

ABSTRACTS
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1 Subcellular differences in muscle calcium and phosphorus due to vitamin D₃ supplementation of beef cattle. J. L. Montgomery^{*1}, K. J. Morrow, Jr.², R. L. Horst³, J. R. Blanton, Jr.¹, and M. F. Miller¹, ¹Texas Tech University, ²Texas Tech University Health Sciences Center, ³USDA, ARS, National Animal Disease Center.

Postmortem tenderization during storage is associated with the degradation of myofibrillar/cytoskeletal proteins as a consequence of calcium activated proteases. The protease μ -calpain is a member of the three protein calpain family, which includes m-calpain and calpastatin. Because of the calcium (Ca^{2+}) dependency of the calpains it has been hypothesized that oral supplementation of vitamin D₃ (VITD) can increase muscle Ca^{2+} content to activate the calpains and improve tenderness. The objective of this experiment was to determine the effect of supplemental VITD on bound and free calcium and phosphorus concentrations in beef. Steers (n=21) were fed one of three treatments consisting of 0 (control), 0.5, or 5.0 million IU/Steer/d of VITD for 9 consecutive d prior to slaughter. Longissimus lumborum samples were collected at 20 min postmortem to determine calcium concentrations and calpain activity. Bound and free Ca^{2+} and phosphorus levels were determined using differential ultra-centrifugation. Bound calcium was localized using potassium pyroantimonate staining and electron microscopy. Warner-Bratzler shear force (WBS) was determined on longissimus and semimembranosus steaks aged 7, 10, and 21 d postmortem. VITD treatments increased ($P < 0.05$) the subcellular calcium concentration of myofibril and sarcoplasmic reticulum proteins and myofibril phosphorus concentrations. Supplementing steers with 5.0 million IU of VITD also increased ($P < 0.05$) free cytosolic Ca^{2+} and bound sarcoplasmic reticulum phosphorus levels when compared to controls. VITD treatments mobilized calcium from the T-tubule system and increased bound calcium deposition near the Z-line. Longissimus sarcomere length was not ($P > 0.05$) affected by VITD treatments. Supplementing 0.5 million IU/steer/d reduced ($P < 0.05$) semimembranosus WBS values at d-7, and both VITD treatment reduced WBS values at d-10 postmortem. Semimembranosus WBS did not differ ($P > 0.05$) at d-21. Supplementing steers 5.0 million IU also tended to increase ($P < 0.09$) sarcomere length of the semimembranosus compared to controls. Decreased WBS and improved tenderness due to VITD treatment may be attributed to increased bound and free muscle calcium concentrations in the myofibril.

Key Words: Beef, Vitamin D, Calcium

2 Microbiological and visual characteristics of whole muscle beef steaks from the round with 3 different USDA grade groups as affected by high oxygen case-ready packaging. J. M. Behrends*, W. B. Mikel, M. C. Newman, and D. K. Aaron, University of Kentucky, Lexington.

Introduction of case-ready fresh meats to the market place has demonstrated a need to evaluate the benefits of this technology. Objectives of this study were to evaluate benefits of high oxygen 80% O₂/20% CO₂ modified atmosphere packaging on microbiological and visual quality of various round muscles (semimembranosus, semitendinosus, biceps femoris) and USDA Grades (High Choice and above, Low Choice, Select). Steaks from each treatment group (3 muscles, 3 grade types, 2 packaging types) were displayed under retail conditions for 1, 3, 5, 7 and 10 d. Three steaks from each muscle - grade - package type combination were evaluated for visual and microbiological characteristics each day. Each steak was evaluated for visual color (lean color, discoloration, overall acceptability) by a five member trained panel and measured for colorimeter L* a* b* values (lightness, redness, yellowness) with a Minolta Chroma Meter CR-300. Differences ($P < 0.05$) between packaging types of microbial populations were observed. PVC steaks were higher in total counts and coliform counts over 10 d than MAP steaks ($P < 0.05$). Lactic acid bacteria were higher in MAP than in PVC steaks ($P < 0.05$). Colorimeter values, a* and b*, displayed greater redness and yellowness respectively for MAP than PVC ($P < 0.05$). Lean color and overall appearance scores were higher for MAP steaks than PVC steaks over 10 d ($P < 0.05$). Packaging type x muscle interactions were found for coliform counts, odor evaluation, colorimeter L* and a* values, lean color, discoloration, and overall appearance ($P < 0.05$). These findings suggest microbiological quality on whole muscle steaks from the round can be extended with use of high oxygen MAP, however, different muscles tend to react differently with respect to color when subjected to high oxygen packaging. Further research is warranted to determine which whole muscle beef steaks best fit into this type of case-ready scenario.

Key Words: Case-ready, Microbiology, Quality

3 Leptin levels in ewes and their subsequent offspring. E. L. McFadin-Buff*¹, J. R. Witherspoon¹, C. D. Morrison¹, P. R. Buff¹, L. D. Spate¹, and D. H. Keisler¹, ¹University of Missouri-Columbia.

Leptin is an adipocyte-derived hormone that suppresses feed intake and increases energy expenditure. Leptin is also involved in regulating body temperature, and thus the presence of leptin in milk, which can be absorbed through the gut of the neonate, may aid in survival of neonates born in cold weather. Our objectives were to determine the relationship between concentrations of leptin in postpartum ewe blood serum (EBS) and ewe milk serum (EMS), and to determine if EBS and EMS leptin levels were correlated with levels of leptin in the blood serum of their lambs (LBS). Approximately 1 wk before the expected date of lambing, blood samples, weights, and body condition scores (BCS; 1 to 5 scale) were collected from 27 mixed-parity ewes. Following parturition, blood and milk samples were collected within 2 h of parturition (d 0), between 12 and 24 h after parturition (d 1), on d 5 and weekly thereafter for 6 wk. Lambs were bled and weighed within 2 h of parturition (d 0), bled daily until d 5, and bled and weighed weekly thereafter for 6 wk. The postpartum interval was classified as early (d 0 to d 26; i.e., preceding peak lactation) or late (d 27 to d 47; i.e., following peak lactation). Pre-lambing EBS leptin was positively correlated with congruent BCSs ($r^2=0.10$, $P=0.06$) but not weight ($P=0.14$). During early lactation, EBS leptin was correlated with ewe weight and BCSs ($r^2=0.16$, $P=0.0001$; $r^2=0.16$, $P=0.0001$; respectively). During late lactation EBS leptin was correlated with ewe weight ($r^2=0.17$, $P=0.0003$) but not BCS ($P=0.9$). EMS leptin was not correlated with ewe BCS, weight, or EBS leptin ($P>0.1$); however, both EBS and EMS leptin varied with day of lactation ($P=0.0001$). EBS and EMS leptin levels were greatest within 24 h of birth and declined to nadir levels by d 5. LBS leptin was correlated with EMS leptin, ($r^2=0.04$; $P=0.0004$), but not EBS leptin ($P>0.1$). LBS leptin increased from birth to d 5 and declined thereafter to nadir levels by d 19. High levels of leptin in milk during the early stages of lactation may provide a mechanism for thermoregulation, satiation, and homeostatic endocrine control in the neonate.

Key Words: Leptin, Ewe, Lamb

4 Nutrient digestibility and utilization and gains of steers consuming broiler litter with or without aluminum sulfate. K. C. Hanson* and B. J. Rude, *Mississippi State University, Starkville.*

The use of broiler litter as a feedstuff for beef cattle is a common practice in the southern U.S. Broiler producers have initiated the application of aluminum sulfate (alum) in the broiler house to reduce volatilization of ammonia and bind phosphorus. Therefore, the objective of this study was to determine how the addition of alum affects nutrient digestibility and utilization and animal gains when fed to steers. To determine nutrient digestibility and utilization, 12 steers (230 ± 65 kg) were housed in individual metabolism crates and fed one of three diets: 1) 50:50 corn:broiler litter treated with alum (A); 2) 50:50 corn:untreated traditional broiler litter (T); 3) 12% protein control diet (C). Dry matter intake did not differ ($P > 0.05$) between treatments. No differences ($P > 0.05$) were observed for ruminal fluid pH. Dry matter (80 and 78%) and organic matter (81 and 79%) were more digestible ($P < 0.05$) in steers fed A and T, respectively, than in steers fed C (53 and 55% for DM and OM, respectively). Neutral detergent fiber was most ($P < 0.05$) digestible by animals fed T (64%) and least digestible by those fed C (39%), with those consuming A being intermediate (52%). No differences ($P > 0.05$) were seen in ADF, CP, or energy digestibility. Energy utilization was not different ($P > 0.05$) between treatments. Protein retention was greater ($P < 0.05$) by steers fed A and T (240 and 348 g/d, respectively) than by those fed C (44 g/d). To determine steer gains, 30 steers (338 ± 63 kg) were equally divided into the same treatments as used in the digestibility trial. Each treatment group of ten steers grazed a five acre paddock for 28 d. Steers supplemented with A and T were given ad libitum access to their supplements. Steers receiving the control diet were hand fed daily to receive an average of 2.28 kg/(steer-d) during the first 14 d of the trial and fed to receive an average of 4.54 kg/(steer-d) during the final 14 d of the study. Steers receiving A gained faster ($P < 0.05$; 1.29 kg/d) compared with those receiving T and C (0.72 and 0.59 kg/d, respectively). Addition of aluminum sulfate to broiler

litter fed to cattle did not inhibit nutrient digestibility or utilization, but did improve gains.

Key Words: beef cattle, digestibility, broiler litter

5 Effects of feeding direct fed microbials and prebiotics on receiving calf performance, health and fecal shedding of pathogens. M.D. Abney*, D.U. Thomson, and A.D. Herring, *Texas Tech University, Lubbock, TX.*

Crossbred heifers ($n = 96$; $185 + 8.8$ kg) were used to determine the effects of feeding a direct fed microbial (DFM) and mannanoligosaccharide (MOS) on performance, health and fecal shedding of pathogenic microbes in newly received feedlot cattle. Cattle were weighed and allotted to two blocks (heavy or light). Cattle were then randomly assigned within blocks to pens (6 hd/pen; 8 pens/trt/block). The pens were assigned to one of two treatments: 1) control diet (65% concentrate, 15.8% CP DM basis) or 2) control diet plus 15 g of DFM and 15 g of MOS. Cattle were weighed on d 0, 14 and 28. Fecal grab samples were taken on d 0 and 28. Fecal samples were cultured for bacterial isolation, and PCR was run on the isolates for serovar identification. There were no interactions therefore only main effects will be discussed. The addition of DFM/MOS decreased ADG (10.3%, $P = .07$) and tended to decrease DMI (6.28%; $P = .17$) for the 28 day period relative to controls. There was no difference in morbidity and mortality between the cattle on either treatment. All cattle on both days of sampling were shedding some serovar of *E. coli*. There were no treatment differences for types of *E. coli* being shed on d 28. Cattle in the light block had higher ADG during the first 14 d (1.01 vs. .46 kg; respectively; $P < .01$) and lower ADG during the second 14 d (1.84 vs. 2.23; respectively; $P < .01$) than cattle in the heavy block. Cattle in the heavy block had decreased G:F relative to cattle in the light block for both the first 14 period (.138 and .304; $P < .01$) and improved G:F during the second 14 d period (.369 vs. .305; respectively; $P = .02$). During the entire feeding period (d 0-28) there was no block effect on ADG, DMI, G:F, morbidity or mortality. Lighter weight cattle shed more attaching and effacing *E. coli* serovars (70 vs. 49%; $P=.03$) than heavy weight cattle on d 0. However, on d 28 there was no block effect on serovars of *E. coli* being shed by cattle. In conclusion, the feeding of DFM/MOS decreased ADG and tended to decrease DMI in newly received feedlot cattle.

Key Words: Beef cattle, Direct fed microbial, Prebiotic

Physiology I

7 Effect of the presence of a male on the characteristics of estrus of synchronized and naturally cycling crossbred heifers. G.T. Gentry, Jr.*¹, R.P. Del Vecchio, and R.A. Godke, *LSU Ag Center, Baton Rouge.*

Two experiments were conducted to determine whether the presence of a male affected the mounting activity of naturally cycling or synchronized crossbred heifers. In Exp. 1, 32, 2-yr-old cyclic crossbred heifers were fitted with radiotelemetric, pressure sensitive devices, stratified by weight and allotted to a treatment with no male (NP, 2 replicates) or a treatment with a vasectomized male present for 25 d (MP, 2 replicates). In Exp. 2, the same four groups of crossbred heifers (n=32) were again weighed, assigned a body condition score and allotted to one of four treatments. Heifers that were synchronized with 25 mg of PG during the luteal phase of their cycle were assigned to a treatment with a male (MPGF, n=8) or no male present (PGF, n=8). Heifers that were implanted with Syncro-Mate-B ear implants were assigned to a treatment with a male (MSMB, n=8) or no male present (SMB, n=8). Heifers remained with bulls for 24 d. Heifers in both experiments were visually appraised for estrual behavior twice daily by trained technicians (n=3) for ≥ 20 min. In Exp. 1, number of mounts, s stood and duration of estrus were similar for heifers in the NP and MP treatment groups. Heifers in the MP treatment group exhibited more mounts/h (2.8 vs. 3.9; $P < .005$) and more s stood/h (17.4 vs. 6; $P < .005$) than did NP heifers. In Exp. 2, s stood, mounts/h and s stood/h were similar for heifers in MPGF and PGF groups. Heifers in the MPGF group exhibited a shorter duration of estrus (11.6 vs. 19.1 h; $P < .05$) and stood longer/mount (3.8 vs. 2.6 s; $P < .005$) than heifers in the PGF group. Number of mounts, s stood, duration of estrus, mounts/h and s stood/h were similar for heifers in both the MSMB and SMB treatment groups. Results suggest that the presence of a male in naturally cycling and PG-treated heifers intensifies mounting activity thereby allowing more opportunities for visually detecting estrus in heifers for AI.

Key Words: synchronization, estrus, behavior

8 Comparison of Select Synch[®] and prostaglandin in estrous synchronization of Brahman females. S.R. Tatman*¹, D.A. Neuendorff¹, and R.D. Randel¹, ¹*Texas Agricultural Experiment Station, Overton, TX.*

Brahman females (n=60; BW 514kg; BCS 6.3) were randomly assigned by age, postpartum interval, sire and sex of calf to receive either Select Synch[®] (SS) or PGF₂α (P). SS consisted of an injection of GnRH (1 μg i.m. of Cystorelin[®], Merial LTD) followed 8 days later by an injection of PGF₂α (25 mg Lutalyse[®], Upjohn, USA). Animals were observed for estrus immediately after GnRH injection and at 4 h intervals thereafter even though the SS protocol suggests estrus detection to begin d 5 after GnRH administration and continue through d 3 after PGF. Females showing estrus before or after the SS protocol period were bred AI. Females in the P group received a PGF₂α injection and were subsequently observed for standing estrus. Females that showed no response were given a second PGF₂α injection 8 d later. Females were bred by AI to semen from 1 bull for cows and a second bull for heifers 12 h after onset of estrus by 1 of 2 technicians which had similar ($P > .7$) first service conception rate (FSCR). Pregnancy was diagnosed 45-60 d after AI by rectal examination. Estrous synchronization was similar ($P > .7$) in SS (50.0%) compared with single PGF treatment (46.6%). Estrous synchronization tended ($P < .07$) to be lower in SS (50.0%) than in cows receiving 1 or 2 PGF injections (73.3%). Females receiving SS had 10% showing estrus before the protocol breeding period and 26.7% were detected in estrus after this period. FSCR in SS females bred during the proposed SS AI period were lower ($P < .10$: 40%) compared with those bred before or after the SS AI period (72.7%). FSCR tended to be higher ($P < .09$) for females receiving 1 or 2 PGF injections (71.4%, 68.2%: respectively) compared with SS (40%). These results suggest that SS does not improve estrous synchronization over 1 PGF injection and tends to reduce FSCR in Brahman females.

Key Words: Estrous synchronization, Brahman females, GnRH

9 Effects of Size of Pen and Number of Cows in Estrus on Estrous Behavior. L. N. Floyd*, C. A. Lents, F. J. White, and R. P. Wettemann, *Department of Animal Science, Oklahoma Agricultural Experiment Station.*

The effects of number of cows in estrus and size of pen on estrous behavior were monitored using the HeatWatch[®] system. Cyclic, non-suckled Angus and Angus X Hereford cows were used in winter (January and February), and summer (July, and August) to determine behavior. During each season, 16 cows were maintained in a drylot (60 x 100 m) and 16 cows were in a pasture (12 ha). Estrous cycles were synchronized with two injections of 25 mg PGF₂α (Lutalyse[®]) at a 10 d interval. Thereafter, cows were treated with PGF₂α so that 1, 2-3, 4-6 or 7 or more cows were estrus concurrently. Plasma concentrations of progesterone were used to determine if cows exhibited a normal ovarian response to PGF₂α. Cows exhibiting normal progesterone concentrations in plasma were used in analyses. Number of mounts and duration of estrus were similar ($P > .10$) for cows in the drylot and pasture. Estrous cows were mounted more times in winter than in summer ($P < .05$) and duration of estrus was longer in winter ($P < .005$). Number of mounts per estrus increased ($P < .0001$) as the number of cows in estrus increased from 1 to 7 or more. Cows were mounted the fewest times ($P < .05$) when one cow was in estrus (10.7 ± 5.3). The number of mounts per estrus was similar when 2-6 cows were estrus (28.3 ± 3.4), and was greatest ($P < .001$) when more than 7 cows were estrus (50.0 ± 3.2). Duration of estrus was similar ($P > .10$) when 2 or more cows were estrus ($16.5 \pm .9$ h) and shortest ($P < .01$) when one cow was estrus (11.6 ± 1.4 h). Increasing the number of cows in estrus increased the duration of estrus and number of times a cow was mounted, and may increase the number of cows detected in estrus.

Key Words: Estrous Behavior , Estrus , Beef Cows

10 Influence of season of birth on reproductive development of Brahman bulls. S.R. Tatman*¹, D.A. Neuendorff¹, T.W. Wilson¹, and R.D. Randel¹, ¹*Texas Agricultural Experiment Station, Overton, TX.*

Reproductive development of Fall (F; n=8) versus Spring (S; n=10) born Brahman bulls was studied. Bulls came from a common breeding herd and were sired by the same bulls. F bulls were born between Aug and Oct, 1998 and S bulls between March and May, 1999. F bulls were weaned in May, 1999 and S bulls in Oct, 1999. After weaning the S bulls, the two groups were maintained together and fed a corn/soybean meal (3:1) diet supplemented with lasalocid at 200 mg/hd/d at 1.5% of BW. Bulls had free access to water, coastal bermuda grass hay, and salt/mineral supplement. Measurements of growth and reproductive development were taken biweekly beginning in Aug 1999 for F bulls and Oct 1999 for S bulls until each bull reached sexual maturity (SM; ejaculate with $\geq 500 \times 10^6$ sperm with $\geq 50\%$ motility). Measurements included BW, body condition score (BCS), hip height (HH), scrotal circumference (SC), and individual testis length. After a bull's SC reached 21 cm, ejaculates were collected biweekly using electroejaculation and continued until the bull reached SM. Stages of reproductive development in the ejaculate were first sperm (FS), 50×10^6 sperm/ejaculate (puberty; P), and 500×10^6 (SM). No differences ($P > .10$) were found for BW, BCS, SC, or paired testis volume (PTV) between seasons of birth at FS or P. Age at FS tended ($P < .08$) to be greater in F (413 ± 13 d) than S (381 ± 11 d) but was similar at P. SM was delayed in F (527 ± 13 d) compared to S bulls (453 ± 12 d). F tended ($P < .07$) to be heavier at SM (470 ± 18 kg) with a greater BCS ($P < .005$; $6.3 \pm .1$) than S bulls (418 ± 17 kg; $5.7 \pm .1$). F tended ($P < .07$) to have greater SC ($32.8 \pm .9$ vs $30.2 \pm .9$ cm) and had greater ($P < .05$) PTV (5366 ± 346 vs 4052 ± 327 cc) than S. Interval from FS to P was similar but interval from P to SM was greater ($P < .05$) in F (72 ± 12 d) than in S bulls (33 ± 11 d). Brahman bulls born in the Fall have SM retarded during the cold months with short photoperiods compared with Spring born bulls who reached maturity during longer photoperiods.

Key Words: Brahman bulls, puberty, season

11 Comparison of endocrine and reproductive tissue weights in tropically-adapted *Bos taurus*, temperate *Bos taurus* and tropically-adapted *Bos indicus* bulls. J.W. Koch^{*1,2}, C.C. Chase, Jr.³, S.R. Tatman², D.A. Neuendorff², T.W. Wilson², T.A. Strauch^{1,2}, R.D. Randel², and T.H. Welsh, Jr.¹, ¹Texas Agricultural Experiment Station, College Station, TX, ²Overton, TX, ³Subtropical Agricultural Research Station, ARS, USDA, Brooksville, FL.

The Romosinuano (R), a tropically-adapted *Bos taurus* breed developed in Colombia, has been imported to the USA. Astute use of tropically-adapted *Bos taurus* germplasm in crossbreeding systems depends on identification of endocrine factors that control metabolism and reproduction. The objective of the present study was to compare the weight of endocrine and reproductive tissues of tropically-adapted *Bos taurus* (R) relative to temperate *Bos taurus* (Angus; A) and tropically-adapted *Bos indicus* (Brahman; B) bulls. Bulls were slaughtered at 69 to 111 d after reaching two consecutive ejaculations with $\geq 500 \times 10^6$ sperm with $\geq 50\%$ motility. The average age of the bulls at slaughter was 647 ± 13.1 , 535 ± 10.6 and 513 ± 12.2 d for B, A and R, respectively. B bulls were heavier ($P \leq .002$) at slaughter (527.4 ± 18.7 kg) than A (431.4 ± 20.0) and R (385.3 ± 16.7) which were similar. R bulls had heavier ($P \leq .04$) total pituitary weights (5.3 ± 2 mg/kg) and anterior pituitary weights (4.0 ± 2 mg/kg) compared to A (4.7 ± 2 ; 3.5 ± 2 , respectively) and B (3.2 ± 2 ; 2.5 ± 2 , respectively) which also differed ($P \leq .004$). B bulls had lower ($P \leq .001$) paired adrenal weight (28.3 ± 1.7 mg/kg) compared to R (38.8 ± 1.5) and A (41.2 ± 1.8) which were similar. B bulls had heavier ($P \leq .03$) paired testis weight (1.2 ± 1 g/kg) and paired epididymis weight (110.5 ± 5.5 mg/kg) compared to R (1.0 ± 0.1 ; 93.0 ± 4.9 , respectively) and A (1.0 ± 0.1 ; 91.1 ± 5.8 , respectively) which were similar. R bulls had lower ($P \leq .01$) seminal vesicle weights (130.1 ± 7.5 mg/kg) than A (163.2 ± 8.9) but not B (145.2 ± 8.4) which were similar to A. In summary, reproductive and endocrine tissue weights of the tropically-adapted *Bos taurus* bulls were more similar to that of temperate *Bos taurus* than tropically-adapted *Bos indicus* bulls.

Key Words: Romosinuano bulls, Endocrine, Reproduction

12 Comparison of traits at puberty of four recently introduced breeds to Angus and Brahman bulls. S.R. Tatman^{*1}, C.C. Chase², T.W. Wilson¹, D.A. Neuendorff¹, A.W. Lewis¹, C.G. Brown¹, and R.D. Randel¹, ¹Texas Agricultural Research and Extension Center, Overton, TX, ²Subtropical Research Station, ARS, USDA, Brooksville, FL.

Reproductive development of Angus (A; n=7) and Brahman (BR; n=10) bulls in comparison to Bonsmara (BO; n=8), Romosinuano (R; n=10), Tuli (T; n=14), and Wagyu (W; n=10) was studied. All bulls were maintained together and fed a 3:1 (corn: soybean meal) ration supplemented with 200 mg lasalocid/hd/d fed at 1.5% of body weight. Bulls had free access to coastal bermuda grass hay, water, and a salt/mineral mix. Measurements of reproductive development were taken at biweekly intervals upon receiving bulls and continued until each bull reached puberty (P; ejaculate with $\geq 50 \times 10^6$ sperm with $\geq 10\%$ motility). Measurements included BW, body condition score (BCS), scrotal circumference (SC), and individual testis length. After a bull reached 21 cm SC, ejaculates were collected biweekly using electroejaculation until the bull reached P. Days of age at P differed among breeds ($P < .0001$) with BO the youngest (291 ± 14 d) followed by W (320 ± 14 d), T (328 ± 10 d), R (369 ± 12 d), A (373 ± 14 d), with the oldest being BR (427 ± 12 d). BCS at P did not differ ($P > .10$) among breeds, but BW differed ($P < .0001$) between breeds with W being the lightest (259 ± 14 kg) followed by T (279 ± 11 kg), R (291 ± 12 kg), A (291 ± 15 kg), BO (304 ± 14 kg), with BR being the heaviest (394 ± 12 kg). Breeds differed ($P < .004$) in SC at P with W being the smallest ($24.5 \pm .8$ cm) followed by R ($26.0 \pm .7$ cm), T ($26.1 \pm .6$ cm), BR ($28.0 \pm .7$ cm), A ($28.1 \pm .8$ cm) with BO being the largest ($28.2 \pm .8$ cm). Breed affected ($P < .003$) paired-testis volume with W being the smallest (2398 ± 238 cc) followed by R (2664 ± 213 cc), T (2910 ± 180 cc), BR (3198 ± 213 cc), BO (3449 ± 238 cc), with A being the largest (3727 ± 255 cc). As expected, BR were the oldest and heaviest at P. The recently introduced BO, T, and W reached P earlier than BR or A bulls with R similar to A. SC and paired-testis volume were smaller at P for R, T, and W than A, BO, or BR.

Key Words: Bulls, puberty, breed

13 Effects of Method and Time of Castration on Growth of Beef Calves. C. A. Lents^{*1}, F. J. White¹, L. N. Floyd¹, R. P. Wettemann¹, and D. Gay², ¹Department of Animal Science, Oklahoma Agricultural Experiment Station, Stillwater, 74078, ²Turley Ranch, Durham OK.

Suckling bull calves (n = 160) were used to determine the effects of banding of the scrotum or surgical castration on growth rate. At two to three months of age, bulls were randomly assigned to one of three treatments: banded, surgically castrated, or intact. Bulls were examined at treatment to determine if both testes had descended into the scrotum. For banding, both testes were pushed to the bottom of the scrotum and two rubber bands were placed around the upper scrotum. For surgical castration, the lower scrotum was removed, the testes exposed and the spermatic cords cut. All calves were implanted with 36 mg of zeranol (Ralgro[®]) at treatment. Calves were weighed at treatment and at weaning (7 to 8 mo of age). Weight change from treatment to weaning averaged 128.8 ± 2.2 kg, and was not influenced by treatment ($P > .1$). At weaning, intact bulls were banded (Callicrate BanderTM) to determine the effects of late castration on weight gain after weaning. All animals were reimplanted with 36 mg zeranol at weaning. Fifty days after weaning, all calves were weighed, and calves banded at weaning were examined to determine if scrotums were absent. Treatment tended ($P = .10$) to alter weight change during the 50 d after weaning. Bulls that were banded at weaning gained less ($P < .05$) weight (21.5 ± 1.0 kg) than bulls that were banded or surgically castrated at 2 to 3 mo of age (24.4 ± 1.1 and 24.1 ± 1.0 kg, respectively). In suckling calves given an estrogenic growth stimulant, intact bulls had no advantage in weight gain to weaning compared with bulls that were banded or surgically castrated at 2 to 3 mo. Banding bulls at weaning may reduce post weaning gain.

Key Words: Castration, Weaning Weight, Bulls

14 Assessment of reproductive tract scoring as an aid in selection at three ages prior to breeding in nulliparous heifers. J. F. Baker^{*1}, R. C. Vann¹, and M. Pence¹, ¹University of Georgia, Tifton, GA.

Reproductive tract scores (RTS, scale 1 to 5) of nulliparous heifers measured just prior to breeding are positively correlated with calving date and pregnancy rate. However, beef producers generally select replacement heifers at an earlier age. Therefore, nulliparous heifers (n = 485) were measured three times (mean ages = 279 d (T1), 356 d (T2), and 417 d (T3)) prior to breeding to assess the changes across time and relationship of score with body weight (WT), body condition score (BCS), real-time ultrasound fat thickness (USFAT), and hip height (HIP). Heifers were reared at eight research locations in Georgia. Breed and location are partially confounded but breeds included: Angus, Hereford, Angus \times Hereford crosses, Gelbvieh \times British, mixed crosses, Angus \times Brahman crosses, and others. Three free-martin heifers were deleted prior to analyses. The correlation coefficients between WT and RTS at each measurement were 0.34, 0.48, and 0.32, respectively for T1, T2, and T3. Correlation coefficients between RTS scores across time were: T1:T2 = 0.31, T1:T3 = 0.25, and T2:T3 = 0.40. Correlation coefficients between BCS and RTS were generally lower than between WT and RTS but still greater than zero for each period (0.24, 0.19, and 0.18 for T1, T2, and T3 respectively). The distribution (%) of RTS at T1 was 3.14, 53.56, 24.69, 17.57, and 1.05 for 1 to 5, respectively. The distribution (%) of RTS at T2 was 0.21, 3.11, 24.07, 38.59, and 34.02 for 1 to 5, respectively. The distribution (%) of RTS at T3 was 0.21, 1.03, 7.02, 31.40, and 60.33 for 1 to 5, respectively. Analyses of the repeated measures with PROC MIXED were completed. Location was a significant source of variation as well as period. In summary, correlations between RTS and WT were moderate, correlations between RTS scores across time were similar and moderate in magnitude. The RTS procedure appears to be most useful near the time of breeding and only moderately correlated with BCS or WT.

Key Words: Heifers, Reproductive tract score, Growth

15 Fertility of beef heifers treated from birth with growth promoting implants. J.G. Floyd*¹, W.H. McElhenney¹, A.M. Heath¹, R.E. Blaylock¹, B.E. Norris², M.D. Pegues², R.L. Carson¹, D.A. Coleman¹, and F.F. Bartol¹, ¹*Auburn University, ²Alabama Agricultural Experiment Station.*

Crossbred beef heifers (n = 241) born in two successive years in three herds were assigned by sequential birth order to one of three groups treated once with a commercial growth promoting implant on the day of birth: Group O, no treatment; Group C, Synovex C (100 mg progesterone + 10 mg estradiol benzoate); Group S, Synovex S (200 mg progesterone + 20 mg estradiol benzoate). At approximately 14 months of age heifers were exposed to bulls that had passed a standard breeding soundness examination. Following bull exposure, each 18 to 20-month-old heifer was palpated rectally for pregnancy diagnosis by two experienced examiners. For Groups O, C, and S, least squares means for pregnancy % (SEM = 5%) were 81, 64, and 34 (O > C & S, P < .001; C > S, P < .001), and least squares means for adjusted weaning weights (SEM = 4 kg) were 243, 258, and 250 kg (O < C & S, P < .02). Effects of herd were detected for both pregnancy % (P < .01) and weaning weight (P < .05), and an effect of year was detected for weaning weight (P < .02). Thus, exposure of heifers to implant steroids from birth decreased pregnancy % and increased weaning weight. Negative effects of implant steroid exposure from birth on pregnancy % increased with dosage (C > S, P < .001). Synovex C is approved for use in beef heifers at 45 days of age, including those intended for breeding. Synovex S is not approved for heifers. Early postnatal exposure to steroids used here alters patterns of uterine development in beef heifers and results in uterine and endometrial hypoplasia that may compromise endometrial function and uterine capacity. Present data can be interpreted to indicate that such exposure decreases fertility in beef heifers. Data reinforce the importance of using implants only according to label restrictions and emphasize the need to define critical postnatal periods during which exposure to such developmentally disruptive agents can have lasting effects on uterine function and reproductive performance in cattle.

