

# Small Ruminant: Sheep Production 1

**M453 Milk yield and composition from dairy ewes fed two sources of lipid supplements associated or not with conjugated linoleic acid (CLA).** M. Baldin<sup>1</sup>, R. Dresch<sup>1</sup>, J. Souza<sup>1</sup>, E. C. Sandri<sup>1</sup>, F. Batistel<sup>1</sup>, E. Ticiani<sup>1</sup>, A. Panzera<sup>1</sup>, L. O. Tedeschi<sup>3</sup>, M. A. S. Gama<sup>2</sup>, D. Fernandes<sup>1</sup>, and D. E. Oliveira\*<sup>1</sup>, <sup>1</sup>*Santa Catarina State University, Chapecó, Brazil*, <sup>2</sup>*National Dairy Cattle Research Center, Juiz de Fora, MG, Brazil*, <sup>3</sup>*Texas A&M University, College Station*.

It is known that rumen-protected lipid (RPL) supplements or CLA may affect milk fat content in dairy ewes, but their combination has not been fully investigated. The objective of this study was to evaluate the effects of 2 sources of RPL with or without CLA supplement (29% t-10 c-12 and 29% c-9 t-11 isomers) on milk yield and milk composition of dairy ewes. Thirty-six East Friesian ewes (50 to 70 DIM) were used in a 2 × 2 factorial design and received the following treatments: 1) 30 g of calcium salts of long chain fatty acids from soybean oil (LCFAS); 2) 27 g of calcium salts of long chain fatty acids from palm oil (LCFAP); 3) 30 g of LCFAS plus 20 g of CLA; and 4) 27 g of LCFAP plus 20 g of CLA. The lipid supplements were isocaloric. CLA, LCFAS, and LCFAP were added into a corn-based concentrate (1.0 kg/d, as-fed) and individually fed twice daily after morning and afternoon milkings. Ewes were grazing *Panicum maximum* Jacq. cv. Aruana pasture during the experimental period (53 d) of which 5 d were used for adaptation, 40 d for data collection, and 8 d for residual effects. Data were analyzed in a repeated measure design, including RPL, CLA, d, and their interactions as sources of variation. Milk yield was unaffected by CLA (1.17 kg/d;  $P = 0.64$ ) and RPL (1.15 kg/d;  $P = 0.95$ ). There was an interaction between CLA and RPL ( $P = 0.02$ ) for milk fat content. For ewes receiving CLA, milk fat content was similar ( $P = 0.49$ ) between LCFAP and LCFAS (4.31 vs. 4.18%, respectively). However, when CLA was not fed, milk fat content was greater ( $P = 0.004$ ) for ewes receiving LCFAP compared with those receiving LCFAS (6.27 vs. 5.52%, respectively). LCFAP increased ( $P = 0.02$ ) milk protein content compared with LCFAS (4.96 vs. 4.77%, respectively). Even though RPL and CLA did not impact milk yield, the source of RPL may affect milk fat composition when CLA is not provided to lactating dairy ewes.

**Key Words:** conjugated linoleic acid, lactating dairy ewes, milk composition

**M454 New management technique in early lactation can improve profitability in dairy sheep farms.** S. P. G. Rasso, C. Carzedda, A. Mazzette, C. Dimauro, A. Mazza, and G. Pulina\*, *Dipartimento di Scienze Zootecniche, University of Sassari, Sassari, Italy*.

The effect of 2 management techniques on farm profitability of dairy Sarda ewes was tested. During the suckling period, i.e., the first month of lactation, 22 Sarda ewes (2–4 year old) were used. Eleven ewes (SL group) were separated from their lambs, starting from 5 d after birth, from 0800 to 1600 h, fed on pasture and milked one time per day before to be rejoined with their lambs. The other 11 ewes (NSL group) were fed on pasture, never separated from the lambs, and milked at the same time of SL group. Lambs of SL group were also supplemented with a commercial feed (0.40 €/kg) to compensate for less available milk. All lambs were slaughtered at 25 d of age. Milk yield of ewes, and body weight of lambs were recorded during the suckling period. Moreover, milk yield, fat and protein contents of ewes were measured during the month after lamb slaughtering. Data were analyzed by a GLM model, using management (SL and NSL), date of the measurement sampling and their interaction as fixed factors. Milk yield was higher in SL compared

with NSL group both during suckling period (g/d 645 ± 38 vs 83 ± 38;  $P = 0.000$ ) and during first month after lambs slaughtering (g/d 1494 ± 31 vs 1334 ± 33;  $P = 0.001$ ). Body weight at slaughter (SL kg 11.4 ± 0.2 vs NSL kg 11.1 ± 0.2;  $P = 0.563$ ) and daily growth of lambs (SL g/d 267 ± 9 vs NSL g/d 263 ± 9;  $P = 0.703$ ) were not different between experimental groups as well as milk fat (SL 5.46% ± 0.09 vs NSL 5.67% ± 0.09;  $P = 0.087$ ) and milk protein content (SL 5.12% ± 0.05 vs NSL 5.06% ± 0.05;  $P = 0.323$ ). Therefore, profitability of SL group was higher than NSL group, in particular during suckling period. Indeed, return of the SL group is equal to 0.393 €/head/d (gain from milk = production 0.645 g/head/d × 0.650 €/kg of milk) minus 0.026 €/lamb/d cost of feeding lambs (pellet feed consumed 65 g/head/d × 0.40 €/kg of pellet) that is equal to about 8.0 €/head in 25 d of suckling. Return of the NSL group is equal to 0.054 €/head/d (no cost for lambs feeding and little gain from milk) that is equal to about 1.0 €/head on the same period.

**Key Words:** sheep, milk, lamb

**M455 Assessment of milk yield and milk composition in ewes fed diets with canola, sunflower or castor oil.** M. O. Maia\*, I. Susin, A. V. Pires, E. M. Ferreira, R. S. Gentil, C. Q. Mendes, D. B. Galvani, and A. L. M. Selegato, *University of São Paulo/ESALQ, Piracicaba, SP, Brazil*.

