0001 Effects of maternal nutritional status on nutrient transporter expression in bovine utero-placental tissue on days 16 to 50 of gestation.
M. S. Crouse[*1], K. J. McLean[1], M. R. Crosswhite[2], N. Negrin Pereira[1], A. K. Ward[1], L. P. Reynolds[1], C. R. Dahlen[1], B. W. Neville[3], P. P. Borowicz[1], and J. S. Caton[1], [1]Department of Animal Sciences, North Dakota State University, Fargo, [2]North Dakota State University, Fargo, [3]North Dakota State University, Streeter.

We hypothesized that maternal nutrition and day of gestation would impact mRNA expression of nutrient transporters *GLUT1*, *CAT-1*, *CAT-2*, and *CAT-3* in beef heifers. Crossbred Angus heifers ($n = 49$) were synchronized, bred via AI, assigned to nutritional treatment (CON = 100% of requirements for 0.45 kg/d gain and RES = 60% of CON) and ovariohysterectomized on d 16, 34, or 50 of gestation ($n = 6$ to 9/d); nonpregnant (NP) controls were not bred and ovariohysterectomized on d 16 of the synchronized estrous cycle ($n = 6$). The resulting arrangement of treatments was a 2×3 factorial $+ 1$. Caruncle (CAR), intercaruncular endometrium (ICAR), and fetal membranes (FM), were obtained from the pregnant uterine horn immediately following ovariohysterectomy. For NP controls, only CAR and ICAR were obtained. Relative expression of the glucose transporter *GLUT1* and cationic amino acid transporters *CAT-1*, *CAT-2*, and *CAT-3* was determined for each tissue utilizing NP-CAR and NP-ICAR tissue as the baseline. For FM, NP endometrium served as the baseline. There was no interaction of day and treatment in FM for any genes ($P \geq 0.05$). Expression of *GLUT1* and *CAT-1* both showed a day effect, being greater ($P < 0.05$) in FM on d 34 and 50, compared with d 16. In CAR there was no day × treatment interaction and *CAT-3* expression tended ($P = 0.06$) to be greater in CON vs. RES heifers. Additionally, expression of *GLUT1*, *CAT-1*, and *CAT-2* in CAR were greater ($P < 0.01$) on d 16 compared with d 34 and 50, d 34 compared with d 50, and d 16 and 34 compared with d 50, respectively. In ICAR, *CAT-2* showed a day × treatment interaction, being greater ($P = 0.01$) on d 50 CON compared with all other groups. Transporter *CAT-3* tended ($P = 0.09$) to be greater in day × treatment in ICAR on d 16 CON compared with all other days and treatments. The expression of *GLUT1* was greater ($P < 0.01$) in ICAR on d 16 than all other days. Arginine transporter *CAT-1* was greater ($P < 0.01$) in ICAR on d 34 and 50 compared with d 16. These results partially support our hypothesis and indicate that day was a more influential factor for mRNA expression of utero-placental glucose and cationic amino acid transporters than maternal nutritional status in heifers during early pregnancy.

Key Words: arginine, gestation, glucose, maternal nutrition, transporters

0002 Effects of dried distiller's grains and lasalocid on feedlot lamb growth, carcass traits, nutrient digestibility, ruminal fluid volatile fatty acid concentrations, and ruminal hydrogen sulfide concentration.
A. R. Crane[*1,2], R. R. Redden[3], K. C. Swanson[2], B. M. Howard[2], T. J. Frick[2], K. R. Maddock-Carlin[4], and C. S. Schauer[1], [1]Hettinger Research Extension Center, Hettinger, ND, [2]Department of Animal Sciences, North Dakota State University, Fargo, [3]Texas A&M AgriLife Research and Extension Center, San Angelo, TX, [4]North Dakota State University, Fargo.

Our hypothesis was increasing the inclusion level of dried distiller's grains with solubles (DDG) to feedlot lambs would increase growth, while the inclusion of lasalocid (LAS; Bovatec, Alpharma, LLC, Bridgewater, NJ) would increase ADG and G:F while not affecting digestibility, ruminal VFA concentration, and pH in the rumen fluid. Furthermore, we hypothesized that rations including LAS and higher levels of DDG would cause increased ruminal hydrogen sulfide gas (H_2S) concentrations. To test this hypothesis, 240 crossbred (Suffolk $\times$ Rambouillet) lambs (31.9 ± 5.87 kg BW; approximately 90 d of age) were allocated to six treatments in a completely random design with a 3×2 factorial arrangement of treatments. Lambs were placed into 24 feedlot pens (four pens/treatment; 10 lambs/pen) for a 111-d finishing study. Main effects included concentration of DDG (0, 15, or 30% DM basis) and inclusion of LAS (0 or 20 g/t LAS) resulting in treatments of (1) 0% DDG without LAS (0DDG-NL), (2) 0% DDG with LAS (0DDG-L), (3) 15% DDG without LAS (15DDG-NL), (4) 15% DDG with LAS (15DDG-L), (5) 30% DDG without LAS (30DDG-NL), and (6) 30% DDG with LAS (30DDG-L). Two-day weights were taken at the beginning and end of the trial. Two hundred and eighteen lambs (63.7 ± 8.78 kg) were harvested on d 112 at a commercial abattoir and carcass data collected after a 24 h chill. The inclusion of LAS increased ($P \leq 0.02$) final BW, ADG, G:F, and HCW. As DDG in the ration increased to 30%, DMI decreased linearly ($P = 0.03$) while G:F increased linearly ($P = 0.03$). A second study was conducted utilizing the same treatments to evaluate N and S balance, ruminal VFA and H_2S concentration, and ruminal pH in 24 crossbred wethers (Suffolk $\times$ Rambouillet; 41.2 ± 12.23 kg BW). Daily urinary sulfur excretion and H_2S production were linearly increased ($P < 0.001$) as DDG increased in the ration. Total ruminal VFA concentration linearly decreased ($P = 0.002$) as DDG increased in the ration. The inclusion of LAS increased ($P = 0.02$) ruminal pH. The results confirm our hypothesis that LAS increased overall growth and increasing DDG increased ruminal H_2S concentration, however, DDG

inclusion did not increase growth. Additionally, we reject the hypothesis that the combined effects of LAS and DDG would have no effect on rumen pH and VFA concentrations.

Key Words: dried distiller's grains with solubles, ionophores, lambs

---

0003 Impacts of stocking density on growth and puberty attainment of replacement beef heifers.

K. M. Schubach[*1], R. F. Cooke[1], A. P. Brandao[1,2], K. Lippolis[1], R. Marques[1], M. T. Hinchliff[1], D. W. Bohnert[1], [1]Oregon State University- EOARC Burns, Burns, OR, [2]UNESP-FMVZ, Botucatu, Brazil.

