatching rate, and PGF had no effect. While high concentrations of PGE with PGF improved hatching rates, increased concentrations of PGF did not affect embryonic development. Further studies are needed to elucidate the roles of PGE and PGF on regulation of embryonic blastocoele formation and hatching.

Key Words: Goat, Prostaglandins, Embryo

60 Prediction of blood plasma progesterone via near infrared transmittance spectroscopy. D. Tolleson*¹, D. Rabbe², R. Randel¹, J. Stuth¹, and K. Busch², ¹Texas A&M University Agriculture Program, ²Baylor University Dept. of Chemistry and Biochemistry.

The objective of this experiment was to determine if near infrared transmittance spectroscopy of blood plasma could: 1) discriminate between cattle differing in reproductive status, and 2) quantify plasma progesterone (P4) concentration. Plasma was collected from three treatment groups: 8 ovariectomized (OVX), 8 early (45 to 60 d, EARLY), and 8 late (> 240 d, LATE) pregnant Brahman (*Bos indicus*) cows. P4 was determined by radioimmunoassay. Intra-assay coefficient of variation = 9.88 %, detection limit = 0.047 ng/mL, maximum and non-specific binding = 34.31 and 5.45 %, respectively. Mean plasma P4 = 0.83 ± 0.42 ,

11.87 ± 1.77 , and 8.30 ± 0.89 ng/mL ($P < 0.01$) for OVX, EARLY, and LATE respectively. Near infrared (NIR) spectra (4000 to 10000 cm^{-1}) were collected on a Thermo-Mattson Model GL-5020 FTNIR spectrometer using a quartz cell with a 2-mm path length. Principal components (PC) of 1st derivative NIR spectra were used in a partial least squares regression to predict P4 concentration or to generate X-Y plots of PC scores to identify groups. Three primary groups were identified. Group 1 contained eight OVX samples. Group 2 contained seven EARLY and one LATE. Group 3 consisted of seven EARLY and two LATE. One sample in the OVX group had 3.73 ng/mL P4. The EARLY sample misidentified had 7.94 ng/ml P4, the two LATE samples misidentified had 7.83 and 11.96 ng/mL P4, respectively. Mean P4 was 0.83 ± 0.42 , 7.79 ± 0.83 , and 11.86 ± 1.57 , ng/mL ($P < 0.01$) for 1, 2, and 3, respectively. Segregation of these samples was based on physiological status as well as P4 concentration within physiological status. Using these 24 samples for calibration resulted in a P4 predictive equation with $R^2 = 0.98$ and SE of calibration = 1.08 ng/mL. The P4 predictive equation met minimum criteria for $R^2 (> 0.8)$. The SE however, indicates that prediction at low P4 concentrations could be insufficiently precise. A larger, more diverse calibration set should be collected to better evaluate the technique.

Key Words: Near Infrared Spectroscopy, Progesterone, Plasma

61 Live animal carcass traits as influenced by estrous synchronization protocol and effects on fertility in nulliparous beef heifers. H.L. Evans*^{1,2}, S.T. Willard², and R.C. Vann¹, ¹Brown Loam Branch Experiment Station, Raymond, Mississippi, ²Mississippi State University, Mississippi State, Mississippi.

Age and weight are common criteria used to estimate an appropriate time to breed in beef heifers. Repartitioning of fat may also influence reproductive efficiency in relation to response to estrous synchronization and fertility at first breeding. The objectives of this study were to determine whether fluctuations in percent intramuscular fat (%IMF) may occur in relation to estrous synchronization method and stage of the estrous cycle, and whether there is a relationship between %IMF and pregnancy rate. Experiment (EXP) I: Angus beef heifers ($n = 20$) were synchronized using a two-injection PGF_{2a} (PG; 25mg, i.m.) regimen. Following the second injection of PG and detection of estrus, real-time ultrasound (RTU) was performed to assess live animal carcass traits and blood samples collected on d 3, 9, and 15 post-estrus. Measurements by RTU consisted of %IMF of the Longissimus muscle at the 11, 12 and 13th ribs, %IMF Stress Score, back fat thickness (BF), rump fat thickness (RF) and gluteus medius depth (GMD). Following a return to estrus 21.2 ± 0.33 d later, measurements were repeated again on d 3, 9, and 15 post-estrus of the next estrous cycle. Blood samples were analyzed for serum concentrations of progesterone and estradiol by RIA. EXP II: Crossbred beef heifers ($n = 78$) were assigned to one of two estrous synchronization groups: oral MGA/PG (0.5 mg MGA/head/day) or two-injection PG. Measurements were consistent with those described in EXP I, with measurements taken at the start (d -14), middle (d -7) and end (d 0) of estrous synchronization, and on d 7 and 14 post-estrus and AI. EXP I: %IMF was negatively correlated to IMF stress score (-0.48, $P < 0.0001$). However, %IMF and IMF stress scores did not differ ($P > 0.10$) relative to overall stage of the estrous cycle. Similarly, BF, RF and GMD did not differ ($P > 0.10$) relative to stage of the estrous cycle over two consecutive estrous cycles (45d). EXP II: Pregnancy rates did not differ ($P > 0.10$) between the synchronization groups (MGA/PG: 56.4%; PG: 53.1%). No difference ($P > 0.10$) in %IMF between MGA and PG groups were recorded at breeding or in relation to first service pregnancy rates. In summary, %IMF did not fluctuate in beef heifers in relation to stage of the estrous cycle and %IMF on the day of breeding did not affect pregnancy rates.

Key Words: Intramuscular Fat, Heifers, Estrous Cycle

62 Single versus split dose of PGF_{2a} in a GnRH + PGF_{2a} protocol combined with melengestrol acetate (MGA) in lactating *Bos taurus* x *Bos indicus* cows. G. E. Portillo*, G. A. Bridges, M. K. Shaw, J. W. de Araujo, W. W. Thatcher, and J. V. Yelich, *University of Florida, Gainesville.*

Lactating *Bos taurus* x *Bos indicus* cows ($n = 304$) were used to evaluate effectiveness of a single versus a split dose of PGF_{2a} in a GnRH/PGF_{2a} protocol. On d 0 of the experiment all cows received 100 μ g GnRH and 7 d later half the cows received either 25 mg PGF_{2a} (LUTALYSE® Sterile Solution) on d 7 or 12.5 mg PGF_{2a} on d 7 and

8. All cows received MGA (0.5 mg/head/day) on d 1 to 6. Estrus was detected from d 7 to 10 and cows AI 8 to 12 h after observed estrus. Cows not in estrus by d 10 were timed-AI and administered 100 µg GnRH (Fertagy1[®]). Cows were classified as cycling (progesterone ≥ 1 ng/mL on either d -10 or 0) and noncycling (progesterone < 1 ng/mL on d #10 and 0) on d 0. Regression of the corpus luteum (CL) was defined as cows with progesterone ≥ 1 ng/mL on d 7 and exhibited estrus or had progesterone < 1 ng/mL at timed-AI. Cycling status (CS), estrous (ER), conception (CR), timed-AI pregnancy (TAIPR), synchronized pregnancy (SPR), and CL regression (CLREG) rates were evaluated. There were no treatment x CS effects (P > 0.10) for any variable tested so data were pooled. The following responses were similar (P > 0.10) between single and split dose of PGF2α: CS (83/141 = 58.9%; 101/146 = 69.2%), ER (54/145 = 37.2%; 45/149 = 30.2%), CR (33/54 = 61.1%; 19/45 = 42.2%), TAIPR (30/91 = 33.0%; 43/104 = 41.4%), SPR (63/145 = 43.5%; 62/149 = 41.6%), and CLREG (72/85 = 84.7%; 90/102 = 88.2%). The TAIPR and SPR were greater (P < 0.05) for cycling (56/120 = 46.7%; 90/182 = 49.5%) than noncycling (17/69 = 24.6%; 33/103 = 32.0%) cows, respectively. For the noncycling cows on d 0, 40.2% (41/102) had progesterone ≥ 1ng/mL at PGF2α with CLREG (16/18 = 88.9% vs. 22/23 = 95.7%) being similar between single and split dose of PGF2α, respectively. In conclusion, split dose of PGF2α did not improve effectiveness of GnRH/PGF2α protocol nor enhance CL regression in lactating *Bos taurus* x *Bos indicus* cows.

Key Words: *Bos indicus*, GnRH, Melengestrol Acetate

63 Efficacy of a single versus a split dose of PGF2α in a GnRH + PGF2α estrous synchronization protocol combined with melengestrol acetate (MGA) in lactating Angus cows. G. A. Bridges*, G. P. Portillo, M. K. Shaw, J. W. de Araujo, and J. V. Yelich, *University of Florida, Gainesville*.

A GnRH + PGF2α protocol combined with MGA was used in Angus (n = 207) cows to evaluate the effectiveness of two PGF2α treatments. On experimental d 0, cows were equally distributed to treatments by days postpartum and body condition and received GnRH (100 µg; FERTAGYL[®]). On d 7, half the cows received either 25 mg PGF2α (single; LUTALYSE[®] Sterile Solution) or 12.5 mg PGF2α (split) on d 7 and 8. All cows received MGA (0.5 mg/cow/day) on d 1 to 6. Estrous detection was conducted for 72 h following PGF2α and cows were AI 8 to 12 h after an observed estrus. Cows not observed in estrus by 72 h after PGF2α were timed-AI (TAI) and received GnRH (100 µg; FERTAGYL[®]). Pregnancy was diagnosed by ultrasonography 50 to 60 d following TAI. Blood samples were taken on d -10, 0, 7, and at TAI for progesterone (P4) concentrations to determine cycling (P4 ≥ 1 ng/ml at either d #10 or 0) and non-cycling (P4 < 1 ng/ml at both d #10 and 0) status and corpus luteum regression (CLR). There was no treatment x cycling status effects for any variable so data were pooled. Estrous response was decreased (P < 0.05) in the split (n = 103; 58.3%) compared to the single (n = 104; 71.2%) treatment. Conception (n = 74; 56.8%; n = 60; 56.7%), TAI pregnancy (n = 30; 33.3%; n = 43; 27.9%), and overall AI pregnancy rates (SYNPR; n = 104; 50.0%; n = 103; 44.7%) were similar (P > 0.05) between single and split treatments, respectively. Estrous response tended (P < 0.1) and SYNPR were greater (P < 0.05) for cycling (n = 128; 68.8%; 52.3%) than non-cycling (n = 79; 58.2%; 39.2%) cows, respectively. In cows with P4 ≥ 1.0 ng/ml at PGF2α, CLR (sum of the estrous response and P4 < 1 ng/ml at TAI) was similar between the single (n = 56; 92.9%) and split (n = 64; 98.4%) treatments. In conclusion modifying PGF2α from a single to a split treatment reduced estrous response but had no effect on conception, TAI, SYNPR, and CLR rates in Angus cows.

Key Words: PGF2α, GnRH, Synchronization

66 Effect of Supplemental Copper on Copper Status, Calf Weaning Weights, and Reproduction in Beef Cattle. J. W. Spears*, K. E. Lloyd, C. L. Wright, T. E. Engle, M. E. Tiffany, and C. S. Whisnant, *North Carolina State University, Raleigh*.

A 2-yr study was conducted to determine the effects of Cu supplementation, from copper oxide needles, on Cu status and performance of beef cattle. In yr 1, 140 Angus (n = 65) and Simmental (n = 75) cows in

64 Influence of GnRH and estradiol on estrus and luteal activity of anestrous postpartum beef cows. I. Rubio, F. J. White, N. H. Ciccioli, and R.P. Wettemann*, *Oklahoma State University, Stillwater*.

Anestrous Angus x Hereford lactating cows were used to determine if treatment with GnRH or estradiol influences onset of first estrus and luteal activity. Thirty-four cows were randomly assigned to one of three treatments: GnRH (100 µg; Cystorelin, Abbott Laboratories; n = 12), estradiol cypionate (1 mg; Pharmacia & Upjohn, E; n = 12) or saline (S; n = 10). Ovarian follicles were evaluated by ultrasonography on two consecutive days at 40.5 (SD = 2.3 days) postpartum. If the dominant follicle was at least 10 mm in diameter at the first measurement, the cow was classified as < 11 mm or ≥ 11 mm. Body condition score (BCS) was measured and cows were classified as < 5 or ≥ 5. Blood samples were collected twice a week, starting at 30 d postpartum, then on the day before treatment (d #1), d 0, d 3, d 6 and every 3 d until day 22 post treatment to determine luteal activity (progesterone ≥ 0.5 ng/ml). Estrus was monitored with electronic mount detectors (HeatWatch) from d 30 until d 70 postpartum, and was defined as cows that received more than 2 mounts in 4 h. Cows lacked luteal activity and estrus before treatment. During 1 to 10 d after treatment, more GnRH cows (67%) had luteal activity than E cows (25 %; P < 0.10) or saline cows (0 %; P < 0.01), and E and S cows were not different (P > 0.10). Treatment did not influence the percentage of cows with luteal activity 13 to 20 d after treatment. Percentage of cows detected in estrus during 1 to 6 d after treatment was greater for E (58%) than GnRH (8% ; P < 0.05) or saline cows (0 %, P < 0.01), but was similar for GnRH and saline treated cows (P > 0.10). The number of cows in estrus during 7 to 20 d after treatment was not influenced by treatment. Follicle size and BCS did not influence the effect of treatment on estrus and luteal activity (P > 0.10). Treatment of postpartum anestrous cows with GnRH initiated luteal activity without estrus, and treatment with estradiol increased the incidence of estrus without altering luteal activity.

Key Words: Postpartum Beef Cow, Estrus, Luteal Activity

65 Estrous synchronization for beef heifers: CO-Synch versus Hybrid-Synch. B. K. Reed,*¹ and C. B. Rodgers², ¹*BKR Cattle Etc*, ²*Triple R Farms*.

Many studies have evaluated the synchronization of estrus. Although virgin heifers do not have the concerns associated with postpartum anestrous, and should be easier to synchronize, results using timed-breeding protocols are varied. We compared pregnancy rates of Brangus cross heifers subjected to two of the currently used synchronization programs. Heifers (n=145) were randomly allotted by weight to one of two treatments for the synchronization of estrus and ovulation. Only heifers that exhibited behavioral estrus twice before the beginning of the study were included. Approximately half of the heifers (n=73) received an injection of GnRH (100 µg; i.m.) on d 0, an injection of PGF2α (25 mg; i.m.) on d 7, and a second injection of GnRH (100 µg; i.m.) on d 9, coupled with timed insemination (CO-Synch). The remaining heifers (n=72) received an injection of GnRH (100 µg; i.m.) on d 0 and an injection of PGF2α (25 mg; i.m.) on d 7. Heifers were then observed from d 7 to d 11, and heifers exhibiting behavioral estrus were artificially inseminated. Any heifers not inseminated after detected estrus received an injection of GnRH (100 µg; i.m.) on d 12, coupled with timed insemination (Hybrid-Synch). First-service conception rates for heifers that received CO-Synch (93%) were not different (P > 0.10) than heifers that received Hybrid-Synch (85%). Both methods for the synchronization of estrus evaluated in this study resulted in extremely high pregnancy rates, with the only advantage being the elimination of estrous detection when using CO-Synch.

Key Words: Estrous Synchronization, CO-Synch, Hybrid-Synch

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their last trimester of pregnancy were blocked by breed and age and randomly assigned to treatments. Cows were given no supplemental Cu or a 25-g CuO needle bolus at the beginning of the study and at the start of yr 2. Calves born to Cu-supplemented cows were given a 12.5-g CuO needle bolus at approximately 3 mo of age. A free-choice mineral supplement was provided that contained all minerals typically supplemented to cattle with the exception of Cu. Cattle grazed pastures that

were predominately tall fescue during the grazing season and were fed hay, limited silage, and a protein supplement during the winter. Cows were synchronized and those showing estrus were bred AI followed by a 28-d natural mating period. In yr 2, cows remained in the same Cu treatment, and 2-yr-old heifers were added to the study to replace cows that were culled after yr 1. Liver Cu concentrations were higher ($P < 0.01$) in cows receiving a Cu bolus. Even 257 d following administration of the Cu bolus, liver Cu concentrations were 60% higher ($P < 0.01$) in Cu-supplemented cows. Calves, born to Cu-supplemented cows, that received a Cu bolus in March had liver Cu concentrations over 10-fold higher ($P < 0.01$) than controls in June. Calves born to Cu-supplemented dams had heavier ($P < 0.01$) birth weights in yr 1, but not in yr 2. Weaning weights of calves given a Cu bolus averaged 12.2 kg heavier ($P < 0.01$) than controls in yr 1, when adjusted for sex, calf age, and age of dam. Weaning weights tended ($P < 0.13$) to be higher for Cu-supplemented calves in yr 2. Cow reproductive performance was not affected by Cu. Results indicate that administration of a CuO needle bolus to beef cows and their calves is an effective method for providing Cu. Copper supplementation improved calf weaning weights.

Key Words: Copper, Beef Cattle

67 Effect of Selenium Supplementation of Beef Cows on Immune Responses of Weaned Beef Calves. P. A. Beck*¹, T. J. Wistuba², M. E. Davis², and S. A. Gunter¹, ¹Southwest Research and Extension Center, Hope, AR, ²Department of Animal Science, University of Arkansas, Fayetteville.