The inclusion of fat sources in ruminant diets is an alternative to achieve nutritional requirements, especially in early lactation. Additionally, vegetable oils can modify milk fatty acid profile. Forty-four Santa Inês ewes (66.6 ± 4.9 kg BW and 14 ± 3 d in milk) were penned individually and used in a complete randomized block design to determine the effects of adding canola, sunflower or castor oil on DMI, milk production, and milk composition. Ewes were fed a basal diet (14.7 ± 0.1% CP, DM basis) containing 50% concentrate and 50% coastcross hay. The 4 treatments included control (0% oil, CONT), canola oil (3%, CAN), sunflower oil (3%, SUN) or castor oil (3%, CAS). Ewes were fed the diets from the wk 2 to 8 of lactation. Milk production was determined every 7 d during the experiment. Ewes were separated from lambs, oxytocin (10 IU) was infused i.v. to stimulate milk letdown, and ewes were mechanically milked. After 3 h, the procedure was repeated and milk production was recorded and a sample collected for milk composition analysis. Ewes were weighed for 3 consecutive days at the start and end of the experiment. Data were analyzed using SAS PROC Mixed procedure and means compared by Tukey Test. Dry matter intake was greater ( $P ≤ 0.01$ ) for ewes fed CONT diet (2.48 kg), whereas, no effect was observed on DMI among diets with oil inclusion (2.06, 2.18, and 2.09 ± 0.03 for CAN, SUN, and CAS, respectively). Milk production, milk protein and milk lactose were not different ( $P ≥ 0.05$ ) among diets. However, milk fat (7.9, 8.2, 7.7, and 9.3 ± 0.12% for CONT, CAN, SUN, and CAS, respectively) and total solids (18.6, 18.7, 18.6, and 20.0 ± 0.12% for CONT, CAN, SUN, and CAS, respectively) concentrations were greater ( $P ≤ 0.001$ ) for ewes fed the diet containing castor oil. There was no difference on BW change among treatments. In conclusion, the addition of oil regardless of source decreased DMI, but no effect on milk production was observed. Milk fat was increased with the inclusion of castor oil in lactation diets.

**Key Words:** lipids, oil source, Santa Inês

**M456 Effect of different vegetable oils fed to lactating ewes on milk and cheese fatty acid profile.** R. Bodas<sup>1</sup>, P. Gómez-Cortés<sup>2</sup>, A. R.

Mantecón<sup>1</sup>, M. Juárez<sup>2</sup>, M. A. De la Fuente<sup>2</sup>, and T. Manso<sup>\*3</sup>, <sup>1</sup>*Instituto de Ganadería de Montaña (CSIC-ULE), León, Spain*, <sup>2</sup>*Instituto del Frío (CSIC), Madrid, Spain*, <sup>3</sup>*E.T.S. Ingenierías Agrarias (Universidad de Valladolid), Palencia, Spain*.

The aim of this study was to evaluate the effects of different vegetable oils fed to lactating ewes on milk and cheese fatty acid (FA) profile. After lambing, 48 Churra ewes were fed 2.1 kg of 40:60 (as-fed basis) lucerne:concentrate total mixed ration (TMR) daily and were milked twice a day. Ewes were assigned to 1 of 4 groups, which received 3% (as-fed basis) of the corresponding oil added daily to the TMR: hydrogenated palm oil (Con), olive oil (Oli), soybean oil (Soy) or linseed oil (Lin). On d 55 of lactation, 3 cheeses per treatment were made from the milk and samples of milk and cheeses were collected for FA analyses. The data were subjected to ANOVA according to a 2 (milk and cheese) by 4 (oils) factorial design using the MIXED procedure of SAS. Regardless the type of oil added to the diet, milk and cheese FA profiles were not different ( $P > 0.10$ ). Cheese and milk samples from Con treatment had the greatest saturated FA (SFA) contents, but the least long chain FA (LCFA,  $> 18C$ ), vaccenic (VA), and rumenic (RA) acid contents ( $P < 0.001$ ). Milk and cheese from Soy treatment had the least SFA ( $P < 0.001$ ), but the greatest VA, RA and linoleic acid contents and n6/n3 ratio ( $P < 0.001$ ). Lin and Soy ewes produced milk and cheese with the greatest amount of polyunsaturated FA ( $P < 0.001$ ). Olive oil supplementation increased oleic acid and decreased linoleic acid content ( $P < 0.001$ ), whereas Lin gave raise to the greatest linolenic acid content and the least n6/n3 ratio ( $P < 0.001$ ). From the results observed, it can be concluded that supplementing the diet of lactating ewes with oils is a suitable way of modulating naturally the FA profile of their milk and cheese.

**Key Words:** cheese, fatty acids, sheep

**M457 Milk performance of ewes fed fish oil and soybean oil.** E. M. Ferreira\*, A. V. Pires, I. Susin, C. Q. Mendes, S. Gilaverte, R. S. Gentil, M. O. Maia, D. B. Galvani, and R. C. M. Meneghini, *University of São Paulo/ESALQ, Piracicaba, SP, Brazil*.

Dietary fish oil in combination with linoleic or linolenic fatty acid source consistently increases milk vaccenic and conjugated linoleic fatty acid concentrations. However, inclusion of fish oil in the diet can decrease DMI and milk production. Fifty Santa Inês ewes ( $64.9 \pm 5.9$  kg BW and  $18 \pm 2$  d in milk) were used in a complete randomized block design and assigned to individual pens to determine the effects of replacing soybean oil with fish oil on lactation performance. The control diet (CONT) contained 29% forage (sugarcane bagasse) and 71% concentrate on a DM basis. In the remaining 4 treatments, fish oil replaced soybean oil (4% on DM basis) at 0, 0.25, 0.50, and 0.75%. Ewes were fed the diets from wk 2 to 8 of lactation. Milk production was measure every 7 d during the trial. Ewes were separated from lambs, oxytocin (10 IU) was infused i.v. to stimulate milk letdown, and ewes were mechanically milked. After 3 h, the procedure was repeated and milk production was recorded and a sample collected for milk composition analysis. Preplanned contrasts were supplemental fat (soybean oil or fish oil) versus no fat and linear, and quadratic contrast of fish oil inclusion. Dry matter intake (2.34, 2.12, 2.13, 2.07, and  $2.11 \pm 0.02$  kg/d for CONT, 0FO, 0.25FO, 0.50FO and 0.75FO, respectively) was greater ( $P < 0.01$ ) for ewes fed the CONT diet vs. fat inclusion, whereas, no effect ( $P > 0.05$ ) was observed on DMI with fish oil inclusion. A linear increase ( $P < 0.01$ ) for milk production (184.1, 190.2, 207.2, and  $220.9 \pm 4.5$  g/3 h for 0FO, 0.25FO, 0.50FO and 0.75FO, respectively) was shown with fish oil inclusion. Milk fat concentration was similar ( $P < 0.05$ ) for all diets. Milk protein (4.8, 4.7, 4.5, and  $4.5 \pm 0.04\%$  for 0FO, 0.25FO, 0.50FO and 0.75FO, respectively) and total solids (18.0, 17.5, 17.4,

and  $17.3 \pm 0.01\%$  for 0FO, 0.25FO, 0.50FO and 0.75FO, respectively) concentrations decreased ( $P < 0.01$ ) linearly with fish oil addition. Milk lactose (4.6, 4.8, 4.8, 4.8, and  $4.8 \pm 0.02\%$  for CONT, 0FO, 0.25FO, 0.50FO and 0.75FO, respectively) concentration was greater ( $P < 0.05$ ) for ewes fed the fat-supplemented diets vs. the control. In conclusion, replacing 4% soybean oil with fish oil up to 0.75% of the diet improved milk production without detrimental effect on DMI.