Sixty Angus × Hereford heifers were ranked by age and BW (210 ± 2 d and 220 ± 2 kg, respectively) on d 0, and assigned to: (A) 1 of 3 drylot pens (10 × 14 m pens; 10 heifers/pen) resulting in a stocking density of 14 m²/heifer (HIDENS), or (B) 1 of 3 pastures (1-ha pastures; 10 heifers/pasture), resulting in a stocking density of 1000 m²/heifer (LOWDENS). Before the beginning of the experiment, pastures were harvested for hay, leaving no forage available for grazing for LOWDENS heifers. All heifers received the same diet consisting of (as-fed basis) 5 kg alfalfa hay and 3.5 kg of corn per heifer/d. On d 0, heifers were fitted with a pedometer (HJ-321; Omron Healthcare, Inc., Bannockburn, IL). Each week for the duration of the experiment (d 0 to d 161), pedometer results were recorded, heifer BW was measured, and blood samples were collected. Heifer shrunk BW (after 16 h of water and feed deprivation) was also collected on d –5 and 162 of the experiment. Puberty onset was determined according to plasma progesterone concentration. Heifers were considered pubertal when plasma progesterone concentration was >1.0 ng/mL for two consecutive weeks. A treatment × day interaction was detected ($P < 0.01$) for BW, considering HIDENS heifers were, on average, 10 ± 4 kg heavier than LOWDENS heifers beginning on d 28. This difference in body weight can be attributed to increased physical activity of LOWDENS heifers, as they exhibited more ($P < 0.01$) steps compared with HIDENS heifers. However, ADG using shrunk BW values did not differ ($P = 0.49$) among treatments. Treatment × day interactions were detected for plasma cortisol ($P < 0.01$) and IGF-1 ($P < 0.01$), given that concentration of these hormones were greater for LOWDENS compared with HIDENS heifers on d 84 ($P < 0.01$) and d 140 ($P \leq 0.04$). A treatment × day interaction was also detected ($P < 0.01$) for puberty attainment, considering a greater proportion of LOWDENS heifers reached puberty compared with HIDENS cohorts during the experiment (54.6 vs. 3.4% of heifers pubertal by d 161, respectively; $P < 0.01$, SEM = 5.3). In conclusion, heifers reared in a low-stocking density exhibited hastened puberty attainment, despite the observed decrease in heifer BW attributed to increased physical activity, compared with heifers reared in high stocking density.

Key Words: beef heifers, growth, puberty, stocking density

0004 Physiologic, health and production responses of dairy cows supplemented with an immunomodulatory feed ingredient during the transition period.

A. P. Brandao[*1,2], R. F. Cooke[1], F. N. Correa[3], M. B. Piccolo[2], R. Gennari[4], T. Leiva[2], and J. L. M. Vasconcelos[5], [1]Oregon State University– EOARC Burns, Burns, [2]UNESP- FMVZ, Botucatu, Brazil, [3]Department of Animal Sciences, University of Florida, Gainesville, [4]UNESP- FMVZ, Botucatu, FL, [5]Sao Paulo State University, Botucatu, Brazil.

This study compared physiological, health, and productive parameters in dairy cows supplemented or not with Omnigen-AF® (OMN) during the transition period. Thirty-eight nonlactating, multiparous, pregnant Holstein × Gir cows were ranked by BW and BCS, and assigned to receive ($n = 19$) or not (CON; $n = 19$) OMN at 56 g/cow daily (as-fed basis) beginning 35 d before calving. Before calving, cows had ad libitum access to corn silage, and received (as-fed basis) 3 kg/cow daily of concentrate. After calving, cows were milked twice daily, offered (as-fed basis) 35 kg/cow daily of corn silage, and individually received a concentrate formulated to meet their nutritional requirements. Cows received OMN individually as top-dressing into the morning concentrate feeding. Before calving, cow BW and BCS were recorded weekly and blood samples collected every 5 d beginning on d –35 relative to calving. After calving and until 46 d in milk (DIM), BW and BCS were recorded weekly, individual milk production was recorded, and milk samples were collected daily. Blood was sampled daily from 0 to 7 DIM, every other day from 9 to 21 DIM, and every 5 d from 26 to 46 DIM. On 30 and 46 DIM, cows were evaluated for endometritis via cytobrush technique, based on percentage of polymorphonuclear (PMN) cells in 100 total cell count (PMN + endometrial cells). On 48.7 ± 1.6 DIM, nine cows/treatment received a lipopolysaccharide (LPS) injection (0.25 μg/kg of BW), and blood was sampled hourly from –2 to 8 h, at 12-h intervals from 12 to 72 h, and at 24-h intervals form 96 to 120 h relative to LPS administration. No treatment differences were detected on BW, BCS, and serum concentrations of cortisol, NEFA, insulin, glucose, haptoglobin, cortisol, and IGF-I ($P \geq 0.15$). Cows receiving OMN had greater ($P \leq 0.04$) milk yield (30.3 vs. 27.1 kg/d; SEM = 0.9) and percentage of PMN cells in endometrial cell population (12.2 vs. 3.9%; SEM = 2.9) compared with CON cows. After LPS administration, cows receiving OMN had greater ($P \leq 0.04$) mean serum haptoglobin (212 vs. 94 μg/mL; SEM = 38) and serum concentration of tumor necrosis factor α at 1, 2, and 3 h relative to LPS injection compared with CON cows. In conclusion, OMN supplementation during the transition period enhanced innate immunity parameters and increased milk production in dairy cows.