Key Words: Heifer, Implant, Uterus

Breeding and Genetics

17 Genotype x Forage Interaction for Mature Weight and Rate of Maturing for Angus, Brahman, and Reciprocal Cross Cows. B.A. Sandelin*¹, A.H. Brown, Jr.¹, M.A. Brown², Z.B. Johnson¹, and A.M. Stelzleni¹, ¹*University of Arkansas, Fayetteville, ²USDA-ARS Grazinglands Research Laboratory, El Reno, OK.*

Mature weight (A) and rate of maturing (k) were estimated in 177 Angus, Brahman, and reciprocal cross cows grazing common bermudagrass or endophyte-infected fescue over a 4-yr period to evaluate genotype x forage interactions. Data was collected every 28 d until approximately 18 mo and then at prebreeding, postcalving, and weaning of calf. All cows must have had data to 42 mo to be included in the analysis. Mature weight and k were estimated using the three-parameter growth curve model as described by Brody. Data were pooled over year and analyzed by the general linear model (GLM) procedure of SAS. Included in the model were the dependent variables of A and k and the independent variables of genotype, forage and genotype x forage interaction. There was a significant (P < 0.01) genotype x forage interaction for A but not for k. Angus cows had greater (P < 0.01) mean A on fescue than did Angus x Brahman cows on Bermudagrass (611 ± 17 vs 546 ± 16 kg). Angus x Brahman cows grazing Bermudagrass had lower (P < 0.05) mean A than did Brahman x Angus cows grazing Bermudagrass or Fescue and Brahman cows grazing Bermudagrass (546 ± 16 vs 624 ± 19, 614 ± 22 and 598 ± 20 kg). Brahman cows grazing fescue had smaller (P < 0.05) mean A than all genotype x forage combinations except for Angus x Brahman cows on Bermudagrass. Angus cows had a slower (P < 0.05) mean k than Angus x Brahman and Brahman x Angus cows (0.039 ± 0.002 vs 0.054 ± 0.002 and 0.049 ± 0.002), respectively, and Angus x Brahman cows had a faster (P < 0.05) mean k than Brahman x Angus and Brahman cows (0.054 ± 0.002 vs 0.049 ± 0.002 and 0.041 ± 0.002) respectively. These data suggest that the choice of breed type is important in maintaining a crossbreeding program, in that mature size

16 A preliminary study comparing manual and computer assisted semen analysis of spermatozoal motility and morphology in yearling beef bulls. E.L. Atkins*¹, C.E. Thompson¹, L.W. Grimes¹, and H.L. Higdon III², ¹*Clemson University, Clemson, SC, ²Greenville Hospital System, Greenville, SC.*

Traditionally, a manual method for determining potential breeders among yearling bulls is ascertained by breeding soundness evaluation (BSE) criteria established by the Society for Theriogenology (SFT) 1993 system. Recent advances in computer technologies may allow for a more objective determination of semen characteristics. Our objective was to determine relationship of bull spermatozoal characteristics generated by traditional methods to an automated semen analyzer. Semen specimens from 81 yearling beef bulls from two discrete bull test stations were evaluated by traditional method (SFT 1993) and automated semen analyzer [Hamilton-Thorne V10 Integrated Visual Optical System (IVOS), Beverly, MA]. To provide accurate values using IVOS, three replications from each semen specimen were diluted in 1% BSA:PBS to 20-50 million spermatozoa/mL, vortexed, and loaded into a MicroCell™ 20 micron chamber slide (Conception Technologies, San Diego, CA). A minimum of six fields were counted for each replication; slow moving cells were not counted as motile. Spermatozoal morphology results by IVOS method were generated by two replications from each specimen smeared, fixed, and stained to glass slides. For each replication, 200 individual spermatozoa were evaluated and classified: normal, abnormal, or rejected. The IVOS method and traditional method were moderately correlated for progressive spermatozoal motility (r = 0.55; P=0.0001). Correlation for normal spermatozoal morphology between methods was r = 0.16 (P=0.15). Preliminary data suggest similar results may be obtained using either method for determining progressive spermatozoal motility, however, inconsistencies associated between methods for normal spermatozoal morphology warrant further investigation. Future studies will continue to focus on utilizing IVOS to objectively analyze bovine spermatozoa.

Key Words: Computer Assisted Semen Analysis, Breeding Soundness Evaluation, Beef Bulls

and rate of maturing are critical to the match of animal requirements to available production resources.

Key Words: Mature Weight, Rate of Maturing, Genotype x Forage Interaction

18 Evaluation of F₁ cows sired by Brahman, Boran and Tuli bulls for birth and weaning weight, calf crop born, calf survival and calf crop weaned. A. E. Ducoing*¹ and J. O. Sanders¹, ¹*Texas A&M University, Animal Science Department, College Station.*

Birth (n = 745) and weaning weight (n = 598), calf crop at birth (n = 881) and weaning (n = 755) and calf survival (n = 645) were evaluated from 1994 to 2000 in calves out of 144 F₁ cows sired by Boran (Bo), Brahman (B) and Tuli (T) bulls and born to multiparous Hereford and Angus cows during 1992 and 1993. Birth and weaning weights were evaluated using the model components: sire breed of dam, dam breed of dam, age of dam, calf birth year and calf's gender as fixed effects, dam's sire within sire breed, dam within dam's sire within sire breed as random effects, and birth date within year as a covariate. Calf crop at birth and weaning and calf survival were evaluated using as model components: sire breed of dam, dam breed of dam, age of dam and calf birth year as fixed effects, dam's sire within sire breed, dam within dam's sire within sire breed as random effects. Birth weight (BW) adjusted means for calves out of cows by B, Bo and T sires were 34.93 # 0.61, 34.19 # 0.67 and 34.48 # 0.64 kg respectively, and were not different (P > 0.05). The effect of the birth date within birth year was significant (P < 0.01), showing a positive relationship between birth date and BW in all years. Least squares mean for calves out of B sired cows for weaning weight (WW) was 218.1 # 3.58 kg and was higher (P < 0.01) than those out of cows sired by Bo (202.76 # 4.04 kg) and T (193.24 # 3.81 kg) bulls. The regression on birth date within calving year accounted for variation observed in WW (P < 0.01). Calf crop at birth (CCB) adjusted means for B, Bo and T sire breeds were 80.14 # 2.14, 87.38 # 2.51 and 84.35 # 2.28% respectively; Bo was higher (P < 0.05) than B. Calf survival

adjusted means for B, Bo and T sire breeds were 93.83 # 4.16, 97.49 # 4.29 and 95.05 # 4.11% showing the same trend as CCB, but no differences ($P > 0.05$) were found among them. Calf crop weaned showed the same trend as CCB and calf survival, with adjusted means of 77.71 # 6.01, 86.45 # 6.23 and 82.15 # 5.96% for B, Bo and T sire breeds; B and Bo were different ($P < 0.05$).

Key Words: Brahman Tuli Boran, calf weights, cow productivity

19 Evaluation of age of dam on milk production in multi-lactation Angus daughters of high and low maternal EPD sires at three locations in the Southern United States. M. E. Boyd*¹ and J. F. Baker², ¹Mississippi State Univ., Mississippi State, ²University of Georgia, Tifton.

Angus bulls ($n = 21$) were selected for either high or low maternal EPD but similar growth EPDs. Records were obtained from Tifton, GA, Reidsville, GA, and Starkville, MS. Lactation records for 124 daughters milked from 1994-1998 were used to evaluate milk production (MLK, kg/12 h), milk fat (MF, %), milk protein (MP, %), and weaning weight of offspring (WWT). Dam age (AOD) ranged from 2 yr to 6 yr. Milk production was measured at least four times during the lactation at regular intervals (overall mean post-partum intervals: 56, 101, 156, and 198 d) within location. Dams were separated from their calves the night prior to milking and milked with a portable milking machine the next morning to estimate 12 h milk production. A sample of the milk was collected from each cow and submitted to a DHIA laboratory for analysis of MF and MP. The PROC MIXED procedure in SAS was used to analyze the data. The repeated records (subject = dam id within period and year) model included fixed effects of location, genetic line of sire, sex of calf, milking period, age of dam, and year. Post-partum interval was used as a covariate. Random effects included sire of dam nested within line. Genetic line and sex of calf were significant sources of variation for MLK but not for MF or MP. Location was significant for MLK, MF, and MP. The interaction between line and location was not significant for MF but was for MLK and MP. Line by AOD interaction was significant for MLK but not MF. High line cows produced more milk across all AOD's than low line cows except for the 4-yr-olds. Line, location, calf sex, age at weaning, and AOD were significant sources of variation for WWT. The difference between the least squares means for high and low lines for MLK was 0.67 kg/12 h. and 16.75 kg for WWT. Significant WWT differences exist between all adjacent AODs except for years 5 and 6 ($P = 0.34$). Age of dam effects are important regardless of genetic line of cow. Correction factors are needed for fair comparisons across ages.

Key Words: Maternal EPD, Beef cattle, Milk production

20 Evaluation of milk production in first lactation for Angus daughters of high and low maternal EPD sires at six locations in the Southern United States. J. F. Baker*¹, M. E. Boyd², A. H. Brown³, D. E. Franke⁴, and C. E. Thompson⁵, ¹University of Georgia, Tifton, ²Mississippi State Univ., Mississippi State, ³University of Arkansas, Fayetteville, ⁴Louisiana State University, Baton Rouge, ⁵Clemson University, Clemson, SC.

Angus bulls ($n = 21$) were selected for either high or low maternal EPD but similar growth EPDs and were mated within location at random to Angus cows. Daughters from these matings were bred to calve first at 2 yr of age to common reference sires across locations. Records were obtained from the following locations: Edisto, SC, Tifton, GA, Reidsville, GA, Starkville, MS, Baton Rouge, LA and Fayetteville, AR. Lactation records for 183 daughters were used to evaluate milk production (MLK, kg/12 h), milk fat (MF, %), milk protein (MP, %), and weaning weight of offspring (WWT). Milk production was measured four times during the lactation at regular intervals (overall mean post-partum intervals: 69, 112, 161, and 200 d) within location. Dams were separated from their calves the night prior to milking and milked with a portable milking machine the next morning to estimate 12 h milk production. A sample of the milk was collected from each cow and submitted to a DHIA laboratory for analysis of percentage milk fat and protein. The PROC MIXED procedure in SAS was used to analyze the data. The repeated records (subject = dam id) model included fixed effects of location, genetic line of sire, sex of calf, and milking period. Post-partum interval was used as a covariate. Random effects included sire of dam nested within line, sire of calf, and year. The estimation method was

REML, with a heterogeneous compound symmetry structure for variance/covariance components. Genetic line was an important source of variation for MLK ($P = 0.002$), but not for MF ($P = 0.07$) or MP ($P = 0.62$). Location was significant for MLK, MF, and MP ($P < 0.0001$). The interaction between line and location was not significant. The sex of calf was significant for MLK but not for MF or MP. Line, location, calf sex, and age at weaning were significant sources of variation for WWT but the interaction of line and location was not important ($P = 0.49$). The difference between the least squares means for high and low lines for MLK was 0.62 kg/12 h. and 13.4 kg (18.3 kg. without Baton Rouge) for WWT. The results indicate that there was not evidence for a genotype by environment interaction in milk production for daughters from divergent sires selected for high or low maternal EPDs.

Key Words: Milk production, Maternal EPD, Beef cattle

21 Determining the relationship between production traits and milk estimated progeny differences in beef cattle. C. E. Thompson*, E.L. Atkins, M.A. Worrell, and R.H. Williams, *Clemson University, Clemson, SC.*

Estimated progeny differences (EPD's) are used in the cattle industry as a means to predict the breeding value (calf potential) of a particular dam, sire, or mating. In this study, purebred Angus cows ($n=51$) were categorized based upon their sires' milk EPD. The variation, in milk production and other economically important production traits, between cows with divergent milk EPD's was assessed. The cows were machine milked four times throughout the lactation period on days 60, 105, 140, and 185 postpartum. Calves were removed 12 hours prior to milking; therefore the milk measured 12-hr. production. The high and low groups' milk EPD's differed ($P < .05$) (5.7 kg and -4.4 kg resp.). Milk production (24-hr.) differed among the high and low groups at first two milkings ($P < .05$). 24-hr. milk production was the same at the last two milkings. Milk composition was also assessed; no differences were found in fat content. The high EPD group had higher protein content at the second, third, and fourth milking than the low EPD group ($P < .05$). Birth weights were the same among groups. No significant differences were noted for interim calf weights among groups at the first and second milking. However, the high EPD group had heavier calf weights at the third and fourth milking ($P < .05$). Dam weights among groups were alike at each of the four milkings. Likewise, dam body condition score was similar among groups at all of the milkings. There is a moderate correlation between milk EPD and weaning weight ($r = .36$, $P = .02$).

Key Words: Beef Cattle, Milk Production, Estimated Progeny Difference (EPD)

22 Sire breed x sex of calf interaction for birth and weaning traits in multi-breed data. J. E. Devillier*¹, A. Yilmaz¹, D. E. Franke¹, and F. A. Thrift², ¹Louisiana State University Agricultural Center, ²University of Kentucky, Lexington.

It is well known that sire breed of calf influences birth and weaning traits. Several studies have found a sire breed x sex of calf interaction for birth and some weaning traits. The purpose of this study was to evaluate sire breed x sex of calf in multibreed data involving Angus, Brahman, Charolais, and Hereford sire breeds. A total of 3445 complete calf records were produced from 4732 straightbred and rotational crossbred matings. A linear mixed model was used to evaluate Julian birth date, birth weight, average daily gain, 205-d weaning weight, weaning weight per cow exposed and weaning rate. Maternal additive and maternal heterosis effects were included in the model to adjust for cow genetic differences. Sire breed influenced all traits ($P < .01$) except weaning weight per cow exposed. Sire breed x sex of calf influenced Julian birth date, birth weight, average daily gain, and 205-d weaning weight. The sire breed x sex of calf interaction was due to differences in magnitude between sexes rather than to a change in rank across sire breeds. Brahman-sired male calves were born 4.4 d later, weighed 5.0 kg more at birth, gained .088 kg more per d, and had 13.3 kg heavier 205-d weaning weight than Brahman-sired heifer calves. Differences found between Brahman-sired male and heifer calves were greater than those for the other sire breeds which had similar differences. These data support other studies showing later birth dates and larger birth and 205-d weights of Brahman-sired male calves compared to heifer calves than found in calves sired by Bos taurus bulls.

Key Words: Cattle, Genotype Environment Interaction, Body Weight

23 Sire effects on feedlot growth of straightbred Brahman calves in Central Florida. D. G. Riley*, C. C. Chase, Jr., and S. W. Coleman, *USDA, ARS, Subtropical Agricultural Research Station, Brooksville, FL.*

A quadratic regression model was used to assess the influence of Brahman sires on the postweaning growth of their straightbred steer and heifer progeny. Brahman calves ($n = 503$), produced by 22 sires and out of 240 dams, were born from 1995 through 1999. Numbers of calves per sire ranged from 7 to 51; one sire from each year was used for two breeding seasons to tie years. After weaning, calves were penned by weight and sex and fed a high concentrate diet until the median backfat thickness for the pen was 10 mm (determined by ultrasound). Calves were weighed every 28 d and, in some cases more frequently, as a pen approached the target degree of finish. Weight records ($n = 5,615$) were analyzed in a model with dam, pen (as block) and residual error as random effects with estimates of 455.3 kg², 230.4 kg², and 415.97 kg², respectively ($P < 0.001$ for all). Sire, sex, and year were included as fixed effects, as well as regression on age at weaning, linear (β_1) and quadratic (β_2) regressions on day of feeding (day or day²), sire \times sex of calf interaction, sire $\times \beta_1$, and sire $\times \beta_2$. The sire \times sex of calf interaction ($P < 0.001$) was evidenced by the differences between steer and heifer weights for different sires, which ranged from 4.48 to 55.15 kg. Three sires had less than 20 kg difference between steer and heifer progeny. However, one of these sires had records on only 7 progeny; the sex difference for this sire (11.5 kg) is likely the result of sampling error. The β_1 and β_2 regression coefficient estimates were 1.32 per day and 0.001 kg per day² ($P < 0.001$). Sire $\times \beta_1$ regression coefficient estimates ranged from 1.07 to 1.79 kg per day ($P < 0.001$). Sire $\times \beta_2$ regression coefficient estimates ranged from 0.003 to 0.0001 kg per day² ($P < 0.001$).

Key Words: Brahman, Feedlot Growth, Sire by Sex Interaction

24 Variation in scrotal circumference of yearling bulls on a 112-d gain test. J. L. Guerra*¹, D. E. Franke¹, D. F. Coombs¹, and A. R. Williams², ¹*Louisiana State University Agricultural Center*, ²*Mississippi State University*.

Objectives for this study were to evaluate sources of variation influencing scrotal circumference and rate of change in scrotal circumference in yearling bulls on a 112-d gain test and to determine the minimum scrotal circumference necessary at the start of the test to give a high probability of reaching 30 cm at the end of the test. Bull test data ($n=580$) were obtained from the Dean Lee Research Station and Louisiana Tech University. Scrotal circumference was measured following guidelines of the Society of Theriogenology. Bull tests occurred in Summer and Winter at the Dean Lee Station but only in Winter at Louisiana Tech University. Location, season of the test, and year were combined to form one source of variation with 8 levels. Because of small numbers of bulls in some breeds, British, Continental, and Zebu breed groups were formed. Breed group and location-season-year influenced variation in initial scrotal circumference, scrotal circumference rate of change on test, and final scrotal circumference ($P < .01$). The linear and quadratic effects of initial age influenced initial scrotal circumference ($P < .01$). Final hip height and final age influenced final scrotal circumference ($P < .05$). Continental and British breed groups had larger initial and final scrotal circumference than the Zebu breed group ($P < .05$), however the Zebu breed group had a larger scrotal circumference rate of change than the British breed group. The minimum scrotal circumference needed at the start of a test to ensure a 90 percent probability of reaching 30 cm at the end of the test was 22, 21, and 23 cm, respectively for Continental, British, and Zebu bulls.

Key Words: Cattle, Scrotal Circumference, Development

25 Genetic Parameter Estimates of Yearling Live Animal Ultrasonic Measurements in Brangus Cattle. A. M. Stelzleni*¹, T. L. Perkins², A. H. Brown, Jr.¹, Z. B. Johnson¹, and B. A. Sandelin¹, ¹*University of Arkansas, Fayetteville*, ²*Southwest Missouri State University, Springfield*.

The objective of this study was to estimate genetic parameters for real-time ultrasound measurements of longissimus muscle area (LMAU) and 12th-rib backfat thickness (FTU), percent intra-muscular fat (PFAT), and yearling weight (YW) for 1023 yearling Brangus bulls and heifers. A single ultrasound technician took all measurements. Number of observations were 1020, 1020, 937, and 910 for LMAU, FTU, PFAT, and YW, respectively. Genetic parameters were estimated for each trait using

single- and multiple-trait DFREML procedures (MTDFREML). Fixed effects were contemporary group (defined as same sex, same age within six months, and same environment), and age in days as a covariate. The MIXED procedure of SAS was used to obtain initial starting values for variance components. Each trait was analyzed as a single-trait, then in combination with each other trait in a series of two-trait models. Means for LMAU, FTU, PFAT, and YW were 27.66 \pm 0.16 cm², 0.53 \pm 0.008 cm, 3.20 \pm 0.03 %, and 467.51 \pm 2.73 kg, respectively. Heritabilities for the single-trait analysis of LMAU, FTU, PFAT and YW were 0.44, 0.25, 0.40, and 0.48, respectively. Average heritabilities from the two-trait analyses for LMAU, FTU, PFAT, and YW were 0.41, 0.38, 0.15, and 0.47, respectively. Genetic correlations for LMAU and FTU, LMAU and PFAT, LMAU and YW, FTU and PFAT, FTU and YW, and PFAT and YW were -0.22, -0.31, 0.35, 0.65, 0.11, and 0.34, respectively. These data suggest a substantial additive genetic effect for YW, FTU, and LMAU and a strong relationship between phenotypic value and breeding value for these traits.

Key Words: Ultrasound, Heritabilities, Genetic Correlations

26 Sire variation for shear force and thaw and cooking loss of loin steaks from Brahman steers. J. D. Domingue*¹, T. Smith², D. E. Franke¹, T. D. Bidner¹, M. A. Persica, III¹, and J. L. Guerra¹, ¹*Louisiana State University Agricultural Center*, ²*University of Louisiana, Monroe*.

Steers with a high percentage Brahman inheritance often are less tender than steers with a greater percentage British or Continental breed inheritance. The purpose of this study was to evaluate sire variation for tenderness and thaw and cooking loss in purebred Brahman steers. Thaw and cooking loss and shear force data were available on 235 Brahman steers from 39 sires. Steers were obtained at weaning, backgrounded and grazed on ryegrass, and fed in a South Texas feedlot until slaughter at an average age of 557 \pm 52 d. Wholesale loins were obtained from the right side of each steer carcass after a 48-h chill. Two steaks (2.54 cm) were cut from each loin, vacuum packaged, and assigned to 7 or 14 d aging. Following aging the steaks were frozen at -20 C until cooking. Cooking procedures followed guidelines published by the American Meat Science Association (1995). Traits of interest included shear force, percent thaw loss, and percent cooking loss. Seven and 14 d averages (SD) were 4.9 (1.2) and 3.9 (0.9) kg for shear force, 8.9 (3.1) and 9.3 (2.5) for percent thaw loss, and 21.1 (4.3) and 22.0 (3.7) for percent cooking loss, respectively. Sire of steer influenced ($P < .05$) shear force of 14 d aged steaks, percent thaw loss of 7 and 14 d aged steaks, and percent cooking loss of 14 d aged steaks. Slaughter age influenced ($P < .05$) shear force of 14 d aged steaks and thaw loss of 7 and 14 d aged steaks. Percent cooking loss influenced ($P < .01$) variation in shear force. Partial regression coefficients of shear force on cooking loss for 7 and 14 d aged steaks were .1314 \pm .0168 and .1012 \pm .0153 kg, respectively, indicating a greater shear force due to increased cooking loss. Simple correlations between cooking loss and shear force were .47 and .36 for 7 and 14 d aged steaks. Sire least squares means ranged from 3.24 to 5.96 kg for shear force at 7 d aging, 2.73 to 4.90 kg for shear force at 14 d aging, 14.23 to 26.72 for percent cooking loss at 7 d aging, and 15.15 to 26.25 for cooking loss at 14 d aging. These data suggest significant sire variation for shear force and for thaw and cooking loss in Brahman steers.

Key Words: Cattle, Brahman, Tenderness

29 Response to wool color selection in Romney sheep. T. Wuliji*¹ and K.G. Dodds², ¹*E (Kika) de la Garza Institute for Goat Research, Langston University*, ²*AgResearch Invermay Agricultural Research Center, Mosgiel, New Zealand*.

Yellow discoloration of sheep fleece is undesirable as it limits the range of dyeing shades of apparel, knitwear, and carpet products. Therefore, in this experiment the potential of genetic selection to alter the whiteness or yellowness of fleece wool was evaluated. Scoured wool color was measured as Commission Internationale de l'Éclairage (CIE) X, Y, Z values, where Y measures brightness and Y-Z is related to yellowness. Romney rams with high breeding values for wool brightness or yellowness were selected as parents. Ewes ($n=200$ /year) were randomly allocated to each selection line (brightness or yellowness) at the initiation of the trial, and subsequently replacements were selected from within the lines. Data from four consecutive births ($n=500$, born in 1994, 1995, 1996, and 1997) comprising 30 sire groups in two flocks were analyzed by residual maximum likelihood. Traits included weaning weight (WW), yearling

weight (SW), greasy (GF) and clean (CF) fleece weights, fiber diameter (FD) and coefficient of FD variation (FDCV), brightness (CIE Y) and yellowness (CIE Y-Z). The wool brightness and yellowness selection lines differed for CIE Y ($P < 0.01$), CIE Y-Z ($P < 0.001$), and FD ($P < 0.01$); however, the color differences were small. The effect of sex was significant ($P < 0.001$) for all traits except FDCV, with males being heavier for WW, SW, and higher for Y-Z but lower for other characteristics. Paternal half-sib heritability estimates were high for fleece weight, FD, and FDCV, moderate for live weight, low for brightness, and negligible for yellowness. These results suggest that response to selection on wool color is slow; therefore, a strict fleece classing, void of shearing in wet seasons, and subjective culling on yellow discoloration in flocks should be effective for improving brightness of wool clips.

Body weight, fleece weights and wool characteristics, and heritability estimates in flocks selected for wool brightness and yellowness

	WW	SW	GF	CF				
	kg	kg	kg	kg	Y	Y-Z	FD	FDCV %
Brightness	21.9	36.6	2.76	2.14	57.08	3.41	34.8	26.4
Yellowness	21.6	37.0	2.85	2.24	56.15	3.82	37.2	27.1
SED	0.4	0.6	0.06	0.05	0.26*	0.07*	0.6*	0.9
h^2	0.24	0.34	0.40	0.48	0.15	0.02	0.58	0.66
SE	0.14	0.16	0.16	0.18	0.11	0.08	0.43	0.47

Key Words: Wool, Brightness, Heritability

30 Importance of maternal genetic effects on performance traits for three breeds of swine. Z. B. Johnson*¹ and R. A. Nugent, III², ¹University of Arkansas, Fayetteville, ²The Pork Group, Rogers, AR.

The objective of this study was to investigate the importance of maternal genetic effects on performance traits of Landrace, 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. At this time all pigs were weighed (WT100) and selected for performance testing based on phenotypic weight ($n = 15,594$, 12,267, and 9,782 for Landrace, Duroc, and Hampshire, respectively). All pigs were weighed at the end of the 77 d performance test, and backfat (BF) and loin eye area (LEA) were measured over the 12th rib by ultrasound. Daily feed intake (DFI) was calculated for boars, and ADG was calculated for all animals. Genetic parameters were estimated for each breed and trait using multiple-trait DFREML procedures (MTDFREML). Fixed effects were contemporary groups and initial test age as a covariate. Four models were examined. Model 1 included only the additive genetic effect of the animal. Model 2 added the common litter environmental effect; Model 3 added the maternal genetic value assumed to be uncorrelated with additive genetic effects. Model 4 was the same as Model 3 with additive and maternal genetic effects assumed to be correlated. All models were two-trait models including WT100. Ratios of likelihoods were used to compare models. Maternal effects were important ($P < 0.05$) for WT100, ADG, DFI, BF, and LEA for Landrace; for Duroc, they were important ($P < 0.05$) for WT100 and ADG, and for Hampshire maternal effects were only important ($P < 0.05$) for WT100. Heritabilities for WT100, ADG, DFI, LEA, and BF were 0.21, 0.28, 0.34, 0.48 and 0.63 for Landrace, 0.07, 0.14, 0.20, 0.21 and 0.35 for Duroc, and 0.16, 0.17, 0.30, 0.24 and 0.33 for Hampshire, respectively. In summary, maternal effects may need to be considered in genetic evaluation of performance traits in some breeds of swine.

Key Words: Swine, Performance Traits, Maternal Effects

Meat Science

31 Effect of dietary protein supplements on muscle fatty acid composition and energy partition in the carcass of lambs. E. N. Ponnampalam*¹, A. J. Sinclair², B. J. Hosking³, and A. R. Egan³, ¹E (Kika) de la Garza Institute for Goat Research, Langston University, Oklahoma, ²Royal Melbourne Institute of Technology, Melbourne, Australia, ³University of Melbourne, Victoria, Australia.

This experiment examined the effects of feeding diets having isonitrogenous amounts of rapidly degradable and slowly degradable dietary protein with or without rapidly fermentable energy supplement on carcass weight, total tissue depth (fat + muscle tissue depth at 12th rib 110 mm from mid line) and fatty acid (FA) composition in lambs. Thirty-eight crossbred cryptorchid lambs (9 mo, 35-48 kg) were allocated by stratified randomization and fed one of six dietary treatments for 8 weeks: 1) oat hay: lucerne hay 4:1 (w/w) ad libitum (BAS); 2) BAS plus 358 g DM/d lupin (LUP); 3) BAS plus 168 g DM/d fish meal (FM); 4) BAS plus 358 g DM/d barley (BAR); 5) BAS plus 179 g DM/d of both barley and lupin (BL); or 6) BAS plus 179 g DM/d barley and 84 g DM/d fish meal (BFM). Lambs were then slaughtered, and hot carcass weight (HCW) and total tissue depth were recorded. Samples of the longissimus thoracis were collected at 24 h post mortem from chilled carcasses and analyzed for intramuscular fat content and FA composition. Lambs fed LUP, BL, FM and BFM had heavier HCW ($P < 0.001$) than those fed BAS or BAR. (20.9, 25.8, 23.5, 21.1, 24.9 and 23.6 kg for BAS, LUP, FM, BAR, BL and BFM, respectively). Total tissue depth was greater ($P < 0.01$) for LUP and BL carcasses compared with FM and BFM fed lamb carcasses (10.3, 15.7, 10.0, 10.4, 13.6 and 10.2 mm for BAS, LUP, FM, BAR, BL and BFM, respectively). Inclusion of fish meal in the diet either alone or with barley resulted in meat with 111% greater ($P < 0.001$) levels of long-chain omega-3 FA and 25% lower levels of omega-6 FA than found in lambs fed lupin either alone or in combination with barley. Long-chain omega-3 FA levels were 35, 35, 74, 41, 33 and 72 mg/100 g muscle for BAS, LUP, FM, BAR, BL and BFM fed lambs, respectively. Muscle total omega-6 FA was increased ($P < 0.01$) in LUP and BL fed animals compared with other treatments (160, 202, 141, 169, 190, 156 mg/100g muscle for BAS, LUP, FM, BAR, BL and BFM, respectively) but no differences were observed in intramuscular fat content among treatments. Results demonstrate that there was

an association between muscle long-chain omega-3 FA enrichment and reduction in carcass fatness through energy partitioning.

Key Words: Muscle Omega-3 Fatty Acid, Carcass Fatness, Energy Partition

32 Pre-chilled versus chilled carcass grading of ovine carcasses. R.K. Peel*, W.S. Ramsey, C.T. Boleman, and J.W. Savell, Texas A&M University, College Station.

The objective of this experiment was to determine if ovine carcasses could be graded pre-chilled to the same degree of accuracy as they are presently graded chilled. Lamb carcasses were collected for the study on three consecutive days (day 1, $n=219$; day 2, $n=206$; day 3, $n=155$) at a commercial slaughter facility in San Angelo, TX. Carcass sampling was established by the order each lamb carcass arrived on the slaughter floor, although an effort was made to obtain carcasses with variation in subcutaneous fat thickness. Each lamb carcass was graded pre-chilling at an average time of 15 minutes post stunning. Following a 20-hr average chill, each carcass was graded a second time to establish chilled grade. Three experienced evaluators (USDA Meat Grading Supervisors) independently graded each unribbed carcass to closely simulate industry conditions. These grades were assigned without the aid of a measuring device. Correlation coefficients between pre-chilled and chilled carcasses were ($P < 0.05$) 0.125, 0.200, 0.440, 0.604 and 0.771 for bone, lean, flank streaking, quality grade and yield grade, respectively. Regression analysis comparing pre-chilled to chilled carcasses yielded r^2 values ($P < 0.05$) of 0.015, 0.039, 0.0004, 0.003, and 0.595 for bone, lean, flank streaking, quality grade, and yield grade, respectively. Grader training will be required to accurately evaluate pre-chilled ovine carcasses. Pre-chilled grading does not appear to be feasible in the establishment of maturity or quality grade of the carcass but may be adequate in the determination of yield grades.