**Key Words:** milk production, sheep, fish oil

**M458 Evaluation of inbreeding depression effect on birth weight of Baluchi sheep breed of Iran.** G. Motaghinia\*<sup>1</sup>, H. Farhangfar<sup>1</sup>, M. Bashtani<sup>1</sup>, A. Shadparvar<sup>2</sup>, H. Saracee<sup>1</sup>, H. Janati<sup>3</sup>, and J. Modarresi<sup>4</sup>, <sup>1</sup>*Birjand University, Birjand, Iran*, <sup>2</sup>*Guilan University, Rasht, Iran*, <sup>3</sup>*Baluchi Sheep Breeding Station, Mashhad, Iran*, <sup>4</sup>*Agricultural Jihad Organisation, Birjand, Iran*.

The main objective of this research was to estimate the effect of inbreeding on birth weight of Baluchi sheep breed of Iran. A total of 13,007 birth weight records was utilized. The data were collected from 13,007 lambs (born from 1984 to 2006) in Baluchi sheep breeding station, northeast region of Iran. The lambs were born between December and April. Birth weight average was 4.27 kg. Inbreeding coefficient was calculated for individual lambs using pedigree software. In the data set, minimum and maximum of the inbreeding coefficient were 0 and 0.321, respectively. Dependent variable was birth weight and the data were analyzed by a Mixed Linear Model applied in SAS software. In the model, fixed main effects of herd, year and month of birth, lamb sex, birth type, as well as 2-way interactions between herd and month of birth, sex and birth type, year and sex, year and birth type, month and sex, month and birth type, herd and birth type, and between herd and lamb sex were included. Dam age and coefficient of inbreeding were also included in the model as covariables. The results indicated that dam age (linear and quadratic terms), year and month of birth, sex and birth type of lamb, interactions between year and birth type, sex and birth type and herd and birth type had significant influences on birth weight ( $P < 0.05$ ). Regression coefficient of birth weight on inbreeding was found to be  $-343$  g but it was not statistically significant.

**Key Words:** Baluchi sheep, birth weight, inbreeding

**M459 Cubicle use and maternal bonding in sheep: tests of an alternative lambing management strategy.** N. L. Pettifor\* and M. L. Thonney, *Cornell University, Ithaca, NY*.

Many farm flocks are intensively managed while lambing in barns, where ewes are often kept in high-density areas and moved with their lambs to claiming pens shortly after lambing. Other methods may improve the process of maternal bonding and use less labor. One alternative to traditional lambing management uses "cubicles," open  $2.4 \times 1.5$  m pens in which ewes may choose to isolate themselves at lambing time. As ewes on pasture will naturally seek isolation at lambing, it is expected that more ewes would choose to lamb in the privacy of a cubicle. Additionally, time spent on the birth site may increase the strength of a ewe's bond with her lambs because lambing in a cubicle avoids the disruption of being moved from a lambing area to a claiming pen. To test the cubicle concept, 43 Dorset, Finnsheep, and Dorset  $\times$  Finnsheep ewes were lambed in a cubicle system. Ewes were regularly added to the lambing area to maintain a stocking density of 1.9 to 2.3 m<sup>2</sup> per ewe and were video-recorded 24 h per day for the duration of the lambing season. An additional 110 ewes were managed traditionally, using claiming pens. After the end of the lambing period, ewes from the traditional system were compared with 2 groups of ewes from the

cubicle system: one set that did use cubicles and another set that did not. Two behavioral tests of maternal bonding, also video-recorded, were used to compare these groups: a 2-choice discrimination task and a modified maternal behavior score (MMBS, 1 to 5) test. Ewes did not preferentially lamb in cubicles: 23.3% of recorded ewes were located in cubicles when they lambed; 29.6% of the total lambing area consisted of cubicle space. MMBS scores were not statistically different between cubicle-using and non-using experimental ewes ( $4.33$  and  $4.05 \pm 0.47$ , respectively), but were higher ( $P = 0.26$ ) than the value of  $3.15 \pm 0.47$  for the traditionally managed group. The cubicle approach appeared to result in easier sheep movement and reduced shepherding, and may have improved maternal behavior.

**Key Words:** behavior, maternal, sheep

**M460 Selective genotyping using genome-wide association studies (GWAS) that are associated with fiber diameter in Merino sheep.** M. Goher\*, W. Rauw, D. Thin, and L. Gomez-Raya, *University of Nevada Reno, Reno.*

The objective of this study was to investigate methods and statistical power for mapping quantitative trait loci (QTL) using selective genotyping and Illumina's 50K BeadChip. A large unrelated population is recorded for a phenotypic trait. Animals with extreme phenotypes are used for genotyping with Illumina's arrays and QTL are mapped by linkage disequilibrium (LD). We carried out computer simulations to compute statistical power using this approach after varying QTL allele frequency, proportion selected in the extremes, and population size. For example, power for a population of 1,000 animals after genotyping the top and bottom 5% (QTL effect of 0.5 phenotypic standard deviations,  $\alpha$  of 0.01 and allele frequency of 0.1) and assuming maximum LD, was 0.95. The method was tested in a Merino flock with 979 ewes in which fiber diameter (FD) was recorded. Illumina 50K BeadChip was used for simultaneous genotyping of 54,000 SNPs in selected animals. Three different approaches were used to rank and to use selective genotyping of animals: 1) extreme phenotype for FD, 2) extreme estimated breeding value for FD, and 3) extreme phenotypes within the year class with the highest number of animals. Statistical tests were carried out comparing the number of copies for each of the 2 alleles at each SNP in the 2 extreme phenotypes (top and bottom 5%). No genome-wide significant results were obtained when using extreme phenotypes for FD. Analyses using extreme estimated breeding values and extreme phenotypes from the largest year class are currently in progress.

