ABSTRACTS
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BEHAVIOR

1 Effects of rearing from the second week to weaning on heifers behavior in maze learning ability tests. J.J.J. Broucek*[1], C.W. Arave[2], T.H. Friend[3], M. Uhrincat[1], S. Mihina[1], P. Kisac[1], A. Hanus[1], and S. Marencak[1], [1]*Research Institute of Animal Production, Nitra, Slovakia,* [2]*Utah State University, Logan, 84321, USA,* [3]*Texas A&M University, College Station, 77843, USA.*

During the milking period, the calf is exposed to several environmental factors that can affect its behavior in the maze. Fifty-eight Holstein heifer calves were assigned to one out of three feeding treatments and to two housing systems after having nursed their mothers for the first week: BN) bucket with nipple, n=25; DF) machine milk feeder, n=16; NC) nursing cow, n=17; GH) group housing in pens, n=33; IH) individual housing in the hutch, n=25. After weaning at 8 weeks, all calves were kept in group pens. At 15 weeks of age, the time to traverse a 6-unit maze (16.4x4.5 m) comprising five internal barriers was determined. On the first observation day, the calves were tested five times (the first one for training); on the second day there were four runs. The calves had to solve two tasks. In the A task, the passage was open on the left side, and on the right side (task B) on the next day. We were testing two hypotheses: the speed of traversing the maze is affected by the feeding method and housing system. 1) The slowest were NC calves. On the first day (task A), the average time to traverse the maze among treatments DF (43.9 s), BN (53 s) and NC (111.3 s) was different (F8.26***,P=0.0007). On the second day (task B), the averages were: BN 77.1 s, DF 83.8 s and DC 166.6 s (F8.17***, p=0.0008). 2) IH calves ran across the maze faster. When the maze was open on the left side (task A) , the difference was not significant (IH 53 s vs. GH 78.6 s), but when the maze was open on the right side, groups differed (IH 77 s vs. 111.3 s; F5.35*, p=0.0245). The results indicate that the feeding method and housing used to rear calves may have a significant impact on their maze behavior.

Key Words: Heifer, Rearing, Behavior

2 The relationship between Bos taurus feedlot cattle temperament and cannon bone measurements. J. L. Lanier*[1] and T. Grandin[1], [1]*Colorado State University.*

Two groups of feedlot cattle on two different mineral supplement trials were used to assess the relationship between temperament and cannon bone measurements. The cannon bones of seven month old crossbred Bos taurus European, Continental, and British steers (n = 135), primarily Angus, Charolais, and Hereford breeds, and 54 Charolais x Hereford heifers were measured postmortem. Postmortem measurements were taken on the left front 3rd and 4th fused metacarpal (cannon) bone. Length (middle peak of the base to the sagittal ridge) was measured with an Absolute Digimatic caliper (Mitutoyo Corp., Japan) CD-12" CP, while width (lateral to medial), and thickness (cranial to caudal) measurements were taken with an Absolute Digimatic caliper model CD-8" CS. Steers were individually scored on speed of exit from the squeeze chute after physical restraint; 1 = walked, 2 = trotted, and 3 = ran out of the chute. Heifers were scored on their reluctance to place their head in the head restraint: 1 = not reluctant and 2 = reluctant. Steer cannon bone thickness ($P = 0.008$) and width ($P < 0.001$) were related to the speed of exit from the chute. Steers with thicker and wider bones exited the chute at a slower pace than those with smaller cannon bones. Heifers with wider ($P = 0.07$) and thicker ($P = 0.06$) bones tended to be less likely to balk at the head restraint. Cattle with larger cannon bones were calmer than those with smaller bones. Use of physical indicators such as cannon bone size may assist producers in predicting individual cattle temperament.

Key Words: Cattle, Temperament, Cannon bone

3 Use of Naloxone Challenge to Predict Sexual Performance of Eight and Seventeen Month-Old Rams. J.N. Stellflug*, *USDA-ARS US Sheep Experiment Station, Dubois ID 83423.*

A hormone based test for libido was developed using response of LH and testosterone (T) after naloxone challenge. Naloxone is an opiate inhibitor that stimulates an LH release followed by increased testosterone secretion. This test was previously proven to identify sexually active (SA) and sexually inactive (SIA) mature rams in November and December. The objective was to determine if the test detects differences in sexual performance in post-pubertal rams in November (8 mo-old) and in late August (17 mo-old). Rams (n = 38 crossbred, 16 Polypay and 49 Targhee) were classed at 18 to 20 mo of age as SA and SIA using serving capacity tests. Naloxone (0.75 mg/kg BW) was injected i.v. Blood samples were collected at 15-min intervals 1 h before and 2 h after naloxone. Concentrations of LH and T were measured by RIA. Mixed model analyses for repeated measures were used for LH and T

data. Main plot included class of ram (SA, SIA), breed, and class by breed. Subplot included sample time, two-, and three-way interactions. Probability of predicting sexual performance (SA, SIA) was estimated by Proc Logistics. The LH response for 8 mo-old rams differed by breed ($P < 0.01$) but not by ram class ($P > 0.67$). At 17 mo of age, LH response differed by breed ($P < 0.01$) but not by ram class ($P > 0.31$). Breed by time interaction for LH response differed ($P < 0.01$) at 17 mo of age. The T response differed ($P < 0.01$) by breed for 8 mo-old and 17 mo-old rams, and differed ($P < 0.01$) for breed by time interaction for 8 mo-old rams. In 8-mo-old rams, T peaked 60 to 75 min after naloxone and was elevated out to 105 min. In 17 mo-old rams, T peaked at 75 to 105 min after naloxone and was elevated out to 120 min. The naloxone challenge failed to accurately identify 8 mo-old rams that would eventually become SA and SIA rams. The 17 mo-old rams were correctly predicted at a rate of 53% for SA and 57% for SIA in late August. This study indicates that the naloxone challenge cannot effectively discriminate between SA and SIA rams at 8 mo of age in November.

Key Words: Libido, Naloxone, Rams

BREEDING AND GENETICS

4 Genetic variation in domestic reindeer and wild caribou (*Rangifer tarandus*). M. A. Cronin*[1], J. C. Patton[2], and M. D. MacNeil[3], [1]*LGL Alaska Research Assoc. Inc., Anchorage, AK,* [2]*Texas A&M University, College Station, TX,* [3]*USDA-ARS, Miles City, MT.*

Domestic reindeer (*Rangifer tarandus tarandus*) are a significant source of meat, hides, and antler products in arctic regions. Also, management of wild caribou (*Rangifer tarandus granti*) herds is an important consideration affecting development of natural resources in Alaska. Our objective was to quantify genetic distances among herds of reindeer and caribou. We assessed genetic variation at 19 microsatellite DNA loci in herds of domestic reindeer from Alaska, Scandinavia, and Russia, and wild caribou from Alaska and Canada. The microsatellites were identified from cattle gene maps, and may be useful for future domestic reindeer selection programs and comparative gene mapping. There is an average of three to seven alleles per locus and average heterozygosity of 0.330 to 0.448 in these herds. Reindeer in Alaska originated from transplants from Siberia, Russia more than 100 yr ago, and extant herds in these areas have relatively similar allele frequencies. In contrast, wild caribou and domestic reindeer in Alaska have significantly different allele frequencies at many loci, although some introgressive hybridization may have occurred over the last 100 yr. The wild Central Arctic and Porcupine River caribou herds in arctic Alaska are not genetically differentiated and there is probably interbreeding between the herds. Geographically distant caribou herds in eastern Canada are highly differentiated from the Alaska caribou. Genetic distances between the major groups are: 0.23 among three Alaska reindeer herds; 0.24 between Russian and Alaskan reindeer, 0.16 between the two Alaska caribou herds; 0.31 between Alaska caribou and Alaska reindeer; and 0.38 between Russian reindeer and Norwegian reindeer. The results indicate that in Alaska there is more genetic differentiation between wild caribou and domestic reindeer populations than there is between herds of either type.

Key Words: Genetic Distance, Allele Frequency

5 Quality of sperm morphology in Angus yearling bulls may be related to hair whorl shape. M. Meola*, T. Grandin, P. Burns, and R.G. Mortimer, *Colorado State University.*

In humans, abnormal hair whorl patterns on the scalp are found in children with developmental disorders such as Down's syndrome and Prader-Willi syndrome. Previous research has shown that hair whorl position on a bovine's forehead may be related to temperament. The objective of this study was to determine the relationship between sperm morphology and facial hair whorl epicenter. Breeding Soundness Evaluations (BSE) were given to 150 Angus yearling bulls (avg. age = 364 ± 1.4 days of age) from 3 different locations. Animals had 1 (n = 120), 2 (n = 12) whorls or no facial hair whorl (n = 18). Bulls with no facial hair whorls were not included in the analysis. Facial hair whorls were categorized by 2 distinct characteristics: having a round epicenter or having a non-round epicenter. Bulls with 1 or 2 facial hair whorls with a round epicenter had a higher percentage of morphologically normal sperm (79 ± 1.5%) than bulls with 1 or 2 facial hair whorls with a non-round epicenter (71 ± 2.1%; $P = 0.005$). Age of bull did not have a significant effect on percentage of normal sperm ($P = 0.80$). Bulls with facial hair whorls with a round epicenter were more likely to have satisfactory sperm morphology scores (70% morphologically normal sperm) than bulls with facial hair whorls with non-round epicenters ($P = 0.002$). Eighty-two percent of bulls with facial hair whorls with round epicenters had satisfactory sperm morphology scores, while only 57% of bulls with facial hair whorls with non-round epicenters had satisfactory sperm morphology scores. It is possible that a facial hair whorl could be used as a visual aid in determining the quality of sperm morphology either during or prior to a BSE.

Key Words: Hair Whorl, BSE, Bulls

6 Genetic distance between a multi-breed composite and two inbred lines of Hereford cattle. C. G. Kealey*[1], M. D. MacNeil[1], and B. L. Golden[2], [1]*USDA-ARS, Miles City, MT,* [2]*Colorado State University, Fort Collins, CO.*

Our objective was to estimate genetic differentiation between two isolated lines of Hereford cattle produced in the western region of the U.S. To provide an indication of the relative magnitude of the genetic distance between these lines, a multi-breed composite (CGC) of Red Angus, Charolais, and Tarentaise germplasm was also assessed. The lines of Hereford cattle were Line 1 (L1) developed by the Agricultural Research Service and Prospector (CSU) developed by Colorado State University. Forty-one microsatellite markers separated by at least 50 cM and spanning all 29 autosomal chromosomes were selected for use in this study. No more than two markers were on any one chromosome. Allele frequencies were computed for the three populations. Mean heterozygosity and genotypic frequencies were compared with Hardy-Weinberg expectations for all polymorphic loci. Estimates of the Nei#s unbiased genetic distances between all pairs of populations based on all loci were calculated. Populations were clustered using the unweighted pair-group method with arithmetic averaging. Number of animals genotyped, percent polymorphic loci, number of alleles per locus, correlation between uniting gametes (F_{IS}), and average heterozygosity of 41 microsatellite markers in Line 1 Hereford, CSU Hereford, and CGC composite beef cattle are shown in the accompanying table. Nei#s unbiased genetic distances between CGC and CSU, CGC and L1, and CSU and L1 were 0.249, 0.421, and 0.206, respectively. The finding that CSU was nearly equidistant between L1 and CGC is suggestive of substantial genetic variability within the Hereford breed. *A priori* we hypothesized CSU and L1 would be more closely related to each other than either was to CGC.

Item	CGC	CSU	Line 1
No. observations	50	49	54
% polymorphic loci	100	98	98
No. alleles per locus	6.9±0.5	5.0±0.3	3.9±0.2
F_{IS}	-0.01	0.03	0.01
Avg heterozygosity, %	67 ±2	58±3	49±3

Key Words: Beef Cattle, Genetic Distance, Gene Frequency

7 A genome-wide scan for QTL affecting carcass traits at constant fat depth in a Hereford x composite double backcross population. M. D. MacNeil*[1] and M. D. Grosz[2], [1]*USDA-ARS, Miles City, MT,* [2]*Monsanto, Chesterfield, MO.*

A genome-wide scan for chromosomal regions influencing carcass traits was conducted spanning 2.497 Morgans on 29 bovine autosomes using 170 microsatellite markers. There were 151 progeny from a single Hereford x composite bull produced by backcross matings to both Hereford and composite dams. Cattle were fed out and slaughtered serially over 13 wk when they were between 614 and 741 d of age. Phenotypes measured at harvest were: carcass weight; slaughter weight; fat depth; marbling; percentage kidney, pelvic, and heart fat (KPH fat); and longissimus muscle area. Dressing percentage and USDA Yield Grade were calculated from these data. Analysis of covariance was used to adjust these

phenotypes to a constant fat depth. Residuals from the analysis of covariance were analyzed by interval mapping to detect putative QTL. Nominal significance was established by permutation analysis. Approximate genome-wide significance levels were established by applying the Bonferroni correction to the nominal probability levels. At a constant fat depth, putative QTL were detected affecting live weight on BTA 12, BTA 17, and BTA 18; dressing percent on BTA 16 and BTA 24; longissimus muscle area on BTA 12; KPH fat on BTA 15, BTA 17, and BTA 20; USDA Yield Grade on BTA 12; marbling score on BTA 2, BTA 14, BTA 18, and BTA 26. These results indicate new promising locations for QTL segregating in *Bos taurus* that affect carcass traits. Greater marker saturation in these regions coupled with refined methods for data analysis will lead to more precise determination of QTL positions.

Key Words: Beef Cattle, Carcass, Quantitative Trait Loci

8 Carcass characteristics of steers sired by high marbling EPD or high percent retail product EPD bulls. K. C. Davis, M. W. Tess, R. P. Ansotegui, and S. Yamamoto*, *Montana State University, Bozeman, MT*.

Data from 95 serially slaughtered steers was collected during May of 2001. The steers represent progeny from 7 sires with high EPD for marbling (n=44), 7 sires with high EPD for percent retail product (n=45) and one sire rated as both high marbling and percent retail product (n=6). Additionally, half of the steers were assigned within sire to receive an implant of Revalor®. Calves were born at a cooperator ranch near Martinsdale, MT with an average calving date of March 25, 2000. Calves were weaned at an average age of 207 d. Calves were fed at the ranch for 45 d., and then moved to a feedlot for finishing. Average age at slaughter was 417 d. Measurements reported here are birth weight (BWT), weaning weight (WWT), hot carcass weight (HCWT), ribeye area (RIB), marbling score (MBL), backfat (FAT), yield grade (YG), and quality grade (QG). The QG was numerically assigned as Prime = 1, Choice + =2, Choice = 3, Choice - = 4, Select = 5 and Standard = 6. The model included age at measurement as a covariate, sire type (TYPE), and implant status (IMPLANT). Sire within sire type was used as the error term for sire type. Age was not significant for any trait being reported. Average birth weight was 35 kg with no difference due to TYPE. Average WWT was 247 kg and was affected by TYPE (P=.008). Calves sired by percent retail product bulls were heaviest (250 kg), those sired by marbling bulls were intermediate and not different (244 kg), and calves sired by the crossover sire were lightest (217 kg) and different from the others. The IMPLANT affected HCWT, MBL, and QG. Those calves receiving an implant were heavier (314 kg) than those not implanted (299 kg). Marbling and QG decreased when an animal was implanted (5.7 versus 4.7, and 2.9 versus 3.9). Sire type also affected MBL and QG. Calves from percent retail product sires had significantly less MBL and lower QG. There were no differences due to an interaction of TYPE by IMPLANT. Bull selection on carcass trait EPD can be effective for targeting specific markets.

Key Words: Beef Cattle, Carcass Traits

9 Predicted rate of inbreeding for a closed line of Hereford cattle. Batchimeg Tseveenjav*[1], Maiwashe Norman[1], Bruce L Golden[1], and Harvey D. Blackburn[2], [1]*Department of Animal Sciences, Colorado State University, Fort Collins, CO, 80523,* [2]*National Animal Germplasm Program, ARS-USDA, Fort Collins, CO, 80523*.

The purpose of this study was to determine the rates of inbreeding (F) for a closed line of Hereford cattle at San Juan Basin Research Center Colorado. The Prospector line was established to examine the effects of intensive inbreeding and subsequent line crossing on various traits. The individual inbreeding coefficient was estimated using complete pedigree data collected from 1946 to 2000. The relationship matrix included 323 individuals traced back to foundation animals and forty six percent of individuals had a non-zero inbreeding coefficient with an average and maximum coefficient of 21.51 and 57.84% respectively during the period. The rates of inbreeding (F) were estimated for overlapping generations and under selection. Thirty three percent of individuals were identified the direct descendants of foundation animals. The mean of additive genetic relationship of the current generation was estimated at 0.12. Avoiding the mating of relatives reduces short- term inbreeding, however, under selection inbreeding affects which animals get selected as parents, and the extent of their use. Minimization of the predicted rate of inbreeding in future generation is important for the maintenance of future genetic variation.

Key Words: Rate of Inbreeding, Genetic Diversity, Hereford Cattle

10 Effects of stressfull hot conditions on milk yield and reproductive traits of first lactation cows grouped by coat color. L San Juan[1], S Cobos[1], J Rodriguez[1], F Bueno[1], A Marquez*[1], and J Guerrero[2], [1]*Universidad Autnoma de Baja California,* [2]*University of California- Agricultural & Nat. Resources*.

Three hundred fifteen first lactation records for milk yield of Holstein cows of two dairy herds at north west region of Mexico were analyzed by using least squares. The objective was to evaluate the effects of stressfull hot conditions on milk and reproductive traits of Holstein cows grouped by coat color. Cows were classified in three groups: (1=60% or more white color, 2= mixed coat color was 50% black and 50% white and 3=60% or greater black color). Cows were also grouped by season of freshening. The model included: coat color, season of freshening, coat color, and coat color x season of freshening as fixed effects, and the residual as a random component. The average milk yield of cows grouped by coat color (1, 2 and 3) were: 9071.671279.82, 8582.101386.21 and 8853.701578.38 and 6534.661312.51, 5774.441638.65 and 5896.671277.07 kg in herds 1 and 2 respectively. Milk yield in cows 60% or more white color was 4.06% higher (P>.05) than the average milk yield of the other coat color cows groups. The average estimates of open days to cows grouped by coat color (1, 2 and 3) were (131.4091.11, 143.7594.76 and 149.5687, and 113.2586, 116.3555 and 136.40 27 d) for herds 1 and 2 respectively. The average estimates for services per conception in cows grouped by season of freshening (October to January, Februry to May and June to September) were: 2.37 1.59, 2.53 1.33 and 3.03 1.15, and 2.59 2.24 , 2.86 2.01 and 3.232.27 in herds 1 and 2 respectively. The coat color x season of freshening interaction was found to be not significant (P>.05) on milk production. The coat color x season of freshening interaction was found to be significant (P<.05) on the open days and services per conception however.

Key Words: Coat Color, Hot Conditions, Milk Yield

11 Comparison of scrotal circumferences in the progeny of Limousin sires mated to dams involving inheritance of Limousin in a herd in Samalayuca, Mexico. A Marquez[1], J Ponce[1], J Rodriguez[1], F Trejo[1], H Gonzalez[2], and J Guerrero[3], [1]*Universidad Autnoma de Baja California,* [2]*Universidad Autnoma de Ciudad Jurez,* [3]*University of California- Agricultural & Nat. Resources*.

Abstract Data came from a herd of Limousin (L) cattle located in Samalayuca, Mexico, under an extensive rangeland system representative of the desertic region at the north of the country.The objectives were to compare the scrotal circumferences of (n= 41) Limousin sires, estimates heritabiliy for this trait, and descriptive statistics for growth traits as weights at birth and weaning, and weight at 365 d. Data was analyzed by using least squares mixed procedure. SAS, version 6.07 (SAS, 1992).Each trait was analyzed separately.The analytical model used for analyses of all traits measured in progeny included: year of birth of the calf, sex of the calf (for all the analyzed traits), age of dam, and season of parturition as fixed effects;sire and the residual as random components.Age of calf was added as a covariate. Data expressed on an age constant or weight constant basis were adjusted to 365 d of age or 401 kg liveweight as average weight af all sires at yearling, using linear and quadratic regression within breed. Average weights of the progeny (n=41) of the n sires were: 37.97, 204.31, and 359.19 kg for birth, weaning and at weight at 365 d respectively. The average scrotal circumference of the (n= 40) Limousin sires was 35.49 cm. The heritability value of scrotal circumference was (h= 0.39.05).

Key Words: Scrotal Circumferences, Heritability, Growth Traits

12 Estimates of genetic and reproductive parameters in a Holstein dairy herd in the desertic at northwest region of Mexico. A Marquez[1], A Quintana[1], J Rodriguez[1], S Cobos[1], F Bueno[1], V Vizcarra[1], H Gonzalez[2], and J Guerrero[3], [1]*Universidad Autnoma de Baja California,* [2]*Universidad Autnoma de Ciudad Jurez,* [3]*University of California- Agricultural & Nat. Resources.*

Three hundered ninety-eight first lactation records for milk yield of Holstein cows, daughters of 51 Holstein sires, were analyzed by using least squares. The objective was to estimate genetic parameters and breeding values. The environmental correlation (c) used to estimate breeding values was 0.02. Cows were classified in three groups according to the season of parturition. The model included: cow, age of dam, and season of parturition as fixed effects: sire, sire x season of parturition interaction and the residual as random components. The average milk yield 305 d 2x in first lactation cows was 8,725.75 1,401.89 kg. The projected milk production to mature equivalent was 11, 012.20 1,735.62 kg. Open days and services per conception were 148 103, and 2.84 2.09 respectively. The averages for milk yield by season were: 9,0281,294.34, 8,232.901,163.96 and 8,8731,602.42 kg for October to January, February to May and June to September, respectively. A significant diference (P< 0.01) in milk yield was found between cows for which parturitions occurred October to January and cows for which parturitions occurred February to May, but no significant differences (P> 0.05) were detected for cows which parturitions occurred among June to September. The variance component for milk yield due to sire (209,865.28) was highly significant (P<0.01). The estimated value of heritability for milk yield was (h= 0.330.37). The average predicted milk difference was 65 113 kg. These estimates were different than reported values in sires summaries. The phenotypic correlation between 305 d milk in first lactation cows and projected milk difference was (rp=0.93).

Key Words: Heritability, Predicted Difference, First Lactation

13 Estimates of genetic parameters for birth weight in crossbred calves Jersey x Holstein. A Marquez[1], S Cobos[1], J Bauelos[1], and J Guerrero[2], [1]*Universidad Autnoma de Baja California,* [2]*University of California- Agricultural & Nat. Resources.*

The objective of the study was to estimate the heritability value of birth weight in the progeny of 51 Holstein heifers mated artificially to Jersey sires, under an irrigated grazing system, and hot stressfull conditions in a dairy herd located in a desertic region at north west of Mexico. Least squares were used to estimate variance components. The analytical model included: dam, sex of the calf, and season of parturition as fixed effects; sire, sire x season parturition interaction and the residual as random. Averaged birth weight was 31.821.59; 32.04 1.60 and 30.44 1.52 kg for male and female calves respectively. The avearage age of heifers at first mating was 17.392.03 month. The number of services per conception was 1.37 0.07. The average gestation length was 270.719.40; 268.68 5.37 and 272.59 5.45 d for female and male calves respectively. Gestation length of Jersey x Holstein heifers was 12.41 d (4.36%)shorter than Holstein calves. Estimates of heritability value for birth weight was (h = 0.300.04). Male calves were 5.25% heavier (P<0.05) than female calves; eight births (15.68%) required to be assisted. Estimates of phenotypic correlations among birth weight and age at first mating and length of parturition were (rp= 0.200.04, and rp=0.21 0.06 respectively. A negative phenotypic correlation (rp=-0.160.05) was found between age at first mating and length of parturition. These results which are based in limited numbers of observations suggest the advantage of using sires Jersey sires to be mated to Holstein heifers to reduce calving difficulty because birth weight is the main cause of dystocia in young cattle.

Key Words: Heritability, Birth Weight, Crossbred Heifers

14 Comparison of component EPD between Herefords with high versus low values for a maternal productivity index. D. H. Crews, Jr.*, *Agriculture and Agri-Food Canada Research Centre, Lethbridge, Alberta, Canada.*

A maternal productivity index (MPI) was developed for Canadian Herefords (n = 577,048) with the breeding objective to increase genetic potential to consistently wean heavy calves over a sustained productive life while maintaining input costs. Economic weights in the index were 3, 2.72, -0.49, and 3.62 for component trait EPD, including direct and maternal weaning weights (kg), cow weight at weaning (kg), and survival (%), respectively. Component trait EPD were estimated using a multivariate animal model. Animals with MPI more than two standard deviations above the overall mean (4.48 ± 19.52) were classified in the high group (n = 17,328), whereas animals with MPI more than two standard deviations below the mean were classified in the low group (n = 11,496). Accuracy of component EPD were moderate and similar between the high and low MPI groups. Component trait EPD were compared between the groups by expressing within-group mean, minimum and maximum EPD as deviations from the overall mean in standard deviation units. Standardized mean EPD for high (low) groups were 0.89 (-0.43), 2.06 (-2.23), 0.89 (-0.50), 0.97 (-1.17) for direct and maternal weaning weight, cow weight at weaning, and survival, respectively, indicating significant mean differences between the groups and that increasing selection for the MPI would result in positive genetic trend for all components. The minimum EPD was in the low group, and the maximum EPD in the high group for all component traits. However, 82, 14, 74, and 39% of the range in component EPD included animals in both the low and high groups for direct and maternal weaning weight, cow weight at weaning, and survival, respectively. The MPI was more closely related to genetic differences in maternal weaning weight and survival rather than preweaning growth or cow weight. These results suggest that selection for the MPI would not be equivalent to selection for any of the component traits alone.

Key Words: Hereford, Maternal Productivity, Selection

15 Average effect of gene substitution for milk protein loci on first lactation production in dairy cattle. A. Barreras-Serrano*, J.C. Cruz-Lpez, and O. Robinson-Navarro, *Universidad Autónoma de Baja California, Mexicali, B.C., Mxico.*

The objective of this study was to determine the changes on first lactation performance resulting from the average effect of the gene substitution for α_{s1}-casein, κ-casein, α-lactalbumin and β-lactoglobulin. Blood samples and milk yield from 251 Holstein first lactation cows located in Tijuana, B.C. were used. Genotyping of milk proteins was made by DNA analysis using the polymerase chain reaction method. Data was analyzed using a linear model, in which the average effect of gene substitution for each protein type was obtained by treating the gene contribution of each protein type as an independent variable. Non-genetic effects accounted for by the model were herd, calving year and month of calving. Least square procedure was utilized for estimating each component to be included in the model. Additive genetic variance due to each milk protein locus, was calculated using $2pq\alpha^2$. Total additive genetic variance due to the four milk protein loci was estimated as the composite sum of each one of them. B allele frequencies for α_{s1}-casein, β-lactoglobulin, α-lactalbumin and κ-casein were: .802, .530, .665, and .096 respectively. Substitution of B for C allele at α_{s1}-casein locus had a significant effect on milk yield (P<.05). Substitution of B for A allele at β-lactoglobulin, α-lactalbumin or κ-casein locus did not show significant effects on milk yield (P>.05). Substitution of B for C allele at α_{s1}-casein locus resulted in an increase of 446.52 Kg in milk production. The replacement of B for A allele at β-lactoglobulin, α-lactalbumin and κ-casein would increase milk yield. The contribution of the four milk protein loci taken together, accounted for 7.62% of phenotypic variance in milk yield. Milk protein typing would be used as an aid in the improvement of milk yield by selection.

Key Words: Milk Protein Polymorphism, Milk Yield, Dairy Cattle

16 Seroprevalence of respiratory infectious diseases in breeding cattle in northwest Mexico. F.J. Monge*, A. Barreras, and S. Cueto, *Universidad Autnoma de Baja California, Mexicali, B.C., Mxico.*

The objective of the study was to establish the serological prevalence of Bovine Respiratory Sincityal Virus (RSV), Infectious Bovine Rinotracheitis (IBR), Bovine Viral Diarrhea (BVD) and Parainfluenza (PI3) in breeding cattle from northwest Mexico. Fout hundred samples of blood were collected from the municipality of Ensenada, Baja California and analized by an indirect ELISA test, using commercial kits (SVANOVAVIR^{TM}) to detect antibodies against RSV, IBR, BVD and PI3. Optical density values were obtain using a automated ELISA reader with a 450 nm filter. The mean of the optical density (m-OD) for positive control serums to RSV was 0.542 and for negative control serums 0.010, for IBR the m-OD for positive control serums was 0.714 and for negative control serums 0.0002, for DVB the m-OD for positive control serums was 1.228 and for negative control serums 0.043 and for PI3 the m-OD for positive control serums was 0.981 and for negative control serums 0.048. Using an OD cut-off value $\geq$ 0.2 for seropositive result, the prevalence for RSV was 55.25 %, for IBR 61.50 %, for BVD 70.75 % and for PI3 84.50 %. The prevalence of antibodies for all four antigens is high, nevertheless only one farm (n=54) reported the use of the vaccin for this diseases. The application of specific tests to confirm the presence and classification of those viruses in the zone is highly recommended, it is also advisible the introduction of sanitary strategies aimed to control them.

Key Words: Seroprevalence, ELISA, Breeding Cattle

17 Center for Animal Agriculture and Community Enhancement. J.G. Davis*, *Colorado State University.*

The newly-formed Center for Animal Agriculture and Community Enhancement at Colorado State University has the mission of fostering animal agriculture that strengthens communities. Our goals are to evaluate the environmental, economic, and social impacts of animal feeding operations on rural and urban communities and to enhance the beneficial impacts of animal agriculture while helping to solve problems arising from negative impacts. We will reach these goals through open communication across departments (11) and colleges (6); creative collaborations in interdisciplinary research, education, outreach, and grantsmanship; and strong linkages with leaders in animal agriculture and community development. Our programs will focus on problem solving in four specific areas: air quality, water quality, pharmaceuticals, and mortality management. Education and outreach are integral components within each problem-solving area. Air quality research will explore three major concerns: greenhouse gases, odor, and dust. We will evaluate the effects of diet and management on greenhouse gas emissions from beef and dairy systems. Management options, such as pH reduction of the pen surface and algal aeration of lagoons, will be developed to reduce odors from both feedyards and lagoons. Water quality problems are often related to concentration of animal feeding operations in areas close to water bodies. We will evaluate high-value manure uses as a means to overcoming high transportation costs and relieving pressure on water quality. In addition, we will evaluate the potential for composting coops, custom composting services, or subsidies to encourage composting as a means to increasing the value of manure. Pharmaceuticals, including both antibiotics and hormones, will be surveyed to determine the degree of potential contamination of land and water and pathways of exposure of humans, wildlife, and other organisms. We will also investigate management practices that could minimize release and toxicity of pharmaceuticals off-farm. Lastly, we will define the extent of the mortality disposal problem and provide solutions. Alternative modes of disposal will be evaluated regarding capacity, economic feasibility, environmental impacts, and safety.

