

## Small Ruminant: Goats

**T268 Evaluation of the FAMACHA(R) system, fecal egg counts, hematocrits and weight of sheep and goats associated with parasitism fed varying levels of herbs and protein/energy grain.** H. A. Swartz\*<sup>1</sup>, A. Stewart<sup>1</sup>, D. Sommerer<sup>1</sup>, F. Wulff<sup>1</sup>, and M. Ellersieck<sup>2</sup>, <sup>1</sup>Lincoln University, Jefferson City, MO, <sup>2</sup>University of Missouri, Columbia.

A study was conducted to determine the effects of feeding various levels of protein/energy grain in an herbal mixture to Katahdin (K) hair sheep (n=39), Dorset(D) wool sheep (n=36) and Boer (B) goats (n=52), evaluating the FAMACHA<sup>®</sup> system for anemia compared to the red blood cell volume (hematocrit). The FAMACHA<sup>®</sup> system has been shown to be a useful tool in sheep in identifying clinical anemia associated with parasitism. However, the application of FAMACHA<sup>®</sup> to goats has not been evaluated. The FAMACHA<sup>®</sup> system has a scale based on the color of the ocular conjunctiva; 1-2 red and healthy, 3 borderline and 4-5 pale pink to white indicating anemia. The herbs consisted of 40.5% wormwood (*Artemisia absinthium*). Treatment groups were Dorsets, 1) control, 2) .11 gm/hd herbs plus .227kg/hd 14% protein/corn based diet daily (grain), 3) .11 gm/hd herbs weekly plus .227 kg/hd grain weekly. Katahdin sheep received 4) control, 5) 5.5 gm/hd herbs weekly and .113 kg of grain daily, 6) 5.5 gm/hd herbs plus .113 kg/hd grain weekly. Boer goats were fed 7) .113 kg/hd grain weekly 8) 5.5 gm/hd herbs plus .227 kg/hd grain daily and 9) 5.5 gm/hd herbs plus .113 kg/hd grain daily. Fecal egg counts (FEC), hematocrits (HEM), FAMACHA<sup>®</sup> (FAM) readings and weight (WT) were collected at the beginning of the project in all treatments and every four weeks. Data were analyzed in the SAS system for Pearson correlation coefficients and MIXED procedure in all treatments. The correlations of FEC to HCT (r = -.37), FEC to FAM (r = .27), HCT to FAM, (r = -.27) & HCT to WT (r = .43) with the K & D, significantly related (P < .05). The FAM to HCT in the Boer goats was not applicable showing no relationship in differences. There were no significant differences in treatment groups of K, D & B. The daily feeding of grain compared to the weekly feeding in sheep and goats and increase in feed from .113 to .227 in D and one group of B showed no significant differences in treatments. The FAM readings were effective in the sheep but not in the meat goats in HCT.

**Key Words:** FAMACHA, Deworming, Herbs

**T269 The effect of garlic on *Haemonchus contortus* infection in goats.** Z. Wang\*, E. Loetz, A. L. Goetsch, S. P. Hart, and T. Sahl, American Institute for Goat Research, Langston University, Langston, OK.

Garlic has been used in some countries as an ingredient in deworming remedies for humans and animals for many years. The study reported here determined the efficacy of garlic for treatment of *H. contortus* infection and effect on immune responses in goats. Twelve Spanish wethers (1.5 yr, 35 ± 1.5 kg BW) naturally infected with *H. contortus* were allocated to two groups of six each and housed individually. Goats were fed hay-based diets (ME = 8.7 MJ/kg DM; CP = 10%) without or with 2% of garlic powder. The diets were offered for 4 wk at a maintenance level of intake. The initial mean fecal egg counts (FEC) were 4,983 ± 1,973/g (range of 1,125 to 13,652/g) for the Control group and 8,654 ± 3,548/g (range of 2,050 to 22,225/g) for the Garlic group. There was not a time x treatment interaction in FEC (P > 0.05). With initial FEC as a covariate, the garlic treatment reduced FEC (geometric mean:

7,872 ± 38.6/g for Control and 699 ± 38.4/g for Garlic, respectively; P < 0.001) during the experimental period. Serum concentrations of IgA, IgE, and IgG on d 0, 14, and 28 were not affected (P > 0.05) by garlic intake. The BW of goats did not change during the experiment and was not affected by treatment (P > 0.05). These data suggest that the decline in FEC may be attributable to cell mediated immunity rather than a humoral immune reaction or direct garlic toxicity to the parasites. The results demonstrate that garlic is a potent anthelmintic herb and warrant more work to elucidate the mechanism.

**Key Words:** Goats, Garlic, *Haemonchus*

**T270 Efficacy of wormwoods (*Artemisia* spp.) as an anthelmintic in goats.** S. P. Hart\*<sup>1</sup>, J. F. S. Ferreira<sup>2</sup>, and Z. Wang<sup>1</sup>, <sup>1</sup>American Institute for Goat Research, Langston University, Langston, OK, <sup>2</sup>Appalachian Farming Systems Research Center, USDA-ARS, Beaver, WV.

