

ABSTRACTS

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2005 Distinguished Service Award

1 Strategic low-cost supplementation. M. K. Petersen*, *New Mexico State University, Las Cruces.*

Numerous forces influence nutritional management decision-making of ranchers in the West including resource and cow condition, production goals, labor cost, when, what and how much to supplement and ultimately the marginal return to supplementation. Our range nutrition program has a goal to design a nutritional management plan that is flexible, yields biological results, is cost-effective, and practical to implement. We have progressed in achieving this goal through collaborative research and extension efforts, and have incorporated 45 yr of range nutrition research from New Mexico State University into one strategy. This plan focuses on sustainable range management and improvement, while providing cows with all the forage they can eat. To guide supplementation decision-making we ask ourselves if the color of the vegetation is green or brown. If it is brown then, protein supplementation will likely improve forage digestibility and intake. Next, we compare the expected nutrient intake with production goals and cow condition. If

nutrient intake is low and productivity likely will be delayed or diminished, then supplementation options are explored. Minerals and vitamins should be available year-round to reduce negative productivity impacts due to undernutrition. If protein supplementation will improve cow productivity, one of five supplements (varying in protein composition and degradability) can be fed based on practicality within a scenario. The five options are: minute (58 g/d-self-fed), minimum (250 g/d-self-fed or 1.5 kg 1d/wk), moderate (454 g/d-fed 2 to 3 times/wk), maximum (908 g/d-fed 2 to 3 times/wk) and supermax (908 g/d-fed 2 to 3 times/wk). Protein supplement is fed for 80 d/yr and depending upon forage, climatic and animal conditions can increase. This program implemented at the Corona Range and Livestock Research Center sustains a 90% or greater fall pregnancy rate within a 60-d breeding season while maintaining total feed cost below \$30 cow⁻¹•yr⁻¹. This program is designed to be efficient, improve cow nutrient intake, and achieve production goals while minimizing purchased feed costs.

Key Words: Supplementation, Range cows, Management

Graduate Student Paper Competition

2 Effects of supplemental RDP versus increasing supplemental RUP on visceral N flux in lambs fed a low-quality forage. R. L. Atkinson*, C. D. Toone¹, D. L. Harmon², and P. A. Ludden¹, *University of Wyoming, Laramie*, ²*University of Kentucky, Lexington.*

Sixteen multi-catheterized wether lambs (BW = 32 ± 5 kg) were used in a completely randomized designed experiment to measure net flux of N metabolites across the portal-drained viscera (PDV) and liver in response to supplementation with ruminally degradable protein (RDP) or increasing amounts of ruminally undegradable protein (RUP). Lambs were fed a basal diet of crested wheatgrass hay (4.9%CP) for ad libitum consumption, plus one of four protein supplements: isolated soy protein, a source of RDP, fed to meet estimated RDP requirements (CON), or corn gluten meal (RUP) fed at 50, 100, or 150% of the supplemental N provided by CON (C50, C100, C150, respectively). Although forage N intake was not affected ($P = 0.29$) by treatment, total N intake increased ($P = 0.003$) with increasing RUP, and was similar ($P = 1.00$) between CON and C100. Net release of ammonia N from the PDV was greater ($P = 0.02$) for CON than C100 and increased linearly ($P = 0.002$)

as level of RUP increased. Consequently, net uptake of ammonia N by the liver was not affected ($P = 0.23$) by protein degradability, but increased linearly ($P = 0.04$) as level of RUP increased. However, net urea N release from the liver was not affected ($P = 0.58$) by treatment. Net uptake of urea N by the PDV was greater ($P = 0.02$) for C100 than CON, and increased linearly ($P = 0.04$) with increasing RUP. Neither net release from the PDV nor hepatic uptake of α -amino N were affected ($P = 0.12$) by treatment. Hepatic ammonia N uptake accounted for 82, 38, 98, and 79% of net urea N release from the liver for the CON, C50, C100, and C150 treatments, respectively. However, hepatic α -amino N uptake for all treatments greatly exceeded that required for the remaining urea N release by the liver, suggesting that α -amino N may serve as a temporary means of storing excess N by the liver between supplementation events. However, the pattern of net release or uptake of N metabolites between supplementation events remains to be investigated.

Key Words: Ruminally undegradable protein, N recycling, Ureagenesis

3 Body condition score at parturition and day of lactation affect lipogenic enzyme messenger RNA abundance in milk somatic cells from lactating beef cows fed supplemental fat. C. M. Murrieta^{*1}, S. L. Lake², E. J. Scholljegerdes³, B. W. Hess¹, and D. C. Rule¹, ¹University of Wyoming, Laramie, ²Purdue University, West Lafayette, IN, ³USDA ARS, Mandan, ND.

Our objective was to determine mammary RNA transcript abundance by measuring messenger RNA in milk somatic cells of three-year-old Angus × Gelbvieh beef cows nutritionally managed to achieve a BCS of 4 ± 0.07 (BW = 479 ± 36 kg; n = 18) or 6 ± 0.07 (BW = 579 ± 53 kg; n = 18) at parturition. Beginning 3 d postpartum, cows within each BCS were assigned equally and randomly to a hay diet plus low-fat control supplement or supplements with either cracked high-linoleate safflower seeds or cracked high-oleate safflower seeds until d 60 of lactation. Diets were formulated to be isonitrogenous and isocaloric, and diets with safflower seeds had 5% of DMI as fat. At d 30 and 60 of lactation, somatic cells from 500 mL of milk were collected for RNA extraction, and ribonuclease protection assay was used to measure transcript abundance for lipoprotein lipase (LPL), acetyl-CoA carboxylase (ACC), fatty acid synthase (FAS), and stearoyl-CoA desaturase (SCD). Cow BCS did not affect transcript abundance for LPL ($P = 0.13$) or ACC ($P = 0.16$). Transcript abundance was greater for FAS ($P = 0.02$) and SCD ($P = 0.04$) in cows of BCS 4 than 6, suggesting that cows in BCS 4 had less adipose tissue to draw upon for milk fat synthesis. Dietary treatment had no effect ($P = 0.27$ to 0.43) on transcript abundance. Greater ($P = 0.002$) LPL transcript abundance from d 30 to 60 likely reflected increased demand for uptake of fatty acids from circulating triacylglycerols by the mammary gland. Decreased ($P = 0.004$) transcript abundance for FAS from d 30 to d 60 of lactation indicated that peak lactation could have passed when the 60-d sample was obtained. In conclusion, cow BCS, as well as day of lactation had the greatest impact on messenger RNA abundance for lipogenic enzymes in the lactating mammary gland of the beef cows. Moreover, transcription of lipogenic enzyme RNA might be up-regulated in mammary glands of cows in BCS of 4 to counter the lower supply of fatty acids from body fat reserves.

Key Words: Milk, Messenger RNA, Lipogenesis

4 Body condition and somatotropin influence endocrine and follicular dynamics of postpartum Brahman-influenced cows. R. Flores^{*1}, M. L. Looper², R. W. Rorie¹, M. A. Lamb¹, S. T. Reiter¹, D. M. Hallford³, D. L. Kreider¹, and C. F. Rosenkrans, Jr.¹, ¹University of Arkansas, Fayetteville, ²USDA-ARS, Dale Bumpers Small Farms Research Center, Booneville, AR, ³New Mexico State University, Las Cruces.

Influence of body condition (BC) and bovine somatotropin (bST) on number of follicles, diameter of largest follicle, and concentrations of GH, IGF-I, triiodothyronine (T_3), thyroxine (T_4), and prolactin were examined in postpartum Brahman-influenced beef cows. Cows (n = 99) were blocked by BC [low BC (BCS = 4.2) or moderate BC (BCS = 6.1)] and treated with bST every 2 wk for 6 wk beginning at 35 d prior to breeding (d 0) or no bST (control). Blood was collected on d -35, -28, -21, -7, and 0 to quantify concentrations of GH, IGF-I, T_3 , T_4 , and prolactin. All cows received a controlled internal drug releasing (CIDR) device 7 d prior to breeding. On d 0, CIDR were removed and cows

received PGF_{2 α} . Ultrasound was performed on d 1 after CIDR-PGF_{2 α} to determine number of small (2 to 9 mm) and large (= 10mm) follicles, and size of largest follicle. Cows treated with bST had increased ($P < 0.05$) GH on d -28, -21, -7, and 0. Cows treated with bST in low BC had increased ($P < 0.05$) IGF-I vs. control-low BC cows on d -28, -21, -7, and 0. Number of small and large follicles were not influenced by BC and (or) bST. Triiodothyronine was greater ($P < 0.05$) in moderate BC vs. low BC cows on all sample dates. Thyroxine was greater ($P < 0.05$) in moderate BC cows on d -28, -21, -7, and 0 vs. low BC cows. On d -28 and 0, bST-treated cows had greater ($P < 0.05$) T_4 vs. control cows. Prolactin was greater ($P = 0.09$) in bST-moderate BC and control-moderate BC on all sample dates vs. bST-low BC and control-low BC cows. Diameter of largest follicle was correlated with IGF-I ($r = 0.18$; $P = 0.08$), T_3 ($r = 0.18$, $P = 0.09$), and prolactin ($r = 0.20$, $P = 0.05$). Treatment with bST increased IGF-I in low BC cows, and IGF-I was correlated with diameter of the largest follicle 1 d after CIDR-PGF_{2 α} . Endocrine influences on follicular dynamics can be mediated by BC, GH and (or) IGF-I.

Key Words: Body condition, Follicles, Somatotropin

5 AP-2 γ is necessary for normal embryonic epithelial development. J. Guttormsen^{*1}, H. Gavin¹, A. Howlett¹, M. Koster², D. Roop², and Q. Winger¹, ¹Utah State University, Logan, UT, ²Baylor College of Medicine, Houston, TX.

Skin is needed for an animal to survive. Therefore, any errors in skin formation can have detrimental effects on an animal's ability to grow and produce an agricultural product. The embryonic formation of epithelium depends on the correct expression of genes needed to drive proper skin differentiation, growth and development. AP-2 γ is one such gene needed for proper skin development. AP-2 γ is a transcription factor that binds to a specific DNA consensus sequence in other genes and stimulates their expression. During embryonic skin development AP-2 γ is expressed in the basal layer of epithelium, a layer known to contain proliferating keratinocytes. When traditional knock out methods were used to disrupt AP-2 γ , embryos died around 7.5 dpc; therefore to study the skin the Cre/lox P system was used to bypass this early lethality. AP-2 γ mutant mice do not develop a proper epithelial layer and die shortly before or at birth. Skin histology revealed that mutant skin had abnormal stratification showing a lack of differentiation. Protein expression in embryonic stages 10.5, 12.5, 14.5 and 16.5dpc skin showed that mice mutant for AP-2 γ had delayed expression of the skin proteins K1, K14, and p63. To investigate gene expression further, mRNA expression was analyzed using Microarrays. These arrays were performed on 16.5dpc mutant embryos and control littermate skin samples and detected differential expression in an important late embryonic skin differentiation gene filaggrin. Quantitative real-time PCR verified that AP-2 γ mutants have lower expression of filaggrin. It appears as though AP-2 γ plays an important role in driving differentiation in the development of the skin. Proper regulation of epithelium is critical to the function of many tissues in the animal including mammary glands. Understanding the role of AP-2 γ in mammary epithelium could impact the study of breast cancer and dairy science.

Key Words: AP-2 γ , Epithelium, Mouse development

6 Growing beef steers do not require supplemental dietary methionine during an endotoxin challenge. J. W. Waggoner*, C. A. Loest, T. M. Thelen, M. K. Petersen, D. M. Hallford, M. D. Remmenga, and C. P. Mathis, *New Mexico State University, Las Cruces.*

Acute phase response protein synthesis by the immune system during gram(-) bacterial infection increases metabolic amino acid demand in non-ruminants and limits the efficiency of N utilization for growth in newly received feedlot calves. Therefore, we hypothesized that steers would have increased requirements for amino acids, such as Met, during an endotoxin challenge. This study evaluated the effects of supplemental dietary Met on N balance and blood metabolites in Angus-cross steers (n = 20; BW = 262 ± 6.3 kg) exposed to an endotoxin (LPS; gram(-) bacterial lipopolysaccharide, Sigma). Treatments (2 × 2 factorial) were LPS infusion and dietary Met addition (0 vs. 14 g/d rumen-protected; Smartamine M, Adisseo). Steers were adapted to a corn silage-based diet (DM intake = 1.4% of BW) and supplemental Met for 14 d, and were then infused (1 mL/min via i.v. catheter) with LPS on d 1 (LPS1; 2 ug/kg BW) and 3 (LPS2; 1 ug/kg BW) of a 5-d N balance collection period. Blood was collected prior to LPS infusions and every 2 h thereafter for 12 h. Serum cortisol peaked 4 h following LPS1, and remained elevated (P < 0.01) for 12 h. Cortisol peaked 2 h after LPS2 and remained elevated (P < 0.01) for 6 h (LPS × h interaction, P < 0.01). Plasma Met was greater (P < 0.01) for Met-supplemented steers prior to LPS administration, but declined (P < 0.01) for steers infused with LPS such that plasma Met concentrations at 4 to 10 h post-LPS were not different (P > 0.09) from both healthy and LPS-challenged steers that received no supplemental Met (LPS × Met × h interaction, P < 0.01). Infusion of LPS increased (P < 0.05) urinary N excretion and decreased (P < 0.01) N retention resulting in a negative N balance for LPS-challenged steers. Supplementation of Met did not affect (P = 0.49) N retention, and the absence of an LPS × Met interaction (P = 0.25) for N retention indicates that supplemental dietary Met does not improve the efficiency of N utilization for growing beef steers during an endotoxin challenge.

Key Words: Methionine, Endotoxin challenge, Steers

7 Inheritance of hair slickness score and its correlation with growth. J. L. Williams*, D. J. Garrick, R. M. Enns, and K. L. Shirley, *Colorado State University, Fort Collins.*

Cattle hair length and time of shedding are variable and in combination with temperature can affect performance. In a highly humid, subtropical region such as Brazil, where temperatures often reach 43°C during the summer, cattle that shed hair early and maintain a short hair coat tend to be the most productive. The objective of this research was to determine heritability of hair slickness score and its correlation with growth. Hair scores were collected on Limousin cattle (n = 1807) in the United States in the summer of 2004. Records represented 347 sires and included 1775 females and 32 males. Hair slickness scores were based on coat length and extent of shedding, and ranged from 1 (short, early shedding) to 5 (long, late-shedding). A multivariate ASREML model was fit using the fixed effects age of dam, sex, and a contemporary group effect that consisted of herd, score date, and year of age. Animal was the random term in the model. Heritability estimates of hair slickness score, weaning weight direct, weaning weight maternal, and post weaning gain were 0.40 ± 0.07, 0.23 ± 0.07, 0.12 ± 0.05 and 0.37 ± 0.08, respectively. Estimated genetic correlations between hair slickness score and growth traits were -0.56 ± 0.16 for weaning weight direct and 0.30 ± 0.15 for post weaning gain. Sires whose progeny were slick haired had higher weaning weights

but lower post weaning gain than progeny of non-slick sires. The ability of an animal to shed hair could be evaluated and the resultant EPDs may aid cattle producers selecting bulls from the United States to improve offspring growth in Brazil.

Key Words: Cattle, Hair slickness score, Growth

8 Effects of hCG and progesterone administered to ewes post breeding on serum concentrations of progesterone and estradiol. R. R. Redden*, B. J. Herron, C. H. Martinez, and T. T. Ross, *New Mexico State University, Las Cruces.*

The objective of the experiment was to increase serum concentrations of progesterone (P₄) and estradiol (E₂) in the ewe during the period of maternal recognition of pregnancy. Thirty multiparous ewes were randomly assigned a treatment of control, hCG, and hCG + progesterone. Vasectomized rams were used to determine onset of estrus (d 0) in all ewes and fertile rams were hand mated to each ewe at onset of estrus and 12 h post onset. Control ewes were given 0.1 ml of saline and 0.1 ml (100 IU) hCG was administered to both hCG and hCG + progesterone treated ewes all on d 11.5. Progesterone (0.3 mg) was administered via CIDR to hCG + progesterone treated ewes on d 4 and removed on d 18 postbreeding. Blood samples were collected on d 11, 12, 13, and 18 from each ewe. Serum E₂ and P₄ concentrations were analyzed using RIA. No difference in P₄ concentrations were observed among treatments on d 11 (P > 0.1) or d 18 (P > 0.5). Day 12 serum P₄ concentrations were greater (P = 0.01) for hCG + progesterone ewes than hCG and control ewes, however, d 13 P₄ concentrations were greater (P < 0.05) for hCG and hCG + progesterone treated ewes than for control ewes. No difference in E₂ concentrations were observed among treatments for d 11 (P > 0.1) and d 18 (P > 0.5). Estradiol concentrations for hCG and hCG + progesterone treated ewes were greater than controls for both d 12 (P < 0.05) and d 13 (P < 0.01). In conclusion P₄ containing CIDRs had no effect on serum P₄ concentrations on d 11 (before hCG injections) or d 18 (after hCG effects diminished) and only increased d 12 and 13 serum P₄ concentrations after hCG injections. Also, hCG increased E₂ concentrations on d 12 and 13, while increasing P₄ on d 13.

Key Words: Sheep, Progesterone, hCG

9 Effects of leafy spurge (*Euphorbia esula*) on ruminant gas production and in vitro digestion. K. D. Richardson*¹, W. L. Kelly², M. S. Reil², R. C. Waterman², and S. L. Lodge-Ivey¹, ¹*New Mexico State University, Las Cruces,* ²*USDA-ARS, Fort Keogh Livestock and Range Research Laboratory, Miles City, MT.*

Leafy spurge (LS; *Euphorbia esula*) is indigenous to Eurasia and is rapidly changing the landscape in the northern Great Plains and Intermountain West. Sheep consume LS at a higher rate than cattle. Our objectives were to investigate LS in vitro digestibility (IVDMD) and gas production by bovine vs ovine inoculum with or without LS in the diet. Two phases were used with two ruminally cannulated cows and ewes as rumen fluid donors. Each phase allowed for 7 d adaptation to diets. Phase 1 consisted of animals fed a diet of (DM basis) 15% LS (21.9% CP, 48% NDF, DM basis) and 85% barley hay (BH; 12% CP, 56%NDF, DM basis) based on previous day intake. Phase 2 animals were fed 100% BH. Substrates for in vitro digestion and gas production consisted of alfalfa or LS:BH ratio in 10% increasing increments for a

total of 12 treatments. Gas production extent (mL) and rate (mL/h) were calculated after 96 h of incubation. There was a LS exposure × treatment interaction ($P < 0.01$) observed for extent of gas production. Extent of gas production with increasing LS was reduced by 9% when animals were exposed to LS and by 11% with no LS exposure. A species × LS exposure interaction for rate of gas production ($P = 0.02$) was observed. Exposure to LS decreased rate of gas production by 5% for bovine compared to ovine. However, no exposure to LS caused the opposite effect with a 5% increase in bovine rate of gas production. In vitro digestion was evaluated after 48 h incubation. Model main effects of treatment and species were significant for IVDMD ($P < 0.01$ and $P = 0.06$, respectively). Increasing LS:BH ratio in the substrate resulted in an 18% increase in IVDMD and bovine IVDMD was higher than ovine (72.1 vs 71.3 ± 0.31). Alfalfa, BH, and LS IVDMD was 66, 64, and 81%, respectively. These data indicate LS is highly digestible and prior exposure to LS may change rumen microbial ecology and ultimately influence utilization of LS in vivo.

Key Words: Leafy spurge, Rumen microbiology, IVDMD

10 Effects of ractopamine in combination with various hormone implant regimens on feedlot performance and carcass attributes in calf-fed Holstein steers. P. Bass*, J. Beckett, and R. Delmore, *California Polytechnic State University, San Luis Obispo.*

Anabolic steroid hormone implants have been used commercially in feedlot cattle for several decades. Recently, the \hat{I}^2 -adrenergic agonist, ractopamine (RAC), has been approved for use as a feed supplement in beef cattle to increase lean muscle deposition, ADG, and improve feed efficiency. The effects of several anabolic steroid implants were examined with or without RAC to determine feedlot and carcass performance of calf-fed Holstein steers treated with both implants and RAC. In a completely randomized design, 800 cattle were evaluated; cattle were divided into eight treatments (Table; contains treatment abbreviations). Terminal implants were administered 104d prior to harvest, and RAC was fed (200mg/hd*d) continuously during the 36d immediately preceding harvest. Cattle administered RAC had improved HCW and longissimus muscle area (LMA) of 5.7 kg and 1.94 cm^2 ($P < 0.05$) respectively over cattle not fed RAC. All RAC plus implant treatments had greater final weights, HCW, and LMA than C ($P < 0.05$). In addition, treatments MTR and EP resulted in mean HCW greater than CR ($P < 0.05$); treatments MT and MTR resulted in greater REA than CR ($P < 0.05$); treatments MTR, MT, HTR, HT, and EPR resulted in larger LMA than CR ($P < 0.05$). Treatment MTR had the largest mean LMA overall ($P < 0.05$). Overall, the addition of RAC to feedlot diets increased ADG, HCW, and LMA in a manner that is additive to implant effects.

Table 1. Treatment Abbreviations

Implant Treatments	(-) RAC	(+) RAC
Control	C	CR
20mg Estradiol benzoate + 200 mg Progesterone	EP	EPR
24 mg Estradiol + 120 mg Trnebolone acetate	HT	HTR
16 mg Estradiol + 80 mg Trenbolone acetate	MT	MTR

Key Words: Ractopamine, Holstein steer, β adrenergic agonist

11 Genetic parameters for mature weight and lifetime litter weight weaned in Rambouillet and Targhee ewes. A. L. Kelley*, K. C. Davis, P. G. Hatfield, R. W. Kott, and J. M. Rumph, *Montana State University, Bozeman.*

Records of ewe weights and lifetime production measured as lifetime litter weaning weight were analyzed to determine the genetic parameters associated with mature weight (MW) and lifetime litter weight weaned (WW). Data consisted of 24,438 ewe weights, measured a maximum of four times per year, and 8,510 records of lifetime weaning weight produced in four lines of Rambouillet and one line of Targhee ewes managed together at the Red Bluff Research Ranch near Norris, Montana. Based on the likelihood ratio test, the model that best fit the MW data included only the random effects of direct genetic, maternal genetic, and the direct-maternal genetic correlation. Although direct permanent environmental effect was not a significant random effect, it was also included to account for repeatability due to repeating records across years and seasons. Fixed effects included in the model for MW were year measured, number of lambs born, sex of lambs, number of lambs reared, season, and body condition score as well as a linear and quadratic covariate for date weighed. Based on the log likelihood ratio test, random effects included in the model for WW included direct genetic, maternal genetic, direct-maternal genetic correlation, and direct permanent environmental effects. Fixed effects included were year of ewe birth and line. Estimates of direct heritability were 0.59 and 0.13 for MW and WW, respectively. The estimate of direct genetic correlation of MW with WW was 0.66. Estimates of maternal heritability were 0.18 and 0.03 with a maternal genetic correlation of 0.96. Mature weight is a highly heritable trait that can be used to make important selection decisions. Furthermore, MW is highly correlated with WW, indicating that larger ewes will be more productive measured in lifetime kg of lambs weaned.

Key Words: Litter weight weaned, Lifetime production, Mature weight

12 Estimation of digesta kinetics of forage kochia and tall wheatgrass using Yb and Dy when fed alone or mixed together. A. R. Wall*, K. C. Olson, C. A. Stonecipher, M. Stuart, M. A. Maughn, and J. C. Malechek, *Utah State University, Logan.*

Little is known about the nutritional value of forage kochia (*Kochia prostrata*) for grazing beef cattle when mixed in low-quality forage diets. Our objectives were to evaluate digesta kinetics using different ratios of forage kochia and tall wheatgrass (*Agropyron elongatum*) and to examine the use of two rare earth markers to simultaneously measure the kinetics of each feedstuff. Five ruminally fistulated beef steers (mean BW = 504 kg) were allocated to 6 treatments in a 5×6 incomplete Latin square design. Treatments were arranged in a 3×2 factorial arrangement of diets (0:100, 50:50, and 100:0 of forage kochia and tall wheatgrass) and markers (Yb or Dy attached to kochia or wheatgrass). Steers were fed twice daily at 110% of mean intake over the previous 5 d. Steers were allowed a 12 d adaptation period. Feed intake and fecal output were measured during the following 7 d. After this, digesta kinetics were determined using pulse doses of Yb- or Dy-labeled forages. Rectal fecal grab samples were collected at 0 (before marker dose), 4, 8, 12, 16, 20, 24, 28, 32, 36, 42, 48, 54, 60, 72, 84, 96, 108, and 120 h post dosing. Data were analyzed in a Latin square-design in the MIXED procedure of SAS. Diet, marker, and forage did not interact ($P > 0.30$) for passage rate or retention time. As the amount of kochia increased in the diets,

passage rate increased linearly ($P = 0.0005$) and mean retention time decreased quadratically ($P = 0.0034$). Passage rate estimates tended ($P = 0.12$) to be higher using Dy than Yb, but retention time estimates did not differ ($P = 0.78$) between markers. Kochia tended to pass more quickly ($P = 0.11$) and have a shorter retention time ($P = 0.06$) than wheatgrass, regardless of the diet they were in. Kochia affects digestive tract kinetics in a low quality diet by increasing the rate of passage and decreasing retention time as the level of kochia increases in the diet. Two rare-earth markers can be used to simultaneously measure kinetics of two forages that are mixed in the diet.

Key Words: Beef cattle, Forage kochia, Rare earth markers

13 Effects of ovariectomization (OVX) and Synovex-Plus on the somatotropic axis in feedlot heifers. C. R. Bailey*, S. R. Sanders, G. C. Duff, S. P. Cuneo, C. P. McMurphy, S. W. Limesand, J. A. Marchello, and D. W. Schafer, *The University of Arizona, Tucson*.