Selenium (Se) is an essential micronutrient, which can have substantial effects on immune function because of its role in the antioxidant enzyme glutathione peroxidase (GTH-Px). Eighteen spring-born Angus sired steers (BW = 200 ± 5.2 kg) were selected from six groups of 20 cow-calf pairs, to test the effects of feeding no selenium (Se), or 26 ppm of Se as sodium selenite or Se-yeast in a free-choice mineral supplement to cows before calving and during lactation on the whole blood Se, GTH-Px activity, and immune function of their weaned offspring. Twenty-two days after weaning, the steers were weighed and blood was collected via jugular venipuncture for analysis of whole blood Se, GTH-Px activity, lymphocyte proliferation, macrophage phagocytosis, and interferon- γ production. Cell-mediated immunity was tested by measuring swelling response to intradermal injection of phytohemagglutinin. Blood Se, GTH-Px activity, lymphocyte proliferation, macrophage phagocytosis, and interferon- γ data were analyzed as a completely randomized design. Skin-swelling response was analyzed as a split-plot in time experimental design. Supplementation with Se-yeast increased ($P < 0.05$) whole blood Se concentration by 214% and glutathione peroxidase activity by 258% compared to unsupplemented calves. Inorganic Se supplementation increased ($P < 0.05$) whole blood selenium by 92% and glutathione peroxidase activity by 196%. Supplementation with Se-yeast increased ($P < 0.05$) whole blood Se concentration by 63% and macrophage phagocytosis by 111% compared to supplementation with sodium selenite. Supplementation with Se-yeast also numerically increased ($P > 0.47$) proliferation of lymphocytes cultured with concanavalin A, phytohemagglutinin, and pokeweed mitogen compared to unsupplemented and sodium selenite supplemented calves. Interferon- γ production was not affected ($P = 0.20$) by Se supplementation. Swelling response was not affected ($P = 0.35$) by Se supplementation and the Se treatment by time interaction was not significant ($P = 0.80$). Supplementation of cow herds with Se-yeast before weaning has the ability to alter immune function and improve selenium status of weaned calves in marginally Se deficient conditions.

Key Words: Selenium, Beef Cattle, Immune Function

68 Feeding Value of Pelleted and Loose Soybean Hulls, and Corn Gluten Feed in Self-Feeding Programs for Backgrounding Calves. M. H. Poore*, North Carolina State University, Raleigh.

This trial was conducted to evaluate self-feeding pelleted (PSH) or loose (LSH) soybean hulls or loose corn gluten feed (CGF) compared to a diet of only hay. Eight groups of five calves each (Angus and Angus-cross, initial shrunk BW 234 kg) were fed at the Upper Mountain Research Station near Laurel Springs, NC. All groups received free-choice hay and mineral, and two groups received one of the three byproducts in a self-feeder. Endophyte-free fescue hay was of high quality (17.6% CP and 28.8% ADF), while PSH, LSH, and CGF were 14.1, 14.2, and 23.7% CP;

43.6, 43.3, and 11.9% ADF; and 2.3, 2.6, and 15.5% starch, respectively. The CGF was 0.56% sulfur. Cattle were hand-fed an increasing amount of byproduct for 1 wk and then were fed all they would consume for the remainder of the 83-d trial. No health problems were observed. Differences presented indicate $P < 0.05$ and means are presented ± SEM. Cattle fed the byproducts ate less hay than the control while cattle on CGF consumed more hay than those on PSH or LSH (6.86, 3.20, 2.57, and 5.09 ± 0.199 kg/d for hay, PSH, LSH, and CGF, respectively). Byproduct intake differed for each treatment (6.27, 7.57, and 2.75 ± 0.199 kg/d for PSH, LSH, and CGF, respectively). Total dry matter intake as kg/d or % of BW differed for each treatment (6.92, 9.52, 10.21, and 7.90 ± 0.081 kg/d; and 2.54, 3.19, 3.40, and 2.79 ± 0.017% of BW for hay, PSH, LSH, and CGF, respectively). Daily gain (determined using 24-h feed and water withdrawal) was lowest for hay, highest for PSH and LSH, and intermediate for CGF (0.96, 1.55, 1.59, and 1.20 ± 0.049 kg/d for hay, PSH, LSH, and CGF, respectively). Gain/feed was not influenced by treatment (0.139, 0.163, 0.156, and 0.155 ± 0.006 for hay, PSH, LSH, and CGF, respectively). Ruminal fluid samples (obtained by rumenocentesis) showed that acetate:propionate ratio was higher for PSH and LSH than for CGF or hay (3.61, 4.68, 4.38, and 3.22 ± 0.139 for hay, PSH, LSH, and CGF, respectively), while ruminal pH was not influenced by treatment (6.63, 6.49, 6.26, and 6.72 ± 0.092 for hay, PSH, LSH and CGF, respectively). In this study all three byproduct concentrates were fed successfully. Loose soybean hulls resulted in slightly higher intake than PSH with similar daily gain.

Key Words: Soybean Hulls, Corn Gluten Feed, Backgrounding Calves

69 Cool-Season Annual Swards with Legumes to Supplement Wintering Beef Cows. T. G. Montgomery*¹, W. A. Whitworth², and S. A. Gunter³, ¹University of Arkansas-Monticello, ²Southeast Research & Extension Center, Monticello, AR, ³Southwest Research & Extension Center, Hope, AR.

On 21 December 2001, 50 beef cows nursing calves (552 ± 9.4 kg ± SE; calving started on 22 September 2001), stratified by breed, body condition score (BCS), BW, and cow age, were divided randomly into six groups and assigned to one of six cool-season annual swards (0.45 ha/cow) that had been inter-seeded into a dormant bermudagrass/dallisgrass pasture in October. All groups had *ad libitum* access to a warm-season grass hay (12% CP; 58% TDN) plus the sward containing the following forages as the treatment: 1) wheat and ryegrass (WRG; control group), 2) wheat and ryegrass plus red clover (WRR), or 3) wheat and ryegrass plus white and crimson clovers (WRW). Wheat, ryegrass, and red, white, and crimson clovers were seeded at rates of 101, 25, 9, 4, and 12 kg of seed/ha, respectively. Beginning the second week in December, cows were synchronized with SelectSynch, and were subsequently inseminated to a Beefmaster sire on observed estrus. On December 21, a bull that had passed a breeding soundness examination was placed with each group for a 60-d breeding season. Data were analyzed by ANOVA and contrast statements were used to compare WRG versus the average of WRR and WRW, and WRR versus WRW. Body weight and BCS did not differ ($P \geq 0.15$) between cows grazing WRG and the average of cows grazing WRR and WRW; however, cow BW on March 21 did tend ($P = 0.08$) to be greater for cows grazing WRR than for cows grazing WRW. Calf birth weight did not differ ($P = 0.65$) between WRG and the average of WRR and WRW and there was no difference ($P = 0.55$) between WRR and WRW. Calf BW on any date and ADG did not differ ($P \geq 0.25$) between WRG and the average of WRR and WRW. There were no differences ($P \geq 0.17$) between WRR and WRW in ADG or calf BW on any date. Cows grazing WRG seem to perform as well as cows grazing swards fortified with red clover (WRR) or white and crimson clovers (WRW).

Key Words: Beef Cows, Legumes, Pastures

70 The Effect of a Condensed Tannin-Containing Forage on Methane Emission by Goats. R. Puchala*, B. R. Min, A. L. Goetsch, and T. Sahl, *E (Kika) de la Garza Institute for Goat Research, Langston University, OK.*

The objective of this study was to investigate the effect of dietary condensed tannins from *Sericea lespedeza* (*Lespedeza cuneata*; 6% condensed tannins; SL) on methane emission by goats. The experiment was conducted with Angora does that had grazed SL (n = 6; 43 ± 2.7 kg BW) or crabgrass/tall fescue forage (CF; n = 6; 40 ± 2.7 kg BW) for approximately 4 months. After 5 d of adaptation to metabolism crates, gas

exchange was measured for 24 h in an open-circuit respiration calorimetry system with four head boxes (Sable Systems; Henderson, NV). Heart rate (HR) was monitored using Polar S610 heart rate monitors (Polar Electro, Woodbury, NY). Goats began adaptation periods sequentially in three sets, with two SL and two CF does in each set. During adaptation and measurement periods, freshly cut forages were fed three times daily. Concentrations of CP were 10.3 and 13.0% DM and *in vitro* DM digestibility (with NDF as the end-point measure) was 64.5 and 75.3% for SL and CF, respectively. Dry matter intake (1.29 vs 0.68 kg/d) and digestible DMI (0.84 vs 0.51 kg/d) were greater ($P < 0.01$) for SL vs CF. Daily energy expenditure (432 vs 439 kJ/kg BW^{0.75}) and methane emission (12.4 vs 10.9 L/d for SL and CF, respectively) were similar between treatments. However, daily methane emission relative to DMI (8.5 vs 18.8 L/kg) and digestible DMI (13.2 vs 25.0 L/kg) were considerably lower ($P < 0.01$) for SL than for CF. Treatment had no effect on HR (75.5 vs 74.7/min) or the ratio of daily energy expenditure to average HR per minute (5.73 vs 5.88 kJ/kg BW^{0.75} for SL and CF, respectively). In conclusion, condensed tannins in forages such as SL may provide a means of decreasing methane emission by ruminants.

Key Words: Methane, Angora Goats, Condensed Tannins

71 Tifton 85 and Alicia Bermudagrass Hay and Supplement Intake and Digestion by Steers. G. M. Hill¹, S. Savage¹, R. N. Gates², R. D. Hatfield³, B. C. Hand¹, and B. G. Mullinix, Jr.¹, ¹University of Georgia, Tifton, GA, ²USDA-ARS, Tifton, GA, ³US Forage Research Center, Madison, WI.

Tifton 85 (T85) and Alicia (A) bermudagrass hays harvested August 9 (5-wk) and September 30 (7-wk) were fed with a supplement (SUP) to steers to determine DMI and digestibility. Meadows (0.81 ha) of A and T85 received poultry litter (January and April, total 17.92 t/ha) and fertilizer (4 monthly applications, total 269 kg N/ha; plus 56 kg K₂O/ha, June 17). Beef steers (n = 24; BW = 314.8 ± 15.2 kg) were randomly assigned to treatments (TRT) in a completely random design. Digestion and DMI data were analyzed as a 2 × 2 factorial with initial BW class as blocks and DMI in a 7-d standardization period (SP) as a covariate. Steers were individually-fed Tifton 85 hay free-choice with SUP (2.3 kg/steer daily; 12.5% CP; 87.5% corn, 10% soybean meal, 2.15% minerals and vitamins) in the SP, followed by four TRT hays with SUP in a 14-d treatment period (TP). Chromic oxide was fed in SUP (10 g/steer daily, d 12 to d 20) as a marker, and fecal samples (12 /steer; d 17 to d 21) were analyzed for Cr and nutrients. Hay DM, CP, ADF, NDF, and ADL (% DM basis), respectively, were: A 5-wk = 92.1, 11.7, 36.6, 72.2, 5.3; A 7-wk = 91.9, 11.4, 37.2, 71.5, 4.9; T85 5-wk = 91.8, 10.2, 36.7, 71.8, 5.0; T85 7-wk = 91.6, 11.8, 37.8, 74.0, 5.2. Main effect means (Table) for hay ether ferulic acid (EFA; mg/g cell wall), for TP dietary DMI (kg), and apparent digestion (%) had no hay × maturity interactions ($P > 0.10$). Digestion of OM, CP, ADF, and NDF were higher for diets with T85 than A, and digestion was not affected ($P > 0.10$) by initial BW classification. Higher OM and CP digestion of 7-wk hay diets resulted from increased pre-harvest rainfall. Lower EFA in lignin of T85 hays contributed to higher digestibility of diets with T85 than with A.

Item	A	T85	SE	P <	5-wk	7-wk	SE	P <
EFA	7.7	5.6	0.27	0.01	6.6	6.6	0.27	ns
DMI	6.1	6.2	0.19	ns	6.5	5.8	0.18	0.01
OM	72.5	78.5	0.96	0.01	74.0	77.7	0.89	0.05
CP	72.2	75.5	0.98	0.05	72.6	75.2	0.91	0.10
ADF	67.2	74.7	1.21	0.01	69.6	72.3	1.13	ns
NDF	64.4	75.3	1.28	0.01	68.7	71.1	1.19	ns

Key Words: Steer, Hay, Digestion

72 Effect of Fatty Acid Profile on In Situ and In Vitro Digestibility of Raw Soybean in Grazing Cattle. B. C. Housewright¹, L. L. Pickering¹, H. L. Richardson¹, D. D. Kee², J. Heitholt³, V. Pantalone⁴, and K.W. Davenport, ¹Texas A&M University - Commerce, ²Texas Cooperative Extension Service, ³Texas Agricultural Experiment Station - Dallas, ⁴University of Tennessee, Knoxville.

Development of soybean cultivars that vary in fatty acid profile, in order to meet an increasing demand in human nutrition, could alter their digestibility in ruminants. A total of eight soybean cultivars were used to determine if variations in fatty acid profile would have an effect on *in situ*

and/or *in vitro* digestibility of soybean in grazing cattle. Two cultivars were selected that represented the average fatty acid profile of soybean. Other cultivars were selected based on variation of one or more fatty acids: Low Linolenic, Low Palmitic, Low Palmitic and Linolenic, High Stearic, High Oleic, and High Palmitic. For *in situ* and *in vitro* trials, ruminal fluid was extracted from a ruminally cannulated cow grazing Coastal bermudagrass pasture with no additional feed supplement. *In situ* and *in vitro* trials were performed identically. Samples from each cultivar were ground to pass through a 1-mm screen and subsamples were taken for *in situ* and *in vitro* trials. Eight samples from each cultivar were incubated, with a sample from each cultivar removed at 3, 6, 9, 12, 15, 18, 21, and 24 h of incubation. Cultivar had no effect on DM digestibility (DMD) at any incubation time in either *in situ* or *in vitro* trials ($P > 0.05$). Digestibility of all cultivars, *in situ* and *in vitro*, increased ($P < 0.05$) through 12 h. After 12 h of incubation, no additional increases ($P > 0.05$) in DMD were detected, *in situ* or *in vitro*. *In vitro* digestibility increased ($P < 0.05$) from 69.02% at 3 h to 76.69% at 12 h. *In situ* digestibility increased ($P < 0.05$) from 88.55% at 3 h to 95.52% at 12 h. Rates of DMD showed similar patterns, *in situ* and *in vitro*, but *in situ* rates were approximately 20 percentage units higher. This study suggests that digestion rates of soybean are not affected by fatty acid variations due to cultivar differences, and DMD is maximized at 12 h of incubation. Supported by Texas Soybean Board.

Key Words: Raw Soybean, Fatty Acid, Dry Matter Digestion

73 Evaluation of Rice Mill Feed in Diets Fed to Beef Cattle. W. N. Stacey* and D. L. Rankins, Jr., Auburn University, AL.

Rice mill feed is a low-cost by-product similar to broiler litter in that it contains high concentrations of ash and fiber. Two trials were conducted to evaluate the effects of replacing broiler litter with rice mill feed (RMF) on nutrient digestibilities and growth rate. In Trial 1, 40 predominantly Angus steers (initial body weight = 277 kg) were fed one of four diets over a 112-day period (five steers/pen; two pens/diet). On a dry matter basis, diets were as follows: 1) 47% broiler litter:53% corn, 2) 60% RMF:40% corn, 3) 50% RMF:50% corn, and 4) 40% RMF:60% corn. All diets were fed free-choice, and bermudagrass hay also was offered free-choice. Daily gains were greater ($P < 0.06$) for diets 3 and 4 (1.3 and 1.3 kg/d, respectively) than for diets 1 and 2 (0.9 and 1.0 kg/d, respectively). Daily feed intakes were not different ($P > 0.10$) among diets (9.9, 9.8, 9.9, and 9.7 kg/d, respectively). However, hay intake was greater ($P < 0.05$) for steers consuming diet 1 (2.7 kg/d) than for diets 2, 3, or 4 (1.0 kg/d). In Trial 2, 16 Angus × Charolais steers (initial body weight = 277 kg) were fed the same four diets while housed in individual metabolism stalls and nutrient digestibilities were determined. Daily dry matter intake was not different ($P > 0.10$) among diets (4.8, 5.5, 5.4, and 5.5 kg/d, respectively). Nutrient digestibilities did not differ among diets ($P > 0.10$). Nutrient digestibilities (%) for the four diets were as follows: DM - 73.6, 69.0, 74.2, and 70.8; OM = 74.4, 70.2, 75.9, and 72.1; NDF = 62.9, 60.6, 65.7, and 61.9; and ADF = 57.3, 56.9, 61.0, and 59.6, respectively. Rice mill feed can be used to replace broiler litter to formulate low-cost diets for stocker calves.

Key Words: Beef Cattle, Broiler Litter, Rice Mill Feed

74 Ruminal Dry Matter Disappearance Using Dacron or F57 Bags. M Yavuz¹, C. J. Richards¹, A. M. Saxton¹, J. L. Klotz¹, and J. C. Waller¹, ¹The University of Tennessee, Knoxville, TN.