Key Words: Environment, Economics, Communities

18 Feeding value of cholla cactus. R. L. Endecott*, J. E. Sawyer, V. A. Munn, C. A. Loest, and M. K. Petersen, *New Mexico State University.*

Cholla cactus has been used as an emergency feed during drought conditions in New Mexico for many years. Three wethers (avg wt 65 kg) were used in a replicated 3 x 3 Latin Square to determine the digestibility of singed cholla cactus (*Opuntia imbricata*) when fed with a basal diet of mature blue grama hay (9.0% CP and 69.0% NDF, OM basis). Treatments consisted of 0%, 15%, and 20% cholla in the diet on a DM basis (treatments 0, 15, and 20, respectively), which were assumed to be similar to amounts that would be consumed by grazing animals. Cholla contained 20.3% DM, 79.6% OM and 36.4% NDF (OM basis). Cholla was harvested in September and clippings consisted of green, non-woody segments. The cactus was singed with a propane torch until no spines remained, chopped into 5.1 x 5.1 cm pieces and added to the diet each day. Cholla and hay were sampled daily and compiled for each period. Total fecal collections were subsampled and reserved for later analysis. Feed and fecal samples were analyzed for DM, OM, and NDF and digestibilities were calculated. Digestibilities of cholla were calculated by difference. Mean cholla DM, OM, and NDF digestibilities averaged 32.6%, 44.3%, and 27.9%, respectively. Diet dry matter digestibilities averaged 52.6%, 50.2%, and 47.8% $\pm$ 1.6 for treatments 0, 15 and 20, respectively ($P > 0.05$). Organic matter digestibilities of the diet were 59.3%, 57.7%, and 55.4% $\pm$ 1.6 for treatments 0, 15 and 20, respectively ($P > 0.10$). The diet NDF digestibilities were 58.0%, 54.2%, and 51.0% $\pm$ 1.9 for treatments 0, 15 and 20, respectively. The NDF digestibility of the diet containing 20% cholla (51.0% $\pm$ 1.9) was lower ($P < 0.05$) than that of the diet with no cholla (58.0% $\pm$ 1.9). When the diet contained 20% cholla, overall diet NDF digestibility decreased because of the greater concentration of the poorly digestible cholla. Due to its poor feeding value, the use of cholla cactus as an emergency feed should be carefully considered.

Key Words: Cholla, Digestibility, Feeding Value

19 Fenceline contact of beef calves with their dams at weaning reduces the negative effects of separation on behavior and growth rate. E.O. Price*[1], J.E. Harris[1], S.M. Mongold[1], R.E. Borgwardt[1], M.I. Sween[1], and J.M. Connor[2], [1]*University of California, Davis, CA,* [2]*University of California Sierra Foothill Research & Extension Center, Browns Valley, CA.*

One-hundred Angus/Hereford-cross calves in each of three years were assigned to five treatments for seven days to determine the effects of different weaning techniques on their behavior and subsequent growth. Treatments were: 1) fenceline separation from dams - on pasture; 2) total separation from dams - on pasture; 3) total separation from dams - in drylot - preconditioned to hay; 4) total separation from dams - in drylot - not preconditioned to hay; 5) non-weaned controls - on pasture. At the end of the seven-day treatment period, all calves were placed on pasture in large groups. Calf behaviors were monitored for five days following weaning and body weights were obtained weekly for 10 weeks. Fenceline calves and cows spent approximately 60% and 40% of their time, respectively, within 3 m of the fence separating them during the first two days post-weaning. For the first three days, fenceline calves vocalized less and spent more time eating and lying down and less time walking (pacing) than calves in the three totally-separated treatments. Treatment differences in behavior were greatly reduced on days four and five. At two weeks post-weaning, fenceline calves had gained 95% more body weight than calves in the three totally-separated treatments (21.4 vs. 11.0 kg, respectively). At 10 weeks post-weaning, fenceline calves had gained 31% more weight than the average calf in the totally-separated groups (50.0 vs. 38.2 kg, respectively). A follow-up study demonstrated similar advantages of fenceline contact when calves were weaned under drylot conditions and their dams had access to pasture. It was concluded that fenceline contact between beef calves and their dams at weaning reduces the negative effects of separation on calf behavior and growth.

Key Words: Beef Cattle, Weaning, Behavior

20 Daily vs alternate day supplementation of soybean meal or wheat middlings to steers consuming low quality hay. T. R. Shirley*[1], C. J. Ackerman[1], G. D. Pulsipher[2], T. DelCurto[2], C. S. Schauer[3], and T. R. Currier[3], [1]*Oregon State University, Corvallis OR,* [2,3]*Eastern Oregon Agricultural Research Center,* [2]*Union,* [3]*Burns, OR.*

The objectives of this trial were to investigate the impacts of daily vs alternate day (AD) supplementation of soybean meal (SBM) or wheat

middlings (WM) on forage DMI, total tract digestibility, and ADG of steers consuming low quality hay. Exp. 1; five Angus x Hereford steers (403 32 kg) fitted with rumen cannulas were utilized in a 5 x 5 Latin Square design. Steers were individually fed low-quality (5.5% CP) fescue hay ad libitum and were randomly assigned to one of five treatments: no supplement (CON); WM fed daily (WMD); WM fed AD (WMAD); SBM fed daily (SBMD); and SBM fed AD (SBMAD). Supplements were formulated to meet 100% of degradable intake protein (DIP) and metabolizable protein (MP) requirements (level 1 NRC; 1996). Supplementation increased ($P < 0.05$) hay and total DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) and DM digestibility (%) compared to CON. Daily supplementation increased ($P < 0.05$) hay and total DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) and DM digestibility (%) when compared to AD supplementation. Hay DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) was greater ($P < 0.01$) for SBMD compared to WMD, but total DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) and DM digestibility (%) were not different ($P > 0.68$). Hay DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) was greater ($P < 0.01$) for SBMAD compared to WMAD, but total DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) and DM digestibility (%) were not different ($P > 0.75$). Exp. 2; 96 Angus x Hereford steers (280 32 kg) were blocked by weight (three groups) into 12 pens in a randomized complete block design. Steers were fed low-quality (6.5% CP) fescue hay ad libitum, and one of four supplements formulated to meet 100% of the DIP requirements (level 1 NRC; 1996): WM fed daily (WMD); WM fed 3d/week (WMAD); SBM fed daily (SBMD); and SBM fed 3d/week (SBMAD). Hay DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) decreased ($P < 0.01$) and ADG increased ($P < 0.01$) for WM compared to SBM. Daily supplementation increased ($P < 0.03$) ADG and hay DMI ($g \cdot kg^{-1} \cdot BW^{-1}$) compared to AD supplementation.

Key Words: Supplementation, Supplement Frequency , Low Quality

21 An evaluation of production efficiency in a cow/calf system designed to add value.

R. V. Anderson*, R. J. Rasby, T. J. Klopfenstein, and C. N. Macken, *University of Nebraska, Lincoln.*

Crossbred cows were blocked by age, weight, and body condition score into two treatment groups for 3 yr to compare inputs of resources, cow, calf, and feedlot performance, and carcass characteristics of a conventional (C) production system to a value-added (VA) system that matched cattle to the forage resource. In the C (n = 85) system cows grazed pasture and were fed hay. C steer calves were transported directly to the feedlot after weaning and finished. In the VA (n = 85) system, cows grazed pasture and crop residue, followed by a short hayfeeding period. Steer calves in the VA system grazed crop residue after weaning, grazed pasture in the spring and summer, and were finished in the feedlot. Cow weight and body condition score (BCS; 1 = emaciated; 9 = obese) were determined at weaning and before and after crop residue grazing. Cow weights were similar for C and VA cows at weaning and before crop residues, but were greater (P < 0.01) for C cows in years 1 and 3 after residue grazing. Similarly, BCS was similar at weaning and before crop residues, but was greater (P < 0.01) for C cows in all years after crop residues. Pregnancy rates were not different between groups (C = 99%; VA = 96%). Steer post-weaning weights were not different between groups. C steers (n = 42 per year) were slaughtered after a 211 d finishing period. On average, VA (n = 44 per yr) steers gained 0.53 kg per d during the winter phase (197 d), 0.93 kg per d during the summer phase (118 d), and 1.96 kg per d during the finishing phase (90 d). VA steers had greater (P < 0.05) average daily gain, dry matter intake, final weight, and lower feed efficiencies compared to C steers. Hot carcass weight and ribeye area were greater (P < 0.05) for VA steers. Marbling score was not different between groups (C = 505; VA = 565; 500 = small 00). Yield grade was reduced (P < 0.05) for VA steers. Cow weight and BCS differed but pregnancy rates were similar. VA and C steers differed in feedlot performance and carcass characteristics.

Key Words: Cow/calf, Systems, Carcass Quality

22 Using sheep in grain production systems to reduce pesticide use I. Control of wheat stem sawfly infestations in wheat stubble.

H. B. Goosey*, T. Spezzano, P. G. Hatfield, S. L. Blodgett, P. M. Denke, and R. W. Kott, *Montana State University, Bozeman, Montana.*

Wheat Stem Sawfly (WSS, *(Hymenoptera Cephidae)* is the most destructive pest to Montana's one billion dollar per yr grain industry. Acreage infested with WSS has increased over the past 5 yr and current control methods have minimal impact on WSS populations. Our objective was to compare over-wintering WSS larval populations in sheep-grazed (fall, fall and spring, and spring), burned, tilled, and no input control plots (130 m^2) at two sites in Montana infested with WSS. A randomized complete block design was used with 4 blocks per site. Five mature ewes were randomly assigned and confined with electric fence to each grazing plot for 24 h resulting in a stocking rate of 400 (fall only and spring only) and 800 (fall and spring) sheep days/ha. Tillage and burn treatments were imposed within one wk of fall grazing. Wheat stem sawfly larval numbers were determined by collecting all plant material from three, 0.5 m lengths of randomly selected rows in each plot. Sampling was conducted in the fall before imposition of treatments, and in the spring, after imposition of treatments but before larvae hatched. Contrasts were used to compare all grazing treatments to control, tilled and burned treatments. Percent mortality from pre- to post-spring treatment were analyzed using site, treatment, block, and site x treatment. No site x treatment interactions were detected (P > 0.28). Percent larval mortality was greater (P < 0.05) in grazed (50.2%) compared to tilled (36.5%), burned (31.1%) and control (27.0%) plots. Percent mortality was greater (P < 0.04) in plots grazed in both the fall and spring compared to plots grazed only in the fall or spring. This study indicates the potential for using grazing sheep to control wheat stem sawfly infestations in grain production.

Key Words: Grain Fallow, Stubble Grazing, Sheep

23 Surveillance system in abattoirs for the detection of bovine tuberculosis during 1995 to 1998, in Baja California, Mxico.

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The objective of this study was to compare annual prevalences of tuberculosis in cattle slaughtered at Baja California abattoirs from 1995 to 1998, as well as determining the presence of an association between the number of samples sent to the laboratory and the frequency of detection of mycobacteriosis. The diagnosis of Tuberculosis (TB) cases was based in the histopathologic findings. Detection and recollection of granulomatous lesions was conducted in the slaughtered cattle at the abattoirs of Baja California, which slaughtered approximately 193,729 cattle each year of this study. Tissue specimens with suggestive TB lesions were fixed in neutral-buffered 10% formalin and taken to the Brucellosis and Tuberculosis laboratory of the Instituto de Investigaciones en Ciencias Veteinarias (Veterinary Sciences Research Institute) of the UABC and were embedded in paraffin, sections were stained by Hematoxilin-Eosin and Ziel Neelsen techniques and examined for typical Tuberculosis lesions and acid fast bacilli. The prevalence of TB in all slaughtered cattle during 1995 was 1.15/1,000 animals, the corresponding prevalence for 1996 was 4.74/1,000, during 1997 the prevalence dropped to 2.19/1,000 while in 1998 the drop continued to 1.05 out of every 1,000 slaughtered animals. These prevalences showed significant differences when they were compared, with 1996 the highest (P< 0.05).

Key Words: Bovine Tuberculosis, Monitoring System, Mycobacteria

24 Predicting the time of parturition in spring-calving beef cows.

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Calf mortality due to dystocia continues to plague beef producers. If the time of day that parturition occurs could be predicted on an individual basis, loss due to dystocia could potentially be reduced and management of pregnant females improved. To determine whether beef cattle display a predictable pattern of parturition as individuals, time of parturition was recorded to the nearest half-hour for 5 consecutive years in a herd of spring-calving crossbred (Hereford x Angus and Brahman x Hereford x Angus) beef cows at Kansas State University Agricultural Research Center-Hays. Each year calving began the third or fourth week of January and ended the third or fourth week of April. Births that could not be estimated within an hour of occurrence were excluded. Cows ranged from 2-7 years of age and number of observations for parturition time ranged from 2-5 (n=523) per cow. Cows were fed forage sorghum hay daily each year between 1600 and 1800. Days were divided into 6 periods (P): P1=0600-0959; P2=1000-1359; P3=1400-1759; P4=1800-2159; P5=2200-0159; P6=0200-0559 and the percentage of cows giving birth within each period was 34.23, 21.23, 29.83, 8.41, 4.40, and 1.91%, respectively. Average time of parturition was determined for each cow and the

difference from the individual's average for each parturition time was calculated. The mean difference from an individual's average calving time was 2.66±0.12 h for all cows. The level of significance was set at 3 h and a one sample t-test indicated the mean difference from an individual's average time of parturition was significantly (P=0.002) less than 3 h. Two sample t-tests indicate that cows giving birth during daylight hours tend to display less variation than cows giving birth during dark hours. These data reveal that for a majority of animals in this herd, the time that parturition will occur may be predicted within ±3 h based on the average time of day that cow had previously given birth. However, alteration of feeding time or other factors may affect the predictability of parturition time.

Key Words: Time of Parturition, Beef Cattle

25 Using sheep in grain production systems to reduce pesticide use II. Comparing stubble grazing with tillage and burning on weed and soil characteristics. T. M. Spezzano*, H. B. Goosey, P. G. Hatfield, S. L. Blodgett, P. M. Denke, and R. W. Kott, *Montana State University, Bozeman, Montana.*

Chemical fallow to conserve soil moisture represents the largest variable cost to Montana grain production. Sheep grazed wheat stem sawfly infested stubble fields can reduce over-wintering larval numbers, but the use of sheep to control weeds on fallow ground has not been investigated. In addition, wheat producers are concerned with soil compaction on grazed stubble fields. Our objective was to evaluate changes in weed frequency and soil compaction in fall (**F**), spring (**S**), fall and spring (**FS**) grazed, burned (**B**), tilled (**T**), and no input control (**C**) plots at four sites in Montana. Treatments were imposed on 130 m^2 plots in a randomized complete block design, with 4 blocks per site. Five ewes were randomly assigned to each grazed plot for 24 h. Stocking rate were 400 (F and S) and 800 (FS) sheep days/ha. Tilled and B treatments were imposed within one wk of fall grazing. Three randomly located soil core samples and three 0.25m^2 quadrants per plot were taken before imposition of fall treatments and again after S to determine percent change in soil compaction and weed frequency. Contrasts were used to compare all grazing treatments to C, T and B in a model that included site, treatment, block, and site x treatment. No site x treatment interaction was detected for soil compaction ($P > 0.25$). Change in soil compaction did not differ (P>0.45) when grazing was compared to T, B, or C. Site x treatment interaction was detected for change in weed frequency ($P < 0.01$). Change in weed frequency did not differ ($P > 0.45$) between grazed and B treatments on any of the sites. Grazed treatment resulted in a greater ($P < .001$) reduction in weed frequency compared to C at all sites. At two sites, reduction in weed frequency was greater ($P < .10$) for grazed than T, but did not differ ($P > 0.27$) at the other two sites. Sheep grazing did not negatively impact soil compaction and may be a viable method for weed control in grain fallow systems.

Key Words: Chemical Fallow, Weeds, Sheep

26 Evaluation of Drought Management Strategies for Cow-Calf Enterprises: A Practical Predictor of Growing Season Forage Production. R. E. Kruse*[1], M.W. Tess[1], R. K. Heitschmidt[2], J. P. Paterson[1], and K. Clement[2], [1]*Department of Animal and Range Sciences, Montana State University, Bozeman, MT 59717,* [2]*USDA Ft. Keogh Livestock Animal and Range Research Laboratory, Miles City, MT.*

Our research addresses the hypothesis that spring precipitation data can be used to predict forage production early in the growing season. Forage production on the mixed-grass prairie in eastern Montana and southeastern Alberta is related to seasonal precipitation. The Rangetek range model was used to simulate yearly forage data based on historical precipitation and temperature records from the Fort Keogh Livestock Animal and Range Research Laboratory near Miles City, Montana and the Manyberries Substation near Lethbridge, Alberta. Thirty years of climate data from Fort Keogh and fifty years of climate and forage data collected from the Manyberries Substation were used to develop regression equations predicting growing season forage production. Independent variables included monthly or seasonal precipitation as well as maximum and minimum temperature. At Fort Keogh, fall precipitation (October and November) and spring precipitation (April and May) were highly significant predictors of simulated forage production ($P < 0.01$) where the model explained 84% of the variation seen in forage production. At the Manyberries Substation, April and May were highly significant predictors of forage production ($P < 0.01$) where the model explained 46 % of the variation using the simulated results from Rangetek. Using the actual forage data from Manyberries resulted in similar results where April and June were highly significant predictors of forage production ($P < 0.01$, $R^2 = 0.46$). Adding July precipitation did not improve the regression equations from the Rangetek results. July precipitation did increase the R^2 value to 0.58 for the forage production data from Manyberries, but it does not increase the ability of the equation to detect emerging drought. Each regression model can reasonably forecast forage production by July 1st. Our results show emerging drought can be detected with spring and early summer precipitation (April-June), and that mid-summer precipitation (July) makes little to no improvement in identifying drought years.

Key Words: Primary Production, Drought, Forecast

27 Effects of steroidal glycoalkaloids from potatoes (*Solanum tuberosum*) on in vitro bovine embryo development. S. Wang*[1], K.E. Panter[2], W. Gaffield[3], R.C. Evans[1], and T.D. Bunch[1], [1]*ADVS Department, Utah State University, Logan, UT 84322,* [2]*Poisonous Plant Research Laboratory, USDA-ARS, Logan, UT 84341,* [3]*Western Regional Research Center, USDA-ARS, Albany, CA 94710.*

Alpha-solanine (SOL) and α-chaconine (CHA) are two naturally occurring steroidal glycoalkaloids in potatoes (*Solanum tuberosum*), and solanidine-N-oxide (SNO) is a corresponding steroidal aglycone. A randomized complete block (10 replications) design with four in vitro culture (IVC) treatments (TRT) was used to evaluate the effects of these steroidal alkaloids on bovine preimplantation embryo development. Bovine oocytes (n=2370) were aspirated from abattoir ovaries and subjected to in vitro maturation (IVM) and in vitro fertilization (IVF). The IVM/IVF derived ova were then in vitro cultured in medium supplemented with 6 uM of α-solanine (TRT 1), α-chaconine (TRT 2), solanidine-N-oxide (TRT 3) or IVC medium only (TRT 4, Control). Data were analyzed by the general linear model ANOVA. Cleavage rates were 77.0%, 71.2%, 77.6% and 80.2% for TRTs 1, 2, 3 and 4, respectively. Percentage of morulae at d 6 of IVC was 47.8, 51.1, 50.7 and 53.2; percentage of blastocysts at d 8 of IVC was 15.2, 19.5, 23.9 and 23.4; and percentage of expanded and hatching blastocysts at d 10 was 9.2, 12.0, 12.9 and 19.1 for TRTs 1, 2, 3 and 4, respectively. Cleavage rate in medium containing α-chaconine (TRT 2) was significantly lower (P<0.05) than other treatments. The yields of expanded and hatching blastocysts were significantly (P<0.05) reduced compared to control. Therefore, we conclude that in vitro exposure of fertilized ova to these steroidal glycoalkaloids from potatoes inhibits preimplantation embryo development.

Key Words: Embryo Development, Glycoalkaloids, *Solanum tuberosum*

28 Frecuency, distribution and risk factors asociated to presence of bovine tuberculosis in dairy cattle of Baja California, Mexico. G. Lopez*[1], H. Magdaleno[2], A. Barreras[1], R. Searcy[1], and E. Sanchez[1], [1]*Universidad Autonoma de Baja California, Mexicali, B.C., México ,* [2]*Secretaría de Agricultura Ganadería Pesca y Alimentos, Mexicali, B.C., México.*

An epidemiologic study was carried out in 45 technified dairy farms, located in the state of Baja California, Mexico, to determine the frequency and distribution of tuberculosis (TB), and to evaluate the risk factors associated to the presence of this disease. The study included 20,000 cows allocated in 39 positive and 6 disease free dairy farms. The frequency and distribution of TB was estimated using information contained in the goverment official reports of TB tests, from 1997 to 1999. Two major areas were defined in the Baja California state, DDR001 (wich includes the municipalities of Tecate, Tijuana, Rosarito and Ensenada) and DDR002 (municipality of Mexicali). A questionnaire was applied to the owners of the 45 dairy farms in order to identify the risk factors. Two-way frequency tables were constructed and Yate's correction to chi-square statistic, the odds ratio, and a 95% confidence interval of the odds ratio were obtained. The average prevalence of TB in the state was 18.1% (20.7 and 9.4% for DDR001 and DDR002, respectively). Trend for TB prevalence from 1997 to 1999 by major area was decreasing in DDR001 (27 vs 10.5%) and increasing in DDR002 (8.7 vs 10.8%). According to the Yate's test, Risk factors (P<.05) associated to presence of TB were the location of the dairy farms into the major area (DDR001 OR=10; 95%CI=1.18-294.14), management of positive

reactor animals (without management OR=6.47; 95%CI=0.51-124.40), milking management (positive and negative cows together OR=10; 95% CI=0.94-251.54). Manure management, contact with other animals species, re-population of the dairy farm and feeding of calves were not significant factors (P >.05).

Key Words: Tuberculosis, Risk Factors, Dairy Cattle

29 Incidence of genetic susceptibility to scrapie in selected purebred and commercial flocks. B. M. Alexander*[1], R. H. Stobart[1], W. C. Russell[1], K. I. O'Rourke[2], A. N. Taylor[1], and G. E. Moss[1], [1]*University of Wyoming,* [2]*USDA-ARS.*

Scrapie is one of several transmissible spongiform encephalopathies (TSE) including bovine spongiform encephalopathy (BSE). The apparent transmission of BSE to humans in the United Kingdom resulted in a call for eradication of all TSEs in food producing animals. In the United States, scrapie has been detected only in sheep possessing alleles of the prion protein with glutamine (Q) or histidine (H) at codon 171, both reported as Q. Scrapie resistance is conferred with at least one allele for arginine (R) at 171. The objective of this study was to determine the inherent susceptibility of the Univ. of Wyoming flocks to scrapie. Columbia (n = 62), Hampshire (n = 76), Rambouillet (n = 79), and Suffolk (n = 48) ewes from the purebred flocks were genotyped for scrapie susceptibility. In addition, genotypes of 27 whiteface lambs produced by placing Rambouillet rams with the University's commercial ewes were determined. The profile of genotypes at codon 171 in the purebred flocks varied ($P< 0.0001$) by breed. Incidence of scrapie susceptibility (QQ) was highest in Columbia (59.7 %) and Suffolk (75.0 %) ewes. Hampshire ewes were intermediate with 26.3 % QQ, 59.2 % QR, and 14.5 % RR. Rambouillet ewes exhibited the greatest resistance to scrapie with 62 % being RR, 35.4 % QR and 2.5 % QQ. Genotypes of commercial whiteface lambs were 7.4 % QQ, 74.1 % QR and 18.5 % RR. The genotype of sires may be the single most important factor to imparting scrapie resistance to replacement ewe lambs. The distribution of scrapie susceptibility (QQ) and total resistance (RR), respectively, among rams was 87.5 and 0 % for Columbia (n = 7), 36.8 and 10.5 % for Hampshire (n = 19), 27.3 and 0 % for Suffolk (n = 11) and 0 and 75.0 % for Rambouillet (n = 8). Although it is not known whether the genotypic profiles of U. W. sheep are indicative of the general sheep population, scrapie susceptibility appears to differ by breed. Relationships among scrapie susceptible/resistant genotypes and production traits remain to be determined.

Key Words: Scrapie, Sheep, Genotype

30 Effects of thyroid inhibition during gestation on serum thyroxine and weight responses of fine-wool ewes. J. L. Duffey, D. M. Hallford, C. A. Gifford, and R. L. Rosencrans, *New Mexico State University, Las Cruces, NM/USA.*

Hormones produced by the thyroid gland are involved in onset of anestrus in sheep, and thyroid inhibition before onset of anestrus can extend the breeding season in ewes. In this study, 12 pregnant Rambouillet ewes were used to examine effects of short term propylthiouracil (PTU) administration on serum thyroxine profiles. Ewes were mated with Rambouillet rams during a fall breeding season after which they were maintained in a single pen (12 x 4 m) with access to shade, salt, water, and alfalfa hay (1.8 kg/d) throughout the experiment. Beginning on d 0 (January 2, first day of treatment when all animals were 72.2 ± 0.9 d of gestation), ewes received daily treatments (gavage) consisting of either 0 (n = 6) or 40 (n = 6) mg PTU/kg BW/d for 15 d. After 15d, the 40 mg dosage was decreased to 20 mg/kg BW for an additional 20 d (35 d of PTU). Blood samples were collected daily for the 35-d treatment period and for an additional 2 wk thereafter. Ewe BW were similar throughout the experiment and were 74.4 and 75.4 (± 2.3) kg (P = 0.56) in control and PTU-treated females, respectively, 1 wk after treatment ended. Likewise, serum thyroxine (T4) did not differ (P > 0.10) between groups through d 4; but on d 5, control females had a serum value of 66.9 ng/mL compared with 46.2 (± 5.3) ng/mL for PTU-treated ewes (P = 0.02). On the last day that 40 mg of PTU was administered (d 14), serum T4 averaged 66.7 and 6.8 (± 5.1) ng/mL (P < 0.001) in the two respective groups. Serum T4 values remained very low and were 79.8 and 0.3 ng/mL (P < 0.001) in control and treated ewes on d 34. During the 2-wk recovery period, serum T4 rose gradually after PTU but remained different from that observed in control ewes (67.9 and 48.8 ± 5.7 ng/mL for control and treated animals, respectively; P = 0.04). One PTU-treated ewe aborted 23 d after treatment ended. Results demonstrate that the 40/20 mg PTU treatment regimen is an effective method for inducing and studying effects of hypothyroidism in pregnant ewes.

Key Words: Sheep, Thyroid, Reproduction

31 Serum thyroxine and environmental conditions during three stages of the reproductive cycle of Rambouillet ewe lambs in southern New Mexico. C. A. Gifford, N. H. Wells, J. A. Hernandez, J. L. Duffey, R. L. Rosencranz, and D. M. Hallford, *New Mexico State University, Las Cruces, NM/USA.*

Spring-born (March 21, SD = 5 d) Rambouillet ewe lambs (n = 22) were monitored for 1 yr beginning in Sept after birth. Animals were housed under ambient conditions and fed alfalfa (2 kg) and cracked corn (0.45 kg) daily. Monthly weights and serum (2x/wk) were collected. Date of puberty was the sampling date before serum P4 first rose above 1 ng/mL and remained elevated for two sampling dates. Date of anestrus was the date when serum P4 fell below and remained below 1 ng/mL. The sampling date before serum P4 again rose above and remained above 1 ng/mL was the beginning of summer cycling. Ewe lambs weighed 51.8 ± 0.7 kg at the beginning of the study and 65.2 ± 1.3 kg 12 mo later. Females reached puberty on Oct 24 (SD = 15 d) at which time they weighed 57.9 ± 1.l kg. Ovarian cyclicity ceased on Dec 25 (SD = 26 d) when ewes weighed 61.2 ± 1.3 kg. Ovarian cyclicity resumed on July 16 (SD = 20 d) at a BW of 65.2 ± 1.3 kg. During the 3-wk period before each ewe reached puberty, solar radiation (MJ/m^2) measured 414 ± 5 compared with 336 5 during the 3 wk after puberty (P ¡ 0.01). Hours of daily sunlight were 11.5 and 10.8 (± 0.04, P ¡ 0.01) before and after puberty, respectively. Serum T4 was similar (P = 0.94) before and after puberty. Serum T4 and environmental conditions were similar (P ¿ 0.10) for 3 wk before and after anestrus. Serum T4 was similar (P ¿ 0.10) before and after resumption of ovarian cyclicity in the summer. Solar radiation (592 and 558 ± 7) and hours of sunlight (14.0 and 13.7 ± 0.03) were greater (P ¡ 0.01) during the 3 wk before than the 3 wk after onset of summer cyclicity. Serum T4 was greater (P = 0.09) during 3 wk before and after resumption of summer cyclicity (75.0 ± 2.4 ng/mL) than during the same periods before and after puberty and anestrus (68.0 and 69.8 ± 2.4 ng/mL, respectively). Decreasing sunlight and solar radiation appear to play little role in onset of subsequent cyclicity once puberty is attained in Rambouillet ewes in southern New Mexico.

Key Words: Sheep, Reproduction, Photoperiod

32 Comparison of progesterone containing sponge and controlled internal drug releasing device pessaries on estrous behavior and pregnancy in sheep. T. J. Stow*[1], B. R. Faris[1], T. T. Ross[1], and M. L. Looper[2], [1]*Department of Animal and Range Sciences, New Mexico State University,* [2]*Extension Animal Resources, New Mexico State University.*

A common method of synchronization utilizes a progesterone (P4) containing vaginal sponge pessary. However, the use of sponge pessaries is often coupled with problems related to retention of mucus and fluid in the vagina. Controlled internal drug releasing devises (CIDR) are similar pessaries that reduce levels of mucus retention. This study compares the use of sponge and CIDR pessaries in similar estrous synchronization protocols. Fifty-nine multiparous blackface ewes were fitted with HeatWatch transmitters to monitor estrous activity. Ewes were stratified by weight, age, and body condition and assigned to three treatment groups. Twenty ewes were administered a progesterone containing sponge pessary, 19 ewes received a CIDR pessary, and 20 ewes were left unsynchronized. Both sponge and CIDR pessaries remained in ewes for 10 days. Ewes were housed in pens with sterile rams to detect estrous activity. Each ewe was hand mated to a fertile ram twice daily during estrus. Hours from removal of pessary to onset of estrus, length of estrus and the number of standing events experienced by each ewe were recorded. Sixty days after completion of breeding, number of fetuses present were determined via ultrasound techniques. Duration of estrus (27.6, 23.9, and 25.4 ± 2.2 h; $P = 0.48$), standing events (16.6, 13.4, and 13.5 ± 1.5; $P = 0.22$) were similar for control, CIDR and sponge treatments, respectively. Hours from pessary removal to behavioral estrus was 53.2 and 53.4 ± 9.9 h for CIDR and sponge treatments, respectively ($P = 0.99$). Number of fetuses per ewe was similar ($P = 0.56$) among treatments.

This indicates that either sponge or CIDR pessaries can be used effectively to synchronize estrus with no differences in pregnancy or estrous behavior.

Key Words: Estrous Synchronization, Progesterone, Sheep

33 Impacts of implants on carcass quality and gross income. C. J. Ackerman, R. R. Mills, R. L. Dickson, and M. J. Fisher*, *Oregon State University*.

Thirty-five Angus steers were used to evaluate impacts of implanting on gains, carcass quality and economic returns. Steers were randomly assigned to: implanting with Synovex®-C while suckling, Synovex®-S at the initiation of the feeding period and Revalor®-S approximately 100 d prior to harvest (IMP), or no implants (CON). All steers were managed similarly in regards to weaning, health, and feeding. Steers were fed to a finished weight as one group in one pen. Steers were harvested in two groups two weeks apart, visual appraisal by feedlot personnel was used to determine when steers were ready for harvest. Average daily gain of IMP steers was greater ($P = 0.03$) during the suckling phase (1.27 vs 1.19 kg/d for IMP and CON, respectively). Additionally, ADG of implanted steers was greater ($P = 0.01$) during the finishing phase (2.00 vs 1.74 kg/d for IMP vs CON, respectively). Days on feed were less ($P = 0.04$) for IMP (161.8) vs CON (167.4) steers. Hot carcass weights of IMP steers were heavier ($P < 0.01$; 378.7 vs 344.2 kg for IMP and CON, respectively). There were no differences in backfat thickness (1.45 vs 1.37 cm), ribeye area (78.2 vs 75.9 cm^2), or yield grade (2.82 vs 2.88) for IMP vs CON, respectively. However, kidney, pelvic, and heart fat percentage was greater ($P = 0.03$) for non-implanted steers (2.27 vs 1.93% for CON vs IMP, respectively). Implanted steers graded 0% prime, 64.7% choice, and 35.3% select while CON steers graded 5.9% prime, 82.3% choice, and 11.8% select (grades assigned by a USDA grader). As a result of differences in quality grades, value of CON steers ($/kg) tended to be greater ($P = 0.07$) than IMP steers (2.74 vs 2.64 $/kg for CON vs IMP, respectively). However, overall final value of IMP steers tended to be greater ($P = 0.08$) than CON steers ($997.82 vs $942.18). Implanting steers with three implants during their lifetime decreased carcass value/kg, however, implanted steers gained more BW throughout their life and had greater final hot carcass weights and subsequently greater overall value.