A 2 x 2 factorial design was used to evaluate the effects of OVX and implantation (200 mg of trenbolone acetate and 28 mg of estradiol benzoate; Synovex-Plus) on performance, serum urea nitrogen (SUN), serum IGF-1 (SIGF), and mRNA expression of hepatic IGF-1 (HIGF), total growth hormone receptor (HGHR) and estrogen receptor alpha (HERA) as well as pituitary growth hormone (GH), estrogen receptor alpha (PERA) and growth hormone releasing factor (GRF). Thirty-two British x Continental heifers were randomly assigned to 1 of 2 gender groups (OVX or intact) and then to a non-implanted control (CON) or to receive a Synovex-Plus implant (IMP) and fed a 90% concentrate steam-flaked corn based diet for 42 d. Liver biopsies were taken prior to OVX for baseline expression of HIGF, HGHR and HERA which did not differ ($P > 0.45$). Blood and BW were taken on d 0, 28 and 42 and 1 animal/pen was slaughtered on d 42 for liver and pituitary samples. Initial and final BW did not differ due to gender or treatment ($P > 0.19$). No gender x treatment interaction was observed for ADG ($P > 0.24$) and gender did not affect ADG at d 28 or 42 ($P > 0.07$), but ADG was increased in IMP heifers at both d 28 and 42 ($P < 0.04$). No gender x treatment interaction was observed for SUN ($P > 0.16$). However, a three way interaction ($P < 0.01$) was observed for SUN, which decreased both linearly ($P = 0.04$) and quadratically ($P = 0.02$) with respect to d and was lower ($P = 0.02$) in IMP than CON heifers. Two and three way interactions were observed for SIGF ($P < 0.01$), which increased linearly ($P < 0.01$) with day and was higher ($P < 0.01$) in both intact and IMP than their respective counterparts. Neither gender nor

treatment affected HERA, HIGF, HGHR, GRF, GH, or PERA ($P > 0.06$). Data indicate that reductions in performance of OVX heifers can be eliminated through the use of an aggressive implant program. This is likely due to the implant related increase of SIGF, but the reason for this increase cannot be explained by mRNA expression in the present study.

Key Words: Gender, Implant, mRNA

14 Effects of supplemental safflower and vitamin E during late gestation on lamb growth and thermogenesis. J. M. Dafoe*, P. G. Hatfield, R. W. Kott, B. G. Sowell, J. G. Berardinelli, and K. C. Davis, *Montana State University, Bozeman*.

Twin bearing Targhee ewes ($N = 52$) were used in a 2 x 2 factorial arrangement of treatments to determine the effect of supplemental safflower (SS) and vitamin E (VE) on lamb growth and thermogenesis. Isocaloric and isonitrogenous treatments were: 226 g safflower seeds and either 350 (SSVE) or 0 IU vitamin E (SSVC), 340 g of a grain-based supplement (SC) and either 350 (SCVE) or 0 IU vitamin E (SCVC). Ewes were fed individually once daily the last 30 d of gestation. At 1 h postpartum, lambs from 42 ewes were placed in a 0°C dry cold chamber for 30 min. Rectal temperature was automatically recorded every 60 s. Blood samples were taken from lambs via jugular puncture immediately before and after cold exposure. Samples were analyzed for blood urea nitrogen (BUN), T3, T4, cortisol, and NEFA. Change during the 30 min cold exposure was calculated for each of these metabolites. Interactions were detected ($P < 0.10$) for NEFA and the repeated measure of lamb temperature. Body temperature was lower ($P = 0.7$) for SSVC than all other treatments. Serum BUN increased in SS lambs and decreased in SC lambs ($P = 0.01$). Change in serum T3 tended to be greater ($P = 0.13$) in SS than SC lambs. Cortisol, NEFA, and T4 did not differ ($P > 0.10$) among treatments. Supplemental vitamin E did not affect ($P > 0.47$) birth weight, 30 d BW, or BW at weaning (120 d). Although birth weight did not differ ($P = 0.50$) between SS and SC lambs, there was a tendency for ($P = 0.15$) heavier 30 d BW and heavier ($P = 0.10$) BW at 120 d for SC than SS lambs. In summary, lower body temperature in SSVC lambs at birth, and a greater change in BUN and T3 during the cold exposure for SS than SC lambs suggest that SSVC supplemented ewes gave birth to lambs with an apparent decrease in basal metabolic rate. This may compromise the newborn lamb's ability to adapt to extreme environmental conditions.

Key Words: Safflower, Thermogenesis, Vitamin E

Breeding and Genetics

15 Inheritance of facial hair whorl attributes in Holstein cattle. K. L. Shirley*, D. J. Garrick, T. Grandin, and M. Deesing, *Colorado State University, Fort Collins*.

Facial hair whorls are present on the forehead of most cattle but height of the whorl center (HT), location in relation to the midline (asymmetry, AS), and rotation (anti-clockwise or clockwise, ROT) vary considerably. Hair whorl attributes have been implicated as determinants of individual reproductive performance in bulls, left- and right-handedness in humans, and homosexual tendencies in men. These associations may

result from genetic and (or) developmental associations with whorl attributes. The objective of this study was to estimate genetic parameters for facial hair whorl in Holstein cattle ($n = 945$). Whorl attributes were collected by a single observer for 470 related bulls and 14 half-sib sire families where measures on dam and offspring were included. The pedigree included 112 sires and 617 dams and genetic parameters were analyzed in ASREML with sex as the sole fixed effect. Heritabilities for HT, AS and ROT were 0.54 ± 0.08 , 0.11 ± 0.06 , and 0.14 ± 0.07 , respectively. There was no evidence these traits were under simple genetic control as all mating combinations generated all offspring pheno-

types, although in slightly different proportions. Pairwise bivariate analyses generated estimates of phenotypic and genetic correlations between HT and AS of 0.04 ± 0.03 and -0.08 ± 0.24 , between HT and ROT of -0.04 ± 0.03 and -0.03 ± 0.22 , and between AS and ROT of 0.06 ± 0.03 and -0.07 ± 0.38 . Results indicated genetic control of HT, AS and ROT was independent. Bivariate analyses that examined anti- and clockwise rotations as different traits produced genetic correlations of 0.68 ± 0.24 for HT and 0.40 ± 0.58 for AS. Results suggest hair whorl height, asymmetry and rotation are moderately to highly heritable polygenic traits, whorl height and asymmetry are the same traits regardless of whorl direction, and different genes are involved in determination of each of these three attributes.

Key Words: Hair whorl, Heritability, Cattle

16 Genetic parameters of first lactation curve traits for Holstein-Friesian cows in Tunisia. B. Rezik¹, A. Ben Gara¹, and N. Medini², ¹ESA Mateur, Mateur, Tunisia, ²INAT, Tunis, Tunisia.

Genetic parameters of lactation curve traits were estimated for Holstein-Friesian cows in Tunisia. A total of 17,456 first lactation records collected from 1991 to 2002 in 137 herds were used in the analysis. Records were of daughters of 246 AI bulls with at least 50 progeny each. The Incomplete Gamma function was fit to test-day yields to determine curve traits: Factors a, b, and c representing the beginning of lactation, the increasing phase before peak yield, and the decreasing phase after peak yield, respectively; peak yield; and persistency. Heritability estimates were determined by ML and REML applied to a sire model that included herd, calving year, and calving month as fixed effects, and by Dam on daughter regression. Phenotypic correlations were estimated using residuals from the analysis of variance of the same model without the sire effect. Heritability estimates were 0.19, 0.26, 0.24, 0.26, 0.59, and 0.25 for a, b, c, total and peak yields, and persistency, respectively. Phenotypic correlations ranged from -0.78 (a with b) to 0.76 (total with peak yields). It should be possible to change the shape of the lactation curve through selection to improve yield production.

Key Words: Dairy cows, Lactation curve, Genetic parameters

17 Breed of the dam effects on carcass traits and shear force of beef cattle. D. C. Anderson^{1,2}, M. W. Tess¹, K. C. Davis¹, D. L. Boss², and D. D. Kress¹, ¹Montana State University, Bozeman, Montana, USA, ²Northern Agricultural Research Center, Havre, Montana, USA.

The effect of breed of the dam on carcass traits and shear force of progeny were evaluated over four years on 534 steers and heifers. Dam breeds included in the combinations were formed by mating Hereford(H), Tarentaise(T), Angus(A), Piedmontese(P), Salers(S), and Charolais(C) bulls to Hereford, Tarentaise, and Tarentaise-Hereford cross cows. Female calves produced from these matings were bred to Simmental, Gelbvieh, Angus, Red Angus, or Hereford sires producing steers and heifers evaluated for carcass traits and tenderness. Average calf age at harvest was 428 days. Data were analyzed with GLM procedures of SAS and the model included effects of year, age of dam, sex of calf, sire within year, treatment within year, and sex by treatment within year interaction. Covariates were age at harvest, percent individual heterosis,

percent maternal heterosis, and dam breed percentages. Breed of dam effects were expressed as deviations from Piedmontese. Traits analyzed were hot carcass weight (HCW), longissimus area (RIB), 12th rib fat (FAT), calculated yield grade (CYG), marbling score (MARB), and shear force to evaluate tenderness (SHEAR). Year was significant ($P < .01$) for all traits but age of dam had no effect on the traits analyzed. Steers were different from heifers ($P < .01$) with heavier HCW, greater CYG value, less MARB and greater tenderness (lower SHEAR values). Dam breed effects on hot carcass weight were lightest for P, H, and T with A, S, and C heaviest; on RIB, P were greater ($P < .01$) than H,T,A,S, and C; on SHEAR, P had the lowest value with T the greatest ($P < .01$); on FAT, P was less ($P < .01$) than H,T,A,S, and C. Deviations from P on SHEAR for H, T, A, S, and C were (0.47, $P = .20$), (1.05, $P < .01$), (0.38, $P = .23$), (0.58, $P = .06$) and (0.59, $P = .08$) kg, respectively. Piedmontese breed combinations had largest RIB, least FAT, and smallest SHEAR. Dam breed had significant effects on carcass traits.

Key Words: Beef cattle, Dam breed, Carcass traits, tenderness

18 Genetic correlations of component carcass traits with retail product percentage in Simmental cattle. D. H. Crews, Jr.^{1,2}, R. M. Enns², J. M. Rumph³, E. J. Pollak⁴, and R. L. Quaas⁴, ¹Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada, ²Colorado State University, Ft. Collins, ³Montana State University, Bozeman, ⁴Cornell University, Ithaca, NY.

The objective of this study was to estimate genetic parameters required for genetic evaluation of retail product percentage (PRP) in Simmental cattle. Carcass weight (HCW, $n = 6,558$), fat thickness (FAT, $n = 6,188$), longissimus muscle area (REA, $n = 6,527$), and kidney, pelvic, and heart fat (KPH, $n = 6,434$) records were available from steers ($n = 5,171$) and heifers ($n = 1,400$) in the American Simmental Association carcass database. Animals with carcass records were sired by 561 Simmental bulls and out of 5,889 crossbred dams, with percent Simmental breed composition ranging from 50 to 94%. Approximately three ancestral generations were used to construct the inverse relationship matrix among 49,766 animals. Genetic parameters were estimated using an animal model and REML with fixed harvest contemporary group effects (harvest date \times sex \times percentage Simmental [50, 62, 75, 94%], $n = 244$), random animal genetic effects, and a linear covariate for age at harvest (455 d, $SD = 50$). A five-trait model including all component carcass traits with PRP failed to converge due to linear dependencies of PRP with FAT and REA. Two three-trait models were then used to compute parameters among HCW, REA, and PRP (M1), and among FAT, KPH, and PRP (M2). Heritability estimates (± 0.05) from M1 were 0.51, 0.46, and 0.41 for HCW, REA, and PRP, respectively, and were 0.36, 0.18, and 0.41 for FAT, KPH, and PRP, respectively, from M2. Estimated genetic correlations of PRP with HCW, FAT, REA, and KPH were -0.16 ± 0.08 , -0.83 ± 0.03 , 0.68 ± 0.05 , and 0.01 ± 0.12 , respectively. Based on these estimates, PRP is strongly associated with genetic potential for muscle and fat deposition, but essentially independent of carcass weight and body cavity fat. Genetic evaluation of PRP would therefore be straightforward using multiple trait index methods to decrease the numbers of mixed model equations to be solved and to avoid a genetic (co)variance matrix among PRP and its components that is not positive definite.

Key Words: Genetic evaluation, Percent retail product, Simmental

19 Parameter estimates and breeding values for days to finish to a constant fat endpoint. B. W. Brigham¹, S. E. Speidel¹, D. W. Beckman¹, D. J. Garrick¹, S. Willmon², W. Vanderwert², and R. M. Enns¹, ¹Colorado State University, Fort Collins, ²American Gelbvieh Association, Westminster, CO.

Genetic predictions are typically calculated to a constant age endpoint. However in the feedlot industry, cattle are rarely fed and harvested to a constant age. This difference in production practices versus prediction endpoints may lead to inappropriate selection decisions. To compare these alternatives, carcass data was linearly adjusted to a constant fat endpoint, rather than age endpoint, with the outcome variable being days to reach that fat endpoint. Heritability was estimated and breeding values subsequently calculated for days to finish. Data from the American Gelbvieh Association included 6,672 animals with carcass data and 16,376 pedigree animals. Contemporary groups were formed using breed association CG code, harvest date, producer and sex of animal. Weaning weight direct and maternal effects were included in a multi-trait model. All data from each weaning contemporary group was included if any animal within the contemporary group had a carcass fat record. A total of 4,150 animals with weaning observations were included in the analysis of which 2,138 animals possessed a carcass fat observation. Estimates of genetic variances were 645, 2,183 and 364 for days to fat endpoint, weaning weight direct and weaning weight maternal respectively. Residual variances were 775 and 1,227 for days to endpoint and weaning weight direct respectively. Heritabilities were 0.45 (0.05) for days to constant fat endpoint, 0.58 (0.07) for weaning weight direct and 0.10 (0.03) for weaning weight maternal. The genetic correlation between weaning weight direct and days to constant fat endpoint was -0.29, indicating that genetically heavier cattle at weaning require fewer days to reach a constant fat endpoint. Aligning genetic predictions with industry practices is necessary to facilitate accurate genetic progress through selection.

Key Words: Beef cattle, Days to finish, Genetic evaluation

20 Insignificant re-ranking of sires for weaning weight in above- and below-average environments. S. E. Speidel^{*}, R. M. Enns, and D. J. Garrick, Colorado State University, Fort Collins.

Heritability estimates for maternal weaning weight have been shown to be higher in environments with restricted cow feed intake as opposed to environments with less limiting feed resources. Sires evaluated in better than average environments may re-rank in poor environments. The purpose of this study was to determine the magnitude of sire re-rankings when accounting for different heritabilities in different environments. Data from the Red Angus Association of America consisting of 91,061 cow weight observations and 23,243 calf weaning weight observations were used. In the first analysis, weaning weights were analyzed with a single trait model including random direct (D), maternal (M) and permanent environmental effects. Second, weaning weights were classified as occurring in a good (g) or poor (p) environment, depending upon their dam's weight change since the previous year, and then analyzed using a two trait model with random direct (Dg and Dp), maternal (Mg and Mp) and permanent environmental effects for both traits. Spearman rank correlation coefficients were calculated between breeding values from the single trait and the multiple trait model for all animals and for the 50 most accurate sires. For all animals, correlations were 0.96 (D and Dg), 0.97 (D and Dp), 0.94 (M and Mg), 0.96 (M and Mp), 0.99 (Dg

and Dp) and 0.97 (Mg and Mp). Correlations between the 50 most accurate sires were above 0.96 for all traits. These data have shown that while accounting for heterogeneous variance estimates for weaning weights in differing environments may be technically more appropriate, there was insignificant re-ranking of sires.

Key Words: Beef cattle, Weaning weight, Heterogeneous variance

21 Breed comparisons and trends for ewe productivity and lamb growth traits in sheep managed as contemporaries in a western range system. T. D. Leeds^{*} and G. S. Lewis, USDA, ARS, U.S. Sheep Experiment Station, Dubois, ID.

Ewe productivity and lamb growth traits are economically important for commercial sheep production systems, thus our objectives were to utilize retrospective data to characterize trends in performance and quantify breed differences for these trait types. Data were from purebred Columbia, Polypay, Rambouillet, and Targhee ewes and lambs from 27 yr of production beginning in 1978 at the U.S. Sheep Experiment Station near Dubois, ID. All breeds were managed for spring (shed) lambing, summer mountain grazing, and 120 d weaning. Genetic selection practices throughout generally emphasized increased litter weight weaned. Data were analyzed using general linear and mixed models to test for fixed effects of breed, age of dam, year, types of birth and rearing, lamb gender, and breed \times year interactions and the random effect of band (summer grazing). Breed least squares means (\pm SE) from 1978 for Columbia, Polypay, Rambouillet, and Targhee, respectively, were: number born alive per ewe lambing: 1.50 ± 0.04 , 1.82 ± 0.05 , 1.57 ± 0.03 and 1.49 ± 0.03 ; birth weight (kg) of live lambs: 4.4 ± 0.04 , 3.6 ± 0.04 , 4.2 ± 0.04 , and 4.4 ± 0.04 ; number weaned per ewe lambing: 1.42 ± 0.05 , 1.51 ± 0.05 , 1.39 ± 0.04 , and 1.35 ± 0.04 ; litter weight (kg) weaned: 44.4 ± 2.0 , 44.0 ± 2.1 , 38.9 ± 1.8 , and 41.7 ± 1.8 . Breed least squares means (\pm SE) from 2005 for Columbia, Polypay, Rambouillet, and Targhee, respectively, were: number born alive per ewe lambing: 1.79 ± 0.04 , 1.99 ± 0.03 , 1.73 ± 0.03 and 1.68 ± 0.03 ; birth weight (kg) of live lambs: 5.0 ± 0.04 , 4.2 ± 0.04 , 4.7 ± 0.04 , and 4.7 ± 0.04 ; number weaned per ewe lambing: 1.57 ± 0.05 , 1.63 ± 0.04 , 1.52 ± 0.05 , and 1.49 ± 0.04 ; litter weight (kg) weaned: 64.4 ± 2.1 , 58.8 ± 2.0 , 56.3 ± 2.0 , and 55.4 ± 2.0 . Coefficients for regression of trait least squares means on year were positive and different from zero ($P = 0.05$) for all traits within all breeds. Results of these analyses document progress in ewe productivity and lamb growth traits and provide Western range producers with the data necessary to make statistically valid breed comparisons.

Key Words: Sheep, Maternal, Genetics

22 Analysis of scrotal circumference adjusted for age or weight in Charolais field data. J. M. Rumph^{*} and R. E. Williams², ¹Montana State University, Bozeman, ²American-International Charolais Association, Kansas City, MO.

Records from 7,410 Charolais bulls were analyzed to determine if adjusting yearling scrotal circumference (SC) for weight or age results in different genetic parameters, ranking of animals, or genetic trends. Scrotal circumference was analyzed with direct genetic effects and residual as random effects and year and contemporary group as fixed effects. Contemporary group was defined as percent Charolais (<25, 25-50, 50-

75, 75-94, and >94%), breeder defined yearling management group, breeder defined yearling pasture, and breeder as fixed effects. A linear and quadratic covariate was included as an additional fixed effect to adjust for either age at measure (AGE) or yearling weight (YGW), depending on the model. Age was measured in days with bulls having to be between 320 and 410 days of age and yearling weight being recorded the same day as SC. Genetic parameters between the two models did not differ with estimates of direct heritability being 0.39 (0.04) and 0.38 (0.04) for AGE and YGW adjusted models, respectively. The Spearman Rank correlation for the EBV on the 26,117 animals in the pedigree was 0.90 ($P > 0.01$). Genetic trends were similar for both models with SC increasing at an average rate of 0.005 cm per year. Initial analysis of SC data shows that there is negligible difference if SC is adjusted to an age or yearling weight basis.

Key Words: Adjustments, Scrotal circumference, Yearling weight

23 Genetic parameters for stayability and body condition score in beef females. D. W. Beckman*, S. E. Speidel, B. W. Brigham, D.J. Garrick, and R. M. Enns, *Colorado State University, Fort Collins.*

Stayability (ST), the ability of a beef female to avoid culling, and body condition score (BCS) are both indicators of reproductive performance. Body condition scores are used to estimate energy reserves in beef

females. Scores 1 through 9 represent a continuum from emaciated to very fat, respectively. Stayability, defined as a binary trait, is achieved when females calve at both two and six years of age. The objective of this research was to estimate genetic parameters for BCS and ST and determine whether a relationship exists that would allow BCS to be used as an early indicator. Early indicators allow producers to make timely selection decisions on economically relevant traits that are not observed until later in the life of a beef female. Data and pedigree information came from the Red Angus Association of America (RAAA). Stayability and body condition score were analyzed as continuous traits. Three separate linear analyses were performed. Each contained fixed effects of body condition score (BCSCG) and stayability (STCG) contemporary groups. REML procedures were used to estimate random direct genetic and residual variances for BCS and ST from a two trait animal model. Separate bivariate analyses were conducted for ST and BCS at two (AGE2), three (AGE3), or four years of age (AGE4). Estimates of heritability (SE) for BCS were 0.15 (0.03), 0.12 (0.03), and 0.16 (0.04) for AGE2, AGE3 and AGE4 and for ST were 0.19 (0.05), 0.15 (0.04) and 0.08 (0.04). Genetic correlations between BCS and ST were -0.14 (0.17), -0.12 (0.18), and -0.22 (0.27) for AGE2, AGE3 and AGE4. The small correlations and large standard errors associated with the genetic correlation estimates imply any benefit from using BCS to predict ST may be small.

Key Words: Red Angus, Reproductive performance, Genetic correlation

Extension Symposium

24 Working together to achieve natural resource sustainability in central Oregon. C. Parsons*¹, G. Hudspeth², and J. Dedrick³, ¹*Oregon State University, Baker County Extension, Baker City, OR,* ²*Crook County Soil and Water Conservation District, Prineville, OR,* ³*Crooked River Watershed Council, Prineville, OR.*

Understanding natural resource management objectives is often confusing and daunting to livestock producers who are not intimately familiar with Government regulations and standards. In order to help livestock producers and natural resource management personnel understand these regulations and standards the Oregon State University Crook County Extension office worked collaboratively with the Crooked River Watershed Council and the Crook County Soil and Water Conservation District to provide annual educational workshops focusing on livestock management strategies aimed at improving and sustaining our natural resources. These educational programs were called "Cows and Creeks, Managing for Healthier Watersheds" and were held over a three year period focusing on different natural resource management issues relating to sustainable use of our natural resources by grazing livestock. Following these programs many local producers stopped in our respective offices asking for technical and financial assistance in implementation and installation of various management techniques that were discussed during the workshops. Collaboratively we were able to work together providing both the requested technical and financial assistance that the producers requested while implementing many resource conservation practices totaling over \$50,000 in on ground practices.

Key Words: Natural resources, Conservation practices, Sustainability

25 Dutchwoman Butte revisited: Examining paradigms for livestock grazing exclusion. J. Sprinkle*¹, M. Holder², C. Erickson², A. Medina³, D. Robinett⁴, G. Ruyle¹, J. Maynard⁵, S. Tuttle¹, J. Hays, Jr.¹, W. Meyer¹, S. Stratton⁶, A. Rogstad¹, K. Eldredge⁷, J. Harris⁵, L. Howerly¹, ¹*University of Arizona, Tucson, AZ,* ²*Gila County Cattlegrowers, Tonto Basin, AZ,* ³*Rocky Mountain Research Station, Flagstaff, AZ,* ⁴*Natural Resources Conservation Service, Tucson, AZ,* ⁵*Southwest Resource Consultants, LLC, Las Cruces, NM,* ⁶*Natural Resources Conservation Service, Chandler, AZ,* ⁷*Arizona State Land Department, Pinetop, AZ,* ⁸*Tonto National Forest, Phoenix, AZ.*

In 2000, a collaborative rangeland monitoring program was established with the University of Arizona, Gila County Cattlegrowers, and the Tonto National Forest. Dutchwoman Butte (DWB) is an isolated, ungrazed 40 ha mesa with relict vegetation. Our objective was to contrast the vegetation of DWB to that of a grazed site, Whiskey tank (WT), across multiple years (2001, 2003, 2004, and 2005). Data were collected for plant frequency, botanical composition (dry weight rank procedure), ground cover, and distance to the nearest perennial plant base (fetch). In 2001, DWB had 42% composition from perennial grasses. In 2003, the total species composition from perennial grasses was 2.0% and in 2004 and 2005, 6.5% and 2.1%, respectively. On WT, the composition from perennial grasses was 57% in 2001, 19% in 2003, 45% in 2004, and 37% in 2005. The dominant grass species present on DWB in 2001 was green sprangletop (*Leptochloa dubia*; 24% frequency) and sideoats grama (*Bouteloua curtipendula*; 22% frequency). The dominant grass species present on WT in 2001 was curly mesquite (*Hilaria belangeri*; 37% frequency) and sideoats grama (20% frequency). Hairy grama frequency (*Bouteloua hirsuta*) in 2001 was similar ($P > 0.05$) on

both sites (14% on DWB and 13% on WT), decreased ($P < 0.05$) at both sites in 2001, but recovered ($P < 0.05$) at WT in 2004 to 19% while remaining less than 1% at DWB. In 2005, hairy grama frequency was still greater ($P < 0.05$) at WT than at DWB (10 vs 1%). Sideoats grama was similar on both sites in 2001 ($P > 0.05$) but decreased ($P < 0.05$) at both sites in 2003 and never increased above 6% during the trial. Curly mesquite frequency at WT in 2005 was similar ($P > 0.05$) to that observed in 2001, being 40% in 2005 and 37% in 2001. Green sprangletop on DWB was less ($P < 0.05$) in 2005 than in 2001 (3 vs. 24%). Fetch was less ($P < 0.05$) on DWB than on WT in 2001 (10.9 ± 0.71 vs. 13.0 ± 0.89 cm), but was greater ($P < 0.05$) than at WT from 2002 to 2005. The WT site appeared more resilient to drought than DWB and the greater presence of low growing sod forming species like curly mesquite could have aided in drought recovery at WT.

Key Words: Cooperative extension, Rangeland monitoring, Grazing

26 Digital imagery and landscape-scale rangeland monitoring. J. B. Taylor¹, D. T. Booth², and C. M. Moffet¹, ¹USDA, ARS, U. S. Sheep Experiment Station, Dubois, ID, ²USDA, ARS, High Plains Grasslands Research Station, Cheyenne, WY.