Key Words: inflammation, milk production, Omnigen-AF, transition cows

0005 Bioavailability of supplemental ruminally-protected leucine in sheep.

J. G. Castro*, J. B. Alford, K. E. Quinn, F. A. Lopez, S. L. Pillmore, E. J. Scholljegerdes, and C. A. Loest, *New Mexico State University, Las Cruces.*

The objective of this study was to evaluate the effects of rumen-protected L-Leu on plasma branched-chain AA concentrations and rumen fermentation characteristics of lambs. Four ruminally-cannulated wether lambs (34 ± 2.4 kg BW) were used in a 4×4 Latin square. Each period consisted of 7 d: 5 d for adaptation, 1 d for collections, and 1 d of rest. Lambs were fed a basal diet (corn grain and alfalfa hay; 0.6 kg/d DM) and supplements (0.1 kg/d DM) containing no added leucine (CON), 6 g/d of unprotected L-Leu (UP-LEU), and 18 g/d ruminally-protected L-Leu (RP-LEU), or postruminally infused with 6 g/d of L-Leu (INF-LEU). Blood and rumen fluid samples were collected on d 6 of each period at 0, 3, 6, and 9 h after feeding. The statistical model included period, sheep, treatment, hour, and treatment × hour. Lambs receiving INF-LEU had plasma Leu concentrations that were greater at 3 and 6 h, but not different at 9 h compared with CON, UP-LEU, and RP-LEU (treatment × h; $P < 0.01$). Plasma Ile concentrations were lower for RP-LEU than CON, UP-LEU, and INF-LEU at 0 h, lower for INF-LEU than CON, UP-LEU, RP-LEU and at 3 h, not different among treatments at 6 h, and lower for RP-LEU and INF-LEU than CON and UP-LEU at 9 h (treatment × h, $P = 0.02$). Rumen fluid acetate (mol/100 mol) tended to be lower for RP-LEU than CON, UP-LEU, and INF-LEU at 0 h, lower for UP-LEU than CON, RP-LEU, and INF-LEU at 3 h, not different among treatments at 6 h, and greater for UP-LEU than CON, RP-LEU, but not INF-LEU, at 9 h (treatment × h, $P < 0.01$). Rumen isovalerate (mol/100 mol) was greatest for RP-LEU, intermediate for UP-LEU, and lowest for INF-LEU and CON ($P < 0.01$). Rumen fluid pH, NH_3, total VFA, and molar proportions of propionate, isobutyrate, butyrate, valerate, and acetate:propionate ratio were not altered by treatments ($P \geq 0.01$). Although supplementation of RP-LEU was unable to elevate plasma Leu concentrations, decreases in plasma Ile concentrations are likely due to the antagonistic effects of postabsorptive L-Leu on plasma Ile concentrations. This data implies that the ruminally-protected Leu was absorbed by the gastrointestinal tract of lambs. Altered rumen fermentation also demonstrated that the ruminally-protected L-Leu source was not entirely protected from rumen microorganisms.

Key Words: leucine, rumen-protected, sheep

0006 Key metabolic pathways associated with differences in weight maintenance and gain in mature cow skeletal and adipose tissue.

H. C. Cunningham[1], *K. J. Austin*[1], *K. M. Cammack*[1], *H. C. Freetly*[2], *A. K. Lindholm-Perry*[2], [1]*Department of Animal Science, University of Wyoming, Laramie,* [2]*USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

During the production year of a cow, the majority of nutrients are used to support maintenance. Differences in feedstuff utilization and metabolism can impact the ability of the cow to meet maintenance requirements. Tissue specific metabolism is critical to energy homeostasis of the animal, and therefore, regulation of metabolism is critical to understand. The objective of this research was to determine whether cows that differ in efficiency of weight maintenance and weight gain differ in the relative abundance of transcripts associated with protein and lipid turnover of skeletal muscle and adipose tissue, respectively. Crossbred cows ($n = 121$) were feed restricted for 112 d followed by an ad libitum feeding period for 98 d. Individual feed intake was monitored and body weights were collected to estimate ADG. Adipose and muscle biopsies were collected at d 105 of restricted feeding and at d 49 of ad libitum feeding. Total RNA was extracted from these tissues of the cows with the highest ($n = 6$) and the lowest ($n = 6$) ADG during the ad libitum period. The Affymetrix GeneAtlas microarray system was used to determine relative transcript abundance differences between ADG classes within feeding periods and tissue type. Subsequent analyses using the Database for Annotation, Visualization, and Integrated Discovery (DAVID) and Ingenuity Pathway Analysis (IPA) programs identified key gene clusters and pathways associated with differential gene expression, largely including pathways associated with lipid and carbohydrate metabolism, cell-cell signaling and interaction, and cellular function and maintenance. These data suggest key metabolic pathways may be critical to differences in weight maintenance and gain.

Key Words: adipose tissue, metabolism, skeletal muscle

0007 Effects of grazing intensity and advancing season on chemical composition and in vitro organic matter disappearance in steers grazing mixed-grass prairie.

K. E. Chilcoat*, *Animal Sciences Dep., North Dakota State University, Fargo.*

A study was conducted to evaluate the influence of advancing season and grazing intensity on dietary chemical composition and in vitro organic matter disappearance (IVOMD) in beef steers grazing mixed-grass prairie in the Missouri Coteau of south central North Dakota. Five sampling periods were conducted from mid-May to early September 2015. Twelve ruminal cannulated crossbred steers were used to collect diets while 188 crossbred steers were used to maintain specific

grazing intensities on 12 pastures. Treatments were light (LT), moderate (MOD), heavy (HVY), and extreme (EXT) grazing intensities. Each treatment was assigned to 3 pastures. Grazing treatment × sampling period interactions were not present ($P \geq 0.29$) for all variables measured except IVOMD ($P < 0.01$). There were no main effects of grazing treatment for NDF, ADF, total N, soluble N (SN), insoluble N (IN), and ADIN. Responses to grazing season were evaluated with linear, quadratic, and cubic contrasts. Neutral detergent fiber increased linearly ($P < 0.01$) and cubically ($P = 0.01$), while ADF tended ($P = 0.17$) to increase linearly with advancing season. Dietary N decreased linearly ($P < 0.01$), quadratically ($P = 0.01$), and cubically ($P = 0.01$). Soluble N and IN expressed a linear ($P < 0.001$) and quadratic ($P = 0.03$) decrease across advancing season, while IN also showed a cubic response ($P < 0.001$). Acid detergent insoluble N did not change as season advanced ($P > 0.14$). In vitro OM digestibility decreased from May to September ($P < 0.01$) in all sampling periods, but did not show any trends across treatments ($P = 0.82$). However, IVOMD did show a treatment × period interaction ($P < 0.01$). In summary, these data indicate increases ($P < 0.001$) in dietary NDF and decreases ($P < 0.001$) in N, SN, IN, and IVOMD with advancing season. These data suggest seasonal factors are a more important driver of grazed masticate forage nutrient composition than the grazing intensities evaluated in this study.

