

Small Ruminant: Health, Reproduction, Growth, Management

TH381 The effects of condensed tannin-rich pine bark diet on gastrointestinal parasite infection in meat goats. B. R. Min^{*1}, S. Solaiman¹, A. Wilson¹, N. Gurung¹, and J. Miller², ¹Tuskegee University, Tuskegee, AL, ²Louisiana State University, Baton Rouge.

The objective of this study was to assess gastrointestinal (GI) parasite load and animal performance of goats fed condensed tannin (CT)-containing pine bark (PB) diet. Pine bark is one of the abundant forest by-products in the southern US and contains 11–13% CT on a DM basis. Thirty-two Kiko-cross meat goats (*Capra hircus*; BW = 28.0 ± 1.0 kg) were randomly assigned to 2 experimental diets: (1) 0% PB and 30% wheat straw (WS) and (2) 30% PB and 0% WS. The remainder of each diet was a mix of 85% grain and 15% bermudagrass hay. Animals were dewormed and one half of each diet group was inoculated with 5000 infective stage (L3) *Haemonchus contortus* larvae (n = 8). Feed intake and performance were monitored for 87 d. Blood samples were taken twice, once at the beginning and once at the end of the experiment. Fecal egg and coccidia oocyst counts (FEC/FOC) were determined approximately every 2 wk. At the end of the experimental period, goats were slaughtered, and GI parasite load was determined. Abomasal worms were identified and counted. Overall, there were no differences ($P > 0.10$) in DMI and BW among diets or inoculation groups. Mean hematocrit (packed cell volume) was greater ($P = 0.03$) for goats fed the PB diets. Mean FEC, FOC, and total number of worms were lower ($P < 0.05$) for goats that were fed PB diet. On d 84, control goats on WS diet had greater ($P = 0.01$) FEC (1186 vs. 508) than PB diet group, respectively. Animals on PB diet had lower ($P = 0.03$) FOC on d 56 and the lowest ($P = 0.0001$) FOC were on d 84 for goats on PB diet. Feeding PB diet reduced both male (486 vs. 1357) and female (571 vs. 1386) worm counts compared with the WS diet, respectively. The results indicate that ground PB as a feed ingredient has the potential to decrease internal parasite infection.

Key Words: tannin, parasite, pine bark

TH382 Effect of six condensed tannin containing plants on the third larval stage of *Haemonchus contortus* in an in vitro system. S. A. Armstrong¹, H. N. Naumann², B. D. Lambert^{*1,3}, and J. P. Muir^{2,3}, ¹Tarleton State University, Stephenville, TX, ²Texas A&M University, Department of Crop and Soil Sciences, College Station ³Texas A&M AgriLife Research, Stephenville.

This study was conducted to determine the anthelmintic effectiveness of extracts from 6 condensed tannin containing legumes (*Desmanthus illinoensis*, *Lespedeza cuneata*, *Lespedeza stuevei*, *Leucaena retusa*, *Acacia angustissima* south Texas ecotype and *Acacia angustissima* central Texas ecotype) on the third larval (L3) stage of *Haemonchus contortus* (HC) using an in vitro system to measure percent larval migration inhibition (LMI). Rumen fluid, buffer and extracts (legumes or Ivermectin) were anaerobically incubated in 100 mL flasks (one per treatment) overnight to extract potential plant bioactive compounds. A no CT legume, *Arachis glabrata* (rhizoma peanut) was included as a control treatment. After incubation, fluid was transferred into a 96-well plate containing a 20- μ m screen with 10 μ L of pure HC L3 larvae (2000–2500/mL). Well plates were incubated anaerobically overnight. Following incubation, the screen was removed and fluid from the bottom of the well plate was placed under a microscope and larvae that migrated through the screen were counted. LMI was calculated with the following equation: $(A - B)/A \times 100$ where A represents the number of larvae migrating

through control wells and B represents the number of larvae migrating through treatment wells. Each treatment was replicated in 9 wells per repetition, and 3 repetitions of the experiment were conducted. *Leucaena retusa*, *L. stuevei*, and *A. angustissima* (Central Texas ecotype) resulted in the greatest percent LMI (65.4%, 63.1%, and 42.2%, respectively). *Desmanthus illinoensis* (33.6% LMI), *A. angustissima* (south Texas ecotype; 35.2% LMI), *A. angustissima* (Central Texas ecotype; 42.2% LMI), and *L. cuneata* (30.6% LMI) responded with a similar efficacy to that of the no-CT legume *A. glabrata* (34.3% LMI). Ivermectin showed the lowest percent LMI (12.5%) but was not different than larvae incubated in a control solution (34.3% LMI) or *L. cuneata* (30.6% LMI). Further evaluation, including in vivo trials, of *L. retusa*, *L. stuevei*, and *A. angustissima* as a suppressor of L3 HC is warranted.

Key Words: small ruminant, *Haemonchus contortus*, condensed tannin

TH383 A modified method for larval migration inhibition. S. A. Armstrong^{*1}, H. N. Naumann², B. D. Lambert^{1,3}, and J. P. Muir^{2,3}, ¹Tarleton State University, Stephenville, TX, ²Texas A&M University, Department of Crop and Soil Sciences, College Station ³Texas A&M AgriLife Research, Stephenville.

Larval migration inhibition (LMI) assays have been conducted using varying methods to determine the anthelmintic effect of different compounds. Previous assays often require more sample than was available for investigative screening studies and sometimes added aerobic conditions with extended incubations, which unnecessarily prolonged and complicated the procedure. This experiment was conducted to determine if sample size of treatment plant tissues could be reduced from those required by existing methodologies, and to compare the effectiveness of a modified method to previously published assays. Rumen fluid, buffer and treatments (control or *Juniperous pinchotii* or Ivermectin) were anaerobically incubated in 100 mL flasks (one per treatment) overnight to extract potential plant bioactive compounds. After incubation, fluid was transferred to a 96-well plate containing a 20- μ m screen and inoculated with 10 μ L of pure *Haemonchus contortus* (HC) L3 larvae (2000–2500/mL). Well plates were incubated anaerobically overnight. Following incubation, the screen was removed and fluid from the bottom of the well plate was placed under a microscope and larvae that had migrated through the screen were counted. LMI was calculated using the following equation: $(A - B)/A \times 100$ where A represented the number of larvae migrating through control wells and B represented the number of larvae migrating through treatment wells. Each treatment was duplicated in 9 wells per repetition, and 2 repetitions of the experiment were conducted. Percent LMI was then compared with a previously published LMI assay (9 wells per repetition, 2 repetitions) which required a larger plant sample size and exposure to aerobic conditions. The results for LMI between the new and existing assay did not differ ($P = 0.88$) indicating that this method is a viable alternative to investigate anthelmintic compounds in a simplified, streamlined procedure requiring smaller sample sizes.

Key Words: *Haemonchus contortus*, larval migration assay, small ruminants

TH384 Effects of feeding a pelletized diet containing pumpkin seeds (*Cucurbita* sp.) on nematode fecal egg counts and hematocrit of wether goats. E. N. Escobar, J. Rodriguez, A. N. Gideon^{*}, V. Purnell-Cropper, and H. Taylor, University of Maryland Eastern Shore, Princess Anne.

This field trial was conducted to evaluate the effect of a pelletized diet containing 21% ground pumpkin seeds (PS) on fecal egg counts (FEC) and blood hematocrit (% PCV) and to evaluate gastrointestinal nematode burden in goats kept in a pasture setting. Thirteen naturally infected meat goat wethers (GWs), average BW = 55 kg, had a mean FEC of 840 eggs per gram (epg) at the beginning of the experiment. A pelletized commercial 15% crude protein diet was used as the control (CTRL) diet. The treatment (TRT) diet was formulated with the same ingredients in the CTRL diet plus 21% PS. To minimize feedstuff selection, PS were ground and incorporated into the pelletized mixture. GWs were kept in 2 separated paddocks (CTRL and TRT paddock) with ad libitum hay, mineral salt and water. GWs were trained to each enter an individual stall to eat the experimental diets until every one finished their ration. The piece of equipment used to individually feed the GWs restrained them until an operator would release them; this action ensured that each goat was eating the allotted feed amount only. During 6 consecutive weeks, 6 wethers were fed the CTRL diet and 7 wethers were fed the TRT diet. The GWs were fed twice daily, up to 400 g of the corresponding experimental diet (total 800 g daily). Weekly, the GWs were restrained to collect rectal fecal samples to determine FEC (epg) using a modified McMaster technique. Also, blood samples were collected via jugular venipuncture and hematocrit (%PCV) was determined in whole blood. The data were analyzed as repeated measures using the SAS statistical package. FEC+100 was natural log-transformed to stabilize variance. No significant difference ($P > 0.05$) was determined between the wethers eating the CTRL diet (623.4 epg) and those eating the TRT diet (515.3 epg). The % PCV was similar ($P > 0.05$) between the goats eating CTRL and TRT (26.8% vs. 25.0%, respectively). PS fed to pastured goats did not affect gastrointestinal nematode burdens as related to FEC or hematocrit.