Monitoring is critical when manipulating rangeland ecosystems toward a desired goal. Unfortunately, cost and/or logistics may limit a rangeland manager's choice of monitoring tools. Ultimately, such tools must be affordable and provide rapid, accurate, and precise information that can be used to determine the status and effectiveness of management strategies. In October 2005, USDA-ARS scientists from the High Plains Grasslands Research Station (Cheyenne, WY) and the U. S. Sheep Experiment Station (USSES; Dubois, ID) hosted a rangeland monitoring workshop titled "Successfully Using Digital Imagery and Vegetation Analysis Software." The workshop goals were to demonstrate the use of and to transfer digital imagery technologies that enable rangeland managers to obtain meaningful data quickly and efficiently on a landscape-size scale. In attendance, were field technicians and regional administrators from the USDA-Forest Service, Department of Interior (DOI) Bureau of Land Management, DOI-U. S. Fish and Wildlife; state and local coordinators of weed management cooperatives in Montana and Idaho; and range technicians from Montana State University. The ARS scientists discussed the use of high-resolution digital imagery, obtained on the ground or from a fixed-winged aircraft, combined with various vegetation-measurement software packages to determine 1) vegetation response to fire, grazing, and herbicide treatments, 2) herbivore selectivity, and 3) distribution of exotic weeds across extensive landscapes. Both in the classroom and field, these technologies were demonstrated to be quickly applied and generate data that can 1) represent large and small landscapes, 2) be analyzed immediately or during the off-season, and 3) be stored for an indefinite period of time without loss of quality. Vegetation analysis software (freeware), technology instruction bulletins, validation literature, and contact support information were given to the participants.

Key Words: Rangeland, Monitoring, Imagery

27 Vegetative management using controlled sheep grazing – The Montana Sheep Institute. L. M. M. Surber^{*1}, R. W. Kott¹, J. D. Moore¹, B. L. Roeder¹, G. Hewitt¹, J. Smith², and K. Williams³, ¹Montana State University, Bozeman, ²Powell County Weed District, Deer Lodge, MT, ³Custer County Extension, Miles City, MT.

Sheep may provide the most economical and environmentally sound alternative to chemical control of the encroachment of noxious weeds. The Montana Sheep Institute's objective is to develop, implement and evaluate controlled sheep grazing strategies for managing large infestations of leafy spurge (*Euphorbia esula*) and spotted knapweed (*Centaurea maculosa*). Suitable sites located throughout Montana were identified, after which a sheep grazing plan was developed and initiated for each specific site. Prior to the initiation of the study, planning meetings were held that included the landowners, sheep producers, county agents, weed supervisors, agency groups such as the Bureau of Land Management, and the Montana Sheep Institute and partnerships developed. Photo and vegetative production monitoring were performed prior to sheep grazing. Monitoring was also done on approximately the same date every calendar year in order to capture the vegetation in a similar stage of growth each year. A transect was placed from the photo plot and five 50 x 50 cm quadrants located and clipped. Three paired plots with individual plots within each pair visually selected to be similar in soil, topography and vegetative type, per research site were established. Prior to sheep grazing, an enclosure was placed on one plot within each pair and after grazing plots were sampled to establish utilization of target weed vs. other forage. Photo plot data from a total of eight sites indicated the composition of leafy spurge decreased and grass increased at sheep grazing sites. Following the summer grazing season meetings were held with all stakeholders to discuss results of monitoring, potential successes and opportunities for improvements. Leafy spurge composition decreased ($P < 0.01$) by 9 % per year of grazing while the grass component increased ($P < 0.01$) by 10 %. Utilization data from 22 sites throughout Montana demonstrated 50 – 70 % utilization of noxious weed and only 30 – 40 % utilization of grasses. Over time this type of grazing should favor the re-establishment of grass and forb component of the landscape.

Key Words: Sheep grazing, Vegetative management, Noxious weeds

28 Using pre-weaning and post-weaning variables to predict carcass quality. J. S. Davy^{*}, D. J. Drake, J. W. Oltjen, and A. L. Van Eenennaam, *University of California, Davis.*

A preliminary study was conducted to determine which pre- and post-weaning variables most contribute to predicting carcass quality (rib eye area, back fat and marbling) in a standard commercial production setting with variable treatment of animals. Data from 46 British crossbred steers and heifers reared on a Northern California ranch were grouped into three categories: pre-weaning data (birth weight, weaning weight, weaning age, sire, and sex), post-weaning through harvest data (sex, feedlot in-weight, average daily gain, days on feed, harvest age, carcass weight, and time of year when put on feed), and a group with all data combined. Calves from dams that were not artificially inseminated were DNA tested to determine their sire. The mean weaning weight of all calves was 189 kg with a standard deviation of 20 kg. Carcass weights averaged 309 kg with a standard deviation of 18 kg. Rib eye area, back fat, and marbling score had means of 69.5 cm², 5.4 mm, and 6.5 with standard deviations of 4.6 cm², 1.0 mm, and 0.5, respectively. Using a

linear statistical model R² for rib eye areas were: 0.73 for pre-weaning variables, 0.86 for post-weaning variables, and 0.97 for all variables combined. Back fat R² values were 0.59 for pre-weaning, 0.36 for post-weaning, and 0.85 for combined variables. Marbling score R² values were 0.44 for pre-weaning, 0.43 for post-weaning, and 0.74 for all variables combined. Root mean square errors for the model with all variables combined were 1.8 cm², 0.8 mm, and 1.5 for rib eye area, back fat and marbling, respectively. Variation in rib eye area was best accounted for in the models. Little potential was shown for prediction of marbling score or back fat from only pre-weaning and post-weaning data. Prediction values improved when all variables were combined. Results of this preliminary study indicate that common production variables from both pre- and post-weaning are of limited usefulness in explaining variation in carcass quality. Further studies will investigate how much additional variation can be accounted for by using ultrasound measures near or after weaning.

Key Words: Carcass quality, Production data, Beef production

29 Survey provides information on cow-calf handbook use and value. J. B. Glaze, Jr.¹, J. W. Oltjen², and D. J. Drake², ¹University of Idaho, Twin Falls, ²University of California, Davis.

The Cow-Calf Management Guide & Cattle Producer's Library is an educational resource for beef cattle producers. Available in loose-leaf and CD-ROM formats, the 937-page guide has 246 fact sheets which are divided into sections: Quality Assurance, Nutrition, Reproduction, Range and Pasture, Animal Health, Management, Marketing, Finance,

Genetics, and Drought. The handbook is the result of research and practical experience by members of the Western Beef Resource Committee (WBRC), which is a collaboration of state and county Extension faculty from the 12 western states. The WBRC meets annually to support fact sheet revisions, additions, and deletions. All fact sheets are peer reviewed before they are accepted in the handbook. Since the release of the Second edition in October 1992, in excess of 6,000 copies have been distributed to users in 42 states and eight countries. In 2005, a mail-in survey was conducted to gauge the use and value of the Cow-Calf Management Guide & Cattle Producer's Library. An eight-question survey was mailed to every (n=961) current handbook subscriber. Subscribers are individuals that keep their handbook current through purchased updates. Twenty-five percent (n=239) of handbook subscribers responded to the survey. Handbook users can be categorized as producers (53%), Extension faculty (30%), allied industry representatives (6%), students (3%), and agency employees (1%). The percent of handbook users owning 0 to 50, 51 to 200, 201 to 500 and more than 500 cattle was 43%, 23%, 19%, and 16%, respectively. The percent of respondents citing the frequency of handbook use as daily, weekly, monthly, and quarterly, was 2%, 19%, 42%, and 37%, respectively. The handbook format was preferred by users over the CD-ROM format (74% vs. 24%). A web version of the handbook has been considered. Thirty-one percent of respondents were in favor of, and sixty-four percent were against paying a web subscription fee. Current price of the handbook is \$95.00 which was cited as accurate by seventy-seven percent of respondents. Respondents rated the nutrition, animal health, reproduction, range and pasture, and management sections as the top five based on use.

Key Words: Handbook, Beef cattle, Survey

POSTER PRESENTATIONS

30 Effects of early weaning on cow performance, grazing behavior, and winter feed costs in the intermountain west. D. W. Bohnert¹, D. C. Ganskopp², D. D. Johnson², S. J. Falck², M. L. Merrill*¹, and A. A. Clark¹, ¹Oregon State University, Burns, ²Eastern Oregon Agricultural Research Center, USDA-ARS, Burns, OR.

Our objective was to determine the influence of early weaning (EW) and traditional weaning (TW) on cow performance and grazing behavior in a 2 yr study. In addition, cow winter feed costs were compared. Each year, 156 cow/calf pairs (78 steer calves and 78 heifer calves) were used in a randomized complete block design. Cows were stratified by calf sex, BCS, and age and assigned randomly to one of two treatments (TRT) and one of three 810-ha pastures. Two cows from each TRT and pasture were fitted with global positioning system collars each year (6 cows/TRT/yr) to evaluate grazing behavior. The EW calves were removed from dams at approximately 130 d, while TW calves grazed with their dams until approximately 205 d of age. All cows were removed from pastures following TW and placed in six separate 25 ha pastures.

The same cow groups (blocks) remained intact; however, EW and TW cows were separated and randomly allotted to pastures. All cows were fed to attain a similar BCS (minimum of 5) by approximately 1 mo prior to calving. The TW cows lost 0.8 BCS and 40 kg while the EW cows gained 0.1 BCS and 8 kg from EW to TW (P < 0.01). After winter feeding (approx. 110 d), there was no difference between EW and TW cow BCS (P = 0.52). However, winter feed costs were \$29 greater (P < 0.01) for TW compared with EW cows. Grazing time, distance traveled, and number of visits to water were unaffected (P > 0.10) by TRT. However, the proportion of each pasture visited by EW cows tended to be greater than that of TW cows (P = 0.08). Results indicate that EW improves cow BCS entering the winter feeding period, thereby, decreasing winter feed costs. Cow grazing behavior was minimally affected by weaning treatment.

Key Words: Alternative, Economics, Management

31 Vitamin D supplementation in fall born Rambouillet lambs raised on small grain pastures. J. M. Self¹, M. W. Salisbury*¹, B. J. May¹, G. R. Engdahl¹, C. B. Scott¹, and R. Horst², ¹Angelo State University, San Angelo, TX, ²National Animal Disease Laboratory, Ames, IA.

During preliminary data collection it was determined that lambs grazing lush small grain fields during the winter months are deficient in total vitamin D plasma concentrations. Should deficient conditions exist it could impede proper bone growth and formation. Therefore, this study was designed to determine if vitamin D supplementation shortly after birth would prevent vitamin D deficiencies in lambs grazing small grain pasture during the winter months in West-Central Texas. Forty Rambouillet lambs, born between October 15 and December 1, were blocked by sex and randomly assigned to 1 of 3 treatment groups. Treatment 1 received no vitamin D supplementation (placebo), Treatment 2 received 250,000 IU injections of vitamin D at day 14 and 42; Treatment 3 received 500,000 IU injection of vitamin D at d42. Weights and plasma vitamin D were measured at d14, 42, 68, and 90 after birth. There were no differences in weight gains, plasma vitamin D3 or total plasma vitamin D concentrations on d14 ($P>0.05$). However, lambs supplemented on d14 had higher ($P<0.05$) total plasma vitamin D concentrations on d42 than both the control and treatment 3 lambs. Both supplementation treatments were higher ($P<0.05$) than the control on d68 and 90. Data suggests that supplementing with vitamin D will correct vitamin D deficiencies in fall born lambs grazing small grain fields.

Key Words: Rambouillet, Vitamin D, Bent leg syndrome

32 Fenceline weaning and forage barley to extend the grazing season for replacement heifers. R. J. Pruitt*, W. B. Epperson, V. N. Owens, and A. J. Smart, South Dakota State University, Brookings.

In a 3-yr study an average of 47 heifers/year were allotted to two weaning treatments in early October to evaluate fenceline weaning on pasture and forage barley as an alternative to drylot weaning. The pasture-weaned group (P) was separated from their dams and grazed grass pasture across the fence from their dams for 2 wk. Then, until early December, they grazed Robust barley that was planted into oat stubble in early August. The drylot-weaned group (DL) was transported to a drylot and received grass hay, corn and protein supplement that provided .73 kg CP and 14.5 Mcal ME/day. All heifers were managed as one group from December to April. The impact of treatment on weight gain was dependent on year ($P < .05$). In year 1, P gained more than DL during the first 2 wk after weaning ($P < .10$). In year 2, DL out gained P at 2 and 4 wk after weaning ($P < .05$). Gain from weaning to December and April was not affected by treatment in year 1 or 2. In year 3, P gained less than DL from weaning to early December ($P < .05$). In April, P weighed 23 kg less than DL ($P = .05$). Typical weaning behavior (walking the fence and bawling) was observed for DL. The P group appeared to be less stressed. No disease symptoms were observed for either group. Response to weaning vaccination was measured by IBR and BVD type 1 and 2 titers at 2 and 4 wk after weaning. There was a year x treatment interaction ($P = .06$) for BVD type 1 titer at 2 wk. In year 2, DL had a higher mean BVD type 1 titer than P (136.9 versus 73.1; $P = .06$). Titer values were similar at 4 wk. BVD type 2 and IBR titers were not affected by treatment. The P heifers had less rib fat ($P < .001$), smaller rib eye area ($P < .001$), and lower %IMF ($P = .02$) as measured by ultrasonography in April. Fenceline weaning on pasture combined with small grain pasture is a feasible alternative for managing

replacement heifers compared to traditional drylot weaning. Weaning management has potential to impact response to vaccination.

Key Words: Weaning, Heifers, Barley

33 Corn germ as a source of supplemental fat for cows in late gestation. R. J. Pruitt*, J. A. Clapper, W. B. Epperson, and G. A. Perry, South Dakota State University, Brookings.

To evaluate corn germ as a source of supplemental fat, cows at one location in year 1 and two locations in year 2 were allotted by age, breed and projected calving date to two treatments. Starting approximately 50 d prior to the first expected calving, cows received grass hay free choice and were supplemented with either corn germ (CG, 1.25 kg DM) or soybean meal (SBM, 0.36 kg DM) to provide an equal amount of CP. Within 24 hr after calving, cows were individually removed from treatment and managed as a single group (within location) until weaning in the fall. Within location, cows grazed a common pasture, from approximately 14 d prior to the breeding season until weaning. Treatment did not affect cow weight change. Corn germ did not improve any measure of reproduction. Calf performance, calf health, or measures of colostrum absorption (total serum protein or IgG of blood samples collected 24 to 48 hr after birth) were not influenced by treatment. The results were similar whether all age groups were included in the analysis or when data for only 2- and 3-yr old cows were included in the data set. Under the conditions of this study there was no advantage to feeding supplemental fat from corn germ during late gestation.

Table 1.

	CG	SE	SBM	SE	P =
No. of females	127		128		
Initial weight, kg	624	14	630	14	0.79
Cow ADG to post-calving weight, kg	-0.51	0.19	-0.55	0.19	0.90
Calving to cycling, d	66.9	8.9	68.4	9.1	0.91
Calving to conception, d	88.4	2.3	88.1	2.3	0.97
% pregnant	92.6		94.3		0.58
Calf birth weight, kg	39.8	1.4	39.0	1.4	0.71
Calf ADG to weaning, kg	1.14	0.05	1.13	0.05	0.90
Calf total serum protein, g/dl	6.6	0.2	6.6	0.2	0.95
Calf IgG, mg/dl	4951	323	5444	335	0.38
% calves treated, birth to yearling	7.6		6.8		0.82

Key Words: Beef cows, Corn germ, Reproduction

34 Reproductive wastage and lamb survival of Western White Face sheep grazing rangelands. R. R. Redden*, S. H. Cox, M. R. Rubio, and T. T. Ross, New Mexico State University, Las Cruces.

The objective of the three year study at the New Mexico State University Corona Range and Livestock Research Center was to identify the periods at which reproductive wastage are greatest. Western Whiteface Ewes were randomly divided into four similar pastures in 2003, 2004,

and 2005. Rams were assigned to each treatment at a rate of less than 25 ewes per ram for a breeding season of 34 to 40 d. In 2005, ovulation rates were measured in eight randomly selected ewes from each pasture via mid-ventral laparotomies 28 d after the breeding season began. Each year, one week before expected lambing half of the ewes from each pasture were randomly selected and brought in the corrals to be shed lambed in order to estimate the number of lambs born per ewe. Lambs born to the shed lambing ewes were ear tagged, weighed, and returned to their original pasture within 24 h of birth. Approximately 55 d after onset of lambing, lambs were docked, castrated, weighed, and ear tagged (pasture born lambs). Lambs were weaned at about 150 d after lambing began and all lamb IDs and weights were recorded. Across all pastures and years potential lamb survival averaged 134, 121, and 113 percent of ewes exposed to rams for birth (shed lambing), marking, and weaning rates, respectively. Shed lamb survivability at birth was greater ($P < 0.001$) than shed lamb survivability at marking and weaning. Lamb survivability was similar from marking to weaning for both pasture ($P > 0.5$) and shed lambs ($P > 0.10$). Ovulation rates (1.75 CL per ewe) were greater ($P < 0.01$) than birth, marking, and weaning rates for 2005. Assuming ovulation rates represent potential lambs, combining prenatal and pre-marking lamb loss a total of 35 % potential lambs were absent at weaning.

Key Words: Lamb survival, Rangelands, Sheep

35 Effect of early weaning and retained ownership on cattle performance, forage disappearance, and annualized net return in a spring-calving beef system. D. G. Landblom¹, S. Paisley², S. Fausti³, P. Johnson³, R. Gates³, R. Salverson³, and H. H. Patterson⁴, ¹North Dakota State University, Dickinson, ²University of Wyoming, Laramie, ³South Dakota State University, Rapid City, ⁴Padlock Ranch, Rancho, WY.

Weaning calves early impacts beef systems. The objective of this two-year three-state study was to evaluate the effects of August weaning (AW) versus November weaning (NW) on cow and calf production traits, forage utilization, and economics. Five hundred-five cow-calf pairs from the NDSU-Dickinson RE Center (DREC; $n=176$), SDSU-Antelope Station (ANT; $n=136$) and the University of Wyoming (UW; $n=193$) were stratified by BW and body condition score (BCS) and assigned to either AW (~140 d of age) or NW (~215 d of age). Cows grazed native range between the two weaning dates. At AW date, a subset of cows from each treatment at DREC were randomly assigned to six 20-ha. pastures ($n=3$ /treatment) to measure biomass disappearance between AW and NW dates. Steer calves at ANT and DREC were weaned and backgrounded 7.4 wk and finished in a commercial feed yard. Steers at UW were backgrounded 42 d and finished on site. Treatment by location interactions were detected for cow BW change, BCS change, calf ADG, and gain:feed. At each location, AW cows lost less weight ($P < 0.01$) than NW cows. Similarly, cow BCS change was improved ($P < 0.01$) for AW vs. NW at DREC (0.91 and -0.55), and ANT (0.34 and -0.02). At UW BCS change did not differ (0.22 and 0.47). Biomass disappearance, between weaning dates, was reduced by 27.7% ($P=0.15$) when calves were AW. AW steers at DREC had higher ($P < 0.01$) ADG during backgrounding than NW; AW steers at DREC and ANT were more feed efficient ($P < 0.01$). During finishing, AW steers grew slower ($P < 0.01$), but were more efficient ($P < 0.01$). On average, at all locations, NW steers entered the feedlot heavier ($P < 0.01$) and required less days ($P < 0.01$) on feed to harvest; however, AW steers were 46 days younger at harvest. Early weaning lowered feedlot cost/calf and regres-

sion analysis suggests a positive effect on annualized rate of return. Weaning early reduced forage utilization, improved cow BW and BCS, improved backgrounding performance and finishing FE, reduced age at harvest, yielded similar finishing performance, and increased annualized rate of return.

Key Words: Early weaning, Forage disappearance, Annualized return

36 Alternative supplementation strategies for replacement beef heifers grazing dry California foothills annual range or irrigated pasture during summer. R. B. Monteiro*, G. D. Cruz, D. M. Myers, J. Maas, J. W. Oltjen, and R. D. Sainz, *University of California, Davis, Davis.*

California's foothill rangelands make up the primary forage source for the state's range livestock industry and are characterized by marked seasonal variations in forage availability and quality. Feed supplementation to correct deficiencies in protein, energy and minerals is essential to maintain adequate growth rates and achieve early reproductive maturity. The objective of this research was to evaluate different types of supplementation for weaned heifer calves grazing dry range or irrigated pastures. The supplements were: a commercial molasses-based tub supplement (COM-DR; 20% CP), or a low-cost protein/energy/mineral formulation (UCD-DR; 58% CP) for dry range; and trace mineral salt (TMS-IP; 0% CP) or a protein/energy/mineral supplement (UCD-IP; 20% CP), for irrigated pasture. One hundred twenty weaned replacement Angus-Hereford heifers (259 ± 4.2 kg BW) were stratified by BW and allocated randomly to 12 groups in a $2 \times 2 \times 3$ design: two pasture types: irrigated or dry range; and two supplement types for each pasture type, with three replicate groups of 10 heifers for each treatment. Heifers were given supplements weekly (TMS), every 3 d (UCD-DR and UCD-IP) or every 20 d (TUB) for 70 d. Supplement intakes averaged 740, 350, 30 and 950 g/d for the COM-DR, UCD-DR, TMS-IP and UCD-IP groups, respectively. Heifers' ADG were 121, 274, 440 and 611 g/d for the COM-DR, UCD-DR, TMS-IP and UCD-IP groups, respectively ($P < 0.05$). Providing protein supplementation to heifers improved ADG on both low-quality (dry) and high-quality (irrigated) forage. On dry range the UCD-DR supplement was superior ($>2X$, $P < 0.05$) to a commercial tub supplement, at much lower (1/3) cost. With appropriate feeders the UCD supplements can be fed free choice to improve calf performance and reduce costs of production.

Key Words: Beef heifers, Grazing, Supplementation

37 Metabolic hormone profiles in Rambouillet lambs during the preweaning period. M. J. McBee*, R. L. Knight, J. M. Benavidez, L. D. Abercrombie, and D. M. Hallford, *New Mexico State University, Las Cruces.*

Rambouillet lambs (21 singles, 54 multiples) were used to examine effects of gender and type of birth (TOB) on growth and serum concentrations of triiodothyronine (T3), thyroxine (T4), IGF-1, and prolactin (PRL). Lambs (32 males, 43 females; birth date = March 24, d 0) were weighed on d 0 (5.1 ± 0.2 kg) and at weaning (60 d, 20.4 ± 0.2 kg). Serum was collected on d 1, 14, 28, 42, and at weaning. No gender x TOB interactions were detected ($P > 0.30$). Males were heavier at birth than female lambs ($P = 0.02$), but weaning weight and ADG were similar ($P > 0.20$). Single lambs were heavier ($P < 0.001$) at birth and weaning than multiple-born lambs. Likewise, ADG was greater ($P < 0.001$) in single

than multiple-born lambs (0.33 and 0.23 ± 0.01 kg/d, respectively). Gender x TOB and gender x TOB x day interactions were not observed (P > 0.20). Male and female lambs had similar (P > 0.30) serum T3, T4, and PRL (gender x day, P > 0.15). Male and female lambs had similar (P > 0.17) IGF-1 on d 1 and 14; but on d 28, 42, and at weaning, males had greater (P < 0.01) IGF-1 than did females. Single lambs had elevated (P < 0.01) T4 (TOB x day, P = 0.98) compared with multiple-born lambs. Serum T3, PRL, and IGF-1 were influenced (P < 0.03) by TOB x day interactions. Compared with multiple-born lambs, singles had elevated (P < 0.02) serum T3 on d 1, 14, and 28, but values were similar (P > 0.20) on d 42 and at weaning. Serum IGF-1 was similar (P = 0.18) between birth types on d 1 but was greater (P < 0.01) in singles on other sampling days. Serum PRL was similar (P > 0.15) between birth types through d 28 but was increased (P < 0.04) in singles on d 42 and at weaning. In general, T3 and T4 declined (linear, P < 0.01) from birth to weaning while PRL and IGF-1 increased (quadratic, P < 0.01). Serum T3 on d 1 (r = 0.60) and IGF-1 on d 42 (r = 0.64) were related (P < 0.0001) to weaning weight. Preweaning serum hormones are influenced by gender, TOB, and age, and early postnatal concentrations appear related to growth characteristics.

Key Words: Sheep, Growth, Hormones

38 The effects of breed type and growing program on feedlot performance and fat gains in beef steers. D. I. Jones*, F. R. C. Araujo, F. R. B. Ribeiro, M. J. Yokoo, A. C. Sanches, J. W. Oltjen, and R. D. Sainz, *University of California, Davis.*

In order to study the impact of energy restriction during the growing phase on subsequent fat development, 60 Angus x Hereford (BX) steers averaging 225 kg and 9 months of age and 60 Gelbvieh x (Angus x Hereford) (GX) steers averaging 250 kg and 10 months of age were stratified within biological type by weight and hip height and assigned to one of two dietary treatment groups. Moderate (M) and Low (L) dietary groups were fed to gain 1.50 and 0.90 kilograms per day, respectively, until reaching 327 kg (BX) or 354 kg (GX). Growing diets contained 11% crude protein and 1.32 (L) and 1.59 (M) Mcal NEm/kg DM. At that point, all animals were placed on a high-energy ration (2.22 Mcal NEm/kg DM) and fed until they reached 12 mm backfat. Backfat (UFAT) and intramuscular fat (UPFAT) were determined by real-time ultrasound at the 12-13th rib. Steers were fed in group pens (10/pen), and the pen was used as a replicate in all analyses. Average days on the high-energy rations during the finishing phase were 157, 79, 199, and 94 for BX-L, BX-M, GX-L and GX-M respectively. During the growing phase, GX steers had greater DMI and ADG than BX steers (P < 0.001), with no difference in gain:feed. Animals in the M dietary group had greater DMI, ADG and gain:feed in the growing phase than those in the L group (P < 0.001). In the finishing phase, BX steers had greater ADG and gain:feed than GX steers (P < 0.05), as well as more rapid gains of UFAT (P = 0.003) and UPFAT (P < 0.10) than GX steers. Also, the L dietary groups had lower UFAT and UPFAT gains than the M groups (P = 0.005). During the finishing phase, the L dietary groups required an increased number of DOF and also exhibited a reduced gain:feed ratio when compared to the M dietary groups. Growing program did not affect DMI or ADG during the finishing phase. However, the L dietary groups showed reduced rates of backfat and marbling fat deposition during the subsequent (finishing) phase (P = 0.005), supporting the hypothesis that energy restriction during the growing phase impairs adipose tissue development and fat accretion during finishing.