In situ digestion is a widely accepted procedure for estimating rates of ruminal degradation. These procedures traditionally use dacron bags designed for ruminal incubation. After incubation, sample residues must be removed from the dacron bag for additional analyses such as ADF and NDF. An alternative may be the F57 bag developed by ANKOM Technology (Fairport, NY) for *in vitro* digestion and fiber analyses. The potential exists for these bags to be used for *in situ* digestion and the residue in that bag could be further analyzed for CP, NDF, ADF, or ash within the bag. The objective of this experiment was to compare ruminal *in situ* degradation rates of feedstuffs determined in dacron and F57 bags. Feedstuffs used for the comparison were alfalfa hay (*Medicago sativa*), bermudagrass hay (*Cynodon dactylon*), Kentucky 31 endophyte infected hay (*Festuca arundinacea*), corn, soybean hulls, and soybean meal. A ruminally cannulated cow fed a diet of 80% alfalfa cubes and

20% of a grain mix at a maintenance energy level with adequate degradable intake protein was used to incubate all feedstuffs. Feedstuffs were incubated for 0, 6, 12, 24, 72, and 96 h. *In situ* DM disappearance rates were calculated for each feedstuff using SAS proc nonlinear statement. *In situ* DM disappearance rates were similar for alfalfa ($24.1 \pm 0.01\%/h$) and soybean meal ($26.0 \pm 0.01\%/h$). Corn DM disappearance rate ($16.4 \pm 0.01\%/h$) was different ($P \leq 0.05$) than all others. Bermudagrass, tall fescue, and soybean hulls DM disappearance rates were similar and ranged from 6.2 ± 0.01 to $8.0 \pm 0.01\%/h$. *In situ* DM disappearance rates were similar ($P = 0.05$) for dacron and F57 bags. The average for all feedstuffs was $14.4 \pm 0.009\%/h$ for the dacron bags and $14.6 \pm 0.008\%/h$ for the F57 bags. There were no treatment x feedstuff interactions. These results suggest that F57 bags may be used for *in situ* incubations with similar DM disappearance rates to dacron bags. In addition, sample residue in the F57 bag may be directly subjected to additional analyses.

Key Words: Ruminants, Digestion, Measurement

75 Stocking Rate - Plant, Animal, and Environmental Implications. F. M. Rouquette*, *Texas Agricultural Experiment Station.*

Pasture stocking rate is the single most important factor controlling forage morphology and regrowth, animal performance, gain per unit land area, grazing behavior, efficiency of sward utilization, distribution and total quantity of defecation, and economic returns. Stocking rate recommendations to end users are site specific and management controlled due to forage species, climatic conditions, management input, duration of stocking, and gain per animal vs gain per area expectations. Multiple stocking rates used to create graded levels of herbage mass provide valuable forage-animal relationships which identify management boundaries of forage sustainability and production risks. In general, as stocking rates are increased, herbage mass decreases and subsequent animal performance declines. Forage response to stocking rate is species dependent with respect to changes in morphology, nutritive value, DM production, and survival. Method of stocking, continuous, rotational, strip, mob, etc., influences effects of stocking rate on plant, animal, and environmental parameters. Several experiments have shown a negative, linear relationship between average daily gain (ADG) and stocking rate. However, there has been shown to be an asymptotic relationship between ADG and herbage mass. Long-term stocking rate experiments on perennial pastures can provide valuable information on nutrient cycling which, in turn, has impact on nutrient management plans for pastures. Design and duration of stocking rates on pasture-animal performance can have profound effects on implementation strategies used by clientele and their resultant economic success. Stocking rate experiments have often taken the direction of short-term, objective-driven goals rather than year-long scenarios for producer-management. Attention needs to be diverted to follow-up data collection to quantify stocking rate effects on forage sustainability, compensating animal growth, and nutrient accountability in the environment.

Key Words: Stocking Rate, Forage, Animal Performance

76 Animal and Plant Responses to Stocking Rate. G. E. Aiken* and M. L. Looper, *USDA-ARS, Dale Bumpers Small Farms Research Center, Booneville, AR.*

Stocking rates that livestock producers choose to graze pastures will be a critical factor in meeting their economic goals and sustaining pasture productivity. This is primarily because stocking rate will determine the efficiency of production, production per unit land area, and depending on the grazing intensity imposed, increase the need for inputs of fertilizer and weed control. Therefore, both the biologic and economic implications of increasing or decreasing stocking rates must be understood to maintain stability and profit potential of a forage system. Stocking rate experiments conducted over the past forty years have typically reported linear declines in average daily weight gain as stocking rate increased. This linear trend in average daily gain with increases in stocking rate has been directly related to parallel declines in forage mass, but factors other than forage quantity can also affect intake of digestible dry matter. As canopies are grazed to lower heights, changes in forage quality, bulk density, and morphology can occur to grasses that alter selective grazing and dry matter intake by grazing livestock. Heavy grazing intensities can also shift the botanical composition over a period of time

from desirable to less desirable forage species. It is possible that actual trends in average daily gain over a range of stocking rates could be slightly non-linear, but the precision of most grazing experiments is too low to allow detection.

Key Words: Forages, Grazing, Stocking Rate

77 Effect of Cattle Price and Contract Grazing on Economic Optimum Stocking Rates for Stockers. D. I. Bransby*, *Auburn University, Auburn, AL.*

In most economic analyses of results from stocking rate experiments with young beef cattle, it has been assumed that animals were bought and sold at the same price per kg, or that any differential between buying and selling price is equal across stocking rates. These assumptions often result in identification of economic optimum stocking rates that are somewhat lower than the stocking rate that results in maximum animal gain per ha. However, in commercial markets, price per kg of cattle decreases as animal body weight increases. In addition, the difference between beginning and end weights of cattle (and therefore, the difference in buying and selling prices per kg) varies according to stocking rate. This means that the assumptions used in previous economic analyses of data from stocking rate experiments did not take into account typical market conditions, and are therefore invalid. Furthermore, no economic analyses have been conducted on stocking rate data, assuming that pastures were contract grazed for a fixed price per kg of gain. Analysis of data from a stocking rate experiment in which stockers were grazed on annual ryegrass indicated that when these factors are taken into account, the economic optimum stocking rate is equal to or close to the stocking rate that results in maximum animal gain per ha.

Key Words: Economic Optimum Stocking Rate, Stockers, Grazing

78 Effect of Grazing on Subsequent Animal Response: Performance, Body composition, Visceral Organs, and Nutrient Flux. C. R. Krehbiel*, M. J. Hersom, and G. W. Horn, *Oklahoma State University, Stillwater.*

Most of the energy consumed in ruminant production systems is derived from ad libitum consumption of forage. Maintenance and growth of grazing ruminants depends on the animal's ability to consume and extract usable energy from forage. Forage species and seasonal patterns of forage growth result in variations in forage availability and nutritive value, which can influence forage intake, nutrient metabolism, body composition, subsequent feedlot performance, and potentially carcass traits. It has been suggested that alterations in body composition through previous nutrition can alter NE_m requirements of growing cattle. The Level 1 Model of NRC (1996) suggests that as body fat content of cattle increases at a given BW, ME allowable ADG decreases. This implies that greater body fat content of cattle entering the feedlot decreases subsequent performance. In contrast, grazing systems that restrict growth and limit body fat accretion can positively affect cattle performance through compensatory growth, and alter composition of BW gain in the feedlot. Limiting energy intake during the grazing phase has been shown to increase mature size and carcass protein:energy. However, differences in initial body composition following grazing can be effectively minimized by the end of the feedlot phase if all cattle are fed to the same backfat endpoint. A positive correlation exists between fasting heat production and visceral organ mass, because visceral tissues and liver account for 40 to 65% of total body oxygen consumption. Changes in visceral organ mass, and therefore energy use, may change the amount of energy and protein available for growth. In addition, extensive inter-conversions and metabolism in the rumen and nutrient metabolism by portal and hepatic tissues often appear to have little effect on nutrients available to peripheral tissues. However, mechanisms by which these organs adjust to provide needed nutrients to other tissues and the regulatory interactions between these tissues and other body organs are not well understood. The objective of this review is to provide information on utilization of grazed forages and their effects on visceral and liver organ weights, net nutrient flux, subsequent performance, and body composition.

Key Words: Grazing Ruminants, Splanchnic Tissues, Compensatory Growth

79 Environmental Considerations for Grazing Management. P. A. Moore*¹, B. E. Haggard¹, S. Formica², P. B. DeLaune³, and B. C. Bellows⁴, ¹USDA/ARS, Fayetteville, AR, ²Arkansas DEQ, Little Rock, AR, ³University of Arkansas, Fayetteville, AR, ⁴ATTRA, Fayetteville, AR.

Excessive nutrient runoff from pastures is currently a problem in many areas of the country since it results in eutrophication of adjacent waterbodies. Over-grazing can result in compaction of the soil surface, which increases the amount of runoff, aggravating this problem. The objectives of this research were to evaluate the effects of over-grazing versus haying on runoff from pastures and to determine if simple remediation strategies such as pasture renovation could reduce the amount of runoff from over-grazed pastures. Two studies were conducted. In the first experiment, small (1 x 2 m) plots were constructed on land cropped to tall fescue that was either hayed, over-grazed, or over-grazed with cattle trails. Rainfall simulators were used to provide a 7 cm/h storm for one hour on two consecutive days. Runoff volumes were significantly lower for the hayed area (14.6 L) than for the over-grazed pasture (36.5 L) or the over-grazed area with cattle trails (47.3 L). These differences were attributed to higher bulk densities at the soil surface, which was believed to be due to compaction from cattle. In the second experiment the effects of pasture renovation on infiltration and runoff were evaluated on two soils under three fertilization regimes (unfertilized, swine manure, or poultry litter). The time to runoff was significantly longer on renovated land, infiltration was greater, and runoff was less. On average the amount of runoff was reduced by 45% with renovation, which translated into reductions in nutrient runoff of the same magnitude. These data indicate that pasture renovation and/or converting fields with high runoff potential from pastures to hay fields may be two best management practices to reduce nutrient runoff.

Key Words: Grazing, Runoff, Eutrophication

80 Winter Pasture Grazing Performance Effects on Feedlot and Carcass Traits in Cattle. J. J. Cleere*¹, A. D. Herring², J. W. Holloway³, H. Lippke³, C. R. Long¹, M. F. Miller⁴, K. R. Pond⁴, F. M. Rouquette¹, and B. G. Warrington³, ¹Texas A&M University, Overton, ²Texas A&M University, College Station, ³Texas A&M University, Uvalde, ⁴Texas Tech University, Lubbock.

During two successive years, steers (n = 189) and heifers (n = 72) were assigned to two stocking rates (SR) at the Texas Agricultural Experiment Stations in Uvalde (UVL) and Overton (OVT) to create different pre-feedlot growth rates. Animals were Angus, Angus x Angus-Brahman, Angus x Brahman-Hereford, Brahman, Hereford x Brahman, Braunvieh cross, or Bonsmara cross and stocked on TAM 90¹ annual ryegrass (*Lolium multiflorum*) (RG) in UVL or Maton¹ rye (*Secale cereale*) and RG in OVT from December-January to mid-May. Cattle were placed on feed at the Texas Tech University Alltech research feedlot in May 2000 and May 2001 to determine the influence of grazing growth rate (GGR) (High, Medium, and Low gains) on feedlot and carcass traits. Cattle were assigned to pens within location, breed type, stocking rate, sex, and weight with 4 to 7 animals per pen. Separate individual animal analyses were conducted for each location and sex. Feedlot performance of the UVL steers and OVT heifers was not affected by GGR. The OVT low and medium GGR steers had higher final feedlot ADG than the high GGR steers (1.83 and 1.79 vs 1.59 kg/d, respectively; P < 0.05). Final feedlot weights of the low and medium GGR animals within the three groups were lower than the high GGR animals due to an apparent failure to compensate for differences in initial feedlot weight (P < 0.05). The GGR affected hot carcass weight of all cattle (P < 0.05). The GGR affected total carcass value in the UVL steers and OVT heifers (P < 0.05), and in the OVT steers (P = 0.06). Cattle with higher gains during the winter grazing period had heavier final feedlot weights and carcass weights and subsequently higher carcass values. Stocking rate on pasture affected GGR and carcass traits, but had modest influence on animal performance in the feedlot. Thus, compensatory feedlot gains due to previous GGR was not a significant factor in this two year experiment.

Key Words: Beef Cattle, Feedlot Performance, Ryegrass

81 Season-Long Versus Intensive-Early Stocking at Two Nitrogen Fertilization Rates with Stocker Cattle Grazing Bermudagrass/Dallisgrass Pasture. L. G. Driggers¹, S. A. Gunter*², P. A. Beck², and M. J. Phillips², ¹Department of Agricultural and Extension Education, University of Arkansas, Fayetteville, ²Southwest Research & Extension Center, Hope, AR.

The objectives of this project were to compare the effects of season-long (SLS) with intensive-early stocking (IES) of pastures with different rates of N fertilization on the performance of grazing stocker cattle on pasture and in the feedlot. On April 17 (d 0), 82 Angus sired calves (BW = 225 ± 5.5 kg) were assigned randomly to one of twelve dallisgrass/bermudagrass pastures (0.81 ha each). One of the following three treatments was randomly applied to four pastures: 1) SLS with 169 kg/ha N fertilizer over the 168-d grazing period (4.9 steers/ha), 2) IES with 85 kg/ha N fertilizer over the 84-d grazing period (9.9 steers/ha), and 3) IES with 169 kg/ha of N fertilizer over the 84-d grazing period (9.9 steers/ha; IES+N). After the grazing phase was completed, cattle were finished in a commercial feedlot in western Oklahoma. Data were analyzed by ANOVA and contrast statements were used to compare SLS versus the average of IES and IES+N, and IES versus IES+N. By d 84 (July 10), SLS cattle were 29 kg heavier (P < 0.01) than the average of the IES and IES+N cattle; however, the IES+N cattle tended (P = 0.12) to be 16 kg heavier than the IES cattle. Total BW gain/ha was 31% greater (P = 0.02) for SLS cattle than the average of the IES and IES+N cattle. The IES+N cattle gained 44% more (P = 0.07) BW/ha than the IES cattle. In the feedlot, the ADG for the average of the IES and IES+N cattle (184 d on feed) was 12% greater (P = 0.03) than the SLS cattle (161 d on feed); ADG for IES cattle did not differ (P = 0.77) from IES+N cattle. Using SLS increased (P < 0.01) dressing percentage by 3% (P < 0.03) and fat thickness over the twelfth rib tended to decrease by 26% when compared to the average of IES and IES+N. No other carcass characteristics of the IES and IES+N cattle differed (P ≥ 0.24) from SLS cattle and there were no differences (P ≥ 0.33) between IES and IES+N.

Key Words: Beef Cattle, Grazing Systems, Fertilizer

82 Performance of Romosinuano Steer Calves as Winter Stockers for the Southern Great Plains. W. A. Phillips*¹, S. W. Coleman², D. G. Riley², C. C. Chase², and H.S. Mayeux¹, ¹USDA-ARS, Grazinglands Research Laboratory, El Reno, OK, ²USDA-ARS Subtropical Agricultural Research Station, Brooksville, FL.

Beef calves must be genetically equipped to withstand the climatic conditions of the coastal region of the Southern US to be productive. However, after weaning they may be transported to more temperate regions for growth and finishing. The objective of this experiment was to determine the performance of a new tropical breed reared in a tropical environment but grown in a temperate environment. In the fall of 2001, approximately 21 d after weaning, Romosinuano (n = 36) and Angus (n = 18) steers born and reared at Brooksville, FL were transported 2,025 km to El Reno, OK. Twenty-eight days after arrival, calves were blocked by breed and randomly assigned to graze one of three winter wheat pastures. One-third of the Angus and one third of the Romosinuano calves within each pasture were weighed after 10, 20, or 30 d of grazing to determine the rate of gain at 10-d intervals when exposed to winter wheat pasture for the first time. All weights were taken at approximately 1000 without fasting. Initial BW at the beginning of the 30-d grazing period were similar (P = 0.65) between the two breeds (Angus = 212 kg and Romosinuano = 208 kg). Angus calves tended (P = 0.15) to gain weight more rapidly than Romosinuano calves, but the impact of the sudden shift to a diet of winter wheat forage was similar between the two breeds. During the first 10 d of grazing, calves lost 7.4 kg of BW. By d 20, the calves had recovered most the weight lost and had BW similar to those observed on d 0. After 30 d of grazing winter wheat, Angus calves had gained 10.5 kg and Romosinuano calves had gained 5.2 kg. Romosinuano calves gained weight at a slower rate than Angus calves reared in a subtropical environment, but the capacity to adapt to the unique chemical and physical characteristics of winter wheat pasture were similar between Angus and Romosinuano calves.

Key Words: Stocker Calves, Adaptation, Wheat Pasture

83 Comparison of Respiration Rate, Body Temperatures, and Temperament in Temperate and Tropically Adapted Beef Steers. R. J. Hollenbeck^{*1}, S. T. Willard², T. H. Welsh¹, and R. D. Randel³, ¹Texas Agricultural Experiment Station, College Station, ²Mississippi State University, Starkville, ³Texas Agricultural Experiment Station, Overton.