Gastrointestinal nematodes (GIN) are the greatest health problem in goat production and control of GIN has become difficult due to development of anthelmintic resistance. Therefore, there is a need to investigate plant materials with potential anthelmintic activity. The objective of this study was to investigate the efficacy of two wormwood species against GIN in goats. A native wormwood (*Artemisia ludoviciana*) was harvested at the mature stage and whole plants were air-dried and fed to goats (B). *Artemisia annua* was cultivated and harvested at the late vegetative stage and air-dried; leaves were stripped from the stalks, dried at 45°C in a forced-air oven and crushed (L). Dry open Boer and Boer cross does (average BW = 42.3 kg) adapted to Calan headgates were used in this study. Does were housed in a barn and fed a control diet, 0.45 kg of a grain supplement (13% CP and 75% TDN) and 0.9 kg of a low quality hay (7% CP and 68% NDF) for a 7-d adaption period. Goats were randomly assigned to treatments. Seven does received the control diet throughout the study. Four animals received 0.34 kg B, 0.34 kg grain supplement, and 0.68 kg hay for 4 d and then received the control diet for the remainder of the study. Six animals were fed 0.45 kg L, 0.45 kg supplement, and 0.45 kg hay for 6 d and then received the control diet for the rest of the study. Fecal samples were taken for two consecutive days prior to feeding treatment diets and then on alternate days for 14 d. Fecal egg counts (FEC) were conducted by the McMaster procedure. The FEC were log transformed prior to statistical analysis. There was a significant time (pre-treatment vs post treatment) by treatment interaction (P < 0.002). Control FEC increased from 1,266/g to 1,673/g whereas B FEC decreased from 3,998/g to 2,979/g. Conversely, FEC for L was unchanged (2,510/g vs 2,419/g). The apparent anthelmintic activity of *Artemisia ludoviciana* merits further investigation, especially at a younger stage of maturity.

**Key Words:** Anthelmintic, Gastrointestinal Nematodes, Alternative Dewormer

**T271 Influence of sericea lespedeza pellets on gastrointestinal parasite fecal egg counts in goats.** N. C. Whitley\*<sup>1</sup>, T. H. Terrill<sup>2</sup>, J. E. Miller<sup>3</sup>, J. M. Burke<sup>4</sup>, and M. C. Gooden<sup>1</sup>, <sup>1</sup>University of Maryland Eastern Shore, Princess Anne, <sup>2</sup>Fort Valley State University, Fort Valley, GA, <sup>3</sup>Louisiana State University, Baton Rouge, <sup>4</sup>USDA-ARS-DBSFR, Booneville, AR.

The objective of the experiment was to determine the influence of sericea lespedeza pellets (SLP) on gastrointestinal parasite fecal egg counts (FEC) in goats. Naturally infected, mixed sex Boer crossbred goat kids were used at  $22.5 \pm 0.74$  kg body weight. Animals housed on pasture and being supplemented at approximately 2% BW concentrate daily were removed from pasture at an average FEC of  $2468 \pm 302$  epg. Goats were placed in individual pens with concrete-slatted or expanded metal flooring with goats allotted to treatments of 0 (CON), 20, 40, or 60% SLP (20SLP, 40SLP, 60SLP) to account for sex, body weight, pasture FEC and flooring type with 13, 10, 9 and 13 goats per treatment, respectively. Diets were mixed to be isonitrogenous and isocaloric, and included alfalfa pellets to provide a pelleted legume forage control. Blood samples for packed cell volume (PCV; packed red blood cell level/serum level  $\times 100\%$ ) and fecal samples for FEC (using the Modified McMasters technique) were collected on d-1, 7, 14, 21 and 28. Larval culture for speciation was conducted on fecal samples collected on d 28 of the study. Statistical analysis was conducted using the MIXED procedure of SAS for repeated measures and Pearson Product Moment correlations were conducted using the CORR procedure of SAS. In this study, PCV and FEC were negatively related ( $r = -0.37$ ;  $P < 0.0001$ ) as were FEC and body weight ( $r = -0.20$ ;  $P < 0.004$ ). Mean PCV and FEC were not influenced by treatment, averaging  $27 \pm 1.5\%$  for CON,  $33 \pm 1.8\%$  for 20SLP,  $33 \pm 1.7\%$  for 40SLP and  $31 \pm 2.2\%$  for 60SLP. The FEC averaged  $2690 \pm 483$  epg for CON,  $1406 \pm 551$  epg for 20SLP,  $1517 \pm 529$  epg for 40SLP and  $1266 \pm 690$  epg for 60SLP diets. Larval speciation through fecal culture indicated that at the end of the study, *Haemonchus contortus* larva were 43, 39, 35 and 31% of the sample for CON, 20SLP, 40SLP and 60SLP, respectively. So, overall larval cultures and PCV indicated a modest to low infestation level of *H. contortus*, which might have been selectively reduced by SLP. However, more research is needed to determine the influence of SLP on gastrointestinal nematodes in goats.

**Key Words:** Parasites, Tannin, FEC

**T272 Effect of somatic cell count in goat milk on yield and sensory quality of semi-hard cheese.** S. S. Chen<sup>1,2</sup>, L. Zhang<sup>1,3</sup>, B. Bah<sup>1</sup>, and S. S. Zeng\*<sup>1</sup>, <sup>1</sup>American Institute for Goat Research, Langston University, Langston, OK, <sup>2</sup>College of Food Science & Nutritional Engineering, China Agricultural University, Beijing, China, <sup>3</sup>Northeast Agricultural Research Center of China, Changchun, China.

This study investigated the effect of somatic cell count (SCC) in goat milk on yield and sensory quality of semi-hard cheese. Thirty kilograms of goat milk with SCC levels of 410,000 (Low), 770,000 (Medium), and 1,250,000 cells/ml (High) was obtained from the Alpine herd of the American Institute for Goat Research for the manufacture of semi-hard cheese in the Langston University dairy processing pilot plant for two consecutive weeks at three stages of lactation. Cheese milk prior to cheesemaking was analyzed for SCC, total solid (TS), protein, and fat in the Langston Dairy Herd Improvement (DHI) laboratory. Cheese yield was recorded on day 1 and cheese samples on days 1, 60 and 120 of aging were analyzed for scores of total sensory, flavor, and body/texture, and contents of moisture, protein, and fat. Results indicated that there were no significant differences ( $P > 0.05$ ) in cheese yield among milk with different SCC levels. However, goat milk with high SCC resulted in significantly lower ( $P < 0.05$ ) scores of total sensory and body/texture than milk with low or medium SCC, although no difference was observed in flavor score. A higher ( $P < 0.05$ ) cheese yield was obtained from goat milk in early lactation (April) than in mid- (July) or

late lactation (October) probably because of a higher total solids content in early lactation milk. Aging for 60 days or more improved ( $P < 0.05$ ) scores of total sensory, flavor, and body/texture in cheese as expected. It is concluded that SCC in goat milk did not affect the yield of semi-hard cheese but high SCC resulted in inferior sensory quality.