Key Words: dietary nutrient composition, grazing intensity, season

0008 Altering the time of vaccination against respiratory pathogens to enhance vaccine efficacy, health, and performance of feedlot cattle. K. Lippolis[*1], R. F. Cooke[1], K. M. Schubach[1], A. P. Brandao[1,2], R. Marques[1], M. T. Hinchliff[1], and D. W. Bohnert[1], [1]*Oregon State University–EOARC Burns, Burns,* [2]*UNESP- FMVZ, Botucatu, Brazil.*

Ninety Angus × Hereford calves were ranked by gender, BW, and age, and assigned to 1 of 3 vaccination schemes against respiratory pathogens: (1) vaccination at weaning (d 0) and at feedlot entry (d 30; CON, $n = 30$), (2) vaccination 15 d before weaning (d −15) and 15 d before feedlot entry (d 15; EARLY, $n = 30$), and (3) vaccination 15 d after weaning (d 15) and 15 d after feedlot entry (d 45; DELAYED, $n = 30$). From d −15 to 6, calves were maintained on pasture. On d 7, calves were placed according to treatments into 1 of 18 drylot pens (6 pens/treatment; 5 calves/pen), and fed a forage-based preconditioning diet. On d 30, calves were transported 1440 km in a livestock trailer and returned to different drylot pens for a 45-d receiving period. Calves were fed a forage + concentrate diet during the receiving period. Blood samples and BW were collected on d −15, 0, 15, 30, 45, 60, and 75. Additional BW was collected on the day after blood sampling so two consecutive BW were recorded and averaged. There were no treatment effects on BW preweaning, weaning, or during the preconditioning and receiving periods ($P \geq 0.59$). The EARLY calves had less ($P \leq 0.05$) ADG preweaning, however had greater ($P \leq 0.04$) ADG during feedlot receiving compared with the other treatments. During preconditioning, CON had greater ($P = 0.05$) DMI compared with EARLY and DELAYED calves, but there were treatment effects ($P \geq 0.20$) on DMI during the feedlot receiving. There were no treatment effects ($P \geq 0.16$) on G:F, morbidity, or mortality. By 15-d after initial vaccination, DELAYED calves had the greatest ($P < 0.01$) antibody titers against *Mannheimia haemolytica,* and EARLY calves had the lowest ($P \leq 0.05$) antibody titer against this pathogen. By revaccination, there was no difference ($P = 0.82$) between DELAYED or CON for antibody titers against *M. haemolytica* titers, while EARLY titers remained the lowest ($P < 0.01$). However, by 45-d after initial vaccination, EARLY calves had the greatest antibody titers ($P \leq 0.05$) against *M. haemolytica*, which remained the greatest until 60-d after initial vaccination. These data suggest that while preweaning ADG may be inhibited by vaccination before weaning, vaccination before weaning and revaccination before feedlot receiving can improve overall antibody titer to *M. haemolytica* and ADG during feedlot receiving.

Key Words: feeder cattle, health, performance, vaccination

0009 Evaluation of genetic structure across five U.S. climate zones using prominent AI sires of two British *Bos taurus* breeds. B. C. Krehbiel[*1,2], M. G. Thomas[1], H. D. Blackburn[2], S. E. Speidel[1], R. M. Enns[1], and L. Keenan[3], [1]*Department of Animal Sciences, Colorado State University, Fort Collins,* [2]*National Animal Germplasm Program ARS-USDA, Fort Collins, CO,* [3]*Red Angus Association of America, Denton, TX.*

Cattle performance in diverse climates can be problematic if they cannot adapt to climate variability. Previous research showed Hereford cattle to have genetic substructure associated with U.S. climates: cool arid (CA), cool humid (CH), transition zone (TZ), warm arid (WA), and warm humid (WH). Allele frequencies of 66 SNP from BovineSNP50 (Illumina BeadChip) were associated with the following traits: mature cow body weight, heat stress, milk yield, heifer conception rate, and early embryonic survival. Knowledge of these genotype to phenotype associations were queried from CattleQTLdb. The GENALEX (6.501) software was used to estimate population genetic results. To characterize the diversity in another British *Bos taurus* breed, population genetic characteristics were estimated in Red Angus bulls ($n = 175$) that were included in the 2000 Bull Project. Similar software, climate zone regions, and SNP were used in the analyses. The number of sires in the climates zones of CA, CH, TZ, WA, and WH were 126, 32, 11, 5, and 1, respectively. We hypothesized

Red Angus bulls would possess genetic substructure across the five climatic zones as observed in Hereford bulls. ARLEQUIN (3.5.2.2) software was used to estimate Hardy-Weinberg Equilibrium (HWE) and conduct an analysis of molecular variance for genotype to phenotype associations. The number of significant ($P < 0.05$) SNP for the traits of milk yield, early embryonic survival, and mature cow body weight were 4, 1, and 1, respectively. Based on the results and genotypes from the bulls studied in the 2000 Bull Project, we reject our hypothesis that Red Angus bulls possess genetic substructure similar to Hereford bulls across five U.S. climate zones. These results provide evidence to suggest that Red Angus cattle in the United States appear to be preferred in beef production systems in cooler climate zones, whereas Hereford cattle populate these regions as well as drier climate zones.

Key Words: *Bos taurus*, genetic diversity management, molecular markers

---

0010 Effect of processing of supplemental corn on metabolizable protein of beef cows grazing winter wheat pasture. C. S. Hebbert[*1], M. A. Lopez-Baca[2], L. Avendaño-Reyes[2], U. Macias-Cruz[2], and S. A. Soto-Navarro[1], *[1]New Mexico State University, Las Cruces, [2]Instituto de Ciencias Agricolas, Universidad Autonoma de Baja California, Ejido Nuevo Leon, Baja California, Mexico.*

Eight ruminally and duodenally cannulated, Angus-crossbred cows (587 ± 49.0 kg) grazing winter wheat pasture (WWP) were used in a completely randomized design with the objective of evaluating effects of processing of supplemental corn (ground vs. steam-flaked) on forage intake and metabolizable protein. The experiment was conducted from 23 Mar. through 6 Apr. 2015. Cows grazed a single WWP with ground corn (GC) or steam-flaked corn (SFC) offered individually at 0.4% of BW, once daily at 0700 h. Forage DM intake and total DM intake were greater ($P = 0.01$) for SFC than for GC supplementation. Forage OM, CP, and NDF intake was greater ($P = 0.01$) for SFC than for GC supplementation. Total OM, CP, and NDF intake was greater ($P < 0.02$) for SFC than for GC supplementation. Although feed CP flow to the small intestine was not affected ($P = 0.97$) by corn processing method, microbial CP synthesis was greater ($P = 0.01$) for SFC than for GC supplementation. Therefore, total CP flow to the small intestine (metabolizable protein) was greater ($P = 0.03$) for SFC than for GC supplementation. Total tract digestibility of OM, CP, and NDF (expressed as g/d) were greater ($P < 0.02$) for SFC than for GC supplementation. In conclusion, forage intake, microbial protein synthesis, and metabolizable protein improved by steam-flaking as compared with grinding supplemental corn for cattle grazing WWP. Steam flaking, as compared with grinding supplemental corn, may improve performance of cattle grazing WWP by improving forage intake

and microbial CP synthesis.