**Key Words:** GWAS, statistical power, selective genotyping

**M461 An alternative wool harvesting system for wool sheep flocks.** T. Wuliji\*<sup>1</sup>, T. Watts<sup>2</sup>, A. Qi<sup>1</sup>, and T. Filbin<sup>3</sup>, *<sup>1</sup>University of Nevada, Reno, <sup>2</sup>Heiniger Australia Pty, Perth, Western Australia, Australia, <sup>3</sup>Rafter 7 Ranch, Yerington, NV.*

The objective of this investigation is to evaluate the efficacy of a biological wool harvesting system-Bioclip as an alternative to mechanical shearing of the wool sheep flocks in the US, which mostly farmed for meat and wool dual production. Bioclip reagent was developed for a biological wool harvesting in Merino breed or its derived sheep in Australia. Twenty-two 10-mo-old ewes were selected for Bioclip shearing comparison experiment. Ewes were weighed and stratified by BW and breed, and divided into a control (conventional shearing,  $n = 10$ ) and Bioclip treatment group ( $n = 12$ ). Treatment group animals were each given 2.5 mL Bioclip injection formula (7.5 mg/ml epidermal growth factor (EGF) subcutaneously on the inguinal bare skin area, and subsequently put fleece retention net on them. Animals were fed alfalfa hay for 4 wk under a semi-sheltered pen until fleece removal at 28 d later. Post

treatment wool re-growth was monitored and compared for the control and bio clipped groups. After 5 wk re-growth, wool fiber length (mm) and weight ( $\text{mg}/\text{cm}^2$ ) collected from the mid side skin patch area was measured, analyzed and compared for differences. Data were analyzed for one-way ANOVA and mean values compared using  $t$ -tests. Bioclip injection resulted a simultaneous and complete shedding of fleeces in all treated animals. There was no difference in post treatment BW, weight gain, fiber diameter and wool re-growth rate between control and Bioclip treatment. However, fleece staple length and re-growth fiber length measured significantly ( $P < 0.01$ ) longer for Bioclip harvested wool than conventional shorn sheep. The results suggest that Bioclip can improve wool clip quality, animal welfare, and farm labor intensity. Therefore, Bioclip may be used as an alternative biological wool harvesting system to the traditional mechanical shearing procedure for wool sheep flocks.

**Key Words:** biological wool harvest, epidermal growth factor, Merino sheep

**M462 Comparison of two instruments for measuring fiber characteristics of wool.** F. A. Pfeiffer\*, C. J. Lupton, and D. F. Waldron, *Texas AgriLife Research, San Angelo.*

An experiment was designed to compare an on-farm OFDA2000 instrument with a lab instrument, the OFDA 100 (BSC Electronics, Ardross, W. Australia). The OFDA 100 measures average fiber diameter (AFD) and variability (SDFD and CVFD) of animal fiber snippets (2-mm lengths) and was approved for use in standard methods. Cleaned, conditioned ( $21^\circ\text{C}$  and 65% RH) snippets are measured between 2 glass slides. Average fiber curvature (AFC), variability (SDFC and CVFC), and comfort factor (CF, % fibers  $<30 \mu\text{m}$ ) are also estimated. The OFDA2000 measures greasy fiber staples with corrections being made for non-standard atmospheric conditions, grease, and other contaminants on the raw fiber. A retrofitted add-on permits the OFDA2000 to measure cleaned snippets mounted on glass slides. Two sets of greasy wool staples ( $n_1 = 108$ ,  $\text{AFD} = 22.8 \pm 1.5 \mu\text{m}$ ,  $n_2 = 107$ ,  $\text{AFD} = 25.7 \pm 2.1 \mu\text{m}$ ) shorn from rapidly growing yearling Rambouillet rams were first measured on the OFDA 2000. Snippets were then guillotined from the base of each staple, cleaned, conditioned, and spread onto a glass slide. Each slide was measured on the OFDA 100 and then on the OFDA2000. Data were analyzed using the paired  $t$ -test, and CORR procedures of SAS. Results for the finer set only are presented in Table 1. Average snippet AFD was not different between instruments ( $P = 0.11$ ) though it was for the coarser set ( $\Delta \text{AFD} = 0.11 \mu\text{m}$ ,  $\text{SED} = 0.02 \mu\text{m}$ ,  $P < 0.01$ ). All other measured traits were different ( $P < 0.01$ ). Thus, some caution is required when comparing results from the 2 instruments.

**Table 1.** Means and r values for wool characteristics measured with 2 instruments

Item	1, 100, snippet	2, 2000, staple	3, 2000, snippet	r, 1 vs 2	r, 1 vs 3	r, 2 vs 3
AFD, $\mu\text{m}$	22.8 <sup>a</sup>	21.6 <sup>b</sup>	22.8 <sup>a</sup>	0.88	0.99	0.87
SDFD, $\mu\text{m}$	3.9 <sup>a</sup>	3.6 <sup>c</sup>	3.8 <sup>b</sup>	0.87	0.99	0.89
CVFD, %	17.0 <sup>a</sup>	16.5 <sup>b</sup>	16.5 <sup>b</sup>	0.81	0.95	0.83
CF, %	95.8 <sup>c</sup>	97.7 <sup>a</sup>	96.1 <sup>b</sup>	0.86	0.96	0.89
AFC, $^\circ/\text{mm}$	100.1 <sup>a</sup>	86.2 <sup>c</sup>	97.8 <sup>b</sup>	0.77	0.97	0.76
SDFC, $^\circ/\text{mm}$	57.7 <sup>a</sup>	58.5 <sup>a</sup>	55.8 <sup>b</sup>	0.65	0.93	0.63
CVFC, %	57.8 <sup>b</sup>	68.0 <sup>a</sup>	57.2 <sup>c</sup>	0.26	0.82	0.23

<sup>a,b,c</sup>Within a row, means without common superscripts differ ( $P < 0.01$ ).

**Key Words:** fiber diameter, objective measurement, wool

**M463 Comparison of Rambouillet sheep with Australian Merino F1 crosses.** C. J. Lupton<sup>\*1</sup>, F. A. Pfeiffer<sup>1</sup>, W. S. Ramsey<sup>2</sup>, M. W. Salisbury<sup>3</sup>, D. F. Waldron<sup>1</sup>, J. W. Walker<sup>1</sup>, and T. D. Willingham<sup>1</sup>, <sup>1</sup>Texas AgriLife Research, San Angelo, <sup>2</sup>Texas A&M University, College Station, <sup>3</sup>Angelo State University, San Angelo, TX.

The objective of this study is to estimate the differences in wool production and value between Rambouillet (R) and R × Australian Merino (M) crosses. Semen from the desired type of M sires (n = 5 in 2007, 3 in 2008) was located and purchased. The M sires had similar mature BW but greater fleece weight and finer wool than R rams. R ewes (n = 407, 3–5 yr of age, BW = 61.5 ± 6.9 kg, average fiber diameter [AFD] = 21.3 ± 2.1 μm) were bred to the M rams via laparoscopic artificial insemination in June 2007 and October 2008. Contemporary R lambs were produced naturally by exposing R ewes (n = 235) to R rams (n = 4 in 2007 and 2008). Lambs born in 2008 and 2009 were weighed at 5 mo of age. Fleece weights (greasy and clean, GFW and CFW) and fiber characteristics were determined on yearling fleeces. Data were analyzed using the MIXED procedure of SAS. The model included fixed effects of genotype and sex and a random effect of sire within genotype. BW at 5 mo of age (27.1 kg) for lambs born in 2008 and 2009 was not different between genotypes. Least squares means of yearling fleece weights and fiber characteristics for lambs born in 2008 are presented in Table 1. Fleece weights and average staple length (ASL) did not differ between genotypes. The M × R yearlings produced higher yielding and finer (more valuable) wool with less crimp (lower average fiber curvature, AFC) than R sheep. Female yearlings produced coarser wool than males.