Key Words: Beef cattle, Growing program, Fat accretion

39 Organic Zinc in diets for weaned pigs. M. Muniz¹, D. Berto¹, F. Wechsler¹, C. Fracaroli¹, A. Passos², G. Lima³, and V. Castro¹, ¹UNESP, Botucatu, São Paulo, Brasil, ²Tortuga, São Paulo, São Paulo, Brasil, ³Embrapa, Concórdia, Santa Catarina, Brasil.

Zinc, in the form of ZnO, has been largely used as a promoter of growth among piglets. This leads to a zinc excess over the nutritional requirement and increases the zinc output through the manure. Different studies indicated the possibility of reduction in trace mineral levels of diets using organic minerals. The objective of this study was to compare different levels of Organic Zinc to ZnO added to pig diets. Ninety 21-day-old pigs, male and female, were used in a randomized block design with five treatments (0, 300, 600, 900 ppm of Organic Zinc and 2400 ppm of ZnO) and six replicates. Data were collected in four periods (0-15; 0-21; 0-35 and 0-42 days of the experiment). There was no treatment effect on feed conversion (FC) among different periods (P > 0.10). Higher levels of Organic Zinc had a linear effect on average daily feed intake (ADFI, P < 0.01) and average daily weight gain (ADG, P < 0.01) for the 0-15 day period, on ADFI (P < 0.01) and ADG (P < 0.05) for the 0-21 day period and ADFI (P < 0.07) for the 0-35 day period. The treatments 900 ppm of Organic Zinc and 2400 ppm of ZnO were not different (P > 0.05) for ADFI in the 0-42 day period, ADG in the 0-35 day period and ADG in the 0-42 day period. Incidence of diarrhea (ID) was evaluated in the 0-15 day period of the experiment and was lower (P < 0.05) in the animals fed the 2400 ppm ZnO treatment. In conclusion, animals fed ZnO had better performance than animals fed any of the Organic Zinc diets. However, the linear response among these treatments suggests that a higher Organic Zinc level than 900 ppm may promote an equivalent result to ZnO.

Table 1. Performance of pigs feed Organic Zinc and ZnO.

Period	Item	Organic Zinc	Organic Zinc	Organic Zinc	Organic Zinc	ZnO	CV
(days)	(ppm Zn)	0	300	600	900	2400	(%)
0-15	ADFI*(g)	209b	235b	233b	278b	331 ^a	11.90
	ADG*(g)	141b	142b	159b	190b	235 ^a	17.90
	FC	1.59 ^a	1.69 ^a	1.46 ^a	1.47 ^a	1.42 ^a	17.90
0-42	ADFI(g)	628b	692b	669b	713a	800a	10.20
	ADG(g)	359b	378b	390 ^a	396 ^a	457 ^a	11.90
	FC	1.76 ^a	1.83 ^a	1.72 ^a	1.80 ^a	1.75 ^a	4.70
0-15	ID(%)	24.90b	23.16b	19.03b	20.47b	0.56 ^a	50.80

(*)Linear; a,b—Means in the same line with different letter are different (Dunnnett-Hsu - P < 0.05).

Key Words: Pigs, Zinc, Performance

40 A study of sweet (Surumi, Patacamaya, Sayana, Chucapca) and bitter (Real) Bolivian quinoa cultivars compared to corn, barley, and oats on the growth of improved Guinea pigs. R. N. Pate¹, N. P. Johnston¹, E. Rico², A. Bonifacio³, R. O. Kellems¹, and D. L. Kooyman¹, ¹Brigham Young University, Provo, UT, ²University Mayor of San Simojn, Cochabamba, Bolivia, ³University of San Andres, La Paz, Bolivia.

Quinoa is an Andean grain that is noted for its amino acid profile which is especially high lysine. Traditionally the production of bitter (saponin-containing cultivars) has prevailed. However, many new sweet cul-

tivars that are saponin-free now exist but there is little information as to their feeding value. A trial was conducted to evaluate the feeding value during growth of the sweet quinoa cultivars Surumi, Patacamaya, Sayana and Chucapaca and the bitter cultivar Real using the improved Andean guinea pig as the animal model. The quinoa-based diets were compared to those based on corn, barley and oats. The bitter variety Real was fed as-is (saponin-containing) or washed (saponin-free). Growth and feed conversion of the weaned guinea pigs were used as parameters. For the 42-day growth trial, 108 fourteen day old guinea pigs were divided into the nine treatment groups. Weight gains from feeding the sweet quinoas (366 to 414g) were greater ($P < 0.05$) than from Real, unwashed (307g) or washed (308g). Growth of guinea pigs from feeding corn (337g) was similar ($P > 0.05$) to the three sweet cultivars but lower than from Surumi (414g). Surumi-fed guinea pigs exceeded ($P < 0.05$) the growth of all other treatments while those fed barley (246g) gained at a lower ($P < 0.05$) rate than all others. Feed conversion was more efficient ($P < 0.05$) for the sweet quinoa treatments (4.15 to 4.37) than for feeding corn (5.71) and barley (5.71). Feed intake was lower ($P < 0.05$) for Real (1278g) and higher ($P < 0.05$) for corn (1896g) than the other feeding groups. In conclusion sweet quinoa appears especially promising as a guinea pig feedstuff. Sweet quinoa was more effective than bitter quinoa (saponin containing or free) in stimulating animal growth and growth from sweet quinoas exceeded that of barley and was similar to corn and oats except the cultivar Surumi which significantly exceeded all quinoas, corn and barley. Feed conversions were generally more efficient from the sweet quinoas than from traditional grains or bitter quinoa.

Key Words: Quinoa, Growth, Saponin

41 The palatability of sweet (Surumi, Patacamaya, Sayana, Chucapaca) and bitter (Real) Bolivian quinoa cultivars, corn, barley, and oats as Guinea pig feedstuffs. R. N. Pate¹, N. P. Johnston^{*1}, E. Rico², A. Bonifacio³, R. O. Kellems¹, and D. L. Kooyman¹, ¹Brigham Young University, Provo, UT, ²University Mayor of San Simon, Cochabamba, Bolivia, ³University Mayor of San Adres, La Paz, Bolivia.

Quinoa is an Andean grain that is noted for both its protein quantity and quality. Lysine content as % of protein mirrors that of soybean. Traditionally the production of bitter (saponin-containing cultivars) has prevailed. However, many new sweet cultivars that are saponin-free now exist but there is little information as to their feeding value. Trials were conducted to evaluate the feeding value of the sweet quinoa cultivars Surumi, Patacamaya, Sayana and Chucapaca and the bitter cultivar Real using the improved Andean guinea pig as the animal model. Two trials were conducted to observe the palatability of quinoa by guinea pigs: one comparing the quinoa cultivars with corn, oats and barley and second comparing the cultivars with each other independent of the traditional grains. In the first trial 32 weaned guinea pigs were divided into four replicate groups and concurrently offered all of the quinoa cultivars plus corn, oats and barley for three weeks. The preference for oats (46%) was overwhelming ($P < 0.05$) and corn a distant second (17%). Sweet quinoa consumption was less ($P < 0.05$) than corn and ranged from 10.6% for Surumi down to 1.6% for Sayana. Almost no bitter (Real) quinoa was consumed (0.3%) while washing it improved ($P < 0.05$) its consumption to (7.4%). Barley consumption was similar to sweet quinoa. In the second palatability trial, 32 four-week old guinea pigs were separated into four replicate groups and fed only the quinoa cultivars for three weeks. Preferences for all four of the sweet cultivars and bitter Real-washed were statistically similar ranging from 11.5 to 24.2%, with

the preference for Real (saponin-containing) at 1.1%. In conclusion, when offering a concurrent choice of oats, corn, barley or quinoa, guinea pigs had a strong preference for oats over corn over any of the others. Corn was preferred to quinoa and sweet quinoa to bitter quinoa. Removing the saponin from bitter quinoa improved its palatability significantly.

Key Words: Quinoa, Guinea pig, Palatability

42 Effects of preservation and time of processing on blood glucose concentrations in beef heifers. S. L. Lake^{*}, V. Nayigihugu, and B. W. Hess, *University of Wyoming, Laramie.*

Eighty-four Angus \times Gelbvieh rotationally crossed beef heifers (369 kg average BW) were used to evaluate preservation method and time of processing on blood glucose concentrations. Whole blood was collected from each heifer via venipuncture of the jugular vein into tubes (3 tubes/heifer) containing sodium fluoride and potassium oxalate (plasma) and tubes (3 tubes/heifer) containing no preservative (serum). All tubes were placed immediately on ice, transported to the laboratory, and stored at 4 ° C until processed. Serum or plasma was separated by centrifugation at 2, 12, or 24 h after sampling, collected into 5 mL polypropylene tubes, and immediately stored at -20 ° C for subsequent glucose analysis. Glucose concentration data were analyzed by ANOVA with a 2 \times 3 factorial arrangement of treatments. A preservation method \times time of processing interaction ($P = 0.04$) was noted for glucose concentration. Concentrations of glucose from serum samples decreased from 2 to 12 h and from 12 h to 24 h. Glucose concentrations in plasma samples were greatest at 2 h but did not differ between 12 and 24 h. Glucose oxidation occurred during the first 12 h of storage despite the presence of sodium fluoride and potassium oxalate; however, oxidation was arrested in plasma samples after 12 h. Glucose continued to be oxidized through the first 24 h in serum samples collected without a preservative. For samples pooled across time, glucose concentrations were greater ($P < 0.001$) in serum compared with plasma. These data suggest that serum and plasma should be harvested before 12 h after collection of whole blood to obtain accurate values of glucose concentration. Caution also should be exercised when comparing mean glucose concentrations from non-preserved serum to plasma collected in a preservative.

Key Words: Beef heifers, Blood, Glucose

43 Effect of dilution, refrigeration and cryopreservation on capacitation-like changes in ram spermatozoa. F. A. Rodríguez-Almeida^{*}, C. O. Ávila, A. Anchondo, B. E. Sánchez, and J. A. Jiménez, *Universidad Autónoma de Chihuahua, Chihuahua, México.*

The objective was to quantify capacitation-like changes on spermatozoa of diluted, refrigerated and frozen ram semen at different time periods. Three young (1 yr old) and three adult rams of each Pelibuey and Blackbelly hair sheep breeds were used. Five ejaculations at least 3 d apart were obtained per ram. Each ejaculation sample was diluted with a citrate-yolk base extender and divided into three aliquots. One was conserved as fresh semen in a digital water bath at 36°C and evaluated at 3 (F3) and 6 h (F6). A second aliquot was cooled to a refrigeration temperature (5°C) and evaluated at 3 (R3), 6 (R6) and 24 h (R24). The

third aliquot was added with a second part of the extender (citrate-yolk + glycerol) and frozen (FN) in liquid nitrogen. The sample was then thawed for evaluation. Evaluation was for patterns B (acrosome intact capacitated spermatozoa) and AR (acrosome reacted spermatozoa) of the chlortetracycline epifluorescence assay (CTC), and for sperm progressive motility (PM). A linear model with fixed effects of type by time subclasses of preservation (PRE), breed of ram, age of ram (young and adult), double and triple interactions among those effects, and random effects of sire within breed by age, and interaction of sire by PRE within breed by age subclasses, was adjusted. Least squares means for the B pattern percentages were 23.9, 30.8, 32.8, 42.5, 44.5 and 36.6 (SE=2.3; $P < 0.01$) for F3, F6, R3, R6, R24, and FN, respectively. There was an interaction effect of PRE by age of ram for AR pattern. The mean percentage of the AR pattern was greater ($P < 0.01$) for the young than for the adult rams in refrigerated semen at 24 h (27.8 ± 1.6 vs 19.8 ± 1.6) and in frozen semen (33.9 ± 1.6 vs 26.3 ± 1.6), but not for the rest of PRE levels. Progressive motility of spermatozoa was reduced ($P < 0.01$) with dilution at 36°C for 6 h and with freezing, compared to the rest of the PRE levels. In conclusion, fresh diluted semen is well preserved for 3 h but progressive motility is reduced at 6 h if semen is not refrigerated. Freezing increases acrosome reacted spermatozoa and decreases progressive motility.

Key Words: Ram Semen, Cryopreservation, Chlortetracycline assay

44 Estrus synchronization and fertility in Creole cows treated with CIDR[®], progesterone, β -estradiol and PGF2 α . J. P. Zarate Martinez*, J. A. Ramirez Godinez, and F. A. Rodriguez Almeida, *Universidad Autonoma de Chihuahua, Chihuahua, Mexico.*

Creole cows do not respond favorably to estrus synchronization protocols; therefore, the objective was to study estrus response and fertility using fixed-time artificial insemination (AI) after a hormonal protocol. To increase progesterone levels (P4) during the CIDR (1.9 mg of P4) treatment, 11 cycling cows (T1) received 50 mg of P4 + 1 mg of β -estradiol i. m. and 11 cows (T2) received 1 mg of β -estradiol. At CIDR removal, all cows received 30 mg of Lutalyse[®] + 1 mg of β -estradiol 24 h later. Cows were AI at 54 h after CIDR removal. Blood samples were collected every other day from day 0 (CIDR insertion) to day 6 and daily from day 7 to day 10 (AI). Serum progesterone concentrations decreased progressively from day 0 ($P4 > 4$ ng/mL) to day 9 ($P4 < 1$ ng/mL), which coincided with the day all cows were detected in estrus. On day 9 estrogen (E2) levels were higher ($P < 0.01$) in T1 (34 ng/mL) vs T2 (26.7 ng/mL). Pregnancy rate was similar ($P > 0.05$) in both groups (18.18 %). We concluded that treating cycling Creole cows with 50 mg of progesterone in addition to 1 mg of β -estradiol at the time of CIDR insertion did not improve conception rate.

Key Words: Creole cows, Synchronization, β -estradiol

45 Effect of ferrous chloride on suckling calves and on microbial growth and metabolism using an *in vitro* rumen culture system. P. S. Hole*¹, M. B. Schelvan², and J. O. Hall¹, ¹Utah State University, Logan, ²University of Montana, Missoula.

Water is an important but often overlooked nutrient in man and animals. Fe and other minerals can exist dissolved in drinking water, and may be

present at detrimental concentrations even in palatable water. In ruminants, Fe may affect microbial growth or interact with other minerals such as Mo, Cu, or S in the rumen environment. A study was designed to take advantage of the esophageal groove of suckling calves in order to bypass the rumen. Fifteen individually-housed Holstein calves, 45 to 55 days old, were given water with 0, 20, or 40 mg Fe L⁻¹, as ferrous chloride, for 8 w utilizing a nipple delivery system. No significant differences were observed between treatment groups for water or feed intakes, growth rates, or liver mineral content. Further studies focused on the rumen. To determine the effects of Fe on microbial metabolism and growth, changes in pH and DNA concentrations were measured. Rumen contents were cultured for 9 h in the presence of 0, 25, 50, 100, 200, 400 or 800 mg Fe L⁻¹, as ferrous chloride. Rate of ruminal pH drop was inversely related ($P = 0.059$) to Fe concentration and was highly significant ($P = 0.005$) during the final 3 h of culture. During the final 3 h of culture, an inverse relational trend ($P = 0.058$) was observed between rates of DNA concentration change and Fe concentration. During the final 6 h of culture, this inverse relationship was significant ($P = 0.044$). Concentrations as low as 50 mg Fe L⁻¹ were significantly detrimental to rumen microbes in culture. As this was a single administration of Fe at the beginning of culture, and when taking into account the amount and frequency of water consumed daily by high production dairy cows, concentrations of Fe well below this 50 mg L⁻¹ are likely to result in adverse effects. Depression of microbial growth and metabolism likely translate into altered VFA production or profiles, decreased milk or milk protein yield, and/or altered milk fat%.

Key Words: Iron, Rumen, Microbes

46 Correlation between water mineral content and production parameters in dairy cattle. P. S. Hole*, A. J. Young, and J. O. Hall, *Utah State University, Logan.*

A survey of dairy herd drinking water was performed at 75 dairies in Utah and Idaho, and mineral content in the water was correlated with production parameters from Provo Dairy Herd Improvement Association (DHIA). Two water samples, taken 30 to 60 d apart, were obtained from a single source of the herd drinking water at each dairy, analyzed for minerals, and averaged. The water was analyzed for Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Tl, V, and Zn. Eight dairies had water mineral content with one or more minerals (As, Fe, K, Mg, Mn, Na, and P) above the currently recommended drinking water standards. The maximal estimated percentage of the recommended daily intake (RDI) for P was less than 1%, Mn was 11%, Mg was 20%, Fe was 53%, and Na was 62%. Ca, Cu, and Zn were also present in maximal amounts of 17 to 52% of RDI even though these minerals were not above their standard. Minerals are often fed at maximal RDI based only on dietary components; thus, this study suggests not taking water mineral content into consideration in formulating diets could result in intakes exceeding upper RDI limits for these minerals.

DHIA milk test records were obtained for the three-month period surrounding the two water-sampling dates, and averaged. Nine DHIA parameters had correlations ($P < 0.05$) or trends towards correlation (trends, $P < 0.1$) with one or more minerals. The minerals that had correlations or trends were Al, Ca, Fe, Mo, Pb, and Si. The majority of these correlations or trends indicated a detrimental impact on the DHIA parameter involved. Al had a detrimental impact on three reproduction parameters,

including two relating to spontaneous abortions. The highly significant ($P < 0.001$) positive correlation of Al with abortion before 151 d gestation ($r = 0.60$) was the strongest found in this study. It is of interest that of these six correlating minerals, only Fe was found to be above standards in livestock drinking water. Further studies are needed to determine whether the adverse effects of Al, Ca, Pb, and Si in drinking water have firm scientific basis in dairy cattle.

Key Words: Mineral, Water, Milk production

47 Effects of graded levels of Zeolite on digestibility and nutrient intake in sheep. O. Ruiz-Barrera, Y. Castillo-Castillo*, C. Arzola-Alvarez, and C. Rodriguez-Muela, *Universidad Autonoma de Chihuahua, Chihuahua, Chihuahua, Mexico.*

The objective of the present work was to determine the effects of four levels of zeolite (clinoptilolite) on in vivo digestibility and nutrient intake of sheep fed a basal diet of alfalfa hay (70%) and concentrate (30%) both *ad libitum*, at 1000 and 1700 h. Four rumen-fistulated pelibuey male sheep (32.5 kg average BW) were allocated to the treatments: 0% zeolite (T1), 1.5% zeolite (T2), 3.0% zeolite (T3) and 4.5% zeolite (T4). Each experimental period consisted of 17 d, 10 d for adaptation and 7 d for collection. Animals were housed in individual pens (1.5 x 0.7 m) on concrete floor, using wood shavings as bedding. Daily dry matter intake (DMI) was determined as the difference between offered and refusal feed, given 10% more than the previous day's intake. Water was freely supplied. In vivo dry matter digestibility (IVDMD) was measured using indigestible acid detergent fiber (IADF) as an internal marker. A 4 x 4 Latin square design was utilized and ANOVA and mean comparison was performed using a statistical package (Minitab 2000). Results for DMD were 67.9, 66.9, 69.3 and 70.8%; for organic matter digestibility (OMD) were 72.8, 73.5, 77.6 and 79.7% and for acid detergent fiber digestibility (ADFD) were 32.2, 34.4, 37.4 and 33.4% for T1, T2, T3 and T4 respectively. No significant differences were detected for these variables ($P=0.05$). Data for dry matter intake (DMI), organic matter intake (OMI), acid detergent fiber intake (ADFI), neutral detergent fiber intake (NDFI) and crude protein intake (CPI) neither showed statistical differences ($P=0.05$). However, a significant quadratic effect ($P=0.02$) was observed for digestible acid detergent fiber intake (DADFI) with values of 72.0 (T1), 94.4 (T2), 98.6 (T3) and 87.3 (T4) g/anim/d. The results of this experiment indicated that zeolites can increase digestibility and intake when the source of fiber is alfalfa hay. These improvements may not be evident when poor quality roughage is utilized.

Key Words: Clinoptilolite, Ruminant, Fiber

48 Phosphorus absorption of feed ingredients commonly used in ruminant production systems in Venezuela. S. Godoy* and C. F. Chicco, *Instituto Nacional de Investigaciones Agrícolas, Maracay, Aragua, Venezuela.*

Phosphorus digestibility of different feed ingredients, commonly used in ruminant production systems in Venezuela, was determined with 20 West African mature wethers with $30\bar{i}, \pm 3.3$ kg live body weight. The animals were distributed in five treatments, with four animals each. In the experiment, cotton seed (CS), cotton cake (CC), bran and oil ex-

tracted corn germ (CBG), and rice polishing (RP) were evaluated, using a dicalcium phosphate (DCP) as a reference control. A balance trial was carried out in two periods of 10 days each. In both, P intake and excretion were determined. In the first period, animals were fed a basal diet containing 0.10% total P, and, in the second, a diet with 0.25% total P, by the addition of the different feed ingredients. These represented 80% of total dietary P. Phosphorus apparent absorption (AA), net utilization (NU), calculated by the difference between P levels, and true absorption (TA), by estimating fecal endogenous P, were measured. Phosphorus AA values (%) were higher ($P < 0.05$) for CBG (41.8) and DCP (39.4) diets, in relation to CC (36.3), CS (33.3) and RP (30.0). Phosphorus TA and NU values (%) were 57.8 and 60.0; 51.1 and 46.4; 55.6 and 56.3; 61.9 and 70.7; and 48.5 and 41.0, respectively, for DCP, CS, CC, CBG and PA, being DCP and CBG higher ($P < 0.05$) than the other feed ingredients. Digestibility values were highly correlated ($r = 0.99$). It is concluded, in this study, that the majority of vegetable feed ingredients had lower P bio-availability than DCP.

Key Words: Absorption, Phosphorus, Sheep

49 Effect of level of urea and soybean meal in solid state fermentation of apple byproducts. D. Díaz-Placencia*, C. Rodríguez-Muela, F. Salvador-Torres, A. Alarcón-Rojo, O. Ruiz-Barrera, C. Arzola-Alvarez, and J. Jiménez-Castro, *Universidad Autónoma de Chihuahua, Chihuahua, México.*

In order to evaluate the effect of the level of urea (UR) and soybean meal (SM) at solid state fermentation (SSF) of apple byproducts for microbial protein production, an experiment was carried out. Four treatments containing ground apple waste, 1.5 or 2% UR, and 0 or 3.5% of SM were prepared. A design factorial arrangement of 2 x 2 was used. All samples were added with 0.2% of ammonium sulfate and 0.5% of a mineral and vitamins supplement. Each treatment had 6 replicates consisting of 1 kg of sample, which were placed into a stove at controlled temperature of 28°C during 196 h. Replicates were mixed each 6 h taking samples each 12 h. The variables evaluated were pH, crude protein (CP), true protein (TP), and optic density of yeasts (OD). The results showed an increase in pH starting at 48 h of fermentation and an effect of the addition of SM ($P < 0.01$) was observed with values of 4.9 and 5.7 for the levels of 0 and 3.5% of SM in the mixture, respectively. The values detected for the effect of UR ($P > 0.05$) were 5.5 and 5.1 for the levels of 1.5 and 2% of UR in the mixture, respectively. The CP at the end of the fermentation showed significant difference ($P < 0.01$) due to the addition of SM with values of 76.18 and 55.57% of CP in the levels of 0 and 3.5% of SM in the mixture, respectively. In addition, the CP showed an effect ($P < 0.01$) by the increment of UR to the mixture with values of 61.90 and 69.85% of CP for the levels 1.5 and 2% of UR in the mixture, respectively. There was an interaction of TP among the factors UR and SM indicating that there was an improve in the production of TP by the addition of 3.5% SM to the mixture, only when the level of UR was 1.5%, although, with the levels of 2% UR and 3.5% SB at the mixture an OD at 196 h of fermentation, at the chamber of Newvauer a count of 450×10^6 Ufc/ml of sample, was observed. In conclusion, the addition of UR at a 2% level in the SSF of apple waste, improve the production of CP and TP while the SM alone improves the TP when the UR does not exceed from the 1.5% of the mixture.

Key Words: Fermentation, Solid state, Apple byproducts

50 Effect of organic and inorganic selenium supplementation on weight performance of ewes and lambs. C. Arzola¹, J. Segovia¹, O. Ruiz¹, C. Rodriguez-Muela¹, J. Salinas², and J. Jimenez¹, ¹Universidad Autonoma de Chihuahua, Mexico, Chihuahua, Chihuahua, Mexico, ²Universidad Autonoma de Tamaulipas, Mexico, Cd. Victoria, Tamaulipas, Mexico.

Two selenium sources (organic and inorganic) were evaluated using 28 multiparous (M) and 18 uniparous (U) ewes, of 54.8 ± 9.4 and 39.7 ± 5.6 kg live weight, respectively. They were randomly assigned to two treatments: basal diet plus inorganic selenium (IS); and basal diet plus organic selenium, Sel-Plex 50® (OS). A split plot design in time was used; the variables were analyzed using PROC MIXED of SAS. Results showed no effect ($P > 0.05$) of the main effects: treatment, maturity and the weight of lambs in time (lactation days); however the interaction treatment*time showed statistical difference ($P < 0.05$) with weights of 56.8 and 57.3 in IS and OS, respectively at 22 d post-weaning. The maturity*time interaction was different ($P < 0.05$) with weights of 57.6 for M and 56.4 for U. The weight of lambs was similar ($P > 0.05$), although inorganic selenium had better weights at weaning. In conclusion, organic selenium could improve the weight of ewes after weaning; however lamb weight tended to be higher with inorganic selenium.

Key Words: Selenium, Weight-performance, Sheep

51 Protein supplementation of low-quality forage: Influence of frequency of supplementation on ruminant and nutrient utilization. C. S. Schauer¹, M. M. Stamm¹, D. W. Bohnert², and J. S. Caton³, ¹North Dakota State University, Hettinger, ²Oregon State University, Burns, ³North Dakota State University, Fargo.