Key Words: Lamb, Carcass, Grading

33 Carcass and meat quality characteristics of pigs fed a rendered poultry (broiler) mortality product. R. O. Myer*, J. H. Brendemuhl, and F. W. Leak, *University of Florida, Gainesville.*

The resultant effects on carcass cut out and pork quality were evaluated from pigs fed diets containing a rendered product made with broiler mortalities. Fresh mortalities from commercial operations were collected daily and stored (frozen) on site. The frozen mortalities (-12 to -7°C) were transported to a central site, minced, blended with soybean meal, dried (final product temp - 120 to 130°C), and cooled. The final rendered product (PS) contained about 45% dried broiler mortality. The PS analyzed 6.3% moisture, 51.4% CP, 2.88% lysine, 7.0% ash, and 14.6% EE. A feeding trial involving 72 growing-finishing pigs (27 to 111 kg; 6 reps) was conducted to compare corn based diets containing either soybean meal (SBM) or PS as the supplemental protein source. From this trial, 24 representative pigs were slaughtered (112 kg avg wt) to obtain carcass and pork quality data. Pigs fed PS had an ADG that was similar to ($P>0.10$) and F/G that was 9% better ($P<0.01$) than the corresponding values for the SBM-fed pigs. Carcass lean yield, cut out, and pork quality characteristics (lean color, marbling, firmness, and texture) were not affected detrimentally ($P>0.10$) by feeding PS. Subjective carcass fat firmness scores indicated slightly softer fat ($P<0.05$) from pigs fed PS. Subsequent fatty acid analysis on back fat from representative pigs ($n=4/trt$) confirmed an increase in total unsaturates from 59 to 62% ($P<0.10$). The rendering of broiler mortalities can produce a safe and nutritious protein feedstuff for pigs with only a small effect, if any, on various carcass and meat quality characteristics.

Key Words: Pigs, Carcass Traits, Pork Quality

34 Carcass and meat quality traits of pigs from the sixth generation of a genetic line selected for leanness and growth efficiency. C.R. Kerth*, W.R. Jones, K. Nadarajah, D.L. Kuhlers, and L.B. Cagle, *Auburn University.*

Duroc pigs from two genetic lines representing the progeny of the sixth generation of pigs selected for increased leanness and growth efficiency (LEAN) or a control line maintained from the base population (CON) were tested to determine carcass and muscle quality traits. Thirty-one pigs of mixed sex were randomly sampled from each genetic line and slaughtered in two slaughter groups ($N = 62$ pigs) when they reached 114 kg. Postmortem temperature and pH were measured in the longissimus (LM) and semimembranosus (SM) muscles at 0.5, 1, 2, 3, 4, and 22 to 24 h postmortem. Midline fat at the first rib, last rib, and last lumbar vertebrae, tenth rib fat (measured 3/4 of the distance across the LM edge), LM area, carcass length, and muscle conformation scores were determined. Chops were removed from the LM, SM, and biceps femoris (BF) for determination of visual color, firmness/wetness, and marbling scores, Hunter L*, a*, and b* values, and drip loss. Hot carcass weight and LM area did not differ ($P > 0.15$) between LEAN and CON pigs. However, carcass length (79.4 vs 77.1 cm) and muscle conformation scores (6.0 vs 4.7) were higher ($P < 0.001$) and fat thickness measurements measured at the first rib (40.0 vs 45.1 mm), tenth rib (23.0 vs 32.7 mm), last rib (21.7 vs 27.0 mm), and last lumbar vertebrae (25.9 vs 30.2 mm) were lower ($P < 0.015$) for LEAN compared to CON pigs. Postmortem muscle pH was not affected by genotype, muscle, or their interaction with time postmortem ($P > 0.10$). Muscle temperature did not differ ($P > 0.05$) between genotypes in the SM at any time postmortem, but LM temperature was lower ($P < 0.05$) in LEAN pigs compared to CON pigs at 2, 3, and 4 hours postmortem. Genotype did not affect drip volume, percent drip loss, Hunter L*, a*, visual color, firmness, or marbling ($P > 0.11$). Hunter b* values were lower ($P = 0.009$) for LEAN than CON pigs across all muscles. These data suggest that selecting Duroc pigs for lean growth efficiency improved leanness without negatively affecting muscle quality.

Key Words: Pork Quality, Growth Efficiency, Genetic Selection

35 Effects of magnesium mica and halothane-genotype on performance and carcass traits of growing-finishing swine. J. K. Apple*, C. V. Maxwell, A. L. Hays, D. L. Kirkpatrick, M. R. Stivarius, and L. K. Rakes, *University of Arkansas, Fayetteville.*

Halothane free (HH) and carrier (Hh) pigs ($n=120$) were used to test the effects of supplemental magnesium mica (MM) on performance and

carcass traits of growing-finishing swine. Pigs were blocked by weight, allotted to pens (6 pens/block), and 1 of 3 treatments was assigned randomly to pens (5 pigs/pen) within blocks. Dietary treatments included: 1) control corn-soybean meal starter, grower and finisher diets; 2) control diets supplemented with 1.25% MM; and 3) control diets supplemented with 2.5% MM. Diets were fed during the starter (1.10% lysine; 17.4 to 33.4 kg), grower (0.95% lysine; 33.4 to 67.0 kg), and finisher (0.85% lysine; 67.0 to 106.8 kg) periods. When the lightest block averaged 106.8 kg, pigs were transported approximately 10 h to a commercial pork slaughter plant. At 24 h postmortem, tenth rib fat (10R) and longissimus muscle depth (LMD) were measured electronically, and midline backfat measurements opposite the first rib (FR), last rib (LR), and last lumbar vertebra (LLV) were recorded. Wholesale loins were captured during fabrication, vacuum-packaged, and shipped back to the University of Arkansas. All pork quality traits were obtained on the longissimus muscle (LM) after a 30-min bloom period. Although dietary MM had no effect ($P>0.14$) on ADG, HH-pigs had greater ADG during the grower ($P<0.03$) and finisher ($P<0.06$) periods than Hh-pigs. Dietary MM had no effect ($P>0.14$) on carcass cutability traits; however, carcasses from Hh-pigs had higher ($P<0.01$) dressing percentages, less ($P<0.01$) fat opposite the FR, LR, LLV and 10R, greater ($P<0.01$) LMD, and higher ($P<0.01$) percentages of muscle than carcasses from HH-pigs. In contrast, LM from Hh-pigs had greater ($P<0.01$) drip loss percentages and L* values, received lower ($P<0.01$) color, marbling and firmness scores, and had lower ($P<0.01$) a* and b* values than HH-pigs. Although there were distinct genotype-effects on performance and carcass traits, long-term supplementation of diets with MM had no appreciable effects on carcass quality or cutability.

Key Words: Magnesium, Genotype, Pork

36 Effects of supplemental magnesium and short-term transportation stress on pork quality. J. K. Apple*, E. B. Kegley, L. K. Rakes, K. S. Anschutz, T. J. Wistuba, and C. V. Maxwell, *University of Arkansas, Fayetteville.*

Crossbred pigs were used to determine the effect of feeding magnesium mica (MM) on longissimus muscle (LM) quality of pigs heterozygous for the halothane gene. Pigs were blocked by weight, penned in groups of 6, and pens (3 pens/diet) were randomly assigned to either a control corn-soybean meal or the control diet supplemented with 2.5% MM. Diets were fed during the grower (0.95% lysine; 43.6 to 68.6 kg) and finisher (0.85% lysine; 68.6 to 102.8 kg) periods, and MM was included in the diet at the expense of corn. At the conclusion of the feeding trial, 12 pigs from each dietary treatment were randomly selected and subjected to either no stress (NS) or 3 h of transportation stress (TS). Upon completion of TS, pigs were harvested at 45-min intervals with TS pigs harvested first, followed by NS pigs. Immediately following stunning and at 0.75, 1.5, 3, 6, 12, and 24 h postmortem, samples from the LM were aseptically excised from left sides for pH, glycogen, and lactate determinations. At 48-h postmortem, right sides were fabricated into wholesale cuts, and subjective and objective measurements of pork quality were obtained from the LM after a 45-min bloom period. Dietary MM had no effect ($P>0.10$) on ADG or ADFI; however, gain-to-feed ratio was improved during the grower phase when pigs were fed MM-supplemented diets (0.365 vs. 0.351; $P<0.04$). Postmortem LM pH decline was similar between NS pigs fed either 0.0 or 2.5% MM; however, LM from TS pigs fed 2.5% MM had higher ($P<0.04$) initial and 0.75-h pH values than TS pigs fed the control diet. Although not significant ($P=0.26$), TS pigs fed 2.5% MM had glycogen levels similar to NS pigs at 1.5, 3, 6, 12, and 24 h postmortem, and these concentrations tended to be higher than in the LM from TS pigs fed the control diet. However, LM color and water-holding capacity were not affected ($P>0.10$) by dietary MM or TS. Dietary MM appears to elevate early postmortem pH, possibly explaining the lack of discernable change in pork quality traits of stressed pigs.

Key Words: Magnesium, Stress, Pork Quality

37 Effect of vitamin D₃ supplementation on carcass tenderness in Brahman-based cattle. L. A. Kotrla*¹, R. L. Stanko¹, N. C. Tipton², and J. C. Paschal³, ¹Texas A&M University-Kingsville, Kingsville, ²Texas A&M University, College Station, ³Texas Agriculture Extension Service, Corpus Christi.

Effects of supplementing vitamin D₃ (D3) to feedlot cattle on carcass tenderness was determined in a 13-d experiment. Brahman-based steers

(n=59, 479 ± .1 kg) and heifers (n=16, 392 ± .1 kg) were randomly assigned to one of four treatments: 1) control diet and harvested on d 6 (C6), 2) control diet + D3 and harvested on d 6 (V6), 3) control diet and harvested on d 13 (C13), or 4) control diet + D3 and harvested on d 13 (V13). Vitamin D3 (3.5 million IUhd⁻¹d⁻¹) was fed on d 1 thru 5. Cattle in C13 and V13 consumed the control diet on d 6 thru 12. Blood samples were obtained from all cattle and liver biopsies were collected from a subset of cattle on d 0 and at day of harvest. Five steaks from the *longissimus dorsi* were randomly assigned to either 2, 4, 6, 8, or 14 d of aging and frozen until Warner-Bratzler shear force (WBSF) determination. Serum calcium (ng/dL) at harvest was greater ($P<0.02$) on d 13 than d 6 (10.3 ± .2 vs 9.6 ± .2). Both diet and day of harvest affected ($P<0.001$) liver D3 concentration at harvest. Harvest liver D3 ($\mu\text{g/g}$) was greater ($P<0.001$) in V6 (342.2 ± 23.2) compared to C6 (89.5 ± 24.4) cattle. Following the 7-d period without D3, V13 (89.3 ± 24.4) and C13 (54.6 ± 31.3) liver D3 levels ($\mu\text{g/g}$) did not differ ($P>0.10$). Vitamin D3 supplementation did not affect ($P>0.10$) WBSF, regardless of d of aging. Steaks collected on d 13 and aged for 2, 4, 6, or 8 d had lower ($P<0.002$) WBSF than steaks collected on d 6 when accounting for serum calcium concentration at harvest. Across d of aging, C6 (4.8 ± .3 kg) and V6 (5.1 ± .4 kg) WBSF were similar ($P>0.02$), but V13 (4.0 ± .3 kg) steaks were more tender ($P<0.0001$) than C13 (4.2 ± .4 kg). Acute, pre-harvest vitamin D3 supplementation, followed by a 7-d period of normal feeding, may improve the tenderness of carcasses from Brahman-based cattle.

Key Words: Brahman, Tenderness, Vitamin D₃

38 The impact of aerobic, vacuum or carbon dioxide mixing of beef trimmings or ground beef on lipid, microbial, instrumental color and Electronic Nose characteristics through simulated retail display. F. W. Pohlman*, K. S. McElyea, S. Suwansri, and J.F. Meullenet, *University of Arkansas, Fayetteville.*

The effect of aerobic, vacuum or carbon dioxide (CO₂) mixing of beef either before grinding or after grinding on lipid, microbial, and instrumental color stability of ground beef was studied. In addition, the Electronic Nose was used to determine the impact of mixing treatments, as well as duration of display, on aromatic volatiles produced. For this, 90% lean beef trimmings or 90% lean ground beef were mixed (either before or after grinding) aerobically, in vacuum or with liquid CO₂ for 6 min, packaged on foam trays with absorbent diapers and overwrapped with a polyvinyl chloride film. Samples were then placed under simulated retail display conditions (deluxe warm white fluorescent lighting, 1630lx, 4°C) and sampled on days 0, 1, 2, 3, 6 and 10 for surface, subsurface and average thiobarbituric acid reactive substances (TBARS), aerobic plate count (APC), instrumental color and Electronic Nose characteristics. Aerobic, vacuum or CO₂ mixing of either beef trimmings prior to grinding, or ground beef had no effect ($P>0.05$) on ground beef surface, subsurface or average TBARS values, APC, hue (hue angle) or oxymyoglobin (630 nm/580 nm) content. However, beef trimmings mixed under vacuum prior to grinding were ($P<0.05$) lighter (L*) in color than those

mixed either aerobically or under CO₂. In addition, ground beef mixed under CO₂ was ($P<0.05$) redder (a*) in color than beef trimmings mixed under CO₂ prior to grinding, yet similar ($P>0.05$) in redness to all other treatments. Increasing duration of display increased ($P<0.05$) surface TBARS values and APC. Likewise, ground beef became ($P<0.05$) darker (L*), less red (a*), less yellow (b*), and less vivid (saturation index) in color and contained less oxymyoglobin (630 nm/580 nm) as duration of display progressed. Additionally, the Electronic Nose detected increases ($P<0.05$) in aromatic compounds, particularly in polar compounds, hydrocarbons, aldehydes and other aromatic compounds.

Key Words: Ground beef, Mixing, Electronic Nose

39 The effects of ozone and chlorine dioxide on microbial, instrumental color and sensory color and odor characteristics when used in a ground beef production system. F. W. Pohlman*, M. R. Stivarius, K. S. McElyea, J. K. Apple, and J. R. Jimenez-Villarreal, *University of Arkansas, Fayetteville.*

The objective of this study was to evaluate the effects of ozone and chlorine dioxide in the production of ground beef on microbial, color and odor characteristics. For this, lean beef trimmings were thawed to 4°C, inoculated with a mixture of 7 log CFU/mL of each *E. coli* (ATCC 11775; EC) and *Salmonella typhimurium* (ATCC 1769NR; ST), then treated with either a 1% ozonated water bath for 7 min (7O) or 15 min (15O), or with a 200 ppm chlorine dioxide (CLO) solution and compared with a negative control (C). Trimmings were ground twice, packaged on foam trays with absorbent diapers, overwrapped with a polyvinyl chloride film, and sampled at 0, 1, 2, 3 and 7 days of simulated retail display (deluxe warm white fluorescent lighting, 1630lx, 4°C) for EC, ST, coliforms (CO), aerobic plate counts (APC), instrumental color, as well as sensory color and odor characteristics. The 15O and CLO treatments reduced ($P<0.05$) all bacterial types evaluated, whereas the 7O treatment reduced ($P<0.05$) APC and ST. All treatments caused ground beef to become lighter (L*) in color ($P<0.05$), however, the 15O treatment was similar ($P>0.05$) in redness (a*) and vividness (saturation index) of color, as well as sensory evaluated percentage discoloration, beef odor and off odor intensities when compared to C. In addition, ground beef from the 15O treatment was similar ($P>0.05$) in sensory evaluated overall color by day 1, and through the duration of display, to C. Likewise, panelists found no difference ($P>0.05$) in percentage discoloration, beef odor or off odor characteristics between CLO, 7O and C treatments. By d 7 of display, EC was reduced ($P<0.05$) by 0.44 log CFU/g and ST was reduced ($P<0.05$) by 0.82 log CFU/g compared to initial (d 0) display, while CO and APC were similar ($P>0.05$) between d 0 and d 7 of display. As expected, ground beef became less ($P<0.05$) red (a*), less ($P<0.05$) vivid (saturation index), and more ($P<0.05$) discolored (percentage discoloration) as display progressed. Therefore, the use of chlorine dioxide or ozone in ground beef production systems can be effective for reducing microbial pathogens, with minimal effects on color or odor characteristics.

Key Words: Ground Beef, Decontamination, Microorganism

Small Ruminant Production I

40 Economic implications of the interaction between genetics and nutrition in goats bred for meat. Will R. Getz*¹, M. Nelson, and S. Gelaye, ¹*Georgia Small Ruminant Research and Extension Center, Fort Valley State University.*

With the relatively recent introduction and use of breeds for meat production which have larger body mass and the genetic potential for more rapid growth rate than brush goats or the Spanish goat, it becomes appropriate to consider if the higher levels of productivity come an economic advantage or disadvantage. The published literature on this topic is relatively thin, but some interesting modeling work and budget analyses are available and are brought to light for discussion. The proposition that there is a great deal of interaction between genetics and nutrition is examined closely. It is suggested that the daily nutritional requirements of larger and perhaps less efficient goats are likely to increase feed costs which are already substantial. This is expected to be countered by the genetic potential to reach a given weight at an earlier age, hence reducing number of days that feeding is required. The impact of market price and various feeding practices on economic outcome of the enterprise is considered. Although genetic potential exists for certain

breeds to reach a heavier market weight, there may be limited scope for taking advantage of that fact particularly where prevailing demand is for modest carcass weight. Profitability in goat sales is considered in terms of feed costs, alternative use of resources, and genetic potential for efficiency. Examples of selected models used for optimization are shared.

Key Words: Small ruminants, Economics, Genetic nutrition interaction

41 Adaptation of Dorset, St. Croix, and crossbred lambs to wheat pasture. M. A. Brown*, W. A. Phillips, and L. A. Richards, *USDA-ARS, Grazinglands Research Laboratory, El Reno, OK.*

Purebred and crossbred stocker lambs (n=59) were used to evaluate factors affecting adaptation to winter wheat pasture. Breed groups included Dorset (D), St. Croix (S), Dorset x St. Croix (DS) and St. Croix x Dorset (SD). Fall-born lambs were weaned in December and one-half of each breed group was placed in drylot (DL) or on wheat pasture (WP)

in January. Lambs in DL were fed a high roughage diet formulated to approximate lamb gains on wheat pasture. Weight changes in DL and WP lambs were measured weekly from January 18 to February 28 after which both DL and WP lambs grazed wheat pasture. From February 28 to March 28, adaptation of DL treatment to wheat pasture was measured. For the first three weeks of the trial, lamb gains on WP were less than gains in DL ($P < .05$). For the next three weeks, gains were similar between DL and WP treatments ($P > .10$), suggesting adaptation to wheat pasture had occurred. When both treatments were grazing wheat pasture, DL lambs were lower than WP for the first week ($P < .01$) and similar thereafter. Based on adaptation results, data were categorized and summarized into three time periods for breed group comparisons: period 1 was the first three weeks; period 2 the second three weeks; and period 3 the last four weeks. There was a trend for larger differences in ADG between DL and WP treatments in D and SD lambs compared to DS and S lambs for periods 1 and 3, but not for period 2. These data suggest up to three weeks are required for stocker lambs to adapt to wheat forage, but adaptation time may be shorter when lambs naive to wheat pasture are mixed with those previously exposed to wheat pasture. Magnitude of adaptation relating to rate of gain within a period may be influenced by animal genetics, but not length of adaptation.

Key Words: Sheep, Crossbreeding, Wheat pasture

42 Carcass weight, dressing percentage and lean tissue component of fall born Spanish kids fed on either forage or high concentrate diets. T. Wulji¹, A.L. Goetsch¹, R. Puchala¹, S. Soto-Navarro¹, R. Merkel¹, G. Detweiler¹, T. Sahl¹, and A. Litherland², ¹E. (Kika) de la Garza Institute for Goat Research, Langston University, OK, ²AgResearch Grasslands, Palmerston North, New Zealand.

The manipulation of seasonal reproduction in goats for fall kidding allows for marketing of young meat goats during Christmas and Easter holiday seasons. Although meat goats are often reared on low to moderate planes of nutrition, high quality diets may be desirable for production of out-of-season meat goats. Fifty-eight (29 males and 29 females) fall born (October) Spanish kids with an initial average BW of 13.5 kg were used in an experiment with two 9-wk feeding phases (I and II), and individually housing. Goats consumed *ad libitum* prairie hay (L), dehydrated alfalfa pellets (M), or 70% concentrate diet (H), either throughout the 18-wk experiment (MM and HH) or with a diet change at the beginning of phase II (LM, LH, and MH). Four goats per treatment were slaughtered at the end of phase II. Body weight, hot and chilled carcass weights, dressing percentages were determined. Proportion of lean, fat, and bone tissues in the selected primal cuts (leg, rack and loin of a half carcass) were calculated from dissected weights. Body weight of slaughtered animals was 22.3 (SE 1.5), 19.7 (SE 1.8), 20.9 (SE 2.2), 24.6 (SE 1.7), and 23.3 (SE 1.7) kg, and mean dressing percentage was 49.2 (SE 1.4), 47.8 (SE 0.5), 43.5 (SE 0.6), 47.8 (SE 1.1), and 45.8% (SE 1.1) for HH, LH, LM, MH, and MM, respectively, being greater for treatments consuming H vs M in phase II. Chilled carcass weight was less ($P < 0.05$) for LM and LH than for MM, MH and HH (10.9, 9.1, 8.7, 11.4, and 10.2 kg for HH, LH, LM, MH, and MM respectively). Lean, fat and bone proportions of three primal cuts (leg, rack, and loin) were 63.6, 16.4, and 20.6% for HH; 67.0, 12.1, and 20.8% for LH; 67.0, 10.4, and 22.6% for LM; 62.5, 17.6, and 19.9% for MH; and 66.6, 11.6, and 21.7% for MM, respectively. The fat component of dissected primal cuts was greater ($P < 0.05$) for goats on H than M in phase II. In conclusion, pelleted high quality forage may support ADG of meat goats at least as great as concentrate-based diets, both with a constant nutritional plane and the low quality forage feeding. High concentrate diets appear to promote fattening beyond what would be expected from ADG.

Key Words: Goat, Carcass, Lean

43 Comparison of carcass component weights of Spanish and Tennessee Stiff-legged goats at different ages. C.O. Smith¹, J.M. Dzakuma, E. Risch, N. Beckford, and P.M. Johnson, ¹Prairie View A&M University, TX.

Two goat breeds (Spanish (SP) and Tennessee Stiff-legged (TS)) were studied for growth. After weaning at 70 days of age, 24 kids (12M, 12F) from each breed were divided into three groups of 8, individually penned, and fed three levels (100% or *ad libitum*, 85% and 70%) of an 18% crude protein ration. These breeds were classified as intermediate (SP) or small (TS) in size. Daily feed intake and bi-weekly weights were

collected until yearling age. Twenty four goats (2M and 2F goats from each breed and from each dietary level) were slaughtered at 6 mo of age and carcass data collected. The other 24 goats were slaughtered at 13 mo of age. The objective of this study was to compare differences in carcass component weights of SP and TS breeds. The following carcass cuts were studied: *Neck, Breast, Flank, Shoulder, Fore-shank, Leg, Loin* and *Rack*. The weights of these carcass components were expressed as a proportion of their respective cold carcass weights. With the exception of *Shoulder* at 6 mo (.130, .116 and .127), *Fore-shank* at 12 mo (.188, .193 and .181) and *Leg* at 12 mo (.229, .231 and .218), where differences ($P < .05$) were observed in the carcass components of goats maintained at 70%, 85% and 100% dietary levels, respectively, statistical differences were not observed in the weights of the other carcass components at the two slaughter ages ($P > .05$). Differences ($P < .05$) were observed only in the *Neck* component of SP and TS breeds, respectively (.047 vs .059), slaughtered at 6 mo age. All other carcass components of goats of SP and TS breeding slaughtered at 6 or 13 mo of age were not different ($P > .05$). Body weights of SP and TS breeds, respectively, were similar ($P > .05$) at 6 mo (19.1 vs 18.6 kg) and at 13 mo (26.1 and 25.9 kg). Despite the significantly small size ($P < .001$) of the TS breed compared to the SP breed at birth (2.5 vs 3.2 kg) and at weaning (10.1 vs 12.8 kg), proportionately similar carcass component cuts were obtained from either breed at 6 and 12 mo slaughter ages.

Key Words: Tennessee Stiff-legged goats, Spanish goats, Carcass components

44 Comparative study of organ weights of Spanish and Tennessee Stiff-legged goats at different ages. J.M. Dzakuma¹, E. Risch, C.O. Smith, N. Beckford, and P.M. Johnson, ¹Prairie View A&M University, TX.

Two goat breeds (Spanish (SP) and Tennessee Stiff-legged (TS)) were studied for growth. After weaning at 70 days of age, 24 kids (12M, 12F) from each breed were divided into three groups of 8, individually penned, and fed three levels (100% or *ad libitum*, 85% and 70%) of an 18% crude protein ration. These breeds were classified as intermediate (SP) or small (TS) in size. Daily feed intake and bi-weekly weights were collected until yearling age. Twenty four goats (2M and 2F goats from each breed and from each dietary level) were slaughtered at 6 mo of age and carcass and offal data collected. The other 24 goats were slaughtered at 13 mo of age. The objective of this study was to evaluate differences in organ weights of these goats in relation to their mature weights (SP=47.5 and TS=36.8 kg) and their feed intake amounts. The following organs weights were studied: *Lung, Liver, Spleen, Heart, Small Intestine, Large Intestine* and *Kidney*.

Statistically significant differences were observed in some organ weights for goats maintained at the 70%, 85% and 100% levels, respectively: *Lung* wt at 6 mo (187.3, 208.1 and 248.6 g); *Liver* wt at 6 mo (254.8, 275.4 and 358.5 g) and 13 mo (350.9, 299.2 and 396.4 g); *Heart* wt at 6 mo (66.4, 73.7 and 89.5 g); *Small Intestine* wt at 6 mo (412.5, 500.4 and 492.8 g); and, *Large Intestine* wt at 6 mo (568.3, 594.0 and 659.2 g). No differences were observed in *Spleen* or *Kidney* wts at both slaughter ages. Differences which were observed at 6 mo, disappeared at the 13 mo slaughter age.

Average daily feed intake for SP and TS goats, respectively, at 6 mo (.47 vs .49 kg) and 13 mo (.38 vs .38 kg) were not statistically different. Neither were there any differences in organ weights. Growth weights at 6 mo (19.1 vs 18.6 kg) and 13 mo (26.1 and 25.9 kg) for SP and TS breeds, respectively, were not different ($P > .05$). It would appear that even though these goats were significantly different ($P < .001$) in weight at birth (3.2 and 2.5 kg) and at weaning (12.8 vs 10.1 kg), within the period of observation, the TS ate the same amount and grew almost as fast as the SP. At the end of the study period, organ sizes in these two breeds were not statistically different.

Key Words: Tennessee Stiff-legged goats, Spanish goats, Organs

45 Comparisons of carcass characteristics of Spanish and Myotonic goats. B.L. Sayre*, S. Wildeus, J.R. Collins, and M.P.L. Dismann, *Virginia State University, Petersburg.*

Myotonic goats have a short, wide stature, which gives the appearance of heavier muscling, and limited data has suggested the Myotonic has a larger rib eye area (REA) and higher lean to bone ratio. The objective of this experiment was to compare carcass characteristics of Myotonic and Spanish goats. Intact male Myotonic (n=8) and Spanish (n=8) goats

were fed grass hay ad lib supplemented with a 16% CP corn/cottonseed mixed diet at 2% of body weight and weighed every two weeks. After 200 d on feed (approx. 295 d of age), the animals were slaughtered, and hot and chilled carcass weights, REA, backfat (BF), kidney and pelvic (KP) fat, and weights of primal cuts were recorded. A subset (n=4/breed) of carcasses were separated into lean, fat, and bone portions. Spanish had a greater ADG (114 vs. 92 g/d; $P<.05$), final weight (39 vs. 29 kg; $P<.001$), and had heavier carcasses (17 vs. 14 kg; $P<.001$). Spanish had less BF (1.0 vs. 2.0 mm; $P<.001$), but greater KP fat (3.7 vs. 2.4%; $P<.001$). Myotonic had a greater dressing percentage (46 vs. 43%; $P<.001$). Spanish had greater actual weights of primal cuts, but when adjusted for carcass weight, the breeds did not differ (37, 18, 13, 32% for shoulder, rack, loin, and leg, respectively). Spanish had greater REA (10.7 vs. 9.0 cm^2 ; $P=.05$), and a trend toward greater longissimus dorsi (LD; 468 vs. 371 g; $P=.09$). After REA and LD were adjusted for carcass weight, the breeds did not differ. Likewise, the percent of lean, fat, and bone (59, 15, 26%, respectively) and the lean:fat and lean:bone ratios (4.1 and 2.3, respectively) were not statistically different between breeds. These data indicate that Spanish grew faster and produced a larger carcass than Myotonic. Myotonic had a higher dressing percentage and a different pattern of fat deposition. The percentage of lean and lean to bone ratio did not differ between breeds. Additional research is needed to characterize carcass traits in the Myotonic goat.

Key Words: Meat goat, Carcass characteristics, Myotonic goat

46 The effects of feeding a fungal extract (Amaferm) in a finishing diet on growth performance, feed efficiency and carcass characteristics of lambs. S. L. Campbell*¹ and S. P. Jackson¹, ¹Texas Tech University, Lubbock.

The objectives of this study were to determine differences between breed and treatment for growth performance, feed efficiency and carcass characteristics of lambs either fed a 13% finishing diet (control) or a similar diet (AMF) containing the fungal extract *Aspergillus oryzae* (Amaferm). Thirty-six Dorper x Rambouillet (DFW) cross lambs (mixed sex) and 32 Rambouillet (FW) lambs (mixed sex) were blocked by sex and breed and divided and randomly assigned to 8 pens. Treatments were randomly assigned to each pen. Initial weights were approximately 33 kg and final weights 50 kg for females and 55 kg for males. Each diet was fed to 4 pens, which were of two breed types. There were no differences observed for ADG between lambs on AMF and the control diets (.28 vs .26 kg; $P = .46$) or between FW and DFW (.27 vs .29 kg; $P = .43$) lambs. Gain to feed ratios (G:F) did not differ ($P = .9$) between lambs on AMF (.15) and the control diets (.148) or between breeds ($P = .44$). The ADFI was not different between breeds ($P = .5$) or between treatments ($P = .19$). Wethers from both treatments were slaughtered and carcass data was collected ($n = 33$) on 17 wethers from the AMF treatment and 16 wethers from the control treatment. Quality grade, flank streakings, yield grade, fat thickness and carcass weight did not differ ($P > .3$) between treatment or breed. Lambs on AMF had higher ($P = .008$) leg scores than the lambs on the control diet. No other differences were associated with the treatment. In this study, Amaferm addition to the diet did not affect ADG, feed efficiency, or feed intake. The only carcass parameter that was affected was leg score, which was higher for lambs fed Amaferm.

Key Words: Amaferm, Sheep, Growth

47 Supplementation of Boer and Spanish kid goats on millet and Bermudagrass pastures. 1. Growth and linear measurements. L. C. Nuti*¹, F. Pinkerton², and S. Gebrelul³, ¹Prairie View A&M University, TX, ²The Goat Works, Grapeland, TX, ³Southern University, Baton Rouge, LA.

The objective was to determine the growth and changes in body dimensions of meat goats finished on pasture or supplemented with grain on pasture. Boer-cross (n=80) and Spanish (n=80) winter-born kid goats were weighed and sorted in June into 16 body weight groups by breed and assigned to pasture treatments of spring-planted millet, established coastal bermudagrass, coastal bermudagrass plus 0.23 kg corn/goat/d, and coastal bermudagrass plus 0.45 kg corn/goat/d. Each replication and treatment group had 10 goats on each 1.1-hectare pasture plot during the 105-d feeding trial. One half of the animals (one of each replicate pair) were shipped to San Angelo, TX, for auction sale and the other half were transported to Baton Rouge, LA for humane sacrifice, carcass evaluation, fabrication, and sensory tests. All goats were graded live using previously established conformation selection standards. Goats

were measured for linear traits using calipers and tape measure. Boer goats fed 0.45 kg corn per day were heavier ($P<0.05$) at slaughter than Spanish goats at the same supplementation level or goats in other diet groups, with ADG of 0.1 kg. Boer and Spanish goats fed 0.45 kg corn per day were longer ($P<0.05$) in the rump, loin, chine; larger in heart girth, and wider through the shoulder than goats finished on pasture. Differences in live conformation score, chest width and depth, barrel circumference, and wither and hip heights of goats from different breeds or diets were minimal. Grain supplementation for pasture finishing of goats increased live weight gains and many of the linear body measurements indicating larger skeletal size and tissue deposition.