Key Words: Implanting, Average Daily Gain, Carcass Quality

34 Effects of pH on survival of *Escherichia coli* O157:H7 in continuous cultures of rumen contents. B. H. Thran[1], H. S. Hussein*[1], D. Redelman[2], and G. C. J. Fernandez[3], [1]*Department of Animal Biotechnology,* [2]*Flowcytometry Center,* [3]*Nevada Agricultural Experiment Station, University of Nevada-Reno, Reno, NV 89557*.

The objective of this study was to assess the effect of rumen pH (i.e., 5.5, 5.75, 6.0, 6.25, 6.5, 6.75, 7.0, and 7.25) on survival of *E. coli* O157:H7 in continuous culture fermenters (1,020 mL volume each). On d 1, eight dual-flow fermenters were inoculated with rumen fluid from steers on a diet containing 50% grass hay and 50% corn. All fermenters were supplied daily with a diet (75 g DM [divided into 12 equal portions fed every 2 h]; 13.3% CP [DM basis]) containing 49.6% grass hay, 35.8% corn, 11.9% soybean meal, and 2.7% vitamin/mineral mix. The liquid and solid dilution rates were 10 and 5% h^{-1}, respectively. The first 3 d were used for adjusting the rumen fluid (pH = 6.2) microbial population to the test pH while the following 4 d were used for adjustment to the diet at the test pH. On d 8, each fermenter was inoculated with 1 mL (10^9 cells) of *E. coli* O157:H7 (ATCC 43888) suspension. To monitor survival of the pathogen, samples (1 mL each) were collected hourly for 12 h and every 2 h for additional 12 h and were analyzed by flow cytometer (B. H. Thran, H. S. Hussein, and D. Redelman, 2000; p. 38, Abstracts of the Food Safety Objectives Conference, Georgetown Univ., Washington, DC). *E. coli* O157:H7 could not be quantified in the samples collected after 24 h and their detection was only possible after enrichment. Because the pathogen was washed out of the fermenters 5 d post-inoculation (i.e., d 13), the fermenters were reincoulated on d 17 and d 22 and samples were collected in a manner similar to that for first inoculation. The data (percentage of initial dose) remaining at a given time was analyzed as a repeated measure in a randomized complete block design with a factorial (time # pH) treatment structur by using Proc MIXED of SAS. The numbers of *E. coli* O157:H7 in the fermenters decreased from 10^6 to 10^4/mL in a quadratic ($P < 0.05$) fashion over the 24-h period. These numbers were reduced at a slower ($P < 0.05$) rate for cultures at pH 7.0 than those under other pH treatments. Our data suggest that diet effects (through pH) on survival, proliferation, and shedding of *E. coli* O157:H7 is postruminally. Diet effects on colonization, proliferation, and subsequent shedding of this foodborne pathogen by ruminants appear to be through alteration of small and(or) large intestinal environments.

Key Words: Continuous cultures, Rumen pH, *Escherichia coli* O157:H7

35 Effects of water quality on performance and health of growing steers. H. H. Patterson*, P. S. Johnson, T. R. Patterson, and D. B. Young, *South Dakota State University, Brookings, SD*.

Water available to livestock in western South Dakota is often high in total dissolved solids (TDS) and sulfates. Eighty-one crossbred steers (317 kg) were used to determine the effects of TDS and/or sulfates in water on cattle performance and health. Cattle were stratified by weight and randomly assigned to one of 12 pens (6-7 steers/pen). Pens were randomly assigned to one of four treatments (three pens/treatment) based on supplied water: 1) rural water (RW; 1,000 mg/L TDS; 400 mg/L sulfates, 2) well water (WW; 4,800 mg/L TDS; 3,000 mg/L sulfates), 3) dam water (DW; 6,200 mg/L TDS; 4,000 mg/L sulfates), and 4) DW early switched to 10,000 mg/L TDS water mid-summer (DWS). The DWS treatment was not achieved, resulting in six pens in the DW treatment (three treatments). Dam water was transported from a local stock dam, and well water was pumped from a well on the research station. From June 20 to September 12, steers were fed a diet of grass hay and wheat middlings (NEg = 0.84 - 0.93 Mcal/kg), and the respective water was hauled into each pen. Water intake was lower (P = 0.06) for steers supplied WW (41.3 L) and DW (41.0 L) than for steers supplied RW (47.4 L). Steers supplied RW had higher DMI (P = 0.07) and gain:feed (P = 0.01) than steers supplied WW or DW. Steers supplied RW also had higher ADG (P = 0.005) than steers on WW or DW (0.63, 0.46, and 0.46 kg/day for RW, WW and DW, respectively). The incidence of polioencephalomalacia (PEM) was 15% and 12.5% for WW and DW, respectively, compared to no cases in RW (P = 0.08). Three steers died of PEM (one from WW and two from DW). Dietary sulfur concentrations were 0.27, 0.74, and 0.93% of dry matter for RW, WW and DW, respectively. It is unclear whether sulfur alone caused the reductions in performance or if other factors associated with TDS were important. Performance and health did not decline as TDS and sulfates increased above that in the WW treatment, indicating a threshold was achieved. Increased TDS and/or sulfates in the water reduced performance and health of growing steers.

Key Words: Steers, Water, Performance

36 Early weaning effects on feedlot performance and carcass quality: a meta-analysis. A.D. Jinks*[1], B.J. Renquist[1], and J.W. Oltjen[1], [1]*University of California, Davis*.

Early weaning has been studied since at least the 1940#s. However, there is little agreement on performance of early-weaned calves. This may be due to animal genetic differences, diet variation, different management practices such as creep feeding and implantation, and experimental design. A meta-analysis was conducted with data from six early weaning experiments to compare feedlot performance trends of early and normal weaned steers. Included in the studies were Angus x Hereford x Simmental, Angus x Simmental, Angus x Hereford, Angus x Hereford x Simmental x Gelbvieh (MARC II), Angus and other Angus crosses. Finishing rations ranged from 10.36% to 18.51% crude protein and 66% to 95% concentrate. Nutrition management included step-up programs of varying increments, ad libitum vs. programmed feeding, and use of creep feed. Three studies used implants. Within experiments, steers were slaughtered at a constant backfat varying from .81 to 1.27 cm or by constant weight of 546 kg. Data were split into three weaning groups: 1) calves weaned at 90 to 108 days (EW), 2) calves weaned at 150-177 days (MW) and 3) calves weaned at 200 to 215 days postpartum (NW). EW steers were on feed 70 days longer than NW steers, and had a dry matter intake of 1.8 kg less per day (P<.05.) EW steers were slaughtered 40 days younger than their NW counterparts. There were no significant differences in average yield grade, hot carcass weight, ADG or the percent of steers grading higher than average choice between the EW and NW groups. 5.2% more EW steers graded prime than the NW steers (P<.05). MW calves spent 40 more days on feed than NW steers

(P<.05) and had a .0185 higher gain:feed ratio. The MW steers were not significantly different in ADG, harvest age, hot carcass weight, yield grade or quality grade. Dry matter intake for MW steers was .14 kg/day higher than NW steers (P<.05). Early weaning does not appear to have benefits in normal production situations. However, early weaning does not negatively affect feedlot performance or carcass characteristics, and can be used to decrease cow nutrient demand and increase cow body condition in years of low forage availability.

Key Words: Weaning, Feedlot Performance, Carcass Quality

EXTENSION

37 Do-it-yourself Comprehensive Nutrient Management Plan workshops for livestock producers. J.G. Davis*[1], K.V. Iversen[1], J. Andrews[2], J.L. Sharkoff[2], P. Shelton[2], G. Brown[3], and B. Stevens[3], [1]*Colorado State University,* [2]*USDA-Natural Resources Conservation Service,* [3]*University of Wyoming.*

We held a series of 26 workshops throughout Colorado and Wyoming during the winters of 1998-2001. The purpose of the workshops was to provide beef and dairy producers with the information and tools necessary to develop Comprehensive Nutrient Management Plans (CNMPs). A CNMP includes nutrition, engineering, and agronomic aspects of manure management. The 1999 USDA/EPA National Strategy outlines an expectation that all animal feeding operations (regardless of size) will have CNMPs by 2009. We aimed these workshops at small producers (<1000 head) who may not be able to afford to hire consultants for this purpose, and 68% of participating producers fit this category. Eight-eight percent of participants had 2000 head or less. The workshops are a cooperative effort among land-grant universities, USDA-Natural Resources Conservation Service, and soil conservation districts with funding from the USDA-Sustainable Agriculture Research and Education program and EPA Region VIII. We developed CNMP notebooks and worksheets for producers to fill out for their own operations during these hands-on workshops. Producers work on developing their own CNMPs during the workshops, and 75% said that they knew how to complete their CNMPs after the workshop. About 500 producers have participated in these workshops in CO and WY, and about three-quarters of them said that the workshops impacted their operations. Over 90% of participants made plans for improvement in their manure management. In addition to the producer workshops, we held a train-the-trainer workshop in each state to train NRCS field staff, extension agents, and consultants in CNMP development. The curriculum for the workshops and the train-the-trainer manual is available on the web at www.csuag.com (click on Nutrient Management Plans). This curriculum is being modified for use in Montana, North Dakota, South Dakota, and Utah. Each of these states will hold a train-the-trainer workshop, five producer workshops, and make their CNMP curriculum available on the web.

Key Words: Manure Management, CNMP, Extension Education

38 Utah's Intermountain Beef 3910 Workshop - Partnering with industry in Extension education. D. R. ZoBell*, D. Whittier, C. Kim Chapman, C. Burrell, C. Bagley, and K. Heaton, *Utah State University.*

A two day hands-on workshop was developed, in collaboration with industry partners, for individuals involved in the beef industry. The objectives of this workshop are to provide participants with a basic understanding of the beef grading system and Beef Quality Assurance (BQA) and how these principles relate to them and the beef industry as a whole. This workshop is conducted twice per year with sponsorship from various industry groups and the Utah Cattlemen's Association and is limited to 20 participants per workshop. On day one the participants are assigned to one of four groups and instructed on the fundamentals of the US grading system and price discovery. The groups then evaluate one set of four slaughter steers (SS1) to determine live price and various carcass traits. The SS1 steers are then slaughtered at a nearby ConAgra facility. A video is viewed of another set of four steers (SS2). A simulated auction is held and each group purchases one of the SS2 steers. Each group breaks down the carcass of the steer they purchased with carcass data collected and economic values obtained which are compared to live price bids for the SS2 steers. On day two, a tour of the ConAgra facility is conducted and participants view the SS1 steers carcasses as well as discuss various aspects of the industry with company graders and others. At other locations participants view demonstrations on the use of ultrasound as a tool to determine carcass characteristics and proper vaccination and implant procedures of beef cattle. All meals are provided with an educational component assigned to each meal which includes new beef products and information on the NCBA beef quality audit. Five workshops have been held to date and evaluations by participants have been excellent.

Key Words: Extension, Beef, Carcass

GRADUATE STUDENT COMPETITION

39 Factors influencing the shedding of *Escherichia coli* and *Salmonella spp.* in Holstein cattle. A. C. Fitzgerald*[1], T. S. Edrington[2], T. R. Callaway[2], R. O. Elder[2], J. D. Thomas[1], R. C. Anderson[2], D. J. Nisbet[2], and M. L. Looper[1], [1]*New Mexico State University, Las Cruces, NM,* [2]*USDA/Agricultural Research Service-Southern Plains Agricultural Research Center, College Station, TX.*

Fecal samples were obtained in replicate from lactating (LAC; n = 60) and non-lactating (NLAC; n = 60) Holstein cows to determine the influence of time of day (AM vs PM), parity, and lactation phase [$\leq$ 60 or $>$ 60 d in milk (DIM)] on shedding of *Escherichia coli* O157:H7 (EHEC), *Escherichia coli* (EC), and *Salmonella spp.* (SM). Samples were collected at 0700 (AM) and 1700 (PM), placed on ice and shipped to our laboratory for microbiological analyses. Mean ambient temperatures at time of collection were 24.9 and 31.8°C for AM and PM, respectively. Mean relative humidity was 50 and 24% for AM and PM, respectively, on the day(s) of collection. Temperature-humidity index was 72 for AM and 76 for PM. Incidence of EHEC, EC, and SM shedding was 56, 100, and 53%, respectively, in all cows. In LAC cows, SM shedding was increased ($P < 0.05$) in AM (60%) compared to PM (40%). Shedding of EHEC was increased ($P < 0.05$) in the AM, and SM shedding was increased ($P < 0.05$) in the PM in NLAC cows. Shedding of EHEC was more ($P < 0.05$) prevalent in LAC (66%) than NLAC (34%) cows with no differences for EC and SM. More ($P = 0.06$) multiparous (67%) LAC cows shed SM than primiparous (33%) LAC cows. Parity did not influence ($P > 0.10$) shedding of pathogens in NLAC cows. Cows in early lactation ($\leq$ 60 DIM) shed more ($P < 0.05$) SM and had a tendency ($P = 0.10$) to shed more EC than cows $>$ 60 DIM. The most common *Salmonella* serotypes were Senftenberg (18%), Newport (17%), and Anatum (15%) of a total of 17 serotypes, and several cows were shedding more than one *Salmonella* serotype within a day. Time of day that fecal samples are collected may influence shedding of bacterium. In the current study, lactating cows shed more *Escherichia coli* O157:H7 than non-lactating cows. Cows in early lactation ($\leq$ 60 DIM) shed more *Salmonella* and *Escherichia coli* compared to cows in later lactation.

Key Words: Dairy cattle, *Escherichia coli*, *Salmonella*

40 Effect of follicle size at time of GnRH-induced ovulation on luteal function and fertility. G. A. Perry*[1], T. W. Geary[2], M. C. Lucy[1], and M. F. Smith[1], [1]*University of Missouri-Columbia, Columbia, MO,* [2]*USDA-ARS, Fort Keogh LARRL, Miles City, MT.*

The use of GnRH in fixed-time AI protocols results in the ovulation of a wide range of follicle sizes. The objective of this experiment was to determine the effect of follicle size at induced ovulation on corpus luteum (CL) function and fertility in cyclic and anestrous cows. Multiparous beef cows (n = 45) were assigned to one of three treatments: Cyclic cows treated with the CO-Synch protocol (n = 20), anestrous

cows treated with the CO-Synch protocol (n = 16), and anestrous control cows (n = 9). CO-Synch treated cows received GnRH (100 μg; i.m.) on d 0 of treatment, and all cows received PG (25 mg; i.m.) on d 7. Forty-eight hours following PG injection, cows received GnRH (100 μg; i.m.) and were artificially inseminated. Blood was collected daily from d 0 to d 31 and once weekly from d 34 to d 69. Ovarian follicles were measured by transrectal ultrasonography on d 7, 8, and 9 to determine growth rate and ovulatory size. Transrectal ultrasonography was used to determine pregnancy rates on d 34 and fetal viability on d 41, 48, 55, 62, and 69. Cyclic cows were further postpartum than anestrous cows (51.4 $\pm$ 1.9 d and 36.8 $\pm$ 1.7 d; $P < 0.05$) on trial start date. Follicular growth rate (d 7 to 9) and size of the ovulatory follicle did not differ among treatments ($P > 0.05$). CO-Synch treated cows had longer luteal lifespan than control cows (19.7 $\pm$ 0.9 d and 9.6 $\pm$ 1.8 d; $P < 0.05$). Cows that were pregnant on d 25 post breeding had higher ($P < 0.05$) concentrations of progesterone than nonpregnant cows from d 10 to d 22 post breeding. On d 25 post breeding, there was no difference ($P > 0.05$) in pregnancy rates among follicle size groups of CO-Synch cows [4/7 (57%), 8/10 (80%), 10/13 (77%), and 4/6 (67%) for 10 to 12, 12.5 to 14, 14.5 to 16, and > 16 mm; respectively]; however, by d 60 post breeding, cows that ovulated 10 to 12 mm follicles maintained fewer pregnancies [2/7 (29%); $P < 0.05$] than cows that ovulated 14.5 to 16 [9/12 (75%)] mm follicles. This decrease in pregnancy rate was due to greater embryonic mortality in cows that ovulated 10 to 12 mm follicles. In summary, ovulation of smaller follicles does not affect CL formation and progesterone secretion, but may lead to increased embryonic death.

Key Words: Fixed-time AI, Follicle Size, Embryonic Mortality

41 Production responses to range supplements with increasing concentrations of glucogenic precursors fed to young postpartum beef cows. R.C. Waterman*[1], L.A. Stalker[1], W.D. Bryant[1], J.E. Sawyer[1], D.E. Hawkins[1], E.E. Parker[1], S.H. Cox, J.A. Hartung[1], F. Valdez[2], J. Horton[2], and M.K. Petersen[1], [1]*New Mexico State University, Las Cruces, NM/USA,* [2]*Kemin Industries, Inc., Des Moines, IA/USA.*

Cattle grazing winter range forage often exhibit yearly variation in response to supplementation. This variation may be predisposed by circulating concentration and subsequent metabolism of glucose, which is significantly influenced by the quality and availability of dormant range forage. Therefore, a study conducted at the Corona Range and Livestock Research Center during two dry years, 2000 and 2001 (driest), evaluated the responses of supplements differing in glucogenic precursors fed to young postpartum beef cows. Supplements were fed at 908 $ghd^{-1}d^{-1}$ 2 x wk^{-1} for approximately 95 d postpartum and provided 327 g CP, 118 g UIP (Logluc); 327 g CP, 158 g UIP (Midgluc); 327 g CP, 164 g UIP + 100 g propionate salt (Higluc; NutroCal^{TM}, Kemin Industries, Inc.). Days to postpartum nadir were similar (P = 0.56) for both years among supplemented cows (46, 50, and 48 2.9 d for Logluc, Midgluc, and Higluc, respectively). Average daily gains from BW nadir to the end of supplementation in yr 1 were similar (P > 0.05; 0.30, 0.35, and 0.34 .05 kgd^{-1} for Logluc, Midgluc, and Higluc, respectively), whereas in yr 2, ADG from BW nadir to the end of supplementation were different (P < 0.03; 1.22, 1.11, and 0.74 0.12 kgd^{-1} for Logluc, Midgluc, and Higluc, respectively). Adjusted weaning weights for calves were lighter by 16 to 20 % in yr 1 when compared to yr 2 (P < .05; 160, 165, and 155 3.5 kg vs. 191, 199, and 194 3.4 kg for Logluc, Midgluc, and Higluc, respectively), but were not influenced by treatment in either year (P > 0.1). These results emphasize yearly variations encountered in response to supplementation and tend to suggest that alterations in nutrient partitioning do occur depending on availability of circulating glucose and quality of dormant range forage.

Key Words: Glucose, Propionate, Protein Supplements

42 Effects of Vitamin E Supplementation on Lipid Oxidation and Sensory Characteristics of Irradiated Beef Patties. K. A. Stith*[1], H. D. Woody[1], M. J. Roeder[2], H. L. Ashraf[1], S. Ohene-Adjei[3], and R. A. Roeder[1], [1]*Southern Illinois University at Carbondale,* [2]*Purina Mills, Inc.,* [3]*University of Illinois.*

This study was to determine if vitamin E (VE) supplementation in feedlot steers decreased the incidence of lipid oxidation (LO) and undesirable sensory characteristics in irradiated (CP) beef patties. Twelve Angus x Hereford steers (BW: 383 $\pm$ 41 kg) were penned in concrete-slatted floor facilities. Steers were fed a ration formulated to meet NRC (1996) requirements. Six steers received 1000 IU VE daily (VEST) as alpha-tocopheryl acetate (Rovimix E 20, Roche Vitamins) and six steers received no supplemental VE (CON). After a 122-d feeding period, the steers were harvested. High-fat (28.75%; HF) patties were made from the chuck and low-fat (13.84%; LF) patties were obtained from the sirloin of each animal. The patties were vacuum-packaged, frozen, and irradiated at 0, 2.3, and 7.6 kGy. High performance liquid chromatography measured an average of 3.53 and 3.50 μg/g alpha-tocopherol for CON and 8.7 and 7.5 μg/g alpha-tocopherol for VEST in HF and LF patties, respectively (P < 0.05). Thiobarbituric acid residue (TBAR) values were determined at 30 d of storage to measure LO. Lipid oxidation was increased 44% by CP (P < 0.008), and there was a dose response between 0 and 7.6 kGy (P = 0.002) but none between 2.3 and 7.6 kGy. Vitamin E did not (P > 0.05) decrease CP-induced LO regardless of fat level. High-fat patties had higher (P = 0.004) TBAR values than LF patties. After 3 mo of storage, the patties were submitted for trained sensory panel evaluation. The sensory characteristics brothy, serumy/bloody, astringent, and wet dog/hairy increased (P < 0.05) as a result of CP regardless of fat or VE. Wet dog/hairy was the most prevalent off-flavor occurring in all 2.3 and 7.6 kGy treatments (P < 0.0001). Vitamin E was unable to alter LO and the development of off-flavors caused by CP in this experiment. This research was supported by the Illinois Council for Food and Agricultural Research.

Key Words: Vitamin E, Cold pasteurization, Lipid oxidation

43 Ability of the uterus in anestrous ewes to resist infections. L. E. Mink*[1], M. C. Wulster-Radcliffe[2], and G. S. Lewis[1], [1]*USDA, ARS, U.S. Sheep Experiment Station,* [2]*Fort Dodge Animal Health.*

When progesterone (P4) is basal, the uterus can contain bacteria without developing infections. Infections typically develop with onset of luteal function. Thus, we used an anestrous ewe model to study events associated with this phenomenon. For this study, bacterial inoculations contained 750 x 10^6 cfu of *E. coli* and 350 x 10^6 cfu of *A. pyogenes* in 5 mL of saline. Blood samples were collected from vena caval catheters placed just cranial to the entry of uteroovarian blood. Endometrial characteristics and sediment (SV) after centrifugation of, and culture of *E. coli* and *A. pyogenes* from, uterine flushings were used to diagnose infections. In Exp. 1, we determined whether the uterus in anestrous ewes could resist infections. On d 0, ewes (n = 5/group) received intrauterine infusions of either bacteria or 5 mL of saline. Blood was collected on d 0 through 3. Uteri were removed and flushed on d 3. In Exp. 2, we determined whether P4 would prevent the uterus in anestrous ewes from resisting infections. Uteri (n = 8 ewes/group) were inoculated on d 0. Blood was collected on d 2 through 5. Either P4 (2.5 mg/2.5 mL of safflower oil) or safflower oil (2.5 mL) were injected i.m. twice daily from d 3 through 5 and once on d 6. Uteri were removed and flushed on d 6. In Exp. 1, none of the ewes developed infections. Progesterone in all ewes was basal throughout. Treatment did not affect basal, lipopolysaccharide (LPS)-stimulated, or concanavalin A (Con A)-stimulated lymphocyte proliferation in vitro. Number of lymphocytes per 100 white blood cells (WBC) was greater (60 vs 40; P < 0.01) and number of neutrophils was less (35 vs 54; P < 0.01) in bacteria than in saline ewes. In Exp. 2, P4 increased (P < 0.05) the incidence and severity of infections. Treatment did not affect basal, LPS-stimulated, or Con A-stimulated lymphocyte proliferation, nor did it affect lymphocyte and neutrophil numbers per 100 WBC. However, lymphocytes per 100 WBC increased (P < 0.01) between d 0 and 3 (from 42 to 63), while neutrophils per 100 WBC decreased (P < 0.01) between d 0 and 3 (from 55 to 35). We conclude that the uterus in anestrous ewes can resist infections until P4 concentrations increase.

Key Words: Anestrus, Sheep, Endometritis

44 Selenium concentration and distribution in range forages from four locations in the Northern Great Plains. T. L. Lawler*[1], J. B. Taylor[2], E. E. Grings[3], J. W. Finley[4], and J. S. Caton[1], [1]*North Dakota State University, Fargo, ND,* [2]*USDA-ARS, Dubois, ID,* [3]*USDA-ARS, Miles City, MT,* [4]*USDA-ARS, Grand Forks, ND.*

Locations representing high to low selenium areas were selected to assess selenium concentration in diets vs available forage [masticate (MS) vs clipped grass (TG)] and distribution in forage fractions [grass stems (GS) vs grass leaves (GL)] across season. Locations were near Pierre,

SD (PSD), Fargo, ND (FND), Jamestown, ND (JND), and Miles City, MT (MMT). Sampling dates were May 29 to June 8 (JUN) and July 11 to 20 (JUL). At each location, four 27.4 m diameter sites of similar plant species composition were selected and ten 0.25 m^2 areas within each site were clipped to a 0.64 cm height. Clipped forage was pooled within site, divided into grasses and forbs, and further subdivided into leaf and stem fractions. After clipping, ruminally cannulated cattle were tethered (one per site) and MS taken via ruminal evacuation techniques. Data were analyzed as a split plot design within location. Forage type (MS, TG, GS, and GL) was the main plot and season the subplot. Dietary Se (MS) concentration did not differ from TG ($P > 0.19$) within location (3.40 vs 4.07 ± 1.08; 0.11 vs 1.20 ± 0.43; 0.78 vs 0.50 ± 0.17; and 0.29 vs 0.28 ± 0.04 ppm for PSD, FND, JND, and MMT, respectively). Likewise, Se distribution of forage fractions (GS vs GL) was not altered ($P > 0.19$) within location (4.32 vs 4.86 ± 1.32; 0.38 vs 0.07 ± 0.27; 0.42 vs 0.78 ± 0.24; and 0.51 vs 0.57 ± 0.04 ppm for PSD, FND, JND, and MMT, respectively). At JND and MMT, forage samples in JUN had less ($P < 0.04$) Se compared with JUL (0.37 vs 0.88 ± 0.16 and 0.27 vs 0.55 ± 0.02 ppm, for JND and MMT respectively). In conclusion, Se concentrations are not different between MS and TG across season; however, much variation seems to occur in Se concentration within location (e.g., FND). Furthermore, Se distribution between GL and GS was not different.

Key Words: Selenium, Forage, Masticate

45 An Evaluation of Hemogram Values and Pulse Oximetry as Predictors of Pulmonary Arterial Pressure (PAP) Score in Yearling Bulls. J. K. Ahola*[1], B. L. Golden[1], R. M. Enns[1], J. C. Whittier[1], T. Holt[2], and P. Perkins[3], [1]*Colorado State University, Ft. Collins, CO,* [2]*Town and Country Animal Hospital, Gunnison, CO,* [3]*Heska Corporation, Ft. Collins, CO.*

In order to increase testing and a subsequent widespread genetic prediction of susceptibility to High Altitude Disease (HAD) in beef cattle, an easier, cheaper, and less invasive alternative to Pulmonary Arterial Pressure (PAP) testing is needed. This study evaluated the ability of hemogram values and pulse oximetry to predict PAP score in yearling bulls. The PAP (mm Hg), arterial oxygen saturation (Sp02), and 10 hemogram values: pack cell volume (PCV), hemoglobin (HgB), red blood cell count (RBC), mean cell volume (MCV), mean cell hemoglobin concentration (MCHC), red cell distribution width (RDW), nucleated cells (NC), platelet count (PLAT), mean corpuscular hemoglobin (MCH), and mean platelet volume (MPV) determined in venous blood within six hours of collection were measured on yearling purebred Angus bulls (n=39). The Sp02 was obtained with a Heska Vet/Ox 4404 Pulse Oximeter applied both rectally and against the upper gum. Neither Sp02 measurement was correlated (P>0.10; r=-0.06 rectal, r=0.10 gum) with PAP. Three of the 10 hemogram values were correlated (P<0.10) with PAP: PCV (r=0.31), HgB (r=0.33), and RDW (r=-0.36). All of the hemogram values combined had an R-squared value of 0.375 relative to PAP, with HgB and RDW having the largest R-squared value (0.305) of any two variable combination. In this preliminary study, we conclude that pulse oximetry does not appear to predict PAP. However, several hemogram values are individually correlated with PAP at low to moderate levels, and multiple regression models with two variables had low to moderate R-squared values. Further research involving additional blood components, other breeds, and larger sample sizes is necessary to develop an accurate method to predict HAD susceptibility in individual bulls.

Key Words: Beef Cattle, Pulmonary Arterial Pressure, Brisket Disease

46 The effects of copper source and concentration on lipid metabolism in growing and finishing steers. L. R. Johnson*[1], T. E. Engle[1], and C. K. Swenson[2], [1]*Colorado State University, Fort Collins, CO/USA,* [2]*Zinpro Corporation, Eden Prairie, MN/USA.*

Forty-eight individually fed Angus Steers (body weight 220 kg ± 9.1) were utilized to investigate the effects of copper (Cu) source and concentration on lipid metabolism and carcass quality. Steers were stratified by body weight and randomly assigned to one of five groups. Groups were then randomly assigned to treatments. Treatments consisted of: 1) control (no supplemental Cu); 2) 10 mg Cu /kg DM from $CuSO_4$; 3) 10 mg Cu/kg DM from Availa Cu; 4) 20 mg Cu/kg DM from $CuSO_4$; and 5) 20 mg Cu/kg DM from Availa Cu. Steers were fed a corn-alfalfa-based growing diet for 56 d. Steers were then switched to a high concentrate diet for 145 d. Prior to slaughter subcutaneous adipose tissue biopsies were obtained from three steers per treatment to determine in vitro lipolytic rates. Ceruloplasmin activity was higher ($P<0.04$) for steers receiving 20 mg/kg DM from Availa Cu relative to steers receiving 20 mg/kg DM from $CuSO_4$. Plasma non-esterified fatty acids were similar across treatments. Steers receiving 10 mg Cu/kg DM from Availa Cu had higher ($P<0.02$) plasma cholesterol concentrations relative to steers receiving 10 mg/kg DM from $CuSO_4$. Steers receiving 20 mg Cu/kg DM from Availa Cu had lower ($P<0.03$) triglyceride concentrations than steers supplemented with 20 mg Cu/kg DM from $CuSO_4$. Fatty acid profile of longissimus muscle was similar across treatments. Steers supplemented 10 mg Cu/kg DM from Availa Cu had heavier ($P<0.03$) hot carcass weights (HCW) and a greater ($P<0.02$) dressing percentage than steers supplemented with 20 mg Cu/kg DM from $CuSO_4$. Furthermore, Cu supplementation tended ($P<0.06$) to increase basal and increased ($P<0.04$) epinephrine stimulated in vitro lipolytic rates in subcutaneous adipose tissue. The results of this study suggest that Cu supplementation has minimal effects on blood and lean tissue lipid profile. However, it appears that Cu may play a role in lipid metabolism in subcutaneous adipose tissue.