**Key Words:** Somatic Cell Count, Goat Milk, Cheese

**T273 Replacement of coastcross hay by soybean hulls in lactating dairy goat diets.** R. S. Gentil\*, C. Q. Mendes, I. Susin, A. V. Pires, G. H. Rodrigues, F. S. Urano, E. M. Ferreira, R. C. Amaral, and M. F. Ribeiro, *Escola Superior de Agricultura Luiz de Queiroz (ESALQ)/University of São Paulo (USP), Piracicaba, SP, Brazil.*

Soybean hulls (SH) can be used to replace either grain or forage in diets for lactating dairy ruminants. Most of research has been directed towards dairy cows, while for lactating goats there is little information about the effects of SH on intake, milk yield and composition. Thirty-six lactating Saanen goats ( $45 \pm 8$  DIM) were assigned to a complete randomized block design (according to milk production, DIM and number of lactation) to determine the effects of replacing coastcross hay neutral detergent fiber (NDF) by soybean hulls NDF on dry matter intake (DMI) and milk yield and composition. Goats were housed individually in a tie stall for a period of 8 weeks. Does were fed a 50:50 (concentrate:roughage ratio) TMR with 15% crude protein and with similar amount of NDF. Soybean hulls replaced hay by 0%, 33%, 67% or 100% on a DM basis, corresponding to the experimental treatments OSH, 33SH, 67SH and 100SH, respectively. Does were milked twice a day and milk samples were saved in-bromo-2-nitropropane-1-3-diol to determine composition by infrared absorbance. There was a linear decrease in daily milk production (2.76, 2.48, 2.58 and 2.05 kg), 3.5% fat-corrected milk (2.93, 2.54, 2.42 and 2.05 kg), lactose (4.51, 4.44, 4.38 and 4.33%) and total solids (12.45, 12.14, 11.60 and 11.63%) for OSH, 33SH, 67SH and 100SH, respectively, when SH were added to the diet. However, milk fat (3.86, 3.63, 3.23 and 3.56%) and milk protein concentration (2.99, 3.03, 2.94 and 2.85%) were similar ( $P > 0.05$ ) among treatments. There was a quadratic response ( $P < 0.01$ ) on daily DMI (2.18, 2.70, 2.46 and 1.89 kg) and feed efficiency (1.33, 0.93, 0.98 and 1.10 3.5% FCM.DMI-1) when SH replaced coastcross hay in the diet. These data suggest that partial replacement of coastcross hay by SH improves DMI. However, there was no beneficial effect on milk production and composition.

**Key Words:** Co-Products, Fiber, Saanen

**T274 Classification tree analysis of grazing behavior in goats.** T. A. Gipson\*, A. R. Askar, A. Beker, R. Puchala, A. Asmare, G. D. Detweiler, and A. L. Goetsch, *American Institute for Goat Research, Langston University, Langston, OK.*

Electronic monitoring equipment may allow for characterization of grazing behavior without potential effects of human visual observation. Translating equipment output into specific activities, however, is challenging. Therefore, this study was conducted to develop means of predicting grazing behavior based on visual observation from output of currently available electronic monitoring systems. There were 1,538 5-min observations of grazing activity (G = grazing; RL = resting, lying; RS = resting, standing; W = walking) at two locations collected by four

observers on 28 goats over 4-d periods. There were 390, 627, 478, and 43 observations for G, RL, RS, and W, respectively. Goats were fitted with GPS collars (GPS 3300, Lotek, Newmarket, Ontario, Canada) to ascertain distance between consecutive GPS fixes. Collars were equipped with left-right (X-activity), forward-backward (Y-activity), and head-down motion sensors. A leg activity/position sensing system (IceTag, IceRobotics, Midlothian, Scotland, UK) was employed to determine stepping, standing, and lying. Classification tree analysis was conducted using CART<sup>®</sup> software. A decision tree, which is a diagram representing a classification system, with a minimum relative cost criterion of 0.560 yielded 18 terminal nodes. Prediction success rate for G was 70.3% (i.e., 274, 35, 48, and 33 G observations were classified into G, RL, RS, and W terminal nodes, respectively). Success rate for RL was 74.0% (57, 87, and 19 RL observations classified as G, RS, and W, respectively). Success rate for RS was 48.5% (93, 106, and 47 RS observations classified as G, RL, and W, respectively). Success rate for W was 83.7% (5, 1, and 1 W observations classified as G, RL, and RS, respectively). Output from currently available electronic monitoring equipment systems can be used to predict grazing behavior of goats based on visual observation; however, prediction success rate is less than optimal. Other potential monitoring equipment should be evaluated to improve success rate.

**Key Words:** Goats, Grazing, Predictive Model

#### **T275 Integration of meat goat production into pine silvopasture.**

R. C. Lawler<sup>\*1</sup>, N. K. Gurung<sup>1</sup>, M. S. Goodman<sup>2</sup>, and O. Bolden-Tiller<sup>1</sup>, <sup>1</sup>Tuskegee University, Tuskegee, AL, <sup>2</sup>Auburn University, Auburn, AL.