Key Words: grain processing, metabolizable protein, winter wheat pasture

---

0011 Does adaptive grazing management influence dietary quality of yearlings during the grazing season on western Great Plains rangelands? T. R. Plechaty[*1], J. D. Scasta[1], J. D. Derner[2], *[1]University of Wyoming, Laramie, [2]USDA–Agricultural Research Service, Cheyenne, WY.*

Grazing management decisions, such as timing of herd movements, can have a direct impact on the diet quality and nutritional plane of cattle. The variation in diet quality relative to adaptive versus continuous grazing strategies can lead to differences in cattle weight gains which directly impacts the profit margin for livestock producers. Near Infrared Reflectance Spectroscopy (NIRS) was used on fecal samples collected weekly from yearlings during the 2015 grazing season (May through October) to evaluate if differences occurred in measurements of dietary quality (crude protein and digestible organic matter) between adaptive grazing and continuous, season-long grazing in two rangeland ecosystems of the western Great Plains: shortgrass steppe and northern mixed-grass prairie. Yearling cattle under traditional grazing management at a moderate stocking rate had a 1.2 to 2.4% higher dietary crude protein ($P < 0.003$, $P < 0.001$) and a 0.5 to 1.4% higher digestible organic matter ($P < 0.1$, $P < 0.001$) than yearling cattle under adaptive grazing management across the season at HPGRS and CPER, respectively, with maximum differences for both protein and digestibility exceeding 5% at times. At CPER, adaptive grazing management caused a two- to greater-than-fourfold steeper decline in digestibility between rotations compared with traditional grazing management.

Key Words: beef cattle, diet quality, grazing management

0012 Long-term progesterone influence on feed efficiency, body composition, nonesterified fatty acids, and metabolic hormones in mature Rambouillet ewes. M. R. Herrygers*, J. M. Thomson, K. A. Perz, P. J. Merta, M. Knerr, K. Metcalf, K. B. Herrygers, and J. G. Berardinelli, *Montana State University, Bozeman.*

The objectives of this study were to evaluate the effects of long-term progesterone (P4) treatment on changes in feed efficiency, BW, body composition, NEFA and metabolic hormones in mature Rambouillet ewes. Thirty multiparous 5- and 6-yr-old Rambouillet ewes were stratified by age and metabolic BW and assigned randomly to receive long-term P4 administration using a sequential replacement of either a P4-containing controlled internal drug release device (CIDR) or non-P4-containing CIDR (CIDRX). Initially, ewes were

synchronized for estrus using a 7 d CIDR and $PGF_{2\alpha}$ protocol. All ewes exhibited estrus within 72 h after $PGF_{2\alpha}$. Twelve days after estrus (d = 0), each ewe received either a CIDR ($n = 15$) or a CIDRX ($n = 15$). Every 14 d thereafter, the CIDR or CIDRX was removed from each ewe and replaced with a new CIDR or CIDRX for 126 d. Jugular venous blood samples were collected from each ewe at the time of CIDR or CIDRX replacement. Serum samples were assayed for P4, NEFA, insulin (INS), triiodothyronine (T3), and thyroxine (T4). Individual feed intake was recorded using GrowSafe units, beginning at d 0 following a 3-wk adaptation period. Ewes were fed a mixed grass hay diet ad libitum that met the nutrient requirements for maintenance. BW for each ewe was collected every 14 d when CIDR or CIDRX were replaced. Back fat (BF) and rib-eye area (REA) were measured for each ewe every 28 d using ultrasonography. BW, residual feed intake, BF and REA did not differ ($P > 0.10$) between CIDR- and CIDRX-treated ewes. Calculated estimates of body composition did not differ ($P > 0.10$) between CIDR- and CIDRX-treated ewes. NEFA, T3, and T4 concentrations did not differ ($P > 0.10$) between CIDR- and CIDRX-treated ewes. However, INS concentrations did differ ($P < 0.05$) between CIDR- and CIDRX-treated ewes. In conclusion, long-term P4 treatment did not appear to alter feed efficiency and partitioning of nutrients. However, maintaining P4 may alter the homeostatic relationship between INS and carbohydrate metabolism in ewes.

Key Words: carcass traits, ewe, metabolism, progesterone, residual feed intake

---

0013   Health evaluation of immune-stimulated and hay-supplemented feedlot receiving calves as assessed by blood gas analysis. E. R. Oosthuysen[*1], M. Hubbert[2], K. L. Samuelson[1], E. J. SchColljegerdes[1], G. C. Duff[1], and C. A. Loest[1], [1]*New Mexico State University, Las Cruces, [2]Clayton Livestock Research Center, New Mexico State University, Clayton.*

This study evaluated blood parameters, health, and performance of immune-stimulated and hay-supplemented feedlot receiving calves. Heifers ($n = 705$; 179 ± 0.58 kg BW) were blocked by six truckloads and assigned to 48 pens and four treatments in a randomized complete block design. Treatments were a factorial arrangement of hay (+HAY vs. –HAY) and immunostimulation (+IMMUN vs. –IMMUN). Pens assigned +HAY received supplemental alfalfa hay to the receiving ration for the first 14 d. Calves assigned +IMMUN received a DNA immunostimulant on d 0. On d 0, 14, and 28, BW, rectal temperatures, and venous blood were collected. Health was recorded throughout the 56-d study, and pen weights on d 56. No HAY × IMMUN interactions occurred ($P \geq 0.18$). During the first 14 d, calf ADG was greater ($P < 0.01$) for +HAY than-HAY, but d 14 to 28 ADG was lower ($P < 0.01$) for +HAY than-HAY. Calf ADG was lower ($P \leq 0.01$) for +IMMUN than –IMMUN from d 28 to 56 and from d 0 to 56. Total DMI was greater ($P < 0.01$) for +HAY than –HAY from d 0 to 14, but lower ($P \leq 0.04$) from d 14 to 28 and from d 28 to 56. Gain efficiency of +HAY calves was greater (less negative; $P < 0.01$) from d 0 to 14, but lower ($P < 0.01$) from d 14 to 28 when compared with –HAY. Gain efficiency was lower ($P \leq 0.02$) for +IMMUN than –IMMUN calves from d 28 to 56 and d 0 to 56. Calf morbidity, mortality, and blood parameters (pH, glucose, lactate, hemoglobin saturated with oxygen [sO_2]) were not affected ($P \geq 0.18$) by treatments. Blood sO_2 was lower ($P < 0.01$) on d 0 than d 14 and 28, and glucose was greater ($P < 0.01$) on d 28 than d 0 and 14. Blood sO_2 correlated ($P < 0.05$) with glucose ($R^2 = 0.09$), lactate ($R^2 = -0.12$), and mortality ($R^2 = 0.08$). Glucose correlated with lactate ($R^2 = 0.61$), and first ($R^2 = -0.22$) and second ($R^2 = -0.13$) medical treatment. Lactate correlated ($P < 0.05$) with first medical treatment ($R^2 = -0.12$) and mortality ($R^2 = -0.12$). In conclusion, hay supplementation and immune stimulation did not affect calf health, performance, or blood gas parameters. Changes in calf health can be observed in measures of blood parameters.