Key Words: Steer, Copper, Lipid Metabolism

47 40-year trends in the Tucumcari New Mexico performance bull test. M.D. Garcia*[1], M.G. Thomas[1], R.M. Enns[2], and W.R. Parker, [1]*New Mexico State University, Las Cruces, NM,* [2]*Colorado State University, Fort Collins, CO.*

The objective of this study was to evaluate potential performance trends among breeds and evaluate sources of variation in the data collected from 1961 to 2000 at the performance bull test in Tucumcari, New Mexico. To date, 4784 bulls from 23 different breeds have been tested. Bulls were grouped three or four to a pen by breed and cooperator and fed for 112 days according to the guidelines of the Beef Improvement Federation and the New Mexico Beef Cattle Performance Association. Spring-born bulls were weaned in the fall, transported to the test site, and weighed each 28 days until a final test weight was collected on d 112. Subsequently, bulls were given a breeding soundness exam and those that passed and had an index ranking in the upper 80% were eligible for sale. In 1961, Hereford bulls comprised 74% of the bulls in the test. However, the number of Hereford bulls tested declined at a rate of 1.5 bulls/year since 1961 while the number of Angus and Charolais bulls tested increased at a rate of 0.8 bulls/year. In 1961, initial weights were 249.8 ± 3.9 kg and the final weights were 361.8 ± 5 kg. Initial and final weights in the year 2000 were 326 ± 3.7 and 515.9 ± 4.8 kg, respectively. Regression analyses revealed a linear increase in growth traits across years (Birth weight = 0.1 kg/yr, initial weight = 2.25 kg/yr, ADG = 0.01 kg/day/yr, 205-d adjusted weaning weight = 1.84 kg/yr, and adjusted yearling weight = 2.87 kg/yr). Greater than 500 bulls of Angus, Charolais, Hereford, and Polled Hereford breeds have been tested. Prediction analyses revealed that Charolais bulls had the greatest (P < 0.05) ADG (1.6 > 1.5 > 1.4 > 1.3 ± 0.01 kg/day) relative to Angus, Polled Hereford, and Hereford across years. However, analyses of independent regressions indicated that Angus and Hereford made greater (P < 0.05) improvement across years in ADG than Charolais and Polled Hereford (0.01 > 0.007 kg/day/year). Breed representation has been dynamic in 40 years of performance testing at Tucumcari with the number of Angus and Charolais bulls increasing each year. Growth traits steadily improved with Charolais bulls having the highest levels for growth traits while the greatest improvement occurred in *Bos taurus* breeds of British ancestry.

Key Words: Performance, Bulls, Breed

48 Increases in circulating levels of vascular endothelial growth factor (VEGF) during the second trimester of gestation are correlated with calf birth weight in beef heifers. K.A. Vonnahme* and S.P. Ford, *Department of Animal Science; University of Wyoming.*

Calving difficulty has a major economic impact on the beef industry due to extra labor and health care costs. A major contributing factor in dystocia is elevated calf birth wt. Placental efficiency (PE; birth wt/ placental wt) has been used in a variety of mammalian species to assess

placental quality. In pigs and humans, PE is directly related to placental vascularity and with the potent angiogenic factor, VEGF. Concentrations of VEGF in maternal blood during gestation have been positively correlated with birth wts in both the human and pig. In the cow, we have observed elevated concentrations of VEGF in uterine venous blood during midgestation, a time of accelerating cotyledonary (placental component functioning in nutrient and oxygen transfer) vascular development. Further, a preliminary experiment conducted in 2001 demonstrated a strong positive correlation between placental wt and cotyledonary surface area (r= 0.95; P<.001) at parturition in heifers. Thus, only placental wts were taken in the 2002 calving season. It was our objective to determine if increases of VEGF in maternal blood during the second trimester of gestation in the cow were predictive of calf birth wt. Heifers (n=31) were bled 3 times from the tail vein on d 132.5 0.1 (Bleed 1), d 151.0 0.2 (Bleed 2) and d 182.5 0.1 (Bleed 3) of gestation and birth wts and placental wts were determined at calving. PE ranged from 5.9 to 16.2 suggesting marked differences in placental quality. VEGF concentrations from Bleeds 1 and 2 were similar, thus the values were averaged and compared to Bleed 3. The percentage increase in VEGF in maternal blood from Bleeds 1 and 2 to Bleed 3 was positively correlated with both placental wt (r=0.57; P<0.02) and calf birth wt (r=0.45; P<0.02). Monitoring increases in VEGF in maternal blood during the second trimester of gestation may be an important management tool in detecting animals with an increased placental quality and thus calf birth wt.

Key Words: Maternal VEGF, Calf Weight, Placental Efficiency

49 Altered steroid profiles of beef cows during and after MGA® Select or 7-11 Synch and resulting differences in interval to estrus.

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This experiment was designed to characterize differences in serum concentrations of estradiol 17β (E_2) and progesterone (P_4) that may be associated with interval to estrus of cycling beef cows whose estrous cycles were synchronized with the MGA® Select (73.3 ± 7.8 h) or 7-11 Synch (55.4 ± 4.2 h) protocols. MGA® Select treated cows (n=8) were fed melengestrol acetate (MGA; 0.5 mg·hd^{-1}·d^{-1}) for 14 d followed by an injection of GnRH (100 μg Cystorelin) on d 26 and prostaglandin $F_{2\alpha}$ (PG: 25 mg Lutalyse) on d 33. Cows assigned to 7-11 Synch (n=7) were fed MGA for 7 d followed by PG on d 7 of MGA, GnRH on d 11, and PG on d 18. Variances associated with synchrony of estrus and ovulation were compared by performing an F-test and differed between treatments (P<0.01). Follicle growth and differences in concentrations of steroids during and after treatment were compared by repeated measures analyses over time using mixed model procedures of SAS. Follicle diameter at GnRH or PG did not differ (P>0.10) between treatments. Serum concentrations of E_2, however, differed between treatments on the day GnRH was administered (P<0.01; 2.5 ± 0.6 pg/mL; 5.1 ± 0.6 pg/mL); 4 d after GnRH (P< 0.02; 0.9 ± 0.6 pg/mL; 2.7 ± 0.6 pg/mL); and 24-h post-PG (P<0.05; 3.7 ± 0.6 pg/mL; 5.5 ± 0.6 pg/mL) for MGA® Select and 7-11 Synch cows, respectively. Conversely, mean concentrations of P_4 were greater (P<0.01) for MGA® Select cows beginning 1 d prior to and 8 d after GnRH. Regression analysis ranked variables contributing to variance in interval to estrus after treatment. Forty-four percent of this variation was explained by concentrations of E_2 24-h post-PG, and increased by 8% with the inclusion of P_4 concentrations 4, 5, 6, or 7 d after GnRH. These data characterize the manner in which estrous cycles of cows are hormonally manipulated with these treatments and help to explain differences in length of interval to estrus following administration. (Supported by USDA-NRI 00-35203-9175)

Key Words: Estrus Synchronization, Beef Cow, Steroids

50 Cow efficiency and calf growth to weaning of purebred Wagyu and Angus cows with purebred and reciprocally crossed calves.

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Objectives were to characterize Angus and Wagyu cow efficiency and calf production to weaning. Differences in Angus and Wagyu cows were assessed using 30 purebred Angus and 28 purebred Wagyu cows which were weighed and assigned a body condition score monthly (BCS) from January to August in 2001. Cows were mated to 2 Angus and 2 Wagyu sires to produce 13 AxA, 18 WxA, 14 AxW, and 14 WxW calves (Sire x Dam). Weights of cows at weaning were 653 ±9.8 and 537 ±11.2 kg for Angus and Wagyu, respectively. Differences in cow weight (p< .01) were due to breed of dam, age of dam, and BCS of dam. Body condition score (1-9) for Angus (5.0 ±0.1) and Wagyu (4.8 ±0.1) was affected by age of dam (p< .01) and breed of dam (p< .05). Wagyu dams had longer gestation lengths (p< .01) carrying purebred (287 d ±1.45) and crossbred AxW calves (283 d ±1.46) compared to Angus dams with purebred (277 d ±1.36) or crossbred calves WxA (279 d ±1.30). Birth weight of calf affected gestation length (p< .01) whereas sex of calf did not (p> .1). Angus and Wagyu dams did not differ (p= .38) in cow efficiency (calf weight/cow BW$^{\cdot 75}$). Calves from Angus dams had significantly heavier birth weights, 180-d adjusted weaning weights and higher pre-weaning average daily gain (ADG). Sire breed affected only birth weight, indicating that maternal ability has more influence on calf weaning weight and ADG than breed of sire. Birth weights (kg) for AxA, WxA, AxW, and WxW calves were 39 ±0.96, 37 ±0.98, 31 ±1.06, and 29 ±1.12, respectively, while adjusted 180-d weaning weights (kg) were 220 ±6.7, 219 ±6.4, 195 ±7.1, and 194 ±7.1, respectively. Sex of calf (p< .05) and age of dam (p< .01) also influenced birth weight, 180-d adjusted weaning weight and ADG. Cow weight and BCS of cow at birth and/or weaning did not affect calf weights. Angus cows were superior to Wagyu cows in weight of calf weaned, but there was no difference in efficiency of production.

Key Words: Wagyu, Cow Efficiency, Weaning Weight

51 Trace mineral impact on reproductive performance, immune response and calf performance in grazing beef cattle.

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Crossbred beef cows (n = 178) and heifers (n = 47) were used to determine the effect of source of Cu, Zn and Mn supplementation on reproductive performance, immune status and calf performance of cattle grazing native perennial grass pastures. Animals were blocked by expected calving date, weight and body condition score and assigned to treatments. Treatments for multiparous cows consisted of: 1) no supplemental Cu, Zn or Mn (control), 2) 50% organic/ 50% inorganic Cu, Zn and Mn (ORG), and 3) inorganic Cu, Zn and Mn (ING). Heifers were assigned to ORG or ING treatments only. Mineral supplements were formulated to provide NRC recommended levels of Cu, Zn and Mn and were supplied in free-choice mineral feeders to allow ad libitum access throughout the trial. Supplementation began 54 d and 82 d prior to the average calving date for heifers and cows, respectively, and continued for 120 d post calving. Liver Cu concentrations were higher in ORG groups (P < 0.05) than in ING or control groups at the end of the supplementation period, although liver Zn and Mn, and plasma Cu and Zn, did not differ by treatment. Cows receiving ING trace minerals also had higher (P < 0.05) liver Cu concentrations than control cows. Primary humoral immune response was measured by injecting 5 ml of 20% porcine red blood cell (PRBC) solution intramuscularly and obtaining blood samples on d 0 pre-injection and on d 7, 14, and 21 post injection. Total antibody titer concentrations specific for PRBC were similar across treatments. However, IgG titers specific for PRBC were higher (P < 0.05) in heifers supplemented with organic trace minerals. Estrus response, pregnancy rate to AI and final pregnancy rate following a 60 d breeding season did not differ by treatment. Calves of cows receiving control and ING treatments had heavier (P < 0.01) weaning weights compared to calves of cows receiving organic trace minerals. In contrast calves born to heifers had similar weaning weights across treatments. These results indicate that trace mineral supplementation, regardless of source, has little affect on reproductive performance in grazing beef cattle. However, humoral immune response and calf performance may be affected by trace mineral source under certain circumstances.

Key Words: Beef cattle, Trace minerals, Reproduction

52 Strategies to reduce antibiotic residues in market dairy cows.

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A three-phase study was conducted to identify management strategies to reduce antibiotic residue violations and increase carcass merit in market dairy cows. Questionnaires (Phase I) were mailed to 145 dairies to determine marketing strategies. Holstein market cows (n = 77) from four dairies were randomly assigned to one of three feeding treatments (0,

30, or 60 d) in Phase II. Carcass characteristics (longissimus area, backfat, fat color, and marbling), ADG and body condition scores (BCS) were assessed. Phase III determined the meat withdrawal time of 62 cows administered penicillin G procaine (1 mL/45 kg BW, i.m.; 10-d meat withdrawal). Urine from penicillin-treated cows was tested using a β-lactam specific enzyme-linked immunosorbent assay. In Phase I, 29% of dairy producers, representing 64,296 lactating cows, responded. Questionnaires indicated five percent of market cows were condemned annually, predominately for malignant lymphoma or cancer eye. Fifty-seven percent of respondents utilized computerized medication records. In Phase II, BCS increased in 60-d cows ($P = 0.09$; BCS = 3.2) compared to 30-d cows (BCS = 2.8). However, ADG was greater ($P < 0.05$) in 30-d cows than 60-d cows (1.4 vs 0.9 kg/d, respectively). Additional feeding did not influence ($P > 0.10$) carcass characteristics studied. Hot carcass weights were similar ($P > 0.10$; 284, 274, and 296 kg for 0, 30, and 60-d cows, respectively). Kidney, pelvic and heart fat was different ($P < 0.05$) among feeding groups (1.4, 1.0 and 2.1% for 0, 30, and 60-d cows, respectively). Incidence of condemnation was 8.3, 10 and 0% for 0, 30 and 60-d cows, respectively ($P > 0.10$); condemnations were not the result of antibiotic residues. In Phase III, 31% of cows treated with penicillin G procaine exceeded the 10 d label withdrawal recommendation by an average of 3.1 d (range 1 to 8 d). Feeding market cows can increase BCS, ADG and decrease condemnation, but may not influence carcass characteristics. Furthermore, antibiotic-treated market cows may exceed recommended meat withdrawal times and cause antibiotic residue violation at processing.

Key Words: Dairy Cow, Antibiotic Residue, Carcass Characteristics

53 The influence of cow age on grazing distribution and utilization of mountain riparian areas and adjacent uplands.

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The objective of this study was to evaluate the influence of cow age on grazing distribution relative to mountain riparian areas. In each of two years, sixty cow-calf pairs were stratified by age into the following treatments: 1) thirty first calf heifers (442 kg, BCS=4.43), and 2) thirty mature cows, (5, 6, and 7 years of age; 569 kg, BCS=4.86). Treatments were randomly assigned to four pastures (15 hd/pasture, average of 21.5 ha) with treatments reversed in year two. The research was conducted in the Milk Creek drainage at Oregon State University's Hall Ranch in northeast Oregon from late July to early September. The analysis of 13,000 cattle location observations taken early (d15 to d18) or late (d36 to d39 in year one; d29 to d32 in year two) during the grazing bout revealed a three-way interaction between cow age, time of day, and grazing bout ($P < 0.01$). During the early grazing bout, mature cows distributed farther from the stream during the morning than first-calf heifers ($P < 0.01$). In contrast, there were no significant differences between the distances of first-calf heifers and cows from the stream or in the percentage occupying the riparian vegetation type from noon until dark. During the later portion of the grazing bout no significant differences were observed ($P > 0.10$) between the distribution of the age classes from the stream or in the percentage of each age class in the riparian vegetation type. In addition, forage utilization and utilization pattern were not different ($P > 0.10$) when comparing pastures grazed by the different age classes. Fecal deposits within one meter of the stream did not differ between mature cows and first calf heifer treatments ($P > 0.10$) during the entire grazing bout. Though mature cows had higher average BW and BCS at the beginning of the trial ($P < 0.01$), there were no differences ($P > 0.10$) between age classes in weight change, BCS change, or calf average daily gain during the trial. In summary, mature cows distributed farther from water and spent more time outside the riparian vegetation zones early in the grazing period and during the morning hours as compared to first calf heifers.

Key Words: Beef cattle, Riparian areas, Distribution

54 Effects of use of four levels of exogenous phytase on growth, performance and carcass characteristics of finishing beef steers.

Pablo Loza*, Tim Stanton, Dave Schutz, and Angela Rhoads, *Colorado State University.*

An experiment was performed to determine the effects of supplemental phytase levels on growth performance, feed efficiency and carcass characteristics of beef steers. Two hundred and sixty three crossbred steers were blocked by weight (Mean 312 40 kg) and stratified by breed then randomly assigned to four treatments and 24 pens. Treatments consisted of 1) control, no phytase supplemented, 2) 400 Phytase Units (FTU), 3) 800 FTU and 4) 1200 FTU per kg of dry matter. Steers were fed a diet that periodically increased in concentrate levels for the first 20 days on feed. Thereafter they were fed a finishing ration for the following 154 d until harvest. Phytase supplementation was provided by top dressing the feed on a daily basis. Feed intake (8.33, 8.18,8.15 and 7.93 0.73kg DM /d), average daily gain (1.53,1.52,1.52,1.42 0.10 Kg/d) and feed efficiency (0.18, 0.18, 0.18 and 0.17 0.03) for treatments one, two, three, and four respectively were not significantly affected ($P > 0.05$) by phytase level across treatments. Unshrunk dressing percentage (60.21, 60.02, 59.78 and 59.69 % 0.69) was not significantly affected ($P > 0.05$) by treatment. Rib eye area (13.2, 13.12, 13.0, and 13.0 0.97 sq. in), fat thickness (0.42, 0.42, 0.42 and 0.41. 0.06 in) and KPH (Kidney, Pelvic and Heart Fat) (2.05, 2.04, 1.99 and 1.99 0.11%) were not significantly affected ($P > 0.05$) by treatment. Skeletal maturity (161.0, 159.4, 156.5 and 156.25 8.97), marbling (406.6, 401.8, 396.5 and 386.4 29.87) and lean maturity (164.67, 163.36,161.19 and 159.52 6.96) were not influenced by treatment. Percentage choice or better (61.9, 57.2, 46.4 and 45.5 17.79 %) and yield grade (2.70, 2.65, 2.63 and 2.62 0.34) were not affected ($P > 0.05$) by treatment. There was neither a linear nor quadratic ($P > 0.05$) effect for any dependent variables. A tendency for linear response (P=0.0796) was observed for the average daily gain for the initial period. The results indicate that the use of phytase as a feed additive did not affect growth performance and carcass characteristics of feedlot steers.

Key Words: Steers, Phytase, Carcass

55 Resumption of postpartum ovarian cycling activity in first-calf restricted suckled beef cows exposed to a bull or excretory products of bulls.

P.S. Joshi*, J.G. Berardinelli, K. Anderson, A. Jacobs, and R. Adair, *Montana State University, Bozeman, MT, 59717.*

The objective of this study was to evaluate the influence of bull excretory products on resumption of postpartum ovarian cycling activity in first-calf restricted suckled beef cows. The hypotheses tested were that postpartum interval to ovarian cycling activity or proportions of cows cycling did not differ among first-calf restricted suckled beef cows exposed continuously to presence of a bull **(BE)**, exposed to excretory products of bulls **(EPB)**, not exposed to a bull **(NE)**, or exposed to excretory products of cows **(EPC)**. Two-yr-old Angus X Hereford cows were assigned randomly on d 35 2 d (SEM; d 0) after calving to one of the four treatments: 1) BE (n = 15); 2) EPB (n = 16); 3) NE (n = 16); and, 4) EPC (n = 15). EPB and EPC cows were placed into enclosures for 10 to 12 h, between 1830 and 0800 h daily. Each enclosure was occupied by bulls (EPB) or left empty (EPC) for 10 to 12h (0800 to 1830 h) daily. All cows were restricted to suckling twice daily (0800 and 1800 h) for 30 min beginning d 0. Blood samples were collected from each cow starting on d 1, and every third d until the end of experiment (d 70). A rise in progesterone of > 0.5 ng/ml in three consecutive samples was used as evidence of resumption of cycling activity. Postpartum interval from d 0 or from calving to resumption of cycling activity did not differ ($P > 0.10$) among BE, EPB, and EPC cows; however, these were shorter ($P < 0.05$) than that for NE cows. Proportions of cows cycling by d 50 did not differ ($P > 0.10$) between NE and EPC cows; however, proportions of EPB and BE cows were higher ($P < 0.05$) than NE and EPC cows by d 50. Proportions of cows cycling by d 70 were higher ($P < 0.05$) for BE, EPB, and EPC cows than for NE cows; however, proportions of BE and EPB cows did not differ ($P > 0.10$). Proportion of BEP cows cycling was higher ($P < 0.05$) than that of EPC cows, but the proportion of BE cows cycling did not differ ($P > 0.10$) from that of EPC cows by d 70. We conclude that exposing first-calf restricted suckled beef cows to excretory products of bulls hastened the resumption of postpartum cycling activity. Therefore, the biostimulatory role of bulls appears to be mediated by pheromones present in their excretory products.

Key Words: Postpartum, Bulls, Pheromones

56 Influence of undegradable intake protein mixed with mineralized salt on intake and fermentation profiles of cows grazing dormant winter range. L. A. Stalker*[1], J. E. Sawyer[1], M. G. Thomas[1], C. Baily[1], D. Wood[1], and M. K. Petersen[1], [1]*New Mexico State University*.

Six crossbred, mature beef cows (609 kg) fitted with ruminal cannulas were used in a crossover design to evaluate the affects of small quantities of supplemental blood meal and feather meal combined with mineralized salt (40% NaCl, 41% $CaHPO_4$, 7%KCl, 7%MgO, 5% trace minerals) on blood urea nitrogen, ruminal fermentation profiles, *in situ* dry matter disappearance and fecal output. Cows grazed dormant winter range in a 481 ha pasture at the New Mexico State University Chihuahuan Desert Rangeland Research Center. Mineralized salt, blood meal, and feather meal (SBF) were combined in a 2:1:1 ratio and dosed directly through the cannula of 3 cows daily for 14 d at a rate of 128 g per d, while mineralized salt (MS) was dosed into another 3 cows at a rate of 64 g per d. To determine the appropriate amount of SBF to dose, SBF was offered free choice in open tubs to 53 cows in 3 pastures for 60 d. Cows were bolused with a slow release Cr device in each period. Fecal samples were collected and supplement and forage samples were incubated *in situ* for 0, 4, 8, 12, 24, 36, 48, 72 and 96 hours on d 10-14. Blood and ruminal fluid samples were collected at 0, 3, 6, 9, 12, 15, 18, and 24 h after supplementation on d 14. To assess forage quality, rumen extrusa was collected from 2 cows allowed to graze for 1 hour following complete rumen evacuation. Forage was 7.4% CP, 53% NDF, and 14% Ash. Blood urea nitrogen concentration was greater (8.4 vs. 7.7 mg/dL, $P<0.05$) for SBF treated cows. Ruminal ammonia concentration, *in situ* dry matter disappearance, and fecal output, were 4.1 vs. 3.7 mg/dL ($P>0.21$), 2.2 vs. 2.8%/h ($P>0.41$), and 5.4 vs. 5.6 kg/d ($P>0.52$) for SBF and MS treated cows, respectively. Results suggest that basal forage supplied sufficient protein to render the amount of supplemental protein inadequate to alter intake and fermentation profiles. However, supplemental UIP may have increased metabolizable protein supply as evidenced by increased blood urea nitrogen.

Key Words: Protein Supplementation, Mineral Supplementation

57 Pasture, feedlot, and carcass responses to grazing management and protein supplementation of beef steers summer-grazing Old World bluestem. T. N. Bodine*[1], P. D. Kircher[2], H. T. Purvis II[1], G. W. Horn[1], and C.J. Ackerman[3], [1]*Oklahoma Agricultural Experiment Station, Stillwater,* [2]*University of Missouri Cooperative Extension Service, Higginsville,* [3]*Oregon State University, Corvallis*.

In a 3-yr study, a total of 1098 steers (239 $\pm$ 11 kg) grazed 12 pastures (106 ha) of Old World bluestem (**OWB**) to determine the effects of grazing management and protein supplements on pasture, feedlot, and carcass responses. In mid-May, steers were weighed and allotted to one of four grazing treatments: 1) intensive early stocking (**IES**; stocking density of 1340 kg/ha, 65d of grazing); 2) half intensive early stocking (**HIES**; 670 kg/ha, 65d of grazing); 3) season long (**SL**; 670 kg/ha, 131d of grazing); and 4) season long supplemented (**SLS**; same as SL but fed 1.3 kg of protein supplement 3X/wk from mid-July to late Sept). Steers were placed in the feedlot following grazing in yr 2 (IES/HIES on July 20; n=60, 10/pasture; and SL/SLS on Sept. 28; n=60, 10/pasture). Early (IES/HIES) and late (SL/SLS) steers were fed a corn-based diet (13% CP, 2.2 NE_m, 1.4 NE_g) in 24 pens (5hd/pen) for 173 and 139d, respectively. Steers were fed to 1 cm backfat and carcass data was collected after a 24-hour chill. Steers previously grazed with IES had reduced ($P<0.01$) ADG (0.5 vs 0.8 kg/d) than HIES and reduced gain/ha (177 vs 266 kg/ha) vs late steers. Pasture supplementation (SL vs SLS) did not affect ($P>0.36$) ADG (0.70 vs 0.75 kg/d) or gain/ha (257 vs 274 kg/ha). Feedlot ADG was greater ($P<0.01$) for IES vs late steers (1.67 vs 1.05 kg/d) and greater ($P<0.04$) for SL vs SLS steers (1.12 vs 0.99 kg/d). Daily DMI (12.2 vs 8.3 kg/d) was greater ($P<0.01$) for IES vs late steers and greater ($P<0.01$) as a percentage of BW compared with HIES (2.98 vs 2.79%). Gain per 100 kg of feed was greater ($P<0.06$) for IES vs late steers (13.6 vs 12.7 kg/100 kg) and greater ($P<0.03$) for SL vs SLS steers (13.4 vs 12.1 kg/100 kg). All carcass characteristics were similar ($P>0.21$) across treatments, except IES steers had greater ($P<0.01$) KPH fat and fewer Choice carcasses than late steers. Neither IES nor protein supplementation were effective in maximizing gain/ha of steers grazing OWB, nor did they affect carcass measures. However, feedlot DMI, ADG, and G:F were greatest for IES-grazed steers, whereas pasture protein supplementation reduced feedlot gain and efficiency.

Key Words: Bothriochola Ischaemum, Feedlot Performance, Carcass Characteristics

58 Nutritional manipulation of reproductive and growth parameters of beef cows and subsequent offspring. B.J. Renquist*, J.W. Oltjen, R.D. Sainz, J.M. Connor, and M.L. Sween, *University of California, Davis*.

In beef cows, both reserve body energy and dietary energy intake affect postpartum acyclicity. Body condition score (BCS) is a good indicator of body energy reserves, and dietary energy is associated with both quantity and quality of feed. We tested the effects of reserve body energy as well as quality and quantity of feed on pregnancy rate, calving interval, and offspring weaning weight of mature, fall-calving beef cows in California foothill rangeland over five years. Nutrition level was manipulated by three supplementation strategies–continuous supplementation, no supplementation, and strategic supplementation (animals with BCS<5.5 were supplemented during September–February) and two forage level treatments–moderate or heavy stocking rate. This stocking rate was measured as cows per hectare. Cows in the high stocking rate and moderate stocking rate groups were moved when residual dry matter was 575 to 735 kg/hectare or greater than 735 kg/hectare, respectively. BCS was determined and strategically supplemented cows were reassigned approximately every 3 months. Data were analyzed as a 3x2 factorial. A production year by supplementation strategy interaction was significant for BCS at calving, weaning, and breeding. A stocking rate by production year interaction significantly affected BCS at breeding and between weaning and calving. The production traits examined include pregnancy, calving interval, and weaning weight. Supplementation interacted with production year for pregnancy rate, calving interval, and weaning weight (p=0.0109, 0.0132, and 0.0020, respectively). Pregnancy rate and weaning weight increased with decreased stocking rate (p = 0.0044, <0.0001). Offspring of animals in the moderate stocking rate group averaged 5.65% higher pregnancy rates and 5.96 kg higher weaning weights than animals from the low forage group. Supplementation interacted with production year for pregnancy rate, calving interval, and weaning weight (p=0.0109, 0.0132, and 0.0020, respectively). This study implies that nutritional manipulation of cows may be most effectively promoted by affecting forage level, however in times when quality and quantity are both limiting the addition of supplement may prevent low pregnancy rates and long calving intervals.

Key Words: Nutrition, Reproduction, Forage Level

GROWTH

59 Effects of isocupressic acid (ICA), a pine needle abortifacient toxin, on in vitro bovine oocyte maturation and subsequent embryo development. S. Wang*[1], K.E. Panter[2], D.R. Gardner[2], R.C. Evans[1], and T.D. Bunch[1], [1]*ADVS Department, Utah State University, Logan, UT 84322,* [2]*Poisonous Research Laboratory, USDA-ARS, Logan, UT 84341*.

Isocupressic acid (ICA) [15-hydroxylabda-8(17),13E-dien-19-oic acid], a diterpene acid from pine needles in ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), common juniper (*Juniperus communis*) and Monterey Cypress (*Cupressus macrocarpa*), is known to induce abortions in cattle during the last trimester of pregnancy when administered orally or by intravenous infusion. A randomized complete block (16 replications) design with three in vitro maturation (IVM) treatments (TRTs 1-3) was used to investigate the effects of ICA on bovine oocyte maturation. Oocytes (n=2659) were aspirated from abattoir ovaries. ICA was added into IVM medium at 2.6 ug/ml (TRT 1), 1.3 ug/ml (TRT 2) and 0 ug/ml (TRT 3). The in vitro matured oocytes were then subjected to in vitro fertilization (IVF) and in vitro culture (IVC). Cleavage rates were determined at 48 h after IVF. Preimplantation embryo development was evaluated at day 6, 8 and 10 of IVC. Data were analyzed by the general linear model ANOVA. Cleavage rates were 82.0%, 78.2%

and 80.0%; percentage of morulae at d 6 of IVC was 55.2, 54.4 and 56.0; percentage of blastocysts at d 8 of IVC was 21.8, 22.0 and 26.0; and percentage of expanded and hatching blastocysts at d 10 was 19.5, 18.8 and 22.2 for TRTs 1, 2 and 3, respectively. There was no significant (P>0.05) difference with respect to oocyte cleavage and subsequent embryo development. In conclusion, in vitro maturation of bovine oocytes was not adversely affected by isocupressic acid and subsequent in vitro preimplantation embryo development was not inhibited.

Key Words: Bovine, In vitro Maturation, Isocupressic Acid

60 Heifer development within three seasons of calving. E. E. Grings*, R. E. Short, T. W. Geary, and M. D. MacNeil, *USDA-ARS, Miles City, MT.*

A 2-yr study was conducted to evaluate the impact of season of calving (SOC), weaning age (W), and post-weaning management (PWM) on growth and reproduction of beef heifers (n = 483). Heifer calves born in Feb were weaned in Aug (6-mo) or Oct (8-mo) and heifers born in Apr or Jun were weaned in Oct (6- or 4-mo) or Dec (8- or 6-mo). Heifers were managed to enter breeding herds associated with their SOC. After weaning, calves were placed in drylot or on pasture. Heifers in drylot were fed a corn silage and hay-based diet. Heifers on forage treatments were placed on pasture but were fed grass hay and/or a supplement depending on forage conditions. Three months before their respective breeding seasons, heifers on forage were moved to drylot and fed a corn silage and barley-based diet (Feb or Apr) or moved to high quality spring pasture (Jun). Data were analyzed as a completely random design with treatment (n = 12), year, and treatment by year included in the model. Linear contrasts were used to compare treatments. Rates of gain during drylot and forage phases differed ($P < 0.05$) with SOC, W, and PWM. For heifers weaned at 6-mo of age, gains were greatest ($P < 0.01$) for Feb followed by Apr and then Jun (0.73 vs 0.65 vs 0.62 kg/d). Overall gains were 0.77, 0.65, and 0.55 kg/d for 8, 6, and 4 mo W in Oct (linear effect, $P < 0.01$). Overall gains were less ($P < 0.01$) for heifers on forage than drylot treatments (0.66 vs 0.69 kg/d). Weights at the beginning of the breeding season did not differ with PWM ($P > 0.10$) but were affected ($P < 0.05$) by SOC and W, reflecting differences in initial weights. Prebreeding weights for heifers weaned at 6-mo were 390, 369, and 340 kg for heifers born in Feb, Apr, or Jun and were 386, 369, and 325 kg for heifers weaned in Oct at 8, 6, or 4-mo of age. Proportion of heifers cycling at the beginning of the breeding season was greater ($P < 0.01$) for heifers in drylot (0.98) than forage treatments (0.92). Thus, SOC and W effects on initial weight carried through to weight at breeding, whereas post-weaning management affected cyclicity of beef heifers.