In order to measure variation in thermoregulation and temperament, 46 yearling steers [Angus (A), n=8; Brahman (B), n=10; Bonsmara (BM), n=10; Bonsmara x Angus (BA), n=9; Braunveigh crossbred (BV), n=9] maintained on ryegrass overseeded on Coastal bermudagrass were used. Average ambient temperature was 24.06 ± 0.13 C, with relative humidity of 41.96 ± 0.57 % and temperature-humidity index value of 69.68 ± 0.12. Respiration rates, rectal temperatures, digital infrared thermography imaging (DITI) data, and temperament (TPT) scores were obtained as the steers came through a squeeze chute. DITI techniques detected differences in dorsal heat between A (37.6 ± 0.4C) and BM (36.4 ± 0.4C, P < 0.05), with intermediate values for B (37.2 ± 0.3C), BV (36.8 ± 0.7C), and BA (36.7 ± 0.4C). DITI of each animal's right side found A (36.5 ± 0.4C) to be warmer than B (35.9 ± 0.3C, P > 0.10), BA (35.5 ± 0.4C, P < 0.05), BM (35 ± 0.4C, P < 0.05), and BV steers (34.9 ± 0.5C, P < 0.05). DITI of the dorsal surface and right side were positively correlated with respiration rate (r = 0.48, P < 0.0006; r = 0.44, P < 0.002). Respiration rate differed among breeds, with A taking 71.2 ± 4.5 breaths per min (BPM), compared to 56.6 ± 4 for BM and 56.3 ± 4.3 for BV (P < 0.02), 48 ± 4.3 for BA (P < 0.0006), and 38.1 ± 4 for B (P < 0.0001). Rectal temperature (RT) was highest in BV (39.76 ± 0.13C) and A (39.72 ± 0.13C), compared with B (39.62 ± 0.12C), BA (39.1 ± 0.13C, P < 0.004), and BM (38.96 ± 0.12C, P < 0.0003). RT was correlated with TPT (r = 0.56, P < 0.0001) and escape velocity (EV) from the chute (r = 0.58, P < 0.0001). BM were more docile than BV (P < 0.01), A (P < 0.004), or B (P < 0.001). TPT was positively correlated with EV (r = 0.43, P < 0.003). EV differed among breeds: B = 2.21 ± 0.23 m/s; BV = 2.19 ± 0.24 m/s, P > 0.10; A = 1.68 ± 0.26 m/s, P > 0.10; BA = 1.24 ± 0.26 m/s, P < 0.0006; and BM = 1.18 ± 0.24 m/s, P < 0.0003. Breed and color influenced thermoregulation, which was in turn influenced by TPT and EV.

Key Words: Temperament, Thermoregulation, Infrared Thermography

84 Comparison of Adrenal Steroid Secretion and Plasma Metabolites in Temperate and Tropically Adapted Beef Steers. R. J. Hollenbeck^{*1}, S. T. Willard², R. D. Randel³, and T. H. Welsh¹, ¹Texas Agricultural Experiment Station, College Station, TX, ²Mississippi State University, Starkville, MS, ³Texas Agricultural Experiment Station, Overton, TX.

Variation in adrenal function, electrolyte balance, and metabolites was studied in 46 yearling steers [Angus (A), n=8; Brahman (B), n=10; Bonsmara (BM), n=10; Bonsmara x Angus (BA), n=9; Braunveigh crossbred (BV), n=9] maintained on ryegrass overseeded on Coastal bermudagrass. Average ambient temperature was 24.06 ± 0.13C, with relative humidity of 41.96 ± 0.57% and temperature-humidity index value of 69.68 ± 0.12. Blood samples were obtained by venipuncture. Plasma concentrations of cortisol (CS) and aldosterone (ALD) were determined by RIA. Electrolytes (Na⁺, K⁺, Cl⁻), plasma urea (PU), glucose (Glu), and cholesterol (Chol) were determined. B had the highest Glu (114.8 ± 6.5 mg/dL) compared to BV (93 ± 6.8 mg/dL, P < 0.02), BA (87.1 ± 6.8 mg/dL, P < 0.005), A (85.9 ± 7.2 mg/dL, P < 0.004), and BM (76.1 ± 6.5 mg/dL, P < 0.0001). B had the highest PU (24.42 ± 1.1 mg/dL) compared to BV (21.5 ± 1.2, P < 0.08), BM (21.3 ± 1.1 mg/dL, P < 0.05), BA (20.6 ± 1.2 mg/dL, P < 0.02), and A (18.1 ± 1.3 mg/dL, P < 0.0005). PU was correlated positively to Glu (r = 0.25, P < 0.08) and negatively to Cl⁻ (r = -0.35, P < 0.01). Temperate breed types A (78.5 ± 5.1 mg/dL) and BV (77.2 ± 4.8 mg/dL) had lower Chol than BA (85.7 ± 4.8 mg/dL, P < 0.004) or tropically adapted B (105.3 ± 4.5 mg/dL, P < 0.0003) or BM (105.5 ± 4.5 mg/dL, P < 0.0003). CS did not differ by breed. Na⁺ was lower in B (138.7 ± 1.1 mg/dL) than BM (141.7 ± 1.0 mg/dL, P < 0.04), BA (142.3 ± 1.1 mg/dL, P < 0.01), and BV (143.3 ± 1.1 mg/dL, P < 0.003); Na⁺ was correlated negatively with PU (r = -0.26, P < 0.07) and positively with Cl⁻ (r = 0.85, P < 0.0001). Cl⁻ was lower in B (98.2 ± 0.9 mg/dL), A (100.9 ± 1 mg/dL, P < 0.05), and BV (101 ± 1 mg/dL, P < 0.04). ALD was lower in B (82.4 ± 19.5 ng/mL) than BM (150 ± 19.5 ng/mL, P < 0.01) or A (161.6 ± 27.5, P < 0.02); ALD was correlated positively to K⁺ in BV (r = 0.66, P < 0.05), B (r = 0.43, P < 0.2), BM (r = 0.33, P < 0.3), and BA (r = 0.21, P < 0.5), and negatively in

A (r = -0.38, P < 0.5). Coat color and breed type influence electrolyte balance, aldosterone secretion, and metabolites.

Key Words: Aldosterone, Cortisol, Electrolytes

85 Influence of Steroid Implantation and Supplementation on Performance and Lactate Dehydrogenase Activity in Steers Grazing Bermudagrass. M. L. Looper^{*1}, G. E. Aiken¹, J. A. May², and C. F. Rosenkrans, Jr.², ¹USDA-Agricultural Research Service, Dale Bumpers Small Farms Research Center, Booneville, AR, ²University of Arkansas, Fayetteville.

Forty-five steers (BW = 246 ± 5.4 kg) were randomly allocated to one of three paddocks of bermudagrass [*Cynodon dactylon* (L.) Pers] to determine the effects of timing of steroid implantation and supplementation on average daily gain and lactate dehydrogenase (LDH) activity. Steers received either no supplementation or 1.4 kg/d per steer of a corn-soybean meal supplement. Steers were assigned to either no implant, one implant at d 0 and one implant at d 56 (EI), or one implant at d 56 (LI). Steers were weighed at the initiation and termination of the trial to determine weight gain and average daily gain (ADG). Blood samples were collected on d 0, 62, and 108 and LDH activity was quantified. Ultrasonography of steers was performed to determine rump fat (RF) and backfat (BF). Supplementation of steers increased (P < 0.0001) overall weight gain and ADG during 108 d of grazing (0.57 ± 0.04 vs 0.93 ± 0.05 kg/d for non-supplemented and supplemented steers, respectively). Steroid implants tended (P = 0.13) to increase overall weight gain and ADG. Implanted steers (EI and LI) had increased (P < 0.06) overall weight gain and ADG compared with non-implanted steers. Weight gain and ADG were similar (P > 0.10) between implant strategies (EI and LI). Backfat was increased (P < 0.05) in LI steers compared with EI and control steers. Both BF and RF were greatest (P < 0.05) in supplemented steers. Supplementation increased (P < 0.0001) serum protein (99.5 ± 2.6 and 117.5 ± 3.8 mg/mL for non-supplemented and supplemented steers, respectively). There was an implant x supplementation interaction (P < 0.05) for LDHR (lactate as the substrate) and LDHF (pyruvate as the substrate). The LDHR activity was decreased (P < 0.05) in non-supplemented EI steers compared with LI steers with or without supplementation, but was similar (P > 0.10) to control steers with or without supplementation. Likewise, non-supplemented EI steers had decreased (P < 0.05) LDHF compared with control and LI steers with or without supplementation. The ratio of LDHF to LDHR was influenced (P < 0.05) by implantation. Altered LDH activity may be one mechanism by which supplementation and steroid implantation improve steer performance.

Key Words: Steers, Steroids, Lactate Dehydrogenase

86 Responses of Metaphylactic Treatment with Micotil on the Incidence of Bovine Respiratory Disease (BRD) in Southeastern Stocker Cattle. R. C. Vann^{*1}, T. Engelken², B. J. Boyd¹, H. L. Evans¹, and D. McClary³, ¹Brown Loam Branch Experiment Station, Raymond, MS, ²CVM Mississippi State University, Mississippi State, MS, ³Elanco Animal Health, Greenfield, IN.

The objectives of this study were twofold: 1) to determine the effect of metaphylactic treatment with MicotilTM on bovine respiratory disease (BRD) morbidity and mortality compared to the non-medicated control steers; and 2) to monitor feed intake and body weight to determine if a reduction in the incidence of BRD affects the performance of calves during a 45-d pre-conditioning phase prior to grazing. Feeder calves (n = 239) ranging in weight from 179 to 238 kg from Southeastern US origin were assigned to a MicotilTM treatment (n = 120) group or a non-medicated control (n = 119) group. The two treatment groups were evenly distributed among twelve pre-conditioning pens (n = 20 calves per pen). Upon arrival calves were weighed, body temperature recorded, vaccinated, castrated, and administered treatment therapy. Calves were revaccinated at d 10 after processing and body weight was recorded on d 28 and 45. Calves were monitored daily for signs of clinical illness and treated according to post-processing BRD therapy guidelines. Following daily treatments, steers were returned to their original pen. At the completion of the 45-d pre-conditioning period, all steers were weighed, branded, and removed from pen assignments and allowed to graze ryegrass pasture for 107 d prior to shipment to the feedlot. Weight gain and mortality during the grazing period (107 d) were recorded. During the pre-conditioning period, the overall pull rate was greater (P <

0.05) in the non-medicated control group compared to the Micotil™ treated group (88.1 and 70.0%, respectively). The Micotil™ treated group was slightly heavier and had greater total gain and greater average daily gains ($P < 0.05$) compared to the non-medicated control group during the pre-conditioning phase. However, there were no differences between the two treatment groups in average body weight, average total gain, or average daily gain during the grazing period. Metaphylactic treatment with Micotil™ upon arrival decreased the overall pull rate of calves exhibiting signs of BRD compared to non-medicated controls in Southeastern origin stocker calves during the pre-conditioning period.

Key Words: Metaphylaxis, Stocker, Bovine Respiratory Disease

87 Incidence of Fecal Shedding of *Escherichia Coli* and *Salmonella spp.* in Beef Cattle Grazing Endophyte-Infected and Non-Infected Tall Fescue. M. L. Looper*¹, G. E. Aiken¹, T. S. Edrington², C. F. Rosenkrans, Jr.³, and R.O. Elder², ¹USDA-Agricultural Research Service, Dale Bumpers Small Farms Research Center, Booneville, AR, ²USDA-Agricultural Research Service, Southern Plains Ag. Research Center, College Station, TX, ³University of Arkansas, Fayetteville.

Fecal samples were obtained in replicate from mature Angus x Hereford cows ($n = 49$) and spring-born calves ($n = 45$) to determine: 1) influence of grazing endophyte-infected (E+) tall fescue (*Festuca arundinacea*) or non-infected (E-) tall fescue during the summer on shedding of *Escherichia coli* O157:H7 (EHEC) and *Salmonella spp.* (SM), 2) relationship of shedding EHEC and SM between cow and calf, and 3) influence of calf sex and steroid implant on bacteria shedding. Fecal samples were collected at 0700 on each collection date (August 5 and 26), placed on ice, and shipped to our laboratory for microbiological analyses. One-half of the calves were treated with a steroid implant at 60 d prior to fecal collection. Body temperature was measured from cattle at time of fecal collection. Mean ambient temperature and humidity at time of collection were 27.0°C and 77%, respectively. There was an endophyte x age interaction ($P < 0.0001$) for body temperature with 40.9, 40.2, 40.0, and 39.9°C (pooled SE = 0.1) for E- calves, E+ calves, E+ cows, and E- cows, respectively. Overall, incidence of EHEC shedding averaged 8.4 and 7.6% for calves and cows, respectively. *Salmonella spp.* shedding was 4.8 and 0% for calves and cows, respectively. Cows grazing E+ fescue shed less ($P < 0.05$) EHEC than cows grazing E- (1.8% vs 17% for E+ and E- cows, respectively). Likewise, EHEC shedding tended ($P = 0.11$) to be reduced in E+ calves (4.3%) compared with E- calves (13.9%). In calves, type of fescue grazed (E+ or E-) did not influence ($P > 0.10$) the incidence of SM shedding. Cow shedding of either EHEC or SM did not influence ($P > 0.10$) calf shedding of bacteria. Cow and

calf body temperature did not influence ($P > 0.10$) shedding of EHEC or SM. Shedding of EHEC and SM in calves was not influenced ($P > 0.10$) by sex of calf or implant status. Body temperature of cattle grazing tall fescue in the summer did not affect shedding incidence of either *E. coli* O157:H7 or *Salmonella spp.* In this study, mature cows grazing either E+ or E- tall fescue did not shed *Salmonella*. Shedding of *E. coli* O157:H7 tended to be reduced in calves and was decreased in cows grazing endophyte-infected tall fescue.

Key Words: Beef Cattle, Tall Fescue, *Escherichia Coli*

88 Effects of Serum Cu and Se Levels on Antibody Titers of Stocker Calves Exposed to *Leptospiriosos Pomona* Vaccine. H. L. Richardson*, B. C. Housewright, and D. B. Crenshaw, Texas A&M University-Commerce, Commerce, TX.

The trace mineral status of calves may be related to immune system responses to a vaccine challenge. The objective of this study was to investigate the immune response of stocker calves to inoculation of *Leptospiriosos pomona* vaccine in relation to their initial serum Cu and Se levels. For the immune challenge, *Leptospiriosos pomona* was used as a pathogen that steers should not have had previous exposure to, and after inoculation steers could be placed into a communal pasture without cross-contamination. A total of 49 stocker calves at two locations, weighing between 204 and 272 kg, were injected with *Leptospiriosos pomona* vaccine to determine the effects of basal serum Cu and Se levels on antibody titers. Blood samples were taken via jugular venipuncture and collected into vacuum tubes. After blood was drawn, they were inoculated intramuscularly with a 2-mL dose of a *Leptospiriosos* vaccine (Lepto-5; Merial Incorporated, Athens, GA). Blood samples were allowed to coagulate and were centrifuged for harvesting of serum. Serum was analyzed for Cu by atomic absorption spectrophotometry and Se by atomic absorption spectrophotometry-hydride generation. Twenty-eight days post-inoculation serum samples were analyzed for antibody titer to the vaccine. Microscopic agglutination test was used to determine antibody titers for *Leptospiriosos*. Data were analyzed using ANOVA in a randomized block design. There was a difference ($P < 0.05$) in titer between locations. There were no correlations between initial blood levels of Cu or Se and strength of titer to the Lepto-5 vaccine challenge. Calves used in this study had a minimum serum Se level of 20 ppb and maximum serum Se of 134 ppb, with a mean of 27.6 ± 4.0 ppb. Additionally, minimum and maximum serum Cu levels were 0.20 and 0.96 ppm, with a mean of 0.67 ± 0.02 ppm.

Key Words: Copper, Selenium, *Leptospiriosos Pomona*

Small Ruminant Production

89 Gastrointestinal parasitism in pasture and pen-reared lambs of three hair sheep breeds in the southeastern U.S. S. Wildeus*¹, J. E. Miller², and J. R. Collins¹, ¹Virginia State University, Petersburg, VA, ²Louisiana State University, Baton Rouge, LA.

December-born lambs representing the Barbados Blackbelly, Katahdin, and St. Croix hair sheep breeds (6 ewes and 6 wethers each/breed) were allocated to the experiment in May. Lambs were allocated equally to either a pasture or pen feeding group stratified by breed and sex. Pasture animals were maintained as one group on a native, fescue-based sward (1.5 ha), subdivided into 3 units for rotational grazing. Pen animals were allocated equally to 6 pens and fed chopped alfalfa hay *ad lib*. Both groups were supplemented with a corn/soybean mixture at 0.75% of BW. All animals were dewormed (moxystectin) two weeks after the onset of the trial, but were not re-treated for the remainder of the experiment. Fecal egg counts (FEC) and packed cell volume (PCV) were recorded in 14-d intervals throughout the trial. At the end of the grazing season (168 d on trial) animals were slaughtered and intestinal tracts recovered and processed for the determination of total worm burden. FEC and worm counts were analyzed after log conversion to determine effects of breed, treatment (pen vs. pasture), and sex. FECs were higher in Barbados Blackbelly on pasture than any other breed by treatment combination (478 vs. 136 eggs/g; interaction $P < .05$). PCV was higher ($P < .01$) in Barbados Blackbelly (33.9%) than the other two breeds (31.6%) and higher ($P < .01$) in pen (34.5%) than on pasture (30.4%). Abomasal counts of *Haemonchus contortus* tended to

be lower ($P < .1$) in St. Croix (115) than Barbados Blackbelly (451) and Katahdin (316), but were not different between pasture and pen. Worm counts in the small intestine were higher ($P < .01$) in pasture (413) than pen (154), and tended to be lower ($P < .05$) in Barbados Blackbelly (139) and St. Croix (144), than in Katahdin (568). St. Croix appeared to have a lower overall parasite load than the other breeds and no animal showed clinical signs of parasitism during the experiment.