Key Words: calves, hay, immunostimulant

0014   Effect of postweaning heifer development system on average daily gain, pregnancy rates, and subsequent feed efficiency as a pregnant heifer. S. A. Springman*, H. R. Nielson, T. L. Meyer, and R. N. Funston, *University of Nebraska, West Central Research and Extension Center, North Platte.*

A 4-yr study was conducted using Angus-based, spring born heifers. In yr 1, weaned heifers grazed corn residue (CR, $n = 50$) or were fed in a drylot (DLHI, $n = 50$). In yr 2, 3, and 4, heifers grazed CR ($n = 75$), upland range (RANGE, $n = 75$), or were fed diets differing in energy, high (DLHI, $n = 75$) or low (DLLO, $n = 75$), in a drylot. Percentage of mature BW before the breeding season was greater ($P = 0.01$) for DLHI (67%) compared with Range (59%), CR (60%), and DLLO (63%). Pregnancy rates to AI were similar ($P = 0.39$) among treatments (67, 63, 61, 49 ± 7.2%; RANGE, CR, DLHI, DLLO), and final pregnancy rates were also similar (84, 90, 91, 91 ± 5.4%; Range, CR, DLHI, DLLO; $P = 0.59$). A subset of AI pregnant heifers from each treatment was placed in a Calan gate system. Heifers were allowed a 20 d acclimation period before beginning the 90 d trial at approximately gestational d 170. Heifers were offered ad libitum hay; amount offered was recorded daily and orts collected weekly. Initial BW was not different ($P = 0.35$) among treatments (451, 457, 472, 464 ± 10 kg; RANGE, CR, DLHI, DLLO). Body weight at the end of the trial was also similar ($P = 0.24$; 488, 497, 511, 502 ± 14 kg; RANGE, CR, DLHI, DLLO). Intake was similar, either as DMI ($P = 0.27$; 9.74, 9.97, 10.18, 10.00 ± 0.76 kg; RANGE, CR, DLHI, DLLO) or residual feed intake ($P = 0.61$; 0.094, 0.091, –0.056, –0.0743 ± 0.160 kg; RANGE, CR, DLHI, DLLO). There was no difference in ADG ($P = 0.36$; 0.38, 0.45, 0.43, 0.41 ± 0.17 kg/d; RANGE, CR, DLHI, DLLO)

among treatments. Although the development cost was not different among treatments ($P = 0.41$; $166, 141, 160, 171 \pm 12$, RANGE, CR, DLHI, DLLO), there was a $30 numerical difference between the most (DLHI) and least (CR) expensive treatment. Developing heifers to a greater prebreeding BW did not influence subsequent AI or overall pregnancy rates or feed efficiency as a pregnant heifer.

Key Words: beef heifers, feed conversion, heifer development

0015 **Comparison of timed insemination vs. modified estrus detection protocol in beef heifers.**
B. T. Tibbitts[*1], T. L. Meyer[2], D. J. Kelly[3], and R. N. Funston[2], *[1]University of Nebraska-Lincoln, Lincoln, [2]University of Nebraska, West Central Research and Extension Center, North Platte, [3]Kelly Ranches, Sutherland.*

Angus-based, crossbred heifers ($n = 972$, 346 kg ± 14 kg) were assigned to either a fixed-time AI (FTAI) protocol or modified estrus detection with fixed-time AI (MTAI) to evaluate synchronization, conception, and pregnancy rates. During the prebreeding development period, heifers were fed to achieve a target of $60 \pm 5\%$ mature BW at breeding. Heifers were synchronized via melengestrol acetate-prostaglandin $F_{2\alpha}$ (MGA-PG) protocol and received an estrus detection aid (patch) at PG administration. A patch score was recorded for each heifer at AI to reflect what percentage of rub-off coating had been removed. Heifers in the FTAI treatment received 2 mL GnRH injection and were AI 72 ± 2 h following PG. Heifers in MTAI treatment were observed for estrus at 58 ± 2 and 70 ± 2 h after PG. Approximately 72 ± 2 h after $PGF_{2\alpha}$, heifers in MTAI were AI in the following order: heifers in estrus at 58 h post-PG, heifers in estrus at 70 h post-PG, and heifers not expressing estrus at either estrus observation. Heifers not expressing estrus received GnRH at AI. Pregnancy was determined via transrectal ultrasonography. Heifers exhibiting estrus had greater ($P < 0.01$; 71 and $66 \pm 5\%$ for FTAI vs. MTAI, respectively) AI conception rates than heifers not expressing estrus in both FTAI and MTAI treatments vs. 47 and $53 \pm 9\%$ AI conception rates in nonestrus heifers for FTAI and MTAI, respectively. However, overall AI conception rate ($62 \pm 5\%$, $P = 0.49$) and final pregnancy rates were similar ($P = 0.98$; 96 and $97 \pm 3\%$ for FTAI vs. MTAI, respectively). Similar AI conception rates were achieved without estrus detection.