Supplementation frequency (SF) of CP for ruminants consuming low-quality forage can be decreased to once every 7 d; however, no data are available describing the effects of decreasing SF to once every 10 d. Our objectives were to evaluate the influence of length of SF on forage intake, digestibility, N balance, digested N retained, and plasma concentration of urea-N in lambs and performance in pregnant ewes. Treatments included daily (D), once every 5 d (5D), or once every 10 d (10D) supplementation, and an unsupplemented control (CON). Sixteen wethers (31 ± 1 kg BW) were used in a digestibility study ($n = 4$). The amount of CP supplied by each supplement was approximately 0.15% of BW/d (averaged over a 10-d period) formulated to meet CP requirements. Sixty pregnant Rambouillet ewes (75 ± 0.4 kg BW) in the last third of gestation were used in a performance study ($n = 4$). The amount of CP supplied by each supplement was approximately 0.11% of BW/d (averaged over a 10-d period) formulated to meet CP requirements, but did not include CON. Basal diets consisted of low-quality (5% CP) barley straw. Total DMI and OM intake were not affected ($P < 0.92$) by supplementation. However, forage DMI, OM intake, and N intake by lambs decreased ($P = 0.06$) linearly as SF decreased. Apparent total tract digestibility of N for supplemented lambs was approximately 300% greater ($P < 0.001$) than the CON, with no difference ($P = 0.40$) because of SF. Digested N retained and N balance were greater ($P < 0.01$) for supplemented wethers than for CON, with no difference ($P = 0.31$) due to SF. Plasma urea (PU; mM) was measured over a 10-d period and supplemented lambs had increased ($P < 0.001$) PU compared with CON, but was not affected ($P = 0.28$) by SF. Crude protein SF had no effect ($P = 0.06$) on pre- and post-lambing BW and BCS change or lambing date and average lamb birth weight. Results suggest ruminants

consuming low-quality forage can be supplemented with protein as infrequently as once every 10 days while not negatively affecting nutrient digestibility or livestock performance.

Key Words: Lamb, Supplementation frequency, Crude protein

52 Lamb muscle selenium concentration plateaus following 56 days of selenium supplementation. C. S. Schauer¹, J. Held², J. A. Daniel², J. S. Caton³, P. G. Hatfield⁴, R. Stobart⁵, and J. O. Hall⁶, ¹North Dakota State University, Hettinger, ²South Dakota State University, Brookings, ³North Dakota State University, Fargo, ⁴Montana State University, Bozeman, ⁵University of Wyoming, Laramie, ⁶Utah State University, Logan.

Researchers have determined that dietary selenium (Se) affects the Se concentration of skeletal muscle in ruminants. Current research suggests that humans who consume 2 to 4 fold of the recommended dietary allowance (RDA = $55 \mu\text{g Se/d}$) of Se may reduce their chance for developing lung, colorectal, and prostate cancer by 30, 50, and 70%, respectively. However, limited data are available describing the effects of length of supra-selenium supplementation to lambs on selenium status, feedlot performance, or carcass characteristics. Our objectives were to evaluate the influence of length of supra-selenium supplementation on muscle and plasma Se status, feedlot performance, and carcass characteristics of finishing lambs. One-hundred sixty wethers (35 ± 0.3 kg BW) were stratified by weight, randomly allotted to one of 20 pens, and assigned one of five treatments ($n = 4$): supra-selenium supplementation with seleno yeast for the final 84, 56, 28, 14, or 0 d (CON) of finishing. Diets were similar in ingredient composition (73% corn and 25% alfalfa; DM basis), isonitrogenous and isocaloric, and offered once daily (0800) to provide ad libitum intake. Daily selenium intake for CON and supra-selenium supplemented wethers was 4 and $50 \mu\text{g Se} \cdot \text{kg}^{-1} \text{BW} \cdot \text{d}^{-1}$, respectively. On d 0 and 84, two-day weights were recorded and plasma samples collected for determination of circulating Se. On d 85, wethers were slaughtered; carcass data recorded; and foreshank samples collected for Se analysis. Treatment did not affect DMI, final BW, gain to feed, and ADG; fat depth, body wall thickness, longissimus muscle area, and hot carcass weight; or yield and quality grade ($P = 0.28$). Initial and final plasma Se concentrations were not different ($P = 0.06$). Muscle Se concentration increased quadratically ($P = 0.05$) as length of supra-Se supplementation increased, reaching a plateau between 56 and 84 d of supplementation. Results suggest that muscle Se concentration increases when lambs are supra-supplemented with Se without negatively affecting performance or carcass quality. However, muscle Se concentration may plateau following 56 d of Se supplementation.

Key Words: Lamb, Muscle, Selenium

53 Profitable calf backgrounding integrating annual forage crops. M. M. Stamm¹, C. S. Schauer¹, L. M. M. Surber², S. D. Cash², and A. L. Todd², ¹North Dakota State University, Hettinger, ²Montana State University, Bozeman.

In the four-state region of MT, ND, SD and WY, cereal forages have become an increasingly important crop for livestock producers. Some small grains cut for hay have rough awns which can affect palatability and cause mouth irritation in cattle. New cereal forage cultivar develop-

ment has only focused on the absence of awns or biomass production and not animal feeding performance. Our study objectives were to: 1) obtain animal performance comparisons of experimental and traditionally grown cereal forages; 2) demonstrate animal performance for an experimental awnless winter wheat cultivar; and 3) evaluate steer cost of gain for the experimental and traditionally grown cereal forages. A 57 d backgrounding performance study was conducted using 80 purchased crossbred weaned steer calves (308 ± 5 kg BW). Calves were stratified by BW, randomly allotted to pens, and assigned to one of four cereal forage dietary treatments ($n = 4$): 1) barley harvested as hay (BH); 2) barley harvested as silage (BS); 3) oat harvested as hay (OH); and 4) an awnless winter wheat cultivar harvested as hay (WH). Steers were fed once daily (0900) and given ad libitum access to their roughage source, $3.6 \text{ kg} \cdot \text{head}^{-1} \cdot \text{d}^{-1}$ of rolled barley grain, and $0.45 \text{ kg} \cdot \text{head}^{-1} \cdot \text{d}^{-1}$ of a 32% CP supplement containing Rumensin[®]. Diets were isocaloric with a target ADG of 1.19 kg. Two-day weights were recorded on d 0, 28 and 57. Diet, ort, and fecal samples were collected on d 28 and d 57. Diet samples were composited by pen and analyzed for DM, OM, CP, ADF, and NDF. Steers consuming BH and BS had similar ($P > 0.10$) final BW. However, steers consuming OH had lower ($P = 0.09$) final BW as compared to the BH and BS steers, but higher ($P = 0.09$) final BW as compared to the steers consuming WH. Total BW gain and ADG were influenced ($P < 0.001$) by treatment. Calves consuming BS had the highest ($P < 0.10$) total BW gain and ADG of all four treatments. Steers consuming BH had higher ($P = 0.03$) total BW gain and ADG than steers consuming WH. Barley harvested as hay or silage demonstrated greater potential as a backgrounding feedstuff as compared to awnless winter wheat harvested as hay.

Key Words: Calf, Backgrounding, Annual forage

54 Effects of energy level on post-ruminal valine utilization by sheep. S. Kuykendall* and C. A. Loest, *New Mexico State University, Las Cruces.*

Valine is a limiting amino acid (AA) for growing lambs when fed a diet containing little ruminally undegradable protein. Increasing Val utilization may improve growth performance. Therefore, our objective was to evaluate the effects of energy level on post-ruminal utilization of Val by four ruminally-cannulated wether lambs (47 ± 4.8 kg initial BW). Lambs were limit-fed (0.79 kg DM/d) twice daily a diet (80% soybean hulls, 15% alfalfa hay, 3.5% molasses, 0.35% urea, and 1.5% minerals/vitamins) low in ruminally undegradable protein. An AA mixture, devoid of Val, was continuously infused (500 mL/d) into the abomasum of lambs to ensure that all essential AA, except Val, did not limit protein accretion. Treatments (2×2 factorial) were two levels of supplemental energy (0 vs. 0.49 Mcal/d ME) and two levels of Val (0 vs. 4 g/d infused into the abomasum). Energy was supplied by ruminal infusions of acetate (41 g/d) and propionate (14 g/d), and abomasal infusions of glucose (75 g/d). The experiment was a 4×4 Latin square, and each period consisted of 7 d; 3 d for adaptation to treatments, and 4 d for collection of feces and urine to calculate N retention. Blood samples were collected 3 h after feeding on d 7. There were no energy \times Val interactions ($P > 0.08$) for dietary intake, digestibility, and N balance. Infusion of Val increased ($P < 0.05$) total N intake, and energy infusion decreased ($P < 0.05$) DM, OM, NDF, and N digestibility. Urinary N excretion decreased ($P < 0.05$), and N retention increased ($P < 0.05$) in response to Val infusion. Energy infusion did not affect ($P = 0.47$) N retention because it decreased ($P = 0.06$) urinary N excretion, but also increased

($P < 0.05$) fecal N excretion. Plasma Val concentrations increased ($P < 0.05$) in response to Val supplementation. An increase in N retention due to Val supplementation confirms that Val is a limiting AA for growing lambs. A decrease in urinary N excretion due to energy supplementation even when Val was limiting suggests that energy supply affects efficiency of AA utilization.

Key Words: Valine, Energy, Sheep

55 Effects of maternal selenium supply and dietary restriction on cellularity estimates of fetal jejunum, heart, and skeletal muscle. T. L. Neville*, M. A. Ward¹, J. J. Reed¹, J. B. Taylor², K. A. Vonnahme¹, A. T. Grazul-Bilska¹, P. P. Borowicz¹, D. A. Redmer¹, L. P. Reynolds¹, and J. S. Caton¹, ¹Dakota State University, Fargo, ²USDA-ARS, US Sheep Experiment Station, Dubois ID.

Pregnant Targhee-cross ewe lambs ($n = 36$; 53.8 ± 1.3 kg BW) were randomly allotted to one of four treatments in a 2×2 factorial arrangement to examine the effects of nutrient restriction and dietary Se on cellularity in fetal tissues. Treatments were: nutrition (maintenance [M] vs. 60% maintenance [R]) and dietary Se (no added Se, $7.4 \mu\text{g}/\text{kg}$ BW [NSe] vs. Se-enriched yeast, $81.5 \mu\text{g}/\text{kg}$ BW [HSe]). Selenium treatments were initiated 21 d before breeding and nutritional treatments on d 64 of gestation. All diets were similar in CP (16.0%) and energy density (2.12 Mcal/kg). On d 135 ± 5 of gestation, ewes were slaughtered and fetal tissues harvested. Maternal nutritional restriction resulted in decreased: fetal small intestinal weights ($P = 0.01$), fetal jejunal protein content (all contents in mg; $P = 0.01$) and protein:DNA ($P = 0.06$), fetal heart and skeletal muscle protein concentrations (all concentrations in mg/g; $P = 0.07$) and protein:DNA ($P = 0.01$), and fetal heart protein content ($P = 0.01$). Nutrient restriction also resulted in greater ($P = 0.02$) fetal heart RNA concentration. High maternal dietary Se resulted in increases in: fetal jejunal RNA:DNA ($P = 0.07$), fetal heart weight ($P = 0.09$) and RNA content ($P = 0.04$), and fetal skeletal muscle RNA concentration ($P = 0.01$). A nutrient restriction by dietary Se interaction ($P = 0.04$) was observed for fetal skeletal muscle DNA concentration, where R-HSe had greater ($P = 0.10$) DNA concentration compared with all other treatments (1.55, 1.52, 1.46, and 2.38 ± 0.16 mg DNA/g for M-NSe, M-HSe, R-NSe, and R-HSe; respectively). Results indicate that cellularity of fetal tissues are altered by changes in maternal selenium supply and dietary restriction. Partially funded by USDA-IFAFS Grant No. 00-52102-9636 and USDA-NRI Grant No. 2005-35206-15281.

Key Words: Fetus, Nutrient restriction, Selenium

56 Influence of slice baling alfalfa hay on hay quality and digestive function of steers consuming a feedlot finishing diet. F. Loya-Olguin¹, A. M. Encinias¹, D. A. Walker¹, N. A. Elam¹, and S. A. Soto-Navarro*, ¹New Mexico State University, Clayton, ²New Mexico State University, Las Cruces.

A modification of the traditional alfalfa hay baling system has been developed. The new system is referred to as slice baling and consists of slice chopping the hay after sun-drying and before baling. It is suggested that this method chops the length of alfalfa stems to 7.6 cm. Slicing is proposed to cause less damage to the leaves compared to grinding after

baling. Leaves should be more consistent. Also, less leaf material is lost with the slice baling. Anecdotal information suggests that slice baling alfalfa results in a higher quality (higher proportion of leaves), improves rumen function in feedlot cattle because of less fines from leaves, better uniformity of the stem length, and saves cost associated with grinding in the feed yard mill. One hundred and seventy six crossbred steers (393.9 ± 10.81 kg initial BW) were used in an 84-d feeding experiment (four pens per treatment) in a completely randomized experiment design with a 2×2 factorial arrangement of treatments to evaluate the effects of slice alfalfa (ground or slice) and forage level (8 or 14%) on growth performance. Experimental diets were based on steam-flaked corn. Daily weight gain and DMI were not affected ($P > 0.05$) by method that the forage was processed or the forage level. Gain to feed ratio for the first 56 d was affected ($P = 0.03$) by forage level (0.210, and 0.197 ± 0.004 for 8 and 14% forage, respectively) and tended ($P = 0.07$) to decrease for slice alfalfa (0.210, and 0.200 ± 0.004 for ground and slice alfalfa, respectively). However, over that 84-d feeding period, gain to feed ratio was only affected ($P = 0.02$) by forage level (0.194, and 0.182 ± 0.003 for 8 and 14% forage, respectively), but not ($P = 0.20$) by processing method (0.191, and 0.184 ± 0.003 for ground and slice alfalfa, respectively). We conclude that slice baling alfalfa does not improve feeding value of alfalfa used on feedlot finishing diets.

Key Words: Forage, Particle size, Beef cattle

57 Effects of urea supplementation level on performance of Suffolk lambs consuming a high concentrate diet. A. Islas*, L. E. Camacho, K. Beebe, S. A. Soto-Navarro, J. M. Benavidez, R. L. Knight, M. J. McBee, F. O. Loya, L. D. Abercrombie, and D. M. Hallford, *New Mexico State University, Las Cruces.*

Optimal microbial synthesis requires OM and protein to be available for ruminal fermentation. Ruminal microbes have the ability to utilize non-protein N to synthesize protein. However, the ruminally degradable protein requirements of growing wethers consuming concentrate diets supplemented with non-protein N is not known. Sixteen Suffolk wethers lambs (40.8 ± 1.84 kg average initial BW, and 134 ± 22 d of age) were used in a 70-d feeding experiment to evaluate effects of dietary urea level (0, 0.69, 1.37, and 2.06%, DM basis) in 70 % ground corn concentrate diets on growth performance. Diets were formulated to be (DM basis) 9.5% CP (without inclusion of urea) 11.5% CP, 13.5% CP, and 15.5% CP with urea additions. The ratio of DIP: TDN was 0.073, 0.102, 0.131, and 0.16 for the 4 increasing levels of dietary CP, respectively. Average daily gain ($125.9, 112.4, 119.2,$ and 67.1 ± 22.31 g/d for 9.5, 11.5, 13.5 and 15.5% CP diets, respectively) and gain to feed ratio ($92.5, 112.3, 96.7, 64.0 \pm 47.54$ g/kg for 9.5, 11.5, 13.5 and 15.5% CP diets, respectively) were not affected ($P > 0.05$) by urea level. However, DMI declined linearly ($P = 0.02$) with increasing level of urea supplementation ($1,177, 1,117, 1,082,$ and 868 ± 77.4 g/d for 9.5, 11.5, 13.5 and 15.5% CP diets, respectively). Ruminal pH, ammonia concentration and isobutyrate molar proportion increased ($P < 0.05$) linearly with urea supplementation. Increasing CP concentration using supplemental urea did not improve wether growth performance. Sheep may require true protein as a source of ruminally digestible protein.

Key Words: Sheep, Ruminally degraded N, Urea

Environment and Livestock Management

58 Performance of early weaned (~80 d) vs normal weaned (~215 d) cows in the northern great plains. T. Geary*,¹ R. Waterman¹, J. Paterson², R. Ansotegui², and R. Lipsey³,¹USDA-ARS, Miles City, MT,²Montana State University, Bozeman,³American Simmental Association, Bozeman, MT.

Our objective was to determine effects of early weaning at the start of breeding on cow reproductive performance following AI with a 50-d cleanup breeding season among cows in the Northern Great Plains. Angus ($n = 199$) and Angus x Simmental ($n = 158$) cows stratified within breed by age, postpartum interval, calf sex, and AI sire were assigned within strata to one of two weaning treatments. Cows ($n = 232$) receiving early weaning (EW ~ 80 d) had calves permanently removed at the time of prostaglandin (PGF) injection and start of AI breeding. Cows ($n = 125$) receiving normal weaning (NW) were suckled by calves until weaning (~ 215 d). Estrous cycles were synchronized for AI using a protocol including 14 d progesterone insert (CIDR) + PGF 16 d after CIDR removal (primiparous cows) or a CIDR insert for 7 d with gonadotropin releasing hormone (GnRH) at CIDR insertion and PGF at CIDR removal (multiparous cows). Cows detected in estrus by 72 h

after PGF were inseminated approximately 12 h later. Cows not detected in estrus by 72 h after PGF received timed AI with GnRH at 80 h after PGF. Bulls were placed with cows beginning 2 wk after AI for the remainder of a 50-d breeding season. Pregnancy rates from AI were higher ($P < 0.05$) for early weaned cows (66%) compared to normal weaned cows (54%). Cow age and age by weaning treatment had no effect ($P > 0.10$) on AI pregnancy rates. Breeding season pregnancy rates tended ($P = 0.12$) to favor cows that were early weaned (94%) compared to normal weaned (89%). Date of conception was 7 d earlier ($P < 0.05$) for early weaned cows compared to normal weaned cows. Early weaned cows gained more weight during the grazing period and were 36 kg heavier than normal weaned cows at the time of normal weaning ($P < 0.01$). Primiparous early weaned cows were 65 kg heavier than primiparous normal weaned cows. We conclude early weaning at the start of a synchronized breeding season increased AI pregnancy rates and cow weights at the time of normal weaning. Early weaning may be a viable alternative to culling cows during periods of low forage production in the Northern Great Plains.

Key Words: Early weaning, AI pregnancy rates, Reproduction

59 Performance of early weaned (~80 d) vs normal weaned (~215 d) calves in the northern great plains. R. C. Waterman¹, T. W. Geary¹, J. A. Paterson², R. P. Ansoategui², and R. J. Lipsey³, *USDA-ARS, Fort Keogh Livestock and Range Research Laboratory, Miles City, MT*, ²*Montana State University, Bozeman*, ³*American Simmental Association, Bozeman, MT*.

Early weaning, in spring calving production systems, has intrigued many producers to consider this alternative management practice especially during extended droughts and for young developing cows. The objective of the present study was to evaluate performance of early-weaned calves (~80 d of age) and cost of production for two rations that were isonitrogenous and isocaloric but differing in ruminal degradable and undegradable protein (RDP and RUP respectively) compared to normal weaned calves (~215 d of age). Three hundred seventy-three Simmental × Angus calves (108.2 ± 1.07 kg) were randomly allocated to one of three treatments: 1) Weaned and fed a 33:67 forage:concentrate diet containing 15.4 % CP (32 % RUP) and 1.58 Mcal of NEm/kg (EW1); 2) Weaned and fed a 33:67 forage:concentrate diet containing 15.4 % CP (43 % RUP) and 1.62 Mcal of NEm/kg (EW2); or 3) suckled and grazed range forage until normal weaning (NW). Calf weight and age were similar at time of early weaning for all treatments ($P > 0.10$). At the time of normal weaning body weight was heavier ($P < 0.01$) for EW vs. NW steers and a tendency for EW2 steers to be heavier ($P = 0.15$) than EW1 steers. Similarly, EW heifers were heavier ($P < 0.01$) when compared to NW heifers; however, body weights at normal weaning did not differ between EW treatments ($P = 0.62$). Total cost•calf-1•d-1 was greater ($P < 0.01$) for EW treatments than NW; furthermore, calves receiving EW2 had a higher cost•calf-1•d-1 than calves receiving EW1. Value of calves at time of normal weaning were greater ($P < 0.01$) for all EW treatments when compared to NW calves (\$816.55, \$824.82, and \$779.71, for EW1, EW2, and NW steers, respectively and \$714.51, \$718.75 and \$686.55, for EW1, EW2, and NW heifers, respectively). Calf value did not differ between EW treatments ($P > 0.10$). This study demonstrates that early weaning may be an effective management option when forage is limited or removal of production pressures from young cows is desired; however, the additional calf value by itself was not enough to overcome cost of EW diets.

Key Words: Early weaning, Protein, Calf performance

60 Growth performance and carcass characteristics of lambs fed Carnival or Forager field peas. P. L. Price*, J. M. Krall, S. L. Lake, T. R. Weston, V. Nayigihugu, and B. W. Hess, *University of Wyoming, Laramie*.

Twenty-four black faced lambs (24 ± 0.4 kg initial BW) were used in a randomized complete block designed experiment to determine the effects of feeding 2 varieties of field peas on growth performance and carcass characteristics. Lambs were blocked by BW and assigned randomly to 1 of 4 pens within each block (2 lambs/pen). Diets (formulated to be isonitrogenous) included a conventional corn-soybean meal supplement (Control) or either Carnival or Forager field peas (approximately 33% of dietary DM) fed in place of corn and soybean meal. Periods included a growing phase (56% roughage, 44% concentrate), a transitional phase (36% roughage, 64% concentrate), and a finishing phase (14% roughage, 86% concentrate). Lambs were weighed (unshrunk) on 2 consecutive d at the start of each period and immediately before slaughter (14 h shrink). Lambs fed Forager peas tended to have greater

($P = 0.06$) ADG than lambs fed Carnival peas, with lambs fed Control being intermediate during the growing phase. Lambs fed Forager peas had greater ($P < 0.001$) ADG during the transitional phase; however, G:F did not differ ($P = 0.31$) among treatments because lambs fed Forager peas had greater ($P = 0.01$) DMI. No differences ($P = 0.33$) in DMI occurred among dietary treatments during the finishing phase, but ADG ($P = 0.06$) and G:F ($P = 0.10$) tended to be greater for lambs fed Carnival peas than lambs fed Forager peas, with Control lambs being intermediate. Overall (d 1 to slaughter), greater ($P = 0.01$) ADG for lambs fed Forager peas may have been due to an increase in gut fill because these lambs tended ($P = 0.09$) to have the greatest DMI and G:F was not affected ($P = 0.31$) by dietary treatment. Shrunk BW ($P = 0.65$) at slaughter and carcass characteristics ($P = 0.21$ to 0.93) did not differ among dietary treatments. Thus, feeding lambs Carnival field peas at approximately 33% of dietary DM does not influence overall feedlot performance or carcass characteristics. Although shrunk BW at slaughter and carcass characteristics of lambs fed Forager field peas were comparable to that of lambs fed Carnival field peas and the Control diet, greater DMI was necessary to achieve those endpoints.

Key Words: Field peas, Lambs

61 Growth and reproductive performance of beef heifers fed Carnival or Forager field peas. B. W. Hess*, J. M. Krall, B. K. Stevens, S. L. Lake, T. R. Weston, and V. Nayigihugu, *University of Wyoming, Laramie*.

Our objective was to evaluate Carnival or Forager field peas as a replacement for a conventional corn-soybean meal supplement in diets of peripuberal beef heifers. Beginning 60 d before estrous synchronization, 90 Angus × Gelbvieh rotationally crossed heifers (330 ± 1.0 kg initial BW) were stratified by BW and allotted randomly within each BW block to 1 of 3 pens (10 heifers/pen). Bromegrass hay was offered daily at 6.30 kg of DM/heifer for the first 30 d whereas heifers had access to 7.35 kg/d of bromegrass hay (DM basis) for the second 30 d. Dietary treatments (formulated to be isonitrogenous) included a 62.6% ground corn and 37.4% soybean meal (DM basis; Control) supplement fed daily at 1.36 kg of DM/heifer, ground Carnival peas fed daily at 1.41 kg of DM/heifer, and 90.7% ground Forager peas and 9.3% soybean meal (DM basis) fed daily at 1.41 kg of DM/heifer. Data were analyzed as a randomized complete block design, and dietary treatments were compared using the orthogonal single degree of freedom contrast of Control vs. field peas and Carnival vs. Forager peas. Heifers fed field peas tended ($P = 0.08$) to have greater ADG and G:F than heifers fed the Control supplement during the first 30 d. Growth performance was not affected ($P = 0.18$ to 0.19) by dietary supplement during the second 30 d, but over the course of the 60-d feeding period, ADG and G:F were greater ($P = 0.04$) for heifers fed field peas compared with heifers fed the Control supplement. Variety of field peas did not influence ($P = 0.18$ to 0.47) growth performance of heifers throughout the experiment. Likewise, AI pregnancy rate (confirmed at calving) was 43.3% for all dietary treatments. We conclude that field peas can replace conventional corn-soybean meal supplements fed to peripuberal beef heifers for 60 d before estrous synchronization. Moreover, Forager peas are comparable to Carnival peas as a dietary supplement for beef heifers consuming forage-based diets.

Key Words: Beef heifers, Field peas, Supplementation

62 The effects of timber harvest, herbivory, and season of use on diet selection of steers grazing forested rangelands. K. J. Walburger¹, T. DelCurto², and M. Vavra³, ¹University of Saskatchewan, Saskatoon, SK, Canada, ²Oregon State University, Union, ³USDA, Forest Service, La Grande, OR.