Key Words: Hair Sheep, Parasites, Pasture

90 Direct effects of condensed tannins on gastrointestinal nematodes in grazing Angora goats. B.R. Min*, D. Miller, S.P. Hart, G. Tomita, E. Loetz, and T. Sahlu, *E. Kika (de la Garza Institute for Goat Research, Langston University, Langston, OK.*

The objective of this study was to evaluate effects of condensed tannin-containing forage, Serica lespedeza (SL; 5.2% condensed tannins (CT)) on fecal egg count (FEC; eggs/g of feces), rate of larva development (RLD; larvae/10 g of feces), adult worm burden (AWB), and immune response (IMR) compared with a control forage (CF; crabgrass/tall fescue; 0.2% CT) in grazing Angora does and kids. Fifty worm-free does were randomly allocated to three treatments. One treatment (10 does; 45 ± 1.5 kg) was grazed on SL forage from April 25 to July 15, 2002 (81 d), and second treatment (20 does; 43 ± 1.4 kg) grazed CF. A third treatment (20 does; 44 ± 1.4 kg) was introduced to a sward of SL for 2 wk and then was switched to CF for 2 wk (MIX), followed by repeated

change every 2 wk. The FEC was determined every 2 wk. RLD was evaluated on d 60. To gauge levels of infective larvae on pasture, three worm-free kids (12 ± 0.98 kg) were randomly selected and introduced into each treatment as tracers. Tracers grazed for 60 d and were euthanized for determination of AWB. The IMR of does was measured by skin thickness reaction after injection of 250 μ g phytohemagglutinin (PHA). Mean FEC for SL and MIX were substantially lower ($P < 0.01$) than for CF in does (186, 428, and 1148, respectively) and kids (550, 2757, and 3600, respectively). Total fecal egg output ($3.3, 6.0, \text{ and } 26.9 \times 10^5 \text{ d}^{-1}$, respectively); based on FEC and fecal output) and RLD (242, 263, and 792, respectively) were markedly lower ($P < 0.05$) for SL and MIX than for CF. Tracers on SL and MIX had lower ($P < 0.01$) AWB than CF in the abomasum (100, 333, and 783, respectively) and AWB was lowest among treatments ($P = 0.06$) in the small intestine for SL (117, 433, and 350, respectively). Abomasal worms were dominated by *Haemonchus* (52%), but *Trichostrongylus* were predominant (71%) in the small intestine. The IMR of does was similar among treatments at 0 h. However, IMR was greater ($P < 0.01$) for SL (4.9 mm) and MIX (6.0 mm) than for CF (3.0 mm) at 12 and 24 h after injection of PHA. In conclusion, these results indicate that CT in forages can reduce contamination of pastures with infective larvae. Grazing CT forages reduced FEC, RLD, and AWB, and also appeared to enhance IMR.

Key Words: Gastrointestinal Parasites, Condensed Tannins, Angora Goats

91 Dietary organic chromium enhances insulin secretion after an oral propylenglycol challenge in goats. H. R. Vera-Avila¹, C. Valdivia-Aguilar², E. Villagomez-Amezcu¹, and E. Ramirez-Rodriguez¹, ¹INIFAP, Mexico, ²Programa Delfin, Mexico.

To determine the effect of dietary organic chromium on plasma glucose and insulin after a propylenglycol challenge (PGO), 28 adult female Criollo goats (29.0 ± 1.4 kg & 2.8 ± 1.5 BCS) were randomly assigned to one of 4 groups: Control (CR0), Consumption of 30 (CR30), 60 (CR60) or 90 (CR90) μ g/kg^{0.75}/d of chromium given as chromium methionine. Diet was calculated for 100 % of nutrient requirements with chromium methionine included in the grain fraction. Daily average chromium ingestion from chromium methionine was estimated for each group (CHI). BW was registered on d 0, 14 and 28 and ADG calculated for each 14 d period (ADG14 & ADG28). At 29 d on treatment 5 animals/group were subjected after 18 h of food withdrawal to an oral PGO challenge (2.5 ml/kg^{0.75}) and blood samples were collected on EDTA tubes every 10 min from -10 to 90 min. Plasma glucose (PG) and insulin (PI) were determined by standard enzymatic or RIA procedures. Data were analyzed by ANOVA for a completely randomized or repeated measures design with treatment (TR) and time of sampling (TS) as factors. CHI for CR30, CR60 and CR90 were 29.8 ± 3.1 , 60.4 ± 6.5 & 90.3 ± 8.1 μ g/kg^{0.75}. TR did not affect ADG28 ($P \geq .05$) but ADG14 tended ($P = .12$) to differ between CR90 animals and animals in the other experimental groups (-0.06, -0.07, -0.08 & -0.02 ± 0.02 kg/d in CR0, CR30, CR60 & CR90, respectively). No TR or TR \times TS effects ($P \geq .05$) were observed on PG but TS influenced ($P \leq .001$) this variable with a steady increase over time in all treatment groups ($+10.5 \pm 1.7$ mg/dl at 90 min after PGO). A TR \times TS effect ($P \leq .05$) was detected for PI with a biphasic small response after PGO in CR0 ($+0.61$ & $+0.72$ μ UI/dl with respect to time 0) as compared to the greater response in chromium methionine treated animals ($+2.7$, $+1.89$ & $+3.15$ μ UI/dl with respect to time 0 in CR30, CR60 & CR90). These results suggest that an enhanced sensitivity to stimuli that promote insulin secretion might represent a response after organic chromium supplementation in goats, thus the combined use of organic chromium and stimuli for endogenous insulin secretion may be advantageous in this species when insulin-mediated effects are pursued.

Key Words: Goats, Organic Chromium, Insulin Secretion

92 Effect of high dietary Cu on growth performance, rumen fermentation and immune response in goat kids. T.J. Craig, Jr.*¹, S.G. Solaiman, G. Reddy, and C.E. Hopkins, Tuskegee University.

An experiment was conducted to determine the effect of high dietary Cu on growth performance, rumen fermentation and immune response in goats. Fifteen Spanish \times Boer goat kids (BW 21.3 ± 0.7 kg) were randomly assigned to three treatments: 1) control (no supplemental Cu), 2) 100 mg Cu/d and 3) 200 mg Cu/d from Cu sulfate. Copper sulfate was placed in gelatin capsules and inserted in the esophagus via balling gun before AM feeding. Animals were fed ad libitum twice a day a

70:30 grain: hay. Body weight was recorded after 4 h withdrawals from water, for two consecutive days every 2 wk for 14 wk. Rumen samples were collected at beginning, midway and at the end of the experiment via stomach tube. Blood samples were collected in heparinized, non-heparinized and EDTA vacutainers via jugular vein. The cell-mediated immune response was measured by lymphocyte proliferation assay using T cell mitogens, concanavalin A (conA) and phytohemagglutinin A (PHA). On days 50 and 64, goats were injected with chicken ovalbumin (2mg/head) in Freund's incomplete adjuvant. ELISA was performed on serum samples from days 57, 72, and 98 to measure the antibody titers to the chicken ovalbumin. Average daily gain was improved (Q, $P = 0.05$) with 100 mg Cu intake. Protozoa count tended to decrease (L, $P = 0.08$) with higher Cu supplementation, however, acetate, propionate or butyrate (%) did not differ ($P > 0.05$). An increase (L, $P = 0.035$) in leukocytes count was observed, with higher neutrophils (Q, $P = 0.045$) and lower lymphocytes (Q, $P = 0.009$) associated with 100 mg Cu supplementation. There was no difference ($P > 0.05$) in con A-induced lymphocyte proliferation, however, PHA-induced lymphocyte proliferation was higher on day 72 (L, $P = 0.006$) in the Cu supplemented groups. Antibody titers to the chicken ovalbumin tended to be higher (L, $P = 0.08$) on day 72 and it was higher (L, $P = 0.02$) on day 98 in the Cu supplemented groups. These results indicated that Cu supplementation at 100 mg/d, improved gain and enhanced the immune response in goat kids.

Key Words: Copper, Immune Response, Goats

93 Goat meat quality characteristics as influenced by diet and postmortem aging time. K. M. Gadiyaram*¹, S. Galipalli¹, G. Kannan¹, A. Carmichael¹, B. Kouakou¹, T. D. Pringle², K. W. McMillin³, S. Gelaye¹, and T. H. Terrill¹, ¹Fort Valley State University, Fort Valley, GA, ²The University of Georgia, Athens, GA, ³Louisiana State University, Baton Rouge, LA.

There are no data available on the time course of postmortem muscle pH and temperature decline, and meat tenderization in goats. Thus, the objective of this study was to determine the effects of different dietary treatments and postmortem aging times on meat quality characteristics in goats. Twenty castrated dairy goats (BW = 30.7 ± 6.80 kg, age 10 mo) were subjected to one of 4 dietary treatments for 82 d (Treatment): (i) low energy low protein (LELP, 2.5 Mcal/kg DM DE and 12 % CP), (ii) low energy high protein (LEHP, 2.5 Mcal/kg DM DE and 18 % CP), (iii) high energy low protein (HELP, 2.9 Mcal/kg DM DE and 12 % CP), or (iv) high energy high protein (HEHP, 2.9 Mcal/kg DM DE and 18 % CP). Animals were sacrificed at the end of the feeding trial and the *Longissimus dorsi* muscles were used to assess goat meat (chevon) quality characteristics. Muscle pH and temperature were measured at 0, 3, 6, 9, 12, 15, 18, and 24 h postmortem (Time). Data were analyzed using Repeated Measures Analysis with polynomial statement in SAS. Time affected both muscle pH and temperature decline ($P < 0.01$) although there was no effect of Treatment or Treatment \times Time. Average muscle pH decreased gradually from 6.76 ± 0.053 at 15 min postmortem (0 h) to 5.58 ± 0.098 at 24 h postmortem. In contrast, muscle temperature declined rapidly and reached 14.5 ± 2.00 C at 3 h postmortem, while the pH was still high (6.60 ± 0.087). Temperature and pH decline followed cubic ($P < 0.01$) and linear ($P < 0.01$) trends, respectively. Sarcomere length, total collagen, and heated calpastatin measured at 24 h postmortem were not influenced by treatment. Warner-Bratzler shear force values, collagen solubility, and cooking losses of loin/rib chops (2.5 cm thick) aged for 1, 3, or 6 d postmortem were not influenced by Treatment or aging time. Changes in energy and protein levels in the diet did not influence meat quality characteristics in dairy goats, and chevon tenderness did not improve significantly due to postmortem aging. Rapid heat dissipation from goat carcasses during chilling may predispose the muscles to cold shortening, resulting in meat that may not respond to aging.

Key Words: Chevon, Diet, Meat Quality

94 Indicators of gastrointestinal parasitism after an experimental *Haemonchus contortus* infection in young goats receiving dietary Quebracho tannin. S. Wildeus*¹, A. M. Zajac², K. E. Turner³, and J. R. Collins¹, ¹Virginia State University, Petersburg, VA, ²Virginia Tech, Blacksburg, VA, ³Appalachian Farming Systems Research Center, Beaver, WV.

With an increase in resistance of trichostrongylid parasites to commercial anthelmintics, the search for alternative means of parasite control in small ruminants has intensified. Condensed tannins in certain legumes and browse plants have been associated with anthelmintic activity in different studies. Quebracho is a commercial source of condensed tannins, and this experiment evaluated the use of Quebracho to control an experimental infection of *Haemonchus contortus* in goats. Crossbred doe kids (n=32, 6 mo of age) were paired by BW and allocated to 16 indoor, cement floor pens (3 x 4 m), dewormed (leavamisole; 11.8 mg/kg BW), and offered *ad lib* a basal diet of chopped alfalfa hay (12.4% CP, 59.3% NDF, 46.1% ADF), and a corn, soybean and dried molasses supplement (16% CP) at .5% BW. After an initial 5-d adaptation period, the supplement in 8 of the 16 pens was replaced with a modified Quebracho supplement (QT) providing 2.5% condensed tannin of total dry matter intake (d 0). On d 14, half of the pens in each dietary treatment received an oral dose of 10,000 *H. contortus* third stage larvae (HC). Fecal egg counts (FEC) and packed blood cell volume (PCV) were determined at 7 d intervals for another 56 d. Data were analyzed for effects of QT and HC on FEC (after log conversion) and PCV. FEC increased in HC animals and was higher (P<.05) than non-HC on d 63 (1594 vs. 209 eggs/g) and d 70 (1622 vs. 289 eggs/g). However, there was no effect of QT on FEC. PCV decreased in HC animals and was lower (P<.05) than in non-HC starting on d 35 (27.8 vs. 31.7%) and remained lower until the end of sampling. Again there was no effect of QT on PCV. Results suggest that dietary QT provided at level 2.5% of DM intake was not effective in reducing the impact of an experimental *H. contortus* infections, but higher levels of QT in the diet need to be investigated.

Key Words: Goats, Parasites, Tannins

95 Effect of Tasco seaweed extract supplementation on plasma cortisol and antioxidant enzyme activities in goats subjected to transportation stress. S. Galipalli*¹, G. Kannan¹, K. E. Saker², T. H. Terrill¹, B. Kouakou¹, S. Gelaye¹, and K. M. Gadiyaram¹, ¹Fort Valley State University, Fort Valley, GA, ²Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA.

Tasco, an *Ascophyllum nodosum* seaweed containing product, can increase antioxidant activity in various species, but its effect on goats has not been adequately examined. Mature female Spanish (S) and Boer x Spanish (BS) goats (BW=39 kg, n=20/ breed) were housed in pens (5 does/pen). Goats were fed alfalfa pellets plus a supplement at 2% of daily intake either with or without Tasco seaweed extract (Treatment) for three weeks. Animals were transported 6 h to impose stress, and then held overnight without feed to simulate preslaughter conditions. Blood samples were collected at 0, 2, and 6 h transportation, and after holding (Time) to assess cortisol, phagocytosis, antioxidant, and peroxidation status. Data were analyzed using Repeated Measures Analysis in SAS. Plasma cortisol increased due to transportation but decreased after holding (P < 0.01), although concentrations were not influenced by Treatment. Treatment did not influence neutrophil (N), lymphocyte (L), and monocyte counts and N/L ratio, but decreased eosinophil counts (P < 0.05). Lipid peroxidation (LPO) decreased rapidly after beginning of transportation and remained at a lower level during holding in the treated group. In the control group, LPO did not change during transportation and holding. There was a Treatment x Breed interaction such that the reduction in superoxide dismutase (SOD) caused by Tasco was greater in the BS goats than the S goats. Red blood cell glutathione peroxidase (RBC GPx) and white blood cell glutathione peroxidase (WBC GPx) activities were higher in treated than control animals (P < 0.05). Mean RBC GPx activities increased during the first 2 h of transportation and during holding. However, mean WBC GPx activities increased during the first 2 h of transport, but decreased thereafter (P < 0.05). Phagocytosis was greatest at 2 h compared to other sampling times (P < 0.01). Tasco seaweed extract supplementation may help goats by increasing antioxidant status, particularly after onset of stress, with possible beneficial effects on immune function.

Key Words: Goats, Stress, Antioxidant Activity

96 Validation of a goat simulation model using performance test information for young fast growing meat bucks. M. Villaquiran*¹, T. A. Gipson¹, and H. D. Blackburn², ¹E (Kika) de la Garza Institute for Goat Research, Langston University, OK, ²USDA/ARS/NPA/NSSL/NAGP, Fort Collins, CO.

As part of a regional project, a computer simulation model for goat production is being updated. However, the model was developed before the recent interest in meat goat production. The objective of this study was to test the simulation model to determine if its biological assumptions and equations are representative of a young fast growing meat goat, typified by the Boer breed. Validation data were from 180 young Boer bucks enrolled in the Langston University Meat Buck Performance Test. Numbers of bucks enrolled in the test per year were 47, 33, 50, and 50, respectively, for years 1999 through 2002. Components of the simulation model tested were BW and feed intake (air-dry) for 15-d periods. Prior to 165 d of age, simulated BW was intermediate to actual mean BW; however, later the simulation model slightly overestimated BW, with an average difference of 1.0 kg at 180 d and 2.4 kg at 195 d., Table 1. Prior to 180 d of age, simulated cumulative feed intake was intermediate to actual means, although later predicted values were greater than observed. Average overestimation at 180 d was 5.2 kg, Table 2. In summary, the existing simulation model produced accurate estimates of BW and feed intake of young fast growing meat goats; however modifications may be required to improve prediction with age greater than 180 d. Table 1. Simulated and actual mean BW (kg), Table 2. Simulated and actual cumulative feed intake (kg).

Table 1.

Age (d)	Simulation	1999	2000	2001	2002
120	30.5	31.76.7	31.56.2	28.87.6	29.66.4
135	34.0	34.26.8	34.66.3	32.98.6	33.57.3
150	37.8	37.56.9	38.06.4	37.69.2	37.87.9
165	42.1	42.37.5	42.66.0	40.89.0	41.37.9
180	46.0	44.67.3	45.37.0	44.78.9	45.48.3
195	51.0		48.56.9	49.28.9	48.08.0

Table 2.

Age (d)	Simulation	1999	2000	2001	2002
120	18.75	20.70.18	19.30.18	17.40.14	18.60.20
135	41.25	42.40.30	42.50.28	39.40.25	41.90.33
150	68.25	67.60.38	66.10.40	65.80.33	69.80.46
165	98.25	95.20.40	93.70.41	92.30.38	99.60.58
180	129.75		121.60.52	123.20.49	128.90.81

Means +/- Standard Deviations

Key Words: Simulation Models, Goat, Growth

97 Growth of Yearling Meat Goat Doelings with Changing Plane of Nutrition. R. Joemat^{1,2}, A. L. Goetsch*¹, G. W. Horn², T. Sahu¹, R. Puchala¹, B. R. Min¹, J. Luo¹, and M. Smuts³, ¹E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK, ²Animal Science Department, Oklahoma State University, Stillwater, OK, ³Animal Nutrition and Products Institute, Agriculture Research Council, Irene, South Africa.