Key Words: beef heifers, estrus synchronization, timed artificial insemination

---

0016 **Growth and reproductive performance of yearling beef heifers implanted with Revalor G in the Nebraska Sandhills.** B. T. Tibbitts[*1], H. R. Nielson[2], K. C. Ramsay[3], and R. N. Funston[2], *[1]University of Nebraska-Lincoln, Lincoln, [2]University of Nebraska, West Central Research and Extension Center, North Platte, [3]Rex Ranches, Ashby, NE.*

Crossbred beef heifers ($n = 3242$), approximately 12 mo of age, were managed at three locations in the Nebraska Sandhills and randomly assigned to be implanted with Revalor G (40 mg of trenbolone acetate and 8 mg estradiol, IMP), while the control group (CON) did not receive an implant. Heifers (238 ± 2 kg) grazed native Sandhills range for the duration of the trial (164 ± 4 d). Eighty-two ± 2 d following trial initiation, heifers were synchronized for estrus and AI followed with clean-up bulls as part of a 25 d breeding season. Body weight was measured at the beginning and end of trial. Pregnancy detection occurred 45 d following bull removal at the conclusion of the summer grazing period. Implanted heifers gained more and were heavier ($P < 0.05$; 0.68 vs. 0.64 ± 0.01 kg/d and 347 vs. 340 ± 3 kg, IMP vs. CON, respectively) at the end of the trial. However, pregnancy rate was greater ($P < 0.01$) for CON vs. IMP (64 vs. $46 \pm 3\%$, respectively). Implanted heifers also had a lower pregnancy rate in their second breeding season ($P = 0.02$; 93 vs. $96 \pm 2\%$, IMP vs. CON, respectively). Implanting beef heifers with Revalor G at approximately 12 mo of age increased ADG and summer BW gain; however, it decreased initial and subsequent pregnancy rate compared with heifers not implanted.

Key Words: beef heifers, fertility, growth implants

0017 **Performance and net energy in high and low RFI beef cattle.** K. C. Dykier[*] and R. D. Sainz, *University of California, Davis.*

The objective of this study was to relate feed efficiency to performance and net energy in beef cattle. To identify animals with greater or lesser feed efficiency, 98 weaned Angus cross beef calves (71 steers and 27 heifers) were fed individually for 56 d. Feed offered and refused were measured daily, body weights were taken at 14 d intervals, and ultrasound measures (longissimus muscle area and subcutaneous fat over the 12th to 13th ribs) were taken at the beginning, middle and end of the trial. Feed was delivered twice a day, on an ad libitum basis. Residual feed intake (RFI) was determined as the residual of the regression of DMI on mid-test $BW^{0.75}$ and ADG. High and low RFI groups were defined as >0.5 SD above or below zero, respectively, with intermediate animals classified as medium RFI. As expected, RFI groups had similar initial and final BW and ADG, and different DMI, gain:feed and RFI ($P < 0.001$). Fat gain, protein gain, and recovered energy (RE) were not different between RFI groups, although subcutaneous fat over the 12th and 13th rib was 0.19 cm higher in high RFI than low RFI cattle ($P = 0.012$). Heat energy (HE),

Table 0017.

Table 2. Performance, body composition, and net energy in RFI groups and sex after 56 days *ad libitum* feeding.

Trait	RFI			Sex			P-value		
	High	Medium	Low	H	S	SD	RFI	Sex	Sex x RFI
Initial BW, kg	279.3	272.3	277.2	261.3	291.2	30.2	0.67	< 0.001	0.53
Final BW, kg	382.6	370.1	382.4	346.7	410.0	35.9	0.33	< 0.001	0.32
ADG, kg/d	1.844	1.747	1.878	1.524	2.122	0.238	0.11	< 0.001	0.32
DMI, kg/d	9.06	8.17	7.84	7.63	9.08	0.866	< 0.001	< 0.001	0.16
Gain:feed	0.203	0.212	0.239	0.202	0.235	0.02	< 0.001	< 0.001	0.96
RFI, kg/d	0.590	-0.006	-0.634	0.014	-0.047	0.25	< 0.001	0.29	0.29
Ribeye area, cm^2	67.52	65.18	67.80	63.82	69.85	6.26	0.23	< 0.001	0.35
12th-13th rib fat, cm	0.94	0.84	0.75	0.85	0.84	0.18	0.002	0.81	0.09
Fat gain, kg/d	0.64	0.61	0.61	0.517	0.722	0.17	0.65	< 0.001	0.17
Protein gain, kg/d	0.22	0.21	0.23	0.179	0.258	0.05	0.26	< 0.001	0.62
Fat:protein	3.02	2.81	2.73	2.892	2.817	0.67	0.29	0.62	0.06
RE, Mcal/d	7.25	6.89	7.00	5.860	8.231	1.78	0.63	< 0.001	0.19
RE, Mcal kg$^{0.75}$	0.102	0.099	0.098	0.089	0.112	0.02	0.77	< 0.001	0.28
HE, Mcal/d	19.40	17.14	16.08	16.58	18.50	2.69	< 0.001	< 0.001	0.40
HE, Mcal kg$^{0.75}$	0.274	0.248	0.228	0.250	0.250	0.03	< 0.001	0.91	0.55
NEm, Mcal/kg$^{0.75}$	0.103	0.087	0.077	0.098	0.081	0.03	0.001	0.002	0.75

defined as the difference between metabolizable energy intake (MEI) and RE was lower in low RFI cattle ($P < 0.001$). Estimated NE$_m$ requirement (Mcal/kg$^{0.75}$) was lower in low than in high RFI cattle ($P = 0.001$). Overall heifers gained less than steers; however, there were no sex × RFI class interactions. Low RFI cattle have similar weights and weight gains, but lower intakes and higher feed efficiencies as high RFI cattle. This may be partially due to decreased maintenance requirement and heat production.

Key Words: efficiency, net energy, residual feed intake

0018 Impact of maternal protein restriction in first-calf heifers during mid- to late- gestation on gene expression, feedlot performance, and carcass characteristics of progeny. J. J. Kincheloe[*1], M. J. Webb[2], R. N. Funston[3], K. R. Underwood[2], M. G. Gonda[2], A. D. Blair[1], and K. C. Olson[1], *[1]South Dakota State University, Rapid City, [2]South Dakota State University, Brookings, [3]University of Nebraska, West Central Research and Extension Center, North Platte.*