Key Words: Beef Heifers, Weaning, Calving Date

MEAT SCIENCE AND MUSCLE BIOLOGY

61 Comparison of acidic and alkaline catalysts for preparation of fatty acid methyl esters from ovine muscle with emphasis on conjugated linoleic acid. C. M. Murrieta*, B. W. Hess, and D. C. Rule, *University of Wyoming.*

Methanolic reagents containing acidic catalysts, HCl (0.5 *M*, 1 h, 80° C) or BF_3 (14%, 1 h, 80° C), or alkaline catalysts, KOH (0.2 *M*, 30 min, 50° C) or CH_3ONa (0.5 *M*, 30 min, 50° C) were compared for use in preparation of fatty acid methyl esters for GC analysis of total lipids from freeze-dried semitendinosus muscle of lambs fed a 3.6% linoleate diet. Lipid preparations were in duplicate and included a total lipid extract, as well as direct transesterification and direct saponification of freeze-dried muscle. For the total lipid extracts, the weight % of 18:2 cis-9, trans-11 (CLA) with BF_3 (1.10) was 13% lower ($P = 0.03$) than with either KOH (1.27) or CH_3ONa (1.38); however, with HCl (1.24) CLA was intermediate ($P > 0.10$). Concentrations of CLA (mg/ g tissue) were similar ($P > 0.10$) within acidic or alkaline catalysts, but were 19.1% higher ($P = 0.005$) with KOH (2.55) and CH_3ONa (2.69) than with HCl (2.21) or BF_3 (2.03). For direct transesterification, weight % of CLA was similar ($P > 0.10$) with KOH (1.30) and CH_3ONa (1.31), but each was 9.6% greater ($P = 0.002$) than with HCl (1.18) and 17.2% greater ($P = 0.002$) than with BF_3 (1.08). Concentrations of CLA after direct transesterification were greatest ($P < 0.01$) with KOH (3.26), followed by HCl (2.89; $P < 0.01$), BF_3 (2.42, $P < 0.01$), and lowest ($P < 0.01$) with CH_3ONa (1.94), indicating differences in efficiency of direct transesterification. Weight % of CLA in semitendinosus muscle, ranked highest to lowest, was lambs fed 3.6% linoleate ($P < 0.01$) > lambs fed 3.8% oleate ($P < 0.01$) > lambs fed a non-fat supplemented control diet ($P < 0.01$) when either BF_3 (saponified lipids) or KOH (direct transesterification) was used. Thus, dietary treatment effects on muscle CLA were not affected by catalyst. For muscle of the high-linoleate, high-oleate, and control lambs, CLA was 20.2%, 13.9%, and 0.0% higher, respectively, with KOH than BF_3, indicating that degradation of CLA by acidic catalysts decreased with lower starting amounts of CLA.

Key Words: Fatty Acid Analysis, Muscle, Conjugated Linoleic Acid

62 Effects of corn and barley based diets on beef characteristics. C.J. Bergner*[1], J.A. Boles[1], J.G.P. Bowman[1], D.L. Boss[2], L.M.M. Surber[1], T. Spinner[1], and K. Groenlund[1], [1]*Montana State University, Bozeman, MT 59717,* [2]*Northern Agricultural Research Center, Havre, MT 59501.*

Steers (n=160) were fed isocaloric finishing diets based on one of three barley varieties (Chinook, Logan or H3 a newly released barley variety) or corn at two feedlots in Montana. Steers were assigned to pens in the feedlot (40 steers/treatment) by weight so that pen weights were similar. Steers were harvested when visual inspection of animals determined that 75% of the carcasses would grade Choice (130 days on feed). Steers were harvested at a commercial packing plant, using standard industry practices. Carcass measurements, carcass weight, fat thickness, ribeye area, internal fat content, and marbling scores were obtained from each carcass. Beef ribs (IMPS 103) were removed from 72 carcasses, vacuum packaged and transported under refrigeration to Montana State University for analysis. Three consecutive steaks (3.18 cm) were removed from each rib and used to determine color stability, tenderness, proximate analysis and pH. The study was a completely randomized design with animal as the experimental unit. There were no site by treatment interactions detected (P>0.05). Diets fed to steers had no effect (P>0.05) on the quality and yield grade of the carcasses nor on tenderness of beef steaks from the carcasses. Diet fed to steers had no effect (P>0.05) on the initial color of beef steaks, however steaks from steers fed diets based on Logan barley had a more rapid decline (P=0.001) in Hunter a* values (redness) during storage than did steaks from steers fed corn or other barley varieties. Greater color stability results in a longer shelf-life hence different diets fed to cattle can contribute to variability of color in the retail case and thus affect retail shelf-life. Further research is necessary to determine the cause of the color differences.

Key Words: Beef, Color Stability, Barley

63 Predicting retail yield of crossbred bulls. N. Torrentera*[1], H. Perez[2], and R. A. Zinn[3], [1]*Universidad Autonoma de Baja California (Mexicali, Mexico),* [2]*Grupo Vizur, Culiacan Sinaloa, Mexico,* [3]*University of California, Davis.*

Carcasses from eighty commercially fed crossbred bulls were evaluated to develop a contemporary prediction equation for estimating closely trimmed retail yield (RY). Initial and final live weights averaged 201.5 and 412.6 kg, respectively. Cold carcass weight (CCW, kg), rib eye area (REA, cm^2), fat thickness (FT, cm), kidney pelvic heart fat (KPH,%), and hump weight (HW, %) were the variables considered in the model. The KPH and HW were weighed and expressed as % of cold carcass weight. Initial weight was closely associated with days on feed (DOF) at final constant weight (DOF= 354 -.96 IW; R^2 = .93). Retail yield ranged from 70.1 to 77.0 % of cold carcass weight. Retail yield was negatively associated with KPH (r = -. 30), hump weight (r = -.20), and fat thickness (r = -.20), but was positively associated (r = .41) with REA. Stepwise regression procedures, including the same variables, were also performed to develop a prediction model for carcass RY (%). The best model was as follows: YR = 77.84 +.53162 RA -.95756 KPH-.02136 CCW -.41525 HW (R^2 = .33). We attribute the relatively low predictability of RY to the comparatively narrow range (10%) in RY of bulls in the data set.

Key Words: Yield, Bulls, Carcass

64 Sheep Pathogen Reduction Interventions and Animal Production Food Safety Practices. S.B. LeValley*[1], E.A. Duffy, K.E. Belk, J.D. Tatum, J.N. Sofos, G.C. Smith, and C.V. Kimberling, *Colorado State University*.

Microbiological baseline levels for generic Escherichia coli, the (presence/absence) of Salmonella spp., and the (presence/absence) of Campylobacter jejuni/coli were determined from sampling 2,226 lamb carcasses in six U.S. lamb slaughter plants. Sampling was conducted on a seasonal basis, winter and spring. Data were collected using both the three-site (flank, breast, and leg) and one-site (breast only) sponge sampling protocols. The overall incidence of generic Escherichia coli (EEC) in the cooler following chilling of the carcasses across all plants and both seasons using the three site method was (0.70) log CFU/cm2. Mean values for (EEC) increased P<0.05) by approximately 1.5 log CFU/cm2 between pre-evisceration and post-evisceration sampling locations. The overall incidence of Salmonella spp, in samples collected following carcass chilling in the cooler was 1.5% across both seasons using the 3-site sponge sampling protocol. Seasonally the "winter" samples yielded 1.9% positive Salmonella spp, while the frequency of positive Salmonella spp samples in the spring was lower at 1.2%. The overall incidence of Campylobacter jejuni/coli in the 2,226 total samples was very low at 0.3% across all sampling sites. All positive Campylobacter jejuni/coli samples were found on carcasses before chilling. The 1-site sampling method for recovering Salmonella spp was less effective than the 3-site method. Using the 1-site sampling protocol 0.9% of samples tested positive for Salmonella spp, while the 3-site samples protocol revealed 1.5% tested positive for Salmonella spp. The data collected from this study will be helpful to regulatory agencies, lamb producers and those in the lamb packing (slaughtering/dressing) industry. Moreover, the development of microbial data for lamb carcasses brings the U.S. sheep industry in line with other livestock species that have developed baseline data.

Key Words: Sheep, Microbiological Baselines, Salmonella

NONRUMINANT NUTRITION

65 Bio-availability of Venezuela sedimentary phosphates in swine feeding. S. Godoy* and C. F. Chicco, *Centro Nacional de Investigaciones Agropecuarias. INIA*.

To determine phosphorus bio-availability of two Venezuelan sedimentary phosphates, Riecito (RIO: 12.0%P; 1.2%F) and Monte (MONTE: 11.5%P; 2.8%F), in swine feeding, two experiments were carried out, using dicalcium phosphate (DICAL) as a reference control. In the first one, animal performance and bone mineralization were measured with 54 piglet crossbred York x Landrace x Duroc of 12 week age and 17.5 kg body weight. They were randomly assigned to one of nine pens and the three pens were assigned to each of the three treatments. Body weight and feed intake were recorded on weekly bases, and samples of coxal vertebra, tarsus and metatarsus were taken to determine ash, Ca, P and F content. The slope gradient method of linear regressions of response criteria was used to measure P bio-availability with DICAL as control. In the second experiment, with 18 (60 kg) pigs, by the method of two P levels in the diets to estimate metabolic fecal excretions, true absorption of P and Ca was determined, and apparent absorption for Ca, P and F was measured in the diets with the higher level of P. The pigs were kept in metabolic crates, to record feed intake and fecal and urinary excretions. Total body gains (kg/animal) in the growth and finishing periods (92 days) were similar for DICAL (76.9) and RIO (75.9), which were greater (P<0.05) than MONTE (68.7). Accumulated intake (kg) and feed conversion were higher (P<0.05) for DICAL (226.0 and 3.18) and RIO (228.4 and 3.23) than MONTE (217.9 and 3.49). Ash, P and Ca (mg/cm3) content in the vertebra, tarsus and metatarsus were similar for DICAL and RIO, being both greater than MONTE. Phosphorus apparent and true absorption (%) was higher (P<0.05) for DICAL (62.6 and 90.7) than RIO (53.5 and 79.5) and MONTE (53.0 and 75.5). Calcium true absorption (%) was similar for all phosphates (82.5). Fluorine apparent retention (%) was higher (P<0.05) for MONTE than RIO. It is concluded that phosphorus relative bio-availability (%) using response criteria (weight, ash) was 100, 98 and 91, and when based upon absorption criteria was 100, 88 and 83, respectively, for DICAL, RIO and MONTE

Key Words: Bio-availability, Swine, Phosphorus

66 Fermentation characteristics of soluble fiber sources incubated with colonic bacteria from dogs and cats. Y. Chiang*[1], H. S. Hussein[1], H. Han[1], B. W. Wolf[2], V. Edirveerasingam[1], and T. Shenkoru, [1]*Department of Animal Biotechnology, University of Nevada-Reno, Reno, NV 89557,* [2]*Ross Product Division, Abbott Laboratories, Columbus, OH 43219*.

Soluble fiber sources have positive physiological effects (e.g., lowering plasma cholesterol and glycemic response to carbohydrates) on companion animals. These benefits are attributed to the viscosity and water-holding capacity of these fiber sources which are assumed to be readily fermentable. Because fermentation characteristics of several soluble fibers are not well established for dogs or cats, six sources (i.e., locust bean gum [LBG], gum arabic [GA], gellan gum [GG], tomato pectin [TP], apple pectin [AP], and citrus pectin [CP]) were evaluated in vitro by using colonic bacteria from dogs and cats. Serum bottles (336 total; 125 mL each) including 48 blanks and 288 with substrates (0.5 g DM each) were used. Three dogs and three cats on fiber-containing diets were used as fecal (inoculum) donors for the in vitro fermentations (Sunvold et al., J. Anim. Sci. 73:3639-3648). All bottles were prepared anaerobically (95% CO_2/5% H_2), stoppered and aluminum sealed, and incubated at 39^{o}C for 6, 12, 18, or 24 h. The experiment was a randomized complete block (donor) design with treatments being arranged as a 2 (species) × 6 (substrates) × 4 (incubation times) factorial. There were few two-way and three-way interactions ($P < 0.05$) for some of the measurements evaluated. The effects of the main factors, however, were significant for most of these measurements. Acetate, propionate, butyrate, and total short-chain fatty acids (SCFA) productions (mmol) were higher ($P < 0.05$) for dogs (16.9, 7.2, 1.2, and 26.1, respectively) than for cats (10.5, 4.0, 0.6, and 15.5, respectively). CO_2 production (mL) also was higher ($P < 0.05$) for dogs (41.6) than for cats (21.7) while H_2 production was similar (0.3 mL; $P > 0.05$) for both species. Total SCFA productions (mmol) were highest ($P < 0.05$) for TP (39.9) and LBG (39.2), lowest ($P < 0.05$) for GA (5.2) and GG (7.5), and intermediate ($P < 0.05$) for AP (15.1) and CP (18.0). CO_2 production (mL) was highest ($P < 0.05$) for TP (83.8) and lowest ($P < 0.05$) for GG (1.2). Productions of total and individual SCFA and CO_2 (across species and substrates) followed linear ($P < 0.05$) responses over incubation time. Results suggest better fermentation of soluble fiber in dogs than in cats. Of the soluble fiber sources, TP was highest and GG was lowest in fermentation.

Key Words: Soluble Fibers, In vitro, Companion Animals

PASTURES AND FORAGES

67 Influence of different levels of urea supplementation when beef cows grazing winter pasture are supplemented at different frequencies during the prepartum period. C. G. Farmer*, R. C. Cochran, and T. A. Wickersham, *Kansas State University*.

One hundred sixty spring-calving beef cows (BW=525 kg) grazing winter, tallgrass-prairie from 12/6-calving (average date=3/9/01) were used in a 2 × 4 factorial experiment. Four 40% CP supplements were fed that contained one of four levels of urea (expressed as a % of DIP): 0, 15, 30, and 45%. All supplements were fed at each of two frequencies: 7 d/wk and 3 d/wk. Four pastures were used, such that two pastures contained cows supplemented 7d/wk and two pastures contained cows supplemented 3 d/wk. Each urea treatment was represented within each pasture; therefore, each treatment had two replications (with treatment group within pasture serving as the experimental unit). Supplements were group-fed at 1.82 kg/head daily to cows supplemented 7d/wk and

at the same amount per wk for the 3 d/wk treatment, but split equally among the three supplementation events. During prepartum supplementation, cows fed supplement with 45% of DIP from urea refused a portion of supplement fed. Cows fed this particular supplement 3 d/wk refused more of their supplement. Cows fed supplement with 30% of DIP from urea 3 d/wk also refused a portion of their supplement. Supplement refusal became more dramatic immediately before calving. A frequency × urea interaction (P=0.02) was observed for prepartum BW changes, in that, as supplemental urea level increased, prepartum BW loss increased. However, a greater magnitude of prepartum BW loss was observed with the feeding of supplement containing ≥ 30% of DIP from urea 3 d/wk. The frequency × urea interaction was not significant for body condition (BC) change; but a linear decrease (P<0.01) in BC was observed with increasing urea. Averaged across supplementation frequency, increasing the supplemental urea level tended to decrease (linear, P=0.15) subsequent pregnancy rate. Caution should be used in feeding higher protein supplements with higher levels of urea (> 15% of DIP from urea) less frequently (i.e. 3 d/wk).

Key Words: Supplementation, Frequency, Urea

68 Effect of a Fibrolytic Enzyme Preparation on Intake and Digestibility of Bluegrass Seed Straw Fed to Beef Cattle. J.I. Szasz[1], T.M. McCalmant*[1], C.W. Hunt[1], A.V. Grove[1], and L.R. Kennington[1], [1]*University of Idaho, Moscow, Idaho*.

Grass seed straw can be an important feed resource in many areas of the Pacific Northwest; however, its value could be greatly enhanced by methods that improve it digestibility. Two experiments were conducted to determine the effects of a commercial fibrolytic enzyme preparation containing xylanase and cellulase activity on the intake and digestibility of bluegrass seed straw fed to beef cattle. In the first experiment, 8 yearling Charolais heifers were used in a crossover design. Heifers were randomly assigned to one of two diets containing 53% bluegrass straw, 42% steam-rolled barley, and 5% soybean meal (DM basis). The bluegrass straw was either control (**CON**) or enzyme treated (**ENZ**) prior to feeding. Feed intake and total tract digestibility were measured in each cross-over period following a 14-d diet adaptation period. No differences ($P > 0.05$) in DMI and digestibility of DM, OM, NDF and ADF were observed when enzyme was applied to the straw; however, DMI for heifers fed ENZ tended to be greater ($P = 0.11$) than CON (7.08 versus 6.61 kg d^{-1}, respectively). A second experiment was conducted using the same heifers, experimental protocol, and dietary treatments, with the exception that the fibrolytic enzyme preparation was applied to a barley and soybean meal portion of the daily ration. There were no differences ($P > 0.05$) observed in DMI and digestibility of DM, OM, NDF, and ADF between CON and ENZ fed heifers. Bluegrass straw may not have been complementary to the type or activity of enzyme used in the current study. More importantly, optimum fiber digestion appears to have been achieved by the ruminal microorganisms alone, therefore the addition of exogenous sources of fibrolytic enzymes had no added benefit.

Key Words: Forages, Fibrolytic Enzymes

69 Effect of particle length of forage on digestibility, degradability, and ruminal parameters in sheep fed with basal oat straw diet. H. G. Gonzlez*[1,3], O. B. Ruiz[2], C. S. V. Velez[2], C. L. Holgun[2], A. E. Orozco[1], A. P. Mrquez[3], A. C. Correa[3], V. V. Gonzlez[3], H. C. Hernndez[4], and L. B. Gerlach[5], [1]*Medicina Veterinaria y Zootecnia - ICB, Universidad Autnoma de Ciudad Jurez, Mexico,* [2]*Universidad Autnoma de Chihuahua,* [3]*Universidad Autnoma de Baja California,* [4]*Universidad Autnoma de Baja California Sur,* [5]*Universidad de Sonora*.

Eight crossbred sheep fitted with permanent ruminal cannulas were used in a feeding trial. The objective was to evaluate the effect of two physical lenght: 2.5 cm (T1) and 10 cm (T2) of forage on diet digestibility, straw degradability, and ruminal parameters. The animals were fed *ad libitum* by using a basal oat straw diet and providing them with alfalfa hay supplement (20 %); all diets were isonitrogenous. Rumen fluid samples were collected at 0, 1.5, 3, 6, 9, 12, 16, and 24 hours after first meal and analyzed for pH, ammonia-nitrogen (NH_3-N) and volatile fatty acids (VFA) concentration. The digestibility (DM, NDF, and ADF) was estimated by the total collection of feces and mesurement of feed intake. The ruminal degradation of straw was estimated by using the nylon bag technique under a non linear model. The statistical analysis of data was made by using a crossover design. There were detected significant differences (P < 0.01) between T1 and T2 in concentration of acetic (78.6 *vs* 83.7 mM), propionic (15.5 *vs* 11.5 mM), and butiric (P < 0.05; 5.1 *vs* 4.2 mM), DMI (P < 0.07; 56.8 *vs* 50.4 g kg^{-1} $W^{0.75}$), DM digestibility (55.9 *vs* 58.7 %), and into the potential degradation of b constant (P < 0.06; 42.7 *vs* 44.6 %). However there were not found significant differences (P > 0.05) to ruminal pH (7 *vs* 6.9), NH_3-N (12.5 *vs* 12.8 mg 100 ml^{-1}), ADF (54.8 *vs* 55.5 %), and NDF digestibility (56.3 *vs* 58.2 %), degradation rate of straw (2.6 *vs* 2.4 % h^{-1}) and isobutiric acid concentration (0.8 *vs* 0.6 mM). These results suggest that size of the forage affects the diet digestibility and DMI; with an apparent effect into the ruminal conditions.

Key Words: Sheep, Oat straw, Digestibility

70 Effect of particle length of forage on digestibility, degradability, and ruminal parameters in steers fed with basal oat straw diet. H. G. Gonzlez*[1,3], O. B. Ruiz[2], L. C. De la Vega[2], A. P. Mrquez[3], A. C. Correa[3], A. E. Orozco[1], E. T. Rubio[1], I. G. Ramos[1], E. S. Garca[1], and H. C. Hernndez[4], [1]*Medicina Veterinaria y Zootecnia - ICB, Universidad Autnoma de Ciudad Jurez, Mexico,* [2]*Universidad Autnoma de Chihuahua,* [3]*Universidad Autnoma de Baja California,* [4]*Universidad Autnoma de Baja California Sur*.

Four Hereford steers with permanent ruminal cannulas were used to evaluate the effect of two size ground lenght: 2.5 cm (T1) and 10 cm (T2) of forage on diet digestibility, straw degradability, and ruminal parameters. The animals were fed *ad libitum* by using a basal oat straw diet and providing them with an alfalfa hay supplement (20 %), all diets were isonitrogenous. Rumen fluid samples were collected at 0, 1.5, 3, 6, 9, 12, 16, and 24 hours after first meal and analyzed for pH, ammonia-nitrogen (NH_3-N) and volatile fatty acids (VFA) concentration. The digestibility (DM, NDF, and ADF) was estimated through the total collection of feces and mesurement of feed intake. The ruminal degradation of straw was estimated by using the nylon bag technique under a non linear model. The statistical analysis of data was made by using a switch back design. The findings were not statistically different (P > 0.05) nor to pH (7 *vs* 7), NH_3-N (8.5 *vs* 8.7 mg 100 ml^{-1}) neither for VFA (acetic; 80.7 *vs* 80.9 mM), (propionic; 13.2 *vs* 13.3 mM), (butiric; 5.4 *vs* 5.2 mM), (isobutiric; 0.75 *vs* 0.65 mM), and degradability rate (2.6 *vs* 2.6 % h^{-1}) for T1 and T2 treatments, respectively. A higher digestibility (P < 0.01) was detected in DM (68.8 *vs* 71.5 %), ADF (66.9 *vs* 69.6 %), and NDF (68.2 *vs* 71.1 %) in T2 compared to T1. Nevertheless, it implied a reduction (P < 0.05) in DMI (79.7 *vs* 70.8 g kg^{-1} $W^{0.75}$) to T2. Significant differences (P < 0.05) were found in the potential degradability of b constant (31 *vs* 33.3 %) for T1 and T2, respectively. The size of forage particle affected the diet digestibility and DMI and apparently the rumen conditions did not.

Key Words: Steers, Oat straw, Digestibility

71 Digestibility and ruminal parameters in steers fed with a basal oat straw diet and supplemented with alfalfa. H. C. Hernández[4], H. G. González*[1,3], O. B. Ruiz[2], N. E. Bujanda[1], N. A. Loya[1], A. E. Orozco[1], E. T. Rubio[1], O. R. Barrozo[1], R. G. Reyes[1], and H. S. Armendíriz[1], [1]*Medicina Veterinaria y Zootecnia - ICB, Universidad Autónoma de Ciudad Juárez, México,* [2]*Universidad Autónoma de Chihuahua, México,* [3]*Universidad Autónoma de Baja California, México,* [4]*Universidad Autónoma de Baja California Sur, México*.

To evaluate the digestion performance, and ruminal parameters, four Hereford steers (230 kg) with permanent ruminal cannula were fed with a basal oat straw diet and supplemented with alfalfa hay to levels of 0, 10, 20 and 30 % of dry matter intake and 0.5 kg rolled milo per animal d^{-1}, all diets were isonitrogenous. The digestibility (DM, ADF, NDF and cellulose) was estimated through the total collection of feces and measurement of feed intake. Rumen fluid samples were collected at 0, 1.5, 3, 6, 9, 12, and 16 hours after first meal and analyzed for pH, ammonia-nitrogen (NH_3-N) and volatile fatty acids (VFA) concentration. The data were analyzed by using a 4 x 4 latin square design. It was observed an increase (P < 0.01) in digestibility of DM (61.4, 61.2, 68 and 68 %), ADF (54.4, 57.3, 62.3 and 62.4 %), NDF (57, 65.7, 65.3 and 64.6 %), and cellulose (62.4, 63.3, 66.8 and 65.4 %), DMI (64.6, 69.8, 80.7 and 81.1 g kg^{-1} $W^{.75}$), and concentration of NH_3-N (8.48, 7.4, 7.31, and 5.86 mg 100 ml^{-1}), acetic (55.69, 61.7, 68.3, and 69.9 mM), propionic (10.2, 10.5, 13.04, and 13.8 mM), and butyric (4.59,

5.61, 6.11 and 6.1 mM) to supplemented alfalfa diets (0, 10, 20 y 30 %), respectively. Nevertheless the pH values were similar (P > 0.05) between treatments. These findings suggest that the supplementation of a basal straw diet with alfalfa increase the diet digestibility, DMI, and ruminal conditions.

Key Words: Steers, Oat straw, Ruminal parameters

72 Comparison of techniques and grinding size to estimate digestibility of forage base ruminant diets. D. Damiran*[1], T. DelCurto[1], D.W. Bohnert[1], G.D. Pulsipher[1], and S. Findholt[2], [1]*Oregon State University, Union,* [2]*Oregon Department of Fish & Wildlife, La Grande.*

The objectives of the following experiments were to evaluate DM and NDF digestibility estimates for the following techniques; Daisy^{II} *in vitro* , filter bag *in situ* preceded by 48 h pepsin treatment, Tilley and Terry two stage *in vitro*, with *in vivo* digestibility. In addition, effects due to sample size (0.25 vs 0.50 g) and Wiley mill grind size (1mm vs 2mm) were also evaluated. In Exp. 1, 15 forage plants (five grasses, five forbs, four shrubs, and lichen) from mixed conifer rangelands were used to evaluate digestion estimation techniques. Sample ranges for CP, ADF, and NDF were 2.7 to 14.5%, 5.3 to 53.9%, and 24.6 to 81.1%, respectively. Compared to IVDMD, *in situ* overestimated (P < 0.05) DMD by 58, 128, 148, and 164 g/kg and the Daisy^{II} technique overestimated (P < 0.01) DMD by 155, 172, 162, and 236 g/kg for grasses, forbs, shrubs, and lichens respectively. In Exp. 2, Fescue hay samples were used to compare the above techniques to *in vivo* digestibility. *In situ* DMD (653 g/kg), Daisy^{II} DMD (689 g/kg), and IVDMD (583g/kg) values were higher (P < 0.01) than *in vivo* DMD (500 g/kg) values. In contrast, *in situ* NDF digestibility did not differ (P = 0.13) from *in vivo* NDF digestibility. However, Daisy^{II} NDF digestibility (0.25 g sample size) was greater (P < 0.01) than *in vivo* NDF digestibility. In Exp. 3, two grasses, forbs, shrubs, and lichen were used to evaluate the interaction of Wiley mill grind size (1 vs 2 mm) and digestibility technique. For grass hay, Daisy^{II} DM (688 g/kg) and NDF (500 g/kg) and *in situ* DM (713 g/kg) and NDF (510 g/kg) digestibilities were higher (P < 0.05) and IVDMD (526 g/kg) was lower (P < 0.05) compared to *in vivo* DM (624 g/kg) and NDF (572 g/kg) digestibility. In contrast, straw IVDMD (324 g/kg), Daisy^{II} DM (404 g/kg) and NDF (283 g/kg) and *in situ* DM (409 g/kg) and NDF (272 g/kg) digestibilities were lower (P < 0.01) compared to *in vivo* DM (501 g/kg) and NDF (574 g/kg) digestibility. Daisy^{II} and *in situ* digestibility estimates were greater (P < 0.01) for grass hay milled at 1 mm vs 2mm, and for straw samples all technique estimates were higher (P < 0.01) for 1mm. For the Daisy^{II} and *in situ* techniques, using a 250 mg sample resulted in higher (P < 0.05) estimates of digestibility than a 500 mg sample. In summary, filter bag methods failed to accurately estimate digestion as compared to *in vivo* and traditonal *in vitro* techniques.

Key Words: Ruminant, Digestion Techniques, Forages

73 Snakeweed (*Gutierrezia spp.*)consumption by grazing beef cattle. S. H. Cox* and T. T. Ross, *New Mexico State University.*

Two studies were conducted to estimate snakeweed (SW) consumption by grazing beef cattle. In study 1, microhistological examinations were performed on fecal samples (n=337) collected seasonally from beef cows at two independent ranches and New Mexico State University#s Chihuahuan Desert Rangeland Research Center (CDRRC) and Corona Range and Livestock Research Center. Standing crop (kg/ha), percentage of vegetative composition and percentage of ground cover were estimated at each collection period for each study area. Standing crop (excluding SW) ranged from 183 to 1108 kg/ha, while SW ranged from 20 to 536 kg/ha. Snakeweed made up from 0.6 to 13.7% of total vegetative composition of pastures. Stocking rate ranged from 0.2 to 40.5 ha/hd. Fecal occurrence of SW was only evident in a single sample, at 1.25% of total composition. In study 2, 12 Hereford X Angus cross beef cows were assigned by pairs to six 1 ha paddocks (d 0) at the CDRRC. Bite counts were recorded morning and afternoon on d 1 and d 8. Beginning total herbage varied among paddocks from 669 to 928 kg/ha, with SW ranging from 251 to 538 kg/ha (33 and 70% of total herbage by weight). Snakeweed comprised between 17 and 44% of vegetative composition and between 3 and 13% of basal cover for paddocks. All cattle were observed to have bitten SW during the study. SW comprised 4% on the diet (estimated by bite counts) on d 1 and 2% on d 8. Bite counts for SW, grass and forbs were different (P = 0.03, 0.01 and 0.008, respectively) between d 1 and 8, with the selection of snakeweed and forbs shifting downward by half from d 1 to 8. Percentage of SW bites taken was positively correlated with dropseed as a percentage of vegetative composition (P = 0.03) for d 1, and with croton as percentage vegetative composition and basal cover (P < 0.05, < 0.01, respectively) for d 8. The relationship that the increase in SW bitten has with available dropseed and croton may simply be due to a cows desire for green forage during early spring and selecting for color more than plant species.