Key Words: *Haemonchus contortus*, pumpkin seed, wether goat

TH385 Influence of body weight, age, and level of *Haemonchus contortus* infection on measurement of parasite resistance in performance tested rams. B. Allen*, D. Wright, D. Notter, M. McCann, A. Zajac, and S. Greiner, *Virginia Polytechnic Institute and State University, Blacksburg.*

Selection for resistance to gastrointestinal nematode infection is an important consideration for sheep producers. This study was designed to evaluate the effect of age and BW on response to an artificial infection with *Haemonchus contortus*, as well as evaluate level of artificial infection on egg counts per g of feces (FEC), BW, and ADG in ram lambs. A total of 85 Katahdin rams from 13 flocks participated in a post-weaning evaluation at the Virginia Tech Southwest Agricultural Research and Extension Center. Rams were commingled 21 d before the study and dewormed with 3 classes of anthelmintics to clear any previous parasite infections. Following acclimation (June 27), rams were assigned to 3 management groups based on initial BW (Heavy-HWT, Medium-MWT, Light-LWT; n = 17, 28, and 26, respectively), and each received 5,000 infective larvae. A subset of MWT and LWT rams that received 5,000 larvae (5K; n = 12) were compared with an additional group of contemporaries from the same flock which received 10,000 infective larvae (10K; n = 14). All rams grazed fescue paddocks and received 3% BW grain supplement daily (17% CP, 65% TDN). At 2, 4, 6, 8, and 10 wk after infection, BW, ADG, and FEC were measured. FEC was log-transformed to stabilize variance, and data were analyzed in JMP using repeated measures analysis. Final BW for HWT, MWT and LWT rams were 57.6, 43.3, and 38.2 kg, respectively ($P < 0.01$), and HWT rams were older ($P < 0.01$) than MWT and LWT rams (age = 155 vs. 128 and 123 d). Total ADG did not differ among WT groups.

Mean LFEC over the 10 wk period was lowest ($P < 0.05$) for HWT rams. Rams receiving 5K or 10K did not differ in BW or ADG. Mean LFEC was similar ($P > 0.05$) between 5K and 10K infected rams over the 10 wk period. Substantial FEC variation existed across treatments (mean = 593, range 10 to 3480), suggesting selection for resistance is achievable. However, these results indicate that level of infection is affected by age and body weight, and therefore these factors must be taken into account in structured parasite resistance evaluation programs.

Key Words: sheep, *Haemonchus contortus*, resistance

TH386 Effect of continuous suckling/"ewe-rearing" and supplementation on growth performance and degree of parasitism of pasture-raised Katahdin lambs. S. L. Rastle-Simpson*, K. N. D'Souza, A. K. Redhead, Q. S. Baptiste, and M. Knights, *West Virginia University, Morgantown.*

The effects of continuous suckling and supplementation on growth performance and degree of parasitism of pasture-raised, crossbred Katahdin lambs were investigated. Spring-born lambs (n = 103; 20.5 ± 1.0 kg) were randomly assigned within birth-type to be weaned at approximately 75 d or to continuously suckle ewes. All lambs were turned out on pasture, and half of the lambs in each rearing method were randomly assigned to be supplemented (16% crude protein pellet) ad libitum (weaned + supplemented, WS (n = 24); suckling + supplemented, SS (n = 28)) or received no further treatment (weaned + no supplementation, WNS (n = 26); suckling + no supplementation, SNS (n = 25)). All lambs were weighed at birth, at the initiation of the trial, and at approximately biweekly intervals for 3 (3) months. Fecal samples were collected at the beginning of the trial and once every month for the duration of the trial to assess the number of parasitic eggs in feces. ANOVA was conducted using the GLM procedures of SAS. The statistical method included rearing method, supplementation, and the interactions. When interactions were present means were separated using Tukey's HSD. Overall average daily gain (ADG) and total weight gain were significantly higher ($P < 0.001$) in suckling than in weaned lambs (0.18 ± 0.01 and 0.13 ± 0.01 kg/day, and 13.9 ± 0.5 and 10.8 ± 0.6 kg for suckling and weaned lambs, respectively), and in supplemented compared with lambs not receiving supplements ($P < 0.01$; 0.15 ± 0.01 and 0.12 ± 0.01 kg/day, and 13.9 ± 0.5 and 11.1 ± 0.5 kg, respectively). Final weights were higher ($P = 0.05$) in suckling (34.1 ± 0.9 kg) compared with weaned (31.6 ± 1.0 kg) lambs, but were not affected by supplementation. The average number of Trichostrongylid per gram of feces was 2659.71 ± 327.65 and was not affected by treatments. The results of the current study indicate that both ewe-rearing and supplementation independently improve growth performance of pasture-raised lambs. In addition, continuous suckling improved the final weights of lambs.

Key Words: continuous suckling, growth, weaning

TH387 Genetic marker assisted selection for footrot disease resistance in sheep flocks. T. Wuliji*¹, W. Lamberson², B. Shanks¹, J. Caldwell¹, C. Clifford-Rathert¹, J. Pennington¹, H. Swartz¹, S. Azarpajouh¹, and A. Bax¹, ¹Lincoln University, Jefferson City, MO, ²University of Missouri, Columbia.

Developing a genetic marker for marker assisted selection of footrot resistance in sheep presents a greater advantage over traditional selection techniques. The aim of this study was to evaluate the feasibility and effectiveness of genetic marker assisted selection for footrot disease resistance in sheep flocks. The genetic markers (footrot gene marker test) developed in New Zealand was adopted to screen for

footrot resistance and susceptibility genotype within Lincoln University experimental flocks. Initially, 120 Katahdin ewes and 16 rams were selected for marker assisted selection of footrot resistance. We screened and evaluated 7 genotypes including 3 sheep breeds (Katahdin, Dorper, and Texel) and their crosses. All animals were blood tested for the DNA marker screening. The crossbreeding of Katahdin x Dorper was conducted and F₁ lambing was completed in May, 2012. Footrot marker test screening was conducted on 192 blood samples of sheep including the footrot resistant selection (n = 82) and control (n = 110) flocks. The preliminary DNA marker screening results were classed into 5 gene allelic marker categories (M) ranging from a high, moderate or low resistance. The allelic frequency distribution by marker category was analyzed using Chi-squared test. The frequency distribution ratios were found differed significantly ($P < 0.01$) among groups (M1, M2, M3, M4, and M5). The sample population marker frequency presented a normal distribution pattern. Therefore, a high selection differential and genetic gain can be achieved once animals were identified for the markers to footrot resistance.

Key Words: footrot, genetic marker, sheep selection

TH389 Effects of male-female ratios and treatment with testosterone. O. Angel-Garcia¹, C. A. Meza-Herrera³, J. M. Guillen-Munoz¹, P. A. Robles-Trillo¹, G. Arellano-Rodriguez¹, M. Mellado², F. G. Veliz¹, and R. Rodriguez-Martinez*¹, ¹Universidad Autonoma Agraria Antonio Narro, Torreon, Coahuila, Mexico, ²Universidad Autonoma Agraria Antonio Narro, Saltillo, Coahuila, Mexico, ³Universidad Autonoma Chapingo, Bermejillo, Durango, Mexico.