The objectives of this study were to document the effects of timber harvest and herbivory on the botanical composition of steer diets in grand fir (*Abies grandis*) and ponderosa pine (*Pinus ponderosa*) forests. Three grand fir and ponderosa pine sites were established in 1986. Grand fir sites were arranged as a split-plot design and timber harvest treatments: [1] no harvest (CON), 2) thinning (TH), 3) clearcut (CL)] were whole plots and herbivory treatments [1] cattle and big game grazing (GR), 2) big game grazing (BG), and 3) exclusion of cattle and big game grazing (EX)] were the sub-plots. Ponderosa pine sites were arranged as a split-plot design and timber harvest [1] CON, 2) TH] were whole plots and herbivory treatments [1] GR, 2) BG, and 3) EX] were

sub-plots. Diet samples were collected using four ruminally cannulated steers in June and August of 2001 and 2002. Microhistological analysis of ruminal masticate was used to determine the botanical composition of diets. Results from the grand fir sites revealed that graminoids were the major constituent in the diet ranging from 65 to 91%, forbs were intermediate ranging from 8 to 31%, and shrubs were least ranging from 0.2 to 3.5%. Season of use did not affect ($P > 0.10$) the composition of diets. Results from the ponderosa pine sites revealed that graminoids were the major constituent in the diet ranging from 83 to 88%, forbs were intermediate ranging from 10 to 14%, and shrubs were least ranging from 2 to 3%. Again, season of use did not affect ($P > 0.10$) the composition of diets. This study suggests that timing of grazing did not influence botanical composition of diets and that grasses were preferred by cattle grazing forested rangelands.

Key Words: Botanical composition, Ponderosa pine, Grand fir

Physiology

63 Breeding performance of primiparous beef cows exposed to the biostimulatory effect of bulls using a progestin-based estrus synchronization protocol. S. A. Tauck* and J. G. Berardinelli, *Montana State University, Bozeman.*

The objective of these experiments was to determine if factors associated with the biostimulatory effect of bulls alter breeding performance of primiparous suckled beef cows using progestin based estrus synchronization (ES) protocol. We tested the hypotheses that the ES response and AI pregnancy rates do not differ among cows exposed to bulls, continuously exposed to bull urine, and exposed to fence-line contact of bulls, or cows not exposed to bulls or bull urine. Data were collected from three experiments (Exp) performed over consecutive years. Cows were assigned to: physical bull exposure (BE; n=26) or no bull exposure (NE; n=27); bull urine exposure (BUE; n=19) or steer urine exposure (SUE; n=19); bull fence-line contact (BFL; n=26) or no fence-line contact (NE; n=26) in Exp 1, 2, and 3, respectively. The ES protocol in each Exp included the use of CIDR (d -10), PGF_{2α} (PG; d -3), GnRH and fixed-time AI (d 0), and cows that were observed in estrus by 60 h after PG were bred AI 12 h later. In Exp 1, 2, and 3 cows were exposed directly to bulls, bull urine, or bull fence-line contact for 35, 64 and 42 d, respectively. Data were analyzed between treatments within each Exp. Proportion of cows cycling did not differ between treatments at the start of each Exp; however, more ($P < 0.05$) BE and BFL cows were cycling at the start of ES than NE cows in Exp 1 and 3. Proportion of cows that showed estrus and interval to estrus after PG did not differ in Exp 1 and 3; however, in Exp 2, BUE cows tended ($P = 0.09$) to have shorter intervals to estrus and exhibit estrus after PG than SUE cows. Overall AI pregnancy rates were greater ($P < 0.05$) for BE and BUE cows than NE and SUE cows in Exp 1 and 2, respectively. There was no difference between treatments in Exp 3. The presence of bulls and exposure to bull urine appeared to improve breeding performance of primiparous beef cows using a progestin-based ES protocol, whereas, fence-line bull exposure apparently is insufficient to cause this biostimulatory effect.

Key Words: Biostimulation, Breeding performance, CIDR

64 Comparison of CIDR and MGA as progestin sources in an estrus synchronization protocol that included progestin, PGF_{2α}, and timed AI and GnRH in beef heifers. S. A. Tauck*, J. R. C. Wilkinson, and J. G. Berardinelli, *Montana State University, Bozeman.*

The objective of this experiment was to compare the estrus synchronization (ES) response and AI pregnancy rates of beef heifers using protocols that included controlled internal drug release devices (CIDR) or melengesterol acetate (MGA), PGF_{2α} (PG), and, timed AI (TAI) and GnRH. We tested the hypotheses that: 1) ES response after progestin (P) removal and after PG injection; and, 2) AI pregnancy rates do not differ between heifers synchronized using the CIDR or MGA protocol. On d 0 of the experiment 80 yearling crossbred Angus X Hereford heifers were stratified by age, BW, BCS, uterine tract score, and ovarian structures and assigned to be fed a supplement that contained MGA (0.5 MGA mg/hd/d) for 14 d (MES; n=40) or given a CIDR and fed the same supplement without MGA for 14 d (CES; n=40). On d 14 MGA supplementation ceased and CIDR were removed. Heifers were observed for estrus 3 to 4 times daily for 96 h after removal of P and twice daily until PG injection on d 29 and 31 for CES and MES heifers respectively. Thereafter, heifers were observed for estrus during the next 60 h from 0600 to 2400 h. Heifers that exhibited estrus within 60 h after PG were bred by AI 12 h later, heifers that did not exhibit estrus by 60 h were TAI at 72 h after PG and given GnRH (100 ug/hd). The proportion of heifers that exhibited estrus after P removal tended ($P = 0.087$) to be greater for CES heifers than for MES heifers. Interval for heifers that exhibited estrus after P removal was shorter ($P < 0.05$) for CES heifers than MES heifers. More ($P < 0.05$) CES heifers exhibited estrus and were bred by AI within 60 h after PG than MES heifers. Overall AI pregnancy rates did not differ between CES and MES heifers. We conclude that using CIDR as a progestin source in a 14 d progestin, PG, and timed AI and GnRH estrus synchronization protocol is as effective as MGA to synchronize estrus and generate AI pregnancies in beef heifers.

Key Words: CIDR, Estrus synchronization, Heifers

65 Superimposing 14 d MGA Pre-feeding and(or) 7 d CIDR on the Select Synch (GnRH-PG) estrous synchronization protocol in beef cows. J. K. Ahola¹, V. A. Aznarez², G. E. Seidel, Jr.², and J. C. Whittier², ¹University of Idaho, Caldwell, ²Colorado State University, Fort Collins.

Angus-based cows (n = 260, yr 1; n = 247, yr 2) were used to evaluate the combined effect of 14 d MGA pre-feeding and CIDR for 7 d, compared to three proven Select Synch-based estrous synchronization protocols, on estrous response and pregnancy rate to AI. In each year, cows were randomized by BCS, age, and calving date into four treatment groups. The Select Synch protocol (GnRH followed by PG after 7 d) was administered to all cows. Progestin treatments included: 1) MGA pre-feeding for 14 d followed by Select Synch 12 d later (MGA), 2) insertion of CIDR for 7 d concurrent with Select Synch (CIDR), 3) MGA pre-feeding for 14 d followed 12 d later by insertion of CIDR for 7 d concurrent with Select Synch (MGA+CIDR), and 4) Select Synch without a progestin (control). Following PG, cows were observed for estrus for 72 h, and inseminated approximately 12 h after estrus was first observed. Cows not observed in estrus within 72 h of PG were mass inseminated at approximately 78 h post PG and given 100 ug GnRH. Cows were not exposed to bulls for 9 d following mass insemination, and pregnancy rates to AI were determined by transrectal ultrasonography 40 d after mass insemination. Overall estrous response was 31.5%, and pregnancy rate to AI was 61.2%. Rate of estrus was not different (P>0.10) between MGA+CIDR and MGA, but both MGA+CIDR and MGA were lower (P<0.01) than CIDR and Control, which did not differ (P>0.10) from each other. Pregnancy rate to AI did not differ (P>0.10) among the four treatments. When data were evaluated for main effects (MGA and CIDR), pregnancy rate to AI was not affected (P>0.10) by either MGA or CIDR. In contrast, rate of estrus was greater (P<0.01) for cows that did not receive MGA compared to cows that received MGA, although rate of estrus was not affected (P>0.10) by CIDR. Results indicate that combining both MGA pre-feeding and CIDR into the Select Synch protocol does not result in a higher pregnancy rate to AI. Furthermore, incorporation of MGA into the Select Synch protocol appears to delay estrous response to PG, which could be beneficial in a mass insemination protocol.

Key Words: Beef cattle, CIDR, MGA

66 Microarray analysis of gene expression in anterior pituitary glands from anestrous and cycling postpartum beef cows. A. J. Roberts¹ and D. J. McLean², ¹USDA, ARS, Ft Keogh LARRL, Miles City MT, Miles City, MT, ²Washington State University, Pullman.

Oligonucleotide microarrays (GeneChip Bovine Genome Arrays, Affymetrix Inc., Santa Clara, CA) were used to evaluate gene expression profiles in anterior pituitary glands collected from four anestrous and four cycling postpartum beef cows. Anestrous cows were slaughtered 40 to 61 d after calving at ~2 yr of age. Cycling cows were slaughtered 7 to 13 d after estrus, at 54 to 77 d after calving. Anterior pituitary tissue was collected and snap-frozen in liquid nitrogen within 22 to 37 min after exsanguination. Total RNA was isolated from each sample and was reverse transcribed into double stranded cDNA and subsequently transcribed in the presence of biotinylated UTP to generate target for hybridization on the Bovine Genome GeneChip. Each sample was hy-

bridized to an individual Genechip containing 24,027 total probe sets including 23,080 bovine transcripts representing 19,000 unigene clusters as of March 2004. Levels of expression were compared across arrays using GeneChip Operating Software (GCOS; Affymetrix). Nine transcripts were expressed at greater levels in pituitaries from cycling cows than anestrous cows, including: IGFBP-3, gastrin-releasing peptide (GRP), claudin 1 (CLDN1), transcripts exhibiting >91% homology to the human genes 2-hydroxyphytanol-CoA lyase (2-HPCL) and Kelch-related protein 1 (KRP1), and 4 uncharacterized transcripts (Unigene ID Bt.2501, Bt.10261, Bt.12034 and Bt.14570). Transcripts expressed at lower levels in cycling than anestrous cows included: signal transducer and activator of transcription 3 (Stat3), versican (CSPG2), translation initiation factor eIF-4E (eIF-4E), microsomal glutathione-S-transferase (MGST1), protein S alpha (PROS1), and two uncharacterized transcripts (Unigene ID Bt.33897 and Bt.25587). Although further study is required to confirm the role of these genes in the transition from anestrous to cycling status, results demonstrate potential of this methodology for identifying novel mechanisms regulating reproductive function.

Key Words: Pituitary, Anestrous, Gene expression

67 Effects of dam nutrition on growth and reproductive performance of heifer calves. J. Martin¹, K. Vonnahme², D. Adams¹, G. Lardy², and R. Funston¹, ¹University of Nebraska, North Platte, ²North Dakota State University, Fargo.

A 3-yr study was conducted with heifers (n = 170) whose dams were used in a 2x2 factorial to determine effects of late gestation (LG) or early lactation (EL) dam nutrition on subsequent heifer growth and reproductive performance. In LG, cows received either 0.45 kg/d of 42% CP supplement (PS) or no supplement while grazing dormant winter range. During EL, cows were either fed cool-season grass hay or grazed sub-irrigated meadow. Cows were managed in a common group the remainder of the year. Heifer birth date and birth weight were not affected (P>0.10) by LG or EL dam nutrition. Spring meadow grazing and PS increased (P = 0.02; P = 0.07) heifer 205-d weight. Pre-breeding weight and weight at pregnancy determination were greater (P = 0.04; P = 0.03) for heifers from PS dams, but EL nutrition did not affect (P > 0.10) either weight. There was no effect (P > 0.10) of LG or EL dam nutrition on age at puberty or percentage of heifers cyclic before breeding, and no difference (P > 0.10) in pregnancy rates or calving data due to EL nutrition of the dam. However, first service and overall pregnancy rates were greater (P = 0.003; P = 0.05) for heifers from PS dams. Heifers born to PS cows calved earlier (P = 0.07) in their initial calving season, had a greater proportion unassisted births (P = 0.03), but similar (P = 0.61) calf birth weights. Body weight and BCS at the beginning of the second breeding season were not affected by maternal nutrition (P > 0.10). Dam nutrition did not affect (P > 0.10) individually-fed heifer ADG or G:F ratio. There was an LG x EL interaction for DMI (P = 0.09) and residual feed intake (RFI; P = 0.07). Heifers from PS dams had greater DMI (P = 0.09) and RFI (P = 0.07) if their dams were fed hay during EL, but not if their dams grazed meadows. Protein supplementation during LG improved growth and pregnancy rate in heifer offspring.

Key Words: Protein supplement, Fetal programming, Heifer development

Ruminant Nutrition

68 Determination of diet protein and digestibility of native Sandhills upland range. B. G. Geisert*, T. J. Klopfenstein, D. C. Adams, and J. A. Musgrave, *University of Nebraska, Lincoln*.

Abstract: Feed accounts for the majority of the variable costs with beef production. Formulating supplements for grazing cattle to accurately meet their nutrient requirements with economical feedstuffs is challenging due to the limited data on diet quality of pastures. The objective of this study was to determine diet CP and in vitro organic matter digestibility (IVOMD) of Sandhills upland range pastures following varying levels of forage removed by grazing (e.g. high, moderate, and un-grazed). Monthly diet samples were collected from esophageally fistulated cows from May 2003 through November 2005. Samples were freeze dried, ground and composited for CP and IVOMD analysis. There was a year by grazing level interaction ($P < 0.05$) in CP values and no interactions for IVOMD. There was a year effect ($P < 0.01$) where 2003 was lower than 2004 and 2005 which may be explained by drought conditions (54.8, 60.0, and 61.4% for 2003, 2004, and 2005, respectively). High intensity of grazing decreased ($P = 0.01$) IVOMD of diet samples compared to moderate and un-grazed (57.1, 59.2, and 60.0% for high, moderate, and un-grazed levels, respectively). The IVOMD increased ($P < 0.001$) in May and decreased to dormant levels in September and remained relatively constant throughout the dormant season. In vitro OMD were 57.3, 57.8, 58.6, 59.9, 62.6, 61.2, 60.2, 59.6, 56.0, 57.9, 57.0, and 56.8% for January through December, respectively. Monthly CP values followed a similar monthly pattern as IVOMD (6.5, 5.9, 6.9, 9.8, 13.5, 11.2, 11.5, 8.8, 8.3, 7.2, 6.9, and 6.7%, January through December, respectively). Increasing grazing pressure most likely decreased OM digestibility of diet samples by lowering availability of high digestible plants and plant components. Crude protein and IVOMD data from this trial may be used in the NRC to precisely determine nutrient status of cattle and more accurately formulate supplements during the year.

Key Words: Esophageal, In vitro, Grazing cattle

69 Diet quality impacts on ewe nutrient partitioning. R. L. Endecott*, S. L. Lodge-Ivey, K. K. Kane, L. M. Dixon, M. E. Giacomini, B. R. Schilling, S. A. Soto-Navarro, C. A. Löest, D. E. Hawkins, and M. K. Petersen, *New Mexico State University, Las Cruces*.

Diet quality has been implicated as a regulator of nutrient partitioning by altering tissue sensitivity to insulin. Our objective was to investigate diet-induced changes in insulin sensitivity of non-pregnant, non-lactating ewes ($n = 18$). During baseline phase (BPHASE), ewes were fed 50% wheat straw/sorghum sudangrass hay (5.1% CP, 84% NDF, OM basis) and 50% alfalfa hay (21.1% CP, 40% NDF, OM basis) for 4 wk. After BPHASE measurements (glucose tolerance test, 0.5 mg/kg BW), ewes were assigned in an experimental phase (EPHASE) to one of three diets fed 4 wk: 1) 100% alfalfa hay ad libitum (ALF), 2) 100% wheat straw/sorghum sudangrass hay ad libitum (STRAW), or 3) 100% alfalfa pair-fed with a straw/sorghum sudangrass ewe (PAIR). Measurements were repeated after EPHASE. Experimental diet did not impact glucose half-life (phase \times trt $P = 0.85$; 73 and 87 \pm 9 min; BPHASE and EPHASE). Ewes fed STRAW had larger glucose area under the curve (AUC) compared to BPHASE values ($P = 0.06$; 13498 vs 10359 \pm 1134 units,

respectively). Insulin AUC were similar within phase (phase \times trt $P = 0.49$; 155 and 273 \pm 22 units; BPHASE and EPHASE). Because glucose and insulin AUC were similar in BPHASE, insulin resistance was considered equal. In EPHASE, insulin AUC were again similar; therefore, glucose AUC measured insulin's ability to mediate disposal of infused glucose. Because STRAW ewes had larger glucose AUC in EPHASE, insulin resistance was induced. Insulin and glucose AUC indices (insulin AUC:glucose AUC) can indicate insulin resistance. A lower index would be diagnostic of insulin resistance since glucose AUC remained larger even though insulin AUC were similar. Indices for ALF and PAIR ewes increased compared to BPHASE values ($P = 0.03$; ALF 0.019 vs 0.025, PAIR 0.016 vs 0.024 \pm 0.003; BPHASE vs EPHASE), while STRAW ewes had a similar index in both phases (0.017 vs 0.018 \pm 0.003; BPHASE vs EPHASE). Low quality forage diets can induce insulin resistance in a non-pregnant, non-lactating ruminant model.

Key Words: Insulin sensitivity, Low quality forage, Glucose

70 Effect of fat supplementation of steers grazing wheat pasture on forage intake and characteristics of digestion. D. Chabot*, C. Chabot, L. K. Conway, and S. A. Soto-Navarro, *New Mexico State University, Las Cruces*.

Nine ruminally cannulated mixed-breed steers were used in a complete randomized block design to evaluate effects of fat supplementation and forage maturity on intake, digestibility and rumen fermentation characteristics. Treatments were supplements containing: mineral pack (M) offered at 114g/d; mineral pack plus fiber as soybean hulls-wheat middlings (MF) offered at 0.50% BW; and mineral pack plus fiber as soybean hulls-wheat middlings and tallow (MFT) offered at 0.625% BW. Stage of wheat maturity was used as block (prior to jointing, mid-March, MAR; and post-jointing, early April, APR). Steers grazed in a single wheat pasture with supplements offered individually once daily at 0700. There were supplement type \times forage maturity interactions ($P < 0.05$) for forage OM, CP, and NDF intakes. During MAR, forage OM, CP, and NDF intakes differed (MF $>$ M, $P > 0.05$, and MF = MFT, $P > 0.05$). During APR, forage OM, CP and NDF intakes differed (MF $>$ M = MFT, $P < 0.05$). Steers receiving M and MFT supplements were not different ($P > 0.05$) during APR or MAR. There were also supplement type \times forage maturity interactions ($P < 0.05$) for forage OM and NDF digestibility. During MAR, OM and NDF digestibility differed (MF $>$ MFT $>$ M, $P < 0.05$). During APR, OM and NDF digestibility differed (MF $>$ M = MFT, $P < 0.05$). Crude protein digestibility was affected by supplement type (MF $>$ MFT $>$ M, $P < 0.05$) and stage of maturity (MAR $>$ APR, $P < 0.05$). The rates of DM and NDF ruminal disappearance were not affected ($P > 0.05$) by supplement or maturity. Supplementation increased ($P < 0.05$) ruminal propionate concentration (19.7, 21.4, and 25.1 \pm 0.49 mol/100mols for M, MF, and MFT, respectively). Tallow can be used in wheat pasture supplements to increase energy intake without negatively affecting forage intake, ruminal fermentation and digestion specially if used before the jointing stage of wheat maturity. Additional research is required to determine the optimum level of tallow supplementation.

Key Words: Stocker, Wheat pasture, Fat supplementation

POSTER PRESENTATIONS

71 Case study: A five year summary of carcass data from calves enrolled in the Montana Beef Network. K. M. Rolfe^{*1}, J. A. Paterson¹, S. Suther³, M. King², and L. Corah³, ¹Montana State University, Bozeman, ²Colorado State University, Ft. Collins, ³Certified Angus Beef, Manhattan, KS.

The Montana Beef Network (MBN) is a cooperative effort between Montana State University Extension Service and Montana Stockgrowers Association. A project with Certified Angus Beef and Colorado State University was implemented to begin to summarize carcass data (17,306 animals) for the years of 1999 through 2003. The carcass characteristics analyzed were: yield grade (YG); quality grade (QG); hot carcass weight (HCW); ribeye area (REA); back fat (BF); marbling score (MB); and kidney, pelvic, heart fat (KPH). Correlation coefficients were developed from these data. The average hot carcass weights averaged 356 kg (range of 156 to 527 kg) while average QG for the calves was 66.6% which was higher than the national average of approximately 54%. Thirty three percent of the carcasses were average choice or better. Average YG was 3.10 (range of 0.0 to 6.81) but the 10.1% YG 4s & 5s were higher than expected. Ribeye area per hundred pounds (REA/45.4 kg carcass wt) averaged 1.64 with a range of .91 to 3.34. Backfat averaged 1.3 cm and suggested the cattle were harvested at the right weight. Correlation coefficients showed a slightly positive relationship with backfat (.274) and yield grade (.289), but no correlation with carcass weight (-.08). The ratio of REA/carcass weight was nearly twice as important (.764) as backfat (-.314) or carcass weight (-.47) to final YG. These results suggest that these cattle did not have the muscling to be 386 to 409 kg carcasses. Results also suggested that these calves had the genetic potential to grade at least low choice but over feeding to a heavier carcass weight would result in a yield grade discount.

Key Words: Beef cattle, Carcass, Extension

72 Effect of decreasing temperature on the readability of six different radio frequency electronic identification transponders scanned by five different transceivers. L. E. Wallace^{*}, J. A. Paterson, R. Clark, A. Kellom, T. Standley, and M. Vogel, *Montana State University, Bozeman.*

The objective of this study was to determine if different sources of electronic ear tags (transponders) and readers (transceivers) were influenced by temperature extremes. Read ranges of six commercially available, [five full-duplex (FDX) and one half-duplex (HDX)] radio frequency identification (RFID) ear tags were evaluated using five handheld commercially available stick readers at three temperatures (20°C, 2°C and -19°C). Fifty ear tags from each company were randomly selected and scanned by each reader to determine if the coldest temperature decreased tag read range and the scanners ability to read tags. Tags and readers were exposed to three temperatures for 22 h prior to the initiation of the experiment. The distance of the tag from the reader when the reader scanned the tag was then recorded. The tags were read with the orientation that best maximized the read range. Although there were no differences in read range among the three temperatures (P>0.05), there were differences (P<0.05) in the read ranges among the tags. The HDX tag had an average read distance of 23.7 cm, while one FDX tag had an

average read distance of 12.2 cm with the remaining tags being intermediate. There were differences (P<0.05) in the average read range among the scanners as well. The average read distance was 25.5 cm from one reader compared to a distance of 8.6 cm from another reader. These data suggest that cold temperatures (-19°C) did not reduce the read range of various tags. The HDX (half-duplex) tag consistently had the longest read range compared to the FDX (full-duplex) tags. There was a reader by temperature interaction (P<0.05). All readers tested read the different sources of tags in the study with a read range between 8.6 and 25.5 cm. Further research in this area will focus on retention and readability of these RFID transponders in cows over several years.

Key Words: Ear tag, Electronic identification, Temperature

73 Readability and retention rates of radio frequency identification (RFID) ear tags when tracking the movement of calves using three scanning methods. A. Kellom^{*}, J. A. Paterson, R. Clark, and L. Duffey, *Montana State University, Bozeman.*

Calves from three commercial ranches in MT were tagged with Allflex half duplex (HDX) electronic identification (RFID) ear tags. Readability of tags was evaluated by three different methods; 1) handheld-stick reader, 2) ATL-walk through reader, and 3) panel reader. At weaning, calves from Ranch A (491 head) were transported to wheat pasture in OK followed by sale through an auction market and then shipped to a feedlot and finally to a packing plant in NE. Tags were scanned at each movement with a stick reader with read rates between 98.1% to 100%. Tag retention after approximately 210 d was 97.1%. Calves from Ranch B (164 head) were weaned and grazed on a summer Forest Service permit in MT and then sent to a NE feedlot followed by harvest in NE. Calves were scanned onto the permit with an ATL (walk-through) reader and had a read rate of 92.1%. The calves were scanned when removed from summer grazing prior to entering the feedlot with a panel reader. The read rate was 93.4%. Tag retention after approximately 180 d was 100%. Calves from Ranch C (555 head) were born in ID, wintered in MT, summered in ID and then transported to a KS feedlot and finally harvested in NE. Tags were scanned with stick reader when entering MT and had a read rate of 100%. Calves were scanned when moved back to ID with both a stick and ATL reader and had read rates of 100% and 73.6%, respectively. When moved to the KS feedlot, tags were scanned with a panel reader fitted to the loading chute. The read rate of 98.5%. Tag retention after approximately 180 d was 98.0%. These data indicate that the handheld stick scanner read the highest percentage of tags while the ATL walk-through device read the lowest percentage. The panel reader was intermediate in its ability to read tags. Metal panels in corrals appeared to have negative effects on the stationary readers. Tag retention of RFID tags among these three ranches was much higher than with traditional plastic dangle eartags.

Key Words: Electronic identification, Eartag retention, Animal traceability

74 Effects of prophylactic administration of Ceftiofur crystalline free acid on health and performance of newly received beef calves. A. M. Encinias^{*1}, D. A. Walker¹, C. W. Murdock¹, L. A. Reeves¹, K. J. Malcolm-Callis¹, and S. A. Soto-Navarro², ¹New Mexico State University, Clayton, ²New Mexico State University, Las Cruces.

One-hundred six newly received crossbred beef steers (198.2 ± 0.7 kg BW) were used to evaluate effects of ceftiofur crystalline free acid (EXCEDE™, Pfizer Animal Health) on health and performance during a 28-d receiving period. Calves were transported 1440 km from Missouri to the Clayton Livestock Research Center (CLRC) in Clayton, NM. At arrival, steers were individually processed and assigned to one of two treatments: 1) control (CON) no ceftiofur equivalent (CE), or 2) 6.6 mg/kg BW CE (s.c., ear). Alternate steers through the chute were assigned to CE treatment, stratified by BW, and assigned to pens (8 to 9 steers/pen; 6 pens/treatment). All steers had free access to a 70% concentrate diet. Steers were observed once daily after feeding (0800) for visual signs of respiratory disease (BRD). Steers with a rectal temperature greater than or equal to 39.7°C received additional antibiotic therapy for BRD. No steers died from BRD during the experiment. Prophylactic treatment with CE reduced the number of steers treated for BRD over the 28-d period from 89.0% of CON to 42.5% of those receiving CE (P < 0.01). Of steers treated a first time for BRD, 45.8 and 20.8 ± 9.3% of CON and CE calves, respectively, received a second treatment (P = 0.08). Calves receiving CE had greater (P = 0.02) DMI compared with CON. Steers treated with CE tended (P = 0.09) to gain more (1.22 vs. 0.99 ± 0.08 kg/d) than CON over 28-d. Prophylactic use of CE improves health and performance of newly received feedlot calves.