Little is understood about how meat goat production can be included as a value added product to high value saw log production in pine silvopasture. Understanding animal-plant interactions in these systems is key to their sustainable management. The objectives were to determine the optimum stocking rates of Boer cross wethers goats on recently thinned and pruned loblolly pine plantation. Three stocking rates (SR) at 0.50 animal unit equivalent (AUE)/ha (low), 0.75 AUE/ha (medium), and 1.0 AUE/ha (high) (equivalent to 10, 15, and 20 goats/ha, respectively) were evaluated in a randomized complete block design at the Federation of Southern Cooperatives, Epes, AL. Goats were weighed at 30 d intervals over a 90-d period to determine ADG. Available plant biomass quality and quantity were determined before and after the grazing period. Blood samples were collected to assess blood urea nitrogen (BUN). The ADG were higher ( $P < 0.05$ ) for the low SR compared to the medium and high SR while no differences were observed ( $P > 0.05$ ) between the latter two treatments. The BUN concentrations were not different among treatments during the first 30 days ( $P > 0.10$ ), but as the season progressed, goats on higher SR tended to have higher BUN values ( $P < 0.08$ ), particularly at d 60 and 90. At the start of the trial, average plant biomass was 1071, 862, and 1033 kg DM/ha for low, medium, and high SR, respectively. Corresponding values at the end of the trial were 1445, 560 and 813 kg DM/ha. The control paddocks contained an average of 1014 kg DM before and 1852 kg DM at the end of the trial. Biomass DM declined at a faster rate on plots with higher SR; percentage changes were +82.8, +35.0, -35.1, and -21.3 for the control, low SR, medium SR, and high SR, respectively. Nutrient composition of plant biomass, measured as CP, NDF, ADF and acid detergent lignin did not differ ( $P > 0.05$ ) among treatments. Because the study year occurred during a drought year, further studies are required in average or above average precipitation years.

**Key Words:** Goats, Silvopasture, Stocking Rate

**T276 Mineral requirements for growth of Moxoto goats grazing in the semi-arid region of Brazil.** M. J. Araújo<sup>1</sup>, A. N. Medeiros<sup>1</sup>, S. Gonzaga Neto<sup>1</sup>, R. G. Costa<sup>1</sup>, I. A. M. A. Teixeira<sup>\*2</sup>, K. T. Resende<sup>2</sup>, C. A. T. Marques<sup>1</sup>, G. M. P. Melo<sup>2</sup>, and S. F. Souza<sup>1</sup>, <sup>1</sup>Universidade Federal da Paraíba/UFPB, Areia, PB, Brazil, <sup>2</sup>Universidade Estadual Paulista/UNESP, Jaboticabal, SP, Brazil.

Indigenous goats play an important role for the semi-arid region of Northeastern Brazil as a biological resource with great genetic variability. In addition, they are a source of animal protein of high biological value available to people of low income. However, there is a lack of information about these animals; mainly regarding their nutritional requirements. Therefore, the objective of this study was to determine net mineral requirements for growth of thirty-six male Moxoto goat kids (15.69 ± 0.78 kg initial BW), grazing in the semi-arid region of Brazil. Four kids were slaughtered at the beginning of the experiment (baseline group, 15.37 ± 0.30 kg BW) and the remainder (n = 32) were allocated randomly to one of the four levels of supplementation (treatment groups: 0, 0.5, 1.0 and 1.5% BW). There were eight kids per treatment. When the animals in the 1.5% BW treatment group reached 25 kg BW, the animals in all treatment groups were slaughtered. The individual whole empty body was weighed, ground, mixed and sampled for chemical analyses. The body composition (g/kg empty body weight; EBW) ranged from 10.80 to 11.50 g Ca; 7.86 to 8.74 g P; 0.37 to 0.42 g Mg; 1.57 to 1.61 g Na and 1.58 to 1.74 g K, for Moxoto kids between 15 and 25 kg BW. The net mineral requirements (g/kg empty body weight gain; EWG) were determined by comparative slaughter technique which ranged from 9.53 to 10.65 g Ca; 7.41 to 8.65 g P; 0.36 to 0.43 g Mg; 1.31 to 1.41 g Na and 1.47 to 1.70 g K for animals with BW ranging from 15 to 25 kg. In conclusion, our study indicated that indigenous goats grazing in the semi-arid region of Brazil have different mineral requirements from those values recommended by international committees for dairy and meat goats.

**Key Words:** Body Composition, Caatinga, Indigenous Goats

**T277 Mineral requirements of Saanen growing kids.** K. T. Resende<sup>\*1</sup>, D. Oliveira<sup>1</sup>, I. A. M. A. Teixeira<sup>1</sup>, A. N. Medeiros<sup>2</sup>, and A. C. D. Ferreira<sup>3</sup>, <sup>1</sup>Universidade Estadual Paulista/Unesp, Jaboticabal, SP, Brazil, <sup>2</sup>Universidade Federal da Paraíba, Areia, PB, Brazil, <sup>3</sup>Universidade Federal do Sergipe, Aracaju, SE, Brazil.

The aim of this study was to determine the calcium (Ca), phosphorus (P), magnesium (Mg), sodium (Na) and potassium (K) requirements for growth of 20 Saanen intact male kids (5.30 ± 0.34 kg of initial BW). The kids were fed for ad libitum intake, and were slaughtered when they reached an average BW of 5.30 ± 0.14 kg (n = 6), 12.90 ± 0.32 kg (n = 6), and 21.03 ± 0.36 kg (n = 8) kg. Individual body components (head plus feet, hide, internal organs plus blood, and carcass) were weighed, ground, mixed, and samples were taken to chemical analyses. A completely randomized design was used with 3 treatments (slaughter weight). The allometric equations used to estimate the relationship between calcium, phosphorus, magnesium, sodium and potassium contents on the empty body and empty body weight (EBW) presented good data adjustment ( $R^2$  ranged from 0.92 to 0.98). Whereas the proportions of Ca, P, Mg, Na and K in the empty body ranged from 9.91 to 10.85 g Ca/kg of EBW; 8.75 to 8.99 g P/kg of EBW; 0.78 to 0.65 g Mg/kg of EBW; 2.01 to 1.09 g Na/kg of EBW and from 2.71 a 1.62 g K/kg of EBW at 5 and 20 kg of BW, respectively. The net requirements for gain of BW ranged from 903 to 988 mg Ca/day/100 g, from 759 to

779 mg P/day/100 g, from 56 to 47 mg Mg/day/100g; from 84 to 46 mg Na/day/100g, from 132 to 79 mg K/dia/100g BW, for Saanen kids at 5 and 20 kg BW. Our results suggest that the mineral requirement for growing dairy goats raised under tropical conditions differ from the established recommendations.