Key Words: Snakeweed, Beef Cattle

74 Effect of Sheep Grazing or Mowing on the Control of Perennial Pepperweed (Lepidium latifolium L.). C.M. Willliams*, D.W. Holcombe, D.R. Hanks, J.R. Allen, L.B. Bruce, B.L. Perryman, and G.C.J. Fernandez, *University of Nevada, Reno, Nevada.*

Lepidium latifolium L (perennial pepperweed; PP) is a non-native invasive plant, infesting riparian areas, wetlands, and native hay meadows in the western United States. This study examined the effects of sheep grazing and mowing to control PP over 2 years. Only 2001 (YR2) results are discussed. Nine, 47.5 m^2 paddocks, with 75% relative PP density were arranged in a grazing/simulated grazing (six levels) x time (four levels) factorial in a randomized complete block design. Grazing/simulated grazing treatments were: grazed-YR1-control-TR2 (GC), grazed-YR1-grazed (GG), mowed-YR1-control-Yr2 (MC), mowed-YR1-mowed-Year2 (MM) and control-YR1-YR2 (CC). Time treatments were: day 0, 41, 76, and 151. Treatments were implemented when PP plants reached 10 cm height, and applied until approximately 90% utilization was achieved. Open ewes were utilized for grazing treatments and mowing was performed by hand clipping. Plant characteristics were measured before each treatment application. Density and standing crop were estimated for total vegetation, native species, and PP. A two-factor repeated measures ANOVA was performed to test treatment effects. Plant height was also measured for PP. Interactions occurred for treatment x day for PP density (P = 0.001) and height (P = 0.003). Interactions reflected only a difference in magnitude of response. Grazing and mowing reduced PP density and standing crop when compared to control (P = 0.001, P = 0.003, respectively). However there was no difference between grazing and mowing (P > 0.20). There was a difference between MC and GC in regards to native plant density (P = 0.008). No other density differences between treatments occurred. Results suggest that grazing or mowing can reduce density and standing crop of perennial pepperweed without significantly affecting native plant density.
Key words: Sheep, Noxious weed control

Key Words: Sheep, Noxious Weed Control

75 Comparison of immediate washing with storing frozen and subsequent thawing and washing, on in situ residues of DM, OM, N, and ADF from ruminally incubated dacron bags. T. N. Bodine*, H. T. Purvis II, and R. Basurto, *Oklahoma Agricultural Experiment Station, Stillwater.*

Twelve ruminally cannulated steers were fed alfalfa, bermudagrass, or prairie hays to determine if two methods of handling in situ bags caused residue remaining to differ following ruminal incubation for 16 or 96 h. We filled duplicate bags with 5 g of forage, incubated them, rinsed bag exteriors, and either directly washed or stored bags at -20°C. All bags were washed in a washing machine using 10 cycles of a 2-min rinse in cold water and a 1-min spin, either directly after removal, or after thawing. All bags were then dried for 48 h at 55°C, weighed, and residues were analyzed for OM, N, ADF, and ash-free ADF. Data were analyzed with forage, time, and treatment, and all two- and three-way interactions with treatment were included in the model. No three-way interactions were detected (P > 0.20) between treatment, time, and forage. All in situ residues differed (P < 0.01) by forage, time, and their interactions. In situ DM and OM did not exhibit interactions (P > 0.48) between any combination of forage, time, or treatment, suggesting that treatment effects were consistent regardless of forage type or incubation time. Freezing in situ bags prior to washing resulted in greater residues of DM (P < 0.02; 1.95 vs 1.87 g; 4.3%) and OM (P < 0.03; 1.84 vs 1.77 g; 3.9%). However, forage by treatment (P < 0.01) and time by treatment (P < 0.05) interactions were noted for N residues, and may be a result of differences in protein fractions. Treatment resulted in similar residues for ADF (P > 0.22; 1.09 vs 1.01 g) and ash-free ADF (P >

0.37; 0.99 vs 0.93 g), with no treatment interactions detected ($P > 0.23$). We believe that freezing in situ bags prior to washing does not create biologically important differences in the amount of DM, OM, ADF, or ash-free ADF recovered. However, measures of in situ N disappearance may be altered by the method of handling the in situ bags after removal from the rumen. The noted differences introduced by freezing are small and maybe related to the inherent variation of the in situ procedure.

Key Words: Freezing, In Situ Disappearance, Techniques

76 Energy supplementation of steers grazing early-season, native range: Effects on grazing and subsequent finishing performance and carcass merit. S. P. Montgomery*[1], D. A. Blasi[1], J. C. Forcherio[2], and R. R. Scott[2], [1]*Kansas State University, Manhattan,* [2]*Purina Mills, St. Louis, MO.*

Crossbred beef steers (n = 328, BW = 225 ± 0.24 kg) were used in a completely randomized design to determine the effects of energy supplementation on the grazing and subsequent finishing performance and carcass merit of steers grazing early-season, native range. Estimates of rib fat, rump fat, and ribeye area of each steer were obtained using real time ultrasound 16 d prior to the 97 d grazing period. Treatments consisted of either no supplemental energy or access to feeders containing a free choice, grain-based energy supplement. On d 1 of the grazing period, steers were weighed and randomly allotted among eight pastures, providing four replications per treatment, with pasture serving as the experimental unit. Stocking density was increased by 34% for supplemented pastures. At the end of the grazing period, steers were weighed, scanned using real time ultrasound, transported to a commercial feedlot, and allowed ad libitum access to a common finishing diet an average of 171 d. Each pasture of steers was finished in a separate feedlot pen. Visual appraisal of fat cover was used to determine marketing date of each pen. Supplement intake averaged 2.8 ± 0.57 kg /d as fed or approximately 1.0% of BW during the grazing period. Supplementation increased ($P < 0.01$) grazing period ADG and BW; with ADG consisting of 0.67 vs. 1.00 ± 0.051 kg for non-supplemented and supplemented steers, respectively. Supplementation increased ($P < 0.01$) grazing period ribeye area, back fat, and rump fat. Supplementation did not affect subsequent finishing performance or carcass merit; however, supplementation did reduce ($P < 0.01$) the amount of time required during the finishing period by 18 ± 3 d. Energy supplementation of steers grazing early-season, native range resulted in more kg of gain per ha due to improved grazing performance and a 34% increase in stocking density, and reduced the amount of time required during the finishing period.

Key Words: Energy Supplementation, Range, Steers

77 Growth and reproductive performance of Holstein heifers as affected by ruminal degradation of supplemental protein. J. P. Tanner, H. S. Hussein, H. Han*, S. L. Lake, and D. H. Hanks, *Department of Animal Biotechnology, University of Nevada-Reno, Reno, NV 89557.*

Reproductive performance of primiparous and multiparous dairy cows has been improved with increasing the proportion of undegraded intake protein (UIP) in the diet, especially when fish meal (FM) was supplemented. This positive response has not been documented with dairy heifers, in general, or under grazing conditions, in particular. Therefore, the objective of this study was to determine the effects of increasing the UIP level in the supplement on growth and reproductive performance of Holstein heifers in a 104-d grazing trial. A total of 63 heifers (BW SD = 317 14 kg) were allotted at random to nine pastures (7 each). One heifer was later found as a freemartin and, therefore, was excluded from the study. The irrigated pasture (81.8% OM, 11.1% CP, and 61.1% NDF on DM basis) was composed mainly of tall fescue (*Festuca arundinacea*) and Kentucky bluegrass (*Poa pratensis*) with a minor proportion of other forages (e.g., white clover [*Trifolium repens*]). The heifers were group fed one of three supplements (1.9 kg of DM heifer^{-1} . d^{-1}) that were based on corn and dry molasses and contained soybean meal [SBM], FM, or both protein sources to provide graded levels of UIP from FM. This was accomplished by having 0, 50, or 100% of supplemental protein derive from FM. The heifers had ad libitum access to water and mineral-vitamin-molasses blocks. They were estrous synchronized (2 injections; 10 mg each of $PGF_2\alpha$; on d 45 and d 56), artificially inseminated on d 59, allowed to graze without the supplement on d 80, and were tested for pregnancy via rectal palpation on d 104. Over the 80 d of feeding supplements (0, 50, and 100% FM), there were no differences ($P > 0.05$) among treatments for ADG (0.87, 0.82, and 0.94 kg; respectively), gain/supplement (0.42, 0.39, and 0.46; respectively) or conception rate (28.6, 38.1, and 35.0%, respectively). The absence of significant gain or reproductive responses in this study may have been due to the poor quality forage and(or) the low amount of supplement fed.

Key Words: Grazing, Holstein Heifers, Fish Meal

78 Effect of windrow grazing versus feeding baled hay on forage quality and animal performance. V. Nayigihugu*[1], B. W. Hess[1], D. W. Koch[2], and J. W. Flake[2], [1]*Department of Animal Science,* [2]*Department of Plant Science, University of Wyoming.*

Our objective was to determine the effects of previous windrow grazing on forage production, forage quality of hay left in windrows or harvested as round bales, and performance of cows offered each forage type during a winter feeding period. Windrow grazing occurred on two meadows (16.2 and 10.1 ha) during the winter of 2000. On June 12 and July 23, 2001, samples were collected every 1.22 m from the center of the grazed windrow. The meadows were then harvested from July 24 to 26. Windrows were combined together to double windrow size. On one half of each meadow, all bales were removed, while on the other half, alternate windrows were baled and removed. Forage cages (1.5 m^2) were then randomly placed over the windrows in each meadow, and the bale closest to each forage cage was labeled and stored with the other round bales. Forage samples were collected at harvest and approximately once per month until February 2, 2002. Beginning December 21, 110 pregnant cows (avg initial BW = 587.7 kg) were assigned to graze either windrowed or baled forage for 35 (16.2 ha pasture = 27 cows/treatment) or 41 (10.1 ha pasture = 28 cows/treatment) d. Forage production increased ($P < 0.0001$) from 67 g of DM/0.25 m^2 where the windrow was grazed to an average of 123.7 g of DM/0.25 m^2 from 1.22 to 6.1 m from the center of the previous year#s windrow. Averaged across sampling date, forage left in the windrow had greater ($P \leq 0.02$) ADF and NDF compared to forage harvested as round bales. Estimated TDN was lower ($P = 0.01$) for windrowed forage (57.4%) than for baled hay (59.5%); however, CP ($P = 0.83$), and ADG ($P = 0.16$) were not affected by forage treatment. Post-grazing values for forage quality did not differ ($P \geq 0.05$) from values determined at harvest, suggesting that the forage maintained its quality throughout the experiment. Although windrowed forage had greater fiber content, forage CP and cattle ADG were maintained throughout the experiment. Thus, windrow grazing may be a suitable alternative to feeding baled forage to beef cows during winter.

Key Words: Cattle, Forage, Windrow Grazing

79 A comparison of techniques for estimating forage digestion. E. J. Scholljegerdes*, V. Nayigihugu, B. W. Hess, and P. A. Ludden, *University of Wyoming.*

The objective of this study was to compare in situ and in vitro methods for determining rate and extent of forage digestion. Duplicate polyester (10 × 20 mm) or ANKOM F57 filter bags containing 5.0 or 0.5 g of ground (2 mm) bromegrass hay, respectively, were incubated in situ or in vitro (ANKOM Daisy^{II} Incubator) for 3, 6, 9, 12, 15, 18, 24, 48, and 96 h. Bags were incubated in the rumen of 3 ruminally cannulated Angus × Gelbvieh cattle consuming bromegrass hay, or in rumen fluid collected from these cattle. At each time point, duplicate bags were removed, rinsed with tap water and dried (55°C). Residues were analyzed for OM, NDF, and N. Estimates of OM digestibility were higher ($P \leq 0.03$) for in situ than in vitro at 15, 24, 36, and 96 h. At incubation times of 6 through 24 h, NDF digestibility was comparable ($P = 0.10$ to 0.44) between techniques, but differed ($P \leq 0.03$) at 3, 36, 48, and 96 h of incubation. Forage N digestibilty determined in situ was greater ($P \leq 0.01$) than in vitro at all incubation times. Estimates of N fractions A, B, and C did not differ ($P \geq 0.12$) for either technique. However, estimated N degradation rate was eight fold higher ($P = 0.01$) for in situ (8.1%/hr) than in vitro (1.6%/hr), resulting in greater ($P = 0.0001$) estimated ruminally degradable protein of the forage for the in situ (73.6%) compared to the in vitro (53.8%) technique. Because estimates of forage digestibility differed depending on the technique employed, estimates of in situ or in vitro forage digestibility can not be used interchangeably.

Key Words: In Situ, In Vitro, Digestibility

80 Comparison of urea and biuret as nitrogen supplements to low-quality forage: daily and alternate day supplementation effects on efficiency of nitrogen use in lambs. T. A. Currier*[1], D. W. Bohnert[1], S. J. Falck[1], and S. J. Bartle[2], [1]*Eastern Oregon Agriculture Research Center, Burns, OR,* [2]*ADM Alliance Nutrition, Inc., Quincy, IL.*

Five wethers (39 ± 1 kg BW) were used in an incomplete 5 × 4 Latin square with four 24-d periods to determine the influence of supplemental non-protein nitrogen (NPN) source and supplementation frequency (SF) on efficiency of N use in lambs consuming low-quality forage (4.3% CP). Treatments included an unsupplemented control (CON) and a urea (28.7% CP) or biuret (28.6% CP) supplement provided daily (D) or every other day (2D) at 0630. Lambs were provided forage at 120% of the previous 5 d average intake in two equal portions at 0700 and 1900. Experimental periods were 24 d with an 18 d adaptation period. Feces and urine were collected on d 19 to 24. Blood samples were obtained 2, 4, and 6 h post-supplementation on d 19 to 24 for analysis of plasma urea-N (PUN). DMI, OM intake, N retention, DM, OM, and N digestibility, and digested N retained were greater ($P < 0.02$) for supplemented wethers compared with CON with no difference ($P > 0.05$) because of NPN source or SF. However, it is of interest to note that, even though no statistical difference was observed for digested N retained between NPN sources, digested N retained was 110% greater for biuret compared with urea. Supplemented lambs had increased PUN compared with CON ($P < 0.01$) and urea treatments had greater PUN compared with biuret ($P < 0.01$). Also, PUN was increased ($P = 0.02$) with D compared with 2D treatments. In addition, data suggest that PUN exhibited less fluctuation on the d of a supplementation event for biuret compared with urea. These results suggest that supplements containing urea or biuret as the supplemental N source can be effectively used by lambs consuming low-quality forage without adversely affecting N efficiency, even when provided every other d. In addition, biuret should have greater utility for use in supplements offered infrequently to ruminants because it is comparatively nontoxic compared with urea.

Key Words: Urea, Biuret, Forage

81 Comparison of urea and biuret as nitrogen supplements to low-quality forage: daily and alternate day supplementation effects on digestion and ruminal fermentation in steers. T. A. Currier[1], D. W. Bohnert*[1], S. J. Falck[1], C. S. Schauer[1], and S. J. Bartle[2], [1]*Eastern Oregon Agriculture Research Center, Burns, OR,* [2]*ADM Alliance Nutrition, Inc., Quincy, IL.*

Five steers (491 ± 21 kg BW) were used in an incomplete 5 × 4 Latin square with four 24-d periods to determine the influence of supplemental non-protein nitrogen (NPN) source and supplementation frequency (SF) on DMI and DM digestibility in steers consuming low-quality forage (4% CP). Treatments (TRT) included an unsupplemented control (CON) and a urea or biuret supplement placed directly into the rumen daily (D) or every other d (2D) at 0630. Supplements were calculated to provide 90% of the DIP requirement. Urea and biuret supplements (29%CP) were provided on an isonitrogenous basis. Forage was provided at 120% of the previous 5 d average intake in two equal portions at 0700 and 1900. Ruminal fluid was collected 0, 3, 6, 9, 12, and 24 h after supplementation on a d of and a d before supplementation for all TRT. Forage DMI and DM digestibility were not affected ($P > 0.05$) by NPN supplementation, NPN source, or SF. However, total DMI was increased ($P < 0.01$) with supplementation. NH_3N increased ($P < 0.05$) the d of and the d before supplementation with supplemental CP. However, a NPN source × SF interaction ($P = 0.03$) on the d of supplementation indicated NH_3N increased at a greater rate for urea as SF decreased compared with biuret. The data suggest that ruminal degradation of biuret to NH_3N was more moderate and prolonged compared with urea, possibly improving use by ruminal microflora. Ruminal NH_3N on the d before supplementation was greater for D compared with 2D ($P = 0.02$). These results suggest that urea or biuret can be used effectively as supplemental N sources by steers consuming low-quality forage without adversely affecting DMI and DM digestibility, even when provided every other d. Also, biuret should be safer and more useful as a CP supplement when offered infrequently to ruminants because of its slower ruminal degradation to NH_3N compared with urea.

Key Words: Urea, Biuret, Forage

82 Effect of bale density, moisture content, and ammoniation level on in situ degradability of bluegrass straw. A. V. Grove*, C. W. Hunt, and R. W. Lewis, *University of Idaho, Moscow.*

A study with a factorial treatment arrangement was conducted to identify optimal bale density (low and high), moisture content (low = 6%, medium = 14.5%, and high = 17%), and level of ammoniation (3 and 5%) on in situ DM disappearance (**ISDMD**) of bluegrass straw. Bluegrass straw was harvested in 2.4 m x 0.9 m x 0.8 m bales and had densities of 152 and 122 kg/m^3 for high and low density bales, respectively. Four bales per treatment were ammoniated in stacks for 2 months and core samples were obtained from external and internal bale locations. Samples were ground (2 mm) and duplicate bags were incubated in situ for 36 and 96 h in four cannulated cows consuming a bluegrass straw-based diet. PROC TTEST was used to compare ammoniated straws to untreated straws within each bale density. Data were analyzed using PROC GLM to test for main effects and interactions of density, moisture, ammonia, and location within the bales. Thirty-six-h ISDMD of untreated bluegrass was lower ($P \leq 0.10$) than all ammoniation treatments except low moisture, high density bales treated with 3% ammonia ($P \geq 0.16$). Ninety-six-h ISDMD of untreated bluegrass straw was lower ($P \leq 0.01$) than all ammoniation treatments. Low moisture bales had lower ($P \leq 0.05$) ISDMD than medium and high moisture bales at 36 h (46.4 versus 50.3 and 49.3%) and 96 h (69.6 versus 74.9 and 75.4%) of incubation. A level of ammoniation main effect was also observed for 36-h ISDMD with 5% ammoniated straw having greater ($P \leq 0.05$) degradability than 3% ammoniated straw. However, a trend ($P \leq 0.11$) for a moisture x density x ammoniation level interaction was observed for 36-h ISDMD. The nature of this interaction suggests the response to 5% ammoniation is not greater than 3% ammoniation when bales contain 14% or greater moisture or when the bales are of a high density. This interaction was significant ($P \leq 0.05$) for 96-h ISDMD. Moisture content and bale density affected ammoniation response.

Key Words: Bluegrass, Digestibility, Ammoniation

83 Evaluation of barley from the core collection of the USDA National Small Grains Collection for forage quality and yield. L.M.M. Surber*, J.G.P. Bowman, W. L. Bengochea, P. F. Hensleigh, and T. K. Blake, *Montana State University, Bozeman, MT, USA.*

Forage barley breeders select new barley lines based on yield and awnlessness despite the importance of forage quality to livestock nutrition. Our goal is to include yield and forage quality in our selection program for hay barley. The objective of this study was to evaluate the spring barley core collection from the USDA National Small Grains Collection for forage yield and quality. Forage samples were collected on 750 barley genotypes grown under dryland conditions in 2000 near Bozeman, MT. An 8-cm clip forage sample taken at soft dough stage was cut at stubble height and dried at 60C for 48 h. Dry matter forage yield (FY) was estimated: FY, t/ha = ((DM wt of clip sample (g) x 87,120)/1,000,000) x 2.2. Forage samples were ground to pass a 2-mm screen, and analyzed for ADF as an estimate of forage quality. Forage yield ranged from 0.9 to 7.6 t/ha (CV = 27.8%), and ADF content ranged from 16.7 to 44.3% (CV = 10.3%). Correlation analysis indicated FY was positively correlated with forage ADF ($r = 0.16$, $P < 0.01$), however this relationship does not appear to be very strong. Compared with hulless barley lines, covered barley lines had 4.9% greater ($P < 0.01$) forage ADF content (32.8 vs. 31.2%) and 9.3% greater ($P < 0.01$) FY (4.2 vs. 3.8 t/ha). Two-rowed barley lines had 4.3% ($P < 0.01$) greater forage ADF content than 6-rowed lines and 12.2% greater ($P < 0.01$) forage ADF content than irregular head type barley lines. There appears to be substantial variation for forage yield and forage ADF content in the spring barley core collection that could be utilized in the development of improved forage barley varieties.

Key Words: Barley, Forage Quality, Yield

84 Effect of soil addition to feces on acid detergent insoluble ash. L.A. Appeddu*[1] and T.N. Bodine[2], [1]*USDA-ARS Grazinglands Research Laboratory, El Reno,* [2]*Oklahoma Agricultural Experiment Station, Stillwater.*

Acid detergent insoluble ash (ADIA) is the inorganic fraction found after conducting an ADF. It has the potential to be used as an internal

marker to estimate digestibility in forage-fed animals, but may be affected by non-plant inorganic components. The objective of this research was to determine how level and type of soil addition can affect fecal ash, ADF, and ADIA content. Four soils commonly found in the Southern Great Plains [Clay (C), Clay Loam (CL), Sand (S), and Sandy Loam (SL)] were sieved (2.38 mm) and added to 200 g wet feces at 0, 2.5, 5, 10, 15, 20, 30, and 40% of the estimated dry weight. Feces were taken from four, hay-fed steers. Mixed samples were oven-dried and ground (2 mm) before laboratory analysis. Feces without added soil had 18 ± 1.4% ash, 38 ± 1.2% ADF (OM basis), and 12 ± 1.5% ADIA. Average soil ash was 97%. Fecal ash increased 1.2% for each 1% addition of soil ($R^2 = 0.96$). An interaction between added soil level and type was detected ($P < .001$) for ADF and ADIA measures. While fecal ADF content (OM basis) was not affected by C, it increased when 40% CL was added ($P < 0.01$) or by adding more than 30% SL and S ($P < 0.02$). Not correcting for ash increased ($P < 0.01$) fecal ADF as compared to ADF expressed on an ash-free basis. Percent ADIA increased ($P < 0.03$) when more than 10% C, 10% CL, 5% S, or 15% SL was added to feces. Sand inflated ADIA content the most ($P < 0.01$). Because ADIA content may be increased by soil ingestion and contamination, monitoring pasture soil type and validating ADIA levels may prevent artificially high digestibility estimates when using ADIA as an internal marker.

Soil type/level	0%	1%	2.5%	5%	10%	15%	20%	30%	40%
Clay	12	14	10	14	24	27	23	29	25
Clay loam	14	12	13	17	24	24	33	39	35
Sand	11	12	16	21	24	26	45	61	71
Sandy loam	12	15	16	17	17	26	32	44	61

Effect of added soil type and level on fecal ADIA% (SEM = 3.2%).

Key Words: Marker, digestibility, fiber

85 Nutritional quality of windrowed and standing high-sugar corn forage. V. Nayigihugu*[1], B. W. Hess[1], D. W. Koch[2], and J. W. Flake[2], [1]*Department of Animal Science,* [2]*Department of Plant Science, University of Wyoming*.

Our objective was to determine the nutritional quality of windrowed versus standing high sugar-corn forage (Cargill HS 60A), as well as to determine the effect of feeding each forage type on cow performance during fall grazing period. Two non-irrigated high-sugar pastures (3.2 ha and 8.4 ha) were divided each into two halves. Each half consisted of windrowed or standing high-sugar corn forage. Leaves, lower and upper stalks (no grain formation) were collected on September 19, October 1, and November 5 from both windrowed and standing sugar-corn forage for chemical and nutrient determination. Thirty-four pregnant, rotationally crossed (Angus × Gelbvieh), primiparous cows (avg initial BW = 481.3 ± 12.1 kg) were weighed on two consecutive days before being allotted to graze either windrowed or standing corn from October 2 to November 2, 2001 (13 cows/treatment for the 8.4 ha pasture; 4 cows/treatment for the 3.2 ha pasture). Cattle were weighed again on two consecutive days at the conclusion of the experiment. Percent NDF increased ($P = 0.0005$) from 43.0 to 51.1%, whereas the IVDMD decreased ($P = 0.02$) from 75.4 to 70.2% as the season advanced. Lower and upper stalks had less ($P < 0.009$) NDF (44.9 and 45.9%, respectively) and ADF (26.6 and 23.4%, respectively) compared to leaves (NDF = 59.7%, ADF = 34.3%). Consequently, IVDMD of leaves (60.6%) was less ($P < 0.002$) than the upper (77.1%) and lower (73.5%) portions of the stalks. Forage CP content (16.2 ± 1.0) was not affected ($P = 0.33$ to 0.88) by forage treatment, plant part, or sampling date. Standing high-sugar corn tended to have less ($P = 0.10$) NDF (48.1%) than corn left in windrows (52.2%), but IVDMD (70.4 2.4%) did not differ ($P = 0.57$) between the two forage treatments. Cows grazing standing corn forage had greater ($P = 0.03$) ADG than cows grazing windrowed corn forage. Despite detection of statistical differences indicative of declining quality, nutritional quality of high-sugar corn remained relatively high throughout the grazing period. Thus, high-sugar corn is an acceptable alternative forage crop for grazing cattle in the fall.

Key Words: Cattle, Grazing, Forage Corn

86 Grazing Lambs Control Insects In Alfalfa. J.N. Guerrero*, E.T. Natwick, M.I. Lopez, and A.R. dos Santos, *University of California Desert Researach and Extension Center, Holtville*.

During the winter of 2001 at the University of California Desert Research and Extension Center, we conducted a lamb grazing trail to compare the efficacy of lamb grazing to insecticides for insect control on alfalfa. Lambs grazed alfalfa pasture (*Medicago sativa*,var. CUF101) from January through March of 2001. Four wethers, mean initial weight 49 kg, grazed paddocks, 20.1 m x 20.1 m, for 10 to 14 d. Lamb grazing was compared to a control, no grazing and no insecticides; and to Furadan# and Lorsban# insecticides for insect control on winter alfalfa. Esophageal cannulas were placed in four wethers to detect the presence of insects in consumed alfalfa forage. During the winter, the insects that are of most concern in alfalfa culture in the irrigated Sonoran Desert are aphids and the Egyptian alfalfa weevil (*Hypera brunneipennis*). During the first three days of grazing on each paddock; from January 28 to January 31, 11.1 weevils g^{-1} extrusa DM, 0.5 weevil eggs g^{-1} extrusa DM, and 205.3 cowpea aphid (*Aphis craccivora* Koch) aphids g^{-1} extrusa DM were detected. From March 16 to March 18, 3.3 weevils g^{-1} extrusa DM, 0.5 weevil eggs g^{-1} extrusa DM, and no cow pea aphids were detected. On March 5, we took estimates of hay production of the December 1999 through February 2001 treated plots. During the December and early January grazing periods there were no ($P > 0.05$) treatment differences in hay yields, as kg/ha hay. For the plots from January 28 to February 9, the grazed plots produced higher ($P < 0.05$) hay yields, 4472 kg/ha; versus the control, 3925 kg/ha; the Furadan#-treated plots, 4216 kg/ha; or the Lorsban#-treated plots, 3603 kg/ha. We conclude that lamb grazing is equally as efficient as insecticides for weevil and aphid control on winter alfalfa, in the irrigated Sonoran Desert.

Key Words: Sheep, Grazing, Insect Control

PHYSIOLOGY

87 Characterization of estrous behavior in farmed muskox cows. M. P. Shipka*, M. C. Sousa, and J. E. Rowell, *University of Alaska, Fairbanks, Alaska*.

The objective of this study was to characterize estrous behavior in muskox cows during naturally occurring estrous periods. Radiotelemetry transmitters for estrous detection were attached to the rumps of 14 muskox cows as the cows were placed in breeding harem. Cows were penned continuously with a breeding bull except for two 45 min periods each week during blood sampling. Following sampling, plasma was collected and stored frozen at -20 °C for later RIA of progesterone (P4). Hormone data were used to retrospectively validate radiotelemetric data on estrous behavior such that only mounting data that correlated with nadir P4 were included (n = 18). Ultrasonography confirmed pregnancy in all 14 cows approximately 60 days post-breeding. Data were summarized (range and mean ± SE) and analyzed using t-test and chi-square procedures. Eight cows experienced one estrous bout and five cows experienced two estrous bouts during the breeding season. Radiotelemetry correctly identified 95% of estruses (18 of 19). Mean length of estrus, calculated from the time of first mount until last mount, was 771 ± 98 min (range = 4 to 1508 min). Mean number of mounts during an estrous bout was 8.89 ± 1.29 (range = 3 to 25 mounts). Mean number of mounts (range) received during 4h, 6h, 12h, and 24h after the first mount were 4.39 ± 0.59 (2 to 10), 6.19 ± 0.90 (2 to 15), 7.93 ± 1.20 (2 to 17), and 10.78 ± 1.90 (4 to 21), respectively. Length of estrus was not different comparing the expression of standing behavior prior to the first rise in P4 concentration to the expression of standing behavior following the formation and demise of the first CL (589 ± 181 min vs 841 ± 114 min; $P \geq 0.20$). Among the five cows that experienced two estrous bouts, length of estrus was not different between first or second estrus (589 ± 181 min vs 1056 ± 169 min; $P \geq 0.10$). More estrous bouts than expected were initiated during the night (23:00 to 05:00h; $P \leq 0.05$) and fewer estrous bouts than expected were initiated during the time period of human activity on the farm (08:00 to 16:00h; $P \leq 0.05$).

Key Words: Muskox, Estrus, Radiotelemetric Estrous Detection

88 Residual feed intake in beef steers: II. Correlations with hematological parameters and serum cortisol concentrations. C.M. Theis*[1], G.E. Carstens[1], R.J. Hollenbeck[1], M.W. Kurz[1], T.M. Bryan[1], L.J. Slay[1], R.D. Randel[2], and T.H. Welsh, Jr.[1], [1] *Texas Agricultural Experiment Station, College Station,* [2] *Overton, TX.*.

Selection against residual feed intake (RFI) has the potential to improve feed efficiency without affecting growth performance or body size, but measuring this trait in cattle is costly. Identification of physiological indicators of RFI may facilitate early screening of more efficient calves. The objective of the study was to examine correlations among RFI, feed intake (FI), ADG, hematological parameters, and cortisol secretion. Braunvieh-sired crossbred steers (N = 169) were individually fed a roughage-based diet (ME = 2.2 Mcal/kg; 13.7% CP, DM) using Calan feeders. Following 30 d of adaptation, weekly BW and daily FI were measured for 77 d. Residual feed intake was calculated as the difference between actual FI and FI predicted from multiple regression of FI on mid-test $BW^{.75}$ and ADG. Residual feed intake ranged from -2.4 to 2.7 kg/d but was not correlated with ADG or BW. On d 5 of adaptation, blood samples were obtained prior to and 30 min after i.v. infusion of ACTH (0.1 IU/kg BW) and serum analyzed for cortisol (CS). Serum CS was also analyzed from samples collected on d 0, and white (WBC) and red blood cell (RBC) parameters determined from samples collected on d 0 and 70 of the RFI determination period. Pre- and ACTH-induced CS concentrations were not correlated with RFI. However, d 0 CS concentrations were negatively correlated with FI (r = -.16, P<0.05) and ADG (r = -.24, P<0.01), and positively correlated with feed conversion ratio (FCR; r = .18; P<0.05). WBC counts and differentials were not correlated with any growth or efficiency parameters. On d 70 RBC counts, hemoglobin and hematocrit were negatively correlated (P<0.001) with FI (r = -.35, -.34, -.35) and ADG (r = -.36, -.44, -.44) and positively correlated (P<0.05) with FCR (r = .17, .25, .24). These results demonstrate that serum CS and RBC parameters were correlated with ADG, FI and FCR, but not with variation in FI independent of BW and ADG (i.e., RFI). Additional studies are warranted to identify physiological indicators of RFI.

Key Words: Residual Feed Intake, Cortisol, Hematological Parameters

89 Effect of fishmeal supplementation on fertility in young beef cows grazing pasture. P.D. Burns*, E.R. Downing, T.E. Engle, J.C. Whittier, and R.M. Enns, *Colorado State University, Fort Collins, CO.*

The current study was conducted to determine if fishmeal supplementation enhances reproductive performance in beef cows (2-3 yr of age) grazing pasture. Fifty spring calving Angus cows were paired by body weight, age, and body condition score and randomly assigned to one of two treatments. Treatments consisted of 1) pasture alone or 2) pasture + fishmeal supplement at 0.45 kg DM intake. Supplementation began 25 days before the start of the breeding season and continued until the end of the 70-day breeding season. Estrous cycles were synchronized using the Select Synch protocol (d -7, 100 μg GnRH; d 0, 25 mg $PGF_{2\alpha}$; d 0 = the start of the breeding season). Cows were observed twice daily for estrous behavior beginning 24 h before and continuing through 72 h post $PGF_{2\alpha}$ injection. Cows were artificially inseminated 12 h after being detected in estrus. Cows not detected in estrus by 72 hr post $PGF_{2\alpha}$ injection were administered an additional 100 μg of GnRH and mass inseminated. All cows were exposed to clean-up bulls beginning 14 days after mass insemination. Jugular blood samples were collected from six randomly selected cows from each group immediately prior to the initiation of the experiment, and on d -7, 0, 45, and 70 of the breeding season. Samples were subjected to GC analysis to determine plasma fatty acid profiles. Synchronized estrous response, first service conception rates, AI pregnancy rates, and overall pregnancy rates did not differ between the two treatment groups (P > 0.05). Plasma linolenic acid (LNA) and eicosapentaenoic acid (EPA) were similar between treatment groups at the start of the study (P > 0.05). Plasma LNA was higher in cows grazing pasture alone on d -7 and 70 of the breeding season (P < 0.05) whereas plasma EPA was higher in cows supplemented with fishmeal on d -7, 45 and 70 of the breeding season (P < 0.05). Data from the present study indicate that fishmeal supplementation increases plasma EPA in cows grazing pasture. However, this increase in EPA did not enhance reproductive performance. Similar to EPA, LNA has the ability to inhibit uterine $PGF_{2\alpha}$, which may be the reason for no differences in reproductive performance.