The objective of this study was to evaluate the sexual response out-of-season (March 27, 2012, 26°N) in anovulatory goats through the “male-effect” using different male:female ratios and males treated or not with testosterone (25 mg. im, every 3 d during 3 wk). The study compared 2 mating loads (1:5 or 1:10 buck to doe ratios). A total of 30 multiparous mixed-breed anestrus goats were randomly assigned to one of 2 experimental groups: (1) exposure of 20 goats to 2 testosterone-treated bucks, (2) exposure of 10 goats to 2 testosterone-treated bucks. Variables evaluated were interval from start of mating to estrus, tail wagging, and pregnancy rate. Response variables and pregnancy rates were analyzed by categorical procedures using the GENMOD procedure of SAS (SAS Inst. Inc., Cary, NC) with the logit link function. ANOVA considered the MIXED procedure of SAS comparing the number of days to first occurrence of estrus and tail wagging. Interval from mating onset to estrus was shorter ($P < 0.05$) in the 1:5 group when compared with the 1:10 group (66.1 ± 5.4 h vs. 74.2 ± 2.6 h). The onset of tail wagging occurred about 20 h before the onset of estrus for both groups of goats. Pregnancy rates in the 1:5 and 1:10 groups were 85 and 80%, respectively, with no difference ($P > 0.05$) between experimental groups. Although the 1:5 group showed a better response considering time to estrus onset, this advantage was not necessarily important because pregnancy rates were similar in both groups. In conclusion, testosterone-treated bucks regardless of mating load (1:5 or 1:10) were effective in synchronizing estrus in anovulatory goats; this is a reproductive strategy that should increase goat production efficiency during the out-of-season breeding.

Key Words: anovulatory goat, male-female ratio, testosterone

TH390 Reproductive outcomes of nulliparous and multiparous French-Alpine goats synchronized with prostaglandins. R. Rivas-Muñoz¹, E. Carrillo¹, A. Fabela-Hernandez², M. Velazquez-Morales¹, J. A. Garcia¹, J. Cabrera-Reyes¹, C. A. Meza-Herrera³, R. Rodriguez-Martinez², and F. G. Veliz*², ¹Instituto Tecnológico de Torreon,

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The aim of this study was to evaluate sexual response of nulliparous and multiparous goats subjected to 2 prostaglandin treatments applied at intervals of 5 and 10 d. Goats (n = 20) were divided into 4 groups (n = 5 each); the first 2 groups considered nulliparous goats with Group 1 (N5) receiving prostaglandin at 5 d interval and Group 2 (N10) at 10 d interval, while the last 2 groups considered multiparous goats, with Group 3 (M5) receiving prostaglandin at 5 d interval and Group 4 (M10) at 10 d interval. Application of the first dose of prostaglandins (0.2 mL; 160 µg) was carried out in all groups on October 27. Groups N5 and M5 received a second dose 5 d later. Estrus was detected at 0800, 1200 and 1700 h. Groups N10 and M10 received the second dose of prostaglandins 10 d later. Females detected in estrus were exposed to an adult male and full mounts were confirmed. The ovulation was determined 7–9 d after estrus and 45 d after mating pregnant females were detected. Pregnancy was diagnosed by trans rectal ultrasonography scanning. The percentages of estrus, ovulation and pregnant females was subjected to a χ^2 test, while period of estrous response was analyzed by a “t” test. Sexual response from nulliparous and multiparous goats submitted to 2 prostaglandins treatments (5 and 10 d) was as shown in Table 1. Results indicate that prostaglandins can be used to induce estrous synchronization greater than 50% for French-Alpine goats, regardless of their parity, in Northern Mexico.

Table 1. Reproductive outcomes of nulliparous (N5 and N10) and multiparous (M5 and M10) French-Alpine goats treated with prostaglandins (n = 20)

	N5	N10	M5	M10
Estrus	60% (3/5)	60% (3/5)	60% (3/5)	60% (3/5)
Period estrous response (h)	57±9	52±4	80±26	52±4
Ovulations	100% (5/5)	60% (3/5)	100% (5/5)	80% (4/5)
Pregnancy rate	60% (3/5)	20% (2/5)	60% (3/5)	20% (2/5)

**No statistical differences were detected among treatments for any variable ($P > 0.05$).

Key Words: estrus, prostaglandins, ovulations

TH391 Sexual response from Alpine goats stimulated with vaginal sponges vs. intravulvar progesterone. R. Rivas-Muñoz¹, E. Carrillo¹, JA Garcia¹, M. Velazquez-Morales¹, A. Fabela-Hernandez², J. Cabrera-Reyes², CA Meza-Herrera³, R. Rodriguez-Martinez², and FG Veliz*², ¹Instituto Tecnológico de Torreon, Torreon, Coahuila, Mexico, ²Universidad Autonoma Antonio Narro, Torreon, Coahuila, Mexico, ³Universidad Autonoma de Chapingo, Bermejillo, Durango, Mexico.

Use of impregnated vaginal sponges to stimulate estrous and ovulatory activity in seasonal anestrus goats has been practiced worldwide. However, a very commonly used traditional hormonal treatment includes the induction of estrous activity using an intravaginal device impregnated with progesterone or a sponge for at least 7 d. The aim of this study was to compare the use of vaginal sponges and intravulvar progesterone application on reproductive performance of Alpine goats. Adult goats (n = 24; 2.5 yr of age) were divided into 2 homogenous groups (n = 12) according to weight and body condition ($P > 0.05$). Group 1 (GE) received vaginal sponges for 7 d; at sponge removal, 500 IU eCG and 25 mg prostaglandins were applied. Group 2 (GP), received 25 mg intravulvar progesterone; 24 h later goats received 500 IU eCG and 25 mg

prostaglandins. Subsequent to eCG application, goats were exposed to 2 sexually active males per group. Variables evaluated included plasma levels of progesterone, period to estrous response, estrous females, and pregnant females. Percentages of estrous and pregnant females were subjected to a χ^2 Test; while period to estrous response was analyzed using a "t" test. Plasma levels of progesterone were superior in GP as opposed to GE during the 2 d following progesterone application ($P < 0.01$). Probably, those progesterone levels (2.83 ± 0.6 and 1.66 ± 0.3 vs. 0.02 ± 0.01 and 0 ng/mL) may be responsible for the observed percentages of estrous females and synchronization rates. Period to estrous response (GE: 132 ± 34 h; GP: 133 ± 6 h; $P > 0.05$), proportions of estrous females (GP = 11/12; 92% vs. GE = 11/12; 92%; $P > 0.05$) and proportions of pregnant females (GE: 11/12; 92% vs. GP: 10/12; 83%; $P > 0.05$) were similar in both experimental groups. In this study, reproductive performance of Alpine goats was similar using either intravulvar progesterone or vaginal sponges in mid-July. Nonetheless, the cheaper cost of the intravulvar device makes it an economically viable and efficient technology for marginal goat production systems.

Key Words: estrous, ovulatory, sexual response

TH392 The effects of P.G. 600 on fertility and fecundity of non-lactating, seasonally anestrous ewes. K. N. D'Souza*, S. L. Rastle-Simpson, A. K. Redhead, Q. S. Baptiste, and M. Knights, *West Virginia University, Morgantown, WV, USA.*

Using exogenous gonadotropins as part of an estrous induction protocol can have beneficial effects on fertility in ewes bred out-of-season. Few studies have evaluated the ability of P.G. 600, which contains 400 IU of equine chorionic gonadotropin (eCG) and 200 IU of human chorionic gonadotropin (hCG) per 5 mL, to increase fertility in ewes bred out-of-season and, in particular, following the pre-treatment with progesterone delivered via CIDR devices. The objective of this study was to evaluate the effects of P.G. 600 on fertility and fecundity of nonlactating, seasonally anestrous ewes. Crossbred ewes ($n = 610$) from 6 farms in WV and PA received CIDR inserts (between the months of April and July) 5 d before introduction of rams. One d before insert removal, all ewes were assigned randomly to receive either a single IM injection of P.G. 600 (3mL; 240 IU eCG, 120 IU hCG; Intervet) or no further treatment. Rams remained with ewes for 25 – 40 d. ANOVA was conducted using the GLM procedures of SAS, and least squares means were computed. Estrous responses of P.G. 600-treated ewes were not different than those observed for controls ($P = 0.16$). Ewes treated with P.G. 600 had significantly higher conception rates ($P = 0.01$; 51.8 ± 0.04 vs. $39.2 \pm 0.04\%$), pregnancy rates to first service ($P = 0.0007$; 45.8 ± 0.03 vs. $32.0 \pm 0.03\%$), and overall pregnancy rates ($P = 0.07$; 59.9 ± 0.03 vs. $51.7 \pm 0.03\%$) than non-treated control ewes. A greater percentage of ewes lambled in the P.G. 600-treated group than in the control group ($P < 0.0001$; 61.2 vs. 42.2%, respectively), however, prolificacy between the treated group and the control group was not different ($P = 0.56$). In addition, the overall lambing rate in the ewes treated with P.G. 600 was significantly greater than that of the control group ($P < 0.0001$; 92.4 vs. 63.6%). In conclusion, an injection of 3 mL of P.G. 600 one day before CIDR removal significantly increased fertility and fecundity of nonlactating ewes bred outside their normal breeding season.