**Key Words:** Body Composition, Goat, Major Mineral

**T278 Effects of induced copper deficiency with added molybdenum on health and immune responses of male goat kids.** S. Solaiman, S. Roper, K. Beguesse\*, G. Reddy, N. Gurung, and K. Copedge, *Tuskegee University, Tuskegee, AL.*

Eighteen male goat kids (BW = 25.6 +/- 1.04 kg) were randomly assigned to three treatment groups. Groups (1) received grain mix (GM) with no added molybdenum (Mo), (2) received GM with 5 ppm additional Mo, and (3) received GM with 10 ppm additional Mo. Animals were housed individually and fed a 50:50 GM: bermudagrass hay twice daily for 12 wks. Blood was collected every 4 wks to determine blood metabolites and complete blood count. Parasite load was measured through egg counts per g of feces (FEC). Vital signs and body condition scores were recorded every 4 wks. Humoral immunity was evaluated through injection of chicken ovalbumin on wk 10 to measure IgG antibody titer. Cell-mediated immunity was measured via sub-dermal injection of phytohemagglutinin on wk 12, and post measurement of lymphocyte proliferation via caliper measurement of skin folds. Animals were slaughtered and liver and kidney samples were analyzed for copper content. Vital signs and body condition scores were not affected by treatments; however, rumen contraction tended to be lower in goats receiving 5 ppm added Mo (quadratic,  $P = 0.07$ ). There was no difference in FEC between treatment groups. Blood serum chemistry did not change except for creatine decreased (linear,  $P = 0.005$ ), alkaline phosphatase increased (linear,  $P = 0.002$ ), and gamma-glutamyl transferase tended to increase (linear,  $P = 0.07$ ) as Mo increased in the diets. Creatinine kinase tended to be higher (quadratic,  $P = 0.1$ ) in goats receiving 5 ppm added Mo. Serum copper did not change, liver copper decreased (linear,  $P = 0.003$ ) and kidney copper increased (linear,  $P = 0.0001$ ) as Mo increased in the diets. Red blood cells decreased (linear,  $P = 0.02$ ) and white blood cells were higher (quadratic,  $P = 0.01$ ) in goats receiving 5 ppm Mo with no difference in differential counts. Immune response measured by skin thickness, was lower after 24 hours (linear,  $P = 0.007$ ) and 48 hours (linear,  $P = 0.01$ ) as level of Mo increased in the diets. Antibody titer decreased ( $P = 0.04$ ) with added 10 ppm Mo in the diet. Goats on 5 or 10 ppm added Mo had no apparent copper deficiency symptoms, except lowered immune responses.

**Key Words:** Copper-Molybdenum, Goats, Immune Response

**T279 Effects of synchronizing the release of energy and nitrogen in the rumen on nitrogenous flow at the duodenum of cashmere goats.** D. P. Bu<sup>2,1</sup>, D. X. Lu<sup>\*2</sup>, W. Cui<sup>4</sup>, J. Loo<sup>3</sup>, and J. Q. Wang<sup>1</sup>, <sup>1</sup>Chinese Academy of Agricultural Sciences, Beijing, P. R. China, <sup>2</sup>Inner Mongolia Agricultural Science And Technology, Hohhot, P. R. China, <sup>3</sup>University of Illinois, Urbana, <sup>4</sup>Ningxia University, Yinchun, P. R. China.

Twelve cashmere goats with a cannula in rumen and proximal duodenum were used in a 2 x 2 factorial design to examine the effects of

synchronizing (S) the release of energy and nitrogen in the rumen as well as feeding frequency (F) on nitrogenous flow at the duodenum. All diets were isonitrogenous and isoenergetic but differed in their synchrony index (SI). To calculate SI, based on previous results from our laboratory, we set optimum microbial protein synthesis at 23g rumen-digestible-nitrogen (RDN)/kg digestible organic matter (DOM). Calculated SI (0 to 1.0) was 0.92, 0.84, 0.82, or 0.56 for the greater S diet fed 4 x d (GSF4), lower S diet fed 4 x d (LSF4), greater S fed twice per d (GSF2), or lower S fed twice per d (LSF2), respectively. Goats receiving LSF4 or GSF4 were fed at 0600, 1200, 1800, and 2400 h. Goats receiving LSF2 or GSF2 were fed at 0600 and 1800 h. Flow of DM at the duodenum was estimated using Co-EDTA as indigestible marker, during the last 6 d of each experimental period. Duodenal digesta was collected every 6 h/d during the last 6 d of each experimental period and pooled within each animal. Nitrogen intake averaged 11.9, 11.3, 11.6 and 11.0 g/d in GSF4, LSF4, GSF2 and LSF2 ( $P > 0.05$ ), respectively. Flow of total-N at duodenum was 13.8, 11.4, 14.9 and 10.6 g/d ( $P > 0.05$ ), separately. Microbial-N flow was greater when goats were fed either greater-S diets (3.2 vs. 2.1 g/d;  $P < 0.05$ ) or at a greater frequency (3.0 vs 2.3 g/d;  $P < 0.01$ ). Duodenal flow of non-ammonia N (NAN) tended to be greater (2.1 vs 2.72 g/d;  $P = 0.09$ ) in animals fed lower-S diet compared with greater-S diets. There was a linear correlation between flow of microbial-N and rumen SI ( $R^2 = 0.87$ ;  $n = 12$ ). Overall, these results indicated that synchronizing the rate of supply of RDN and DOM in the rumen increased the efficiency of microbial protein synthesis and microbial protein flow to the duodenum. We conclude that flow of microbial-N might be improved by increasing rumen SI.