Yearling meat goat doelings, 25 Boer x Spanish (BS) and 25 Spanish (S) (27 and 21 kg initial BW, respectively; SE = 0.6), were used in a 16-wk experiment to determine effects on growth of length of nutrient restriction and level of supplementation during realimentation. Doelings consumed prairie hay (6.2% CP, 70% NDF, and 9.1% ADL) *ad libitum* and received daily supplementation with 0.75% BW of concentrate (30% CP; C treatment), sequential 28-day periods of no supplementation and daily supplementation with 1.50 or 0.75% of concentrate (H-28 and L-28, respectively), or 56 days without supplementation followed by supplementation for 56 days with 1.50 or 0.75% of concentrate (H-56 and L-56, respectively). Ruminal ammonia N concentrations were below 6 mg/dL when concentrate was not supplemented. Body weight of S doelings was similar among dietary treatments throughout the experiment (d 28: 24.1, 24.1, 24.2, 24.6, and 23.8 kg, SE = 0.57; d 56: 24.2, 24.4, 24.0, 23.3, and 22.7 kg, SE = 0.67; d 84: 24.9, 25.3, 24.8, 25.1, and 24.6 kg, SE = 0.79; d 112: 25.2, 25.9, 26.3, 26.9, and 26.4 kg, SE = 0.81, for C, H-28, L-28, H-56, and L-56, respectively). Body weight of BS doelings also was similar among treatments on d 28 (26.2, 24.8, 23.8, 25.0, and 23.9 kg, SE = 0.57), but was greater (P < 0.05) for C vs L-28, H-56, and L-56 on d 56 (26.8, 25.7, 24.9, 23.2, and 21.3 kg, SE = 0.67), greatest

among treatments ($P < 0.05$) for C on d 84 (29.4, 25.6, 25.2, 26.9, and 24.5 kg, SE = 0.79), and greater ($P < 0.05$) for C than for H-28, L-28, and L-56 on d 112 (31.3, 27.9, 27.5, 29.9, and 27.5 kg, SE = 0.81, for C, H-28, L-28, H-56, and L-56, respectively). In conclusion, maintaining an adequate plane of nutrition for steady growth and development appears more important for BS than for S yearling doelings, with the former possibly requiring longer periods of realimentation than previous nutrient restriction regardless of level of concentrate supplementation.

Key Words: Goats, Nutritional Plane, Growth

98 Prediction of Metabolizable Energy Requirements for Maintenance, Gain, and Mohair Fiber Growth by Angora Goats. J. Luo*, A. L. Goetsch, and T. Sahlu, *E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.*

A database was constructed for Angora goats to estimate energy requirements for maintenance, gain, and mohair fiber growth. Treatment mean observations were classified into preweaning, growing, mature (not lactating or pregnant), lactating, and pregnant goats; however, due to limited numbers of observations, data for preweaning, lactating, and pregnant goats were removed. Data set 1 ($n = 144$) was used to estimate ME requirements for maintenance and whole body gain using simple linear regression analysis; data set 2 ($n = 89$) was employed to estimate ME requirements for maintenance, tissue gain, and mohair fiber growth using multiple regression analysis. Variables, scaled by kg BW^{0.75}, were mean BW (kg), ME intake (MEI, kJ/d), ADG (g), ADG adjusted for grease fleece weight (adjADG, g), and clean fleece growth rate (CFGR, g/d). Because of differences between growing and mature goats in intercepts and coefficients of simple and multiple regressions of MEI ($P < 0.01$ and < 0.08 for simple and multiple regressions, respectively), separate regressions were conducted. Linear, quadratic, and cubic effects of ADG on MEI for growing goats were not significant. The simple linear regression equation for mature goats was MEI = 527 (SE = 19.7) + 42.8 (SE = 4.98) # ADG [$n = 79$; $R^2 = 0.48$]; after removing 11 observations with residuals greater than 1.5 times the residual standard deviation, the final equation was MEI = 496 (SE = 16.6) + 46.8 (SE = 4.06) # ADG [$n = 68$; $R^2 = 0.66$]. The coefficient for CFGR in the multiple regression model for growing goats was not significant ($P = 0.42$). The multiple regression equation for mature goats was MEI = 469 (SE = 52.3) + 33.6 (SE = 7.15) # adjADG + 159 (SE = 55.1) # CFGR [$n = 49$; $R^2 = 0.45$]. In conclusion, estimated ME requirements for maintenance of mature Angora goats were 469 and 496 kJ/kg BW^{0.75} and ME requirements for unadjusted and adjusted ADG and clean mohair growth were 46.8, 33.6, and 159 kJ/g, respectively. This research was supported by USDA Project Number 98-38814-6214.

Key Words: Angora Goats, Energy, Mohair

99 Use of spectral reflectance measures from hyperspectral radiometry in prediction of lamb gains on bermudagrass pastures. M. A. Brown*, P. J. Starks¹, and L. A. Appeddu², ¹USDA-ARS, Grazinglands Research Laboratory, El Reno, OK, ²Southwestern Oklahoma State University, Weatherford, OK.

Spring-born lambs ($n=47$) were used to evaluate the potential for predicting lamb growth directly from hyperspectral radiometer data taken on forage canopies in bermudagrass pastures stocked with lambs. Lambs were randomized to each of four 1.6 ha bermudagrass pastures. Lamb weights and spectral reflectance (R) were measured on June 3, June 11, June 25, July 9, July 22, and July 31. Animal growth data was estimated in five time periods: June 3 to June 11; June 11 to June 25; June 25 to July 9; July 9 to July 22; and July 22 to July 31. Spectral reflectance data were collected at 252 different wavelengths, from 368.4 nm to 1113.7 nm and converted to absorbance estimates by calculating $\log_{10}(1/R)$. Each field was sampled eight times on each date along a transect line subsectioning the field. Relationships of animal gain to 252 spectral absorbance estimates were done by pairing averages of each pasture for gain and spectral absorbance at the beginning of each week or period. Stepwise regression was then performed on the twenty observations (4 pastures x 5 weeks) to identify best multiple linear regression models that would account for the largest proportion of total variance in animal gain. A linear combination of ten spectral absorbance variables ranging from absorbance at 732.3 nm to absorbance at 1025.6 nm accounted for over 94% of the total variance in animal gains. While

further research is needed to verify these results, it appears that prediction of stocker performance from field-level hyperspectral radiometry of forage canopies may be feasible.

Key Words: Lambs, Stockers, Hyperspectral Radiometry

100 Comparison of circulating gossypol in two deer species consuming fuzzy whole or EasifloTM cottonseed. C.G. Brown*^{1,2}, D.A. Neuendorff², T.A. Strauch², A.W. Lewis², B.C. Baldwin³, M.C. Calhoun³, and R.D. Randel², ¹Tarleton State University, Stephenville, TX, ²Texas Agricultural Experiment Station, Overton, TX, ³Texas Agricultural Experiment Station, San Angelo, TX.

Whether consumption of EasifloTM cottonseed (EZF) reduces circulating gossypol compared to fuzzy whole cottonseed (WCS) was evaluated in red (*Cervus elephus*) and fallow (*Dama dama*) deer. EZF was WCS coated with a gelatinized starch solution containing iron as ferrous sulfate. The iron levels in WCS and EZF were 91 ppm and 1730 ppm, respectively. Seventeen red stags (BW=103.9kg) were allotted into three treatment groups: 1)Control (C; 3:1, corn:soybean meal, $n=5$), 2)WCS ($n=6$) or 3)EZF ($n=6$). Fourteen fallow bucks (BW= 47kg) were also allotted into three treatment groups: 1)C ($n=5$), 2)WCS ($n=4$) or 3)EZF ($n=5$). Rations were formulated to be isonitrogenous (17.1% protein) and isocaloric (TDN 90.8%). Animals grazed coastal bermudagrass and alfalfa pellets were provided with treatments. Average consumption of WCS and EZF was 1.82 and 0.91 kg/hd/d for red and fallow deer, respectively. Blood samples were taken via jugular venipuncture biweekly for 211 d. Plasma gossypol was assessed from 28 d samples via high performance liquid chromatography. Total gossypol concentration ($\mu\text{g/ml}$) was reduced ($P < 0.001$) for EZF (3.19 \pm 0.15) vs WCS (4.91 \pm 0.16) after 84 d. From d 0 to d 84, EZF and WCS had similar ($P > 0.1$) gossypol concentrations. On d 211 gossypol concentration ($\mu\text{g/ml}$) for EZF was lower ($P < 0.001$) than WCS (2.93 \pm 0.18 and 6.16 \pm 0.19, respectively). Concentrations of the (+) and (-) isomers of gossypol were lower ($P < 0.001$) in EZF compared to WCS. At d 84 (+)- and (-)-gossypol concentrations ($\mu\text{g/ml}$) were 1.45 \pm 0.06 and 1.73 \pm 0.10, respectively, for EZF vs 2.09 \pm 0.07 and 2.82 \pm 0.10, respectively for WCS. On d 211, (+)- and (-)-gossypol concentrations ($\mu\text{g/ml}$) were 1.42 \pm 0.08 and 1.60 \pm 0.09, respectively, for EZF vs 3.11 \pm 0.09 and 3.41 \pm 0.10, respectively, for WCS. EasifloTM cottonseed is capable of reducing circulating gossypol compared to fuzzy whole cottonseed after a period of time.

Key Words: Gossypol, Cottonseed, Deer

101 Winter annual grasses for meat goats. J-M. Luginbuhl*, J. P. Mueller, and A. P. Conrad, North Carolina State University, Raleigh NC.

A 3-year (YR) grazing study was conducted to evaluate the performance of replacement does and wethers (*Capra hircus hircus*) on cereal rye (CR - *Secale cereale*, var. Elbon), annual ryegrass (RG - *Lolium multiflorum*, var. Marshall) and triticale (TT - *Triticum secale*, var. SR 102). The experimental area was divided into 9 plots of 0.19 ha each in a randomized complete block design with 3 replications. Forage species were sod-drilled in fall and fertilized with ammonium nitrate (56 kg N/ha) in November and February. Each year, 54 yearling goats (full-blood, 3/4 and 1/2 Boer; initial BW: 29 kg) were placed into 6 groups of 9 animals with similar BW and randomly assigned to 1 of 9 plots. Goats were moved to a fresh strip of grass 3 to 4 times per wk and immediately back fenced. Additional goats (2 to 14 goats/plot) were used as put-and-take animals to control forage growth. Goats had free access to a mineral mix, water and movable shelters. In YR 3, blood and ruminal fluid samples were collected from wethers which were then harvested at a commercial facility. The CP values of forage samples hand-plucked periodically from experimental pastures averaged 21.5, 23.3 and 23.0% for RG, CR and TT, respectively. Forage species had no effect on ADG in YR 1, 2 or 3 (avg: 136, 151, 142 g/d, for RG, CR and TT, respectively), but wethers gained more weight than does ($P < 0.01$) in YR 2 (139 vs 94 g/d) and YR 3 (201 vs 137 g/d). Gain per ha was greater ($P < 0.05$) for RG than CR and TT (YR 1: 504, 235, 293 kg; YR 2: 288, 195, 234 kg; YR 3: 532, 251, 137 kg). The pH of ruminal fluid, ruminal ammonia and carcass yield from wethers grazing RG, CR and TT averaged 6.67, 25.7 mg/dL and 51.3%, respectively. Plasma urea N (16.4, 21.9, 24.1 mg/dL), ruminal acetate (62.0, 60.7, 57.7 mM/100mM), propionate (22.0, 25.2, 27.0 mM/100mM) and acetate:propionate (2.83, 2.43, 2.22) differed between forage species ($P < 0.05$). Results indicated that yearling goats performed well when fed only on these forages under

controlled, rotational grazing management but that RG produced the most live weight gain per hectare.

Key Words: Goat, Grazing, Performance

102 Evaluation of kudzu (*Pueraria lobata*) as a feed for goats. R. H. Davis* and R. N. Corley III, *Tuskegee University, Tuskegee AL / USA.*

A study was conducted to determine the potential of kudzu (*Pueraria lobata*) as a feed for goats. Kudzu (leaf and stem: 2:1) was harvested in Tuskegee Alabama in the fall of 2001 and 2002 and compared with coastal bermudagrass hay (CBG). Proximate analysis and measurements of NDF, ADF, Ca, K, and Mg were determined. Kudzu samples were also analyzed for amino acid profile and compared to reported values of CBG. Four non-lactating Nubian female goats fitted with permanent ruminal cannulas were used to determine the kinetics of ruminal digestion. For kudzu and CBG, respectively, values for dry matter (93.6 and 94.7%), crude protein (13.9 and 9.9%), NDF (47.0 and 71.0%), ADF (37.0 and 36.0%), Ca (1.7 and 0.3%), K (.9 and .5%), and Mg (.3 and .3%) were comparable. The amino acid profile of kudzu contained higher values than reported values for CBG. Ruminal digestion kinetics of kudzu and CBG, respectively, estimated that .36 and .30% was soluble, .41 and .37% was potentially degradable, .25 and .33% was indigestible, and that the fractional rate of digestion was 7.3 and 5.5%h⁻¹. Kudzu and CBG were similar ($P > .05$) in estimated digestibility and fractional rate of digestion, but kudzu contained a higher ($P < .05$) solubility and a lower ($P < .05$) indigestibility fraction. As a whole, chemical composition and digestibility characteristics of kudzu were comparable to CBG, which shows its potential as a feed for goats. Further study is needed to determine the effect of kudzu on ruminal fermentation and animal performance.

Key Words: Kudzu (*Pueraria lobata*), Goats, Ruminal digestion

103 Growth rates of Boer and Kiko crossbred wethers fed endophyte-infected tall fescue or orchardgrass. R. Browning, Jr.*, Y. G. Myles, M. Byars, S. H. Kebe, T. Payton, E. Lane, C. Johnson, D. A. Young, and D. Coleman, *Tennessee State University, Nashville.*

This study was conducted to begin assessing how endophyte-infected tall fescue (TF) might affect meat goat performance. A majority of Tennessee goat producers indicated in a survey that tall fescue covers the improved pastures they use to graze goats (Leite-Browning et al., 2001; *J. Anim. Sci.* 80[Suppl. 2]:27). Three-quarter Boer (n = 22) and 3/4 Kiko (n = 15) yearling wethers were fed in drylot over three periods. During the pretrial period (January-March), all goats were provided orchardgrass (OG) hay for ad libitum consumption and were fed 455 g/d of a concentrate supplement. In Trial 1 (April-June), wethers within each breed were paired by weight and evenly divided into groups receiving TF seed and OG seed diets. Seed (227 g/d) was carried in 682 g/d of the concentrate supplement. Both groups were provided OG hay for ad libitum consumption. No breed × diet interaction was detected in Trial 1. Pretrial growth rates did not differ between TF and OG-fed goats (75 vs 78 ± 7 g/d). The TF seed diet lowered ($P < 0.01$) ADG by 32% over 8 weeks compared to the OG seed diet (102 vs 150 ± 7 g/d). For Trial 2 (June-August), half of the wethers within each breed were switched between TF and OG diets. Experimental diets in Trial 2 were in the form of TF or OG hay supplemented with 227 g/d of concentrate without TF or OG seed. Growth rates during Trial 1 did not differ between TF and OG-fed goats as grouped for Trial 2 (123 vs 128 ± 9 g/d). There was no breed × diet interaction detected in Trial 2. The TF hay diet lowered ($P = 0.10$) growth rates by 33% over 8 weeks compared to the OG hay diet (40 vs 60 ± 9 g/d). Across the three observation periods, percentage Kiko wethers had higher ($P < 0.01$) growth rates compared to percentage Boer wethers (214 vs 156 ± 10 g/d). This pilot study demonstrated the potential of endophyte-infected tall fescue to significantly lower the performance of meat goat wethers.

Key Words: Meat Goat, Tall Fescue, Growth Rate

104 Comparison of carcass traits of extensively raised hair breed lambs. J. M. Burke*¹, J. K. Apple², W. J. Roberts², and C. B. Boger², ¹*USDA, Agricultural Research Service,* ²*University of Arkansas, Department of Animal Science.*

The objective was to compare live animal performance and carcass characteristics of 7/8 Dorper (DO; n = 5), 3/4 Dorper (DX; n = 25), pure-bred Katahdin (KA; n = 20) and St. Croix (SC; n = 17) lambs born in February (FEB) and October (OCT) 2001, and FEB Suffolk (SU; n = 10) lambs. After weaning, lambs were fed up to 1 kg corn/SBM while grazing bermudagrass or ryegrass. From weaning to harvest, ADG was greater for DO, DX, and SU than KA and SC lambs ($P < 0.01$). Lambs (FEB: 209 ± 1.9 d of age; OCT: DX, 201.3 ± 6.9; KA, 218.8 ± 8.7; SC, 230.4 ± 7.4 d of age or 40.3, 40.6, 35.8 ± 0.84 kg) were transported to the University of Arkansas Red Meat Abattoir for harvest. At harvest, DO, DX, KA, SC, and SU lambs weighed 40.2, 38.0, 38.4, 34.1 and 45.9 kg, respectively ($P < 0.01$). Carcass quality and cutability data were collected after a 7 d aging period at 2°C. Carcasses from SU lambs were heavier than all other breed types ($P < 0.01$); whereas, fat thickness and yield grades of DO and KA were greater than DX, SC, and SU ($P < 0.01$). Longissimus muscle (LM) areas of DO, DX, and SU were greater than that of SC ($P < 0.01$). Kidney fat weights and percentage of internal fat were greatest from SC and least from SU carcasses ($P < 0.01$), resulting in a greater cooler shrinkage in SU carcasses ($P < 0.01$). Lean maturity was similar among breed types; however, skeletal and overall maturities were greatest from SU carcasses ($P < 0.01$; $P < 0.05$). Carcasses from SC lambs had lower flank streaking scores than DX and KA, with DO and SU carcasses receiving intermediate scores ($P < 0.05$). Conformation scores for DO, DX, and SU carcasses were markedly higher ($P < 0.01$), resulting in higher ($P < 0.01$) quality grades than SC carcasses, with KA receiving intermediate scores. L* values of the LM were lighter ($P < 0.05$) in KA and SC, redder ($P < 0.01$) in DO and DX than SC and SU, and more yellow ($P < 0.01$) in DO than SC. Results from this study indicate that ADG, carcass muscularity and quality was similar among Dorper and Suffolk lambs and, although fatter, carcass muscularity of Katahdin was similar to that of 3/4 Dorper lambs.