**Table 1.** Fleece and fiber characteristics of yearling sheep

Dependent variable	Genotype			Sex		
	M × R (n = 47)	R (n = 44)	P	Female (n = 45)	Male (n = 46)	P
GFW, kg	4.3	4.1	0.543	4.1	4.2	0.509
CY, %	60.8 <sup>a</sup>	56.3 <sup>b</sup>	0.005	57.9	59.1	0.119
CFW, kg	2.6	2.3	0.119	2.4	2.5	0.239
AFD, μm	17.8 <sup>b</sup>	18.7 <sup>a</sup>	0.015	18.6 <sup>a</sup>	17.9 <sup>b</sup>	0.012
ASL, mm	12.0	11.4	0.429	12.0	11.4	0.077
AFC, deg/mm	87.2 <sup>b</sup>	95.5 <sup>a</sup>	0.019	90.7	92.0	0.519

<sup>a,b</sup>Within a row and within genotype or sex, means with a different superscript letter differ ( $P < 0.05$ ).

**Key Words:** Merino, Rambouillet, wool

**M464 Effects of substituting distillers dried grains for cottonseed meal and milo on wool and carcass characteristics in lamb finishing diets.** T. R. Whitney<sup>\*</sup>, A. E. Lee, M. G. Williamson, C. D. Swening, and R. L. Noland, Texas AgriLife Research Center, San Angelo.

Distillers dried grains (DDG) should continue being an economical feed if the market remains saturated. Cottonseed meal and sorghum grain are common feed sources for lamb finishing diets, especially in Texas, but the sheep industry's interest in using greater concentrations of DDG has increased. Limited research exists evaluating carcass characteristics of lambs fed diets containing greater than 50% DDG. Rambouillet wether lambs (n = 42, initial BW = 28.8 ± 3.3 kg) were individually fed ad libitum diets containing DDG that replaced 0% (0DDG), 25% (25DDG), 50% (50DDG), or 75% (75DDG) of the CSM and milo for 72 d in a completely randomized design. On d 72, 35 randomly-selected wethers were humanely slaughtered and evaluated for carcass characteristics. Quadratic trends ( $P < 0.05$ ) were observed for hot carcass weight (22.0,

23.2, 24.6, and 22.5 kg ± 0.7) and 12th-rib back fat thickness (0.5, 0.5, 0.6, 0.4 cm ± 0.06) as percentage of DDG increased in the diet, and backfat thickness was greater ( $P = 0.04$ ) for lambs fed 0DDG than 75DDG. The LM area was similar ( $P > 0.14$ ; 14.4, 14.8, 15.6, 14.5 cm<sup>2</sup> ± 0.54) among lambs. Quadratic trends ( $P < 0.07$ ) were also observed for body wall thickness (1.4, 1.7, 1.7, 1.4 cm ± 0.8) and leg circumference (30.35, 30.96, 31.61, 30.70 cm ± 0.4). Results suggest that carcass characteristics are affected by increasing percentage of DDG in lamb diets; the quadratic trends were unexpected.

**Key Words:** carcass characteristics, distillers dried grains, lambs

**M465 Nutrient intake in Santa Inês sheep fed different levels of metabolizable energy in the ration.** R. M. Fontenele<sup>\*</sup>, E. S. Pereira, P. G. Pimentel, M. S. de Souza Carneiro, A. B. S. Villarreal, and J. G. L. Regadas Filho, Federal University Ceará, Fortaleza, Ceará, Brazil.

The objective of this study was to evaluate the nutrient intake of Santa Inês sheep fed different levels of metabolizable energy (2.08, 2.28, 2.47 and 2.69 Mcal/kg DM) in diets. Twenty lambs, average weight of 13 kg and age 50 d, were distributed in randomized block design with 5 replications. The roughage used was the Tifton 85 hay. Since the experimental variables were subjected to ANOVA and regression using the Statistical Analysis System and Genetic - SAEG. Was found among the energy levels on the dry matter intake, g/day ( $P = 0.002$ ) (695.02, 914.17, 1030.16 and 1287.06, to 2.08, 2.28, 2.47, and 2.69 Mcal/kg DM, respectively) and g/kg<sup>0.75</sup> ( $P = 0.02$ ) (80.54, 93.27, 98.70 and 107.02, to 2, 08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively). For the dry matter intake, in %BW, there was no influence ( $P > 0.05$ ) of energy levels in diets. Intake in g/day of organic matter ( $P = 0.002$ ) (713.50, 946.88, 1071.10 and 1349.90 to 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively), crude protein ( $P = 0.001$ ) (107.58, 172.19, 205.81 and 253.64 to 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively), ether extract ( $P = 0.0001$ ) (11.80, 21.49, 34.96 and 40.28 to 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively), non-fibrous carbohydrates ( $P = 0.00001$ ) (148.69, 243.35, 360.52 and 511.00 to 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively) and total digestible nutrients ( $P = 0.001$ ) (695.02, 914.17, 1030.16 and 1287.06, to 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively), performed equal to the intake of dry matter. There was also increased intake of total carbohydrates ( $P = 0.01$ ), despite the decrease of this nutrient as increased energy levels in diets (538.38, 671.18, 803.37 and 873.01 to 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively). Observed influence of the energy levels on the use of neutral detergent fiber, in %BW ( $P = 0.0004$ ) (44.40, 45.27, 40.27 and 33.77 for 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively) and g/kg<sup>0.75</sup> ( $P = 0.009$ ) (44.40, 45.27, 40.27, and 33.77 for 2.08, 2.28, 2.47 and 2.69 Mcal/kg DM, respectively). The daily intake of acid detergent fiber were not affected ( $P > 0.05$ ) by the dietary energy.

**Key Words:** lambs, performance, ruminants

**M466 Body composition and net energy requirements for growth of Santa Inês lambs.** J. G. L. Regadas Filho<sup>2</sup>, E. S. Pereira<sup>1</sup>, P. V. R. Paulino<sup>\*2</sup>, A. B. S. Villarreal<sup>1</sup>, P. G. Pimentel<sup>1</sup>, R. M. Fontenele<sup>1</sup>, and I. S. G. Maia<sup>1</sup>, <sup>1</sup>Universidade Federal do Ceará, Fortaleza, Brazil, <sup>2</sup>Universidade Federal de Viçosa, MG, Brazil.