**Key Words:** Rumen Fermentation, Synchronization, Feeding Frequency

**T280 Effects of protein and energy supplementation on *in situ* disappearance of low-quality Coastal Bermudagrass hay in goats.** M. S. Reinhard<sup>\*1</sup>, B. D. Lambert<sup>1,2</sup>, J. P. Muir<sup>2</sup>, and R. Harp<sup>1</sup>, <sup>1</sup>Tarleton State University, Stephenville, TX, <sup>2</sup>Texas AgriLife Research, Stephenville, TX.

Cattle grazing forages with crude protein (CP) of 6% or less often need protein supplementation to maximize ruminal forage utilization. Because of the selective foraging ability of goats, it is not known if goats consuming low CP forages have a similar need for supplemental protein and/or energy. The purpose of this study is to determine the digestibility of low-quality forages with protein and energy supplements in goats. Four mature ruminally cannulated goats were used in a 4 x 4 Latin square design experiment. Treatments consisted of either casein (0.122% BW), corn starch (0.15% BW), or dextrose (0.15% BW) administered daily into the rumen, compared to a hay-only control. Goats had *ad libitum* access to Coastal Bermudagrass (CB) hay (5.8% CP) and clean drinking water at all times during the experiment. Each period consisted of 14 days for treatment adaptation followed by 7 days incubation of *in situ* bags. *In situ* hay samples were analyzed for dry matter disappearance after 0, 2, 4, 8, 16, 24, 48, and 72 hours of ruminal incubation. Dry matter disappearance was not affected by any of the treatments in this experiment. More research is needed to define the effects of protein and energy supplements on ruminal forage degradation in goats.

**Key Words:** Goat, Protein, Energy

**T281 Energy requirements for maintenance and growth of Boer crossbred kids.** I. A. M. A. Teixeira<sup>\*1</sup>, K. T. Resende<sup>1</sup>, J. M. Pereira Filho<sup>2</sup>, R. C. Canesin<sup>1</sup>, and T. T. Berchielli<sup>1</sup>, <sup>1</sup>*Universidade Estadual Paulista/Unesp, Jaboticabal, SP, Brazil*, <sup>2</sup>*Universidade Federal de Campina Grande, Patos, PB, Brazil*.

Two experiments were conducted to determine the energy requirement for maintenance and growth of 64 ½ Boer ½ Saanen crossbred, intact male kids (5 and 15 kg of initial BW for experiment 1 and 2, respectively). In the first experiment, the baseline group was 6 randomly selected kids, averaging 5.6 ± 0.8 kg of BW. An intermediate group consisted of 6 randomly selected kids, fed for ad libitum intake, that were slaughtered when they reached an average BW of 10.0 ± 0.4 kg. The remaining kids (n = 18) were randomly allocated to one of 3 levels of DMI (ad libitum and restricted to 70% or 40% of the ad libitum intake) within 6 slaughter groups. Kids were slaughtered when the ad libitum treatment kid reached 15 kg of BW. In the second experiment, the baseline group was composed by 7 kids, averaging 15.3 ± 0.3 kg of BW. An intermediate group consisted of 6 kids, fed for ad libitum intake, that were slaughtered when they reached an average BW of 20.4 ± 0.7 kg. The remaining kids (n = 21) were randomly allocated to one of 3 levels of DMI, similar to the first experiment, within 7 slaughter groups. Kids were slaughtered when the ad libitum treatment kid reached 25 kg of BW. Individual empty bodies were weighed, ground, mixed, and samples were taken to chemical analyses. For young animals (experiment 1) the calculated NE and ME requirements for maintenance were 50.0 and 76.2 kcal/kg<sup>0.75</sup> of empty BW (EBW), respectively, and the partial efficiency of use of ME for NE was 0.66. On the other hand, older kids presented greater requirements, whereas the daily maintenance requirement were 101.0 kcal NE/kg<sup>0.75</sup> of EBW and 181.1 kcal ME/kg<sup>0.75</sup> of EBW and lower partial efficiency of use of ME for NE of 0.56. Net energy requirement for growth ranged from 1.7 to 2.2 Mcal/kg of EBW gain at 5 and 25 kg of BW. These results suggest that meat goats present energy requirement different from the established recommendations. (Sponsored by FAPESP, 04/06626–0).

**Key Words:** Body Composition, Goat, Nutritional Requirement

**T282 Effects of acclimatization on energy expenditure by meat goats.** A. K. Patra, R. Puchala, G. Animit, T. A. Gipson, T. Sahl, and A. L. Goetsch<sup>\*</sup>, *American Institute for Goat Research, Langston University, Langston, OK*.

Seven Spanish and seven Boer yearling wethers were used to assess relationships between energy expenditure (EE) and temperature (Temp), relative humidity (Hum), and temperature-humidity index (THI). The two breed groups were confined separately in 8 x 6 m pens in an enclosed facility with a concrete floor without cooling. Only enough heat was provided to prevent damage to waterers and water lines from excessive freezing. Thus, the intent was to have minimal Temp and Hum control and to incur fluctuations corresponding to outside conditions. Energy expenditure was determined over 2-d periods 13 times during a 1-yr period based on EE:heart rate (HR) measured at 13-wk intervals. Climate variables were averaged over 2, 4, 6, and 8 wk preceding EE measurement. Wethers were fed for the maintenance energy requirement (ME<sub>m</sub>). Mean, minimum, and maximum values during the 2 wk preceding EE determination were 19.9, 7.9, and 31.8°C for Temp and 53.6, 36.1, and 62.5% Hum, respectively. Neither Temp nor THI were correlated with or had significant effects in regression equations to predict the difference between EE at measurement times and the 1-yr mean (EE<sub>diff</sub>).