Key Words: Hair Sheep, Growth, Carcass Traits

105 Growth and carcass traits of St. Croix White and Dorper X St. Croix White lambs in the tropics. R.W. Godfrey and A.J. Weis*, *University of the Virgin Islands, Agricultural Experiment Station, St. Croix.*

St. Croix White (STX; n = 22) and Dorper X STX (DRP; n = 18) lambs were used to evaluate the growth of lambs under tropical conditions. Three wk after weaning (63 d of age) lambs were sorted into pens based on breed and sex and fed a pelleted ration at 4% BW.hd⁻¹.d⁻¹ with access to guineagrass hay and water. Lambs were slaughtered at a BW of 30 kg. Carcass weight, fat thickness over the 12th rib, rib eye area (REA), percentage kidney-heart-pelvic (KPH) fat and leg circumference were measured. Data were analyzed by SAS procedures. Time on feed was higher ($P < 0.002$) for STX than for DRP lambs (153.2 ± 6.8 vs 118.9 ± 7.4 d, respectively). Total weight gained was greater ($P < 0.04$) for STX than for DRP lambs (16.1 ± 0.5 vs 14.6 ± 0.5 kg, respectively). Average daily gain was higher ($P < 0.01$) for DRP than for STX lambs (125.1 ± 4.7 vs 108.1 ± 4.3 g/d, respectively). Feed efficiency was greater ($P < 0.01$) for DRP lambs than for STX lambs (134.2 ± 2.0 vs 122.8 ± 2.7 g gain/kg feed, respectively). The STX lambs had a higher ($P < 0.0003$) cost of gain and a lower net value than DRP lambs (62.73 ± 1.83 and 3.28 ± 1.83 vs 52.07 ± 1.99 and 13.94 ± 1.99 \$, respectively). Cold carcass weight was not different ($P > 0.10$) between STX and DRP lambs (12.6 ± 0.2 vs 12.6 ± 0.2 kg, respectively) or between ewes and wethers (12.8 ± 0.2 vs 12.3 ± 0.2 kg, respectively). The REA of DRP lambs was greater ($P < 0.02$) than that of STX lambs (10.4 ± 0.4 vs 9.0 ± 0.4 cm², respectively). Fat thickness was not different ($P > 0.10$) between DRP and STX lambs (1.5 ± 0.2 vs 1.4 ± 0.2 mm, respectively) or ewes and wethers (1.6 ± 0.2 vs 1.3 ± 0.1 mm, respectively). Percentage KPH was higher ($P < 0.001$) in STX than in DRP lambs (3.6 ± 0.3 vs 2.2 ± 0.3 %, respectively). Leg circumference was greater ($P < 0.007$) in DRP than in STX lambs (37.3 ± 0.4 vs 35.7 ± 0.4 cm, respectively). The decreased days on feed and greater ADG, feed efficiency and net value of DRP lambs compared to STX lambs should result in lower costs and higher returns for the producer.

Key Words: Sheep, Crossbreeding, Growth

106 Postpartum ovarian activity in Pelibuey ewes consuming crystalline wheat protected from ruminal degradation. D. G. Pea-Avila¹, H. R. Vera-Avila*², E. Gonzalez-Padilla¹, G. Mendoza-Martinez³, and J. Lopez², ¹UNAM, Mexico, ²INIFAP, Mexico, ³ Colegio de Postgraduados, Mexico.

To determine the effect of increasing ruminal bypass starch on postpartum ovarian activity in Pelibuey ewes by protecting cereals from ruminal degradation, 36 lactating Pelibuey ewes (2.26±0.18 BCS) under grazing conditions were randomly assigned to receive 30 % of estimated energy requirements from d 0 to 60 pp as: 1) Wheat bran plus 15 % protected fat (WB; Control), 2) Rolled crystalline wheat treated with 5 % formaldehyde solution (14 ml/100 g DM) and mixed with 15 % protected fat (TW; Protected wheat) or 3) Rolled crystalline wheat plus 15 % protected fat (NTW; Non-protected wheat). BW was registered at d 0 and 60 pp for ewes and their lambs and ADG calculated. Blood samples were collected after 3 h of supplement consumption every 3 d from 30 to 60 d pp and serum glucose (SG) and progesterone (SP) determined. SG was used to calculate mean serum glucose concentration (MSG) and SP to estimate interval to first luteal activity (FL) and percentage of luteal activity at d 45 pp (L45). Estrous activity was also monitored to estimate interval to first estrous (FE). Treatment (TR) and litter size (LS) were considered as factors and ANOVA for a completely randomized design was applied. Fisher exact test was used to analyze L45. TR and LS did not affect ($P < .05$) MSG or ewe ADG but influenced ($P < .001$) ADG in the respective lambs (0.13, 0.18 & 0.17 ± .008 kg in WB, TW & NTW; 0.19 & 0.13 ± .007 kg in singles & twins). TR tended to influence ($P = .09$) FE with a numerically shorter interval in TW as compared to NTW and WB (70.0, 76.8 & 84.7 ± 3.2 d). FL was not affected ($P < .05$) by TR or LS but L45 was greater in TW as compared to NTW and WB (16.7, 0.0 & 0.0 %). No TR × LS effect was observed ($P < .05$) in ADG and reproductive response variables. These results suggest that consumption of starch sources protected from ruminal degradation might advance pp ovarian activity in lactating Pelibuey ewes in a manner apparently independent of their energy contribution.

Key Words: Pelibuey Ewes, Postpartum Ovarian Activity, Ruminal Bypass Starch

107 Market Price, Cost of Production, Lambing Patterns and Marketing Options in the WV Sheep Industry. D Singh*, D Smith, and M Knights, *West Virginia University, WV.*

The objective of this study was to analyze the price and lambing patterns, marketing options and cost of production environment for the WV sheep industry. Data on lamb sale transactions for WV sheep producers from 1994-2001 (WV Dept of Agriculture) were collected and analyzed. ANOVA procedures were used to determine the effects of Markets, Month and Market Lamb Class (feeder lambs: < 32, 32-39, 40-45 kgs; slaughter lambs: <39, 40-45, 46-57 kgs) on price and number of lambs sold. Twenty-two individual income and expenditure farm records each for both in-season (spring) and out-of-season (fall) sheep production systems were collected from 1999-2000 and analyzed to determine cost of production and income earning potential of both systems. Surveys of WV sheep producers conducted in 1999 and 2001, with a response rate of 73 and 37 %, were used to analyze current lambing and marketing decisions and assess alternative strategies. The average price received by producers over the 8-year period was \$1.70/kg and was affected ($P < 0.01$) by month, market and lamb class. Producers received the highest prices ($P < 0.01$) in April-June, and the lowest in August-October. The highest prices (\$1.89/kg) and the lowest prices (\$1.55-1.60/kg; $P < 0.05$) were received for lambs sold as lamb category 5 (feeder lambs: 32-39 kgs) and lamb category 3 (slaughter lambs: <39 kgs), respectively. Prices varied with markets irrespective of the number of lambs available for sale. Cost per kilogram of lamb produced were \$1.28 and \$1.12 for fall and spring lambing systems respectively. Lower mortality rates and higher market prices ($P < 0.05$) were observed for fall than for spring lambing (6% and \$2.00/kg, and 10% and \$1.65/kg, respectively). Profits per kilogram of lamb produced were higher ($P < 0.05$) for fall lambing (\$0.73) than for spring lambing (\$0.62). Producers choose to have most lambings occur between January and April (90%), to sell more lambs in September and October than any other months, and to sell lambs at weights above 41 kgs (50%). The results indicate that there is potential for obtaining higher prices by shifting lambing season, orienting

production towards months when prices are highest/supply lowest, marketing more in classes that attain higher prices and by selecting among available markets.

Key Words: Lamb, Price, Market

108 Fatty acid composition of milk and Domiati cheese from grazing Alpine goats during a whole lactation. K.A. Soryal*, S.S. Zeng, S. P. Hart, B. R. Min, and K. Tesfai, *E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.*

Forty-four lactating Alpine goats were randomly allocated to four treatments to investigate effects of grazing with different levels of concentrate supplementation on milk and cheese fatty acid composition during different stages of lactation. Group A does were confined and fed alfalfa hay supplemented with 0.66 kg of concentrate per kg of milk over 1.5 kg/d. Groups B, C, and D were rotationally grazed and received 0.66, 0.33, or 0 kg of concentrate per kg of milk over 1.5 kg/d, respectively. Milk from each group was collected twice monthly for processing of Domiati cheese during the 6-mo lactation period (April to September, 2001). Cheeses were sampled fresh and at 1 and 2 mo of pickling in whey. Milk and cheese fats were extracted and fatty acids were analyzed. Caproic acid represented 0.76 and 1.47% of milk and cheese total fatty acids, respectively. Concentration of palmitic acid was highest among fatty acids in both milk and cheese (30.22 and 30.17%, respectively). Oleic acid concentration was highest among unsaturated fatty acids of milk (85.74% of total unsaturated fatty acids in milk). Grazing without concentrate supplementation (group D) resulted in lower ($P < 0.05$) concentrations of capric and lauric acids in milk compared with group A. Concentrations of capric and lauric acids in cheese ranked ($P < 0.05$) group A > B and C > D (capric: 31.32, 27.16, 28.23, and 24.26 µg/g; lauric: 12.94, 10.95, 10.95, and 9.73 µg/g), and myristic acid concentration was greater ($P < 0.05$) for group A vs D (31.94, 31.44, 30.04, and 28.93 µg/g for group A, B, C, and D, respectively). Contents of caproic, caprilic, and palmitic acids in milk were higher ($P < 0.05$) in mid-lactation than in other stages. In cheese, contents of caprilic and lauric acids were higher in mid-lactation than in other stages while stearic acid concentration was lower ($P < 0.05$) in late than other lactation stages. In conclusion, grazing without supplemental concentrate reduced levels of some saturated fatty acids in milk and cheese, particularly capric, lauric, and myristic fatty acids, which are considered to be cholesterol-raising fatty acids in human nutrition.

Key Words: Domiati Cheese, Fatty Acid Composition, Pasture Feeding

109 Growth, intake and carcass characteristics of Boer- and Kiko-sired crossbred goat kids pen-fed a forage-based diet. S. Wildeus*¹, H. N. Zerby², K. E. Turner³, S. P. Greiner⁴, and J. R. Collins¹, ¹Virginia State University, Petersburg, VA, ²The Ohio State University, Columbus, OH, ³Appalachian Farming Systems Research Center, USDA, ARS, Beaver, WV, ⁴Virginia Tech, Blacksburg, VA.

The South African Boer (B) and New Zealand Kiko (K) goats have potential to serve as sire breeds for market kid production. This experiment evaluated the growth performance of kids sired by either B or K bucks mated to Spanish (S) and Myotonic (M) does during a March mating season. At 3.5 mo of age 24 intact male kids, equally representing the four breed combinations, were allocated to 6 pens by sire breed (3 pens/sire breed), and fed a diet of moderate quality grass hay (10.6% CP, 46.9% IVOMD, 70.4% NDF, 39.5% ADF) *ad lib* and a corn/cottonseed supplement (15.5% CP) at 2% of BW. Pen intake was measured on d 28, 84, and 154 of the trial in 5 d collection periods. At 156 d ultrasonic backfat and rib eye area measurements were made and animals were graded. Animals were slaughtered after 177 d. Data were analyzed for the effects of sire and dam breed. Forage DM intake was similar between sire breeds, but decreased ($P < .01$) from 1.77 to 1.14% BW during the trial. Starting BW tended to be higher ($P < .1$) in K- than B-sired kids (15.8 vs. 14.3 kg), but final BW (34.7 kg) and ADG (105 g/d) were not different. Final BW ($P < .05$) and ADG ($P < .01$) were higher in kids from S (36.8 kg and 117 g/d) than M does (32.5 kg and 94 g/d). Dressing percentage (sire × dam breed interaction: $P < .05$) was higher in B × S kids (48.0%) than the other breed combinations (44-45%). Backfat was greater ($P < .05$) in B (.089 cm) than K-sired kids (.045 cm), however, ribeye area (8.89 cm²) and body wall thickness (.91 cm) were not different between breeds. Ultrasonic and carcass ribeye area measurements

were correlated ($r=.68$; $P<.001$), but not backfat measurements. Live grades were higher ($P<.05$) in B- than K-sired kids. Results suggest similar growth performance between sire breeds, but increased deposition of backfat in B-sired kids.

Key Words: Meat Goats, Growth, Carcass

110 Performance, blood metabolites and visceral organ mass and composition in growing castrated dairy goats. A. Carmichael, B. Kouakou, S. Gelaye, G. Kannan, and T.H. Terrill, *Fort Valley State University, Fort Valley, GA.*

Growing castrated dairy goats ($n = 20$; $BW = 30 \pm 6.8$ kg) were used in an 82-d experiment to assess effects of protein and energy levels on performance and splanchnic tissue mass and composition. Animals were individually housed in elevated pens (1.2×1.2 M), stratified by BW and randomly assigned to 4 dietary treatments. Diets were formulated to provide either 2.5 Mcal /kg DM DE and 12% CP (low energy low protein = LELP), 2.5 Mcal /kg DM DE and 18% CP (low energy high protein = LEHP), 2.9 Mcal /kg DM DE and 12% CP (high energy low protein = HELP), or 2.9 Mcal /kg DM DE and 18% CP (high energy high protein = HEHP). The low and high energy diets contain 3 and 15% poultry fat, respectively. At the end of the experiment, single blood samples were collected by jugular venipuncture, and then animals were weighed and sacrificed. After evisceration, digestive tract segments were tied at junctions, separated, and weighed with and without digesta. Weight of liver and other organs of the abdominal and thoracic cavities were also recorded. Blood samples were analyzed for glucose, NEFA and BUN. Liver samples, intestinal and reticulo-rumen mucosa samples were analyzed for DM, protein, DNA and RNA. Data were analyzed using GLM procedure of SAS. Goats fed low energy diets consumed more feed than those fed high energy diets. Body weight gains were higher for animals fed the low than the high energy diets. Blood glucose and NEFA were similar among treatments, but BUN tended to be greater ($P = 0.08$) in high than in low energy diets-fed animals. There were no differences in organ or digestive tract segment weights. Small intestine weights (full or empty), as percent of slaughter weight, were lower for animal fed low energy (1.8 and 2.0 or 1.4 and 1.5 for LELP and LEHP full or empty, respectively) as compared to high energy (2.9 and 2.5 or 1.9 and 1.9 for HELP and HEHP full or empty, respectively) diets. Liver DNA tended ($P = 0.07$) to be lower (12.5 mg/g of fresh tissue) for LEHP than for animals fed the other diets (15, 17 and 19 mg/g of fresh tissue for LELP, HEHP and HELP, respectively). Small intestinal

mucosa DM contents were higher ($P < 0.05$) in animals fed low than high energy diets. Splanchnic tissue weights are not affected in growing goats when fed diets differing in the proportion of energy coming from poultry fat.

Key Words: Goats, Dietary Energy, Splanchnic

111 Growth and carcass characteristics in lambs from three hair sheep breeds raised on pasture and hay-based diets. S. Wildeus^{*1}, H. N. Zerby², K. E. Turner³, and J. R. Collins¹, ¹Virginia State University, Petersburg, VA, ²The Ohio State University, Columbus, OH, ³Appalachian Farming Systems Research Center, USDA, ARS, Beaver, WV.

This experiment evaluated the use of forage-based diets for hair sheep lamb production. Barbados Blackbelly (BB), Katahdin (KA), and St. Croix (SC) ewe and wether lambs ($n=36$, 100 d of age) were allocated to a pasture or pen feeding group stratified by breed and sex in May. Pasture animals were maintained as one group on a native, predominantly tall fescue pasture (1.5 ha; 12-17% CP, 66-69% NDF, 36-38% ADF), subdivided for rotational grazing. Pen animals were allocated to 6 pens stratified by breed and separated by sex, and offered *ad lib* chopped alfalfa hay (16.6% CP, 60.3% NDF, 45.2% ADF). Both groups were supplemented with a corn/soybean mixture (16.5% CP) at .75% of BW. After 168 d on trial animals were slaughtered. Data were analyzed for effects of breed, nutritional treatment, and sex. ADG was higher ($P<.05$) in pen (77 g/d) than on pasture (67 g/d), and higher ($P<.01$) in KA (84 g/d) and SC (75 g/d) than BB (56 g/d). Starting and final BW were higher ($P<.01$) in KA (31.4 and 45.5 kg, respectively) than SC (22.5 and 31.4 kg) and BB (24.5 and 31.0 kg). Dressing percent (overall 48.0%) was not affected ($P>.1$) by breed or treatment. Backfat was higher ($P<.05$) in pen (.45 cm) than pasture (.27 cm), and higher ($P<.05$) in KA (.50 cm) than BB (.23 cm) and SC (.36 cm). Ribeye area was larger ($P<.01$) in KA (10.9 cm²) than BB (8.3 cm²) and SC (7.1 cm²), but not after adjustment for carcass weight. Body wall thickness and quality score were also higher ($P<.05$) in KA (1.57 cm and 10.3, respectively) than SC (1.33 cm and 9.6) and BB (1.08 cm and 9.3). Hair sheep lambs achieved moderate rates of gain on high forage diets with limited supplementation, with some differences between breeds. The carcasses produced were too small for the traditional lamb market, but acceptable for ethnic niche markets.