Key Words: Meat goats, Pasture, Corn

48 Supplementation of Boer and Spanish kid goats on millet and Bermudagrass pastures. 2. Carcass and primal cut evaluation. L. C. Nuti¹, K. W. McMillin*², F. Pinkerton³, and O. Phelps⁴, ¹Prairie View A&M University, TX, ²Louisiana State University Agricultural Center, Baton Rouge, ³The Goat Works, Grapeland, TX, ⁴Southern University, Baton Rouge, LA.

The objective was to determine differences in carcass traits and primal cuts from goats finished on pasture or supplemented with grain on pasture. Boer-cross (n=40) and Spanish (n=40) winter-born kid goats were humanely sacrificed after 105-d on one of four pasture regimes (spring-planted millet, established coastal bermudagrass, bermudagrass plus 0.23 kg corn/goat/d, or bermudagrass plus 0.45 kg corn/goat/d) and transporting from TX to Baton Rouge. Carcasses were chilled at 2C for 18 hr before evaluation of conformation, kidney and pelvic fat, external fat score, subjective flank color, and objective color measurements (L^* , a^* , b^*) of flank and leg lean. Each carcass was fabricated into standardized primal cuts based upon USDA IMPS barbeque style. Cuts from one side were deboned for boneless cut yield. Dressing percentages were 2.5 to 7% higher ($P<0.05$), resulting in heavier ($P<0.05$) hot and cold carcass weights, for goats receiving supplemental grain on pasture. Carcass conformation, kidney and pelvic fat percentage, and external fat score were higher ($P<0.05$) in carcasses from goats receiving supplemental grain. Carcass shrinkage during chilling was greatest ($P<0.05$) at 6% for Spanish goats on millet pasture. Subjective and objective flank color was not different with breed or diet. Leg L^* was less ($P<0.05$) and a^* (redness) and b^* (yellowness) were higher ($P<0.05$) in carcasses from goats finished with corn on pasture. The heavier carcasses of grain-supplemented goats yielded higher ($P<0.05$) weights of total cuts, but carcasses of Boer-cross goats on pasture had higher ($P<0.05$) percentages of total cuts, primal cuts, and bone-in cuts than other carcasses. Supplemental feeding of corn on pasture increased fatness of carcasses, but did not greatly influence color or primal and bone-in cut yields on a percentage of carcass weight basis.

Key Words: Goats, Carcass, Primal cuts

49 Supplementation of Boer and Spanish kid goats on millet and Bermudagrass pastures. 3. Proximate composition and trained sensory evaluation of leg cuts. L. C. Nuti¹, K. W. McMillin*², F. Pinkerton³, N. L. Dawkins⁴, and J. Gager⁵, ¹Prairie View A&M University, TX, ²Louisiana State University Agricultural Center, Baton Rouge, ³The Goat Works, Grapeland, TX, ⁴Unilever Corporation, Memphis, TN, ⁵Southern University, Baton Rouge, LA.

This study was conducted to determine the relative proximate composition and sensory traits of meat from goats finished on pasture or supplemented with grain on pasture. The leg cuts from Boer-cross (n=40) and Spanish (n=40) winter-born kid goats fed for 105-d on one of four pasture regimes (spring-planted millet, established coastal bermudagrass, bermudagrass plus 0.23 kg corn/head/d, or bermudagrass plus 0.45 kg corn/head/d) were evaluated for proximate composition and trained sensory analysis after humane sacrifice, carcass evaluation, and cut fabrication. Carcasses were chilled at 2C for 18 hr before evaluation and fabrication. Leg cuts were deboned, vacuum packaged, and frozen for 6 mo at -12°C before sensory analysis. Cuts were evaluated in 11 sessions by a 10-member trained panel. Proximate analyses were determined on 36 samples from each breed using AOAC procedures. There were no differences in sensory traits with stewing or oven roasting for meat preparation. Meat from Spanish goats had more ($P<0.05$) initial juiciness and flavor than meat from Boer-cross goats. Meat from goats fed 0.23 kg corn per day had less ($P<0.05$) initial juiciness than meat from goats fed 0.45 kg corn per day. Sustained juiciness and overall tenderness were more ($P<0.05$) in meat from goats fed 0.45 kg corn per day. Meat

from Boer-cross goats had increased ($P < 0.05$) lipid and ash. Feeding corn increased ($P < 0.05$) ash and protein in meat from Boer-cross goats and increased ($P < 0.05$) moisture in meat from Spanish goats compared with pasture diets. Meat composition appeared to influence juiciness and flavor, but not tenderness of meat from goat leg cuts.

Key Words: Goat meat, Proximate composition, Sensory evaluation

50 Supplementation of Boer and Spanish kid goats on millet and Bermudagrass pastures. 4. Market response and economic returns. L. C. Nuti¹ and F. Pinkerton*², ¹*Prairie View A&M University, TX*, ²*The Goat Works, Grapeland, TX*.

The actual market price of kid goats with different feeding regimes was determined by transporting Boer-cross ($n=40$) and Spanish ($n=40$) winter-born kid goats to San Angelo for sorting into groups of 10 head for auction sale after 105-d on one of four pasture regimes (spring-planted millet, established coastal bermudagrass, bermudagrass plus 0.23 kg

corn/goat/d, or bermudagrass plus 0.45 kg corn/goat/d). Live goat conformation was determined by an experienced evaluator using previously determined conformation selection criteria. Highest sale prices per kg were received for Boer-cross kid goats that had received supplemental corn. Spanish goats had lower conformation selection classifications and received lower sale prices than Boer-cross goats within each of the dietary regimes. The three year seasonal auction prices for goats have shown higher prices in March, April, and May due to lower numbers marketed and lower prices, June through October, with increased numbers of goats sold. The numbers of goats slaughtered in federal plants and imported carcasses have steadily increased in the past three years, with increased marketing of goats due to drought conditions. Research on economic effects of more direct marketing channels, management practices and seasonality of production would improve opportunities for market goat producers.

Key Words: Goats, Market prices, Economics

Ruminant Production and Forages I

51 Influence of dietary phosphorus and trace mineral chelates on growth and reproduction in beef cattle. M. E. Tiffany*, J. W. Spears, and K. E. Lloyd, *North Carolina State University, Raleigh*.

Two 2-yr experiments were conducted to determine the effects of dietary P and trace mineral source on growth and reproduction of beef cattle. Experiments were designed as 2×2 factorial arrangements, and data were analyzed using the GLM procedures of SAS. In Exp.1, 104 pregnant Angus cows were stratified by age and production records and randomly assigned to treatment. Treatments were free choice minerals containing either no supplemental P (-P) or supplemental P (+P) and inorganic trace minerals (ITM) or trace mineral proteinates (TMP; 50% of Cu and Mn and 66% of Zn provided as proteinates). Cattle grazed tall fescue pasture during the grazing season, and were fed silage, hay and protein supplement during the winter. Cows were synchronized and those showing estrus were bred AI followed by a natural mating period. Weaning weights were not affected in yr 1, but TMP calves weaned heavier than ITM calves in yr 2 ($P < 0.05$; 258.1 vs 240.5 kg). In yr 1, pregnancy rate ($P < 0.05$) was higher during AI breeding period in cows receiving TMP than those receiving ITM (74.5 vs 50.5 %). In yr 2, TMP improved pregnancy rate in +P (64.0 vs 46.2 %), but not in -P (38.1 vs 45.8 %) cows. In Exp.2, 55 Angus and 57 Simmental cows were randomized by breed, calving date and age of dam, and assigned to treatment groups as described for Exp.1. Grazing and wintering regimen was similar to Exp.1. In yr 1 of Exp. 2, calves born to dams receiving TMP weaned heavier than ITM calves ($P < 0.05$; 249.5 vs 239.5 kg). Overall pregnancy rate was not affected by source in yr 1, however in yr 2, AI and overall pregnancy rate were affected by a breed \times source interaction ($P < 0.05$ and $P < 0.06$, respectively). TMP improved pregnancy rate in Simmental but not Angus cows. Phosphorus supplementation did not affect weaning weights in either year. These results suggest that replacing part of the mineral supplement with TMP improves the performance and reproduction in beef cattle.

Key Words: Phosphorus, Trace Mineral Chelates, Beef Cattle

52 Effects of selenium supplementation on brood cows in southern Arkansas. S. A. Gunter*, P. A. Beck, J. S. Weyers, and J. M. Phillips, *Southwest Research & Extension Center, University of Arkansas, Hope*.

The purpose of this study was to examine the effects of supplemental Se from two sources, sodium selenite (SS) or organically bound Se (OS; SEL-PLEX[®] by Alltech, Inc., Lexington, KY). On 2 December 1999, 120 spring calving cows (calving date, 26 February 2000) were divided into six groups by breed type, body condition score (BCS), BW, and age (two groups/treatment). The following three treatments were applied by providing ad libitum access to a custom blended mineral supplement: 1) no Se (Control), 2) 26 ppm Se from SS, and 3) 26 ppm Se from OS. All six groups of cows had ad libitum access to hay plus limited access to interseeded wheat, rye, and ryegrass paddocks from December until May (2 d/wk; 7 hr/d; total paddock size = 2.4 ha). On 1 May, the cows were allowed access 5.1-ha bermudagrass pastures until September 27. Cows

were bled to determine whole blood Se (WBS) and glutathione peroxidase activity (GTA) in December, February, and April, calves were bled on their birthday and in May. The 60-d breeding season began on April 25. Data were analyzed as a completely randomized design; pasture was the experimental unit. Cow BCS, BW, and conception rates did not differ ($P > 0.16$) between Control and Se supplemented cows or sources. Calf birth weight, calving ease and agility scores, BW, ADG, and 205-d adjusted-weaning-BW did not ($P > 0.16$) between Control and Se supplemented or sources. Calves born from cows supplemented with OS had greater ($P = 0.04$) vigor scores (4.7; 2 = listless, 5 = active and alert) than calves from SS cows. Whole blood Se in cows did not differ ($P > 0.26$) in December, but was greater ($P < 0.01$) in Se supplemented cows compared to Control cows in February and April. In February cows supplemented with OS had greater ($P < 0.01$) WBS than SS supplemented cows. The GTA in cows differed ($P = 0.03$) in all months between Control and Se supplemented cows, but did not differ ($P > 0.32$) between sources. In calves at birth and in May, WBS and GTA was greater ($P < 0.09$) in Se groups than Controls and was greater ($P < 0.03$) in OS than SS calves. Organic Se supplementation usually improved WBS, GTA, and calf vigor scores compared to SS and Control cows and nursing calves.

Key Words: Beef Cows, Selenium, Gutathione Peroxidase

53 Effects of vitamin E level and selenium form on beef cattle performance and carcass characteristics. B. S. Clyburn*¹, C. R. Richardson¹, M. F. Miller¹, C. E. Cloud¹, J. H. Mikus¹, and G. V. Pollard¹, ¹*Texas Tech University, Lubbock*.

Effects of vitamin E level and selenium source on performance and carcass characteristics were evaluated in a completely randomized design involving 96 Angus crossbred steers (374 kg \pm 34). Steers were randomly assigned (four steers per pen and four pens per treatment) to one of six treatments: basal diet containing no added vitamin E or selenium (control), organic form of selenium and vitamin E levels of 500, 250, or 125 IU, or an inorganic form of selenium and vitamin E level of 500 or 250 IU. Organic selenium was supplied using high selenium yeast, while the inorganic diets utilized sodium selenite; both provided 3 mg of selenium per head per d. Means were separated using orthogonal contrasts with pen as the experimental unit. Typical feedlot finishing diets fed during this experiment were isonitrogenous, isocaloric, and formulated to meet or exceed requirements (NRC, 1996) for CP, calcium, phosphorus, and vitamin A. Individual weights were recorded at 28 d intervals and a final weight was determined on d 103. Performance variables measured were ADG, DMI, and feed efficiency (FE). Carcass variables measured included hot carcass weight (HCW), dressing percentage (DP), longissimus muscle area (LMA), final yield grade (FYG), fat thickness, kidney, pelvic and heart fat percentage, and marbling score (MS). Steers receiving organic selenium responded with an improvement ($P < 0.10$) in performance during the first 56 d for ADG, DMI, FE, neither, selenium source nor vitamin E level affected performance over the entire 103 d experiment. Neither selenium source nor vitamin E level affected ($P > 0.10$) HCW, FYG, fat thickness, or MS. Cattle receiving inorganic selenium and 250 IU of vitamin E had a greater ($P < 0.10$) LMA. These

results indicate that organic selenium improved animal performance during the first 56 d. However, carcass quality measurements were similar among treatments at the conclusion of the 103 d study.

Key Words: Vitamin E, Selenium, Cattle

54 Nitrogen utilization and performance in ruminants fed oscillating dietary protein levels. S. J. Simpson*, J. P. Fontenot, and R. K. Shanklin, *Virginia Polytechnic Institute and State University, Blacksburg, VA.*

Experiments were conducted to examine the effect of 48 h oscillation of two levels of low ruminally degradable dietary CP on N metabolism in lambs and performance of steers. In Exp. 1, a metabolism trial was conducted with 28 lambs (31 kg), allotted to four different diets: 8% CP, 10% CP, 12% CP, and 8% and 12% CP diets oscillated every 48 h (8/12%). Ruminant fluid and blood samples were taken at the end of collection and again 2 d later. In Exp. 2, 24 crossbred steers (228 kg) were allotted to four diets: 1) 7.5% CP, 2) 9% CP, 3) 10.5% CP, and 4) 7.5% and 10.5% CP diets oscillated every 48 h (7.5/10.5%). Feed intake was measured, and ADG and gain to feed ratio were calculated. Cattle were weighed every 14 d and blood samples were taken every 28 d. In Exp. 1, N retention was lowest ($P < 0.05$) for the lambs fed the 8% CP diet, with no differences among lambs fed the other diets. Differences in urinary N excretion accounted for most of the differences in total N excretion. Ruminant $\text{NH}_3\text{-N}$ and BUN levels were greater in animals fed higher amounts of CP. Ruminant pH and VFA concentrations were not affected by diet. In Exp. 2, average daily gain was lowest for cattle fed the 7.5% CP diet. No significant difference was evident for ADG between steers fed the 7.5/10.5% CP oscillating, the 9%, and the 10.5% CP diets. Gain to feed ratio was lower ($P < 0.05$) for steers fed the 7.5% CP diet compared to steers fed the other diets. Blood urea N level was higher for cattle fed the 10.5% CP diet than those fed the two lower CP levels, and differences were usually significant. No consistent significant difference in BUN levels existed between steers fed the 7.5/10.5% CP oscillating diet and those fed the 9% and 10.5% CP diets continuously. Oscillating two levels of low ruminally degradable dietary CP every 48 h had no significant effect on N retention in lambs nor on the performance of steers, compared to animals fed the same or higher level of CP continuously in these experiments.

Key Words: Protein, Ruminants, Environment

55 Effects of monensin and lasalocid on performance and mineral metabolism of wethers fed bermudagrass hay with a high phosphorus concentration. S. M. Williamson*, E. B. Kegley, D. G. Galloway, T. J. Wistuba, and K. P. Coffey, *University of Arkansas, Fayetteville.*

Eighteen crossbred wethers (initial BW 34 ± 2.6 kg) were used to evaluate the effects of monensin or lasalocid on performance and mineral metabolism of growing lambs. Wethers were randomly assigned to the 3 treatments, control, 2.3 mg monensin/d, or 2.3 mg lasalocid/d. A corn based supplement (100 g) was individually fed once daily throughout the experiment to administer monensin or lasalocid. Lambs were allowed ad libitum access to chopped bermudagrass hay and water while housed in individual pens. The average phosphorus concentration of the bermudagrass hay fed throughout the study was 0.39%. After 35-d, lambs were moved to metabolism crates for total feed, feces, and urine collection. A 7-d collection period followed a 7-d crate adaptation period. After the collection period, lambs were returned to individual pens and continued on dietary treatments until d 77 or 78, when lambs were slaughtered. Dietary treatment did not affect ($P > 0.10$) growth performance of lambs or DM digestibility during the metabolism phase. Blood phosphorus, calcium, magnesium, potassium, iron, copper, and zinc concentrations (d 0, 14, 28, 35, 49 and 77) were not affected ($P > 0.10$) by ionophore supplementation. Salivary phosphorus concentrations (d 0, 35, 49, and 77) were not affected (10.8 mg/dl; $P > 0.10$) by ionophore supplementation. Fecal magnesium excretion was lower (0.84 vs 1.05 g/d; $P < 0.10$) and urinary Mg excretion was greater (0.601 vs 0.383 g/d; $P < 0.001$) for monensin supplemented lambs when compared to the control lambs. Magnesium absorption, expressed as g/d ($P < 0.10$) and as a percentage of intake ($P < 0.01$), was greater for the monensin fed lambs compared to the control lambs (1.17 vs 0.96 g/d and 58 vs 48%, respectively). Although there were no effects of ionophore supplementation on the retention of phosphorus (0.9 g/d and 26%), calcium, magnesium, or

potassium, magnesium absorption was increased with monensin supplementation.

Key Words: Ionophores, Mineral metabolism, Lambs

56 In vitro ruminal microorganism fermentation of cornstarch and Sudan grass mixtures using two sources of multiple stabilized enzyme products. A. Gueye*¹, C. Richardson¹, and D. Haverkamp², ¹*Texas Tech University, Lubbock,* ²*Natur's Way Inc.*

A completely randomized design in vitro laboratory experiment was conducted to determine the effects of two sources of multiple stabilized enzymes (MSE) on dry matter (DMD) and organic matter digestibility (OMD) of diets containing cornstarch (CS) and Sudan grass (SG). Treatments were arranged as a 3 x 5 factorial to provide three sources of MSE (control, MSE 1, and MSE 2) and five diet mixtures A, B, C, D, E (95% CS + 0% SG; 90% CS + 5% SG; 85% CS + 10% SG; 80% CS + 15% SG and 75% CS + 20% SG, respectively). Diets were ground to pass through a 1-mm screen and samples of approximately 1.0 g were placed in 100 mL digestion tubes. Fermentations (50 mL) were conducted using medium that contained 30% (vol/vol) ruminal fluid in 100 mL digestion tubes. Tubes were incubated for 12, 24, 48 and 96 h in a 39 C water bath. After 12 h of incubation, DMD of diet B, treated with MSE 2 was ($P < 0.05$) higher than that of the control and that of diet B treated with MSE 1. Dry matter digestibility was ($P < 0.05$) higher for diet A treated with MSE 2 and diet A treated with MSE 1 compared to the control, after 24 h incubation. For the same time period diet B treated with MSE 2 had a numerically higher DMD (72.8 vs. 66.3%) than the control. After 48-h incubation time diet B treated with MSE 2 tended ($P < 0.07$) to have a higher DMD than the control. After 96 h of incubation, neither source of MSE had an effect on DMD or OMD. Following 12h and 24 h of incubation, OMD followed the same trend observed in DMD for the different diets. Diet B treated with MSE 2 was ($P < 0.03$) higher in OMD compared to the control after 12 h of incubation. After 24 h incubation, MSE 2 improved ($P < 0.01$) OMD of diet A compared to the control. These results suggested greater potential for effects of MSE 2 with diets very low in fiber such as with 0 or 5% forage.

Key Words: Starch, Sudan grass, Digestibility

57 Growth and thermoregulatory traits of Hereford and Senepol steers on orchardgrass or endophyte-infected tall fescue diets. R. Browning, Jr.*¹, T. Payton, and N. Whittingham, *Tennessee State University, Nashville.*

Heat-sensitive Hereford (278 kg; n = 30; H) and heat-tolerant Senepol (261 kg; n = 28; S) steers were fed endophyte-infected tall fescue (TF) or orchardgrass (OG) to assess breed differences in sensitivity to fescue endophyte toxicity in a 2x2 factorial experiment. All steers were fed the same OG hay before being placed on a diet of TF hay and TF seed or a different source of OG hay with OG seed added. The study was conducted from June to October of 2000 with experimental diets started in July. Body weights, skin temperatures, and respiration rates were measured every 2 wk for 16 wk. Periodic observations (n = 53) on shade usage by steers during daylight hours were recorded over 18 d from August to October. Pretreatment monthly ADG were similar among groups (.76, .69, .88, and $.83 \pm .11$ kg/d for HOG, HTF, SOG, and STF, respectively). Monthly ADG was affected ($P = 0.05$) by breed x diet during the first month of treatment; ADG were lower ($P < 0.001$) for HTF and STF (-0.55 and -0.03 ± 0.08 kg/d) than for HOG and SOG (0.31 and 0.52 ± 0.08 kg/d). During the second month, ADG did not differ. Breed x diet influenced ($P < 0.001$) ADG during the third month of treatment; ADG was greater ($P < 0.001$) for STF (0.92 ± 0.08 kg/d) than for HTF and SOG (0.54 and 0.46 ± 0.08 kg/d). Over 12 wk of dietary treatments, breed x diet affected ($P < 0.001$) ADG with HTF having lower ADG (0.30 ± 0.03 kg/d) compared to HOG, SOG, and STF (0.61, 0.56, and 0.52 ± 0.03 kg/d, respectively). Respiration rates were affected ($P < 0.001$) by breed x diet x week. Before dietary treatment, rates were higher ($P < 0.001$) for H than S. During dietary treatment, peak respiration rates were lower ($P < 0.001$) for SOG (15 ± 1 breaths/15 s) compared to STF, HTF, and HOG (32, 30, and 27 ± 1 breaths/15 s). Diet x time affected ($P < 0.001$) skin temperature. Skin temperature increased ($P < 0.001$) from before treatment to during treatment in TF steers, but was unaltered in OG steers. Shade usage during dietary treatment was affected ($P < 0.001$) by breed x diet; means

were $5 \pm 4\%$ for SOG, $53 \pm 7\%$ for HOG, $77 \pm 3\%$ for STF, and $91 \pm 6\%$ for HTF. Results suggest that heat tolerance in steers can modify animal responses to endophytic tall fescue.

Key Words: Fescue Toxicosis, Cattle Breeds, Heat Tolerance

58 Effects of kelp meal, kelp extract and *Erwinia* on IVDMD of corn grain. K. E. Barrett*, D. U. Thomson, J. R. Blanton, Jr., M. D. Abney, and K. E. Levitt, *Texas Tech University, Lubbock.*

Samples of corn grain with and without kelp meal and kelp extract were analyzed for IVDMD after a 72 h digestion in two trials. Trial 1 consisted of three treatments: 1) 100% corn grain, 2) 99% corn grain with 1% kelp meal, and 3) 98% corn grain with 2% kelp meal. Each treatment was inoculated with 1 mL of five different *Erwinia* concentration levels of 10^4 , 10^5 , 10^6 , 10^7 , and 10^8 cells. This trial was run in triplicate. One mL samples of fluid were withdrawn at 24, 28, and 72 h. Each fluid sample was then plated to calculate *Erwinia* survivability. Trial 2 consisted of three treatments: 1) 100% corn grain, 2) 99% corn grain with 1% kelp extract, and 3) 98% corn grain with 2% kelp extract. Each treatment was conducted in multiples of 7. After digestion, samples were dried for 72 hours at 50°C . Samples were weighed after reaching thermal equilibrium and analyzed for IVDMD. Data were analyzed using the GLM procedures of SAS. In Trial 1, the average IVDMD of all samples that contained no kelp meal was 90.39%. The IVDMD was reduced when kelp meal was added at 1% to 78.8% ($P < .01$). IVDMD was further reduced when kelp meal was added at 2% to 72.6% ($P < .01$). The average digestibility when *Erwinia* was added at concentrations at 10^4 , 10^5 , and 10^6 were not significantly different from each other. The average digestibility when a concentration of 10^8 was added was different from 10^4 , 10^5 , and 10^6 ($P < .06$). Additionally, the average digestibility when a concentration of 10^7 was added was different from 10^6 ($P < .07$). In summary, the addition of kelp meal caused a marked reduction in IVDMD. The addition of *Erwinia* above a concentration of 10^7 also caused a reduction (6.1%) in IVDMD. In trial 2, the addition of kelp extract caused a decrease in IVDMD by 20.2% ($P < .01$) and 33.6% ($P < .01$) when added at 1% and 2% respectively. A possible explanation for a reduction in IVDMD due to the addition of kelp meal or extract is a decrease in survival of beneficial microorganisms. Likewise, competitive inhibition is a possible explanation for the observed reduction in IVDMD due to added *Erwinia*.

Key Words: Beef cattle, Kelp, In vitro digestibility

59 Effect of frequency of hay or corn supplementation on beef heifers grazing ryegrass. B. J. Rude*, K. C. Hanson, and D. J. Lang, *Mississippi State University, Starkville.*

The objective of this study was to evaluate two different supplements fed at three frequencies to replacement heifers while grazing ryegrass. All heifers were fed 112 d and weighed every 28 d beginning January 6, 2000. Forty nine heifers (261 ± 30.6 kg BW) grazed eight 2 ha ryegrass paddocks (initial stocking rate of 913 kg/ha) and were divided equally into one of seven treatments: 1) no supplement (N); 2) 1.1 kg/(d-heifer) corn fed daily (DC); 3) an average of 1.1 kg/(d-heifer) corn fed thrice weekly (TC); 4) ad lib access to 80:20 corn:salt (AC); 5) 0.5 kg/(d-heifer) hay fed daily (DH); 6) an average of 0.5 kg/(d-heifer) hay fed thrice weekly (TC); and 7) ad lib access to hay (AH). Animals were group fed at the given frequency, and heifer served as experimental unit. Animals were rotated weekly among eight paddocks (one empty paddock each week) to minimize paddock effect. Blood was collected every 28 d and analyzed

61 Effect of Southeast Pride Blue Tag Health and Management Program on the gain of postweaned feeder calves. J. B. Neel*, W. W. Gill¹, M. D. Davis¹, M. W. Salisbury¹, and T. M. Steen², ¹*University of Tennessee*, ²*Tennessee Farmers Cooperative.*

Ninety eight (98) Angus, Hereford and Angus x Hereford calves, born in the winter of 1999, were utilized to compare the effect of Southeast Pride Blue Tag health and management program (SEP) on the post-weaning gain of feeder cattle to a control (CON) group of calves that remained on their dams. The calves were from dams that completed a reproduc-

ive management trial at the University of Tennessee, Highland Rim Experiment Station, Springfield, Tn. The calves were previously maintained with their dams on drought stricken pastures supplemented with mixed grass hay and creep feed. The calves were weighed on 8-16-99 and assigned to either the SEP (22 heifers and 32 steers) or CON (24 heifers and 20 steers). The SEP calves weighed 204 kg. and were maintained in dry lot, fed a concentrate at 1.5 percent of body weight with access to free choice mixed grass-clover hay in large bales while CON calves weighed 203 kg. and continued under previous management. The trial ran for 53 days, 8-16-99 to 108-99. Weights were recorded at 14-day

Key Words: supplementation, ryegrass, heifer

60 Previous grazing treatment effects on cattle feedlot performance and carcass traits. J. J. Cleere*¹, A. D. Herring¹, J. W. Holloway², H. Lippke², C. R. Long³, F. M. Rouquette³, and B. G. Warrington², ¹*Texas Tech University, Lubbock*, ²*Texas A&M University, Uvalde*, ³*Texas A&M University, Overton.*

Spring born steers ($n = 89$) and heifers ($n = 36$) were assigned to two stocking rates in December 1999 at the Texas Agricultural Experiment Stations in Overton (OVT) and Uvalde (UVL) to create different growth rates. Animals were either 50%, 75% or 100% Angus and were continuously stocked on TAM 90 (RG) annual ryegrass (*Lolium multiflorum*) in UVL at 2.5 to 4.0 animals/ha (LO) or 4.7 to 7.2 animals/ha (HI). Calves grazed Maton rye (*Secale cereale*) and (RG) in OVT at 3.0 animals/ha (LO) or 6.2 animals/ha (HI). Cattle were placed at the Texas Tech All-tech Research feedlot in May 2000 to determine the influence of location (LOC) and stocking rate (SR) on feedlot performance and carcass characteristics. Cattle were randomly assigned to pens by LOC, breed type (Angus, Angus-cross), SR, sex and weight with 4 to 7 animals per pen. All analyses included initial feedlot weight as a covariate. Analysis by pen indicated no SR, LOC or LOC x SR effects for average daily intake or feed conversion and no SR or LOC x SR effects for average daily gain (ADG) ($P > 0.05$). However, OVT animals had a higher ADG (1.82 ± 0.05 kg) than the UVL (1.61 ± 0.07 kg) animals ($P < 0.05$). Individual animal analyses also used pen as the experimental unit and included the separation of steers and heifers due to a lack of heifer representation from UVL. Among the OVT heifers, SR did not affect ADG, hot carcass weight (HCW), marbling (MARB), fat thickness (FT), adjusted fat thickness (AFT), kidney pelvic heart fat (KPH), rib eye area (REA) or yield grade (YG) ($P > 0.05$). LOC affected ADG, HCW, MARB, FT, AFT and REA in the steers ($P \leq 0.05$). OVT cattle had increased ADG (1.81 ± 0.06 kg), HCW (344.11 ± 5.03 kg), FT (1.65 ± 0.11 cm), AFT (1.83 ± 0.10 cm), REA (75.77 ± 1.31 cm²) and less MARB (505.67 ± 31.65 ; Choice-) than the UVL cattle (1.59 ± 0.03 kg, 326.57 ± 2.94 kg, 1.36 ± 0.07 cm, 1.50 ± 0.06 cm, 71.66 ± 0.75 cm², 621.20 ± 18.08 ; Choice, respectively). There were no SR or LOC x SR effects for ADG, HCW, MARB, FT, AFT, KPH, REA or YG ($P > 0.05$). SR did not affect feedlot or carcass traits, however LOC did.

Key Words: Grazing, Beef cattle, Feedlot performance

Extension

ive management trial at the University of Tennessee, Highland Rim Experiment Station, Springfield, Tn. The calves were previously maintained with their dams on drought stricken pastures supplemented with mixed grass hay and creep feed. The calves were weighed on 8-16-99 and assigned to either the SEP (22 heifers and 32 steers) or CON (24 heifers and 20 steers). The SEP calves weighed 204 kg. and were maintained in dry lot, fed a concentrate at 1.5 percent of body weight with access to free choice mixed grass-clover hay in large bales while CON calves weighed 203 kg. and continued under previous management. The trial ran for 53 days, 8-16-99 to 108-99. Weights were recorded at 14-day

intervals except the last which was 11 days. Weights of the two groups were not different ($P < .05$) until the final (CON = 241 kg., SEP = 262 kg.). Average daily gain (adg) and total gain (TG) were not significantly different until the third (CON, 0.51 kg. adg, 7.1 kg.TG; SEP = 0.67 kg. adg, 11.1 kg. TG) and fourth (CON = 0.67 kg. adg, 5.3 kg. TG, SEP = 1.66 kg. adg, 16.7 kg. TG) periods and overall gain (CON = 0.73 kg. adg, 38.62 kg., SEP = 1.08 kg. adg, 57.6 kg.). The SEP calves gained 28.9 percent and CON calves gained 13.7 percent of their total gain the last period of the trial, these results indicate that the "bunk breaking" period in pre-conditioning programs may need to be extended beyond 30 days.