Conversely, Hum was correlated (P < 0.01) with EE<sub>diff</sub>. When the 13 HR measurement times were assigned to Cool and Warm periods, EE<sub>diff</sub> was affected (P < 0.01) by a genotype x period interaction. Nonetheless, the effect of Hum in models including genotype, period, and genotype x period was significant for 2, 4, 6, and 8 weeks (P < 0.01). The R<sup>2</sup> of linear regressions of EE<sub>diff</sub> against Hum were slightly greater for 2 and 4 vs 6 and 8 wk (0.11, 0.10, 0.08, and 0.07, respectively); regression coefficients for 2 and 4 wk were 1.265 and 1.163 kJ/kg BW<sup>0.75</sup> per 1% Hum, respectively. With a median Hum of 50%, average regression coefficient of 1.2 kJ/kg BW<sup>0.75</sup> per 1% HUM, and average ME<sub>m</sub> of 390 kJ/kg BW<sup>0.75</sup>, predicted ME<sub>m</sub> is 374 and 406 kJ/kg BW<sup>0.75</sup> at minimum and maximum Hum, respectively. In conclusion, without extremes eliciting cold or heat stress, Hum appears to have a slight effect on ME<sub>m</sub> of meat goats in both cool and warm periods of the year.

**Key Words:** Goats, Energy, Acclimatization

**T283 Effect of length of grower/finisher ration supplementation on chevon production and net return from crossbred meat goats.** M. Lema<sup>\*</sup>, S. Kebe, C. Pierfax, and N. Adefope, *Tennessee State University, Nashville*.

Forty weaned crossbred kids were blocked by body weight and genotype and divided into four treatment groups. Each treatment group was replicated in two 0.4 ha choice chicory paddocks with 5 kids per paddock and supplemented with identical total amount of commercial grower/finisher goat ration over variable lengths of time (0 (control), 45, 90 or 135 days). While total grower/finisher ration cost and consumption (27.5, 30.1 and 27.1 kg for the 45, 90 and 135 day supplemented groups, respectively) did not differ statistically, total live weight gain (0.77, 4.95, 6.43 and 7.23 kg, respectively) and net return over feed cost (2.13, 3.44, 6.46 and 9.87 dollars, respectively) increased linearly (P < 0.05) from 0 to 135 days of supplementation indicating that when unpaid family labor is utilized, supplementation of weaned meat goats with the same total quantity of grower ration over a longer duration is economically beneficial than over a shorter duration. When labor cost was factored into the equation, supplementation over a longer period resulted in negative net returns (-1.06, -2.54 and -3.63 dollars for the 45, 90 and 135 day supplemented groups versus +3.13 dollars for the non-supplemented group) making the non supplemented group economically beneficial than the other three supplemented groups. Boneless retail cuts from the leg, loin, shoulder and rack were highest (P < 0.05) for the 135 days supplemented group while the non-supplemented control and those supplemented for 45 and 90 days were not different. No significant difference was observed in back fat thickness, loin eye area and kidney pelvic and heart fat among treatments.

**Key Words:** Meat Goat, Length of Supplementation, Net Return

**T284 Pelleted soybean hulls or cottonseed and corn as supplements for weanling Boer-cross wethers grazing bermudagrass pastures.** M. H. Poore<sup>\*</sup>, J.-M. Luginbuhl, H. M. Glennon, A. D. Shaeffer, and H. A. Deihl, *North Carolina State University, Raleigh*.

A trial was conducted over two years to determine the influence of supplementation with pelleted soybean hulls (SBH) or whole cottonseed plus corn (WCS) on post-weaning growth and carcass characteristics of Boer-cross wether kids (initial BW 21.2 kg). Kids were born mid-

February to mid-March, and weaned in mid-May at 10 to 14 weeks of age. During the weaning period kids were fed grass hay and 1% of BW as a mixed pelleted concentrate. Kids were divided into 3 BW blocks and assigned from within blocks to make 9 groups (3 wethers and 3 does per group in yr 1, and 4 wethers and 2 does in yr 2). Kids were placed on 9 bermudagrass pastures arranged in 3 blocks of 3 pastures each in mid-June. Pastures averaged 0.067 ha of Tifton-44 Bermudagrass (0.075 ha in yr 1 and 0.058 ha in yr 2), and each pasture had an adjacent equal sized pasture of Coastal Bermudagrass as a potential emergency expansion area. Each pasture was divided into 5 paddocks and kids were rotated to a fresh paddock each 3 to 5 d. Pastures were clipped behind the kids as necessary to maintain forage quality. After 2 wk adaptation to the pastures, kids were allotted to three supplement treatments; 1) minerals only (MIN), 2) minerals plus 1% BW SBH, or 3) minerals plus 1% BW of a mix of 65% corn, 33% whole cottonseed, and 2% limestone. In yr 1 all kids remained on the original Tifton-44 pastures for 70 d after treatments were initiated, but in yr 2 pastures were doubled to include all the Coastal Bermudagrass area early in the trial due to dry weather. In yr 2 all doe kids were also removed after 28 d, and the trial was ended after 56 d. Average forage mass was 3606 kg/ha in yr 1 and 1945 kg/ha in yr 2. At the termination of the trial all wethers were harvested. Carcass grade was determined on a scale where 1 to 1.9 = Prime and 2.0 to 2.9 = Choice. Supplementation at 1% BW improved post-weaning growth and carcass characteristics of kids grazing bermudagrass pasture, while supplement type had little influence on growth or carcass characteristics.