Key Words: ewe, fertility, P.G. 600

TH393 Body, carcass, and chemical composition of lambs and young goats produced in Alto Camaquã, Brazil. R. Arnoni*¹, M. T. Osorio², J. C. Osorio², R. Oliveira¹, M. Goncalves¹, M. Borba³, R. Esteves¹, and S. Duckett⁴, ¹Universidade Federal de Pelotas, Pelotas,

RS, Brazil, ²PVNS/CAPES/UFGD, Dourados, MS, Brazil, ³Embrapa/Pecuaria Sul, Bage, RS, Brazil, ⁴Clemson University, Clemson, SC.

The objective of this study was to characterize and compare the meat quality of lambs and young goats produced in a natural (wild) system unique to the territory of Alto Camaquã, Brazil. The experimental design was completely randomized with 2 treatments (species). ANOVA was performed by GLM procedure of the statistical package (SAS). Carcasses of lambs ($n = 15$) and young goats ($n = 20$) were utilized in this experiment. For body composition, the lambs had higher percentages of shoulder than the goats ($P < 0.05$; 22.44 ± 0.93 vs. 20.43 ± 2.10). Leg percentage was higher on average for goats than for lambs ($P < 0.05$; 37.56 ± 2.20 vs. 33.82 ± 1.34). In the shoulder and leg, the subcutaneous fat percentages were higher ($P < 0.05$; 10.86 ± 3.55 vs. 6.32 ± 1.69 , shoulder; 6.78 ± 2.41 vs. 5.11 ± 1.71 , leg) for lambs than goats. Total muscle percentages in shoulder and leg were higher ($P < 0.05$; 53.07 ± 2.01 and 49.32 ± 2.23 , shoulder; 58.59 ± 1.75 and 53.50 ± 3.11 , leg) for goats than lambs. The marbling fat in the shoulder was higher ($P < 0.05$; 3.71 ± 1.10 vs. 2.45 ± 0.61) for the lambs than goats. Muscle:bone ratio in both cuts was higher ($P < 0.05$; 2.37 ± 0.23 vs. 1.86 ± 0.14 , shoulder; 2.91 ± 0.34 vs. 2.013 ± 0.21 , leg) for goats than lambs. Muscle:fat ratio in both cuts was higher ($P < 0.05$; 6.36 ± 1.71 vs. 3.67 ± 1.24 , shoulder; 6.30 ± 1.32 vs. 5.45 ± 1.56 , leg) for goats than lambs. Protein content of the loin was higher ($P < 0.05$; 20.20 ± 0.73 vs. 19.02 ± 0.74 g/100g) for goat than lambs. These results show that lambs deposit more subcutaneous fat and marbling fat than goats; whereas goats have increased muscle and higher muscle to bone ratios due to the reduction in fat deposition. The goats demonstrated superiority in carcass yield and a higher proportion of the leg, which is considered the premium cut, than lambs. These differences may be related to greater exercise of the goat due to foraging behavior and specific species development.

Key Words: carcass, goat, lamb

TH394 Influence of dietary cottonseed on carcass and meat quality characteristics of feedlot lambs. R. A. Souza¹, R. S. Gentil¹, E. M. Ferreira¹, D. M. Polizel¹, A. P. A. Freire¹, L. G. M. Gobato¹, M. A. Trindade², and I. Susin*¹, ¹Escola Superior de Agricultura Luiz de Queiroz (ESALQ)/USP, Piracicaba, SP, Brazil, ²Faculdade de Zootecnia e Engenharia de Alimentos (FZEA)/USP, Pirassununga, SP, Brazil.

Whole cottonseed is a feed ingredient often used in ruminant diet due to its high protein and fiber content with low cost. However, some abattoirs do not take animals fed cottonseed because of lower consumer acceptability of the meat. In addition, lambs are very selective and may not eat homogeneously when whole cottonseed is added to the diet. Grinding could favor a more homogenous eating pattern but could enhance the "off flavor" concern. The objective of this experiment was to determine the effects of feeding high-concentrate diets with whole or ground cottonseed on growth, carcass characteristics, sensory evaluation and meat quality of ewe lambs. Twenty-one White Dorper x Santa Inês ewe lambs (initial BW = 23.6 ± 1.2 kg and 87.7 ± 4.5 d old) were used in a randomized complete block design, according to initial BW and age. The experimental diets were: 1) CS0: control, without cottonseed; 2) WC21: with 21% of whole cottonseed; and 3) GC21: with 21% of ground cottonseed. The diets were isonitrogenous (16% CP) and composed of 90% concentrate and 10% coastcross hay. Diets were fed daily and the trial lasted 62 d. At the end of the performance trial, lambs were slaughtered after a 16-h fasting period and carcass characteristics were recorded. Samples of longissimus muscle were used for meat quality analysis and sensory evaluation. Sensory test was performed by 80 untrained panelists. There was no diet effect on DMI, ADG, dressing percentage, back fat thickness, and longissimus muscle area. Color was different

($P < 0.03$) when control diet was compared with cottonseed (WC21 + GC21) groups (L: 29.6 vs 36.8; a: 9.0 vs 7.5; b: 11.0 vs 8.7). The control group had greater ($P < 0.04$) tenderness (6.6 vs 5.9), succulence (6.8 vs 6.1), acceptability (6.2 vs 5.6), and flavor (6.0 vs 5.6) values compared with cottonseed groups. In conclusion, whole or ground cottonseed fed to feedlot ewe lambs did not impair growth and carcass characteristics. However, there was a detrimental effect on sensory evaluation showing that its use should be restricted.

Key Words: consumer acceptance, high-concentrate diet, sheep

TH395 Impact of spray washing of goats and goat carcasses on microbial counts. C. Harris*, A. K. Mahapatra, G. Kannan, J. H. Lee, and B. Kouakou, *Agricultural Research Station, Fort Valley State University, Fort Valley, GA.*

A study was conducted to investigate the microbiological effect of spray washing goats and goat carcasses with tap water, salt water, electrolyzed water (EO), and ozonated water. Eighty meat goats were slaughtered in 4 groups (replicate) on 4 different days (20 goats per replicate group) at the university abattoir using standard procedures during 2 seasons, summer and winter. Ozonated water was generated from tap water using a Lotus Sanitizing System and EO water was generated by electrolyzing NaCl solution (0.075%) using a Biontech BTM-3000 batch water ionizer. Goats were randomly allotted to one of 5 treatments (4 1-min spray-wash treatments or no wash). Spray-washing of all goats was done by the same individual using a battery-operated backpack sprayer. Blood and skin swab samples were collected from control and treated goats before and after the spray-washing. Muscle pH was recorded at 0 (immediately after skinning) and 24 h postmortem using a portable pH meter with a penetrating probe. Using appropriate serial dilutions, 3M Petrifilm *E. coli* Coliform Count Plates and 3M Petrifilm Aerobic Count Plates were used for enumeration of indicator bacteria. Colonies of treated and untreated samples were counted following 24 h incubation period at 37°C for *E. coli* and aerobic plate counts. Bacterial counts of skin and carcass samples were converted to \log_{10} cfu/mL values. Differences between \log_{10} cfu/mL untreated sample and \log_{10} cfu/mL treated samples were calculated as a log reduction. Loin chops were used to determine the effects of treatment on quality characteristics of goat meat. Color and texture changes after spray washing, and cooking loss were evaluated. The results indicate that bacterial load on goat carcasses can be reduced by innovative pre-slaughter spray washing without significantly affecting the meat quality. The results from this study would be useful for small and very small goat processors and provide consumers with safer meat products.