Key Words: Antibiotic, Bovine respiratory disease, Cattle

75 Prevalence of Shiga toxin-producing *Escherichia coli* in feedlot steers during winter and spring. L. M. Bollinger^{*1}, H. S. Hussein¹, M. R. Hall¹, and E. R. Atwill², ¹University of Nevada, Reno, ²University of California, Tulare.

Beef safety concerns have been on the rise in recent years due to tracing a large number of human illness outbreaks to Shiga toxin-producing *Escherichia coli* (STEC)-contaminated beef. The human illnesses included diarrhea, bloody diarrhea, abdominal cramps, vomiting, hemorrhagic colitis, and the life-threatening hemolytic uremic syndrome (HUS). The objective was to assess STEC prevalence in four large-scale (ranging from 13,000 to 46,000 cattle) feedlots in California during winter and spring. Fresh fecal samples were collected from 161 and 160 steers that had been on feed for the shortest (ranging from 66 to 186 d) or longest (ranging from 197 to 346 d) period of time, respectively. Over the two seasons, STEC were recovered in two of the four feedlots at a similar prevalence rate (3.8%). Prevalence rates of STEC were not altered (P > 0.05) by season (averaging 1.9%) or time on feed (averaging 1.9%). The STEC isolates belonged to five serotypes (*E. coli* O127:H19, O136:HUT [an untypeable H antigen], OUT [an untypeable O antigen]:H2, OUT:H⁻ [a nonmotile isolate], and OUT:HUT). Of these STEC serotypes, two (*E. coli* OUT:H2 and OUT:H⁻) are known to cause HUS and one (*E. coli* OUT:HUT) is known to cause other human illnesses. The *E. coli* O127:H19 serotype detected in this study has not been reported in cattle. Interestingly, *E. coli* O157:H7 isolates were not found in the steers tested. The results of this study emphasize the importance of testing beef cattle for STEC, in general, and suggest the

need for developing pre-harvest control methods to decrease carriage and fecal shedding of these foodborne pathogens.

Key Words: Food safety, Beef cattle, *Escherichia coli*

76 Feedlot performance and carcass characteristics of steers treated with two beta-adrenergic agonists. L. Avendano^{*1}, V. Torres², F. J. Meraz², C. Perez¹, F. Figueroa¹, P. H. Robinson³, A. Correa¹, and F. D. Alvarez¹, ¹Universidad Autonoma de Baja California, Mexicali, Baja California, Mexico, ²Asociacion Ganadera Local Especializada en Bovinos Para Engorda de Baja California, Mexicali, Baja California, Mexico, ³University of California, Davis.

Forty-five crossbred and 9 Brangus steers were blocked by initial BW (424 ± 26.6 kg) and assigned to 18 pens, each containing 3 steers (6 blocks). All steers received the same finishing diet which included steam-rolled wheat grain, whole Upland cottonseed, liquid molasses, Sudan hay, animal fat, and a mineral supplement. Pens were assigned to one of three treatments: 1) Control (C: no feed additive); 2) a group supplemented with 60 mg of zilpaterol hydrochloride (ZH) per head per day, and 3) a group supplemented with 300 mg of ractopamine hydrochloride (RH) per head per day. The beta agonists were added to the diets during the final 30 d of the finishing period. Steers fed ZH and RH had 26 and 24% higher (P < 0.01) ADG vs. C steers. RH steers consumed less (P < 0.05) DM (8.37 kg/d) than C steers (8.51 kg/d), but DM intake of ZH steers (8.46/d) did not differ from C steers. Addition of either beta-agonist to the diet considerably improved (P < 0.01) the ADG:DMI ratio (ZH: 0.253, RH: 0.248, vs. C: 0.185). Both beta-agonists increased hot carcass weights, with carcasses from ZH and RH steers being 7% and 5% heavier (P < 0.01) than carcasses from C steers. Carcass yield was higher in ZH steers (63%; P < 0.01) and RH steers (62.5%; P < 0.05), than in C steers (61%). The LM area was larger (P < 0.05) in ZH steers (75.2 cm²) than in C steers (66.8 cm²), but that of RH steers (72.2 cm²) did not differ from C steers. There was a trend (P = 0.055) for ZH steers to have less 12th rib fat (1.36 cm) vs. C steers (1.65 cm), but the amount in RH steers (1.55 cm) did not differ from C steers. RH steers tended (P = 0.07) to produce more lean (79.6%) vs. C steers (77.4%), while meat yield of ZH steers (79.2%) and C steers did not differ (P > 0.05). Bone and fat yield were similar (P > 0.05) in all groups. In general, feedlot performance was greatly enhanced by both β-adrenergic agonists, as well as some carcass characteristics.

Key Words: Feedlot cattle, Beta adrenergic agonists, Carcass characteristics

77 Meat quality of steers treated with two beta-adrenergic agonists. L. Avendano^{*1}, V. Torres², F. J. Meraz², C. Perez¹, F. Figueroa¹, P. H. Robinson³, F. D. Alvarez¹, and A. Correa¹, ¹Universidad Autonoma de Baja California, Mexicali, Baja California, Mexico, ²Asociacion Ganadera Local Especializada en Bovinos Para Engorda de Baja California, Mexicali, Baja California, Mexico, ³University of California, Davis.

Forty-five crossbred and 9 Brangus steers were blocked by initial BW (424 ± 26.6 kg) and assigned to 18 pens, each containing 3 steers (6 blocks). All steers received the same finishing diet. Pens were assigned to one of three treatments: 1) Control (C: no feed additive); 2) a group

supplemented with 60 mg of zilpaterol hydrochloride (ZH) per head per day, and 3) a group supplemented with 300 mg of ractopamine hydrochloride (RH) per head per day. The beta agonists were added to the diets during the last 30 d of the finishing period. After the feeding phase, steers were transported to a commercial abattoir for slaughter. Two Longissimus dorsi (LM) steaks cut from each carcass were removed between the 12th and 13rd rib interface and half of the steaks from each animal were analyzed 5 d postmortem and the remaining half at 14 d, both considered as raw meat. There was a treatment effect ($P < 0.01$) for shear force (ZH=5.11; RH=4.83; C=4.39 kg/cm²), as well as for hue angle (ZH=29.67; RH=29.52; C=28.15 units) in the LM area for the beta agonist treatments compared with C steers. There was only a trend ($P = 0.065$) for yellowness in treatment RH (9.81) compared with C steers (9.369), while yellowness of the ZH treatment (9.26) did not differ from C steers. A day by treatment interaction occurred ($P < 0.05$) for pH, water holding capacity, drip loss, lightness, redness and chroma variables. However, the values obtained for all these variables were within normal ranges of a standard quality of meat, suggesting that color was similar for all groups. In general, meat color was unaffected by beta-agonist supplementation and toughness was classified as intermediate. The use of these beta agonists can optimize steer performance without substantively compromising meat quality.

Key Words: Feedlot steers, Meat quality, Beta adrenergic agonists

78 Effects of feeding olive pomace on the fatty acid profile of pork. S. P. Doyle^{*1}, K. R. Harrison¹, C. A. Daley¹, P. C. Hamilton², and D. K. Sinnott¹, ¹California State University, Chico, ²Sam Houston State University, Huntsville, TX.

The objective of this study was to determine the effects of including olive pomace in a swine finishing diet on the lipid profile of pork. Sixty crossbred gilts and barrows of Duroc, Hampshire, and Yorkshire breeding were randomly assigned to one of two treatment groups across initial weight: a corn-based control versus olive pomace (10% inclusion rate). Swine were maintained in a concrete finishing facility at the California State University, Chico Agricultural Teaching and Research Center and given free access to feed and water throughout the trial. Upon harvest (45-d finish), *Longissimus* muscle was obtained from matching locations (post-12th rib) from each pig, aged 14 d at 34° C, and then frozen until ground for lipid analysis. Lipids were extracted from chops in triplicate using a modified version of the Stanton et al. (1997) procedure. Saturated, mono- and poly-unsaturated, omega3, omega6, and conjugated linoleic fatty acid contents of each chop were then determined by gas chromatography using procedures described by Realini et al. (2005). Data were analyzed using ANOVA (Statistix 8, 2003) as a 2 X 2 X 3 factorial where there were 2 genders, 2 diets, and 3 sire breeds. Pork finished with olive pomace was significantly lower in saturated fat, polyunsaturated fat and omega-6 fatty acids ($p < .05$) compared to the control diet. Pomace-finished pork appeared to be 5.05% lower in saturated fat, 2.22% lower in polyunsaturated fats, and 2.47% lower in omega-6 fatty acids compared to corn-finished pork. Results also suggested no significant differences among diets for monounsaturated fat, omega-3 fatty acids, omega-6:omega-3 ratio, and conjugated linoleic acid ($p > .05$). Breed and gender did not appear to significantly affect pork lipid profiles. Research suggests the inclusion of olive pomace as a component of a swine finishing diet appears to lower the percent saturated fatty acids, total polyunsaturated fatty acids, and omega-6 fatty

acids in pork, providing consumers a healthier meat product from a human health point of view.

Key Words: Pork, Fatty acid, Lipids

79 Use of a Russian knapweed as a protein supplement for beef cows consuming low-quality forage. D. W. Bohnert^{*1}, R. L. Sheley², S. J. Falck², and A. A. Nyman¹, ¹Oregon State University, Burns, ²Eastern Oregon Agricultural Research Center, USDA-ARS, Burns, OR.

Russian knapweed (*Centaurea repens*) is a perennial noxious weed. Controlling Russian knapweed has proven very difficult and expensive. Sustainable invasive weed strategies may require that weeds are used in livestock production systems. Russian knapweed has protein values similar to alfalfa and may have potential as a protein supplement for beef cattle consuming low-quality forages. Therefore, we compared Russian knapweed and alfalfa (13 and 21% CP, respectively; DM basis) as protein supplements using 48 Hereford × Angus, mid-gestation, beef cows (530 ± 5 kg) offered ad libitum hard fescue straw (4% CP; DM basis) in an 84-d study. Treatments included an unsupplemented control (CON) and alfalfa (ALF) or knapweed (KNAP) provided on an iso-nitrogenous basis (approximately 0.50 kg CP/d). Cows were stratified by weight and BCS and allotted to treatments in a randomized complete block design using 12 pens (4 cows/pen; 16 cows/treatment). Means were compared using orthogonal contrasts (CON vs ALF and KNAP; ALF vs KNAP). Protein supplementation increased ($P < 0.01$) cow weight gain and BCS compared to CON with no difference between ALF and KNAP ($P > 0.27$). There was no difference ($P = 0.60$) in the quantity of straw offered between CON and supplemented groups but ALF cows were offered approximately 11% more ($P = 0.03$) than KNAP cows. Total DM offered to cows was greater ($P < 0.01$) for supplemented compared with CON cows with no difference noted between ALF and KNAP ($P = 0.79$). Russian knapweed can be used as a protein supplement for beef cows consuming low-quality forage. Thus, haying Russian knapweed in the spring and feeding in the winter may provide an alternative to control of large scale infestations.

Key Words: Management, Supplementation, Weed

80 Evaluating beef cow performance: Comparing crested wheatgrass/legume, big bluestem, and foxtail millet in swath grazing. B. W. Neville^{*1}, G. P. Lardy¹, P. Nyren², and K. K. Sedivec¹, ¹North Dakota State University, Fargo, ²Central Grasslands Research Center, Streeter, ND.

The objective of this study was to evaluate cow performance in a swath grazing system on three different forages; crested wheatgrass *Agropyron cristatum* (CWG), big bluestem *Andropogon gerardii* (BBS), and foxtail millet *Setaria italic* (FM) in a split plot treatment arrangement. Grazed native range (NR) was included as a control. For each of the swath grazing treatments, each non-irrigated pasture (12.0 ha) was divided into three paddocks (4.0 ha). Three native range pastures (16.6 ha) were used as the non-swathed grazing treatment. A cooked molasses block supplement was included with BBS due to the low CP content of the forage. One-hundred forty-four cross-bred gestating beef cows (average initial BW 557 kg ± 67 kg) were weighed and body condition

scored (BCS) on two consecutive days and assigned randomly to one of four treatments. Body weights and BCS were collected on two consecutive days at the conclusion of the experiment. Ten 0.25m² plots were clipped at ground level, beginning June 28 and continuing mid-month throughout the growing season to provide samples for nutrient analysis and to estimate forage production. Samples of swathed forage and clipped plots of standing native range were collected throughout the trial for nutrient analysis. Forage production for CWG, BBS, and FM was 3373, 2686, and 7414 kg DM/ha, respectively. Stocking rates were 2.2, 1.7, 5.7, and 0.5 hd/ha for CWG, BBS, FM, and NR, respectively. Cows had similar final BW ($P = 0.97$) and BCS change was similar ($P = 0.12$) between treatments. While there were no differences in final BW, it is notable that the FM treatment had stocking rates 2.6 to 3.3 times that of the other treatments. Therefore, we conclude that swath grazing is an acceptable alternative to grazing native range for wintering beef cows in central North Dakota.

Key Words: Cattle, Swath grazing, Windrowed forage

81 Comparison of techniques for quantitative analysis of acid detergent lignin in roughages. T. R. Weston, V. Nayigihugu*, and B. W. Hess, *University of Wyoming, Laramie.*

The objective of this experiment was to compare the conventional crucible method to a semi-automated method for determination of ADL in roughages. Samples analyzed were selected to provide a broad range of cellulose and lignin content based on ADF. Samples included Kentucky bluegrass (*Poa pratensis*), leaders of Wyoming big sagebrush (*Artemisia tridentata*), medic (*Medicago rigidula*), crested wheatgrass (*Agropyron desertorum*) hay, millet (*Setaria italica*) hay, wheat (*Triticum* spp) straw, and wood shavings. The efficacy of recycling filtered acid back through the crucible versus adding fresh acid was evaluated to allow for a direct comparison with the semi-automated method. Acid detergent lignin did not differ ($P = 0.38$) between recycled and fresh 72% H₂SO₄. Samples analyzed using the semi-automated method tended to have less ($P = 0.07$) ADL (% of DM) than those analyzed using the conventional crucible method. This was due to less ($P < 0.001$) ADF (% of DM) for the ANKOM²⁰⁰ filter bag technique compared with the reflux fiber digestion apparatus because content of ADL expressed as % of ADF did not differ ($P = 0.27$) between the conventional crucible and semi-automated methods. Additionally, ADL expressed as % of ADF was highly correlated ($r = 0.99$, $P < 0.001$) between the two methods. Complete ADL analysis by the semi-automated method required only 3.5 h compared with 5.5 h for completion using the conventional crucible procedure. We conclude that the semi-automated method is an acceptable and more time efficient procedure than the conventional crucible method for determination of ADL in roughages.

Key Words: Acid detergent lignin, Roughage analysis

82 Comparison of catalysts for direct transesterification of fatty acids in freeze-dried forage samples. T. R. Weston¹, J. D. Derner², C. M. Murrieta¹, D. C. Rule*, and B. W. Hess¹, ¹University of Wyoming, Laramie, ²High Plains Grasslands Research Station, USDA-ARS, Cheyenne, WY.

Our objective was to compare 1.09 M methanolic HCl to 14% BF₃ in methanol as catalysts for direct transesterification of fatty acids in

freeze-dried forage samples. Samples included blue grama (*Bouteloua gracilis*), fringed sage (*Artemisia frigida*), western wheatgrass (*Pascopyrum smithii*), needle-and-thread (*Stipa comata*), dalmation toad-flax (*Linaria dalmatica*), needleleaf sedge (*Carex eleocharis*), and scarlet globemallow (*Sphaelercea coccinea*). Thin layer chromatographic evaluation revealed complete conversion of total lipid extracts to fatty acid methyl esters using both catalysts. Additionally, GLC analysis confirmed similar ($P = 0.96$) total fatty acid concentrations for both catalysts. Concentrations of most identified fatty acids (13:0, 14:0, 16:0, 16:1, 17:0, 17:1, 18:0, 18:1, 18:2, 18:3, 19:0, 20:0, 20:1, 22:0, 22:1, 22:3, 24:0, 24:1, and 28:0) were similar ($P = 0.17$ to 0.99) for both catalysts. Concentrations of 14:0 tended to be greater ($P = 0.07$) for HCl but weight percentages of 14:0 did not differ ($P = 0.23$) between catalysts. Concentrations and weight percentages of 17:1 were less ($P < 0.0001$) for HCl compared with BF₃. Boron-trifluoride may cause partial isomerization of predominant fatty acids because the concentrations of unidentified fatty acids with GLC retention times of 8.0, 13.9, and 31.9 min were greater ($P = 0.005$ to 0.05) for BF₃; whereas, only the concentration of unidentified fatty acid eluting at 14.8 min was greater ($P = 0.02$) for HCl. Nevertheless, total concentration of unidentified fatty acids did not differ ($P = 0.71$) between catalysts. Additionally, total weight percentages of identified fatty acids and unidentified fatty acids were not affected ($P = 0.37$) by catalyst (91.2 and 8.8% vs. 90.6 and 9.4% for HCl and BF₃, respectively). It is also possible that BF₃ is more efficient at catalyzing methylation of less common or unusual fatty acids, but BF₃ costs \$0.19 per sample more than HCl. We conclude that 1.09 M methanolic HCl is both a cost effective and appropriate substitute for 14% BF₃ in methanol for preparation of fatty acid methyl esters from freeze-dried forage samples.

Key Words: Fatty acids, Forages, Methyl esters

83 Beef cattle grazing and forage production comparisons of alfalfa-grass versus sainfoin pastures. A.D. Iwaasa*, P.G. Jefferson, and R. Lemke, *Agriculture and Agri-Food Canada - Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada.*

Mixing alfalfa (*Medicago sativa* L.) with grasses has been the most practical bloat prevention method. However, beef cattle producers still are concerned about potential bloat hazards when alfalfa dominates mixtures in the semiarid region of the Canadian prairie. Sainfoin (*Onobrychis viciifolia* Scop.), a non-bloat legume, can provide good forage and beef production in semiarid regions, but sainfoin exhibits poor persistence when grown in combination with other forages. The objective of this study was to compare the grazing and forage production between a new alfalfa-grass mixture (Spredor 4 and hybrid brome) (A+G) versus sainfoin (S) grown as a monoculture. Sainfoin and A+G were established in 2003 and the pastures were grazed at the S bloom stage and when the alfalfa was about 10% bloom, respectively. The experimental design was a 2 X 2 factorial (forages: S & A+G and pasture utilization: 50 & 70%) with three replications. Grazing and forage production data were collected in 2004 and 2005 for average daily gains (ADG), available forage yield (AYD) and grazing days (GD). No significant interactions were observed for ADG and AYD. However, a significant two way interaction (forage treatments x year) was observed for GD. As expected, available forage yield was higher ($P < 0.05$) for the A+G vs. S, and the values were 5,912 and 4,838 ± 251 kg of DM ha⁻¹, respectively. Average daily gains were similar between the A+G and S pastures and the values were 0.71 and 0.67 ± 0.10 kg d⁻¹, respectively. However, a higher ($P < 0.01$) number of GD were observed for A+G vs.

S, and the values were 146 and $77 \pm 17 \text{ d ha}^{-1}$, respectively. A distinctive grazing behavior was observed for yearling steers grazing S, which may explain the similar ADG observed between the two forage treatments and provide a possible grazing strategy to improve the longevity of the S stand. Sainfoin has good grazing and forage potential for the semiarid region of the Canadian prairies, however stand persistence concerns still are being evaluated.

Key Words: Sainfoin, Alfalfa-grass, Pasture grazing

84 Relationships among harvest index, forage quality, maturity and other factors in hay barley varieties. A. N. Hafila*, S. D. Cash, P. F. Hensleigh, and L. M. M. Surber, *Montana State University, Bozeman.*

Producers growing annual forages such as barley for production desire both yield and quality. The objectives of this study were to (1) evaluate yield and quality of forage, grain, and straw of different forage lines and (2) analyze the relationships among these components. Twenty-four barley lines were grown in three replicates under dry land conditions, near Bozeman, Montana. Plots were harvested in the soft dough stage and the samples were dried for 48 hours at 60°C. Straw, forage, and grain samples were ground through a 5 mm screen and a sub sample was then ground through a 1 mm screen. Samples were analyzed on a dry matter basis for acid detergent fiber (ADF), protein and 48 hour *in situ* dry matter disappearance (ISDMD). Data was analyzed using the GLM and CORR procedure of SAS. Differences among lines were found ($P=0.01$ level) in forage yield, grain yield, straw yield, harvest index, forage and straw ADF, 48 h straw ISDMD and heading date. Correlation analysis indicated that forage yield was positively correlated with grain yield ($P=0.0019$), straw yield ($P=0.0004$) and biomass yield ($P<0.0001$). Grain yield was positively correlated with straw yield ($P=0.0017$), biomass yield ($P<0.0001$) and harvest index ($P<0.0001$). Forage ADF was positively correlated with heading date ($P=0.002$), while straw ADF was negatively correlated with heading date ($P=0.0007$) and forage yield ($P<0.0001$). Plant maturity had a significant effect on forage and straw quality. A negative correlation was found between forage ADF and straw ADF ($P=0.0410$), suggesting that quality can change with maturity. There was no significant correlation ($P=0.05$ level) between forage ADF and forage, grain, and straw yield. This study indicates that varieties can be developed with both high grain and forage yield. By simultaneously selecting for high quality and high grain and forage yield, multipurpose varieties could be developed which would give producers more options when deciding to harvest for forage or grain.

Key Words: Barley, Forage quality, Forage yield

85 Assessing the nutritive value of one-seed juniper in sheep. M. E. Giacomini*, S. Utsumi, S. Lodge-Ivey, A. Cibils, S. Soto-Navarro, R. L. Endecott, and M. K. Petersen, *New Mexico State University, Las Cruces.*

One-seed juniper (*Juniperus monosperma*; **JM**) encroachment on rangelands is a problem in the Southwest. A proposed method of JM control is defoliation by small ruminants. Juniper produces secondary metabolites that may be antimicrobial in nature. Ruminants depend on ruminal

microbes for digestion of feed. Five ruminally fistulated wethers (BW $55 \pm 15 \text{ kg}$) were used in two cross-over experiments composed of two 20-d periods to estimate nutritive value of JM as a forage. In Exp.1, sheep were fed either 100% buffalo grass straw (*Buchloe dactyloides*; **BS**; 93% DM, 76.5% NDF, 4.5% CP (DM basis)) or a mixed diet of 75% buffalo grass straw and 25% JM (**BS+JM**; JM contained 73% DM, 71.7% NDF, 6.0% CP (DM basis)) at 2% of BW. In Exp. 2, either soybean meal (**SBM**) or fish meal (**FM**) was added to BS+JM to achieve 12% CP. Protein sources of differing rumen degradabilities were fed to determine the potential for associative effects. Sheep were gradually adapted to a diet over a 10-d period fed at 2% of BW. Orts were weighed and then placed directly into the rumen via rumen cannulae. Total feces and urine were collected and subsampled on d 6-10 of each period. Rumen evacuations were conducted on d 10 of each period. Dry matter and NDF were determined for composited fecal and rumen samples for each sheep fed each treatment combination. Dry matter and NDF digestibility results were analyzed using the GLM procedure of SAS. Rumen NDF and DM fill were similar ($P>0.05$) among sheep and diets; sheep had similar diet digestibilities ($P>0.05$). The BS+JM diet showed higher ($P<0.05$) DM and NDF digestibility compared to the 100% BS diet (BS+JM: 56.18, 65.90% ± 1.83 ; BS: 47.71, 54.39 ± 1.48 for DM and NDF digestibility, respectively). The addition of SBM or FM to the mixed diet had no influence ($P=0.15$) on DM or NDF digestibility (SBM: 49.07, 50.85 ± 1.79 ; FM: 57.37, 61.26% ± 1.41 for DM and NDF digestibility, respectively). Based on these data, adaptation to diets containing JM may reduce the antimicrobial effects of secondary metabolites found in JM.

Key Words: *Juniperus monosperma*, Juniper, Digestibility

86 Feeding value of corn and 'Valier' barley for finishing steers. N. L. Iversen*, A. V. Grove, J. G. P. Bowman, B. L. Robinson, and T. K. Blake, *Montana State University, Bozeman.*

Eighty crossbred steers (average initial weight 358 kg) were used to evaluate the performance, nutrient digestibility, and grain energy content of finishing diets based on corn or 'Valier' barley. Grains were cracked prior to being fed and diets were formulated to be isocaloric (2.04 Mcal/kg NEM and 1.43 Mcal/kg NEM) and isonitrogenous (2.6% N). Diets were formulated to contain 80% grain, 6% straw, 3% soybean oil, and 11% vitamin/mineral supplement. Steers were weighed every 28 d with diet, ort, and fecal samples also collected at these times. Acid insoluble ash was used as an internal marker to estimate fecal output and calculate apparent nutrient digestibility. Steers were slaughtered when 70% were visually estimated to grade Choice and carcass measurements were collected. Weight and carcass data were analyzed using the GLM procedure of SAS with individual animal as the experimental unit. Intake and digestibility data were analyzed as repeated measures using PROC MIXED with pen as the experimental unit. Steer ADG was similar ($P=0.65$) between steers fed finishing diets based on corn and Valier. Percent KPH was lower ($P=0.04$) from carcasses of steers fed Valier compared to carcasses from steers fed corn; however, all other carcass characteristics were similar ($P=0.29$) between treatments. Gain/feed was lower ($P=0.03$) for steers fed finishing diets based on Valier compared to corn. Steers consuming Valier had higher ($P=0.10$) DMI; but lower N, starch, and ADF intake compared to steers consuming corn. Dry matter, OM, N, and ADF digestibility were lower ($P=0.001$) in steers fed Valier than steers fed corn; however, there was no difference ($P=0.40$) in starch digestibility between diets. Corn had higher (P

= 0.10) NEm and NEg content than Valier (2.27 vs 2.12 Mcal/kg NEm and 1.58 vs 1.43 Mcal/kg NEg). Nutrient digestibility was lower for Valier- than corn-based finishing diets; however, this did not result in improved energy value or animal performance.