This study was conducted to determine the body composition and energy requirements for maintenance and growth of Santa Inês lambs. Twenty-four non-castrated males, 50 d old and with 13.00 ± 0.56 kg of initial body weight were used. Four animals were slaughtered at the beginning of the trial, as a reference group, to estimate the initial empty body weight (EBW) and body composition. The remaining ani-

imals were assigned in a randomized block design with 5 replicates per block and 4 diets, with increasing metabolizable energy contents (2.08; 2.28; 2.47 and 2.69 Mcal/kg of DM). The animals were slaughtered at  $28.00 \pm 0.97$  kg of BW. The logarithm of heat production (HP) was regressed against metabolizable energy intake (MEI) and the net energy requirements for maintenance (kcal/kg EBW<sup>0.75</sup>/d) were estimated by extrapolation, when MEI was set to be zero. Regression equations of the logarithm of body fat and body energy on the logarithm of EBW were adjusted. The derivatives of these equations allowed the estimation of the fat content of empty body weight gain (EBWG) and the net energy requirement for EBWG, respectively. The net energy requirement for maintenance obtained was  $50.72 \pm 1.20$  kcal/kg EBW<sup>0.75</sup>/d. The energy and fat contents of the EBW of the animals increased from 1.91 and 85.18 to 2.78 Mcal/kg and 221.23 g/kg of EBW, respectively, as the BW increased from 15 to 30 kg. Similarly, the composition of the EBWG consisted of more fat and energy as the animals became heavier. The net energy requirements for EBWG increased from 2.94 to 4.28 Mcal/kg of EBWG for body weights of 15 and 30 kg, respectively. The net energy requirement for maintenance of Santa Inês lambs is lower than values commonly recommended by the main evaluation systems of food and nutritional requirements of sheep.

**Key Words:** empty body weight, maintenance, tropical sheep

**M467 Body composition and net protein requirements for Santa Inês lambs.** J. G. L. Regadas Filho<sup>2</sup>, E. S. Pereira<sup>1</sup>, P. V. R. Paulino<sup>\*2</sup>, A. B. S. Villarroel<sup>1</sup>, P. G. Pimentel<sup>1</sup>, R. M. Fontenele<sup>1</sup>, M. R. G. F. Costa<sup>1</sup>, and M. S. Duarte<sup>2</sup>, <sup>1</sup>Universidade Federal do Ceará, Fortaleza, Brazil, <sup>2</sup>Universidade Federal de Viçosa, MG, Brazil.

This study was conducted to determine the body composition and protein requirements for maintenance and growth of Santa Inês lambs. Twenty-four non-castrated males, 50 d old and with  $13.00 \pm 0.56$  kg of initial body weight were used. Four animals were slaughtered at the beginning of the trial, as a reference group, to estimate the initial empty body weight (EBW) and body composition. The remaining animals were assigned in a randomized block design with 5 replicates per block and 4 diets, with increasing metabolizable energy contents (2.08; 2.28; 2.47 and 2.69 Mcal/kg of DM) and crude protein (CP) (12.74; 14.36, 15.97 and 17.65% CP of DM). The animals were slaughtered at  $28.00 \pm 0.97$  kg of BW. A regression equation of nitrogen intake (g/kg BW<sup>0.75</sup>/d) on nitrogen retention (g/kg BW<sup>0.75</sup>/d) was adjusted. When N intake was set to be zero, the negative intercept of regression equation was considered as the endogenous N losses, which represents the maintenance requirements. A regression equation of the logarithm of body protein content on the logarithm of EBW was adjusted. The derivative of this equation enabled the estimation of the net protein requirements for gain of empty body weight (EBWG). Endogenous nitrogen loss was estimated to be  $277 \pm 0.05$  mg/kg BW<sup>0.75</sup>/d, which corresponds to the net protein requirement for maintenance of  $1.73 \pm 0.31$  g/kg BW<sup>0.75</sup>/d. Protein content of EBW decreased from 157.83 to 144.33 g/kg of EBW as the animals BW increased from 15 to 30 kg, respectively. The protein deposited in the EBWG decreased from 137.47 to 125.71 g/kg as the animals BW increased from 15 to 30 kg, respectively. Endogenous nitrogen loss and protein requirement for maintenance of Santa Inês lambs are lower than the values commonly cited by the main systems of feed evaluation and nutrient requirements of sheep.

**Key Words:** empty body gain, requirements, tropical sheep

**M468 Effects of dietary copper level on serum cholesterol and nonesterified fatty acids in lambs.** S. Hasanlou\*, A. Zali, M. Ganjkhanlou, and M. Dehghan, *Tehran University, Tehran, Iran.*

An experiment was conducted to determine the effect of dietary Cu on serum cholesterol and NEFA in lambs. Twenty-four castrated male Lori-Bakhtiary lambs (3 to 4 mo of age; average BW =  $26 \pm 0.5$ kg) were used in this experiment. Lambs were housed in individual pens and were assigned randomly to one of 3 treatments. Treatments consisted of 1) control (no additional supplement), 2) lambs received 5 mg Cu/d, and 3) lambs received 10 mg Cu/d. Treatments were gavaged daily (esophagus gun) before AM feeding. Blood samples were collected from the jugular vein by venipuncture. Serum NEFA concentrations were not affected by the supplementations (0.15, 0.15, and 0.21 mmol/L). Total cholesterol of serum had tendency to be lower in groups received 5 mg Cu/d relative to the other supplemented groups ( $P = 0.06$ ). Animals received 5 mg Cu/d had significantly ( $P = 0.01$ ) higher serum HDL-cholesterol compared with others. Whereas serum LDL-cholesterol concentrations was similar between supplemented groups (19.43, 19.39, and 17.34 mg/dL respectively). The Cu concentrations of serum were higher in lambs received 10 mg Cu/d compared with the other supplemented lambs ( $P < 0.001$ ). Based on the current results, Cu supplementations had beneficial effect on reduction of serum cholesterol in lambs.