Key Words: goat, microbial count, spray washing

TH396 Carcass characteristics and yield of lambs fed diets containing crude glycerin. V. B. de Carvalho*, J. M. B. Ezequiel, R. F. Leite, V. C. Santos, E. M. de Oliveira, T. R. Delphino, É. H. Fernandes, L. F. Cremasco, S. F. F. Petrorossi, J. R. Paschoaloto, M. T. C. Almeida, and J. F. Lage, *FCAV, São Paulo State University - UNESP, Jaboticabal, São Paulo, Brazil.*

The goal was to evaluate the effects of crude glycerin (CG) - 83% glycerol - on carcass traits and yield of lambs. Forty-two Santa Ines lambs (initial BW 22.9 ± 4.10 kg) were used in a completely randomized design with 5 treatments: 0% of CG (n = 9), 7.5% of CG (n = 8), 15% of CG (n = 8), 22.5% of CG (n = 8) and 30% inclusion of CG (n = 9) in DM. These animals were housed in individual pens and fed ad libitum twice per day. Diets were isonitrogenous with a concentrate:forage ratio

of 82:18, and consisted of Tifton hay, corn, crude glycerin, corn gluten meal, corn oil, urea, sunflower meal, soybean hulls, and mineral salt. Animals were slaughtered at an average weight of 37.82 ± 1.42 kg. After slaughter and evisceration, carcasses were weighed, kept refrigerated for 24 h at 0°C, and then weighed again to determine dressing percentage (DP). Commercial cut yield was measured in the right half of each carcass by separating into neck, shoulder, rib, loin, and leg. The yield of cuts was calculated by relating the weight of cut with cold carcass weight, expressed as a percentage. The rib eye area (REA) and rib fat thickness (RFT) were measured in Longissimus between the 12th and 13th thoracic rib with a digital caliper. The MIXED procedure of SAS was used for statistical analysis of data and were compared using orthogonal contrasts (linear and quadratic) at 5% significance level. The DP decreases with increasing levels of CG in the diet, showing a linear ($P = 0.0153$) pattern. The weights of the neck ($P = 0.5433$), ribs ($P = 0.4164$), leg ($P = 0.0826$) and shoulder ($P = 0.6126$) were not affected by CG inclusion. However, the weight of the loin ($P = 0.0340$) decreased linearly with increasing levels of CG in the diet. The yield of the neck ($P = 0.2192$), ribs ($P = 0.9315$), leg ($P = 0.0727$), shoulder ($P = 0.0944$) and loin ($P = 0.1929$) were not affected by the treatment. REA ($P = 0.8232$) and RFT ($P = 0.1345$) were also not influenced by inclusion of CG. The results suggest that the use of CG in the diet of lambs at high levels can affect carcass yield.

Key Words: byproduct, commercial cut, glycerol

TH397 Evaluation of productivity carcass indicators in Merino and Corriedale lambs. G. A. Rosa, L. A. O. Ribeiro, and L. Kindlein*, *Federal University of Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.*

The present study was conducted to assess whether objective measures taken in the Longissimus dorsi muscle (rib eye area, REA; maximum rib eye depth, RED; maximum rib eye width, REW) may be used by the meat industry as indicators of productivity through their correlation with cold carcass weight (CCW) in 2 lamb breeds, Merino (wool) and Corriedale (wool and meat). Despite the subjectivity of the quality concept, the meat industry requires specific measurable characteristics to be evaluated by consumers when purchasing the product. Slaughterhouses utilize carcass yield values as indicators of productivity, and as labor and processing costs are fixed, high yielding carcasses optimize production costs. Furthermore, objective measures, such as REA, RED, and REW are characteristics that indicate carcass composition, as they are related to animal muscularity and to cutting yield. For this experiment, 50 male lambs (12 mo old, 25 per breed) were used. The CCW were 14.7, 20.8 and 17.8 kg for Merino, Corriedale, and all animals, respectively. Samples of the Longissimus dorsi were collected for objective measurements. The data showed a positive correlation (R) for all the analyzed variables when all lambs (n = 50) were included: CCW and REA (0.694), REA and RED (0.748), REA and REW (0.726), CCW and RED (0.506), and CCW and REW (0.653). Within breed (n = 25), higher correlations were observed for Corriedale (0.313; 0.839; 0.604; 0.264 and 0.166) compared with Merino (0.199; 0.183; 0.274; 0.304 and 0.135), with the exception of CCW and RED. Differences may be related to the narrower carcass conformation of Merino breed. The results indicate greater muscularity in the Corriedale breed as reflected by the correlation between CCW and REA. There is also a high correlation between REA and RED for Corriedale (0.839), a dual purpose breed, confirming that RED can also be an indicator of meat productivity.

Key Words: carcass, lamb meat, rib eye area

TH398 Influence of zilpaterol (β -agonist) supplementation period on carcass traits of feedlot lambs. J. C. Robles-Estrada*, J. A. Rocha-Yocupicio, B. I. Castro-Perez, A. Estrada-Angulo, and H. Davila-Ramos, *Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico*.

Forty Pelibuey \times Katahdin (37.7 ± 0.67 kg) crossbred male lambs were used in a 43-d feeding trial (5 pens/treatment in a randomized complete block design) to evaluate the influence of zilpaterol supplementation on carcass characteristics. Lambs were fed twice daily with a cracked corn based (60%) experimental diet (2.57 Mcal/kg of ME and 15.2% of CP). The animals were allotted to individual pens (6 m²) with full shade and ad libitum water. Treatments were (1) control (ZIL-0), no zilpaterol supplementation; (2) zilpaterol for 20 d (ZIL-20); (3) zilpaterol for 30 d (ZIL-30); and (4) zilpaterol for 40 d (ZIL-40). Zilpaterol was supplemented at a rate of 0.15 mg/kg of live weight d⁻¹ (as zilpaterol chlorhydrate, Zilmax). The lambs were slaughtered in a local slaughterhouse. Zilpaterol supplementation improved hot carcass weight (6.68%), dressing carcass (1.07%), longissimus muscle area (13.7%, $P \leq 0.01$) and decreased fat thickness (25%) compared with control diet. A similar response was observed when comparing ZIL-30 lambs with ZIL-0 lambs. There were improvements in hot carcass weight (5.78%), carcass dressing (1.82%, $P \leq 0.02$), and longissimus muscle area (10.27%, $P = 0.04$), and reduction in fat thickness (34.5%, $P = 0.03$). Orthogonal polynomial analysis indicated a linear increase for carcass dressing ($P > 0.02$), and a tendency for increase in longissimus muscle area ($P = 0.06$) with increased period of zilpaterol supplementation. The results showed that using zilpaterol in lambs increased muscle mass and reduced fat in the carcass. Carcass weight increased with increasing periods (d) of zilpaterol supplementation. There were no significant differences between ZIL-20 and ZIL-30 groups. It is concluded that due to the high cost involved, a 20-d supplementation is sufficient to improve carcass traits in lambs by increasing protein and reducing fat. However, zilpaterol supplementation in lambs for longer periods can be considered based on local market needs and economic returns.

Key Words: carcass trait, lambs, zilpaterol

TH399 Effect of zilpaterol hydrochloride on growth and carcass characteristics of Nubian \times Criollo weather goats. A. M. Ocampo-Barragan¹, M. A. Lopez-Carlos*¹, J. I. Aguilera¹, H. Rodriguez¹, C. F. Arechiga¹, and R. G. Ramirez², ¹UAMVZ, *Universidad Autonoma de Zacatecas, Zacatecas, Mexico*, ²*Universidad Autonoma de Nuevo Leon, Monterrey, Mexico*.