Key Words: Cows, Fishmeal, Fertility

90 Comparison of two synchronization protocols on estrus characteristics, synchronization rates, and conception rates of beef heifers. C. A. Rogers*[1], T. W. Drummond[2], H. L. Vaughn[3], R. Flores[1], C. P. Mathis[1], and M. L. Looper[1], [1] *New Mexico State University, Las Cruces, NM,* [2] *Catron County Extension, Reserve, NM,* [3] *Triangle C Ranch, Magdalena, NM.*

Two estrous synchronization protocols in nulliparous beef heifers were used to determine their effect on estrus characteristics, synchronization rates, and conception rates. Fifty-three Angus and Angus x Hereford heifers were sorted by body weight and age to compare heifers treated with gonadotropin-releasing hormone (GnRH) 7 d before treatment with prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$; SelectSynch; SS; n = 26) and heifers treated with two injections of $PGF_{2\alpha}$ 14 d apart (Targeted Breeding; TB; n = 27). An androgenized cow fitted with a chin-ball marker was placed within each pen of heifers. A HeatWatch transmitter was attached to the tailhead of heifers to monitor estrus characteristics. Heifers were artificially inseminated after the onset of estrus as determined by HeatWatch. Heifers were rectally palpated for pregnancy 60 d after insemination. Number of standing events tended (P = 0.12) to be increased in TB heifers compared with SS heifers (54.4 ± 7.4 and 37.5 ± 7.7, respectively). Duration of estrus was increased (P < 0.05) in TB heifers (16.0 ± 1.3 h) compared with SS heifers (11.6 ± 1.3 h). Interval between standing events was similar (P > 0.10) for TB and SS heifers (3.2 ± 0.4 and 2.6 ± 0.5 h, respectively). Overall synchronization rate (within 96 h after last PGF injection) was 57% and did not differ between synchronization protocols. Conception rates of synchronized heifers were similar (P > 0.10) between protocols and averaged 54% in SS heifers and 46% in TB heifers. Androgenized cows identified 14 of the 28 estruses detected by HeatWatch. We conclude that the number of standing events tends to increase and duration of estrus is increased in heifers administered $PGF_{2\alpha}$ 14 d apart. Synchronization and conception rates were not influenced by either protocol.

Key Words: Beef Heifer, Prostaglandin, Estrous Synchronization

91 Synchronization of estrus in beef cows using long-term MGA Select-Synch with estrus AI or timed AI 78 or 96 h after PG with or without a second GnRH injection. J. K. Ahola*[1], J. C. Whittier[1], G. E. Seidel[1], R. S. Walker[1], and G. Sides[2], [1] *Colorado State University, Ft. Collins, CO, USA* , [2] *Intervet, Inc., Millsboro, DE, USA.*

Pregnancy response of crossbred beef cows (n=258) was evaluated when estrous cycles were synchronized by feeding melengestrol acetate (MGA; 0.5 mg/hd/d) for 14 d, with cows receiving 100 ug of GnRH i.m. on d 26 and 25 mg of prostaglandin F2alpha (PG) i.m. on d 33. The mean body condition score (BCS) was 5.6 and the mean postpartum interval to AI (PPI) was 70 d. All cows were observed for behavioral signs of estrus for 72 h following PG, and those observed in estrus (EAI; n=81) were inseminated after (mean=12.2 h) estrus was first observed. All cows not previously observed in estrus were fixed-time inseminated (TAI) and randomly assigned to receive 100 ug GnRH i.m. (TAI+GnRH) or no GnRH (TAI-no GnRH). Due to logistical constraints, 77 of the cows were inseminated 74.2 to 82.8 h (EARLY, mean=78.0 h) post PG, and 100 cows were inseminated 91.9 to 101.7 h (LATE, mean=96.4 h) post PG. The overall 72-h estrus response was 32.7% and AI pregnancy rate was 41.9%. The AI pregnancy rate for EAI cows was (55/81) 67.9%. There was no interaction (P>0.05) between time of TAI and GnRH. Among all TAI cows, pregnancy rate was higher (P<0.01) in LATE cows (38/100; 38%) than in EARLY cows (15/77; 19.5%). Also, pregnancy rate tended (P=0.06) to increase when a second GnRH injection was given (31/84; 36.9% vs 22/93; 23.7%). The results of this study indicate that with the Long-Term MGA Select-Synch protocol, the pregnancy rate of cows that have not been observed in estrus can be increased by delaying the average time of TAI from 78 h post PG until 96 h post PG. Further, the addition of a second GnRH injection at the time of TAI may increase pregnancy rate.

Key Words: Beef Cows, GnRH, Timed AI

92 Evaluation of melengestrol acetate/prostaglandin (MGA/PGF), Select Synch, and 7 d MGA/Select Synch estrous synchronization protocols in beef heifers. R. N. Funston*[1], R. P. Ansotegui[1], R. J. Lipsey[2], and T. W. Geary[3], [1]*Montana State University, Bozeman, MT,* [2]*American Simmental Association, Bozeman, MT,* [3]*USDA-ARS, Fort Keogh LARRL, Miles City, MT.*

The objective of this study was to evaluate synchronization, conception, and pregnancy rates of heifers synchronized with MGA/PGF, Select Synch, or Select Synch preceded by MGA (MGA/Select Synch). Heifers in the MGA/PGF group (n = 209; BW = 378 kg) received MGA (0.5 mghd^{-1}d^{-1}) for 14 d and an injection of PGF (25 mg) 19 d later. Select Synch heifers (n = 213; BW = 374 kg) received an injection of GnRH (100 ug) followed by PGF (25 mg) 7 d later. The MGA/Select Synch heifers (n = 211; BW = 373 kg) were fed MGA (0.5 mghd^{-1}d^{-1}) for 7 d, received GnRH (100 ug) the day following the last MGA feeding and PGF (25 mg) 7 d after GnRH. All heifers received PGF on the same day. Heifers were observed for estrus continuously during daylight from 4 d before through 5 d after PGF and bred by AI approximately 12 h after onset of estrus. Pregnancy status was determined by ultrasound approximately 50 d after AI. More ($P < 0.01$) heifers were observed in estrus before PGF injection in both the Select Synch (20%) and MGA/Select Synch (24%) groups than the MGA/PGF (4%) group. Pregnancy rates for heifers in estrus early were higher ($P < 0.05$) for both Select Synch (55%) and MGA/Select Synch (63%) compared to MGA/PGF heifers (18%). Synchronization rate (after PGF) was higher ($P < 0.01$) for MGA/PGF heifers (86%) compared to Select Synch (66%) and MGA/Select Synch (68%); however, conception rate did not differ ($P = 0.13$), 72, 63, and 62% for MGA/PGF, Select Synch, and MGA/Select Synch, respectively. Overall estrous response was higher ($P < 0.05$) for MGA/Select Synch (92%) compared to Select Synch (85%) but did not differ ($P > 0.05$) from the MGA/PGF (89%). The Select Synch (53%) and MGA/Select Synch (57%) protocols provided similar ($P = 0.18$) overall pregnancy rates compared to the MGA/PGF protocol (62%); however, there were considerably more heifers in estrus before the PGF injection in the protocols using GnRH.

Key Words: Estrous Synchronization, GnRH, MGA

93 A fixed-time AI program for beef cows with 7-11 Synch. F. N. Kojima*, J. E. Stegner, B. E. Salfen, R. L. Eakins, M. F. Smith, and D. J. Patterson, *University of Missouri, Columbia, MO/USA.*

The 7-11 Synch protocol for synchronization of estrus in beef cows results in a tightly synchronized estrous response that generally peaks at 54 h following treatment. The objectives of this study were: 1) to determine the potential for fixed-time AI of beef cows using 7-11 Synch; and 2) to determine whether the addition of GnRH at AI improves pregnancy rates resulting from fixed time AI. Field trials were conducted at three locations (location 1, n = 90; location 2, n = 120; and location 3, n = 171). Cows were managed at each location in two or three separate herds (herd 1A, 1B, 2A, 2B, 2C, 3A, 3B, or 3C) based on cow age. Cows at each location and within each herd were stratified by age, days postpartum, and body condition score, and randomly assigned to one of two treatments at AI. All cows were synchronized with 7-11 Synch and were fed melengestrol acetate (MGA; 0.5mg·hd^{-1}·d^{-1}) for 7 d followed by injections of prostaglandin $F_{2\alpha}$ (PG: 25 mg Lutalyse) on d 7 of MGA, GnRH (100 μg Cystorelin) on d 11, and PG on d 18. Fixed-time AI was performed 60 h after the last PG with or without GnRH at the time of AI. AI pregnancy rate was determined by ultrasonography 40 to 60 d after AI. Data were analyzed for each herd separately based on the interaction ($P < 0.05$) among location, herd, age, and AI sire on AI pregnancy rate. There was no difference ($P > 0.10$) in pregnancy rate resulting from fixed-time AI based on whether or not cows received GnRH at AI. AI pregnancy rate and cow age within each herd is summarized below. These data indicate that 7-11 Synch provides significant opportunity to AI cows at a fixed time with resulting high fertility, eliminating the need to detect estrus. Further research is needed to more precisely determine the appropriate time of AI and the necessity of administering GnRH at AI. (Supported by USDA-NRI 00-35203-9175)

Herd	Average age	With GnRH	Without GnRH
1A	5.4	70% (28/40)	60% (24/40)
1B	2.0	44% (4/9)	33% (3/9)
2A	7.0	65% (22/34)	73% (24/33)
2B	2.6	64% (7/11)	80% (8/10)
2C	2.0	53% (8/15)	35% (6/17)
3A	2.0	68% (15/22)	43% (9/21)
3B	5.2	55% (22/40)	41% (16/39)
3C	6.5	31% (8/26)	48% (11/23)

Key Words: Beef Cows, Estrous Synchronization, Fixed-time AI

94 Effects of the *Veratrum* alkaloid, cyclopamine and a synthetic analog on in vitro bovine oocyte maturation and subsequent embryo development. K.E. Panter*[1], S. Wang[2], W. Gaffield[3], L.F. James[1], R.C. Evans[2], and T.D. Bunch[2], [1]*Poisonous Plant Research Laboratory, USDA-ARS, Logan, UT 84341,* [2]*ADVS Department, Utah State University, Logan, UT 84322,* [3]*Western Regional Research Center, USDA-ARS, Albany, CA 94710.*

Cyclopamine (CPA), from the poisonous plant *Veratrum californicum*, and cyclopamine-4-ene-3-one (CPA4-3), a synthetic analog of cyclopamine, are steroidal alkaloids that interrupt Sonic hedgehog (Shh)-mediated dorsoventral patterning of the neural tube and somites and produces cyclopia and holoprosencephaly when administered to gastrulation-stage embryos. A randomized complete block (5 replications) design with three in vitro maturation (IVM) treatments was used to investigate the effects of CPA and CPA4-3 on bovine oocyte maturation. Oocytes (n=799) were aspirated from abattoir ovaries and in vitro matured in medium supplemented with 12 μM CPA4-3 (TRT 1), 12 μM CPA (TRT 2) or IVM medium only (Control). The IVM oocytes were subjected to in vitro fertilization and in vitro culture (IVC). Data were analyzed by the general linear model ANOVA. Cleavage rates were 60.7%, 65.0% and 84.1%. The percentage of morulae was 20.1, 31.8 and 58.3; percentage of blastocysts was 6.3, 8.1 and 28.1; and percentage of expanded and hatching blastocysts was 3.8, 9.2 and 21.5 for TRTs 1, 2 and control, respectively. Cleavage rates were lower and numbers of embryos developing to morula, blastocyst and expanded and hatching blastocyst stages were reduced ($P<0.05$). Also, the adverse effects of CPA4-3 on oocyte maturation was greater than CPA ($P<0.05$). In conclusion, exposure of bovine oocytes to the *Veratrum* alkaloid, cyclopamine and its synthetic analog during maturation inhibited subsequent preimplantation embryo development.

Key Words: Cyclopamine, In vitro maturation, *Veratrum*

95 Changes in reticular and rectal temperature during the periestrous period in cows. P.D. Burns*[1], W.R Wailes, Jr[1], and P.B. Baker[2], [1]*Colorado State University, Fort Collins, CO,* [2]*Phase IV Engineering, Boulder, CO.*

Poor estrous detection or misdiagnosis of estrus results in lower conception rates, increased number of services per conception, and longer calving intervals. Several estrous detection aids have been developed to help alleviate this problem. However, many of these aids can be costly, very labor intensive, and(or) result in a high number of false positive or negative estrous detections. Therefore, it is essential that novel aids be developed to help eliminate these problems. Recently, Phase IV Engineering Inc. has developed a reticular bolus that can monitor internal body temperature in cattle. The objective of this preliminary study was to determine if this reticular bolus can accurately monitor changes in internal body temperature and be able to predict onset of estrus. A bolus was inserted into the reticulum of four individual cows. Cows were then administered 25 mg of prostaglandin $F_{2\alpha}$ to induce estrus. Animals were visually observed twice daily following prostaglandin for estrous behavior in the presence of an intact bull. Rectal and reticular temperatures were taken immediately following visual observations. Three individual reticular and rectal readings were taken at each collection period to ensure accurate measurements. Estrus was detected in all cows within 120 h after administration of prostaglandin. Data were normalized to the onset of estrus (onset of estrus = 0 h) and analyzed by analysis of variance with repeated measures. Reticular temperature was generally 0.2 to 0.3C higher than rectal temperature. Both reticular and rectal temperature declined from 36 to 24 h prior to onset of estrus. This was followed by an increase in temperature at the onset of estrus

and then a decline over the next 48 h after estrus. Temperature (both reticular and rectal) was significantly elevated at estrus when compared to other time points (P<0.05). In conclusion, preliminary data indicate that reticular temperature may be used as an indicator of onset of estrus in cattle and warrants further investigation.

Key Words: Cows, Estrus, Temperature

96 Evaluation of pituitary responsiveness to GnRH and GHRH as a predictor of first observed estrus in developing heifers. K.L. Shirley*[1], M.G. Thomas[1], D.M. Hallford[1], R.M. Enns[2], L.A. Narro[1], M.D. Garcia[1], and J.A. Winder[3], [1]*New Mexico State University, Las Cruces, NM,* [2]*Colorado State University, Fort Collins, CO,* [3]*Samuel Roberts Noble Foundation, Ardmore, OK.*

Two studies evaluated the use of pituitary responsiveness to GnRH and GHRH to predict reproductive traits in heifers. In study 1, 157 spring-born Angus, Brangus, and Noble Line Composite (NLC) heifers were fall-weaned and given 0.22 mg/kg BW of GnRH i.v. Blood samples were collected at 0, 30, and 60 min, serum LH was measured by RIA and area under the response curve (AUC) was calculated using trapezoidal summation. Heifers were then developed and observed twice daily for their first behavioral estrus from January until the heifers were estrous synchronized with a progestogen-based protocol in April. The NLC heifers had greater ($P < 0.05$) AUC than Angus and Angus were greater ($P < 0.05$) than Brangus (501 > 409 > 316 19). A greater ($P < 0.03$) percentage of Angus heifers (75%) were observed in estrus relative NLC (46%) and Brangus (45%) heifers between January and April. However, in those heifers that were observed in estrus, NLC were younger ($P < 0.05$) at their first observed estrus than Angus (346 < 372 8 d) but similar to Brangus (346 = 361 8 d). Logistic regression analysis of first observed estrus as a categorical variable resulted in AUC and breed as significant ($P < 0.01$) sources of variation. In Study 2, 81 spring-born Angus and Brangus heifers were fall-weaned and challenged with GnRH and GHRH and developed as in study 1. Brangus had greater ($P < 0.05$) AUC for serum LH than Angus (924 > 724 38), but less ($P < 0.05$) AUC for serum GH than Angus (938 < 1082 25). Fifty-six percent of the heifers were observed in estrus between January and April. Logistic regression analysis suggested that AUC for LH tended to predict ($P < 0.10$) first observed estrus as a categorical variable. Sire(breed) was a significant ($P < 0.02$) source of variation in prediction of behavioral estrus during synchronization. Results suggest that pituitary responsiveness to GnRH and GHRH may differ between breeds and this response potentially predicts first observed estrus in developing heifers. Results also suggest that measures used in this study to evaluate reproductive competency in heifers could be influenced by sire.

Key Words: Heifer, Estrus, GnRH

97 Serum thyroxine and ovarian cyclicity in Rambouillet ewes receiving decreasing dosages of propylthiouracil before onset of anestrus. J. A. Hernandez*, D. M. Hallford, and N. H. Wells, *New Mexico State University, Las Cruces, NM/USA.*

Fifteen cycling Rambouillet ewes (BW = 88.7 ± 3.1 kg) were assigned to one of three treatments to examine the effects of an antithyroidal compound on the onset of anestrus. Beginning on d 0 (January 2, first day of treatment), 10 ewes received either 20 or 40 mg of propylthiouracil (PTU)/kg BW, while five controls received blank gelatin capsules (gavage) for 14 d. On d 15 the dosage of PTU was decreased to 10 and 20 mg PTU/kg BW for the remainder of the 35-d treatment period. Blood samples (jugular venipuncture) and BW were collected regularly throughout the trial and serum thyroxine (T4) and progesterone (P4) were quantified. Ewe BW were similar ($P > 0.01$) among treatment groups before the trial began and on all subsequent weigh days. Before administering PTU on d 0, serum T4 concentrations were 54.2 ± 3.3 ng/mL ($P < 0.09$) in all ewes. Thyroxine concentrations had declined to less than 20 ng/mL in both PTU-treated groups by 9 d after the initiation of the treatment period. On d 15 (first day of decreased PTU dosage), serum T4 concentrations were 55.2, 6.6, and 1.9 (± 4.0) ng/mL for the three respective treatment groups. Serum T4 declined throughout the treatment period; and on d 35 (last day of treatment), values were 57.6 ± 2.7 ng/mL for controls and 0.1 and 0.1 ± 2.7 ng/mL for the groups receiving 10 and 20 mg of PTU, respectively ($P < 0.01$; quadratic, $P < 0.02$). Four days after termination of PTU (d 39), both treated groups had serum T4 concentrations above 20 ng/mL. However, T4 values continued to differ throughout the 13-d recovery period such that on d 48, serum T4 concentrations were 58.1, 34.0, and 32.1 (± 3.6) ng/mL for the three respective treatment groups ($P < 0.01$; quadratic, $P < 0.03$). Blood samples were also collected twice weekly until all ewes had serum P4 values that decreased to and remained less than 1 ng/mL (anestrus). Ewes treated with 0, 20/10 or 40/20 mg of PTU/kg BW entered anestrus on d 27, 58, and 83 (± 7.7) of the experiment ($P < 0.01$; linear, $P < 0.01$). At the time the 35-d treatment period ended, 40, 100, and 100% of ewes receiving 0, 20/10 or 40/20 mg of PTU/kg BW remained cyclic. These data indicate that large dosages of PTU will dramatically lower serum T4 and this effect appears to inhibit onset of anestrus in Rambouillet ewes.

Key Words: Sheep, Thyroid, Reproduction

98 Precision-cut liver slice methodology for study of snakeweed toxicity. R. L. Ashley*[1], J. R. Strickland[2], T. T. Ross[2], A. K. Clayshulte[1], and M. A. Siepel[2], [1]*Colorado State University,* [2]*New Mexico State University.*

Precision-cut liver slices from 4 adult male Sprague-Dawley rats were used to test the applicability of slice cultures to study liver metabolism as affected by snakeweed (*Gutierrezia spp.*) constituents. Three liver cores were taken from each rat and sliced. Individual slices were placed on titanium mesh screen well inserts positioned in six well plates containing William's Medium E supplemented with heat inactivated fetal bovine serum (**WMEHI**). Snakeweed extracts (0.02 g mL^{-1}) were dissolved in dimethyl sulfoxide (**DMSO**). Liver slices (21 slices/rat) were exposed (37^{O}C; 5% CO_2) to 10^{-2}, 10^{-4}, and 10^{-8} dilutions of snakeweed extracts for 2 h (6 slices/extract/rat). Culture medium containing carrier (0.5% DMSO) served as control (3 slices/rat). Slices were analyzed for protein and potassium content. Medium collected from wells following treatment exposure was analyzed for lactate dehydrogenase activity. Protein (mg mg^{-1} wet weight) and intracellular potassium concentrations (mug mg^{-1} protein) for slices were similar (P>0.05) among treatments and treatment dosages. Lactate dehydrogenase enzyme activity in culture medium (U mg^{-1} wet weight) was similar (P>0.05) for all slices. Viability measures for the current study suggest slice integrity was not compromised. Thus, the data suggest that snakeweed extracts had no cytotoxic effects on liver slices when incubated for 2 h. The lack of cytotoxic effects suggests that this in vitro assay could be utilized to test for metabolic changes induced by snakeweed constituents independent of cytotoxicity effects.

Key Words: precision-cut liver slice, snakeweed, toxicity

99 Ontogeny of adiposity, serum leptin, and hypothalamic-pituitary expression of leptin receptors in wethers treated with zeranol. L.A. Narro*[1], M.G. Thomas[1], G.A. Silver[1], K.J. Rozeboom[2], and D.H. Keisler[2], [1]*New Mexico State University,* [2]*University of Missouri.*

Leptin is a pleiotropic hormone that may play an intricate role in steroid implant management and fat deposition in ruminants. In this study, seventy crossbred wethers of similar age and weight were randomly assigned at birth to one of four treatment groups: control, received no treatment; treatment 1, received a Zeranol implant (12 mg; Ralgro #, Mallinckrodt Veterinary) on experimental day 0, and again every 45 days thereafter through experimental day 135; treatment 2, received a Zeranol implant on experimental day 45 and again every 45 days thereafter through experimental day 135; treatment 3, received Zeranol implant on experimental day 90. Serum was collected every 12 minutes for 4 hours from $n \geq 5$ wethers from each treatment group on days 28, 73, 118, and 135. Wethers were then slaughtered, hypothalami and pituitaries harvested, and body composition quantified. Total RNA was extracted from the anterior pituitary and hypothalamic tissue that included the preoptic and arcuate nuclei regions. Reverse transcriptase real time PCR was used to quantify the amount of mRNA coding for the long-form of the leptin receptor. Percent body fat and serum concentrations of leptin increased linearly ($P < 0.01$) with age, from 7.4% to 14.3% and 5.2 ng/mL to 6.6 ng/mL, respectively. Percent protein decreased linearly ($P < 0.01$) with age from 18.2% to 16%; however, body composition and serum leptin were not influenced ($P > 0.10$) by Zeranol treatment. Expression levels of the leptin receptor in the pituitary tended to be greater ($P < 0.10$) on days 73 and 135 than on day 118 (12090 = 14690 > 8012 molecules/50ng RNA), but no differences ($P \geq 0.43$) were detected in expression levels of the leptin receptor in the hypothalamus across treatments and times.

In summary, serum concentrations of leptin increased with body fat mass in growing wethers. Zeranol treatment did not appear to influence body composition, serum leptin, or leptin receptor abundance in the hypothalamus or pituitary. However, the leptin receptor appeared to be differentially expressed among the hypothalamus and pituitary of zeranol treated wethers.

Key Words: Leptin, Receptor, Zeranol

100 Swainsonine toxicokinetics of acute versus subacute oral exposure in sheep. A.K. Clayshulte*[1], J.R. Strickland[2], R.L. Ashley[1], M.A. Siepel[2], and M.D. Remmenga[2], [1]*Colorado State University,* [2]*New Mexico State University.*

Toxicokinetic profiles of swainsonine (SW) following acute and subacute exposure were investigated. Twenty wethers were stratified by BW (67.8 ± 7.6 kg) and randomly assigned to one of four treatments (n=5/treatment). Treatments were: 0.2, 0.4, 0.8, or 1.6 mg SW kg^{-1} BW. Acute exposure included adaptation to blue grama with no previous locoweed (LW) ingestion. Subacute exposure was defined by ingestion of blue grama and LW (428 μg SW g^{-1}) diet for 21 d with subsequent removal from locoweed for 5 d prior to oral exposure to SW. For sampling periods (acute and subacute) SW was delivered via oral gavage as a LW extract immediately following 0 h sampling. Blood samples were collected via jugular venapuncture every h for 0-12 h, every 3 h for 15-24 h, every 6 h for 30-48 h, and every 12 h for 60-168 h. Serum SW levels were determined via a-mannosidase inhibition assay (detection limit = 25 ng mL^{-1}). No treatment by exposure duration interactions ($P > 0.1$) were noted. Maximal serum SW concentrations were highest ($P < 0.05$) for the 0.8 mg treatment and lowest ($P < 0.05$) for the 0.2 and 0.4 mg treatments. The 1.6 mg treatment had slightly lower ($P < 0.05$) serum levels than the 0.8 mg treatment. Rate of SW absorption was not different ($P > 0.9$) with acute or subacute exposure. However, rate of serum clearance was longer ($P < 0.05$) for acute versus subacute exposure to LW, indicating a longer serum SW half-life with previous exposure to LW. The data indicate multiple compartments involved in SW kinetics likely exist, serum has a maximal capacity for SW, and previous exposure to SW might alter its toxicokinetics. Further research is needed using more sensitive measures of serum SW detection before concrete recommendations on SW exposure and necessary withdrawal periods can be made.

Key Words: Swainsonine, Toxicokinetics, Locoweed

101 Primary postmortem findings in catheterized vessels in sheep. M.L. Barraza*[1], J.R. Strickland[2], H. Zepeda[3], and C.R. Krehbiel[4], [1]*Universidad A. de Ciudad Juarez,* [2]*New Mexico State University,* [3]*Texas Tech University,* [4]*Oklahoma State University.*

Three sheep with chronic indwelling catheters were used for necropsy and pathology studies. Sheep was surgically implanted with four catheters each. Catheter placement included the hepatic portal vein (**PVC**), hepatic vein (**HVC**), distal mesenteric vein (**MVC**) and a mesenteric artery (**MAC**). Catheters were composed of Tygon (polytetrafluoroethylene). In each sheep, 3 catheters were used to collect blood samples (PVC, HVC, and MAC) in a locoweed toxicity experiment and one (MVC) was used to infuse para-aminohippurate to measure plasma flow. Once catheterized, indwelling catheters were maintained for a total of 71d before necropsy. Postmortem observations showed that no catheter was disrupted or displaced from the planned site. Catheter failure coincided with a particular postmortem finding, which suggested the cause of dysfunction. Chronic, hardened clots that progressed inside of two catheters, explained their dysfunction. Another catheter presented a sacciform hyperplasia at its tip while another presented a polypoid hyperplasia at the orifice of its tip. Neoplasms showed the most evident and permanent blockages of these catheters. Apparently, continual mechanical actions of the catheters associated with infection and other uncharacterized factors provoked different tissue responses that impeded their functionality. Current literature presents little information regarding these anormalies in experimental animals. This is one of the first reports regarding complications of surgically implanted catheters on experimental sheep. Further necropsy and pathology studies will be conducted to help expand the knowledge of catheter failures in experimental animals.

Key Words: Sheep, Catheterization, Necropsy

102 Swainsonine effects on para-aminohippuric acid clearence in wethers consuming a locoweed/blue grama hay diet. M.A. Siepel*[1], J.R. Strickland[1], A.K. Clayshulte[2], R.A. Ashley[2], and M.D. Remmenga[1], [1]*New Mexico State University,* [2]*Colorado State University.*

Para-aminohippuric acid (**PAH**) is used to measure blood flow through splanchnic tissues during nutrient flux studies. The study of the effects of swainsonine (**SW**) on nutrient flux through the splanchnic tissues is one of our primary research focuses. However, it is unclear whether SW may impair PAH clearance in orally exposed animals. Therefore, this study was conducted to test the subacute effects of SW at two levels (0.2 and 0.8 mg SW kg^{-1} BW) on PAH clearance in wethers consuming locoweed and blue gramma hay diet. Fourteen sheep (BW= 60.1 ± 6.4 kg) were stratified by weight and assigned to one of three treatments: 1) 0.8 mg SW kg^{-1} BW (HI), 2) 0.2 mg SW kg^{-1} BW (LO), or 3) no SW. The sheep were fed diets of locoweed (used to deliver the SW) and blue gramma hay for 21 d prior to PAH infusion. Blood was drawn via jugular venapuncture immediately prior to PAH infusion (0 min). Para-aminohippuric acid was infused (20 mL of 5% PAH solution; pH= 7.4) into the jugular vein. Following infusion, blood was collected at 5-min intervals from 5 to 30 min and 10-min intervals from 30 to 60 min. No differences ($P > 0.5$) were detected for rate of elimination (range = 0.097-0.109 min^{-1}), elimination half-life (range = 6.62-7.24 min), apparent volume of distribution for the central compartment (range = 7.14 -9.72 L), and clearance (range= 0.73-0.92 L min^{-1}). These data indicate that SW has no effect on the toxicokinetics of PAH. Thus, PAH should be useful as a blood flow marker in sheep consuming locoweed.

Key Words: Para-aminohippuric Acid, Toxicokinetics, Locoweed

103 Effect of time and duration of MGA prefeeding on estrous response and pregnancy rate in beef heifers when synchronized with Select-Synch . D. S. Baker, W. M. Mackay*, J. C. Whittier, M. Osborne, and P. D. Burns, *Colorado State University, Fort Collins, CO.*

Crossbred beef heifers (n=90) were used to compare the efficacy of three estrous synchronization protocols. Heifers were blocked by weight and assigned to one of three treatments as follows: 1) Select-Synch (SS) (n=62), 2) 7 d Melengestrol Acetate (MGA)/Select-Synch (7SS) (n=61), or 3) 14 d MGA/Select-Synch (14SS) (n=67). Body condition score, reproductive tract score, and pelvic measurement did not differ at the start of the trial. MGA, fed at a rate of 0.5mg/hd/d, was discontinued 1 d and 12 d prior to GnRH administration for 7SS and 14SS, respectively. Heifers were observed closely for estrus beginning 24 h prior to PG injection to 126 h post PG injection. Individuals exhibiting standing estrus were bred to AI, using sexed semen, approximately 12 h after first exhibiting estrus. Estrous response varied among treatments (P < 0.05; 7SS=80.3% (56/62); SS=90.3% (49/61); 14SS=95.5% (64/67)) with more heifers in 7SS exhibiting premature estrus (pre PG injection) than in the other two treatments. In the period of peak estrous response (48 h to 96 h post PG injection) this trend was reversed with fewer heifers (P < 0.05) exhibiting estrus in 7SS. Pregnancy rate to AI for heifers detected in estrus did not differ by treatment, 58.9% (33/56), 44.9% (22/49) and 56.3% (36/64) for SS, 7SS and 14SS, respectively. However, overall pregnancy rate to AI, which included heifers not detected in estrus, was higher (P < 0.05) in 14SS heifers (53.7%, 36/67) than in 7SS heifers (36.1%, 22/61). The SS treatment also tended to perform at a higher level (P < 0.06) than 7SS in relation to overall pregnancy rate to AI, 53.2% (33/62) vs. 36.1% (22/61). In conclusion, 7SS had lower AI pregnancy rates than SS or 14SS. This is likely attributed to the elevated estrous response observed in 7SS prior to PG injection and to the elevated estrous response in SS and 14SS during the peak estrous period.