**Key Words:** copper, cholesterol, lambs

**M469 Effects of dietary copper level on growth, performance, and carcass characteristics in lambs.** S. Hasanlou\*, A. Zali, M. Ganjkhanlou, and M. Dehghan-Banadaki, *Tehran University, Tehran, Iran.*

An experiment was conducted to determine the effect of dietary Cu on growth, performance, and carcass characteristics in lambs. Twenty-four castrated male Lori-Bakhtiary lambs (3 to 4 mo of age; average BW =  $26 \pm 0.5$ kg) were used in this experiment. The lambs were housed in individual pens and were assigned randomly to 1 of 3 treatments. Treatments consisted of 1) control (no additional supplement), 2) lambs received 5 mg Cu/d, and 3) lambs received 10 mg Cu/d. Treatments were gavaged daily (esophagus gun) before AM feeding. Daily feed intake and orts were recorded daily. Body weight was measured at the start and the end of experimental period. Least squares means of feed intake was similar for Supplemented and control lambs (1.13, 1.13, and 1.14 kg/d respectively). Lower daily gain observed for lambs received 10 mg Cu/d compared with control and those were fed 5 mg Cu/d ( $P < 0.05$ ). Gain:feed were affected by Cu level, so that lambs received 10 mg Cu/d had the lowest level. Dressing percentage was not affected by supplementations (45.54, 43.54, and 46.95% respectively). Lambs received 10 mg Cu/d had lower back fat versus others ( $P < 0.05$ ). Based on the current results, Cu supplementations had no beneficial effect on the performance characteristics of lambs.

**Key Words:** copper, lambs, carcass

**M470 Effect of zilpaterol and ractopamine feeding program on growth performance and carcass characteristics of finishing lambs.** M. A. Lopez-Carlos<sup>\*1,2</sup>, R. G. Ramirez<sup>2</sup>, J. I. Aguilera-Soto<sup>1</sup>, C. F. Arechiga<sup>1</sup>, F. Mendez-Llorente<sup>1</sup>, H. Rodriguez<sup>1</sup>, and M. Rincon<sup>1</sup>, <sup>1</sup>Universidad Autonoma de Zacatecas, Zacatecas, Mexico, <sup>2</sup>Universidad Autonoma de Nuevo Leon, Nuevo Leon, Mexico.

The objective of this trial was to determine the response on growth and carcass traits when ractopamine (RAC) and zilpaterol (ZIL) were administered at 3 feeding programs (constant, increasing and decreasing concentration) in the diet of finishing lambs for the last 27 d before

harvest. Eighty-four lambs ( $30 \pm 1.6$  kg) were used in a split-plot design with 7 treatments, 3 blocks (grouped by weight) and 3 periods (9, 18 and 27 d; subplots). Treatments were: Control, RAC and ZIL constant (RC and ZC) (0.20 and 0.70 mg/kg BW respectively, main plot), RAC increasing (RI) (0.35, 0.70 and 1.05 mg/kg BW), ZIL increasing (ZI) (0.10, 0.20 and 0.30 mg/kg BW), RAC decreasing (RD) (1.05, 0.70 and 0.35 mg/kg BW), and ZIL decreasing (ZD) (0.30, 0.20 and 0.10 mg/kg BW). Adjustments for RAC and ZIL concentration were made at beginning of each evaluation period. Basal diet was 18% CP and 3 Mcal/kg of ME. The data analysis was performed using the GLM procedure of SAS. Differences between treatments were established by Duncan's test. Total gain (GT), average daily gain (ADG), dry matter intake (DMI), feed:gain (F:G), hot and cold carcass weights (HCW and CCW), meat and fat color (MC and FC), fat thickness (FT), carcass classification (CC) and longissimus muscle area (LM), were determined. During the first period there was a decrease ( $P < 0.01$ ) for DMI, ADG and feed efficiency (FE) for lambs that consumed ractopamine and zilpaterol respect to Control. However, in subsequent periods, growth variables were higher ( $P < 0.05$ ) for ZIL and RAC regardless of dosing schedule. Hot carcass weight (HCW), CCW, CC and LM were higher for RI, ZI, RC and ZC. MC, FC and FT were improved ( $P < 0.05$ ) with RAC and ZIL administration independently of dosing schedule. In conclusion, increasing concentration of dietary RAC and ZIL to finishing lambs prolongs the growth response on time, while constant and increasing dietary RAC and ZIL improve carcass characteristics.

**Key Words:** sheep, zilpaterol, ractopamine

**M471 Use of zeranol and reimplantation on performance of finishing hair lambs.** D. Domínguez, G. Amaya\*, G. Villalobos, H. Castillo, J. A. Ortega, and L. Carlos, *Universidad Autónoma de Chihuahua, Chihuahua, Chihuahua, México.*

Use of zeranol has improved daily gain and gain efficiency of lambs, leading to a higher profitability in sheep industry. This study evaluated the effect of using different zeranol levels and its reimplantation on dry matter intake, body weight, average daily gain and gain efficiency of finishing hair lambs. Thirty-two weaned intact male lambs ( $21.2 \pm 1.58$  kg and 60 d old) crosses of Dorper  $\times$  Pelibuey and Kathadin  $\times$  Pelibuey were blocked by initial body weight and randomly assigned to 4 treatments (n = 10, 5 pens and 2 lambs per pen): Z0 (control); Z12 (12 mg of zeranol, Ralgro), Z24 (24 mg of zeranol in a single application), and Z12-12 (12 mg of zeranol given twice). Lambs were implanted 12 d before starting the experiment, and animals of Z12-12 were reimplanted 28 d after starting the study. Lambs were fed ad libitum a 80:20 concentrate:forage diet (% DM) containing 2.7 Mcal ME/kg DM and 18.2% CP. Dry matter intake (DMI) was determined daily, while body weight, average daily gain (ADG) and gain efficiency (GE) were recorded every 14 d during the 56 d trial. Data were analyzed as a complete random design with repeated measurements on time, using the PROC MIXED. Implanted animals had similar DMI vs. non implanted (1.42 vs. 1.47 kg). Final body weight of implanted animals was not improved vs. non implanted (40.0 vs. 36.9 kg), and was similar among implanted treatments. The ADG of implanted lambs was 12.4% higher vs. non implanted (0.326 vs. 0.290 kg/d;  $P < 0.05$ ), and it was 6.2% enhanced in lambs of Z24 compared with lambs of Z12 (0.340 vs. 0.320 kg/d;  $P < 0.05$ ), and was similar between Z24 and Z12-12 treatments. Implanted lambs had 17% higher GE (4.4 vs. 5.3;  $P < 0.05$ ), and it was 8.7% superior in Z24 vs. Z12 (4.2 vs. 4.6), and was similar between Z24 and Z12-12 treatments. Implanting finishing lambs with 24 mg of zeranol in a single dosis showed the best animal performance.