Key Words: Preconditioning, bunkbreaking, calves

62 Alternative feeds for short-term postweaning feeding of calves. W.R. Burris*, J.H. Randolph, L. Anderson, D.E. Wolfe, and K.M. Laurent, *University of Kentucky, Lexington.*

Alternative feeds were fed in 4 trials utilizing 204 weaned calves with the objective of identifying economical systems for conditioning weaned calves with high-fiber by-product feeds on high forage diets. In trial 1, 64 heifer calves (259 kg) were fed corn silage and corn grain with soybean meal (SBM), soyhulls (SH), raw soybeans (RSB) or wheat midds (WM) for 56 days. Calves gained more ($P < .05$) when fed SBM or SH (1.04 and 1.09 kg/da) than RSB or WM (0.76 and 0.80 kg/da). Feed cost was similar for all treatments except RSB, which was highest. Trial 2 utilized 39 steer calves (286 kg) fed either corn/SBM or SH on accumulated fescue pasture or drylot/hay for 60 days. Calves fed SH gained more (0.2 kg) than those fed corn/SBM on either feeding system. Trial 3 utilized 56 heifer calves (259 kg) grazing accumulated fescue pasture. Calves received no supplementation (none), corn, SH or corn gluten feed (CGF) at 4.1 kg for 60 days. Gains (kg/da) were lowest for none (0.30), intermediate for corn and SH (0.66 and 0.72) and highest ($P < .05$) for CGF (0.83). Trial 4 utilized 45 steer calves (235 kg) which received 4.73 kg/da of corn/SBM, SH/CGF or a commercial feed (COM) with hay. Each supplement contained 13% crude protein. Gains (kg/da) were lowest ($P < .05$) for corn/SBM (1.14) than either SH/CGF or COM (1.41 and 1.45). Feed costs (/454 kg) were 30, 27 and 48 for corn/SBM, SH/CGF and COM, respectively. In summary, some high-fiber feeds can be excellent supplements for high-forage diets, and SH and CGF were better than other alternative feeds in these trials.

Key Words: By-products, Postweaning, Beef

63 A comparison of three ration formulations provided to beef calves as pre-weaned creep and post-weaned supplemental concentrate. W. W. Gill*, M. W. Salisbury, M. D. Davis, J. B. Neel, C. D. Lane, Jr., and B. D. Sims, *University of Tennessee, Knoxville.*

Seventy-five calves weighing an average of 94.42 kg were started on creep formulations forty-six days prior to weaning and continued on the same mixtures into a post-weaning phase of 39 d. The calves were mixed sex (bulls, heifers and steers) with genders being evenly distributed among treatments. In the post-weaned phase, calves were allotted to pens by supplement treatment, with heifers and bulls not penned together. Concentrate formulations were balanced to be approximately iso-nitrogenous and iso-caloric and were: 1) commercial blend (CB, typical of ingredient mixture for the area); 2) high-soluble fiber (HF, containing fifty-three percent soybean hulls as the primary source of soluble fiber); and, 3) high starch (HS, with fifty-three percent coarsely ground corn being the primary starch source). Concentrate was provided as ad libitum pasture supplement in the creep phase and 0.75 to 1.0 percent of body weight during the post-weaning phase. Hay was provided ad libitum during the post-weaned phase. During the creep phase, weight gains for CB, HF and HS were 53.8, 57.4 and 50.1 kg, respectively, with HF being higher than HS ($p \leq .01$). Post-weaning gains were 55.6, 53.8 and 58.6 kg, respectively. The effect of gender during the post-weaned phase was highly significant ($p \leq .02$). Gain differences for heifers and bulls due to supplement treatment were not significantly different in the post-weaning phase, but steers gained less ($p \leq .05$) on the HF supplement.

Key Words: creep, soluble fiber, wean

64 Effect of Revalor-G[®] and Ralgro[®] on growth of stocker heifers. R. L. McCraw, B. C. Allison*, and R. E. Lichtenwalner, *NC State University, Raleigh.*

Numerous studies have shown the use of growth promoting implants to be a profitable management practice for commercial beef producers. This study was initiated to evaluate the response in weight gain of stocker heifers implanted once with either Revalor-G[®] or Ralgro[®] implants, to determine the difference in duration of the response, and to determine the fate of implants after they are administered. Seventy-two heifer feeder calves of mixed breeding housed in six pens were included in this 154-d study. They were graded as medium frame heifers of number 1 thickness. Equal numbers were assigned to a negative control group, a group that received Revalor-G[®] (40 mg trenbolone acetate plus 8 mg estradiol benzoate), and a group that received Ralgro[®] (36 mg of zeranol). Each treatment group was replicated. Heifers were fed corn silage (28.2% DM, 7.5% CP, 71.2% TDN) to appetite plus 0.59 kg SBOM, 0.05 kg limestone, and 0.14 kg Gainpro[®] (19 mg Bambermycins) each, daily. Gains across treatments for 154-d averaged 0.89 kg. After the first 28 d, treated heifers (0.91 kg) gained more rapidly ($P < .10$) than controls (0.80 kg). Gains for the Ralgro[®] group were higher than those for Revalor-G for periods 28-56 d ($P < .10$) and 84-112 d ($P < .10$). The Revalor-G[®] group had higher gains during periods 56-84 d ($P < .10$), 112-140 d ($P < .10$), and 140-154-d ($P < .10$) indicating longer duration of growth promoting activity for Revalor-G[®]. Palpation of implant sites revealed no noticeable change in implants prior to d 84. At d 84, percentages partially dissolved and dissolved were 88% versus 4% ($P < .01$) and 8% versus 0 ($P > .05$) for Ralgro[®] and Revalor-G[®], respectively. By d 154 for Ralgro[®] and Revalor-G[®], respectively, 9% versus 38% ($P < .05$) of implants were partially dissolved, 48% versus 29% ($P > .05$) barely palpable, 43% versus 25% ($P > .05$) dissolved, and 0 versus 8% ($P > .05$) encapsulated. These results suggest that Ralgro[®] pellets may dissolve more rapidly than Revalor-G[®].

Key Words: Growth stimulants, Stocker cattle, Beef heifers

65 Assessment of an organic copper complex and copper sulfate as growth promoters for weanling pigs. A.F. Harper*, C.M. Wood, V.E. Hofler, R.J. Schiele, R.C. Simms, E.J. Walter, and M.J. Estienne, *Virginia Polytechnic Institute and State University, Blacksburg.*

A total of 120 weanling pigs 16 to 23 d of age were used in an experiment to assess the efficacy of a commercial copper complex (BIOPLEX copper, Alltech Inc., Nicholasville, KY) and copper sulfate as dietary growth promoters. The pigs were allotted to four dietary treatments from outcome groups to balance ancestry, weaning weight and sex across treatments. There were six replicate pens per treatment with five pigs in each pen. Treatments included a control diet (11 ppm Cu from trace mineral premix), a diet with 50 ppm added Cu from BIOPLEX, a diet with 200 ppm added Cu from BIOPLEX, and a diet with 200 ppm Cu from copper sulfate. Diet nutrient density was adjusted in two phases to meet NRC (1998) requirements over the five wk trial. Feed and water were available ad libitum. Pig BW and feed consumption were determined weekly. Pigs fed the diet with 200 ppm Cu from BIOPLEX grew 9.3% faster and had 12.3% higher daily feed consumption than pigs fed the control diet ($P < .03$). Growth rates and feed consumption for pigs fed 50 ppm dietary Cu from BIOPLEX and 200 ppm Cu from copper sulfate were intermediate and not different from the controls or those fed 200 ppm Cu from BIOPLEX ($P < .15$). Feed efficiency was not affected by dietary treatment ($P < .50$). Growth rate (g/d), feed consumption (g/d) and feed/gain were 334 ± 9 , 537 ± 15 and $1.61 \pm .03$ for the control pigs, 353 ± 9 , 557 ± 15 and $1.58 \pm .03$ for pigs fed 50 ppm Cu from BIOPLEX, 365 ± 9 , 604 ± 16 and $1.64 \pm .03$ for pigs fed 200 ppm Cu from BIOPLEX and 347 ± 9 , 557 ± 15 and $1.61 \pm .03$ for pigs fed 200 ppm Cu from copper sulfate, respectively. Under the conditions of this experiment, 200 ppm added dietary Cu from BIOPLEX improved weanling pig performance. The appearance of a trend for improved performance with the diet containing 50 ppm Cu from BIOPLEX suggests that some level between 50 and 200 ppm Cu from BIOPLEX may produce a growth response. Further research is needed to test this hypothesis.

Key Words: Pigs, Performance, Copper

66 Developing a niche market for pork. G.E. Conatser* and K.J. Stalder, *The University of Tennessee, Knoxville.*

The objective of the niche market development program is to form marketing alliances between pork producers, slaughter plants and Hispanic markets in order to more effectively service the Hispanic customer with traditional Latino pork products and to increase the producers share of the retail value of pork. Pork producers today find themselves in a painfully ironic situation, on the one hand, the domestic and export demand for pork is at an all time high, but on the other hand, the share of the consumer dollar earned by pork producers was at an all time low of 22 cents in 1998. The loss of equity in the pork industry since 1997 is estimated at 4 billion dollars by the National Pork Producers Council. It is quite clear that innovative and decisive action must be taken to reposition pork producers in the pork value chain so they have an opportunity to capture a greater share of the retail value of pork. Niche markets offer great opportunity to small and medium size producers who are not positioned in a vertically integrated system. Hispanics represents 11% of the total population and is increasing at the rate of 2% annually. In Tennessee there is an estimated 70,000 Hispanics in Memphis and 50,000 in Nashville as well as significant Hispanic population in 21 Tennessee counties. A niche marketing conference was held in October of 1999 with producers, slaughter plant owners, Hispanic leaders as well as educational leaders and governmental officials. A pork value added team was formed to manage the niche marketing program and a new generation cooperative was organized in the middle Tennessee area under the name of Middle Tennessee Fresh Pork. Eighteen Hispanic markets were identified and surveyed in the middle Tennessee area. Data was collected on factors such as clientele and purchasing preferences as well as their concept of pork quality and freshness. A food safety program is being developed in Spanish and a video is being produced to help promote the sale of pork directly from the producer. The producer cooperative will purchase slaughter services from the plants and retain ownership of the pork until it reaches the Hispanic markets. Developing niche markets for pork producers is vital to keeping the industry viable in Tennessee and the South.

Key Words: Pork, Hispanic markets, Pork alliances

67 Taste of Texas consumer camp: beef production from pasture to plate. R.L. Stanko*¹, L.A. Kotrla¹, J.E. Ford², and J.C. Paschal², ¹Texas A&M University-Kingsville, ²Texas A&M University Agricultural Extension Service.

Taste of Texas Consumer Camp was developed and initiated in 2000 as a collaborative effort between Texas A&M University Agricultural Extension Service and Texas A&M University - Kingsville. The objectives of Consumer Camp are 1) to educate and inform the public on beef production principles and 2) to re-introduce consumers to beef. Consumer Camp is designed to provide an integrated, multifaceted one-day beef cattle production program which includes the major segments of the commercial beef industry. Regional military installation personnel and their spouses were solicited for participation in the initial event. Thirteen female and 10 male consumers volunteered for the camp experience. The camp consists of hands on, cow-calf production practices and guided tours of a large ranch, commercial cattle feed yard, beef processing plant, and the meat department of a major retail grocer. Consumers are instructed and accompanied by faculty members, extension agents and specialists, industry professionals, and regional beef producers and/or managers throughout the day. Camp topics include animal well-being, environmental stewardship, genetics for product consistency, food safety, nutrition and health, product value and convenience, preparation tips, and new convenient beef products. Consumers were given a similar survey at the beginning and end of the camp. The majority of consumers were age 31 to 50 yr old (65%), ate beef 3 to 5 times per week (70%), and consumed beef as an evening meal (92%). Pre-camp survey indicated that some consumers would not purchase pre-cooked beef products (13%), did not consider beef part of a heart-health diet (22%), and did not believe beef producers were concerned about food safety (17%). Post-camp survey results verified that the objectives of the program were met. Improved opinions of pre-cooked, beef products ($P=.07$), beef in a healthy diet ($P<.02$), and producer food safety concerns ($P<.04$) were evident when comparing pre- and post-camp survey results. The value of this camp is to inform urban citizens about the

beef industry and to encourage consumers to include beef as a part of a well-balanced, nutritious, and safe diet.

Key Words: Beef, Cattle, Extension

68 Effect of ultrasound evaluation on steer quality in junior market steer shows. M.W. Salisbury*¹, F.D. Kirkpatrick¹, J.D. Gresham², J.D. Bartee¹, C.D. Lane¹, W.W. Gill¹, and J.B. Neel, ¹University of Tennessee Extension Service, ²University of Tennessee, Martin.

The objective of evaluating junior market steers exhibited at the Tennessee Junior Livestock Exposition (Expo) by ultrasound was to provide a tool for teaching youth about carcass quality. Success of the program was measured as the change in carcass quality over the past three years. The program was initiated during the 1998 Expo and has continued for three years. All steers were weighed and carcasses measured by ultrasound. Measurements included fat depth at the 13th rib (BF), marbling and rib eye area (REA), and these measurements along with BW and a constant value for dressing percent and percent kidney, pelvic and heart fat are used in a formula, designed by Kansas State University, to establish an index value, calculate a yield grade (YG) and quality grade (QG). Data from the three years were analyzed and year was considered the treatment and individual animal the experimental unit. Variables analyzed statistically were BF, REA, BW, YG, QG and index value. Total number of steers increased during the three years (1998=115, 1999=120, 2000=136). Body weight remained similar ($P=.75$) for the three years, but QG improved ($P=.01$) and YG decreased ($P=.01$) with 1998 highest, 1999 intermediate and 2000 lowest (2.31, 2.05, 1.90, respectively). Fat thickness decreased ($P=.01$) each year changing from 1.01 cm in 1998 to 0.78 cm in 2000. Quality grade and index values followed the same trends with 1998 and 2000 being similar ($P=.73$), but 1999 was the poorest ($P=.01$) for both traits. This trend in QG and index values is not completely understood, but may be speculated that the above average ambient temperature for 45 d prior to the 1999 measurements may have adversely affected these traits. Overall, the quality of steers exhibited by junior exhibitors in Tennessee has improved during the study period and will continue to be monitored in future events.

Key Words: carcass, market steer, cattle

69 Long-term immune response of weaned heifers vaccinated with either a single or multiple dose clostridial toxoid. M.S. Gadberry*¹, T.R. Troxel¹, D.L. Kreider², P. Widel³, and I. Nicholson³, ¹University of Arkansas, Cooperative Extension Service, Little Rock, ²University of Arkansas, Fayetteville, ³Boehringer Ingelheim Vetmedica, St. Joseph, MO.

The objective of this experiment was to evaluate the long-term immune response of weaned heifers vaccinated with either a single or multiple dose clostridial toxoid. Heifers (194 ± 28.5 kg) were randomly assigned to receive either a one time injection of a 2-mL vaccine (Alpha 7, A7; $n = 15$) on d 0 or injection (d 0) and subsequent booster (d 28) of a 5-mL vaccine (Ultrabac 7, UB7; $n = 15$). All injections were administered s.c. in the neck region using the tented technique. Serum samples were analyzed for *C. chauvoei* (CC) agglutination titers and antitoxin units for *C. perfringens* type C (PC) and D (PD), *C. novyi* (CN), *C. septicum* (CSE) and *C. sordellii* (CSO) on d 0 and every 28 d through d 112. Resulting titers and units lacked normality; therefore, levels were transformed to a natural logarithm prior to statistical analyses. Agglutination titers of CC nor antitoxin units of PC, PD, CN, CSE, or CSO did not differ ($P > 0.10$) between A7 or UB7 prior to vaccination on d 0. *Clostridium chauvoei* titers, PD and CN antitoxin units of A7 heifers were higher ($P < 0.05$) than UB7 heifers on d 28. No differences were detected for PC, CSE or CSO. At d 56, CC titers, PC, CN and CSO antitoxin units were higher ($P \leq 0.01$) in UB7 heifers than the A7. Antitoxin units did not differ between treatments on d 56 for PD or CSE. Day 84 PC and CSO antitoxin units remained higher ($P < 0.01$) for UB7 heifers than A7. By d 112, differences between treatments were only detectable for PD. Heifers treated with UB7 had a lower antitoxin unit than those treated with A7. Alpha-7 invoked a greater immune response by d 28 for CC than UB7; however, the second injection of UB7 increased immunity for CC beyond A7 by d 56. At the completion of the trial, d 112, A7 and UB7 levels were similar.

Key Words: Heifer, Immunity, Clostridial

70 The impact of clostridial vaccination lesions on subsequent immune response. T. R. Troxel^{*1}, M. S. Gadberry¹, W. T. Wallace¹, D. L. Kreider², P. Widel³, and I. Nicholson³, ¹University of Arkansas, Cooperative Extension Service, Little Rock, AR, ²University of Arkansas, Fayetteville, AR, ³Boehringer Ingelheim Vetmedica, St. Joseph, MO.

The study was conducted to compare the clostridial immune response of calves that do and do not develop lesions at the injection site. Weaned crossbred heifers from two locations (location F, n = 15; location G, n = 22) were vaccinated with 2-ml Alpha-7[®] (Boehringer Ingelheim). Injections were administered s.c. in the neck region using the tented technique. On d 25, heifers were visually inspected and palpated for vaccination site lesions. Heifers that developed lesions (n = 24) were designated as the lesion group (L) and those that did not were placed in the no lesion group (NL). The incidence of lesions was 64.9% and did not differ across locations (P > 0.10). Average lesion size on d 25 was 5.6 ± 1.94 cm. Calves were bled for serum analysis at vaccination (d 0) and on d 25, 56, 84 and 112. Serum was analyzed for *C. chauvoei* (CC) agglutination titers and *C. sordellii* (CS) and *C. perfringens* D (CPD) antitoxin units. Resulting titers and units lacked normality; therefore, levels were transformed to a natural logarithm prior to statistical analyses. No differences (P > 0.10) in agglutination titers for CC and antitoxin units for CS and CPD were detected on d 0. The L heifers had elevated titers for CC on d 25 (P < 0.08) and 84 (P < 0.07) as compared to the NL heifers, but were not different on d 56 and 112. Antitoxin units for CS were elevated in the L heifers on d 25 (P < 0.07) and 56 (P < 0.02) compared to the NL heifers but were not different for d 84 and 112. Lesion heifers had elevated CPD antitoxin units on d 25 (P < 0.02), 56 (P < 0.04) and 84 (P < 0.07) compared to NL heifers but not different on d 112. There was a location by lesion interaction (P < 0.01) for CC and CS. The G location heifers had higher immune responses as compared to the F location heifers. In conclusion, immune response of heifers that developed lesions due to Alpha-7 vaccination was enhanced compared to heifers that did not develop lesions.

Key Words: Lesion, Clostridial, Alpha-7

71 Managing Phosphorus Levels in Arkansas Pasture Soil to Improve Water Quality. L. J. Sandage^{*} and D. E. Kratz, *University of Arkansas Cooperative Extension Service, Little Rock.*

The objective of this project was to demonstrate best management practices (BMPs) for applying poultry litter to pastures without increasing current soil test phosphorus (STP) levels. A 3-year broiler litter management project was conducted on 6 Arkansas farms. Three farms were high STP sites (>333 kg/ha) and three farms were low STP sites (<167 kg/ha). An STP budget approach was used to measure the impact of the BMPs implemented. Grid soil sampling methods were used for top soil sampling. During the fall 0-6 samples were used to reference beginning and ending STP. The four forage BMPs used on high STP sites were: 1) forage species considered P accumulators, 2) extending the growing season by species diversification, 3) commercial fertilizers instead of litter and 4) forage utilization methods. The two forage BMPs were used

73 Determination of reproductive status in dairy cattle using near infrared reflectance spectroscopy of feces. D. R. Tolleson^{*1}, S. T. Willard², B. S. Gandy², and J. W. Stuth¹, ¹Texas A&M University, College Station, ²Mississippi State University, Mississippi State.

A study was conducted to determine the efficacy of near infrared reflectance spectroscopy (NIRS) of feces in determining pregnancy and serum progesterone (P4) concentration in dairy cattle. Lactating Holstein (n=24) and Jersey (n=2) cows were bred by AI (Day 0) following estrus synchronization using a modified Ovsynch protocol beginning at 68±15 d postpartum. Daily serum samples were collected via jugular venipuncture for the first 15 d post-AI, and then on alternate days until d 30. Fecal samples (n=142) were collected on d 9, 12, 15, 21, 25 and 30 post-AI, then dried and ground to a 1mm particle size. Fecal spectra (1108-2492 nm) were obtained by NIRS. Pregnancy was determined by ultrasonography on d 30, and confirmed by rectal palpation on d 51. NIRS equations for P4 concentration or pregnancy were calculated

on low STP sites to demonstrate application of poultry litter without increasing STP were: 1) P accumulator forages and 2) application of litter based upon the P content of applied litter. During this 3-year project, STP at three high STP sites was reduced by 132 kg/ha. At 3 low STP sites, litter was applied at an annual rate of 4444 kg/ha with a small drop in STP of 28 kg/ha. Field days (6) were conducted with 617 producers attending representing 53,648 hectares of pasture. A survey of attendees indicated 30% of these respondents have pastures high in STP. Fifty-one percent indicated that they have discontinued using litter on these sites while the other 50% indicated they have reduced litter application rates by 50%. Eighty-seven percent indicated they have changed their forage utilization on high STP sites to a haying only or haying/grazing combination. In addition, approximately 68% of the respondents have discontinued feeding hay on high STP sites. With proper management and careful monitoring, soil phosphorus can be reduced or at least maintained to ensure environmental quality.

Key Words: Phosphorus, Poultry Litter

72 Results of an IRM project to shorten the breeding/calving season from year-round to 90 days. B.A. Helms^{*}, M.S. Gadberry, and T.R. Troxel, *University of Arkansas, Cooperative Extension Service, Little Rock.*

A 3 y breeding and calving season project of the Arkansas Beef Improvement - IRM Program was implemented on a Howard County farm in 1998. The objective of the project was to shorten the breeding/calving season from a year-round program to a 90 d breeding/calving season. The producer's goal was to establish a January through March calving season. The farm consisted of 330 acres with an average stocking rate of 72 animal units from y 0 (1997) to y 3 (1999). Calving season and financial records from y 0 served as the baseline for the project. A March 23 to June 20 breeding season was established. The producer opted to expose mid to late summer calving cows and sold them as bred cows. Starting in y 1 (1998), bulls were subjected to an annual breeding soundness examination, and hay samples were tested for nutrient composition each fall. The percentage of cows calving within the desired calving season was higher (P < 0.001) in y 3 (69%) than y 1 (29%). The average calving interval was reduced from 406 d to 359 d from y 0 to y 3. The mineral and supplemental feeding program was overhauled to more adequately meet herd requirements. This resulted in a 45.7% reduction in mineral cost from y 0 to y 2. Hay samples averaged (DM basis) 12.4% CP and 30.1% ADF in 1998, and 13.3% CP and 33.4% ADF in 1999. Matching hays with animal requirements (NRC, 1996) reduced supplemental feed costs 25.7% and 73.5% in 1998 and 1999 compared to 1997. Return over specified costs was \$209/AU more in 1999 than 1997. Any negative financial effects associated with cows missing a calf during the transition to a controlled breeding season were offset by the increased revenue from the sale of bred cows and reduction in specified costs. The implementation of a controlled breeding season allowed the producer to better manage and adapt new herd activities and to explore marketing alternatives with a more uniform calf crop.

Key Words: IRM, Calving season, Calving interval

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using either partial least squares (PLS) or modified stepwise regression (SWR). Serum P4 concentration was greater in pregnant (n=12) than non-pregnant (n=13) cows on day 21 (3.99±0.53 vs. 2.69±0.52 ng/ml respectively, P<0.094) and day 30 (4.33±0.46 vs. 2.00±0.55 ng/ml respectively, P<0.004). NIRS equations for P4 (PLS, n=103, avg=2.36 ng/ml, R²=0.56 SE calibration=1.1 ng/ml, and SWR, n=109, avg=2.36 ng/ml, R²=0.49, SE of calibration=1.2 ng/ml) were tested using a validation set (n=25, avg=2.36±0.43 ng/ml) of samples randomly selected from the original calibration set. Validation results were: PLS, R²=0.39, SE of prediction=1.7 ng/ml, and SWR, R²=0.42, SE of prediction=1.7 ng/ml. Principal component (PC) analysis was used to determine the presence of a relationship between fecal chemistry, as determined by NIRS, and reproductive status. No significant correlation was found prior to 30 days post-AI. However, at 30 days, a regression equation utilizing 12 PC's (n=25, R²=0.66, F=1.96, P<0.13) as independent variables accurately classified 9/12 samples from pregnant animals and 12/13 from those that were non-pregnant. In summary, fecal NIRS equations did not accurately determine serum P4 concentration in dairy cattle, but fe-

cal NIRS could possibly be used to determine pregnancy in dairy cattle greater than 30 days post-breeding.

Key Words: Near Infrared Reflectance Spectroscopy, Progesterone, Pregnancy

74 Detection of pregnancy in cattle using near infrared reflectance spectroscopy of feces. D. R. Tolleson^{*1}, R. D. Randel², J. W. Stuth¹, S. T. Willard³, and B. S. Gandy³, ¹Texas A&M University, College Station, ²Texas Agricultural Experiment Station, Overton, ³Mississippi State University, Mississippi State.

Recent evidence suggests that near infrared reflectance spectroscopy (NIRS) of feces can be used to detect pregnancy in cattle. Principal component analysis has been used to demonstrate differences in fecal spectra obtained from cattle differing in gender and pregnancy status. Fecal samples from 69 cows with known reproductive status (46 pregnant, 23 non-pregnant) were used to develop a discriminant NIRS equation. Independent validation sets from diverse locations and forage diets were used to test the ability of fecal NIRS to determine pregnancy in individual cattle under production situations. The discriminant equation ($R^2 = 0.92$, SE calibration = 0.02) successfully classified the following independent validation sets: 1) Eight non-pregnant lactating primiparous cows grazing ryegrass/clover, 2) Thirteen two year-old cows in the last trimester of pregnancy grazing ryegrass, fed alfalfa and bahia hay, 3) Eighteen estrous-cycling heifers grazing bermuda grass, 4) Three non-pregnant mature cows fed bermuda grass hay and a 20% CP pelleted ration in dry lot, and 5) Fifteen pregnant two year-old cows grazing cool season grasses. However, the same equation classified eight bulls as pregnant, and 35/36 estrous-cycling heifers grazing cool season grasses as pregnant. To determine if this method could be applied to a composite sample (25-50g wet feces from 5-10 individuals) for a herd, two different sample sets taken from breeding age cross-bred heifers from the beginning of breeding to approximately 60 days post-breeding were analyzed. Fecal NIRS predictions on these composite samples were inconsistent early in the breeding season but did yield a stronger indication of pregnancy as the expected stage of pregnancy in each herd progressed. A larger group of samples representing the entire production year (eg. weaning to weaning) and a diverse population of breed-types and forage species/range sites is needed to adequately determine if this technology can be relied upon to determine reproductive status in production situations.

Key Words: Near Infrared Reflectance Spectroscopy, Pregnancy, Feces

75 Near infrared reflectance spectroscopy of feces did not reliably predict serum progesterone (P4) in cows. D. R. Tolleson^{*1}, T. W. Wilson², R. D. Randel², D. A. Neuendorff², A. W. Lewis², and J. W. Stuth¹, ¹Texas A&M University, College Station, ²Texas Agricultural Experiment Station, Overton.

Near infrared reflectance spectroscopy (NIRS) has been used to identify differences in fecal chemistry between cows differing in reproductive status. Eight mature ovariectomized Brahman cows were utilized in an experiment to determine the efficacy of fecal NIRS in predicting serum P4. Treatment consisted of P4 delivery via either 0, 1, or 2 CIDR intravaginal devices. Cows were randomly assigned to treatments in one of three trials such that each cow received each treatment in a switch-back design. CIDR devices were placed at 0 hrs and removed at 72 hrs. Blood and fecal samples were collected at 6 hr intervals from 0 to 48 hrs, then at 12 hr intervals until 72 hrs. The same regimen was followed after CIDR removal. Blood samples were processed to yield serum and frozen until analyzed for P4 by RIA. Fecal samples were stored frozen, then dried 12 hrs at 60°C, and ground to a 1mm particle size. Fecal spectra (1108-2492 nm) were obtained by NIRS. P4 concentration was 0.61±0.09 ng/ml for all treatments at 0 hrs and was 13.94±1.97 ng/ml for treatment 1 and 20.85±1.88 ng/ml for treatment 2 ($P < 0.0001$) at 6 hrs after CIDR placement. P4 concentration remained > 5.0 ng/ml in treatment 1 until CIDR removal and returned to pre-treatment values (0.67±0.80 ng/ml) by 18 hrs post-CIDR removal. Treatment 2 P4 concentration was > 13.0 ng/ml until CIDR removal, and did not return to pre-treatment values (0.60±0.10 ng/ml) until 42 hrs post-CIDR removal. Serum P4 in the 0 treatment was < 1.0 ng/ml throughout sampling. NIRS predictive equations for P4, utilizing modified partial least squares procedures, were derived from a calibration set of serum P4 values (hr = n) paired with fecal spectra at hr = n+18 due to the estimated time for serum P4 to be metabolized and appear in the feces.

Performance of the equation thus derived ($n=295$, $R^2=0.63$, SE calibration=2.52 ng/ml) was validated against two data sets with known P4 concentrations: 1) 50 random samples selected from the calibration set, and 2) 20 samples from estrous cycling Brahman x Hereford heifers. Neither 1 ($R^2=0.11$, SE prediction=7.7 ng/ml) nor 2 ($R^2=0.15$, SE prediction=13.9 ng/ml) yielded results indicating reliability of fecal NIRS to predict P4 of exogenous origin.

Key Words: Near Infrared Reflectance Spectroscopy, Progesterone, Feces

76 Evaluation of somatotrophic gene expression and function in 3/4 Angus or Brahman steers. T. A. Strauch¹, J. A. Carroll², C. A. Abbey¹, N. H. McArthur¹, S. K. Durham³, M. C. Lucy⁴, R. D. Randel⁵, and T. H. Welsh, Jr.¹, ¹Texas Agricultural Experiment Station, College Station, ²ARS/USDA, Columbia, MO, ³Diagnostic Systems Laboratories, Webster, TX, ⁴University of Missouri, Columbia, ⁵Texas Agricultural Experiment Station, Overton.

Whether genotype influences somatotrophic gene expression and function in 3/4 Angus or Brahman steers was evaluated. Growth rate, somatotroph number, anterior pituitary content of growth hormone (GH) mRNA, liver content of GH receptor and IGF-I mRNA, and plasma GH and IGF-I concentrations in slaughter weight 3/4 Angus (A; $n=47$) and 3/4 Brahman (B; $n=40$) steers were evaluated. Steers were produced by embryo transfer as a series of double reciprocal backcrosses and F2 full-sibling families from purebred Angus, purebred Brahman, and F1 parents, and slaughtered at a target weight of 500 kg. Pituitary and liver tissues were collected for immunocytochemistry and mRNA analysis, and blood was collected for GH (RIA) and IGF-I (IRMA). Tissues were homogenized and total RNA extracted. GH mRNA expression in the anterior pituitary, and GHR and IGF-I mRNA expression in the liver were determined via ribonuclease protection assays and quantified via integrated optical density units. There was no difference ($P > .05$) between 3/4 A and B for ADG from birth to weaning or weaning to finish. The A steers had increased anterior pituitary weight ($P < .0001$; $1.39 \pm .04$ vs $1.05 \pm .03$ g; A vs B); however, B steers had increased GH cell number/mm² ($P < .008$; 1600.1 ± 54.0 vs 1865.2 ± 84.5 ; A vs B). There was no difference ($P > .05$) in GH mRNA expression; however, GHR mRNA expression tended to be higher in B steers ($P < .09$; $.76 \pm .09$ vs $1.06 \pm .15$; A vs B). Plasma GH was not different ($P > .05$). The B steers had higher liver IGF-I mRNA expression ($P < .04$; $.06 \pm .01$ vs $.11 \pm .02$; A vs B); however, there was no difference in plasma IGF-I. These results suggest increased liver responsiveness to GH in B cattle due to increased GHR expression in the liver. This increased responsiveness resulted in increased IGF-I mRNA expression in the liver.

Key Words: Somatotrophic axis, Steers, Angus, Brahman

77 Postpartum nutrient intake influences plasma concentrations of insulin-like growth factor-I during the resumption of ovarian function of primiparous beef cows. N. H. Ciccioli, M. L. Looper, L. J. Spicer, and R. P. Wettemann, Oklahoma Agricultural Experiment Station, Stillwater.