The β -adrenergic agonists (β -AA) improve growth performance, reduce adipose accretion, and increase muscle mass in food animals. Zilpaterol hydrochloride (ZH) is probably the most widely studied β -AA in ruminants (cattle and sheep). However, there have been no reports on its potential use for improving growth and meat production in goats. The objective of this study was to evaluate the effect of ZH added to the diet on growth performance and carcass characteristics of wether goats for the last 42 d before harvest. Forty-8 Nubian \times Criollo wethers (27.6 ± 2.9 kg) were blocked by BW and randomly assigned to pens (3 blocks, 12 pens and 4 wethers per pen). Pens within a block were assigned randomly to 1 of 4 dietary treatments which consisted of the ZH supplementation in diet at doses of 0.0 (control), 0.1, 0.2 and 0.3 mg/kg BW. Data analysis was performed using the GLM procedure of SAS. Preplanned orthogonal contrasts were used to test linear and quadratic effects of dose of ZH feeding, and differences between control and ZH administration. Results were considered significant at $P < 0.05$. Growth performance (total gain, average daily gain, and final weight) improved by ZH administration ($P < 0.003$) and increased linearly ($P < 0.001$) as

dose of ZH increased. Carcass weight and dressing percentage improved by ZH administration ($P < 0.031$) and increased linearly ($P < 0.009$) as dose of ZH increased. Cooling loss percentage was not affected ($P > 0.05$) by ZH administration. Independent of the dose used, leg circumference increased 5.2% ($P = 0.023$), and mesenteric fat decreased 20.2% for wethers fed ZH diets ($P < 0.009$). In conclusion, addition of ZH to diets of wether goats increased growth performance and carcass characteristics in a similar way as reported for cattle and sheep.

Key Words: goat, growth, zilpaterol

TH400 Influence of zilpaterol (β -agonist) supplementation period on primal cuts of feedlot lambs. J. C. Robles-Estrada, B. I. Castro-Perez*, J. L. Martinez-Martinez, S. A. Serrano-Ceberos, and H. Davila-Ramos, *Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico*.

Sixty Pelibuey \times Katahdin lambs were received at the research facility 30 d before initiation of the trial. Forty Pelibuey \times Katahdin (37.7 ± 0.67 kg) crossbred male lambs were used in a 43-d feeding trial (5 pens per treatment in a randomized complete block design, with initial body weight as block factor) to evaluate the influence of zilpaterol (β -agonist) supplementation on primal cuts. Lambs were fed twice daily (2.57 Mcal/kg of ME) with 60% cracked corn, 16% sudangrass hay, 12% soybean meal, 9.5% molasses, and 2.5% mineral premix. Animals were allotted to individual pens (6 m²) with full shade and ad libitum water. Treatments were zilpaterol supplementation for 20 d (ZIL-20), 30 d (ZIL-30), 40 d (ZIL-40), or 0 d (ZIL-0, no zilpaterol, control). Zilpaterol was supplemented at a rate of 0.15 mg/kg of live weight per day (as zilpaterol chlorhydrate, Zilmax, Intervet México, México City). After carcasses were chilled for 48 h, the weights of the following cuts were obtained: rear quarter, leg, loin, skirt, fore quarter, chuck blade, shoulder, chest, and rib. Zilpaterol supplementation increased the final live weight (3.6%, $P = 0.05$) and cold carcass weight (6.2%, $P < 0.01$). Zilpaterol also increased rear quarter weight (8.86%, $P < 0.01$), chuck blade (6.48%, $P = 0.01$), loin (11.76%, $P < 0.01$) and leg (9.59%). Compared with ZIL-0, ZIL-30 increased rear quarter weight (9.0%, $P < 0.01$), chuck blade (7.0%, $P = 0.02$), loin (12.7%, $P = 0.01$) and leg (10%, $P < 0.01$). In both comparisons, there were no effects of zilpaterol on fore quarter weight. Orthogonal polynomial analyzes did not indicate linear or quadratic effects for zilpaterol supplementation days. In conclusion, zilpaterol supplementation increased cold carcass weight and muscle mass, particularly in the rear quarter, but with no effect on fore quarter cuts.

Key Words: lamb, primal cut, zilpaterol

TH401 Influence of zilpaterol (β -agonist) supplementation period on growth performance of feedlot lambs. J. C. Robles-Estrada, J. A. Garcia-Sandoval, B. I. Castro-Perez, and H. Davila-Ramos*, *Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico*.

Sixty Pelibuey \times Katahdin lambs were received at the research facility 30 d before initiation of the trial. From original group, 40 crossbred male lambs (37.7 ± 0.67 kg) were selected and used in a 43-d feeding trial (5 pens per treatment in a randomized complete block design) to evaluate the influence of zilpaterol (β -agonist) supplementation on growth performance of feedlot lambs. Lambs were fed with finishing diet (2.57 Mcal/kg of ME) containing cracked corn 60%, sudangrass hay 16%, soybean meal 12%, molasses 9.5%, and mineral premix 2.5%, twice daily. Animals were randomly allotted to pens (6 m²) with full

shade and ad libitum water. Treatments were: 1) control, no zilpaterol supplementation (ZIL-0); 2) zilpaterol for 20 d (ZIL-20); 3) zilpaterol for 30 d (ZIL-30); and 4) zilpaterol for 40 d (ZIL-40). Zilpaterol was supplemented at a rate of 0.15 mg/kg of live weight d⁻¹ (as zilpaterol chlorhydrate, Zilmax, Intervet México, México City). Zilpaterol supplementation improved the final weight (3.6%), ADG (15.2%), and feed conversion (10%), compared with control group ($P \leq 0.05$). When compared with ZIL-0, ZIL-30 tended to increase ($P \leq 0.08$) the final weight (4%), ADG (16.9%), and feed conversion (11.2%). However, no significant differences were found between ZIL-30 and ZIL-20. Dry matter intake averaged 1.566 ± 0.042 kg/d and there were no differences ($P = 0.34$) among treatments. The orthogonal polynomials (ZIL-20, ZIL-30 and ZIL-40) had similar responses (linear $P = 0.28$, and quadratic $P = 0.74$). The results showed that there were no differences among zilpaterol treatments, and that zilpaterol supplementation upto 30 d maintained improvement in lamb growth performance. Since there were no significant differences between ZIL-20 and ZIL-30, it is concluded that due to the high cost involved, a 20-d supplementation is sufficient to improve the growth performance in lambs. However, zilpaterol supplementation in lambs for longer periods can be considered based on local market needs and economic returns.

Key Words: growth performance, lamb, zilpaterol

TH402 Effect of prepartum administration of recombinant bovine somatotropin (rbST) on plasma beta-hydroxybutyrate levels in ewes subjected to subclinical ketosis. D. Perazzoli*¹, J. O. Feijó¹, A. C. J. Silva¹, A. M. Oliveira¹, L. Mielke¹, L. G. C. Silva¹, I. Bianchi¹, A. Schneider¹, E. Schmitt¹, C. F. Martins¹, F. A. B. Del Pino¹, C. Brauner¹, M. N. Corrêa¹, S. F. Faria Junior², M. B. Ferreira³, ¹Federal University of Pelotas, Pelotas, Rio Grande do Sul, Brazil, ²University Anhanguera-Uniderp, Campo Grande, Mato Grosso do Sul, Brazil, ³MSD Animal Health, São Paulo, São Paulo, Brazil.

The aim of this study was to determine the effect of rbST prepartum administration on plasma BHB profile of pregnant ewes subjected to subclinical ketosis. Twenty-seven Pantaneiro ewes were divided into 2 groups: rbST (n = 14) and control (n = 13). The rbST group received 2 injections of 1 mg/kg of rbST (Boostin 500 mg, Intervet Schering-Plough, Brazil), in a 14 d interval, with the first application at 97 d of pregnancy, whereas the control group received 2 doses of sodium chloride solution, 0.9% (placebo). Blood samples were collected weekly to evaluate BHB, from d 90 of pregnancy until 20 d before expected lambing (pre-induction). During food restriction (from 20 to 15 d prepartum), blood samples were collected twice a day. From d 15 until lambing (post-induction), blood samples were collected every 3 d. Blood samples were collected weekly for 8 wk postpartum. Statistical analysis was performed using SAS software by ANOVA Mixed Model procedure with Tukey Test. Control groups had significantly higher ($P < 0.05$) BHB (2.19 ± 0.21 mEq/dL) compared with rbST-treated group (1.35 ± 0.20 mEq/dL). From the data obtained in this study, we found that the group that received prepartum doses of rbST had lower BHB levels than the control group. Administration of rbST may promote adaptation to lipid mobilization, decreasing the level of ketone bodies produced postpartum, and therefore may be an alternative for ketosis prevention in ruminants.