Key Words: Hair Sheep, Growth, Carcass Characteristics

Teaching and Undergraduate Education

112 A service learning approach to teaching companion animal management. K. M. Downs*, J. G. Gentry, and J. E. Mehlhorn, *Middle Tennessee State University.*

As a content supplement, a service learning model was incorporated into a senior-level Companion Animals course in the animal sciences at MTSU. This course was developed in response to a change in student demographics and the need for a broad based species knowledge, with enrollment (mean = 27) increasing by 39.3% from first to current offering (3 semesters). The service learning application was designed to stimulate interest in community development activities among the undergraduate student in this course by highlighting companion animal specific organizations which perform a service to the local, regional, or national community. As traditional lecture supplements, demonstrations by a therapy dog organization, law enforcement search and rescue group, drug seizure division, and K-9 attack unit are scheduled throughout the semester. Students are required (20% of final grade) to complete a team project whereby they must identify, interview, and report upon a companion animal related service organization. An incentive based university wide donation drive to support the local county animal services by providing needed supplies has also been incorporated into the class structure. Qualitative evaluation of the service learning program was conducted using retention, attendance, and course evaluation data. Over three semesters, retention was 87.5, 71.4, and 100.0%, respectively. While only randomly maintained, attendance has remained high (86.3%). Based on course evaluations, 87.5% of students completing the course are highly satisfied with their learning experiences. Service learning is an innovative approach to supplement the learning experiences of undergraduate students and foster an appreciation for community-based service. Students become active participants in their

education and foster a sense of gratification in making a difference in the community.

Key Words: Teaching, Service Learning, Companion Animals

113 Relationships among prematriculation academic indicators and collegiate success. C. F. Rosenkrans, Jr.* and J. A. May, *University of Arkansas, Fayetteville.*

Universities are being scrutinized for the success of their students. Those successes are based on student retention, grade point average (GPA), and graduation rate. Accurate methods of determining the likelihood of a student's success at a university are needed so that students requiring additional assistance can be helped before it is academically too late. This study was a retrospective evaluation of new freshman students ($n = 120$) who matriculated at the University of Arkansas in the fall of 1994, 1995, and 1996, and enrolled in the Introductory Animal and Poultry Sciences course (AGRI 1003). Student high school GPA (HSGPA) and composite ACT score were related to the student's grade in AGRI 1003, graduation status, and the time in months to graduation. The ACT score was correlated ($r > 0.32$; $P < 0.001$) with HSGPA and AGRI 1003 grade. The HSGPA ($r = 0.58$; $P < 0.001$) was correlated AGRI 1003 grade. Student ACT score, HSGPA, and AGRI 1003 grade were all negatively correlated ($r < -0.38$; $P < 0.01$) with the number of months to student graduation. Student's chosen major was not ($P > 0.3$) a source of variation for HSGPA, ACT score, graduation rates, or months to graduation. Students who earned an A letter grade in AGRI 1003 had the highest ($P < 0.01$) HSGPA, and ACT score, and least ($P < 0.01$) amount of time to graduation. Only 56 (47 %) of the new freshmen

enrolled in AGRI 1003 graduated within six years. Those students who did graduate had a higher ($P < 0.01$) HSGPA than non-graduates (3.4 vs. 3.16, respectively); however, ACT score (mean = 21.4) was not different ($P > 0.25$) for graduates and non-graduates. These data support

previous reports that HSGPA is the best single-quantitative predictor of student graduation rates.

Key Words: New Freshman, Graduation Rate, High School GPA

Undergraduate Research Paper Competition

114 Evaluation of nutraceutical effects on pig immunity: effects of Promax. Leslie Dabovich^{*1}, Lindsey Hulbert¹, Anthony Rudine¹, Sungwoo Kim¹, Fei Ji¹, and John McGlone¹, ¹*Pork Industry Institute, Dept Animal and Food Science, Texas Tech University.*

Non-traditional feed ingredients may have effects on pig immunity and health. One possible nutraceutical is Promax (Promax[®], HumaTech, Inc., Houston, TX) which is a natural, carbon-mineral feed supplement that is mined and minimally processed. Carbon compounds include humic acid, fulvic acid, and other organic compounds and minerals, including bioavailable iron and other trace minerals. In this study we evaluated the effects of Promax formula against a standard corn-soybean meal diet. In study 1, treatments included a control, 46162, and 48162, each added at 5% of the diet from weaning (21 d) to market. In study 2, treatments included a control, 4600, and 5600 each added at 5% of the diet from weaning (21 d) to market. Each study involved 8 replicate pens per treatment with each pen containing 8 pigs (192 pigs per study). Immune measures were collected during the late nursery period in study 1 and during the finishing period in study 2. Immune measures included total number of white blood cells (WBC), differential counts, red blood cell numbers, hemoglobin, hematocrit, lymphocyte proliferation under phytohemagglutinin mitogen, and neutrophil chemokinesis and chemotaxis. In study 1, nursery pigs fed 46162 had elevated ($P < 0.01$) neutrophil chemotaxis compared with pigs fed control or 48162 (82.2, 184.5, 119.5, SE_p=17.2, control, 46162, and 48162, respectively). During study 2, pigs were inadvertently exposed to erysipelas during the early grower phase. All pigs had stimulated immune measures compared with study 1 pigs (e.g., WBC were increased 48%). Immune measures were not different among treatments. However, mortality was influenced by treatment (9.4, 9.4, and 4.7% for control, 4600 and 5600, respectively). In conclusion, Promax has nutraceutical properties in that it stimulates neutrophil activity which may protect against bacterial pathogens and reduce mortality during acute bacterial infections.

Key Words: Pigs, Immunity, Nutraceutical

115 Use of betamethasone to advance fetal maturation in mares with high-risk pregnancies. G. L. Olsen^{*1}, D. L. Christiansen¹, J. Smith¹, R. Hopper¹, M. LeBlanc², and P. L. Ryan¹, ¹*Mississippi State University, Mississippi State, MS*, ²*Rood and Riddle Equine Hospital, Lexington, KY.*

Induction of parturition is often utilized in the high-risk (HR) pregnant mare to secure a viable foal if a history of dystocia or a concurrent, life-threatening condition is present. However, induction of parturition can be problematic because equids exhibit variable gestation lengths and final fetal maturation occurs late in gestation. The incidence of fetal loss in HR pregnancies could be reduced if fetal maturation were advanced to facilitate pre-term delivery. In humans, fetal maturation can be accelerated successfully with dexamethasone (DEX) or betamethasone (BMS). DEX is only effective in equids when injected intrafetally, which can lead to abortion. Therefore, the objective of this study was to ascertain whether fetal maturation could be advanced by maternal injection with BMS at minimal risk to dam and fetus. Quarterhorse mares ($n = 13$) received (i.m.) either 12 mg (low dose, LD, $n = 3$), 24 or 30 mg (high dose, HD, $n = 5$) BMS or saline (SAL, $n = 5$) at 305, 306 and 307 d of gestation. Delivery was clinically induced (20 IU oxytocin) on d 320 in five mares (two LD and three HD). Foal serum samples at 0, 24 and 48 h were analyzed for cortisol, P4, T4 and T3 concentrations. Foal birth and placental weights and blood cell counts at 0 h were determinants of foal maturity. Of the five BMS-treated mares induced, two foals survived while three were euthanized within 48 h due to negative outcome of induction. Consequently, mare data was analyzed as saline non-induced (SAL, $n = 5$), treated non-induced (TNI, $n = 3$) and treated induced (TI, $n = 5$). Serum cortisol was undetectable in four of five TI foals while P4 values were greater (12.5 ± 3.1 ng/ml, $P < 0.2$) at 0 h compared to SAL and TNI foals (9.1 ± 1.9 , 8.7 ± 1.7 ng/ml, respectively). White blood cell counts at 0 h were greater in TI than TNI (P

< 0.05) and SAL ($P < 0.1$) foals. Birth weight was greater ($P < 0.2$) in SAL compared to TNI and TI foals (55.8, 49.8 and 46.6 kg, respectively) while placental weight was greater in TI compared to TNI and SAL foals (6.4, 4.3 and 5.5 kg, respectively). SAL and TNI treated mares foaled at term without complications, with BMS treatment advancing delivery by 7-14 days in TNI mares. In conclusion, maternal BMS treatment did not accelerate fetal maturation adequately to successfully induce pre-term delivery of foals.

Key Words: Equine, Fetal Maturation, Betamethasone

116 Rearing pigs indoors or outdoors: effects on pig growth, and behavior. Anthony Rudine^{*1}, Leslie Dabovich¹, Lindsey Hulbert¹, Jeff Dailey², Julie Morrow², and John McGlone¹, ¹*Pork Industry Institute, Dept Animal and Food Science, Texas Tech University*, ²*Livestock Issues Research Unit, USDA-ARS.*

Pig performance, health and behavior may be influenced by the production system. A conventional indoor system was compared with an outdoor system for system effects on pig growth, performance, and behavior. Contemporary litters were born indoors in standard farrowing crates with woven wire flooring or outdoors on alfalfa pasture in the spring and summer months. Indoor pigs were weaned into a conventional nursery with slatted flooring or outdoors into pastures with alfalfa and a straw-bedded hut. After weaning, pigs were kept with 2 littermates per pen. A total of 6 replicate pens were evaluated per treatment. Pig dominance order was determined by a feed competition test during the post-weaning period. Pig behavior was recorded for 24 h using a scan sample technique which included walking, standing, sitting, feeding, waterer manipulation (apparent drinking), rooting, oral-nasal-facial chewing/manipulating (ONF), and lying down behaviors. Performance data were analyzed as a randomized complete block design with effects of production system, dominance status (dominant or submissive) and their interaction. Behavior data were analyzed as a randomized complete block design with a split plot over time. Pig performance measures (ADG, feed intake, feed:gain ratio) were not different ($P > 0.10$) among treatments. Indoor and outdoor pigs were similarly inactive during the evening, but they differed in the level and distribution of active behaviors. The production system by time effect was significant ($P < 0.05$) for walking, drinking, ONF, and lying down. Outdoor born and reared pigs were more active overall and showed increased walking, ONF, and reduced lying compared with pigs born and reared indoors. Indoor pigs expressed more apparent drinking during most times of the day. In conclusion, pigs born and reared indoors and outdoors had generally similar performance but very different behavioral profiles.

Key Words: Pig, Environment, Behavior

117 Toxicity in mares consuming *C. paspali*-infected dallisgrass hay. M.A. Seitz^{*1}, B.J. Rude¹, N.M. Filipov², and P.L. Ryan^{1,2}, ¹*Mississippi State University, Mississippi State, MS*, ²*College of Veterinary Medicine, Mississippi State, MS.*

Livestock consuming dallisgrass (DG, *Paspalum dilatatum*) infected with the fungus *Claviceps paspali* often develop the condition known as dallisgrass staggers (DGS). Sclerotia produced by *C. paspali* contain the mycotoxin paspalanine, a GABA receptor antagonist that induces symptoms common to DGS such as tremors, ataxia, recumbency, and hyper-excitability. Although symptoms of DGS are well documented, its etiology in the equine species is poorly understood. Thus, the objective of this study sought to examine the affects of *C. paspali*-infected DG hay consumption on the endocrine, hematological and immune parameters of exposed horses. To this end, 12 non-pregnant Quarterhorse mares were given *ad libitum* access to one of four dietary treatment groups: 1) 14 d non-infected hay; 2) 7 d non-infected hay followed by 7 d infected hay; 3) 7 d infected hay followed by 7 d non-infected hay; 4) 14 d infected hay. Mares were randomly re-assigned and the design repeated following a 16 d interval on bermudagrass pasture. Diets were supplemented with

~1.5-kg/d horse feed (10% CP). Mares were given access to dry lots for 6 h/d for exercise. Respiration rates (RR) and rectal temperatures (RT) were recorded daily at 0700 and 1600. Blood samples were collected on d 0, 3, 7, 10 and 14 for blood chemistry, CO₂, catecholamines (3,4-dihydroxyphenylacetic acid (DOPAC)) and cortisol analyses while BW was recorded on d 0, 7 and 14. There was a significant ($P < 0.001$) change in BW where mares on infected hay lost weight while mares on non-infected hay gained weight (-4.0 vs 3.7 ± 1.9 kg). There were no marked differences in blood chemistry, hematology, and serum cortisol concentrations between treatment groups. Also, there were no significant differences in RR or RT. However, catecholamine metabolism was affected in that the dopamine metabolite DOPAC decreased ($P < 0.05$) with increased length of exposure to infected hay. In conclusion, DG exposure did not cause significant hormonal or blood chemistry changes in mares, but did result in altered catecholamine metabolism and reduced body weight.

Key Words: Dallisgrass Staggers, Paspalinine, Equine

118 Somatogenic hormone effects on immunoglobulin M (IgM) production by pig splenocytes *in vitro*. C.A. Davila*, L.A. Solis, and J.C. Laurenz, ¹Texas A&M University-Kingsville.

This study investigated the effect of insulin-like growth factor-1 (IGF-1) and growth hormone (GH) on concanavalin (ConA)-induced IgM production. Pig splenocytes were isolated from fresh spleen by sequential homogenization through stainless steel screens (20, 40 and 80 mesh) and density gradient centrifugation. Splenocytes were plated at 1×10^5 cells/well in DME/F12 containing 10% FBS, 2 mM L-glutamine, ConA (0-10 ug/mL), a synthetic glucocorticoid, dexamethasone (0 to 10^{-6} M; DEX), IGF-1 (0-400 ng/mL) and/or GH (0-400 ng/mL). Cells were incubated for 96 h and IgM production determined using an ELISA specific for pig IgM. ConA induced a dose-dependent increase ($P < .01$) in IgM production with maximal effects occurring at 1.25 ug/mL (287 49 vs. 2436 107 ng/mL for 0 vs. 1.25 ug/mL ConA, respectively). Co-treatment of splenocytes with IGF-1 enhanced ($P < .05$) ConA-induced (0.3 ug/mL) IgM production with a maximal 70.2% increase in IgM production apparent at 25 ng/mL IGF-1. However, IGF-1 did not effect ($P > .05$) IgM production when cells were stimulated with higher concentrations of ConA (1.25 ug/mL). Regardless of the ConA concentration, co-treatment with GH (0-400 ng/mL) did not influence ($P > .05$) IgM production. Consistent with previous research with peripheral blood lymphocytes, when splenocyte cultures were stimulated with low concentrations of ConA (0.3 ug/mL), DEX dose-dependently suppressed ($P < .02$) IgM production with maximal effects occurring at 10^{-7} M. In contrast, DEX dramatically augmented ($P < .01$) IgM production in splenocytes treated with higher concentrations of ConA (1.25 ug/mL) with maximal effects occurring at 10^{-8} M DEX (1220 125 vs. 6362 506

ng/mL for 0 vs. 10^{-8} M DEX, respectively). Neither IGF-1 nor GH were able to overcome the suppressive effects of DEX (10^{-8} M) at low ConA concentrations. However, IGF-1 did dose-dependently enhance ($P < .05$) the ability of DEX to augment IgM production at higher concentrations of ConA (1.25 ug/mL) with maximal effects occurring at 25 ng/mL IGF-1. Collectively, these results demonstrate that IGF-1 can enhance splenocyte function *in vitro*.

Key Words: Spleen, Pig, Immunity

119 Rearing pigs indoors or outdoors: effects on immunity and Salmonella shedding. Anthony Rudine*¹, Leslie Dabovich¹, Scot Dowd², Julie Morrow², and John McGlone¹, ¹Pork Industry Institute, Dept Animal and Food Science, Texas Tech University, ²Livestock Issues Research Unit, USDA-ARS.

Pig performance, health, and behavior may be influenced by the production system. A conventional indoor system was compared with an outdoor system for effects on pig immunity and Salmonella shedding. Contemporary litters were born indoors on slatted floors in farrowing crates or outdoors in spring and summer months. Indoor pigs were weaned into a conventional nursery with slatted flooring while outdoor pigs were weaned into pastures with alfalfa and a straw-bedded hut. After weaning, pigs were kept with 2 littermates per pen. A total of 6 replicate pens were evaluated per treatment for immune measures. Pig dominance order was determined by a feed competition test during the post-weaning period. At 9 weeks of age, pigs were moved to a controlled facility where they were individually housed in biocontainment bubbles and dosed with Salmonella enterica typhimurium (SALM). Fecal samples were collected every 12 hours for 4 days and cultured for SALM. Performance data were analyzed as a randomized complete block design with effects of production system, dominance status (dominant or submissive) and their interaction. Outdoor born and reared pigs had higher hemoglobin concentrations ($P < 0.01$), neutrophil phagocytosis of latex beads ($P < 0.05$) and increased secondary antibody titer to sheep red blood cells ($P = 0.05$), but less primary antibody titer compared with indoor born and reared pigs. Dominant pigs had elevated lymphocyte proliferation to phytohemagglutinin ($P < 0.01$), background titers to sheep red blood cells ($P < 0.02$) and lower ($P < 0.05$) increase in antibody titer to sheep red blood cells than submissive pigs. The interaction between production system and dominance status was not significant for any measure. Pigs born and reared outdoors had reduced ($P < 0.05$) SALM shedding compared with indoor born and reared pigs (2.4 vs. 5.7, SEp=1.03, log colony forming units SALM). In conclusion, pigs in the outdoor production system had enhanced immunity and reduced bacterial shedding of Salmonella compared with pigs in the conventional indoor system.

Key Words: Pig, Environment, Immunity