Thirty-four Hereford x Angus suckled primiparous cows were used to investigate if nutrient intake postpartum influences plasma concentrations of insulin-like growth factor-I (IGF-I). Cows were maintained during gestation on native pasture and were fed supplemental protein to calve with a body condition score of 4 to 5 (BCS = 4.3 .1; BW = 385 17 kg). At parturition, in February and March, cows were blocked by BCS and calving date and randomly assigned to one of two nutritional treatments: fed to gain .45 (Moderate = M) or .90 (High = H) kg/d for 75 d. Commencing at 35 d after calving, blood samples were collected to determine plasma concentrations of progesterone thrice a week and IGF-I weekly by RIA. Estrous behavior was detected with a Heatwatch[®] system. Ovulation with the first estrus was confirmed by three consecutive blood samples with progesterone > 1 ng/mL. During the first 13 wk after calving, BCS increased by .3 and .8 units ($P < .01$) for M and H cows, respectively. During the 10 wk before the first estrus, concentrations of IGF-I increased ($P = .08$) by 21% between wk 7 and 4 before estrus, independently of the nutritional treatments; however, concentrations did not change during the last 3 wk before the first estrus. During 10 wk before estrus, H cows (30.3 1.6 ng/mL) had greater ($P < .01$) IGF-I than M cows (24.0 1.6 ng/mL). Also, IGF-I was greater ($P < .05$) for H (28.9 2.2 ng/mL) than for M (22.0 2.1 ng/mL) during 9 to 15 wk postpartum. Concentrations of IGF-I from 9 to 15 wk postpartum did not differ ($P > .5$) between anestrous cows ($n=14$) and cows ($n=16$)

that were estrus and ovulated on or before 19 wk postpartum. Increased nutrient intake postpartum increases BCS and plasma concentrations of IGF-I in suckled beef cows. Concentrations of IGF-I did not change during the 3 wk before the first postpartum estrus, suggesting that IGF-I may not be the major factor that regulates resumption of ovulation in primiparous beef cows.

Key Words: Nutrition, Postpartum, IGF-I

79 Effect of *E. coli* exposure on production of ACTH, steroidogenic acute regulatory (StAR) protein and cortisol in neonatal pigs. J.A. Carroll¹, K.J. Touchette², G.L. Allee², D. Alberts³, D.M. Stocco^{3,4}, and T.H. Welsh, Jr.^{3,4}, ¹ARS-USDA, Columbia, MO, ²University of Missouri, Columbia, ³Texas Tech University Health Science Center, Lubbock, ⁴Texas A&M University, College Station.

This study examined relationships among components of the adrenal axis during activation of the systemic inflammatory response syndrome (SIRS) in neonatal pigs. We previously demonstrated that administration of *E. coli* to pubertal and neonatal pigs stimulates secretion of tumor necrosis factor alpha, ACTH, and cortisol (CS). The rate-limiting step in adrenal gland synthesis of CS is controlled by the steroidogenic acute regulatory (StAR) protein. To study the effects of an oral *E. coli* challenge on StAR protein production during activation of the adrenal axis, 20 crossbred pigs (n=10 males and 10 females, 14 d, 5.6 kg) were weaned into individual pens in an isolated facility and randomly assigned to one of two treatments (n=5/sex/treatment): Control (C; 5 ml sterile culture media) or *E. coli* (EC; 5 ml of *Escherichia coli* F17, 100 million CFU/ml). Standard starter rations were fed for 7d postweaning. On d6 postweaning, all pigs were non-surgically fitted with jugular cannulae. On d7, an oral dose of either sterile media or *E. coli* was given followed by serial blood samples for 10 hr to determine plasma ACTH and CS by RIAs. Following the 10-hr blood sampling period, pigs were humanely sacrificed for tissue collection. Adrenocortical samples were used in Western blot procedures to determine StAR content (integrated optical density units). Plasma ACTH and CS did not differ between C and EC pigs prior to EC challenge. A time x EC x sex interaction (P<.014) was observed for serum ACTH and CS such that females had a greater response to the EC than males. Likewise, there was an EC x sex interaction (P<.012) for adrenal production of StAR such that EC increased StAR production in females but not males. Adrenal StAR content was not significantly correlated with ACTH or CS parameters in C pigs; however, adrenal StAR was highly correlated with plasma ACTH (r=.75, P<.02) and plasma CS (r=.80, P<.007) in EC pigs. These observations demonstrate a positive relationship of ACTH, StAR protein and CS during SIRS. The direct action of pro- and anti-inflammatory cytokines on ACTH regulation of StAR protein and CS production may be relevant to determining the degree of resistance, susceptibility, damage or recovery from pathogenic challenges faced by neonatal pigs.

Key Words: adrenal axis, steroidogenic acute regulatory (StAR) protein, neonatal pigs

80 Effect of porcine somatotropin on serum leptin concentrations in pigs. C. S. Whisnant* and R. J. Harrell, ¹North Carolina State University, Raleigh.

The adipose tissue hormone leptin has been shown to affect numerous endocrine systems. Intra-cerebroventricular injection of pigs with leptin increased serum growth hormone concentrations. The objective of the current experiment was to determine the effect of growth hormone (somatotropin) administration on serum leptin concentrations in pigs. Barrows were treated with saline or porcine somatotropin (pST, Reporcin, Southern Cross Biotech, Ltd., Australia) daily and blood samples were taken every four hours for 48 hours and then every 8 hours for 128 hours. Plasma urea nitrogen and serum leptin concentrations were determined and compared between groups using a split plot in time analysis of variance. Leptin was measured using the Linco Multi-species Leptin Assay kit (Linco Research, St. Louis, MO). Plasma urea nitrogen was decreased (P < .01) by pST treatment as expected. Serum leptin concentrations were also decreased (P < .01) in pST pigs (1.7 ± 0.4 ng/ml) compared with saline treated pigs (3.3 ± 0.6 ng/ml). This decrease was evident by four to eight hours after pST administration, which is before significant lipolysis could occur. This is evidence for an acute regulatory effect of pST on leptin secretion from adipose tissue.

These data are in agreement with those of other species with growth hormone inhibiting leptin release.

Key Words: Leptin, Somatotropin, Pigs

81 Effects of Sequence and Timing of Gonadotropin Supplementation on Porcine Oocyte Maturation and Subsequent Cleavage In Vitro. T.R. Bilby* and R.W. Rorie, *Animal Science Department, University of Arkansas, Fayetteville.*

This study investigated whether the presence or absence of gonadotropins during the first (0–20h) or second (20–46h) half of in vitro maturation affected porcine oocyte maturation to metaphase II (MII) and cleavage after parthenogenic activation. Cumulus-oocyte complexes (COC's) were aspirated from 3 to 7 mm follicles (on sow ovaries) and randomly assigned across maturation treatments. The maturation medium was M-199 with .1 mM glutathione, 10% serum and 50 g/ml gentamicin. The sequence and timing of hormone supplementation of maturation medium during a 46 h maturation period are shown in the table below. Both FSH and LH were used at .05 NIH units/ml. Some oocytes in each treatment were fixed and stained at 46 h to assess nuclear maturation to MII. The remaining oocytes were activated by exposure to 50 M calcium ionophore A23187 for 3 min, and then cultured in NCSU-23 medium to assess parthenogenic cleavage and development. Analysis of variance for a randomized block design was used with the response variable being the percentage (transformed by the angular transformation) of MII and cleaved oocytes, and morula or blastocyst-stage embryos in each treatment. Pairwise comparisons of treatments were done by multiple t tests. Results indicate that delaying FSH and LH supplementation until after 20 h of maturation reduced maturation of oocytes to MII and cleavage, when compared to all other treatments. In conclusion, timing of gonadotropin supplementation can influence maturation and subsequent cleavage of porcine oocytes.

Hormones added	No (%) oocytes, MII stage @46 h	No (%) oocytes, cleaving	No (%) morulae & blastocysts
0/0	77/114 (67.5) ^b	74/153 (48.4) ^b	11/74 (14.9) ^a
FSH+LH/0	80/134 (59.7) ^{ab}	86/171 (50.3) ^b	14/86 (16.3) ^a
FSH/LH	69/112 (61.6) ^b	74/164 (45.1) ^b	19/74 (25.7) ^a
0/FSH+LH	45/118 (38.1) ^a	48/163 (29.4) ^a	10/48 (20.8) ^a

^{a,b}Within the same column, values with different superscripts differ significantly (P ≤ 0.05).

Key Words: Porcine, Oocyte Maturation, Parthenogenic Development

82 Uteroferrin (Uf) enhances the effect of cytokines on hematopoietic progenitors (HPC) from pig fetal liver. J.C. Laurenz*¹ and F.W. Bazer², ¹Texas A&M University-Kingsville, ²Texas A&M University, College Station.

This study investigated the effect of the recombinant human cytokines granulocyte/monocyte-colony stimulating factor (GM-CSF), erythropoietin (EPO), stem cell factor (SCF), interleukin-3 (IL-3) and porcine Uf on the number of HPC identified in day 35 fetal pig liver. Livers were collected, dissected free of connective tissue and aspirated through 18, 23 and 25 g needles to obtain a single cell suspension. Cells were resuspended in DME/F12 containing 20% heat-inactivated (HI) fetal bovine serum and incubated in 25 cm² flasks for 4 h to remove adherent cells. The number of erythroid progenitors (BFU-E) and granulocyte-monocyte progenitors (CFU-GM) were determined by plating the non-adherent cells (25,000 cells/dish) in colony-forming unit (CFU) assays in the presence of EPO (0 - 4 U/ml), GM-CSF (0 - 50 ng/ml), IL-3 (0 - 50 ng/ml), SCF (0 - 50 ng/ml), Uf (0 - 100 ng/ml) or selected combinations. As expected EPO induced a dose-dependent (P < .05) increase in the number of BFU-E with maximal effects occurring at 2 U/ml (27.3 ± 4.7 colonies). The number of BFU-E formed in response to EPO was not affected (P > .05) by the addition of SCF, Uf or IL-3 at any of the concentrations employed. Similarly, the combination of EPO (2 U/ml) and IL-3 (25 ng/ml) with either SCF or Uf did not effect (P < .05) the number of BFU-E. In contrast, the combination of EPO (2 U/ml) with SCF, Uf and IL-3 (25 ng/ml each) resulted in an increased (P < .001) number of BFU-E (55.8 ± 6.0 colonies). Relative to erythroid progenitors, the number of CFU-GM responsive to GM-CSF alone were low (11.3 ± 2.1 colonies at 25 ng/ml), but were dose-dependently increased

($P < .05$) by the addition of IL-3 with maximal effects occurring at 25 ng/ml (22.8 \pm 2.2 colonies). The number of CFU-GM formed in response to GM-CSF and IL-3 was not affected ($P > .05$) by the addition of either SCF or Uf. However, the combination of GM-CSF and IL-3 (25 ng/ml) with SCF and Uf (25 ng/ml each) resulted in an increased ($P < .05$) number of CFU-GM (31.0 \pm 2.1 colonies). Results indicate that Uf used in combination with SCF and IL-3 can induce increases in the number of HPC from fetal pig liver. In addition, these results suggest that Uf and SCF may help to induce the differentiation of primitive HPC that become responsive to EPO and GM-CSF.

Key Words: Swine, Hematopoiesis, Uteroferrin

83 Lutalyse enhances libido in boars being trained to mount an artificial sow for semen collection. M.J. Estienne*, A.F. Harper, and C.E. Babb, *Virginia Polytechnic Institute and State University, Blacksburg.*

We previously demonstrated that treatment with PGF decreased the number of sessions required to train sexually active boars (i.e., boars experienced with natural mating) to mount an artificial sow and allow semen collection. The objective of this experiment was to determine the effects of PGF on the ability to train for semen collection, young boars that had not experienced natural mating. Six littermate boars (Landrace x Yorkshire), 192.4 \pm 8.7 kg BW and 289 d of age, were used. Boars were moved to a semen collection pen equipped with an artificial sow twice weekly for 5.5 wk (total of 11 training sessions). Training sessions lasted a maximum of 15 min. Sessions 1 to 9 (Period A) were considered the control period and boars received no treatment. Immediately upon entering the collection pen during the tenth session (Period B) all boars received an i.m. injection of 10 mg PGF (Lutalyse; Pharmacia & Upjohn Company, Kalamazoo, MI). During the eleventh session (Period C), boars received no injection of Lutalyse. During each session boars were given a libido score of 1 to 5 (1 = no interest in the artificial sow; 5 = mounted artificial sow and allowed semen collection). The percentage of boars that mounted the artificial sow and allowed semen collection was greater ($P < .01$) during Periods B (100%) and C (100%) compared to Period A (0%). Average libido score during Period A (1.7 \pm .08) was less ($P < .01$) compared to Periods B (5.0 \pm .08) and C (5.0 \pm .08). In summary, use of Lutalyse has potential for expediting the training of sexually inexperienced boars to mount an artificial sow for semen collection. Once boars are trained, injections of Lutalyse are not required for maintenance of libido.

Key Words: Libido, Lutalyse, Boar

84 Effects of P.G. 600 on estrus and ovulation in prepubertal gilts treated with Regu-mate. B.R. Horsley*, M.J. Estienne, A.F. Harper, C.E. Estienne, and J.W. Knight, *Virginia Polytechnic Institute and State University, Blacksburg.*

The effects of P.G. 600 (400 I.U. PMSG and 200 I.U. hCG; Intervet America Inc., Millsboro, DE) on estrus and ovulation were assessed in prepubertal gilts treated with a progestin (Regu-mate; Intervet America Inc.). Prepubertal, crossbred gilts ($n = 40$; 85.9 \pm .8 kg BW [mean \pm SE] and 142.6 \pm .7 d of age) were fed daily 2.7 kg of a complete ration containing 0 ($n = 20$) or 15 mg Regu-mate ($n = 20$) for 18 d (Day 0 = first feeding of Regu-mate). On Day 18, all gilts received an i.m. injection of P.G. 600. Gilts were checked for estrus twice daily (at approximately 0700 and 1900) in the presence of a mature boar, and were killed 7 to 11 d after the onset of estrus. Ovaries were removed

and weighed, corpora lutea (CL) were excised and weighed, and ovulation rate was determined by counting the number of CL. Remaining ovarian tissue was minced and blotted and weight of follicular fluid determined. Ovarian follicles 10 mm or greater in diameter and fluid filled were classified as follicular cysts. Ovarian structures 10 mm or greater with heavy luteinization were classified as luteal cysts. The percentage of gilts displaying estrus and ovulating ≤ 7 d after P.G. 600 injection and the P.G. 600-to-estrus interval were similar ($P > .1$) for Regu-mate treatment (95% and 4.3 \pm .2 d, respectively) and controls (88.9% and 4.2 \pm .2 d, respectively). Number of CL and mean CL weight were similar ($P > .1$) for Regu-mate-treated gilts (16.6 \pm 1.6 and .49 \pm .04 g, respectively) and controls (14.4 \pm 1.8 and .53 \pm .05 g, respectively). Follicular fluid weight was similar ($P > .1$) for Regu-mate-treated gilts (4.2 \pm .3 g) and controls (3.7 \pm .4 g). The number of follicular and luteal cysts was similar ($P > .1$) for Regu-mate-treated gilts (.11 \pm .1 and .05 \pm .09, respectively) and controls (.23 \pm .12 and .30 \pm .11, respectively). In summary, P.G. 600 treatment effectively advanced the onset of puberty in gilts. Pre-treatment with Regu-mate had no effects on the onset of estrus and ovulation rate after P.G. 600.

Key Words: Regu-mate, P.G. 600, Gilt

85 Growth and Plasma Leptin in Yearling Mares fed a High-Fat Diet. P. R. Buff*¹, E. L. McFadin-Buff¹, C. D. Morrison¹, J. S. Seaman¹, J. A. Reynolds², and D. H. Keisler¹, ¹University of Missouri-Columbia, ²MoorMan's Quincy, IL.

Fat supplemented diets are fed to performance horses as a means of increasing energy density and performance potential. Use of traditional concentrate rations as a means of increasing energy density predisposes the horse to maladies such as colic, laminitis, and developmental orthopedic diseases. Adding fat to growing horse rations is an option but is not widely implemented. Our objective was to determine if feeding a fat-added diet vs. a control diet to growing yearling mares would affect growth and body compositional parameters as assessed via body weight, plasma leptin levels, and body condition scores (BCS). Eight yearling mares (348 \pm 19 kg) were paired by initial body weight and fed either a high fat (HF) diet or a control (C) diet at 0.8% of their body weight per day. The diets were fed as two daily meals for 8 wk. In addition to the concentrate, all horses were allowed *ad libitum* access to pasture and water. Diets contained equivalent amounts of protein (14%) and fiber (11.5%). The HF diet contained 16% fat from stabilized rice bran and soybean oil refinery lipid (3.6 Mcal DE/kg). The C diet, MoorMan's[®] GROSTRONG[®] 13% Pelleted Feed, contained 3% fat (2.6 Mcal DE/kg). Intake of concentrate was measured at each feeding. Weekly plasma samples were collected 30 min post feeding for analysis of leptin and insulin. Body weights and BCSs were assessed weekly and increased over time in all mares ($P > 0.4$), but did not differ with respect to diet. There were no differences in feed intake (HF = 1.38 \pm 0.02 vs. C = 1.46 \pm 0.02 kg) or plasma insulin levels (HF = 48.55 \pm 6.8 vs. C = 47.98 \pm 6.8 IU). Conversely, plasma leptin levels were greater among mares fed HF vs. C diets (1.54 \pm 0.12 vs. 0.88 \pm 0.12 ng/ml, respectively; $P=0.03$). We conclude that there is no evidence that growth is adversely affected when growing yearling mares are fed an added fat diet vs. a low fat diet. Furthermore, these data provide evidence that the type of diet may affect the animal's perception of its body composition as reflected by the differences in plasma leptin levels in horses fed high fat vs. low fat rations.

Key Words: Leptin, Horse, Fat-supplementation

Small Ruminant Production II

86 Controlling nematode parasites in small ruminants: An update. James E. Miller*, *Louisiana State University, School of Veterinary Medicine, Baton Rouge.*

Gastrointestinal nematode parasitism is arguably the most serious constraint affecting small ruminant production world-wide. Economic losses are caused by decreased production, costs of prophylaxis, costs of deworming, and the death of infected animals. Problems with nematode parasitism are often classified as production disease. The major nematode parasites affecting small ruminant production in the southeastern United States, are *Haemonchus contortus* and *Trichostrongylus colubriformis*. *Haemonchus contortus* resides in the abomasum and feeds on blood which can cause severe anemia and death. *Trichostrongylus*

colubriformis resides in the small intestine and causes scours which leads to unthriftiness and weight loss or reduced gains, but rarely results in death. The combination of the two nematodes can be devastating unless appropriate control measures are implemented. The principle method of control has traditionally been intensive deworming year around, many times at short (2 to 3 week) intervals whether necessary or not. Unfortunately, small ruminants are considered minor species of livestock, therefore, only a small number of anthelmintics are approved for use. Because *Haemonchus contortus* has developed widespread resistance to all approved anthelmintics, other unapproved anthelmintics have been used and these to are succumbing to resistance. Management practices (old and new) incorporating strategically timed dewormings can play a

major role in controlling nematode parasites, which may be especially important now in light of the resistance problems. It is not practical to believe that new classes of anthelmintics will be developed with any urgency, therefore, recent interest has been to develop alternative control methods such as vaccines, nematode-trapping fungi, diatomaceous earth, forage tannins and breeding programs to select for resistance to nematodes.

Key Words: Small ruminants, Nematodes, Control

87 The efficacy of topical and drench anthelmintics on fecal egg counts in St. Croix White hair sheep in the tropics. E. Panitz, R.E. Dodson, and R.W. Godfrey*, *University of the Virgin Islands, Agricultural Experiment Station, St Croix.*

This study was conducted to determine the efficacy of eprinomectin (Eprinex[®]) used as a pour-on anthelmintic in comparison to ivermectin (Ivomec[®]) used as a drench in hair sheep, by monitoring fecal egg counts (FEC) before and after treatment. Eighteen St. Croix White ewe lambs and wethers, kept on guineagrass pasture, were allocated to three groups of six lambs each based on FEC collected on d 0. On d 7 fecal samples were collected, the animals were weighed and treated with either .2 mg·kg⁻¹ of eprinomectin as a pour-on (POUR), .2 mg·kg⁻¹ ivermectin as a drench (DRENCH), or left untreated (CONT). On d 14 animals were weighed and fecal samples taken. Fecal egg counts were evaluated using the modified McMaster method and were transformed to log₁₀(FEC + 1) for analysis. Analysis of FEC and weights was conducted using ANOVA for repeated measures and Duncan's multiple range test. Prior to treatment (d 0) there was no difference (P > .10) in FEC among POUR, DRENCH or CONT groups (2408 ± 15 vs 2417 ± 22 vs 2442 ± 23 eggs·g⁻¹, respectively). At the time of treatment (d 7) FEC had increased in each group by 5 to 18%. On d 14 FEC of sheep in POUR were lower (P < .05) than those of sheep in DRENCH and CONT groups (442 ± 10 vs 2867 ± 26 vs 3325 ± 22 eggs·g⁻¹, respectively). Body weights were similar (P > .10) among treatment groups throughout the study. Ivermectin drench was not effective in reducing FEC suggesting that the strain of parasite may be resistant to ivermectin but not to eprinomectin. Because the lambs were maintained on pasture throughout the period of the study there may have been continuous exposure to helminth infection and some parasites may have been in an insensitive stage during their development, resulting in a lower efficacy of eprinomectin (87%) than ideally desired. Based on these results it appears that eprinomectin, can be used as a topical treatment for reducing gastrointestinal parasites of hair sheep.

Key Words: sheep, parasites, anthelmintic

88 Field applications of liquid nitrogen fertilizer for controlling gastrointestinal parasites in meat goats. A. P. Conrad*, J-M. Luginbuhl¹, K. L. Anderson¹, J. P. Mueller¹, A. M. Zajac², and M. G. Grice¹, ¹North Carolina State University, Raleigh, ²Virginia Polytechnic University, Blacksburg.

Gastrointestinal (GI) parasites are considered to be one of the most prominent health problems of meat goats. Three trials (1998: 5/8 to 7/2 - T1, 9/25 to 11/6 - T2; 1999: 9/24 to 10/27 - T3) were conducted on predominantly fescue pastures to determine the effectiveness of field applications of liquid N fertilizer (LNF) to suppress goat fecal egg count (FEC). Does and wethers of Boer breeding were used to contaminate fields with trichostrongyle eggs. Goats were then housed in a dry lot and dewormed to lower infestation to close to 0 egg/gram feces. Following contamination, fields were flail-chopped to leave a stubble of about 15 cm (T1), 12 cm (T2) or 5 cm (T3) in height. Fields were then divided into treated (LNF, N/ha: T1 and T2, 56 kg; T3, 73 kg) or control plots (granular urea, N/ha: T1, none; T2, 56 kg; T3, 73 kg). In T1, two groups of 11 wethers (BW: 46 kg) were rotated among 4 treated or 4 control plots (.12 ha/plot). In T2 and T3, fields were divided into 6 plots (.12 ha/plot) in a 2 x 3 randomized complete block design. Dewormed goats (7 goats/plot; BW: T2, 23 kg; T3, 43 kg) were then control grazed on either treated or control plots throughout the length of each trial. Weekly blood (T2 and T3) and fecal samples (all trials) were taken to monitor blood packed cell volume (PCV) and total protein (TP), and FEC. In T2, one goat/plot was slaughtered on d 7 and another on d 14 after the trial started to determine species and quantity of trichostrongyle larvae ingested from the pastures. Results from T1 indicated that LNF suppressed FEC (P < .04), with the presence of a treatment x date interaction (P < .03), whereas no difference in either

FEC, PCV or TP was observed during T2 or T3. In addition, the application of LNF did not affect the number of larvae found in the GI tract of slaughtered goats (T2). Drought conditions during T2, despite irrigation of the plots on six occasions, and drenching (16.5 cm rain) of the experimental site by hurricane Floyd the day after LNF was applied (T3), may have contributed greatly to the lack of response seen in those two trials. Nevertheless, results from T1 indicated that fertilization with LNF could have potential as a component of an integrated GI parasite program to reduce goat worm loads.

Key Words: Meat goat, Liquid nitrogen fertilizer, Gastrointestinal parasites

89 Inactivation of Caprine Glutamate Dehydrogenase in Response to Pesticide Adulterated Diets. Cleantis Braithwaite¹, Sion Mitchell*¹, Peter Cooke¹, Phillip Cooke¹, and Godson Osuji¹, ¹Prairie View A&M University, TX.

Glutamate dehydrogenase, GDH, isomerizes in response to pesticides and environmental chemicals but the biochemical basis of the isomerization is unknown. Responses of GDH to pesticide can be an indicator of stress levels in animals. Clearer understanding of the isomerization of GDH would permit expansion of its use in the diagnosis of responses of an animal to challenged environment. The objective of this study is to analyse the degradation of GDH and isomerization response to Sevin adulterated diets fed to goats. Goats were subjected to different levels of sevin. Red blood cells were collected each day for four weeks. The cells were centrifuged 10,000 x g for 10 mins, the pellet was suspended in GDH buffer and served as the source of GDH. Proteins that precipitated following the saturation of the suspension to 65% with solid ammonium sulphate were pelleted by centrifugation. Free solution isoelectric focusing in the first dimension followed by SDS-PAGE in the second dimension fractionated caprine GDH to its constituent subunits and degradation polypeptides. After Western blotting, the GDH subunits and degradation polypeptides were immunodetected with caprine anti-GDH prepared in guinea pigs. Densitometer tracing of each band was computed. The pesticide treatments induced 25% degradation of GDH, whereas the GDH of the control animals suffered only 12% degradation. These results show that the degradation rate was about double the rate of de novo synthesis in the pesticide treatments.

Key Words: Glutamate dehydrogenase, Pesticide, Caprine

90 Intravenous L-carnitine administration reduces plasma ammonia N in Suffolk ewes sixty minutes after induced subclinical ammonia toxicity. M. M. Kaye¹, J. M. Fernandez*¹, T. W. White¹, C. C. Williams¹, R. L. Walker¹, G. D. Harding¹, and K.Q. Owen², ¹LSU Agricultural Center, Baton Rouge, ²Lonza, Inc., Fair Lawn, NJ.

Ammonia toxicity, also known as hyperammonemia or urea toxicosis, is a metabolic disorder characterized by elevated blood ammonia and glucose concentrations. An experiment was conducted to investigate the potential use of L-carnitine as a therapeutic agent in the treatment of subclinical ammonia toxicity in sheep. Hyperammonemia was experimentally induced using an oral urea load test (OULT; 400 mg urea/kg BW) in 15 mature Suffolk ewes (BW 79 kg) fitted with jugular vein catheters. Blood was collected at 15 min intervals for 330 min. A bolus dose of either 0 (SAL, n = 5 ewes) or 6.4 mmol of L-carnitine per kg metabolic BW was administered through the catheter at 30 (CAR30, n = 5 ewes) or 60 (CAR60, n = 5 ewes) min after the OULT. Ruminal ammonia N increased in response to the OULT (62.2 vs. 4.4 μmol/L; P < 0.0001). Plasma L-carnitine remained stable (48 μmol/L) in SAL ewes compared with CAR30 and CAR60 ewes (avg. peak at 1407 μmol/L; P < 0.0001) where it remained elevated (treatment x time, P < 0.0001). Plasma ammonia N increased (P < 0.0001) from 79 to 283 μmol/L after the OULT. Within 30 min after L-carnitine administration, plasma ammonia N decreased 180.7 and 132.6 μmol/L in CAR30 and CAR60 ewes, respectively (treatment x time, P < 0.02). Plasma urea N continually increased after the OULT to 167% of its peak (P < 0.0001) although there was no treatment or treatment x time interaction (P > 0.10). Plasma glucose increased (P < 0.0001) to 111% of Pre-OULT values following the OULT, and an additional 17 and 10 percentage units, respectively, 15 min after L-carnitine administration, in the CAR30 and CAR60 ewes (treatment x time, P < 0.0005). We conclude that L-carnitine reduces plasma ammonia N and increases plasma glucose in hyperammonemic

ewes, and with further research could one day serve as a therapeutic agent against urea toxicosis.

Key Words: Hyperammonemia, Carnitine, Sheep

91 Inclusion of high fat rice bran in the diet of yearling red deer stags fails to improve growth or reproductive traits. C.G. Brown*, K.C. Candler, D.A. Neuendorff, and R.D. Randel, *Texas Agricultural Experiment Station, Overton.*

Whether increased fat content in the diet would improve weight gain, antler development and testis function in red deer (*Cervus elaphus*) was studied. Fourteen yearling red stags (BW= 86.2kg) were randomly allotted into two treatment groups: 1)Control (C; 4:1, corn:soybean meal) or 2)Rice Bran (RB; 3:1:1, corn:soybean meal:20%fat rice bran). Rations were formulated to be isonitrogenous and isoenergetic. Stags grazed coastal bermudagrass overseeded with ryegrass and were fed 0.5kg ration/head/day plus alfalfa pellets as needed for 196 days with BW, BCS, blood samples, antler and testis measurements taken biweekly. Once in hard antler, ejaculates were collected biweekly via electroejaculation and evaluated for motility, progressive motility and sperm concentration. Total hard antler weight for RB stags (323.7g45.4) was not different ($P>.1$) from control stags (278.2g45.4). Average antler length (RB: 36.2cm2.5; C: 37.72.5) and antler density (RB: 9.0g/cm1.1; C: 7.4g/cm1.1) were not different ($P>.1$) between treatments. RB stag ADG (75.00.9g/day) was not significantly different from control ADG (77.0 0.9g/day; $P>.1$). SC change was not significantly different ($P>.1$) between RB (7.70.5mm) and control stags (7.60.5mm). Paired testis volume change was not significantly different ($P>.1$) between RB (654.8642.42cc) and control stags (622.5942.42cc). BCS, testis widths, lengths and depths were not significantly different between treatments ($P>.1$). Maximum sperm in the ejaculate (RB: 3.3x1081.8x108; C: 4.1x1081.8x108) and Julian date of maximum concentration (RB: 2545; C: 2645) were not different between ($P>.1$) treatments. While high fat diets improve reproductive efficiency in cattle, growth and reproductive efficiency were not improved in red deer stags. Our data indicates that it is not justified to increase feed costs by increasing fat content of the diet of red deer.

Key Words: Rice bran, *Cervus elaphus*, Growth

92 Differences in testicular characteristics, plasma testosterone and mating behavior in male goats of different breeds during the transitional and breeding season. S. Wildeus*, B. L. Sayre, J. R. Collins, and M. Dismann, *Virginia State University, Petersburg.*

Accelerating mating requires breeding during the transitional and breeding season. This experiment evaluated the reproductive characteristics of mixed breed yearling bucks during June (transitional season) and October (peak breeding season). On d 1 of sampling, bucks (n=12/season) were exposed to two estrus-induced does and time to first sniff, mount and ejaculation were recorded during a 10 min period, and a buck odor score was determined (1-3 scale). On d 2, blood samples for plasma testosterone analysis were collected at 15 min intervals for 6 h, with a GnRH injection (50 μ g; iv) after 3 h. On d 3, bucks were castrated, and testis and epididymis were processed for histology and determination of sperm reserves. Data were analyzed in a model with season and breed as main effects. As BW increased ($P<.01$) from 43 kg in June to 52 kg in October, combined testis weight remained unchanged (190 vs 181 g, respectively), resulting in a decreased ($P<.05$) testis weight:BW ratio in October. Seminiferous tubule diameter was larger and epithelial height smaller ($P<.01$) in October than June (220 vs. 207 μ m, and 54 vs. 62 μ m, respectively). Caudal epididymal sperm reserves were higher ($P<.01$) in October than in June (11.8 vs. 7.8 billion). Basal and peak testosterone concentrations after GnRH were higher ($P<.05$) in October (9.3 and 82.0 ng/mL, respectively) than in June (2.8 and 48.3 ng/mL, respectively). Time to first mount and ejaculation were shorter ($P<.05$) in October (143 and 188 s, respectively) than in June (341 and 424 s, respectively). Odor score was not different between seasons. These data suggest that timing of seasonal changes in reproductive characteristics do not occur in complete synchrony, but that certain events (increase in testis weight, development of buck odor) precede others (maximum testosterone, short reaction time).