Key Words: ewe, peripartum, recombinant bovine somatotropin

TH403 Application of wood model to lactation curves of dairy ewes in an organic production system. J. C. Angeles Hernandez*¹, M. Gonzalez Ronquillo², B. Albarran Portillo², J. H. Gutierrez², and

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The Wood mathematical function (1967) has been widely used in the description of the lactation curve of different livestock species. The Wood model (WD) is structured by 3 parameters, where a is the initial milk yield; b and c are the parameters of inclining and declining slopes of lactation curve before and after the peak yield, respectively. The objective of the present study was to assess the degree of fit of Wood's model to the lactation curves of dairy ewes in an organic milk production system in Mexico. A total of 4,861 weekly test-day milk yield (TD) records from 193 lactations of F1 dairy ewes were analyzed to assess their lactation curves. The evaluation criteria were the correlation coefficient between estimated and observed values (R), the coefficient of determination (R²), and the mean square prediction error (MSPE). Total milk yield (TMY), peak yield (PY), and time at peak yield (TPY) were calculated. The WD model showed an adequate fit (R = 0.95, R² = 0.92 and MSPE = 0.024), but is not accurate in predicting PY and TPY, underestimating both due to the presence of atypical curves (51.3%). All WD model parameters had high standard deviations, with higher SD values for parameter b, which indicated high variability in the lactation data used, and a marked polymorphism in the lactation curves due to a high number of atypical curves. There was a negative correlation (-0.39) between parameters a and b, and positive correlation (0.83) between parameters b and c, indicating a high association between different stages of lactation curves. The atypical curves generated model values outside the biological range due to organic system management characteristics, including animal genotype and nutrition.

Key Words: dairy sheep, organic management, atypical curve

TH404 Over-expression of adipose triglyceride lipase (ATGL) gene in mammary gland epithelial cells of dairy goats. J. Li, J. Luo, H. Tian, H. Shi, and W. Wang*, Shaanxi Key Laboratory of Molecular Biology for Agriculture, Northwest A&F University, Yangling, Shaanxi, China.

The objective of this study was to analyze tissue expression profile of adipose triglyceride lipase (ATGL) in Xinong Saanen dairy goat, and to detect its effect on lipid metabolism in goat mammary epithelial cells, to further reveal its important roles in the process of lactation. The tissue expressions of goat ATGL gene were analyzed by RT-qPCR. Total RNA of various tissues were extracted with Trizol reagent. The first strand cDNA was synthesized using the PrimeScript RT kit to conduct the real-time expression. The data were analyzed with SPSS to compare the difference. The results showed that the goat ATGL gene mRNA expression level of subcutaneous adipose tissue was the highest among all the analyzed tissues. It was followed by the lung and mammary gland. The mRNA level of ATGL gene in mammary gland was higher in lactating stage than in dry period. To analyze the function of ATGL, the recombinant plasmid pAdTrack-CMV-ATGL linearized by *PmeI* was transformed into *E. coli* BJ5183 competent cells containing the backbone vector pAdEasy-1 to construct vector pAd-ATGL by homologous recombination. pAd-ATGL was linearized by *Pac I* and transfected HEK 293 cells for packaging. The recombinant adenovirus vector with the titer of virus of 10⁹ U/mL was used to infect goat mammary epithelial cells for overexpression of ATGL gene. The results showed that compared with Ad-GFP controls, mRNA level of ATGL increased by 600-fold in Ad-ATGL infected goat mammary gland epithelial cells for

48 h, and significant lipid droplet reduction was observed by Oil Red O staining. While cellular triglyceride mass was significantly decreased ($P < 0.05$), the free fatty acid level, which is closely related to cellular lipolysis, was significantly increased ($P < 0.05$) in Ad-ATGL infected goat epithelial cells. In conclusion, the overexpression of ATGL gene can cause remarkable changes of cellular contents, which suggest that ATGL gene may have a role in the process of steatolysis in lactating mammary gland of dairy goats.

Key Words: adipose triglyceride lipase (ATGL), dairy goat, over-expression

TH405 Feeding behavior of goats subjected to feed restriction.

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The objective of this study was to evaluate feeding behavior of goats subjected to 3 levels of feed restriction. Fifty-three Saanen goats (18 intact males, 17 castrated male and 18 females) with average body weight of 22.5 ± 1.3 kg were subjected to 3 levels of feed restriction (ad libitum, 25% and 50% feed restriction). Feed restriction was calculated according to the consumption of the animals fed ad libitum. All animals were fed the same diet comprised of corn stover and concentrate based on soybean meal and corn with 45.7% of roughage and 54.3% of concentrate. The animals were housed individually with unrestricted access to water. Feeding behavior of animals was evaluated during a period of 24 h by one observer who performed visual measurements every 5 min, and identified the activities of ruminating standing, ruminating lying, eating, drinking, idle standing and idle lying. The experimental design was a randomized complete block in a factorial scheme (3 sex \times 3 feed restriction levels), data were analyzed using PROC MIXED and means were compared by Tukey test at 5% probability. No significant interaction between feed restriction and sex ($P > 0.05$) was observed for feeding behavior. Ruminating standing and drinking were influenced by sex ($P < 0.05$), with intact males spending longer periods ruminating and drinking than castrated males and females. The animals subjected to 50% feed restriction remained standing idle for a longer period, compared with animals fed ad libitum ($P < 0.05$), which can be explained by greater discomfort of animals subjected to greater feed restriction. In fact, it was observed that animals subjected to greater feed restriction showed agonistic behaviors in the standing position, which also justifies the longer periods observed for these animals in entertainment. In conclusion, sex influences feeding behavior in Saanen goats. And Saanen goats subjected to feed restriction spend more time standing idle.

Key Words: goat kid, ingestive behavior, sex

TH406 Effects of conditions between periods of studies to evaluate electric fence additions to barb wire fence for goat containment.

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Forty Boer (B, 3.7 ± 0.23 yr and 52 ± 1.4 kg) and 40 Spanish (S) does (3.0 ± 0.21 yr and 36 ± 0.7 kg) were used to evaluate effects of treatments between periods (IT) of a Latin square (LS) on behavior (e.g., pen exit and shock) when exposed to pens with barb wire fence and different electric fence strand additions. Breeds were split into 2 sets with 5 groups of 4 does. Five 2.4×3.7 m evaluation pens had 1 side of barb wire strands at 30, 56, 81, 107, and 132 cm from the ground. Fence

treatments (FT) were electrified strands (6 kV) at 15 and 43 (LH), 15 and 23 (LM), 15 (L), 23 (M), and 43 cm (H). For adaptation, there was weekly short-term exposure to test pens with different electric fence strand additions (B: wk 1 - no electric strands (NES), wk 2 - NES, wk 3 - 1 strand at 0 kV, wk 4 - 1 strand at 2.5 kV, wk 5 - NES; S: wk 1 - NES, wk 2 - 1 strand at 0 kV, wk 3 - 1 strand at 3 kV, wk 4 - 1 strand at 4 kV). The adaptation scheme differed between breeds based on initial behavior to prevent very low or high levels of exit during the experiment. Behavior was assessed 1 h every 2 wk in the 5×5 LS with different FT. In the week between measurements, 1 set of each breed was exposed to a NES test pen (IT-Y) and others were not (IT-N). It was thought that periodic exposure to IT-Y might refresh memory of potential pen exit depending on the particular FT. There were interactions ($P < 0.05$) in pen exit between IT and period (28, 38, 18, 0, and 18% with IT-Y and 45, 13, 0, 0, and 0% with IT-N in period 1, 2, 3, 4, and 5, respectively; SE = 4.9), fence treatment (5, 8, 15, 40, and 33% with IT-Y and 5, 3, 18, 23, and 10% with IT-N for LH, LM, L, H, and M, respectively; SE = 4.9), and breed (8 and 32% with IT-Y and 15 and 8% with IT-N for B and S, respectively; SE = 3.8). The IT also affected ($P < 0.05$) does receiving a shock (18 and 10%; SE = 2.4). In conclusion, exposing goats to barb wire fence without electric strands between measurement periods did have some desirable effects but, overall, was not adequate for use of a LS design to evaluate effectiveness of various electric strand additions for goat containment.

Key Words: behavior, goat, fence

TH407 Effects of adaptation and meat goat breed in a method to evaluate electric fence additions to barb wire fence for goat containment.