**Key Words:** implants, finishing lambs, zeranol

**M472 Fatty acid profile and lipid oxidation of meat from Sarda lambs managed in different feeding systems.** S. P. G. Rattu, C. Carzedda, R. Boe, M. G. Manca, and A. Nudda\*, *Dipartimento di Scienze Zootecniche, University of Sassari, Sassari, Italy.*

Fatty acid composition and the lipid oxidation of raw meat were evaluated in suckling lambs managed in 2 different feeding systems. Twenty-two Sarda male lambs were divided into 2 feeding system groups: 11 lambs (SL group), after 5th day of age, were confined in a fold and every day separated from their dams from 8.00 a.m. to 4.00 p.m. and then rejoined after ewes milking. These lambs were also fed with a suitable pellet feed ad libitum to compensate smaller available milk. Remainine 11 lambs (NSL group) were never separated from their dams and herded to pasture with them and confined in a fold during the night. At d 25 of age, the 5 heavier lambs of each group were slaughtered. Mean BW and ADG for NSL and SL group were, respectively: 4.70 and 6.08 kg at birth ( $P = 0.012$ ), 11.2 and 13.4 kg at slaughter ( $P = 0.000$ ) and 270 and 287 g/d ( $P = 0.382$ ). After 24 h of refrigeration at 4°C, the lumbar region was dissected from each right half-carcass and used for analysis. Fatty acid profile was determined by gas-cromatography while lipid oxidation was measured by the Thio-Barbituric Acid Reactive Substances (TBARS) method. Data were analyzed with a one-way ANOVA using group as the main effect. Lipid oxidation was not significantly influenced by group but was higher in NSL group than SL group (0.42 vs 0.34 mg MDA/kg of meat). The content in fat and protein were not significantly affected by feeding system (Table 1). Fatty acid composition was not significantly influenced by group (Table 1).

**Table 1.** Composition of raw meat from suckling lambs raised with 2 different feeding system

	Group	
	NLS	SL
Protein	20.32	20.42
Fat	1.98	2.31
Fatty acid (g/100g of FAME)		
PUFA n-3	9.98	8.79
PUFA n-6	2.79	3.27
SFA	42.72	44.47
UFA	57.28	55.53
MUFA	43.66	43.92
n-6/n-3	3.65	2.82
SFA/UFA	0.75	0.80

**Key Words:** fatty acid, lipid oxidation, lamb

**M473 Deciding whether light lambs should be weaned or left with the dam until slaughter age.** M. Terré<sup>1</sup>, A. Nudda<sup>2</sup>, and A. Bach<sup>\*3,1</sup>, <sup>1</sup>*Institut de Recerca i Tecnologia Agroalimentàries, Barcelona, Spain,* <sup>2</sup>*University of Sassari, Sassari, Italy,* <sup>3</sup>*Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain.*

The objective was to compare the performance and meat quality of 2 different lamb rearing systems: weaning lambs at 7 wk of age and then either feeding concentrate and forage or rearing lambs with their mother until sacrifice. A total of 22 lambs from 17 ewes were assigned to weaning (W) treatment and 20 lambs from 16 ewes to unweaning (U) treatment. Lambs in U treatment were kept with their mother and fed a concentrate ad libitum. Lambs in W treatment were weaned at 7 wk of age and fed concentrate and straw ad libitum. Lambs were weighed weekly until sacrifice. Carcasses were weighed after slaughter. After sacrifice (48 h), Longissimus dorsi (LD) was sampled from 8 male

lambs per treatment to determine color, texture, fat content and fatty acid (FA) composition. Data were analyzed using a fixed effects model with pen as the experimental unit. Lambs in the U treatment tended ( $P = 0.09$ ) to weigh more than W lambs 4 wk after weaning ( $19.7$  vs  $18.3 \pm 0.06$  kg BW, respectively). Lambs in U treatment were 13 d younger ( $P < 0.001$ ) at slaughter than the W lambs. Dressing percentage was greater ( $P < 0.05$ ) in U than in W lambs ( $44.9$  vs  $42.0 \pm 1.23\%$ , respectively). Colorimetric parameters of LD indicated that L and a values were similar in both treatments, whereas b values were greater ( $P < 0.05$ ) in W than in U lambs ( $12.9$  vs  $12.3 \pm 0.16$ , respectively). There were no differences in texture measurements (WBSF) and total fat in LD. The LD from U lambs had a greater ( $P < 0.05$ ) percentage of 16, 18:3 n-3 FA and a lower ( $P < 0.05$ ) percentage of 17, 17:1 FA than LD from W lambs. However, the ratio n-6/n-3 was lower ( $P < 0.01$ ) in U than in W lambs ( $6.47$  vs  $9.19 \pm 0.527$ , respectively). Rearing lambs with the ewe until sacrifice reduces days to slaughter and improves FA composition of LD.

**Key Words:** light lamb, weaning, meat quality

**M474 Lamb finalization allowing free-choice intake of roughage and concentrate.** P. Martinez-Hernandez\*, C. Sanchez-DelReal, E. Cortes-Diaz, E. Maldonado-Siman, and R. Lazo-Soto, *Animal Science Department, University of Chapingo, Texcoco, Mexico, Mexico.*

The objective of this study was to determine performance and feeding behavior of lambs offered roughage and concentrate as either a

mixed diet or split feeds free-choice. Three treatments were evaluated: mixed diet, or concentrate offered once (C1) or twice (C2) a day with roughage provided for ad libitum intake. Mixed diet was 78:22 concentrate:roughage, concentrate was: 78.53% milo; 10.26% soybean meal; 10.18% meat meal poultry; and, 1.03% mineralized salt (estimated ME 2.87Mcal/kg). Roughage source was ground (1.8 cm screen) corn stover. Experimental design was a completely random with 3 replicates; experimental unit was a pen with 2 lambs. Feeding trial lasted 32 d. Rambouillet lambs with initial weight of  $37.7 \pm 3.1$  kg and less than one year old were used. Feed offered was adjusted daily to provide 15% above the day-before intake. Intake was calculated daily by weighing feed offered and rejected. Mixed diet, corn stover and concentrate of C1 and half of C2 were given at 7:00 h, the other half of C2 at 18:00 h. Mixed diet and C1 showed the highest and lowest ( $P < 0.05$ ) of both daily total and concentrate intakes, respectively. Average daily gain, final weight, feed conversion and total time-spent-eating were not different ( $P > 0.05$ ) among treatments. At the beginning, daily time spent eating concentrate in C1 lambs was up to 53% higher ( $P < 0.5$ ) than in C2 lambs, but toward to the end of the trial there was no difference ( $P > 0.05$ ); C1 lambs decreased 38% in time eating concentrate. Daily rumination time was 38% lower ( $P < 0.05$ ) in C1 lambs than the rest of the lambs. Incidence of lambs off-feed was 3 times higher ( $P < 0.05$ ) in C1 than in the other 2 treatments. It was concluded that controlled offering of concentrate could allow for feeding roughage and concentrate as split feeds.

**Key Words:** mixed diets, feeding system, lamb performance