Key Words: Male goats, Seasonal breeding, Reproductive characteristics

93 Effects of supplementation or dietary additives on seminiferous tubules and testicular steroidogenic acute regulatory (StAR) protein in goats consuming *Acacia berlandieri*. C.G. Brown*³, T.D.A. Forbes², S.S. Sieckenius², C.M. Hensarling², T.A. Strauch¹, J.W. Koch¹, S.R. Tatman¹, D.M. Stocco⁴, T.H. Welsh¹, and R.D. Randel³, *Texas Agricultural Experiment Station, ¹College Station, ²Uvalde, ³Overton, ⁴Texas Tech University Health Science Center, Lubbock.*

Whether dietary addition of supplement, monensin, or polyethylene glycol reduced the suppressive effects of *Acacia berlandieri* consumption on testis development and function via StAR production in Boer x Spanish goats was studied. Goats (n=20; BW=26.1.7 kg) were randomly assigned to one of four dietary treatment groups: 1) Basal (B; 34:66, chopped, dry alfalfa: *A. berlandieri* leaves, free choice), 2) B+Supplement (BS; B+high energy, low CP at 1% BW), 3) BS+Monensin (BSM; BS+22 g/ton monensin), 4) B+Polyethylene Glycol (BPEG; B+20 g PEG before and after feeding/day). Goats were hand-fed in pens for 67 d with scrotal circumference (SC) and BW recorded weekly. Three goats per treatment were euthanized at the end of the 67-d feeding period to determine paired testis weight and seminal vesicle weight. Testis samples were taken to determine seminiferous tubule (ST) diameter morphometrically and StAR protein by Western blot. No difference ($P>.05$) existed between B and BPEG or BS and BSM so groups were pooled: no added energy (NE) and added energy (E). Tissue measurements were lower for NE than E: paired testis weight ($P<.009$; 176.6 vs 253.9 g; SE = 16.8; NE vs E), seminal vesicle weight ($P<.004$; 6.6 vs 13.6 g; SE = 1.3; NE vs E). Patterns of testosterone (T) secretion were suppressed in NE compared to E ($P<.001$). ST diameter (mm) was lower in NE ($P<.0001$; 185.20.97) than E (211.140.97) goats. Serum T was correlated with ST diameter (0.68, $P<.02$). Testis StAR concentration did not differ in concentrations between treatments ($P>.1$). StAR protein was not correlated ($P>.1$) to any measurement of testis function. Energy supplementation in goats consuming *A. berlandieri* may reduce suppressive effects on testis function.

Key Words: *Acacia berlandieri*, Goats, Testis

94 Use of near infrared reflectance spectroscopy to differentiate pregnancy status and gender of hair sheep in the tropics. R.W. Godfrey*¹, R.E. Dodson¹, J.K. Bultman¹, D.R. Tolleson², J.W. Stuth², and A.J. Norman³, *¹University of the Virgin Islands, St Croix, ²Texas A&M University, College Station, ³USDA-NRCS Grazinglands Technology Institute, Ft Worth, TX.*

Two trials were conducted to evaluate the ability of near infrared reflectance spectroscopy (NIRS) to differentiate between genders and detect pregnancy. In Trial 1, fecal samples were collected on one day from lactating (L; n = 25) or pregnant (P; n = 21) ewes and rams (M; n = 15) grazing guinea grass pastures. Crude protein (%) and acid detergent fiber (%) for a .25 m² plot in each pasture were: 10.8 and 40.4, 11.0 and 40.2, 7.1 and 44.1 for L, P and M respectively. Fecal samples were frozen, then dried 12 h at 60°C, and ground to 1 mm particle size. Fecal spectra (1108-2492 nm) were obtained by NIRS. Area under the curve (AUC) for log 1/R fecal spectra of each sheep sampled was calculated using the trapezoidal rule and analyzed with GLM procedures. The AUC was higher ($P < .0001$) for M and P than L (286.2 \pm 2.4 vs 287.5 \pm 2.1 vs 272.1 \pm 1.8 units, respectively). Principal component (PC) analysis was used to develop regressions of fecal spectra characteristics vs gender or reproductive status. Multiple regression of 12 PC scores indicated differences ($P < .01$; L vs P vs M; P vs M; L vs M; P vs L). Visual inspection of 3-D plots of the first 3 PC scores identified separation between groups. In Trial 2, weekly samples were collected from P ewes from breeding through mid-gestation (12 wk), and from L ewes in both late gestation and lactation (3 wk). Ultrasound was conducted to confirm pregnancy in P. Approximately 25% of these samples were randomly assigned to be used as a validation set and the remaining 75% (n = 218 pregnant and 110 non-pregnant) were used to develop a discriminant equation for pregnancy. The resulting equation correctly identified 47/50 samples from pregnant and 19/25 samples from non-pregnant ewes. Fecal NIRS successfully distinguished pregnancy status among ewes, but the determination of gender was unclear due to the confounding effects of diet quality.

Key Words: Sheep, Pregnancy, Gender

95 Doe performance in three goat breeds managed for meat production using accelerated mating and two systems of forage management. S. Wildeus* and T. A. Gipson, *Virginia State University, Petersburg.*

Meat production potential was evaluated in Myotonic, Nubian, and Spanish goats using an 8-mo accelerated mating system, managed either on a high forage base (HI: moderate stocking rate, rotational grazing), or restricted forage base (LO: high stocking rate, drylot hay feeding). Does (20-35/breed/forage base) were supplemented with concentrate (16% CP) dependent on forage availability and physiological status. Mating periods (42 d, 2 single sire groups/breed/forage base) started November 1, July 1, and March 1, and were replicated. Kids were weaned at 10 wk of age. Records were analyzed in a model that included breed, mating season, forage base, and interactions. Pregnancy rate tended to be higher ($P=.07$) during November (96%) than July and March matings (65%). Subsequent kidding rates suggested a higher fetal loss in Myotonic and Nubian, than Spanish. Litter size born was similar between seasons in Myotonic and Nubian, but higher in November than July and March matings (2.0 vs. 1.5 kids born/doe kidding) in Spanish (breed x mating season: $P<.01$). Litter size at weaning was reduced under LO in Spanish and Nubian, but not Myotonic (breed x forage base: $P<.05$). Pre-weaning kid loss was larger ($P<.01$) in Nubian (.9) than in the other breeds (.4 to .5). Litter birth weight was higher ($P<.001$) in Nubian (5.2 kg) and Spanish (4.9 kg), than Myotonic (3.9 kg). Adjusted 60-d litter weaning weight was higher following November mating in Nubian (16.2 kg) and Spanish (17.6 kg), than in July and March, but was higher in Myotonic in July (13.7 kg) than in November and March (breed x season: $P<.01$). Litter weaning weights were higher ($P<.05$) under HI (14.3 kg) than LO (13.0 kg). Litter weight weaned as percentage of dam body weight was higher ($P<.01$) in Spanish and Myotonic (36%) than Nubian (31%). These data suggest that the Spanish and Myotonic breeds may be better adapted than Nubian for meat production under a forage-based, accelerated mating system.

Key Words: Goats, Accelerated mating, Doe performance

96 A strategy for managing ewe milk production. D. K. Aaron*, D. G. Ely, W. P. Deweese, E. Fink, and B. T. Burden, *University of Kentucky, Lexington.*

Data from three experiments ($n = 56$) were combined to develop a strategy for increasing ewe milk production during lactation and then suppressing it after weaning. Polypay ewes (73 kg) nursing twins were supplemented with 0 or 240 mg recombinant bovine somatotropin (bST), via s.c. injections, on wk 3, 5, and 7 of lactation. During this phase (9 wk), ewes were fed a lactation diet (63% roughage, 37% concentrate) so daily intake equaled 5.2% BW. Ewes were machine-milked once every 7 d to estimate 24-h milk production. Jugular blood samples were collected and serum concentrations of growth hormone (GH) quantified by RIA. From wk 4 to 9, bST-treated ewes produced more milk and had higher GH concentrations ($P < 0.05$). The post-lactation phase began on wk 9, when ewes were placed on a restricted diet (no concentrate and one-half the roughage fed during lactation). One week later, lambs were weaned and ewes allotted within bST group to three methscopolamine bromide (MB) treatments (I, B, C). The I group received s.c. injections of 96 mg MB at 1030 and 1330 on the day of weaning; B received a 96-mg bolus at the same times; C received no MB. Jugular blood samples were taken 0, 60, 120, and 180 min after each MB treatment. Ewes were milked 180 min after the final MB treatment and placed in drylot without feed for 48 h. Residual milk yields were recorded at 24 and 48 h. No bST effect was found for milk yield during this phase; but, bST-treated ewes continued to have higher ($P < 0.01$) GH concentrations. Milk yields of I ewes (109 g) were lower ($P < 0.01$) than both B and C ewes (150 and 153 g) 180 min after the final MB treatment. Twenty-four hours later, I ewes were still producing less milk than B (120 versus 161 g), but not C ewes (138 g). No differences in yield were evident at 48 h. Ewes in I had lower ($P < 0.01$) GH concentrations than ewes in B and C 60 and 120 min after the first MB treatment. The MB bolus had no effect on either milk yield or GH. These results demonstrate milk production can be altered through strategic use of bST and MB.

Key Words: Ewes, Lactation, Weaning

97 Effect of zeranol or melengestrol acetate (MGA) on testosterone production in farmed fallow bucks. T. W. Wilson*¹, D. A. Neuendorff², A. W. Lewis², and R. D. Randel², ¹*The University of Georgia*, ²*Texas Agricultural Experiment Station, Overton.*

Fifteen yearling fallow bucks were randomly assigned by body weight to treatment groups: control (C; $n=5$), melengestrol acetate (MGA; $n=5$), and zeranol (Z; $n=5$). Each group was maintained in a acre pasture of ryegrass/Coastal bermudagrass and supplemented with 3:1 corn/soybean meal at .45 kg-head⁻¹·day⁻¹. Z bucks received ear implants (36 mg) of zeranol at 90 d intervals and MGA bucks received MGA at 100 µg-head⁻¹·day⁻¹ in the supplement. Blood samples were collected at 14 d intervals to determine serum testosterone (T) profiles from 5/20/99 through 1/4/00. MGA bucks had increased T concentrations compared to C and Z bucks from June 17th through December 16th. When bucks reached hard antler, a Human Chorionic Gonadotropin (hCG) challenge was applied to all treatments monthly. Bucks were challenged from 7/21/99 through 1/4/00. On September 15th, MGA bucks had elevated basal T compared to C ($P<.006$) and Z ($P<.001$) bucks. There was a treatment ($P<.06$), day ($P<.001$) and a treatment X day interaction ($P<.04$) affecting hCG-stimulated peak T. Z bucks maintained lower ($P<.002$) hCG-stimulated peak T than C and MGA bucks through September 15th. hCG-stimulated T peak amplitude was reduced in Z ($P<.003$) compared to C bucks. Maximum peak amplitude did not differ between treatments but Z bucks were delayed ($P<.04$) in reaching the maximum in T response compared to C and MGA bucks. Area under the hCG-induced T curve was influenced by a day ($P<.001$) effect and a treatment X day interaction ($P<.006$). Testosterone response to hCG increased until September 15th for C and MGA bucks and until October 13th for Z bucks. hCG-stimulated T responses in Z bucks were reduced ($P<.10$) compared to MGA bucks. The day of maximum area under the T curve for Z bucks was delayed ($P<.01$) compared to C and MGA bucks.

Key Words: Zeranol, Melengestrol acetate, Testosterone

98 Real-time ultrasound measurements and body condition scores in deer. R. C. Vann*¹, J. F. Baker¹, D. A. Neuendorff², and R. D. Randel², ¹*University of Georgia, Tifton*, ²*Texas A&M University Agricultural Research & Extension Center, Overton.*

Deer farming and ranching for production of velvet antlers, hard antlers, hides and meat has gained popularity in various locations around the world. The study objective was to correlate body condition score (BCS, scale 1 to 9) with live animal ultrasound measurements for back fat (BF) and rump fat (RPFT) in deer. Red ($n=38$) and Fallow ($n=30$) does were assigned a BCS and body composition images were collected for loin eye area, BF and RPFT using real-time ultrasound technology. Both pregnant and open deer were evaluated. Red deer had an age range of 3 to 10 yr and an average weight of 106.4 kg, and the Fallow deer had an age range of 2 to 10 yr with the majority between 4 to 6 yr old, and an average weight of 43.1 kg. All animals were clipped across the rump area and over the last two ribs. Image quality for body composition traits was impaired due to the hair characteristics of the deer, even with close shaving the hollow hair follicle traps air and although sufficient lubrication was used, images were dark and in some cases not readable. Image quality and readable images seemed to be more prominent in animals with higher BCS and more body fat. Red deer average BCS was 6.6 (range 4.5 to 9.0), mean BF was 2.6 mm (range 1.8 to 3.8 mm) and RPFT was 7.3 mm (range 2.0 to 13.0 mm). Fallow deer average BCS was 6.8 (range 4.0 to 9.0), mean BF was 4.7 mm (range 3.0 to 6.4 mm) and RPFT was 4.9 mm (range 2.8 to 7.6 mm). Body condition score was significantly correlated with ultrasound back fat and rump fat, and had correlation coefficients of 0.43 and 0.70, respectively. Body condition scores were predicted with regression procedures ($R^2 = 0.75$) which included BF, RPFT, and $RPFT^2$ ($\hat{y} = 1.593 + 0.33996(BF) + 1.0297(RPFT) - 0.0508(RPFT^2)$). Image quality and the number of readable images using real-time ultrasound technology in prediction of BF or RPFT is reduced in deer with a BCS of 4 or less.

Key Words: Deer, Body condition score, Real-time ultrasound

99 Effect of prolactin administered to a perfused area of skin in Angora goats. R. Puchala*, S.G. Pierzynowski, T. Wuliji, A.L. Goetsch, and T. Sahu, *E. (Kika) de la Garza Institute for Goat Research, Langston University, OK.*

Prolactin is believed to mediate seasonal hair follicle growth cycles; therefore the effect of prolactin infusion on mohair growth of Angora goats was investigated using a skin perfusion technique. Six Angora wethers (average BW 30 # ± 3 kg) were implanted bilaterally with silicon catheters into the superficial branches of the deep circumflex iliac artery and the deep circumflex iliac vein. For the first 14 d of the experiment animals were infused (2.4 ml/h) into the deep circumflex iliac arteries with prolactin (one side) and saline (other side). The infusion rate of prolactin was 221 # g/d and was calculated to triple prolactin blood concentration in the perfused region. The area of skin supplied by the deep circumflex iliac artery was approximately 240 cm². Two weeks after cessation of infusions, 100 cm² areas within the perfused regions

were shorn to determine mohair growth. Greasy and clean mohair production was decreased ($P < 0.05$) by prolactin compared with saline (3.79 vs 4.62 g and 3.02 vs 3.67g/100 cm²/28 d, respectively). Oxygen saturation in blood hemoglobin from deep circumflex iliac veins was greater ($P < 0.02$) on the side infused with prolactin than on the control side (75.1 vs 68.2 %). Higher concentrations of Met, Lys, Val, Ileu and Leu were observed in the venous blood taken from the deep circumflex iliac vein on the side infused with prolactin compared with saline ($P < 0.05$). Direct skin infusion with prolactin decreased fiber synthesis and may have decreased oxygen consumption by the skin. Decreased fiber production/nutrient utilization by the skin may be due to competition for nutrients with other processes that are regulated by prolactin such as lactation or reproduction. Selection of animals with low blood prolactin or low seasonal blood prolactin variation may reduce rest phase of fiber follicles and improve fiber production.

Key Words: Skin perfusion, Prolactin, Mohair

Ruminant Production and Forages II

101 Relationship of clipped diet samples to fecal NIRS diet quality predictions of cattle grazing tall fescue pastures in Georgia. J.G. Andrae*¹, M.A. McCann¹, D.R. Tolleson², J.A. Bondurant¹, R.H. Watson¹, and J.W. Stuth², ¹*The University of Georgia, Athens,* ²*Texas A&M University, College Station.*

A study was conducted at two locations in Georgia to determine if existing fecal near infrared spectroscopy (NIRS) equations can be used to accurately predict diet quality of cattle grazing tall fescue monocultures. At Eatonton, 40 steers (BW = 375 kg) grazed ten paddocks from March 16 to May 25. At Calhoun, 40 heifers (BW = 295 kg) were allotted to eight paddocks from March 28 to July 19. At both locations one hectare paddocks were grazed using put and take stocking to ensure adequate forage availability. Diet clippings and fecal grab samples were collected at d 14, 28, 56, 84 and 112 of the grazing season. Diet clippings were analyzed for crude protein and digestible organic matter content. Fecal samples were composited within sampling date and paddock and evaluated using existing NIRS prediction equations. Clipped forage quality values were regressed against NIRS predicted values using PROC REG of SAS. Crude protein and digestible organic matter content of clipped forage declined throughout the grazing season. Location statistically ($P < 0.05$) affected NIRS diet quality predictions; however, these differences did not appear to be biologically significant. Location differences likely resulted from the small number of samples (n=20) and relatively narrow range of data collected at the Eatonton station. Across locations, a linear relationship ($P < 0.01$) existed between clipped and NIRS predicted digestible organic matter content (clip DOM = 1.01*NIRS DOM; SE_p=1.95). There was also a linear relationship ($P < 0.01$) between clipped and NIRS predicted crude protein content (clip CP = 0.967*NIRS CP; SE_p=2.66). Prediction of tall fescue digestible organic matter content using existing fecal NIRS equations was strongly correlated with clipped diet samples (r=0.82) and appears precise. Crude protein estimates showed a weaker correlation (r=0.39) to clipped samples, and were more variable than digestible organic matter estimates.

Key Words: diet prediction, fescue, grazing

102 Coastal and Tifton 85 spring recovery following ryegrass sod-seeding. G. M. Hill*¹ and R. N. Gates², ¹*University of Georgia, Tifton,* ²*USDA-ARS, Tifton, GA.*

In a 3-yr study, spring recovery of Coastal (C) and Tifton 85 (T85) bermudagrass pastures after sod-seeding with ryegrass (R) was determined. Six C and six T85 pastures (.81 ha each) were sprigged in 1995. Three C and three T85 pastures were drilled with R (cv. 'Passerel') each year (31 October, 1996 and 28 October, 1997, 37 kg/ha; 7 October, 1998, 39 kg/ha). Yearling tester steers (4/pasture) were assigned to C and T85 pastures with R (CR or T85R) in January and February of each year. On 1 April 1997, 9 April 1998, and 15 April, 1999, tester steers (4/pasture; BW 374 kg) were assigned to pastures without R (CNR or T85NR), and previously assigned CR and T85R steers were weighed and continued grazing. Additional steers were used to adjust pasture forage height to approximately 4 cm. Fertilizer (24-6-12, N-P₂O₅-K₂O @280 kg/ha) was applied to R pastures in early February, and to all pastures in mid-March and late-May annually. In the 2 × 2 factorial experiment, bermudagrass cultivar (BC) and R sod-seeding

(RSS) were main effects. The 3-yr mean stocking rates (SR; steers/ha) on April 17, April 30, May 26 and June 22, respectively, were: CNR = 4.5, 5.2, 5.6, 6.7; CR = 4.3, 4.7, 4.1, 4.4; T85NR = 4.1, 5.4, 6.9, 9.8; T85R = 4.3, 4.8, 6.3, 9.6. The SR was higher ($P < .05$) for T85 than C after April 30. Forage mass for T 85 and C pastures on 19 May, 5 June and 20 June, respectively, by bermudagrass was C = 916, 1149, 1397; T85 = 1330, 1781, and 1671 kg DM/ha; $P < .05$). April tester initial BW and 85-d ADG (kg), steer grazing days/ha (d) and gain/ha (kg), respectively, were: BC - C = 373.2, .74, 421, 301; T85 = 374.9, .77, 515, 391; SSR - No R = 380.6, .64, 489, 306; with R = 367.5, .86, 447, 387. Tester ADG was increased ($P < .01$) by R, steer grazing days/ha were higher ($P < .01$) for T85 than C pastures, and both ryegrass and Tifton 85 increased gain/ha ($P < .05$). Sod-seeding with R did not affect forage mass and SR on T85 pastures, but it reduced both on C pastures.

Key Words: Cynodon, Ryegrass, Grass

103 Stocker lamb preference for cool season grass hay harvested in the afternoon. L.A. Richards*¹, M.A. Brown¹, S.W. Coleman², and W.A. Phillips¹, ¹*Grazinglands Research Laboratory, USDA-ARS, El Reno, OK,* ²*Subtropical Agricultural Research Station, USDA-ARS, Brooksville, FL.*

Effects of cool season grass hay variety and morning or afternoon harvest time on lamb preference and performance were investigated. 'Paiute' orchardgrass, 'Luna' pubescent wheatgrass, 'Triumph' fescue, and 'Jose' wheatgrass were cut for hay at 0730 (AM) and 1400 (PM) in April 1998. Winter wheat was cut in AM only. Hay CP and NDF concentrations ranged from 10 to 16% and 52 to 54%, respectively. Crossbred lambs (BW = 29 ± 4.0 kg) were individually penned to select between AM and PM cuttings within the same hay variety (n = 12) or between all two-way comparisons of PM grass hays and wheat AM (n = 20). Lambs were offered each hay cutting or variety at 2% of initial body weight during test meals, and both hays were removed when one was consumed. Lambs consumed more ($P < .001$) PM- vs AM-cut hay (291 vs 164 ± 13.6 g/d), primarily in 'Jose' and 'Triumph.' Across varieties, wheat and 'Luna' were preferred the most ($P < .001$) and 'Triumph,' the least ($P < .001$). To evaluate intake and gain when no choice was offered, 36 crossbred lambs (BW = 31 ± 2.5 kg) were fed one of the nine hay varieties and cuttings ad libitum, and supplemented with a grain mix (20% CP) at .6% BW for 20 d. Intake tended ($P < .10$) to be higher for 'Paiute' and 'Luna' as compared to 'Jose' and 'Triumph' (940, 949, 1115, 1141, and 978 ± 67.3 g/d for 'Triumph,' 'Jose,' 'Luna,' 'Paiute,' and wheat, respectively). Daily gain was not different for hay harvest time ($P = .25$) or variety ($P = .81$). Gain:feed was increased ($P = .04$) in lambs fed PM- vs AM-cut hay (.23 vs .20 ± .0104), primarily in 'Luna' and 'Jose.' Cutting cool season grasses later in the day increased lamb preference, but differences in intake and gain efficiency depended on hay variety and the opportunity to select.

Key Words: Feeding preference, Intake, Sheep

104 Performance of normal- and early-weaned beef calves grazing Endophyte-Infected Tall Fescue. C. L. Schultz*, D. G. Ely, B. T. Burden, J. Wyles, E. S. Vanzant, and D. K. Aaron, *University of Kentucky, Lexington.*

Sixteen Angus and Angus x Beefmaster cows and their calves were assigned to one of two treatments from May 26 through September 21, 1999 to evaluate the performance of calves from two weaning management systems. Treatments were: 1) early weaning (EW) with calves receiving a creep diet for 35 d prior to weaning at an average age of 124 d (June 30) or; 2) a normal weaning (NW) system in which calves were weaned at an average age of 207 d (September 21). Early-weaned calves (n = 8) were grouped together for 2 wk post-weaning, adjusted to a commercial growing diet, and then randomly allotted to four, 1.6-ha, endophyte-infected tall fescue (*Festuca arundinacea*) pastures with two calves/pasture. Calves were also fed the growing diet (3.6 kg/hd) once daily from July 15 to September 21. Cows in the EW treatment were separated from the EW calves and allowed to graze as one herd. Cows and calves in the NW system were randomly allotted to 1.6-ha pastures at the same time as EW calves, with two cows and their calves per pasture. Pasture served as the experimental unit. All cows and calves were weighed at 14-d intervals and body condition scores were assigned to all cows (1 to 10 scale). To determine total DMI and DM digestibility, all calves were bolused with a Cr₂O₃ release-rate capsule (Captec) on July 15 and August 11. Fecal grab samples were collected at 0800 daily from July 25 to 30 and August 21 to 26. Milk consumption was estimated for the NW calves during each period using the weigh-suckle-weigh procedure following a 5-h fast. Data were analyzed using Proc GLM of SAS[®]. Calf weights did not differ when creep feeding began, but EW calves were heavier (P = 0.07) at early weaning. During creep feeding, ADG was higher (P = 0.004) for EW calves. Average daily gains were higher (P = 0.03) for the NW calves during the first 2 wk post EW, but differences to September were not significant. Cow weights were not affected by treatment. Early-weaned calves had a higher (P = 0.009) DMI during period one but not during period two. Dry matter digestibility was higher for EW calves during periods one (68 vs 58%; P = 0.04) and two (64 vs 46%; P = 0.007). Performance of beef calves, early-weaned on endophyte-infected fescue pasture, plus supplement, can be competitive with those in a normal weaning management system.

Key Words: Early weaning, Fescue, Performance

105 Effects of level of cow nutrition and creep feeding on performance of fall calving cows and their calves. S.J. Mayo*, D.L. Lalman, G.E. Selk, R.P. Wettemann, and D.S. Buchanan, *Oklahoma State University, Stillwater.*

Fifty-six mature beef cows were used in a 2x2 factorial design to identify effects of level of cow supplementation and creep feeding on cow and calf performance. Angus and Hereford x Angus cows calved during September and October and grazed abundant tall grass prairie throughout the experiment. Cows were exposed to bulls from November 20 through January 7. Cow/calf pairs were assigned to one of eight pastures based on treatment and calving date block. Treatments were: 1) 0.91 kg of 40% CP supplement with no creep feed (LN); 2) 2.72 kg of 20% CP supplement with no creep feed (HN); 3) 2.72 kg of 20% CP supplement with calves having ad libitum access to creep feed (HC); 4) 0.91 kg of 40% CP supplement with creep feed (LC). Creep feed contained 20% CP, 5% salt and was formulated using a blend of soybean meal, corn, wheat middlings and soybean hulls. Treatments were initiated on January 7 and continued through April 14, when adequate green forage was available. During the treatment period, cows were rotated to adjacent pastures every 14 days. After April 14, all groups were managed as a single contemporary group until calves were weaned on July 6. Cows and calves were weighed and cows were assigned a body condition score (BCS) on January 7, April 14 and July 6 after a 16-h removal from feed and water. Cows were weighed and scored again on August 16. Treatment did not influence (P > .1) cow weight or BCS change during winter, spring or late summer. Least squares means for calf ADG for LN, HN, HC and LC were 0.53, 0.64, 0.88 and 0.81 ± 0.03 kg (P < .01) during winter, and 1.28, 1.34, 1.20 and 1.19 ± 0.04 kg (P < .02) during early summer, respectively. Creep intake was 126.7kg and 154.1 kg for HC and LC, respectively (P > .1). Additional calf winter weight gain due to creep feeding was 22.9 kg for HC vs HN and 27 kg for LC vs LN (P > .1). Creep feeding fall-born calves has no effect on cow weight and

BCS change. Sixty two percent of the additional weight gain from creep feeding was retained through weaning.

Key Words: Beef, Creep Feeding, Cow Performance

106 Intake of Coastal and Tifton 85 bermudagrass hays by beef cows. G. M. Hill*¹ and R. N. Gates², ¹University of Georgia, Tifton, ²USDA-ARS, Tifton, GA.

A drylot confinement feeding experiment was conducted with the objective of determining intake of Coastal (C) and Tifton 85 (T85) hays fed to 24 non-pregnant beef cows (mean initial BW 523 kg). In 1998, hays were harvested from the two meadows in late-June, and fertilizer was applied on July 1. Then, C hay was cut on August 5 at 42 d of maturity, T85 was cut on August 4 at 36 d of maturity, and all hay was stored under shelter. Cows were predominantly of Angus breeding, and they were ranked by BW and randomly assigned to hay treatments (4 pens of 6 cows; 2 pens/treatment) in a completely random design. Hay intake, hay chemical components and cow body condition scores (CS) were analyzed by the General Linear Model Procedures of SAS. Initial and final BW were means of consecutive daily full weights. All cows were treated with an anthelmintic on d 1. Cow CS (Scale 1 to 9, 5=average fat thickness; 9= extremely obese) were recorded on d 1 and d 33. Cows had free-choice access to water and a mineral mixture (7% P; 19% Ca; 22% NaCl). Large round bales (450 to 500 kg) were weighed as they were put into one hay ring/pen, before being fed free-choice under shelter on concrete flooring. Hay that was soiled, pulled out of racks, or not consumed was removed and weighed. New bales were fed approximately every 4 d, based on DMI of cows, and when 85 to 90 kg of hay remained/pen. Four round bales of each kind of hay were sampled, and DM, CP, ADF, NDF and ADL (%; DM basis), respectively, were: C= 94.1, 11.8, 37.9, 80.2, 5.4; T85= 94.5, 11.4, 43.6, 82.7, 5.5. While DM, CP and ADL were similar for the hays, ADF and NDF were both higher (P < .05) for T85 hay than for C hay. In the 33-d hay intake study, DMI was higher for cows fed T85 hay than C hay (13.96 vs 13.06 kg/d, P = .07), despite higher ADF and NDF for T85 hays. Initial and final CS, respectively, for cows fed C hay were 5.00 and 4.84, and for cows fed T85 hay, 4.67 and 4.66, indicating that both hays effectively maintained body condition of cows. Research has indicated that T85 hays are often highly digestible regardless of high ADF and NDF concentrations, and higher digestibility might have influenced increased intake of cows fed T85 hays in the present study.

Key Words: Hay, Bovine, Intake

107 Effect of supplemental energy source and degradable intake protein level on intake and apparent digestibility of stockpiled bermudagrass hay. C.R. Johnson*¹ and D.L. Lalman¹, ¹Oklahoma Agricultural Experiment Station.

Four crossbred steers (422 1.8 kg) were used in a Latin square design to evaluate effects of supplemental energy source and DIP level on DMI, apparent total tract digestibility of organic matter (OMD), fiber constituents (NDF and ADF), and nitrogen (ND) from stockpiled bermudagrass hay. Each period consisted of a 12 d diet adaptation period followed by a 5 d collection of feed, feces, and dirt. Forage was offered with ad libitum access and contained (DM basis) 93.4% OM, 43.7% ADF, 7.2% CP, and 60.8% DIP, as a percentage of CP. The pelleted supplements were individually fed at 0.73 kg/d and included: 1) soybean hull (SH; 14% CP, 52.5 g DIP/steer); 2) corn with supplemental soybean meal to contain equivalent DIP as SH (LC; 14.2% CP, 49.4 g DIP/steer); 3) corn with supplemental soybean meal to contain 2 times the DIP concentration of SH (HC; 23.3% CP, 110.7 g DIP/steer); and 4) non-supplemented control (CON). Supplementation did not affect DMI (1.9 0.06% of body weight; P > 0.1), OMD (49.5 3.0%; P > 0.1), NDF digestibility (45.9 2.1%; P > 0.1), or ADF digestibility (36.9 2.7%; P > 0.1). Both LC (40.6%) and HC (42.9%) increased (P < 0.05) apparent N digestibility as compared to SH and CON (34.1 and 31.0%, respectively). Degradable intake protein level within the corn supplements, LC and HC, did not (P > 0.1) alter apparent N digestibility. The increase in apparent N digestibility of the LC and HC supplemented steers may be attributed to the increase in fermentable substrate in the rumen, increasing microbial growth and efficiency.