**Table 1. Influence of supplements on meat goat growth and carcass**

Item	MIN	SBH	WCS	SEM	Contrast 1	Contrast 2
ADG, g/d	49.5	87.5	88.7	3.0	0.01	ns
Carcass wt, kg	10.53	12.54	12.74	0.15	0.01	ns
Dressing %	43.3	47.2	47.5	0.58	0.01	ns
Carcass grade	2.63	2.27	2.25	0.07	0.01	ns
Pelvic fat, g	91.6	195.5	221.0	13.1	0.01	0.20
Fat cover, mm	1.39	2.36	3.18	0.31	0.01	0.10
Loineye area, sq cm	7.70	9.73	9.28	0.36	0.01	ns

Contrast 1 = P value for MIN vs. Supplements. Contrast 2 = P value for SBH vs. WCS

**Key Words:** Meat Goats, Supplements, Bermudagrass

**T285 Influence of dietary condensed tannins in meat goats on fatty acid composition of carcasses.** J. Lee\*, G. Kannan, B. Kouakou, D. Moore, and T. Terrill, *Fort Valley State University, Fort Valley, GA.*

*Sericea lespedeza* hay decreases nematode infections in goats, although the effect of its high condensed tannin (CT) content on carcass quality has not been adequately studied. Twenty Boer × Spanish meat goats (6 mo of age; BW = 19.2 ± 0.74 kg) were used to determine the effect a high CT diet on fatty acid profiles of tissue samples from different carcass sites. Goats were assigned randomly to pens (5 goats/pen), and each pen was allotted to one of two dietary treatments of 75% hay: sericea hay (SER; high in CT) or Bermuda grass hay (BER; n = 10 goats/treatment) plus a 25% corn-based supplement (18 % CP) consisting predominantly of corn and soybean meal for 14 wk. At the end

of the feeding trial, goats were slaughtered using standard procedures. The *Longissimus dorsi* (LD) muscle, intermuscular, subcutaneous, and kidney fats were obtained from each carcass. Total lipid from each fat depot sample was extracted by the chloroform (0.013% BHT)-methanol method. Extracted lipids were prepared for the fatty acid methyl esters (FAME) and then analyzed by gas chromatography. Palmitic (16:0), stearic (18:0), oleic (18:1n9), and linoleic (18:2n6) acids were the four major fatty acids in the LD muscles and intermuscular fats from goats fed either SER or BER diet. The subcutaneous and kidney fats mainly consisted of myristic (14:0), 16:0, C18:0, and C18:1n9 acids. No significant differences were found in the four major fatty acids on the site of fat depots between SER and BER groups. However, compared with goats fed the BER diet, goats fed the SER diet had lower ( $P < 0.05$ ) concentrations of *trans*-7-hexadecenoic (16:1t) and margaric (17:0) acids in LD muscles; a higher ( $P < 0.05$ ) concentration of linolenic (18:3n3) acid in intermuscular fat; higher ( $P < 0.05$ ) concentrations of C18:2n6 and 11-eicosenoic (C20:1n9) acids in subcutaneous fat; and a higher ( $P < 0.05$ ) concentration of C20:1n9, but a lower ( $P < 0.05$ ) concentration of C17:0 in kidney fat. The results indicated that a diet high in condensed tannins may not influence the major fatty acids in the different fat depot sites in meat goats.

**Key Words:** Goats, *Sericea lespedeza*, Fatty Acid Profile

**T286 Effects of long term feed restriction and monensin on growth, feed efficiency and body measurements in Anglo Nubian does.** P. Turiello\*, V. Coniglio, S. Posadas, M. Chaves, L. Godio, and G. Cufre de Lenardón, *Universidad Nacional de Río Cuarto, Río Cuarto, Córdoba, Argentina.*

Periods of feed restriction results from seasonal deficits of food. The experiment evaluated effects of long term feed restriction and monensin on liveweight gain, BCS, and body measurements to test usefulness of monensin to ameliorate feed restriction. Nineteen weaned Anglo Nubian does (BW 11.9±1.6 kg) were randomly assigned to control (fed ad libitum; n = 5) (C), restricted (78% of C per unit BW; n = 7) (R) and R + 12.5 mg/head/d of monensin (n = 7) (M). A 247-d trial used a 70:30 ground mixture of alfalfa hay:corn grain; ME of the diets was 2.4 Mcal/kg DM and CP was 16 %. Minerals and vitamins were supplemented. Urea was added to restricted diets to equalize CP intake to that of C. Individual feed intake was recorded daily, does were weighed weekly, body measurements and BCS (0-5) were recorded every 28 days. Data analysis was by ANOVA for a completely randomized design; when the F-test was significant, differences between means were determined by Tukey's-test. Average daily DMI was greater in C (.65 vs. .37 and .34 kg/d M and R, respectively) ( $P < 0.001$ ). BW at termination differed among treatments ( $P < 0.001$ ). BW of goats fed ad libitum was higher than M and R (29±1.7). Whereas M does also had greater BW than R (18±0.9 vs. 15±1.0 kg, respectively). Average daily gain was highest for C ( $P < 0.01$ ), whereas M also had higher ADG than R (67±4, 25 ± 4 vs. 12±5 g/d, resp.). Score for BC was highest for C, 3.9, and M had greater BCS than R, 2.2 vs. 1.4 respectively ( $P < 0.05$ ). F: G ratios were 9.7, 15.4 and 26.9. Withers height, chest girth and hip height were greater in does with heavier weight (C > M > R;  $P < 0.01$ ). Monensin lessened the effects of long term restriction, demonstrating its potential to be used with restricted feeding to improve performance.

**Key Words:** Feed Restriction, Monensin, Goat