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Forty Boer (B) wethers (150 ± 2.7 d of age and 20 ± 0.7 kg BW initially), 40 B doelings (163 ± 1.5 d and 22 ± 0.4 kg), 33 Spanish (S) wethers (162 ± 1.7 d and 18 ± 0.6 kg), and 42 S doelings (163 ± 1.6 d and 15 ± 0.4 kg) were used to investigate effects of adaptation treatment (AT) on behavior when exposed to barb wire fence with different electric strand treatments. Breeds were divided into 2 sets with 5 groups of 3 to 4 animals. Five 2.4×3.7 m evaluation pens had 1 side with barb wire strands at 30, 56, 81, 107, and 132 cm from the ground. Fence treatments (FT) were electrified strands (6 kV) at 15 and 43 (LH), 15 and 23 (LM), 15 (L), 23 (M), and 43 cm (H). After animals experienced exit from evaluation pens without electric strands (NES), AT of different modifications with electric fence strands were imposed 1 time each week for <30 min: wk 1 - 1 strand at 0 kV, wk 2 - LH, wk 3 - LH, and wk 4 - NES for 1 set of each breed (BC and SC); wk 1 - NES, wk 2 - 1 strand at 0 kV, wk 3 - L, and wk 4 - NES for the other set of B (BU); wk 1 - 1 strand at 0 kV, wk 2 - LH, wk 3 - LH, and wk 4 - LH for the other set of S (SU). Based on differences in initial behavior, BU and SU were designed to achieve similar behavior during the experiment, with differences between BC and SC expected. After AT, each group was exposed to 1 FT for 1 h in period 1 and 7 wk later in period 2. The % of animals exiting pens differed ($P < 0.01$) among AT (5.5, 39.9, 60.6, and 0.0% for BC, BU, SC, and SU, respectively; SE = 1.18) and FT (9.1, 2.8, 15.4, 62.4, and 22.6% for LH, LM, L, H, and M, respectively; SE = 1.39). Period affected ($P < 0.05$) animals shocked without exit (4.2 and 12.6% in period 1 and 2, respectively; SE = 2.81) and goats exiting with shock (14.5 and 1.3%; SE = 3.47), but did not affect exit. In conclusion, use of the same AT for B and S resulted in different behavior when later exposed to FT and BU affected pen exit as anticipated. However, SU was highly prohibitive to exit and would not be suitable for a method

of evaluating different electric fence strand modifications of barb wire fence for goat containment.

Key Words: behavior, fence, goat

TH408 Growth and survivability of meat goat kids as influenced by breed of dam and sire and forage type from birth to weaning.

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The objective of this study was to determine the effect of forage type and breed of meat goats in a reciprocal cross between Boer and Spanish breeds on growth performance to weaning. Birth weight (BW), weaning weight (WW), pasture type and kid mortality to weaning were studied in 292 kids. Breed of kids were: BB, SS, BS, SB for pure Boer, pure Spanish, Boer with Spanish sire, Spanish with Boer sire, respectively. Dams and kids were randomly assigned to 4 forage treatments: annual ryegrass (ARG)/vetch, ARG/winter peas, ARG/clover, and native pasture (ARG and clover). The main effects on BW and WW analyzed included kid breed, litter size, litter weight, gender, forage type and parity of dam. Average age at weaning was 82.9 and 84.9 d for kids born to Boer and Spanish does, respectively. Death loss of any kid or dam before weaning was recorded. There was a significant difference ($P < 0.05$) in fecundity between Spanish and Boer does (97.0% vs 84.7%, respectively). Spanish does had significantly ($P < 0.05$) fewer male (0.64 vs. 1.05 sex ratios) kids and a significantly higher percentage of twin kids at weaning (50% vs. 23.4%). BB kids had significantly ($P < 0.05$) heavier birth weights than any of the other kid breeds. SS kids had significantly ($P < 0.05$) smaller birth weights than all other breeds. Birth weights of BS and SB (crossbreds) were not significantly different. Although there was no difference in percentage of kids reared to weaning between Spanish and Boer females (62.8% vs 56.9%, respectively), there was a significant difference ($P < 0.05$) in the number of SS kids over BB kids that made it to weaning (70.1% vs 36.0%, respectively). There was no significant effect on WW due to pasture treatment or parity of dam. Analysis of breed of kid and gender on WW revealed significant differences ($P < 0.05$) only with male kids with BS being significantly heavier than SB at weaning. We conclude that selection of the proper sire/dam breeding combination and mothering ability is critical to the overall economic success of a meat goat operation.

Key Words: goat, heterosis, growth

TH409 Dose response effects of supplementing an algal meal in concentrate diets fed to Canadian Arcott lambs on production performance.

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As microalgae are the original source of DHA in the marine food chain, the inclusion of dried marine algae in animal feeds is one strategy to increase the DHA level in foods of animal origin. DHA plays a role in normal cerebral development and function, and has been associated with a reduction in heart disease. Currently, there are very few studies using DHA-Gold, a commercial algal meal (*Schizochytrium* sp.) in ruminant diets, none of which have been conducted with sheep. As such, this study aimed to investigate the effects of supplementing DHA-Gold on growth, carcass characteristics and wool production of Canadian Arcott lambs.

Forty-four lambs were blocked by weight and randomly assigned to 4 diets consisting of a barley-based pellet where DHA-Gold replaced flax oil at 0, 1, 2 or 3% DM. Lambs were individually housed with ad lib access to feed with feed delivery and orts recorded daily. Lambs were weighed weekly and slaughtered once they reached 50 kg LW. Carcass characteristics (hot carcass weight, dressing % and grading rule), rumen pH and liver weights were determined post mortem. Wool yield was determined on mid-side patches of 100 cm² shorn at d-0 and d-140. Dye-bands were used to determine wool growth, micron and staple length. Daily DMI, ADG and G:F were similar among treatments ($P > 0.05$). Neither wool yield, length nor diameter were affected by diet ($P > 0.05$). Carcass characteristics were generally unaffected ($P > 0.05$), except for grade rule values (mm) which showed a quadratic increase (16.1, 21.2, 18.8 and 17.4 ± 1.18 mm for 0, 1, 2 and 3% DM, respectively; $P = 0.01$) with additional DHA-Gold. However, this did not increase the overall value of the carcass (\$7.63 ± 0.30/kg; $P = 0.50$). Liver weight increased linearly ($P < 0.001$) and back score tended ($P = 0.08$) to increase with increasing dietary concentrations of DHA-Gold. This suggests that DHA-Gold can be successfully included in the diets of growing lambs at up to 3% DM, with the potential to improve carcass quality.

Key Words: Canadian Arcott lambs, DHA-Gold, production

TH410 Factors affecting post weaning growth of hair-sheep lambs born in winter and managed under semi-intensive husbandry system.

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A study was conducted to identify main factors affecting postweaning growth between 75 and 145 d of age of hair-sheep lambs born in winter and managed under semi-intensive conditions. Lambs (males and females, n = 208) born during the winter months (December, January and February) were weighed weekly from weaning (d 75 adjusted) until 145 d of age. Date of birth, sex, breed of sire, breed of dam, phenotypic expression (stunted or normal), and litter size (single, double, or triple) were recorded. Data were analyzed as repeated measures using MIXED procedure of SAS. Lambs classified as "slow growing" or "stunted" at the beginning of the experiment had lower ($P < 0.001$) weaning weight and were 12.6 kg lighter than normal growing lambs. During the first 2 wk after weaning, there were no differences ($P > 0.05$) between male and female lambs, although male lambs were up to 3.6 kg heavier ($P < 0.001$) at the end of 145 d. Lambs born from multiple births were 2 kg lighter than single birth lambs, but when they completed 145 d of age, the difference was reduced to only 0.8 kg. Breed of sire (Dorper vs. Katahdin) did not affect the weight of lambs. However, breed of dam influenced weight of the lambs. At 131 d of age, lambs from Dorper, Pelibuey or Katahdin dams showed similar weights of 27.1, 25.8 and 25.2 kg respectively, while lambs from Blackbelly dams weighed 23.5 kg and were lighter ($P < 0.05$) than the rest of lambs. Month of birth significantly ($P < 0.05$) affected lamb weights. Lambs born in February were heavier than those born in January, while the lambs born in December were the lightest. In conclusion, "stunted" lambs had lower growth rate, and farmers should consider whether to keep these animals on the farm or hold for sale at weaning. In addition, factors such as prolificacy, maternal breed, sex, and month of birth should be considered when evaluating the profitability of a farm, as these factors significantly affect lamb development in the post weaning period.

Key Words: growth, hair sheep, lamb