Maternal nutrient restriction in beef cows impacts developmental processes in the fetus that may influence postnatal performance. This study investigated impacts of MP restriction in mid- and late-gestation on the transcriptome of neonatal muscle tissue and subsequent feedlot performance and carcass characteristics of progeny. One hundred eight Angus × Simmental heifers were blocked by BW and method of conception (AI or natural service, based on fetal age at ultrasound) and allocated to 12 pens in a randomized complete block design with a 2 × 2 factorial treatment structure including two stages of gestation (mid- and late-) and two levels of dietary protein (control [CON]; approximately 102% of MP requirements and restricted [R]; approximately 80% of MP requirements). Pens were randomly assigned to CON or R treatments within blocks during mid- and/or late-gestation. Heifers were removed from treatments after calving and managed as a common group. Within 48 h of birth, LM biopsy samples were collected from a subset of three male AI calves from each treatment combination for analysis of gene expression using RNA-Seq technology. Following weaning, calves were backgrounded for 2 wk then finished in a GrowSafe feeding system on a common finishing diet. Individual carcass measurements were recorded. Genes found in pathways associated with muscle tissue development were up-regulated ($P \leq 0.02$) in calves born to dams on the CON treatment throughout mid- and late- gestation. Genes involved in adipogenesis were up-regulated in calves born to dams on the R-R treatment ($P = 0.05$). No differences were observed for calf BW, DMI, ADG, G:F, or residual feed intake (RFI) due to maternal nutritional treatments across the entire feeding period ($P > 0.10$). Hot carcass weight, adjusted 12th rib fat thickness, KPH, marbling score, and proportion of carcasses in each USDA quality grade were not influenced ($P > 0.10$) by maternal diet during gestation. Progeny of dams on the R treatment in late gestation had greater LM area ($P = 0.05$) vs. progeny from CON dams. There was a tendency ($P = 0.06$) for a mid- by late-gestation treatment interaction for

yield grade, with lower yield grades in progeny from dams on CON-R or R-CON treatments vs. CON-CON. Differences in gene expression, animal performance, and carcass characteristics indicate MP restriction during mid- and late-gestation may impact developmental programming.

Key Words: beef cattle, MP restriction, gene expression

ASAS WESTERN SECTION UNDERGRADUATE STUDENT POSTER COMPETITION

0019   Development of an immunohistochemical technique to determine presence and localization of glucose transporter GLUT3 in bovine utero-placental tissues from days 16 to 50 of gestation.
J. Osei*, M. S. Crouse, K. J. McLean, J. A. Flaten, P. P. Borowicz, L. P. Reynolds, J. S. Caton, and C. R. Dahlen, *Department of Animal Sciences, North Dakota State University, Fargo.*

Before the establishment of transplacental exchange, nutrients must be transported to the embryo via nutrient transporters. Glucose transporter *GLUT3* is known as a higher affinity, facilitated diffusion glucose transporter found in high glucose demanding tissues such as the brain, placenta, sperm, pre-implantation embryos, and some cancers. The objectives of our current study were (1) develop an immunohistochemistry technique to localize *GLUT3* in bovine utero-placental tissues, and (2) confirm the presence and location of *GLUT3* in bovine utero-placental tissues. We hypothesized that *GLUT3* would be present in utero-placental tissues from d 16 to 50 of gestation. To test this hypothesis, crossbred Angus heifers ($n = 49$), were synchronized, bred via AI, randomly assigned to nutritional treatment beginning at AI (CON; heifers receiving 100% of requirements to gain 0.45 kg daily) or (RES; 60% of CON), then ovariohysterectomized on d 16, 34, or 50 of gestation ($n = 6$ to 7/treatment), or were not bred and ovariohysterectomized on d 16 of a synchronized estrous cycle ($n = 6$) to serve as nonpregnant (NP) controls. Uterine cross-sections were obtained from the pregnant horn, fixed in neutral buffered formalin, and embedded in paraffin for histology. Rabbit primary antibody for *GLUT3* (Abcam) followed by fluorescently labeled, goat nonrabbit secondary antibody (Alexa Fluor 633; Abcam) was used to localize *GLUT3* transporter. A DAPI stain was used to counterstain cell nuclei. Photomicrographs were taken with a Zeiss Imager.M2 epifluorescence microscope using a $10\times$ objective and AxioCam HR camera with a Zeiss piezo automated stage. To describe localization of *GLUT3*, the mosaic image of a large tissue area covering the whole cross-section of the uterus with fetal membranes (12×3 pictures) on the slide was taken using the MosaiX module of Zeiss AxioVision software. We localized *GLUT3* in fetal membrane [chorioallantois], uterine endometrium [caruncles and intercaruncular endometrium] interglandular (stromal) tissue, superficial glands, deep glands, as well as myometrium in NP, CON, and RES tissues on d 16, 34, and 50. These results accomplished our objectives and clearly supported our hypothesis that *GLUT3* is present in uterine tissues from d 16 to 50 of gestation. Further research and more detailed measurements using fluorescence intensity in utero-placental tissues across day and treatments is needed to determine impacts of maternal nutrition status and day of early gestation on localization as well as concentration of the *GLUT3* transporter within utero-placental tissues.

Key Words: bovine, glucose, immunohistochemistry, utero-placental tissue

---

0020   Do ewes born with a male co-twin have greater longevity with lambing over time?
D. N. Grogan[*1], J. A. Brown[1], and J. B. Taylor[2], [1]*Wingate University, Wingate, NC,* [2]*USDA, ARS, Rangeland Sheep Production Efficiency Research, Dubois, ID.*

Based on a recent analysis of historical records, ewes born co-twin to a ram had greater lifetime reproductive performance than ewes born co-twin to an ewe. We are interested in determining what component(s) of lifetime reproductive performance may be associated with a ewe's co-twin sex. As an initial indicator of longevity in the flock, we hypothesized that co-twin sex will affect the age at which ewes consistently appear in the lambing records (i.e., recorded as having lambed). Therefore, the objective was to determine the percentage of ewes, born with a female or male co-twin, that appear in the lambing records at ages 1 to 7 yr. Using the USDA–ARS, U.S. Sheep Experiment Station database, lambing records from 1994 to 1997 were queried for ewes that were either born with a male or female co-twin. A total of 4442 ewes were identified, and breeds included Columbia ($n = 417$), Polypay ($n = 627$), Rambouillet ($n = 446$), and Targhee ($n = 427$). For each age class, Chi square analysis was used to compare the expected percentage of ewes lambing that were either born to a female or male co-twin. Of ewes born as a twin and subsequently recorded as having lambed, we expected that, within each age class (1 to 7 yr), 50% of the ewes were originally born as a co-twin to a female (FF) and 50% born as a co-twin to a male (FM). The observed percentage of FF (52.7%) or FM (47.3%) ewes did not differ, regardless of age or breed; $P > 0.10$. Within breed, no differences between percentages were observed in Columbia (FF = 53.8% and FM = 46.2%; $P > 0.10$), Rambouillet (FF = 55.2% and FM = 44.8; $P > 0.60$), and Targhee (FF = 46.3% and FM = 53.7%; $P > 0.30$) ewes regardless of age. However, in 2-yr-old Polypay ewes, there were more FF ewes recorded as having lambed compared with FM ewes (FF = 55% and FM = 45%; $P < 0.01$), but no differences were found at any other age. We suggest that the percentage of ewes having a female or male co-twin did not vary from the expected percentage, thus ewes having a male