Key Words: Barley, Corn, Finishing steers

87 Digestibility of barley beta-glucan in beef cattle. A. V. Grove*, C. R. Kaiser, N. L. Iversen, A. Hafla, B. L. Robinson, and J. G. P. Bowman, *Montana State University, Bozeman.*

Oral administration of barley beta-glucan has been shown to stimulate the mammalian immune system. Beta-glucans are assumed to be completely digested in the rumen and few researchers have evaluated the effects of oral beta-glucan administration on immune response in cattle. The objective of the current study was to estimate the *in situ* and *in vivo* digestibility of beta-glucan from different barley varieties in beef cattle. Valier (feed barley, 3.6% beta-glucan), Harrington (2-row malting barley, 4.6% beta-glucan), Hockett (2-row malting barley, 4.2% beta-glucan), Legacy (6-row malting barley, 4.5% beta-glucan), and purified barley beta-glucan (67.2% beta-glucan) were incubated *in situ* for 0, 3, and 6 h. Diet and fecal samples from steers fed a finishing diet containing 80% Valier were analyzed for beta-glucan in order to calculate *in vivo* beta-glucan digestibility. At 3 h of incubation, *in situ* beta-glucan disappearance was lowest ($P = 0.10$) for Valier and Legacy (average 31.2%), intermediate for Harrington and Hockett (average 60.7%), and highest for purified barley beta-glucan (95.1%). At 6 h of incubation, *in situ* beta-glucan disappearance was lowest ($P = 0.10$) for Valier (44.2%), intermediate for Legacy, Hockett, and Harrington (78.0%), and highest for purified barley beta-glucan (98.5%). Total tract *in vivo* beta-glucan digestibility from a Valier barley-based finishing diet was lower ($P = 0.10$) at 42- than 107-d on feed (91.6 vs 98.7%, respectively). We recovered 0.06 to 0.25 g beta-glucan/kg body weight from the feces of mature cattle consuming Valier barley-based finishing diets at 42 d on feed. Other researchers have stimulated the mammalian immune system with oral beta-glucan doses ranging from 0.06 to 0.24 g beta-glucan/kg body weight. By feeding Valier, it may be possible to get enough beta-glucan through the rumen early in the finishing period in order to stimulate the immune system of ruminants.

Key Words: Barley beta-glucan, Beef cattle, Digestibility

88 Feeding value of corn, 'Haxby', 'Valier', and 'H3' barley varieties for finishing steers. A. V. Grove*, J. G. P. Bowman, D. L. Boss, and T. K. Blake, *Montana State University, Bozeman.*

Eighty crossbred steers (average initial weight 392 kg) were used to compare the feedlot performance, nutrient digestibility, and grain energy content of 4 finishing diets based on: corn, or Valier, Haxby, and H3 barley. Grains were cracked prior to being fed and diets were formulated to be isocaloric (2.07 Mcal/kg NEm and 1.40 Mcal/kg NEg) and isonitrogenous (2.0% N). Diets were formulated to contain 80% grain, 6% straw, 3% soybean oil, and 11% vitamin/mineral supplement. Steers were weighed on d 25, 53, 81, and 106 with diet, ort, and fecal samples also collected at these times. Acid insoluble ash was used as an internal marker to estimate fecal output and calculate apparent nutrient digestibility. Steers were slaughtered when 70% were visually estimated to

grade Choice and carcass measurements were collected. Weight and carcass data were analyzed using the GLM procedure of SAS with individual animal as the experimental unit. Intake and digestibility data were analyzed as repeated measures using PROC MIXED with pen as the experimental unit. Average daily gain was greater ($P = 0.10$) by steers fed corn and Valier than Haxby, with steers fed H3 being intermediate and similar to all treatments. Gain/feed was similar ($P = 0.12$) between treatments, averaging 15.5 kg gain/100 kg feed. Carcasses from steers fed Haxby had more ($P = 0.10$) backfat than steers fed all other diets. Quality grade was higher ($P = 0.10$) in carcasses from steers fed corn and Haxby compared to H3 and Valier. Yield grade was lower ($P = 0.10$) from steers fed H3 than Haxby. Starch intake was greatest ($P = 0.10$) by steers fed corn, intermediate by steers fed Haxby and Valier, and lowest by steers fed H3. Organic matter digestibility was greater ($P = 0.10$) by steers fed corn and Haxby compared to H3, while digestibility of ADF was greater ($P = 0.10$) in steers fed corn than barleys. Differences in organic matter and ADF digestibility may help explain differences in carcass quality grade between diets.

Key Words: Barley, Beef cattle, Corn

89 Feeding value of 'Haxby', 'Valier', 'MT960099', and 'Eslick' barley varieties for finishing steers. A. V. Grove*, J. G. P. Bowman, L. M. M. Surber, D. L. Boss, and T. K. Blake, *Montana State University, Bozeman.*

Two feedlot studies (Bozeman and Havre, MT) were conducted in order to evaluate 4 finishing diets based on: Haxby, Valier, MT960099, and Eslick barley varieties. In each study, 80 Angus steers were allotted by weight to 16 pens with 4 pens per treatment. Barley was cracked prior to being fed and diets were formulated to be isocaloric (2.07 Mcal/kg NEm and 1.41 Mcal/kg NEg) and isonitrogenous (2.3% N). Diets were formulated to contain 80% grain, 6% straw, 3% soybean oil, and 11% vitamin/mineral supplement. Steers were weighed on d 28, 56, 84, and 112 with diet, ort, and fecal samples also collected at these times. Acid insoluble ash was used as an internal marker to estimate fecal output and calculate apparent nutrient digestibility. Steers were slaughtered when 70% were visually estimated to grade Choice and carcass measurements were collected. Weight and carcass data were analyzed using the GLM procedure of SAS with individual animal as the experimental unit. Intake and digestibility data were analyzed as repeated measures using PROC MIXED with pen as the experimental unit. Steer final weights and ADG were similar ($P = 0.12$) between barley varieties in both studies. Gain/feed was also similar ($P = 0.30$) between barley treatments averaging 15.1 and 15.4 kg gain/100 kg feed in Bozeman and Havre, respectively. Hot carcass weight by steers fed Eslick tended ($P = 0.11$) to be lower than steers fed the other 3 barleys in Havre, but no difference ($P = 0.77$) in hot carcass weight was observed in Bozeman. In Bozeman, intake of DM, OM, N, starch, and ADF were similar ($P = 0.50$) between barley varieties. In contrast, DM, OM, N, and starch intakes were lower ($P = 0.10$) for steers fed Eslick than all other barleys at Havre. Apparent digestibility of nutrients was similar ($P = 0.10$) between barley varieties in both studies. There were few differences in performance and digestibility between barley varieties with results being in agreement between studies.

Key Words: Barley, Beef cattle, Carcass traits

90 Feeding value of corn, 'Valier' barley, and corn/Valier combinations for finishing steers. A. V. Grove*, J. G. P. Bowman, L. M. M. Surber, and T. K. Blake, *Montana State University, Bozeman.*

Eighty crossbred steers (average initial weight 383 kg) were used to evaluate the performance, nutrient digestibility, and grain energy content of 4 finishing rations based on: corn, Valier barley, 2/3 corn + 1/3 Valier (66CORN), or 1/3 corn + 2/3 Valier (33CORN). Grain was cracked prior to being fed and diets were formulated to be isocaloric (2.04 Mcal/kg NEm and 1.43 Mcal/kg NEg) and isonitrogenous (2.6% N). Diets were formulated to contain 80% grain, 6% straw, 3% soybean oil, and 11% vitamin/mineral supplement. Steers were weighed on d 28, 56, 84, and 100 with diet, ort, and fecal samples also collected at these times. Acid insoluble ash was used as an internal marker to estimate fecal output and calculate apparent nutrient digestibility. Steers were slaughtered when 70% were visually estimated to grade Choice and carcass measurements were collected. Weight and carcass data were analyzed using the GLM procedure of SAS with individual animal as the experimental unit. Intake and digestibility data were analyzed as repeated measures using PROC MIXED with pen as the experimental unit. Steer final weights and overall ADG were similar ($P = 0.25$) between diets averaging 569 kg and 1.9 kg/d, respectively. Dry matter intake was higher ($P = 0.10$) by steers consuming Valier than by steers consuming corn and 66CORN. Starch intake was greater ($P = 0.10$) by steers consuming corn and 66CORN than the other 2 diets. Gain/feed was greater ($P = 0.10$) in steers fed corn and 66CORN compared to steers fed Valier. Apparent DM digestibility was lower ($P = 0.10$) by steers consuming Valier than all other diets; however, apparent starch digestibility did not differ ($P = 0.35$) between diets, averaging 90.4%. USDA quality grade was greater ($P = 0.10$) for steers consuming Valier than all other diets (12.5 vs 12.0); however, all other carcass characteristics were similar ($P = 0.10$) between diets. There was little benefit to feeding corn and Valier in combinations compared to feeding each grain alone.

Key Words: Barley, Beef cattle, Corn

91 Feedlot performance and serum metabolic hormone profiles in lambs receiving four levels of soybean meal supplementation. L. E. Camacho*, S. A. Soto-Navarro, J. M. Benavidez, R. L. Knight, M. J. McBee, F. O. Loya, L. D. Abercrombie, and D. M. Hallford, *New Mexico State University, Las Cruces.*

Twenty Rambouillet wether lambs (initial BW = 27.6 ± 0.5 kg, age = 103 ± 1.2 d) were assigned randomly to 1 of 4 treatments (5 lambs/treatment) to examine effects of dietary CP level on intake, growth, and serum hormone profiles. Lambs were penned individually (3 x 9 m) and fed a 70% corn-based concentrate diet with Sudangrass as the roughage source and soybean meal to supply CP levels of 9.5, 11.5, 13.5, and 15.5% (ratio of ruminally degradable intake protein:TDN = 0.073, 0.091, 0.11, 0.129, respectively). Lamb BW were recorded every 21 d, orts were weighed daily, and serum was collected weekly during the 84-d feeding period. Animal BW tended to increase linearly ($P = 0.09$) with increasing dietary CP (39.3, 42.9, 43.9, 44.1 ± 1.9 kg for lambs receiving 9.5, 11.5, 13.5, and 15.5% CP on d 84, respectively). Likewise, ADG and G:F tended to improve ($P = 0.10$) in a linear fashion as DIP level increased. Daily DMI also increased (quadratic, $P = 0.10$) over the 84-d feeding period (1.22, 1.37, 1.34, 1.30 ± 0.06 kg/d for lambs fed 9.5, 11.5, 13.5, and 15.5% DIP, respectively). Serum growth hormone and triiodothyronine did not differ ($P > 0.30$) among dietary treatments

while serum IGF-1 increased (linear, $P = 0.03$) with increasing levels of CP (138, 176, 180, and 180 ± 11.6 ng/mL in lambs receiving 9.5, 11.5, 13.5, and 15.5% CP, respectively; CP x week, $P = 0.66$). Serum prolactin also differed (cubic, $P = 0.03$) among CP levels (187, 344, 262, and 258 ± 29 ng/mL for 9.5, 11.5, 13.5, and 15.5% CP, respectively; CP x week, $P = 0.97$). Within week (CP x week, $P = 0.04$), serum thyroxine responded to dietary CP by increasing linearly ($P < 0.10$) from wk 4 through 9 of the 12-wk experiment. Increasing dietary CP from 9.5 to 15.5% tended to improve DMI, ADG, and G:F in Rambouillet lambs with the largest improvement resulting from 11.5% CP. This performance response may have partially resulted from altered serum concentrations of IGF-1 and prolactin.

Key Words: Sheep, Growth, Dietary protein

92 Evaluation of animal performance in crossbred hair lambs fed with a high concentrate diet. G. Villalobos*, F.A. Rodríguez-Almeida, G. Lara-Camargo, J.C. Estrada, M. Zapata, and D. Domínguez, *Universidad Autónoma de Chihuahua, Chihuahua, Chih., México.*

This study was conducted to evaluate performance of hair crossbred lambs in terms of dry matter intake (DMI), average daily gain (ADG) and gain efficiency (GE) under production conditions of lambs for the Mexican market. Forty-two post-weaning lambs with an average age of 90 d and an average body weight of 24 kg were used. Lambs came from Suffolk (SF), Charollais (CH), Blackbelly (BB), Pelibuey (PB), and Katahdin (KH) rams and BB and PB ewes. Lambs were housed in individual stalls, fed *ad libitum* a diet consisting of (as-fed basis %): alfalfa hay (20.82), dry rolled corn (57.58), cotton seed meal (11.79), corn gluten meal (4.95), cane molasses (3.57), salt (.44), mineral and vitamin premix (.44), and calcium carbonate (.37). Amounts of feed and orts were recorded daily and lambs were weighed every 14 d until slaughter weight (45 to 50 kg for SF and CH, 40 to 45 kg for KH, and 35 to 40 kg for BB and PB), in a feeding period of 56 to 112 d. A model including fixed effects of ram breed, weaning type (singles, twins and triplets), ewe age, and their double and triple interactions was adjusted for measured variables. For ADG at 56 d of test, BB was lower than CH ($P < 0.02$) and SF ($P < 0.01$). For GE there was a difference only between BB and SF ($P < 0.02$). However, for ADG through slaughter weight the mean was lower for BB than for CH ($P < 0.02$) and SF ($P < 0.02$). There were no differences for GE due to lamb age ($P > 0.05$), weaning type ($P > 0.05$) or lamb breed group ($P > 0.05$) in the whole test. Crossbreeding of hair type ewes with terminal wool type rams improves average daily gain and feed efficiency compared to straightbred hair sheep.

Key Words: Hair sheep, Growth, Feed efficiency

93 Effect of white corn processing method on some digestion indicators of Brahman cross finishing bulls. R. Barajas*, B. J. Cervantes¹, I. G. Gonzalez², J. M. Romo¹, and J. J. Lomeli², ¹FMVZ-Universidad Autónoma de Sinaloa, Culiacan, Sinaloa, Mexico, ²EB-Universidad Autónoma de Sinaloa, Culiacan, Sinaloa, Mexico.

With the objective to determine the influence of steam-flaking processing of white corn on some digestion indicators of Brahman cross finishing bulls, a digestion experiment was performed. Eighty-four bulls (324.61

± 1.7 kg) proximately 75% of Brahman blood, placed in 12 pens and involved in a feedlot experiment were used. Animals were fed with a finishing diet (88% concentrate), containing 68.61% (DM basis) of dry-ground white corn (DGC); or diet similar to previously described, but containing 68.61% of steam-flaked white corn, that substituted entirely the dry-ground corn (SFC). On d 56 to 60, grab samples and feed samples were taken from each pen, fecal pH was measured in fresh feces samples. For feed and feces samples, content of DM, OM and acid insoluble ashes was determined, and apparent digestibility was calculated. Postmortem rumen pH was measured. The experiment was analyzed as a completely randomized design, and each pen was considered as an experimental unit. Corn processing method had no effect ($P = 0.14$) on postmortem rumen pH. SFC diminished ($P < 0.01$) 17% DM of feces. SFC increases ($P = 0.04$) 6.4% DM digestibility, and 6.6% OM digestibility. Fecal pH was augmented ($P < 0.01$) 4.5% by SFC. Fecal starch was reduced ($P < 0.01$) in 84 % by SFC. Apparent starch digestibility was enhanced ($P < 0.01$) 14 % by SFC (85.86 vs. 98.19%, for DGC and SFC, respectively) It is concluded, that steam-flaking processing of white corn, improves the apparent dry matter, organic matter and starch digestibility of the diet of finishing cattle, in magnitudes near that obtained with dent yellow corn.

Key Words: White corn, Steam-flaking, Digestibility

94 Effect of white corn processing method on feedlot performance of Brahman cross finishing bulls. R. Barajas^{*1}, B. J. Cervantes¹, R. J. Virgilio², J. M. Romo¹, and J. J. Lomeli¹, ¹FMVZ-Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, ²Tecnología de Máxima Producción, S.A. de C.V., Culiacan, Sinaloa, Mexico.

The objective of this study was to determine the influence of steam-flaking processing method of white corn on the feedlot performance of Brahman cross finishing bulls. A 70 d feedlot experiment was conducted using eighty four bulls (324.61 ± 1.7 kg), with approximately 75% Brahman blood with the remainder Simmental, Charolais, Brown Swiss, or Angus in indeterminate proportions. This was a complete randomized block design experiment, and treatments were assigned to receive one of two diets that consisted of: 1) Finishing diet (88% concentrate), containing 68.61% (DM basis) of dry-ground white corn (DGC); or 2) Diet similar to previously described, but containing 68.61% steam-flaked white corn, substituting entirely the dry-ground corn into the diet (SFC). SFC did not affect ($P = 0.69$) ending weight. ADG was similar ($P = 0.41$) in both treatments. DMI was diminished ($P < 0.01$) 8.8% by steam-flaked corn (8.35 vs. 7.61 kg/d). Feed/gain ratio was improved ($P < 0.01$) 11.9% by SFC (5.835 vs. 5.139 kg/kg). Diet NEm was enhanced ($P < 0.01$) in 9.9% by SFC (2.059 vs. 2.264 Mcal/kg). Diet NEg was increased ($P < 0.01$) in 12.8% with inclusion of SFC (1.396 vs. 1.576 Mcal/kg). The NE content of steam-flaked white corn was estimated to be 2.479 and 1.762 Mcal/kg for NEm and NEg, respectively. It is concluded, that steam-flaking processing of white corn, improves its energy availability nearly 13%, with respect to dry ground white corn. The benefits of steam-flaked processing on feedlot performance are beyond those attributed by tabular values.

Key Words: White corn, Steam-flaking, Feedlot performance

95 Effect of white corn processing method on carcass characteristics of Brahman cross finishing bulls. R. Barajas^{*1}, B. J. Cervantes¹, R. J. Virgilio², J. M. Romo¹, and J. J. Lomeli¹, ¹FMVZ-Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, ²Tecnología de Máxima Producción, S.A. de C.V., Culiacan, Sinaloa, Mexico.

With the objective to determine the influence of steam-flaking processing method of white corn on carcass characteristics of Brahman cross finishing bulls, an experiment was conducted. Eighty four bulls (324.61 ± 1.7 kg) approximately 75% of Brahman blood with remainder of Simmental, Charolais, Brown Swiss, or Angus in indeterminate proportions, were used in a 70 d feedlot performance experiment. This was a complete randomized block design experiment, and treatments were assigned to receive one of two diets that consisted of: 1) Finishing diet (88% concentrate), containing 68.61% (DM basis) of dry-ground white corn (DGC); or 2) Diet similar to previously described, but containing 68.61% of steam-flaked white corn, substituting entirely to dry-ground corn (SFC). Upon completion of a 70 day finishing period, the bulls were harvested. Corn processing method did not affect ($P > 0.20$) hot carcass weight (268 ± 2.91 kg), carcass dressing percentage ($63.09 \pm 0.31\%$) nor back fat thickness (0.72 ± 0.06 cm). LMA was similar ($P = 0.21$) across treatments (67.73 vs. 71.24 cm², for DGC and SFC, respectively). Marbling score (453 ± 12) was not affected ($P = 0.42$) by treatments. KPH fat was not altered ($P = 0.38$) by corn processing method. Percentage choice was similar ($P = 0.60$) across treatments (39.13 vs. 45.06% for DGC and SFC, respectively). Meat pH was diminished ($P < 0.01$) by SFC (5.83 vs. 5.65, for DGC vs. SFC, respectively). Preliminary yield grade and retail cuts were not affected ($P > 0.20$) by treatments. It is concluded, that processing method of white corn, did not alter most carcass characteristics of finishing bulls, but the modification that induced muscle pH change, could indicate that it is able to modify muscle-cell glycogen content at harvest.

Key Words: White corn, Steam-flaking, Carcass characteristics

96 Performance and residual feed intake are similar in Angus-Hereford steers housed in individual or group pens. G. D. Cruz^{*}, R. B. Monteiro, J. A. Rodriguez, D. B. Monteiro, and R. D. Sainz, University of California, Davis.

Residual feed intake (RFI) calculations require individual measurements of feed intake offered and average daily gain for at least 70 d. Animals may be housed in individual or group pens, but housing type may affect the results (Paulino et al., 2004, J. Anim. Sci. 82 (Suppl. 1): 43). To re-evaluate the effect of housing type, 60 Angus x Hereford crossbred steers (296 kg initial BW) were fed a corn-based finishing ration (2.27 Mcal NEm/kg, 13% CP on a DM basis) during two periods of 60 d each. In the first phase, 30 steers were fed in individual pens and 30 in six pens containing five steers each. In the second period, the animals were switched from group to individual pens and vice versa. Cattle were weighed monthly, and feed offered and refused estimated weekly. Dry matter intake, average daily gain, gain:feed and residual feed intake were analyzed using the GLM procedure (Minitab Inc, State College, PA), with period and housing type as main effects. For both phases, the regression equation fitted without the intercept (not statistically significant) was: DMI (kg/d) = $0.0652 \times BW^{0.75} + 2.06 \times ADG$, $r^2 = 0.64$. There were differences ($P < 0.001$) across periods for ADG (1.49 vs. 1.33 kg/d for periods 1 and 2, respectively) and gain:feed (0.154 vs 0.132 for

periods 1 and 2, respectively), but not for DMI (8.70 vs. 9.01 kg/d for periods 1 and 2, respectively, $P > 0.05$). None of these variables was affected by housing type ($P > 0.05$). Effects of period are likely due to increasing physiological maturity as animals become fatter, gain more slowly and become less efficient. The lack of effect of housing type contrast with our previous results using similar cattle and the same pens. The difference between present results and previous work may be due to a change in personnel and feeding practices. Housing type effects may be more evident under once daily feeding rather than the multiple feedings adopted in the present study.

Key Words: Residual feed intake, Housing type, Beef steers

97 Carcass composition and visceral organs are similar at harvest in low- and high-residual feed intake groups of Angus-Hereford steers. R. D. Sainz, G. D. Cruz*, R. B. Monteiro, J. A. Rodriguez, D. B. Monteiro, V. Guidi, and R. J. Anaruma, *University of California, Davis*.

Residual feed intake (RFI) measurements reflect individual deviations above or below the intake expected for a given weight and rate of gain. These deviations may be due to differences in the animals' maintenance energy requirements, which in turn are often related to visceral organ mass. In order to determine if RFI was related to carcass composition and visceral mass at harvest, 60 Angus x Hereford crossbred steers (296 kg initial BW) were fed a corn-based finishing ration (2.27 Mcal NEm/kg, 13% CP on a DM basis) for 60 d. Cattle were weighed monthly, and feed offered and refused estimated weekly. The highest and lowest 15 RFI steers were classed as high- and low-RFI groups. After the RFI measurement period, all cattle were returned to group pens and fed until reaching market finish. At harvest, carcasses were evaluated according to USDA standards, the 9-10-11 rib section was dissected to estimate carcass fat percentage, and internal visceral organs were dissected and weighed. RFI groups were compared using one-way ANOVA (Minitab Inc, State College, PA). There were differences ($P < 0.01$) between low- and high-RFI groups for DMI (9.19 vs. 10.95 kg/d), gain:feed (0.151 vs. 0.125) and RFI (-0.955 vs 0.977 kg/d), but not for ADG (1.43 vs. 1.44 kg/d, $P > 0.05$). There were no differences ($P > 0.05$) between low- and high-RFI groups for final BW (511 vs. 513 kg), hot carcass wt (324 vs. 321 kg), longissimus muscle area (75.5 vs. 75.5 cm²), backfat (1.29 vs. 1.26 cm), KPH (3.6 vs. 4.0%), marbling score (average Choice for both groups) or carcass fat (33.0 vs. 33.8%). Visceral organ masses and ab-

dominal fat were generally similar (31.44 vs. 31.01 kg and 30.11 vs. 29.59 kg, respectively, $P > 0.05$). These results do not support the existence of major differences in composition and organ mass between low- and high-RFI steers at harvest.

Key Words: Residual feed intake, Carcass composition, Viscera

98 The effect of feeding whey silage to beef cows under maintenance conditions. D. R. ZoBell*, K. C. Olson, R. D. Wiedmeier, C. Stonecipher, and C. K. Chapman, *Utah State University, Logan*.

Two studies were conducted with the objective of evaluating the effects of feeding liquid whey ensiled with wheat straw and wheat middlings to beef cows under maintenance conditions. Whey silage was produced by combining liquid whey, barley straw and wheat middlings at levels of 28.7, 46.8 and 24.6 % for study one (DMB) and 30.3, 45.8 and 23.9 % for study two (DMB) respectively. Dry, pregnant beef cows, initial weight 613.0 kg and 578.0 kg for studies one and two respectively, were randomly assigned to either a control (C) or treatment (T) group with five head per pen and three pens per treatment. Length of study was 56 days for study one and 140 days for study two. In study one the C cows received grass hay and the T ration that consisted of 83.3, 16.0 and .70% whey silage, barley grain and limestone respectively. Study two C cows received a diet consisting of 27.6% alfalfa hay, 55.2% barley straw and 17.2% barley grain and T cows received whey silage and a small amount of limestone. In both studies a TM salt was provided free choice to all cows. Feed intake was adjusted after each weighing such that cows from both treatments gained approx. .20 kg.d-1. Cows in study one gained weight equally between treatments ($P > .05$), with no differences in change of body condition score ($P > .05$). In study two, C cows gained 88.0 kg versus 107.4 kg for the T cows ($P < .05$) although the change in body condition score was not different ($P > .05$) between treatments. Dry matter digestibility was not different between treatments ($P > .05$) with values of 63.1% and 67.8% for the C and T groups respectively. Neutral detergent fiber digestibility differed (C-60.4% and T-49.9%; $P < .05$). For both studies the T cow's diets were approximately 30% lower in cost than C diets. This study confirms that whey silage is a viable alternative to more traditional diets for beef cows under maintenance conditions.

Key Words: Beef cows, Silage, Liquid whey