Key Words: Digestibility, Stockpiled bermudagrass, Supplementation

108 Undegradable intake protein for growing cattle grazing stockpiled tall fescue. P. A. Beck*, S. A. Gunter, and J. M. Phillips, *Southwest Research and Extension Center, University of Arkansas, Hope.*

Tall fescue in the fall and early spring normally contains 15 to 25% CP and 60 to 75% TDN (DM basis). These characteristics create unbalanced TDN:CP ratios that are potentially less than 4:1. Thus, the growth of calves grazing high quality forages may be limited by ruminal metabolizable protein yield, which might be corrected by supplementation with UIP or energy. On 5 January 1999, 40 steers and 40 heifers (initial BW = 255 kg) were allocated to eight 5.1-ha pastures of stockpiled Kentucky-31 tall fescue for 120 d. Each pasture was assigned one of four supplementation treatments which included: no supplement (control); supplemental corn (corn); a 22% CP supplement, supplying 100 g of UIP/d (low escape protein, LEP); or a 42% CP supplement, supplying 200 g UIP/d (high escape protein, HEP). Supplements were fed at a rate of 0.35% of BW (0.91 kg/d) and were designed to supply 200 mg/d of lasalocid. Fishmeal, feathermeal, and poultry bloodmeal were blended on an equal protein basis and mixed with corn to supply the daily supplemental escape protein. Data were analyzed as a completely randomized design using pasture as the experimental unit. Initial BW was used as a covariate in the performance analysis. The gender x supplement treatment was not significant ($P > 0.16$), but gender was significant ($P < 0.02$), which was reflected by lower BW gains and final BW by heifers compared to steers. Performance of steers was increased by supplementation ($P = 0.02$), but the performance of heifers was not significantly increased by supplementation ($P = 0.32$). In steers, corn and HEP increased final BW ($P < 0.01$) by 20 kg and ADG ($P < 0.01$) by 0.16 kg/d, while LEP increased final BW ($P = 0.06$) by 10 kg and ADG ($P = 0.06$) by 0.09 kg/d, compared to control steers. For steers supplemental efficiency (kg of supplement/kg of additional gain) was 5.6 for corn and HEP and 10.5 for LEP. For heifers supplemental efficiency was 16.7, 8.3, and 7.4 for corn, LEP, and HEP, respectively. Based on this trial, corn supplementation is adequate to increase BW gains of steers grazing stockpiled fescue in the winter and spring.

Key Words: Cattle, Supplementation, Undegradable Intake Protein

Small Ruminant Production III

110 Tannins and protein utilization relationships in small ruminant grazing and browsing systems. K.E. Turner*, *USDA, ARS, Appalachian Farming Systems Research Center, Beaver, WV.*

Meat goats are often integrated into pasture management systems to make efficient use of available woody plants and noxious weeds. Evaluation of performance efficiency and development of intensive stocking systems for pasture-based meat goat production is needed to provide information for a fast growing niche market potential for farmers. Good pasture management maintains swards in vegetative state resulting in herbage with high nutritive value (low fiber, high crude protein). Often times in pasture-based livestock finishing situations, nitrogen-utilization by ruminants is inefficient when grazing these vegetative swards. Plant tannins contained in specific forage and browse plants can have positive or negative effects on nitrogen-use and overall livestock performance, depending on the types and concentration of tannins that are present in the diet. In theory, low molecular weight condensed tannins can bind dietary protein at ruminal pH thereby reducing breakdown by microorganism and increasing the rumen escape value of dietary protein. The tannin-protein complex is dissociated in the acidic environment of the abomasum and intestinal absorption of protein and overall nitrogen-use is usually increased. Forages containing 20 to 40% condensed tannin have been reported to increase rumen escape value of herbage and improve weight gain by lambs. Goats tend to tolerate and perform well when grazing plants with higher tannin concentrations. Plant breeders have developed low tannin cultivars of specific legumes that have improved palatability and intake by grazing livestock. Specific information on definitions of tannin classes, tannin concentrations contained in browse and forages throughout the growing season, and critical tannin level x protein interactions in grazing and browsing ruminants is needed in order to optimize utilization of nutrients and small ruminant production.

Key Words: Ruminants, Tannins, Protein-use

109 Performance of beef heifers fed ad libitum soybean hulls and hay with or without a monensin-containing mineral supplement. J.D. Steele*¹, D.L. Lalman¹, J.G. Kirkpatrick¹, and R.P. Wettemann, ¹*Oklahoma State University, Stillwater.*

Weaned Angus/Hereford crossbred heifer calves (n=94) were used to evaluate the effect of a commercial monensin-containing mineral supplement in a soybean hull pellet (SBHP) diet. Heifers were housed in dry-lot pens with ad libitum access to SBHP, prairie hay, and either white salt (SALT) or mineral (MIN). The MIN contained 1.78 mg/kg monensin, 25% NaCl, 10% Ca, 6% P, 1% K and 26 mg/kg Se. A series of four 85-d replications were conducted over a two-year period. Initial mean weights were 183 240, 239 and 282 kg for each of the replications. Initial and final weights were taken after an overnight 12-h removal from feed and water. Heifers were dewormed prior to the beginning of each replication. Hay, SBHP, and supplement refusals were weighed weekly to determine feed and supplement intake. Rumen fluid samples were collected from 5 heifers per treatment in two replications to determine rumen pH. Twelve percent of the SALT group and 6% of the MIN group displayed rumen distention at least once during the trial, while 7% of the SALT group had recurring distention ($P = 0.1$). Rumen pH was not different ($P > 0.1$) among treatments and averaged 5.67 ± 0.1 . Daily weight gain was 4% greater for MIN fed heifers compared to SALT fed heifers (1.11 vs 1.07 ± 0.014 kg; $P < 0.05$). Similarly, MIN increased gain per unit of feed DM by 6% (117.7 vs 125.0 ± 12 g/kg; $P < 0.05$). Treatment did not influence ($P > 0.1$) DM intake of SBHP (8.02 ± 0.12 kg), hay ($.95 \pm 0.045$ kg), or supplement 75 ± 7 g/day. Calculated monensin intake was 138 mg/day. We conclude that SBHP can be used as an effective alternative to high quality forage in growing cattle, and the use of an ionophore-containing mineral supplement improves animal performance and feed efficiency. However, adequate intake of an effective fiber source is necessary to minimize risk of bloat and acidosis.

Key Words: Soybean Hulls, Ionophores, Stocker Cattle

111 Condensed tannins and ruminant nutrition. B.R. Min*¹, S. Hart¹, and T.N. Barry², ¹*E (Kika) de la Garza Institute for Goat Research, Langston University, OK,* ²*Massey University, Palmerston North, New Zealand.*

The objective of this paper is to present a brief overview of effects of condensed tannins (CT) on ruminant nutrition and animal production. Tannins are phenolic secondary compounds and are widely distributed in the plant kingdom. CT are the most common type of tannin found in temperate legumes, trees, and shrubs. Tannins exist primarily as CT and hydrolyzable tannins (HT). HT are potentially toxic to ruminants. Pyrogallol, a hepatotoxin and nephrotoxin, is a product of HT degradation by ruminal microbes. However, CT are considered to be non (or less)-toxic because they are not absorbed from the intestine. CT often precipitate with dietary proteins at pH 5.5 to 7.0, with the extent of this reaction being dependent on the concentration, molecular weight, and structures of the CT and of the protein. Low concentrations of CT (2 to 4% CT, DM basis) in several temperate plant species (e.g., *Lotus corniculatus*, sulla, and sainfoin) are beneficial for ruminants, and have resulted in improved milk yield, wool growth, live weight gain, ovulation, and lambing percentage, as well as preventing pasture bloat and reducing internal parasite burden. This is related to the reduced protein solubility and degradation in the rumen and to enhanced flow of non-ammonia nitrogen to the abomasum and to increase absorption of essential amino acids from the small intestine. However, high forage CT concentrations (5 to 10% CT) reduce voluntary feed intake and digestibilities, especially in tropical regions where feed choices and quality are limited. At present, there are a few opportunities for reducing the negative effects of high CT concentrations in these regions and future progress for improving ruminant productivity is dependent on improving our understanding of the chemical structure of CT from various plants and understanding how CT affect ruminal microbes and forage nutritive value.

Key Words: Condensed tannins, Ruminant, Nutritive value

112 The potential of Black locust foliage as forage for meat goats or sheep. J.-M. Luginbuhl¹, L. J. Unruh¹, and J. P. Mueller¹, ¹North Carolina State University, Raleigh.

Black locust (BL; *Robinia pseudoacacia* L.), a fast growing nitrogen (N)-fixing tree native to the southeastern United States is usually used as a source of timber for fenceposts because of its dense, rot-resistant wood. Besides having the ability to tolerate adverse conditions, BL grows rapidly and is a source of biological N. Biologically-fixed N in the leaves range from 65 to 146 kg N ha⁻¹ year⁻¹. In addition, BL foliage (2,390 to 3,260 kg ha⁻¹ leaf DM per growing season) provides a potential source of browse for meat goats (*Capra hircus*). Leaves of BL are rich in crude protein (CP; 17 to 28%). Nevertheless, BL leaves are high in condensed tannins (proanthocyanidins). In vitro true dry matter disappearance (IVTDMD) of BL leaves (62.2%) was much lower than that of Mimosa (*Albizia julibrissin*) leaves (83.8%) or Honey locust (*Gleditsia triacanthos*) leaves (71.5%). In addition, incubating BL leaves in the same jars with standard forage samples reduced IVTDMD values of the latter by two to three units. Replacing concentrate (30% of total DM) by BL foliage (25% of total DM) in gamagrass (*Tripsacum dactyloides*) hay-based diets containing 17.6% CP did not affect goat intake, but decreased digestibilities of DM 16%, CP 24%, and NDF 22%. In addition, CP excreted as a percent of CP intake increased 63%. Increasing the proportion of BL foliage to 50% of the diet DM had no further negative effects on intake or digestibility estimates. Lambs (*Ovis aries*) fed coarsely ground dry alfalfa (*Medicago sativa*) or BL foliage with similar CP (20%) were reported to consume 11% more of the former. In addition, digestibility of OM was less than a third, and digestibilities of NDF and CP in BL leaves were less than half those in alfalfa. Compared to lambs fed alfalfa, plasma urea N, ruminal ammonia and branched chain fatty acids values of lambs fed BL were 60, 82 and 80% lower, respectively. Under browsing conditions, meat goats have a high relative acceptance index for BL foliage. Furthermore, when grazed with cattle, meat goats very effectively control BL encroachment of mountain pastures by totally defoliating BL branches within their reach and often debarking tree trunks. Additional research is warranted to examine meat goat performance under grazing situations where animals have free access to a much greater variety of herbaceous plants to counterbalance the negative effects of condensed tannins found in BL.

Key Words: Small ruminant, *Robinia pseudoacacia*, Tannin

113 Condensed Tannin Analysis for Nutrition Studies: The Need for a Common Procedure. T.H. Terrill*, Fort Valley State University, Fort Valley, GA.

Condensed tannins (CT) are polyphenolic secondary plant compounds that influence utilization of nutrients by animals. At low concentrations in ruminant diets, CT can increase wool growth, milk yield, and ovulation rate and reduce incidence of bloat and detrimental effects of internal parasites. At high concentrations, CT can decrease feed intake and digestibility (fiber and protein). There have been a large number of recent investigations attempting to assess CT-nutrient interactions and their influence upon animal production, but there is currently little agreement between different laboratories as to an optimum CT analysis method. Tannins are a diverse family of compounds, and there is a large number of different CT analysis techniques. Tannins also readily form complexes with protein which are insoluble in aqueous acetone or methanol, further complicating assessment of CT levels in plants and in the digesta and feces of animals consuming CT-containing feeds. To address this problem, a method for separation of total CT in forage plants, protein concentrate meals, and cereal grains into specific bound (protein-bound, fiber-bound) and unbound (extractable) fractions was developed by Terrill et al (1992). Since originally published, this method has been modified in nearly every laboratory in which it has been utilized. Although no one analysis method will be appropriate for every type and concentration of CT in plants, general agreement on CT analysis methodology for nutrition studies would facilitate comparison of results between laboratories. With some modifications (Jackson et al., 1996; Perez-Maldonado and Norton, 1996), the original method for separation of total CT into extractable and bound fractions can be applied to any feedstuff, as well as to digesta and feces, and may be appropriate as a common procedure for nutrition studies with CT-containing feeds. The procedure to be used in different laboratories should include the same standard (purified CT), solvent mixtures for extracting unbound

and protein-bound CT, and colorimetric assay for all three tannin fractions (extractable, protein-bound, and fiber-bound CT). The procedure can be combined with protein-precipitation techniques to test reactivity of CT.

Key Words: Condensed tannins, Nutrition, Extractable

114 Effects of supplementation or dietary additives on the somatotrophic axis in male goats consuming *Acacia berlandieri*. T. A. Strauch¹, T. D. A. Forbes², C. A. Abbey¹, S. S. Sickenius², C. M. Hensarling², M. C. Lucy³, R. D. Randel⁴, and T. H. Welsh, Jr.¹, ¹Texas Agricultural Experiment Station, College Station, ²Uvalde, TX, ³University of Missouri, Columbia, ⁴Texas Agricultural Experiment Station, Overton.

The effect of supplement, monensin, or polyethylene glycol addition to a basal diet of *Acacia berlandieri* on the somatotrophic axis in Boer x Spanish male goats was studied. Goats (n=20; BW=26.1 ± .7 kg) were randomly assigned to treatment groups. Treatments were: 1) Basal (B; 34:66, chopped, dry alfalfa:*A. berlandieri* leaves, free choice), 2) B + Supplement (BS; B + high energy, low CP at 1% BW), 3) B + Polyethylene Glycol (BPEG; B + 20 g PEG before and after feeding), and 4) BS + Monensin (BSM; BS + monensin at 20 g/ton). Goats were hand-fed for 67 d and BW recorded weekly. Blood samples were collected by jugular venipuncture at d 0, 35, and 62 to determine plasma IGF-I by RIA. At d 67, 3 goats/treatment were euthanized and tissues collected. Anterior pituitary and liver tissues were homogenized and RNA extracted. Growth hormone (GH) mRNA expression in the anterior pituitary, and GH receptor (GHR) and IGF-I mRNA expression in the liver were determined via ribonuclease protection assays and quantified via integrated optical density units. No difference (P > .05) existed between B and BPEG and BS and BSM so groups were pooled: no added energy (NE) and added energy (E). E goats had increased ADG (P < .0001; 1.24 vs 1.17 kg/d; SE=.20; E vs NE). There was no difference (P > .05) in GH and GHR mRNA expression; however, IGF-I mRNA expression was increased (P < .01) in E goats vs NE (.04 vs .001; SE=.009; E vs NE). Plasma IGF-I did not differ (P > .05) at d 0 (104.5 vs 133.8 ng/mL; SE=19.8; E vs NE); but, E goats had higher plasma IGF-I at d 35 (P < .04; 179.0 vs 58.8 ng/mL; SE=35.8; E vs NE) and d 62 (P < 0.0003; 185.2 vs 57.7 ng/mL; SE=16.4; E vs NE). The change in plasma IGF-I during treatment was positive in E goats vs NE (P < .0001; 80.7 vs -76.1 ng/mL; SE=12.9; E vs NE). Energy supplementation in goats consuming *A. berlandieri* may reduce suppressive effects on the somatotrophic axis.

Key Words: *Acacia berlandieri*, Goat, Somatotrophic axis

115 Mineral concentrations in some common browse plants growing in Appalachia. K.E. Turner* and J.G. Foster, USDA, ARS, Appalachian Farming Systems Research Center, Beaver WV.

Meat-type goats readily consume weeds and woody plants and as a result can be integrated into pasture management systems to make efficient use of available plants. Nutrients available to the browsing goat depend upon the types and combinations of plants present. Multiflora rose (*Rosa multiflora* Thunb.; MFR), autumn olive (*Elaeagnus umbellata* Thunb.; AO), and Morrow's honeysuckle (*Lonicera morowii* Gray; HS) were collected throughout the 1999 growing season from replicated plot areas and evaluated for mineral concentrations. Date was significant (P < 0.05) for all minerals. There was a significant (P < 0.05) Date x Plant interaction except for total N, P, and Cu. When averaged over the growing season, total N was higher (P < 0.001) in AO (4.4%) than MFR and HS which were similar (mean 2.6%). Seasonal mean P concentrations (0.28%) and K (1.8%) were similar (P > 0.10) among AO, MFR, and HS. Percent Ca was highest (P < 0.001) for MFR (1.5%) and lowest (P < 0.001) for AO (0.50%); HS was intermediate (1.25%) and different (P < 0.01) from AO and MFR. Average seasonal Mg concentrations were similar (P > 0.10) in MFR and HS (mean 0.27%), but higher (P < 0.001) than AO (0.18%). Seasonal average concentrations of Cu were similar in AO and MFR (mean 12.7 ppm), but higher (P < 0.001) than HS (7.8 ppm). The mean seasonal Ca:P ratio was highest (P < 0.001) in MFR (7.8:1) and lowest (P < 0.001) in AO (2.3:1); HS (6.2:1) was intermediate and different (P < 0.001) from MFR and AO. The N:S ratios were similar (P > 0.10) among AO, MFR, and HS (mean

11.6). Mineral concentrations in browse plants are needed to help refine feeding and supplementation strategies for meat goats used to control weeds and woody plants in pastures.

Key Words: Minerals, Browse, Goat Production

116 Preference of summer annual forages by red deer. G. W. Evers*, T. J. Butler, D. A. Neuendorff, and R. D. Randel, Texas Agricultural Experiment Station, Overton.

Non-native deer farming is a new and expanding agricultural enterprise in the USA. Red deer (*Cervus elephus*) is one of the deer species grown for venison and velvet antler production. There is no available information on which forages adapted to the southeastern US are preferred by red deer. A cafeteria style grazing trial with warm-season annual grasses and legumes was planted in a prepared seedbed in a 0.05 ha paddock. Plots were 1.2- by 4.6-m and arranged in a randomized complete block with four replications. Six yearling red deer grazed the study for 4 d beginning June 14 and 3 d beginning July 27, 1999. Visual estimates on the percent defoliation were made each day of the grazing periods by two individuals. Analysis of variance was performed on the percent defoliation each day with mean separation by LSD 0.05 level. During the first grazing period the most rapid defoliation after 2 d was the hay-type soybean [*Glycine max.* (L.) Merr.] (99%) followed by lablab [*Lablab purpureus* (L.) Sweet] (85%), brown midrib sorghum [*Sorghum bicolor* (L.) Moench] (64%), and cowpea [*Vigna unguiculata* (L.) Walp.] (49%). These four entries were completely defoliated by the third day. At that point the red deer began eating the regular forage sorghum, phaseybean [*Macroptilium lathyroides* (L.) Urb.], and crabgrass [*Digitaria sanguinalis* (L.) Scop.]. By the fourth and last day the red deer had grazed everything except pearl millet [*Pennisetum americanum* (L.) Leeke] and browntop millet [*Panicum ramosum* L.]. During the second grazing period, the initial preference was for hay-type soybean, lablab, brown midrib forage sorghum, and cowpea which were completely defoliated by the third day. Defoliation percentage for phaseybean was 35%, regular forage sorghum 60% and crabgrass 31%. As in the first grazing period, the red deer avoided the pearl millet and browntop millet. Soybean, cowpea, lablab, and brown midrib forage sorghum are the most suitable summer annual forages for red deer.

Key Words: Red deer, Summer annual, Forages

117 Sustainable dairy goat milk production from forages. B.R. Min*¹, S.P. Hart¹, and T. Sahl¹, ¹Langston University, OK.

This study was designed to investigate the effects of different levels of concentrate supplementation on milk production and composition by pastured dairy goats. Forty-four Alpine goats (56 ± 11 kg BW) were randomly allocated to four groups and were supplemented with 0.66 (Groups A and B), 0.33 (group C), and 0 kg concentrate (group D) per kg of milk over 1.5 kg/d. Mixed vegetative forages (rye/crimson clover, rye/ryegrass, wheat/ryegrass, and crabgrass) were rotationally grazed by the goats except for group A (confined and fed alfalfa hay). Milk production was recorded daily and milk samples were collected twice monthly for 7 months (March to September 2000) and analyzed for fat (F), protein (P), lactose, solids-not-fat (SNF), and total solids (TS). Contents of F, SNF, and TS were similar among diets. However, P concentration in group C was higher than for groups A, B (P = 0.1) and D (P < 0.01). Lactose concentration in group D was lower than in other groups (P < 0.05). Average milk concentrations of F, SNF, TS, P, and lactose decreased (P < 0.01) over the lactation (from March to September) by 38, 37, 21, 19, and 12%, respectively. Average milk yield of the 7-month period was 3.4, 2.9, 2.5, and 2.1 kg/d for treatments A, B, C, and D, respectively, with differences (P < 0.01) among all treatments. However, milk yield in the first 2-month period was similar (3.6, 3.3, 3.1, and 3.1 kg/d for treatments A, B, C, and D, respectively) and then decreased during the summer (3.3, 2.8, 2.3, and 1.8 kg/d, respectively; P < 0.01). High summer milk production for treatment group A was probably due to higher energy intake. Goats in group A gained BW (19 g/d); but groups B, C, and D decreased in BW (9.3, -12, and 30 g/d, respectively). Milk yield and composition varied among dietary treatments with some measured affected by stage of lactation and season. It can be concluded that all concentrate levels supported similar high

levels of milk production by pastured dairy goats in early lactation, but were inadequate for high production during the summer.

Key Words: Goat, Milk production, Milk composition

118 Using poultry litter as a protein source in meat goat diets. D. Ferara*¹, B. Rude², J. Harter-Dennis¹, and N. Whitley¹, ¹University of Maryland Eastern Shore, Princess Anne, ²Mississippi State University, Starkville.

Twenty female and castrated male crossbred meat goats (113 ± 7 d of age) were fed one of two diets to determine if poultry litter can be used as a suitable protein source in diets for meat goats. Animals were fed either a control, commercial diet (75% commercial diet, 25% alfalfa pellets), or a poultry litter-based diet (40% poultry litter, 35% corn and 25% alfalfa pellets) with 3 pens/treatment and 10 goats/treatment. Animals that had been exposed to creep feed while nursing were weaned and placed in an indoor facility with 8 X 8 pens and slatted concrete floors and allowed ad libitum access to feed, water and minerals. The goats were allowed a 14-d adjustment period in which they were gradually introduced to the treatment diet such that at the end of the adjustment period, goats were receiving 100% of the treatment diet and no digestive problems were observed. Goats were weighed weekly and feed consumption determined biweekly for the eight-week trial. Total gain for goats on the control diet (20.1 ± 3.26 kg) was greater (P < 0.05) than for those receiving the poultry litter-based diet (6.2 ± 1.52 kg). Feed efficiency (gain/feed) for the control group (0.12 ± 0.04) was not different from animals receiving the poultry litter-based diet (0.07 ± 0.04). In summary, goats fed a commercial goat diet gained faster but had a similar feed efficiency when compared to goats fed the poultry litter-based diet. However, it was observed that goats were sorting the poultry litter-based diet, so further studies are needed using a pelleted diet to minimize sorting. Also, it is important to note that near the end of the study, two animals receiving the poultry litter-based diet died of urinary calculi.

Key Words: Meat goat, Poultry litter, Feed intake

119 Evaluation of porcine blood cells as an alternative nitrogen source in soybean meal-supplemented lamb diets. B. T. Burden*, D. G. Ely, C. L. Schultz, and D. K. Aaron, University of Kentucky, Lexington.

Two digestion/N balance trials were conducted to evaluate the potential of different levels of porcine blood cells (PBC) to stimulate nutrient utilization. In the first trial, a 5 x 5 Latin square design used five Hampshire x Polypay lambs (4 mo, 32 kg) fed diets in which 0, 20, 40, 60, and 80% of the soybean meal (SBM) protein was replaced with PBC protein. Diets contained 90% concentrate, 10% roughage and 15.7, 15.5, 15.9, 15.5, and 16.1% CP, respectively. Daily rations (2.2% BW) were fed in equal portions at 0800 and 2000. Urine and feces were collected for 7 d following a 14-d adjustment period. Digestibilities of DM, NDF, ADF, and N were not affected by dietary PBC percentage. Daily N retention, expressed as a percent of N intake, resulted in a cubic effect (P = 0.03), with 20 and 40% PBC producing the highest values (23.4 and 21.3, respectively). Percentage of digested N retained followed a cubic trend (P = 0.03), with 20 and 40% PBC again producing the highest values (29.1 and 25.6). The same five lambs (9 mo, 40 kg), assigned to a second 5 x 5 Latin square, were fed diets containing 90% concentrate and 10% roughage. Diets contained 13.9, 13.8, 13.9, 14.0, and 14.6% CP when PBC protein replaced 0, 25, 50, 75, and 100% of the SBM protein, respectively. Rations, provided at 2.2% BW, were fed in equal portions at 0800 and 2000 each day. Urine and feces were collected for 5 d following a 9-d adjustment period. Dry matter, NDF, and ADF digestibilities tended to decrease linearly (P = 0.08, P = 0.1, P = 0.1) as the level of dietary PBC increased. Unlike the first trial, no differences for N retention were found. These results indicate N utilization in young, lightweight lambs can be improved when PBC protein replaces 20 to 40% of dietary protein supplied by SBM. However, no benefit of PBC substitution was found in 9 mo-old, 40-kg lambs.

Key Words: Porcine blood cells, Lambs, Nitrogen

120 Corn gluten feed supplementation for growing-finishing, fall-born Polypay lambs. D. G. Ely*, D. K. Aaron, W. P. Deweese, E. Fink, B. T. Burden, and C. L. Schultz, *University of Kentucky, Lexington.*

Seventy-six Polypay lambs (40 ewes, 27 rams, 9 wethers) were weaned from 47 Polypay ewes at 59 d of age (December 17). All lambs had ad libitum access to a 12% CP creep diet from 2 wk of age until weaning. Pre-weaning ADG was 0.33 kg; weaning weight averaged 23.4 kg. Lambs had ad libitum access to a 14.8% CP diet (90% concentrate) in an enclosed barn from d 59 to 85 (January 12). Then, lambs were individually weighed on two consecutive days and allotted, within sex class, to four, 1.2-ha mixed-grass pastures. Two pasture groups were fed twice daily a 90% concentrate diet supplemented with soybean meal (SBM) to meet NRC requirements for 30-kg lambs (14.8% CP). The remaining two groups were managed similarly, except corn gluten feed (CGF) replaced 27% of the soybean meal. These diets were provided until average lamb weight reached 40 kg (41 d). Diets were then altered to meet NRC requirements for 40-kg lambs (13.3% CP) and fed for the remaining 15 d of the 56-d feeding period (March 8). Daily gains were 0.28 versus 0.27 kg and gain to feed ratios were 0.25 versus 0.22 ($P = 0.09$) for SBM and CGF, respectively, during the first 41 d. For the last 15 d, daily gains were 0.23 versus 0.30 kg ($P = 0.07$) while gain to feed ratios were 0.20 versus 0.24 ($P = 0.03$). No treatment differences were found for either daily gains or gain to feed ratios for the total 56-d period. Final weights for SBM and CGF lambs were 44.3 and 44.2 kg; costs per kilogram of gain were \$0.66 and \$0.68. Although CGF can produce comparable gain, economic efficiency favors SBM supplementation of growing-finishing diets fed to fall-born lambs during winter.

Key Words: Corn gluten feed, Lambs, Fall-born

121 The effects of extruded cotton gintrash on growth performance, feed efficiency and carcass characteristics of crossbred lambs. S. L. Campbell, S. P. Jackson*, and C. Bridges, *Texas Tech University, Lubbock.*

The objective of this study was to compare three finishing diets containing cotton by-products as the source of roughage. An 8% starch-coated extruded gintrash product (EGT), ground gintrash (GGT) (3/4" screen), and cotton seed hulls (CSH) were used for the roughage sources in three finishing diets. Diets were isocaloric and isonitrogenous. Rambouillet x Hampshire wethers ($n = 72$) were stratified by weight and randomly allotted 8 animals to a pen. Each treatment (trt) was randomly assigned to a pen. Feed efficiency, ADG, and carcass characteristics were compared between treatments. Gain to feed (G:F), ADG, and ADFI, were significant for all three treatments. The G:F ratio was highest for lambs on the CSH diet (.176) and was greater ($P < .05$) than lambs on the EGT (.159) and GGT diets (.118). The G:F for lambs consuming the EGT diet was greater than the G:F for lambs on the GGT diet ($P = .001$). Lambs consuming the CSH diet (.34 kg) had the highest ADG, while lambs on the EGT diet (.28 kg) ($P = .002$) were intermediate and lambs on the GGT diet (.24) ($P < .0001$) had the lowest ADG. The ADFI for lambs on the EGT diet (1.8) was significantly lower than the

GGT diet (2.05). Lambs on the CSH diet (1.98) also consumed less than lambs on the GGT ($P = .01$). Quality grade and flank streakings were not significantly different between trts. Lambs on both the CSH diet and EGT diet had higher ($P = .03$) leg score than lambs on the GGT diet. Lambs consuming the EGT (7.11 mm) and GGT diets (6.85 mm) had lower ($P = .03$) fat thickness than the lambs on the CSH diet (8.32 mm). The lambs consuming the EGT (3.0) and GGT diets (3.0) also had lower yield grades ($P = .05$) than the lambs on the CSH diet (3.5). The lambs on the GGT diet consumed the most feed and were the least efficient and had the lowest ADG and leg score. The lambs on the EGT diet consumed the least feed and were intermediate in ADG, feed efficiency and leg score. These data provide evidence that extruding gintrash improved the ADG and feed efficiency of lambs.

Key Words: Extrusion, Sheep, Growth

122 Effects of milk feeding regime on performance of artificially reared Alpine kids. A. L. Goetsch*, G. Detweiler, T. Sahlu, and L. J. Dawson, *E. (Kika) de la Garza Institute for Goat Research, Langston University, OK.*

Forty Alpine kids (20 females and 20 males) were used to determine effects of different levels of milk intake restriction and number of meals on starter diet intake and growth. Kids began the experiment at 3 to 9 d after birth (3.8 ± 0.15 and 4.2 ± 0.16 kg initial BW for females and males, respectively). A mixed starter diet was consumed ad libitum during the 10-wk suckling and 4-wk post-weaning periods; milk consumption was ad libitum for the first 2 wk. Treatments were: ad libitum consumption of milk in two meals in wk 3-8, then 50% of consumption on the preceding few days with one meal in wk 9 to 10 (AL); 75% of intake on the last few days of wk 2 in two meals in wk 3-8, then 50% consumption (67% of intake in wk 3-8) in wk 9-10 with one meal (R-2X); 75% consumption in one meal in wk 3-8, then 50% consumption in wk 9-10 in one meal (R-1X); and 75% consumption in two meals in wk 3-6, then 37.5% consumption in one meal in wk 7-10 (R-2X-1X). Milk DMI was greatest ($P < 0.05$) among treatments for AL (174, 115, 128, and 113 g/d for AL, R-2X, R-1X, and R-2X-1X, respectively). Starter diet DMI (g/d) was 19, 25, 19, and 35 in wk 3-4 (SE 6); 27, 37, 25, and 48 in wk 5-6 (SE 8); 51, 78, 72, and 143 in wk 7-8 (SE 16); 138, 194, 165, and 249 in wk 9-10 (SE 15); 343, 396, 388, and 417 in wk 11-12 (SE 47); and 508, 530, 489, and 539 in wk 13-14 (SE 38) for AL, R-2X, R-1X, and R-2X-1X, respectively. ADG was 163, 173, 175, and 175 in wk 1-2 (SE 8); 136, 84, 105, and 133 in wk 3-4 (SE 12); 114, 56, 87, and 102 in wk 5-6 (SE 20); 193, 132, 134, and 107 in wk 7-8 (SE 16); 87, 154, 96, and 136 in wk 9-10 (SE 22); 88, 110, 129, and 109 in wk 11-12 (SE 22); and 122, 108, 118, and 126 in wk 13-14 (SE 27) for AL, R-2X, R-1X, and R-2X-1X, respectively. In conclusion, restricted milk intake regimes can be used to increase dry feed consumption for ADG similar to that with ad libitum milk intake. Likewise, opportunities exist for unimpaired growth with restricted milk feeding in one meal daily during the latter portion of the suckling period.

Key Words: Goat, Suckling, Performance