Key Words: Beef Heifers, Synchronization of Estrus, Melengestrol Acetate

104 Using body surface temperature to predict calving. C.L. Coppola*[1], R.J. Collier[2], and R.M. Enns[1], [1]*Colorado State University,* [2]*University of Arizona.*

Body core temperature is a key indicator of an animal's health and reproductive status. Body surface temperature can be measured using infrared devices. In this study, effectiveness of infrared technology to predict calving via surface temperature monitoring was evaluated. Fifty

multiparous and primiparous Brown Swiss (n=29) and Holstein (n=21) gestating cows were monitored daily beginning 14 days prior to predicted calving date. Predicted calving dates ranged from July 1, 2000 to October 28, 2000. Surface temperature measurements of the eye, side and udder were recorded daily until calving. Eye and side temperatures were measured using an infrared thermography camera and udder temperatures were measured using both an infrared thermography camera and an infrared temperature gun. A prepartum drop in udder and side surface temperature was detected by infrared camera approximately 2 days prior to parturition ($P < 0.05$). Significant sources of variation for side and udder temperatures, included breed, parity, solar radiation and air temperature. Sex of calf had no effect on any surface temperatures measured ($P > 0.05$). As parturition approached, all surface temperatures gradually declined until the final two days before calving when it dropped more precipitously. The overall two-day decrease ranged from 0.3°C to 1.1°C with the greatest decrease for side surface and the least for eye surface. Results from this study agree with previous studies indicating a prepartum decline in core temperature. However, we failed to identify sex of calf as a major factor affecting maternal temperature prior to calving. In summary, a decrease in udder and side surface temperature can be detected prior to calving utilizing infrared thermography. However, the infrared temperature gun was not sufficiently accurate in detecting a decrease in surface temperature from the udder to prove useful as an on farm diagnostic aid.

Key Words: Parturition, Dairy Cattle, Body Temperature

105 Use of MGA or MGA plus ECP to resynchronize estrus in previously inseminated beef heifers of unknown pregnancy status.

S.K. Johnson* and J.S. Stevenson, *Kansas State University*.

A study was conducted on 439 yearling beef heifers to determine whether or not estrus might be resynchronized in previously inseminated heifers to accommodate a second AI early in the breeding season. The initial insemination followed a standard MGA + PGF synchronization protocol; 0.5 mg·hd·$^{-1}$d^{-1} of MGA for 14 d and 25 mg of PGF 19 d after the last day of MGA feeding. Resynchronization treatments were: 1) no further treatment (Control; n=87); 2) MGA (MGA; n=176) fed at 0.5 mg·hd·$^{-1}$d^{-1} from d 13 (day 0 = mean day of previous insemination) through d 19; and 3) MGA+ECP (n=176), same as the previous treatment plus 0.5 mg (i.m.) of estradiol cypionate administered on d 13 and 20. Heifers were observed for estrus at least twice daily from d 0 to 33 and reinseminated according to the AM-PM rule. Heifers returning to estrus before d 8 were not included in the resynchronization treatments. Resynchronization treatments had no negative effect on the pregnancy rates resulting from the initial insemination; 58/87 (67%), 132/176 (75%) and 112/176 (64%) for Control, MGA, and MGA+ECP, respectively. Mean hours from the second ECP injection to estrus tended to be less for Control than for MGA or MGA+ECP; 54 9, 72 6 and 74 5, respectively. Greater ($P<0.05$) proportions of Control than MGA or MGA+ECP heifers were in estrus before and during MGA feeding. MGA appeared to delay estrus after the MGA and MGA+ ECP treatments because 14% of heifers in each treatment were in estrus more than 25 d after the first insemination, whereas none of the Controls were in estrus during this period. Conception rates were greater in Control (19/25; 76%) than MGA (18/39; 46%; $P<0.05$) or MGA + ECP (28/51; 55%; $P<0.09$) heifers. Total pregnancy rates resulting from the 1st and 2nd AI did not differ among treatments. Percentages that returned to estrus were not increased after either MGA treatment and return to estrus was delayed compared to Controls. Conception rates were reduced by MGA treatment.

Key Words: Resynchronization, Heifers, MGA

106 MGA®Select improves estrous response in postpartum beef cows in situations accompanied with high rates of anestrous.

D. J. Patterson*, J. E. Stegner, F. N. Kojima, and M. F. Smith, *University of Missouri, Columbia, MO/USA*.

This experiment was conducted to determine whether MGA®Select improves estrous response and synchrony in postpartum beef cows compared to a 14-19 d melengestrol acetate (MGA)-prostaglandin $F_{2\alpha}$ (PG) treatment. Cows were assigned by age, body condition score (BCS), and days postpartum (dpp) to one of two treatments. MGA®Select (n=101) and MGA-PG cows (n=100) were fed MGA (0.5 mg·hd^{-1}·d^{-1}) for 14 d followed by PG (25 mg Lutalyse) 19 d after MGA withdrawal. MGA®Select cows received GnRH (100 μg Cystorelin) 12 d after MGA withdrawal and 7 d before PG. Mean BCS (5.3 ± 0.1; 5.2 ± 0.1) and dpp (43.7 ± 1.4 d; 43.7 ± 1.6 d) did not differ prior to treatment for MGA®Select and MGA-PG cows, respectively. Blood samples for progesterone were collected 10 d before and on the first day of MGA to determine pre-treatment cyclicity. Cows were observed for signs of behavioral estrus with HeatWatch for 7 d after PG, and AI was performed 12 h after estrus. Estrous response was higher ($P < 0.05$) in MGA®Select (87%) than MGA-PG (76%) cows. Differences in estrous response were greater among cows ≥ 5 yr of age assigned to MGA®Select (88%) compared to MGA-PG (67%). Pre-treatment cyclicity status of cows ≥ 5 yr of age was 15%, versus 37% for cows ≤ 4 yr of age ($P < 0.01$). Variances associated with synchrony of estrus were compared by performing an F-test and differed between treatments ($P < 0.06$). The mean interval to estrus after PG was 74.5 ± 1.8 h and 80.4 ± 2.3 h for MGA®Select and MGA-PG cows, respectively ($P < 0.04$). Synchronized pregnancy rate (SPR) did not differ ($P > 0.1$) between MGA®Select (66%, 67/101), and MGA-PG cows (58%, 58/100); however, SPR was higher ($P < 0.01$) among MGA®Select cows ≥ 5 yr of age (71%) than MGA-PG contemporaries (46%). These data indicate that MGA®Select improves estrous response in postpartum beef cows in situations associated with high rates of anestrus, and provides the opportunity to improve pregnancy rate during the synchronized period following treatment. (Supported by USDA-NRI 00-35203-9175 and Select Sires, Inc.)

Key Words: Beef Cows, Estrous Synchronization, Progestin

107 An evaluation of the MGA-Select treatment to synchronize estrus in postpartum beef cows.

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The objectives of this study were to evaluate practical consumption of MGA in an extensive range grazing setting and to assess pregnancy rates among cows receiving the MGA-Select estrous synchronization protocol, either with or without an injection of GnRH and a fixed time AI (TAI) at 72 h after PG. Suckled, multiparous Angus cows (n=376, post partum interval=75 d, BCS=5) were fed MGA (target consumption .5 mg x hd^{-1} x d^{-1}) which was delivered at a rate of 1.3 kg x hd^{-1} x d^{-1} in a 2.2 cm range cube for 14 d. Once per d cows were called in from 900 hectares of rolling to steep native grassland using vehicle horns and other devices. Cows that could be seen from the vehicle were fed in several areas following established grazing patterns. Twelve d after the last d of feeding, all cows were injected with GnRH (100 μg), which was 1 week prior to an injection of PG (25 mg) to synchronize estrus. Calves were removed at the injection of PG for 72 h. Estrus was detected for one h, twice per d, from -24 h PG to +72 h PG and cows were inseminated 12 h later. Cows not detected in estrus by 72 h following PG were time inseminated either with (TAI + GnRH) or without a second injection of GnRH (TAI). We estimate that 60-70% of cows ingested MGA daily, based on kg fed per d. The 72 h estrous response was 57.4% with 5% of cows exhibiting estrus 24 h prior to the injection of PG or the day of PG. Pregnancy to AI following estrus was 67.5% and pregnancy to TAI did not differ ($P > 0.4$) between cows given GnRH (n=65; 25%) or not given GnRH (n=75; 27%). Overall pregnancy rates were not different ($P > 0.2$) between cows injected with GnRH (88%) or not injected with GnRH (84%). Because 5% of cows displayed estrus prior to or the day of PG, pre-feeding MGA did not prevent early estrus. However, we hypothesize that the consumption of MGA in an extensive range setting may not be enough to fully suppress estrus and therefore ovulation during the period of feeding. Also, we conclude that a second injection of GnRH to cows receiving this protocol adds no benefit to conception rates.

Key Words: MGA , Estrous Synchronization, GnRH

108 Effects of feeding high linoleate Safflower seeds prepartum on leptin concentration, weaning, and re-breeding performance of beef heifers.

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Our objective was to identify potential mechanisms by which prepartum diets high in linoleic acid increase calf weaning weight and heifer re-breeding performance. Thirty-six Angus and Hereford-Angus heifers that conceived on the same day to one sire were stratified by weight

(436.1 ± 27.8 kg) and body condition score (BCS, 4.4 ± 0.7) and within strata assigned to receive a prepartum diet high in linoleic acid (S) or control (C) diet. Diets were isocaloric and isonitrogenous. Heifers were fed in pens of six from d -56 until calving. At calving, heifers were housed together and fed the same diet for the duration of the study. Blood samples were collected on d -56, -42, -28, -14, -10 to d 3, and twice weekly from d 0 (calving) to d 172 postpartum. Hip height, BW, BCS, and ultrasound fat depth were measured every 28 d. Heifers were exposed to one bull from d 126 to 175 and examined for pregnancy by ultrasound on d 172 and 209. Ultrasound and twice weekly progesterone measurements were used to estimate date of conception. Weight and BCS at calving did not differ (P > 0.10) between heifers fed S (455 kg, 5.8) or C (445 kg, 5.8). Calf birth weight and dystocia score did not differ (P > 0.10) between heifers fed S or C, but calf vigor was greater (P < 0.05) in calves born to heifers receiving S. Weight, BCS, fat depth over the back and rump, hip height:weight, and serum leptin concentrations were not affected (P > 0.10) by treatment or treatment by day interaction. Pregnancy rate, postpartum interval, and interval from calving to conception did not differ (P > 0.10) between heifers fed S (81%, 129 d, and 137 d) or C (88%, 130 d, and 140 d). Calf weaning weights adjusted for age and sex were similar between heifers fed S (241 ± 18 kg) vs C (232 ± 32 kg). We were unable to identify differences between heifers fed S vs C and thus, unable to investigate potential mechanisms of action related to previously reported improvements in re-breeding and weaning performance.

Key Words: Linoleic Acid, Leptin, Heifers

109 Influence of supplementation with safflower seeds on prostaglandin F metabolite in serum of postpartum beef cows.

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Prostaglandin $F_2\alpha$ produced during the postpartum interval has divergent effects upon the re-establishment of estrous cycles. Supplementation with oils reportedly influences postpartum fertility by increasing $PGF_2\alpha$ synthesis. The objective of these experiments was to determine if oil supplements that differ in fatty acid composition differentially influence serum concentrations of the specific $PGF_2\alpha$ metabolite, PGFM. In trial 1, 36 primiparous beef cows were individually fed control (C; corn/soybean meal), high linoleate (L) or high oleate (O) cracked safflower seed supplements for 92 days postpartum. Supplements were isonitrogenous and had equal amounts of TDN. Safflower seed supplements provided 5% of DMI as fat. All animals had ad libitum access to native grass hay, trace mineralized salt, and water. Serum concentrations of PGFM were influenced by day ($P < 0.001$) and declined from 600 ± 33 pg/mL at day 25 to 363 ± 42 pg/mL by 92 days postpartum. Overall, serum concentrations of PGFM were greater ($P \leq 0.04$) in L (647 ± 62 pg/mL) than O (371 ± 68 pg/mL) or C (452 ± 68 pg/mL) supplemented heifers. No significant ($P = 0.13$) day x treatment interactions were detected. In trial 2, 24 multiparous beef cows were individually fed control (C2; beet pulp/soybean meal) and high linoleate (L2) safflower supplements (5% fat) for 80 days postpartum. Native grass hay was individually fed based upon initial body weight. The diets were formulated to be isonitrogenous and had equal amounts of TDN. As in trial 1, serum concentrations of PGFM were influenced by treatment. Concentrations were greater ($P < 0.001$) in L2 (469 ± 24 pg/mL) than in C2 (328 ± 23 pg/mL) cows. Significant day ($P = 0.12$) or treatment x day effects ($P = 0.83$) were not detected. Although potential impacts on reproductive performance remain to be determined, dietary oil supplements high in linoleate increased serum concentrations of PGFM compared to oleate or control supplements.

Key Words: Oil, Cow, PGFM

110 Influence of short-term fasting on thyroxine and insulin secretion in ewes.

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Mature ewes were used to determine if elevated serum concentrations of progesterone associated with feed restriction during the luteal phase of the estrous cycle could be caused by a reduction in the secretion of thyroxine. Estrous cycles of mature ewes were synchronized and animals were randomly assigned to fasted (n = 10) or control (n = 10) groups. Control ewes were fed ad libitum. Fasted ewes were not fed from day 7 to 11 of their estrous cycle. On day 12, all ewes were treated with $PGF_2\alpha$ and returned to ad libitum feed. Blood samples were collected daily from days 7 through 12 to monitor circulating concentrations of progesterone. Additional samples were collected at 15-minute intervals for 2 h from all animals on days 7, 11 and 12 and twice daily on days 13 to 15 to monitor concentrations of thyroxine and insulin. By day 9, serum concentrations of progesterone were greater ($P < 0.001$) in fasted than control ewes and on day 12 averaged 7.4 ± 0.3 and 3.0 ± 0.3 ng/mL in fasted and control ewes, respectively. Insulin concentrations were influenced by day ($P < 0.001$), but not treatment ($P = 0.89$). However, a significant ($P > 0.001$) fasting x day interaction was detected. Concentrations of insulin averaged 2.8 ± 0.2, 3.0 ± 0.2, 1.9 ± 0.2, and 2.5 ± 0.2 ng/mL in control ewes and 3.0 ± 0.2, 1.6 ± 0.2, 1.8 ± 0.23 and 3.1 ± 0.26 ng/mL in fasted ewes on days 7, 11, 12 and 13, respectively. Change (percentage of day 7 concentrations) in serum thyroxine was influenced by fasting ($P < 0.05$) and day ($P < 0.001$). Serum concentrations of thyroxine on days 11 through 15 in control and fasted ewes, respectively, averaged 88.6 ± 3.0 and 79.0 ± 3.3 percent of values detected prior to the initiation of treatments on day 7. In summary, it is suggested that the elevated concentrations of progesterone detected in ewes fasted during the luteal phase of the estrous cycle may be a result of decreased metabolism as reflected by changes in concentration of the metabolic hormones, thyroxine and insulin.

Key Words: Fasting, Thyroxine, Progesterone

111 Effects of varying energy intake and sire breed on duration of postpartum anestrus, IGF-1 and GH in mature crossbred cows.

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Objectives of this study were to evaluate effects of sire breed (BREED; Angus, Hereford, Shorthorn, Galloway, Longhorn, Nellore or Salers) and level of daily metabolizable energy intake (DMEI; 132 or 189 kcal ME/kg metabolic BW or ad libitum) on postpartum anestrus and nutritional status in F1 cows out of Angus or Hereford dams (6 to 8 cows/BREED/DMEI). Circulating concentrations of progesterone in weekly blood samples collected 2 to 14 wk after calving were used to predict length of postpartum anestrus. Concentrations of IGF-1 and GH were determined at wk 2, 4, 8, and 14 to evaluate changes in nutritional status (i.e., high GH and low IGF-1 indicates negative energy balance). Within cow linear regressions were used to estimate intercepts and slopes for IGF-1 and GH. Analyses of variance were used to evaluate fixed effects of BREED, DMEI, and interaction of BREED and DMEI on length of anestrus, and slopes and intercepts of IGF-1 and GH. Length of anestrus was affected by DMEI in Galloway, Longhorn, and Nellore sired cows, but not other breeds (P < 0.02 for interaction of BREED and DMEI). Intercept for IGF-1 was affected by BREED (P < 0.001) and DMEI (P < 0.01). Intercept for IGF-1 was largest for Nellore (19.5), intermediate for Longhorn (16; P < 0.05 vs others), and smallest (12 to 13), but not different among remaining sire breeds. Intercept for IGF-1 was larger in ad libitum fed cows (16) than 189 kcal (13.7) or 132 kcal (12.7) fed cows. Slope of IGF-1 changed from a negative value (i.e., decreasing concentrations over time, indicating negative energy balance) towards a positive value as DMEI increased, but magnitude of change between levels of DMEI varied by BREED (P < 0.12 interaction of BREED and DMEI). Concentrations of GH increased at a greater rate over time in cows fed 132 kcal than cows fed 189 or ad libitum DMEI (P < 0.01 for DMEI effect on slope). Breed of sire influenced length of postpartum anestrus and energy balance (as predicted by IGF-1) in crossbred cows fed restricted levels of DMEI.

Key Words: Breed, Energy, Estrus

112 Effects of exposure to bull or excretory products of bulls on the breeding performance of first-calf restricted suckled beef cows using a modified CO-Synch protocol.

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The objective of this study was to evaluate breeding performance of first-calf restricted suckled beef cows exposed to a bull or excretory products of bulls using a modified CO-Synch protocol. Two-yr-old Angus X Hereford cows were allotted randomly on d 35 2 d (SEM; d 0) after calving to one of four treatments: 1) not exposed to a bull (**NE**, n = 16); 2) continuously exposed to a bull (**BE**, n = 15); 3) exposed to

excretory products of bulls (**EPB**, n = 16); and, 4) exposed to excretory products of cows (**EPC**, n = 14). EPB and EPC cows were placed into enclosures for 12 to 14 h, between 1830 and 0800 h daily. Each enclosure was occupied by bulls (EPB) or left empty (EPC) for 10 to 12h (0800 to 1830 h) daily. All cows were restricted to suckling twice daily beginning d 0. Cows had been in their treatments for 63 2 d at the start of the CO-Synch protocol. Each cow was given GnRH (100 μg) on d -10, followed by PGF_{2a} (25 mg) 7 d later (d -3). Cows were observed for estrus daily (0700 and 1900h). Cows that exhibited estrus on d -2 and -1 were inseminated by AI 12 h later. Cows that failed to show estrus by 60 h after PGF_{2a} were given GnRH (100 μg) on d 0 and inseminated by AI at this time (72 h after PGF_{2a}). Cows remained in their treatments for 5 d after timed AI. Each cow was examined ultrasonically for the presence of an embryo on d 33. Percentages of cows cycling on d -10 was lower ($P < 0.05$) for NE cows than for EPC, BE, and EPB cows. Proportions of cows that showed estrus after PGF_{2a}, or were timed AI did not differ ($P > 0.10$) among treatments. Pregnancy rates (PR) did not differ ($P > 0.10$) among treatments for cows bred 12 h after estrus, however, were higher ($P < 0.05$) than PR of NE cows bred at timed AI. Pregnancy rate of BE cows bred at timed AI was higher ($P < 0.05$) than that of NE cows, while PR for EPC and EPB cows were intermediate between BE and NE cows bred at timed AI. Exposing postpartum cows to bull or excretory products of bulls increases the of number of cycling cows postpartum for synchronization treatments and AI.Pregnancy rates after timed insemination using a modified CO-Synch protocol were improved by the continued physical presence of a bull.

Key Words: Postpartum, Biostimulation, CO-Synch

113 Effect of incorporating a low dose of estradiol cypionate (ECP) into a timed artificial insemination protocol on estrous behavior and conception rates in beef cattle.

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There is evidence that the induction of ovulation by GnRH during proestrus, as occurs in OvSynch (OVS) breeding protocol [GnRH-7d→PGF2α-2d→GnRH→Timed AI], may impair ovarian estradiol secretion and shorten the subsequent luteal phase in cattle. It was hypothesized that administration of small dose of estradiol 17β at the time of the second GnRH injection would effectively synchronize ovulation and improve conception rate. The objective was to determine the effect of low dose ECP® incorporation into OVS on expression of estrus and conception rate in beef cattle. Seventy British cross-bred cows (55-60 d postpartum) received intramuscular (i.m.) injection of 25mg PGF2α (d -14). Fourteen days later 100 ug GnRH was administered (i.m.;d 0) followed by 25mg PGF2α on d 7. On d 9 cows were assigned randomly to receive either GnRH + 0.25mg ECP® (OVS-ECP; n=35) or GnRH + vehicle (OVS; n=35). All cows were artificially inseminated (AI) 12-15 h post treatment by a single AI technician. Estrus activity was monitored 3 times daily after PGF2α administration and pregnancy determined by ultrasonography 40 and 60 d post-insemination. Four cows exhibited estrus the day before AI. More cows ($P < 0.05$) were detected in estrus in the OVS-ECP group (46%) compared to the OVS group (26%). Conception rate from AI was 80% and 66% for OVS-ECP and OVS, respectively ($P = 0.16$) and was not different between d 40 and d 60 post-insemination. These results suggest that incorporation of a low dose of ECP® into conventional OVS increases estrous behavior and may improve conception rate.

Key Words: Timed AI, Estradiol Cypionate, Conception Rate

114 Evaluation of thermal status of cattle using infrared thermography.

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Thermal stress can adversely effect lactation and growth in cattle. Obtaining core temperatures is difficult under practical management conditions and requires animal restraint or use of expensive telemetry equipment. An alternative is to directly measure an animal/s surface temperature. In this study, infrared devices, camera and temperature gun, were used to evaluate their ability to identify an animal in heat stress. Four hundred Jersey cows were split into two treatment groups, cooled and non-cooled and within each treatment half received bovine somatotropin (bST). Respiration rates (RR), side and udder surface temperatures were taken between 1 and 4 pm on eight randomly chosen animals from each treatment group using an infrared camera and gun. The study period was from June 19 to Sept. 9, 2000, average temperature 34°C with average relative humidity 32%. All surface temperature measurements affected respiration rate ($P<0.05$) and therefore the classification of heat stress (RR >85 breaths/min). Temperature Humidity Index, bST treatment and cooling treatment were also found to influence respiration rate ($P<0.05$). Milk production the day preceding measurements and stage of pregnancy did not have an affect on respiration rate ($P>0.05$). Cooling lowered all surface temperature measurements and advancing pregnancy was associated with decreasing side but not udder surface temperatures. Use of bST to increase milk yield was not associated with an increase in body surface temperatures ($P>0.05$). As ambient temperature increases respiration rates increase as well. This trend was shown in all treatment groups. When surface temperature increased in cooled and non-cooled treatments (37.8°C vs 35.5°C) respiration rates also increased. The respiration rate for non-cooled cows was greater than cooled cows (102 breaths/min vs 80 breaths/min, $P<0.05$). We conclude that it is possible to evaluate thermal status of cattle without restraint using infrared thermography. Based on the relationship between surface temperature and respiration rate, side surface temperature below 35°C is required to maximize heat loss and to avoid increased core temperature and respiration rate.

Key Words: Heat Stress, Dairy Cattle, Body Temperature

115 Dexamethasone (DEX) effects on Pig Lymphocyte Proliferation and Immunoglobulin M (IgM) Production *in vitro*.

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This study investigated the effect of DEX, on concanavalin (ConA)- and pokeweed mitogen (PWM)-induced lymphocyte proliferation and IgM production. Blood from crossbred pigs (n=3/experiment; 45 days of age) was subjected to density gradient centrifugation and isolated lymphocytes plated at 1 X 10^5 cells/well in Dulbecco's Modified Eagles Medium/F12 containing 10% Fetal Bovine Serum, 2 mM L-glutamine, ConA (0-5 ug/ml), PWM (0-300 ng/mL) and/or DEX (0 to 10^{-6} M). Cells were incubated for 96 h and proliferation determined using the CellTiter proliferation assay (Promega, Madison, WI). In replicate cultures, IgM production was determined using an ELISA specific for pig IgM. ConA and PWM induced dose-dependent ($P<0.01$) increases in proliferation with maximal effects occurring at 0.6 ug/mL and 7.5 ng/mL, respectively. However, the extent of proliferation was greater ($P<0.05$) for cells treated with PWM (6.7 vs. 5.9, SEM=0.1 stimulation index for PWM vs. ConA, respectively). Regardless of the mitogen concentration used, DEX dose-dependently ($P<0.01$) inhibited proliferation with maximal effects occurring at 10^{-9} M. However, increased concentrations of ConA and PWM reduced the suppressive effects of 10^{-10} M DEX (0.3 vs 0.8, SEM=0.1 inhibition index for 0.3 vs 1.25 ug/mL ConA and 0.2 vs 0.5, SEM=0.1 inhibition index for 1.8 vs 7.5 ng/mL PWM, respectively). Similar to the effects on proliferation, ConA and PWM dose-dependently increased ($P<0.01$) IgM production by lymphocytes with maximal effects occurring at 2.5 ug/mL and 75 ng/mL, respectively. However, the extent of IgM production was greater ($P<0.05$) for cells treated with ConA (1.5 0.9 vs 0.7 2 ug/mL for ConA vs PWM, respectively). Similar to the effects on proliferation, when cells were stimulated with low concentrations of ConA (0.6 ug/ml) or PWM (37.5 ng/mL) DEX dose-dependently inhibited ($P<0.01$) IgM production with maximal inhibition occurring at 10^{-8} M. In contrast, in cultures treated with 2.5 ug/ml ConA or 150 ng/mL PWM, DEX (10^{-10} M) increased ($P<0.05$) IgM production by 1.3- and 1.6-fold. Collectively, these results demonstrate that glucocorticoids have primarily a suppressive effect on lymphocyte proliferation, but can augment immunoglobin production depending on both the degree of mitogen stimulation and glucocorticoid concentration.

Key Words: Lymphocyte, Glucocorticoid, Lectin

116 Effects of introduction of bulls at different days postpartum and restricted suckling on resumption of ovarian cycling activity in first-calf beef cows. J.G. Berardinelli*, P.S. Joshi, K. Anderson, R. Robison, and R. Adair, *Montana State University, Bozeman, MT, 59717.*

The objective of this study was to evaluate postpartum resumption of ovulatory cycles among first-calf beef cows that were suckled continuously or restricted to twice daily suckling and exposed continuously to mature bulls beginning at various intervals after calving. The hypothesis tested was that proportions of cows cycling did not differ among cows exposed **(BE)** or not exposed **(NE)** to bulls, and suckled continuously **(CS)** or restricted to suckling twice daily **(RS)** beginning on d 15, 35, or 55 postpartum. Angus X Hereford cows (n = 53) were assigned randomly to one of 12 treatments in a 2 (exposure type) x 2 (suckling type) x 3 (d exposed postpartum; **DEPP**) factor arrangement. RS cows were restricted to suckling twice daily for 30 min (0730 and 1830) beginning on d 15, 35, or 55 (designated d 0, respectively). Blood samples were collected from each cow starting on d -1, and every third d until the end of experiment. A rise in progesterone of > 0.5 ng/ml in three consecutive samples was used as evidence of resumption of cycling activity. RS did not affect ($P > 0.10$) proportions of cows in any treatment resuming cycling activity and data were pooled. Proportions of cows resuming cycling activity did not differ ($P > 0.10$) among DEPP for either BE or NE cows; however, the proportion of BE cows that resumed ovarian cycling activity was higher ($P < 0.05$) than that for NE cows for each DEPP. There was an interaction ($P < 0.05$) between exposure type and DEPP in the cumulative distribution for percentage of cows resuming cycling activity in 10-d intervals. Proportions of BE cows cycling that were exposed to bulls on d 15, 35, or 55 increased sooner ($P < 0.05$) than NE cows exposed to bulls during the first 40 d after d 0. More ($P < 0.05$) BE cows exposed to bulls on d 55 resumed cycling activity by 30 d after exposure than BE cows exposed to bulls on either d 15 or 35 postpartum. The effect of bulls on increasing the proportions of first-calf beef cows that resumed ovarian cycling activity was independent of type of suckling. Whereas, cows exposed to bulls later (d 55) in the postpartum anestrous period appeared to respond more rapidly to the biostimulatory effect of bulls than if they were exposed earlier in the postpartum anestrous period.

Key Words: Postpartum, Biostimulation, Bull

RUMINANT NUTRITION

117 Effects of concentration and source of trace minerals on performance, immunity, mineral and lipid metabolism and carcass characteristics of beef steers. A.R. Rhoads*, T.L. Stanton, T.E. Engle, and C.V. Kimberling, *Colorado State University.*

An experiment was conducted to determine if mineral status of steers entering the feedlot affected performance, immunity, carcass characteristics and fatty acid profile of the *longissimus* muscle when fed different sources and concentrations of trace minerals. Prior to weaning, calves had access to either a copper (Cu)-inadequate (n = 139) or Cu-adequate (n = 157) free choice mineral for approximately 225-d. Upon entering the feedlot, steers were stratified by previous treatment, blocked by initial weight and breed, and randomly assigned to pens and treatments. Receiving phase whole diet mineral treatments consisted of: 1) 2xNRC organic mineral from Availa-4, 2) 1xNRC organic mineral from Availa-4, 3) 3xNRC inorganic mineral, or 4) 6xNRC inorganic mineral. Minerals referred to in treatment groups are Cu, Zn, Mn, and Co. Steers were stepped up to a high-concentrate corn-alfalfa diet. Finishing phase whole diet mineral treatments consisted of: 1) 1xNRC organic mineral, 2) 1.5xNRC organic mineral, 3) 1.5xNRC inorganic mineral, or 4) 3xNRC inorganic mineral. Four pens from each treatment were slaughtered at a commercial abattoir after being fed for a period of 198 or 230 d. Average daily feed intake (ADFI) was reduced ($P < 0.0001$) with inorganic mineral supplementation. Antibody titers for Infectious Bovine Rhinotracheitis (IBR) were similar ($P > 0.05$) between treatments during the receiving phase. Hepatic Cu stores increased ($P < 0.0001$) with elevated concentrations of Cu in the diet. Plasma Cu and Zn concentrations were similar ($P > 0.05$) between treatments. Steers supplemented with 1.5xNRC organic mineral had higher ($P < 0.05$) C18:2 *cis9 trans11* fatty acids in *longissimus* muscle than those supplemented with 1.5xNRC inorganic mineral. These results indicate that trace mineral concentration and source had minimal effects on performance and immunity. However, it appears that different mineral sources may alter lipid metabolism in steers.

Key Words: Steers, Trace Mineral, Fatty Acid

118 Effect of high selenium feeds on selenium status in finishing beef steers. J. B. Taylor*[1], T. L. Lawler[2], J. W. Finley[3], and J. S. Caton[2], [1]*USDA, ARS, Dubois, ID,* [2]*North Dakota State University, Fargo,* [3]*USDA, ARS, Grand Forks, ND.*

Selenium status and deposition in edible muscle of beef cattle are greatly influenced by dietary Se. However, limited data are available describing these events in finishing steers consuming feeds naturally high in Se. Therefore, in order to assess the effects of high Se feeds (natural and artificial) on Se status, 45 cross bred steers (BW = 351.1 ± 24.1 kg) were stratified by BW and randomly assigned to one of four dietary treatments: Se adequate (CON; n = 12), or Se provided as high Se wheat (WHT; n = 11), high Se hay (HAY; n = 11), or selenate supplement (SEO; n = 11). Selenium content for WHT, HAY and SEO diets was 60 to 70 $\mu g \cdot kg^{-1}$ BW$\cdot d^{-1}$, and for CON, 7 to 12 $\mu g \cdot kg^{-1}$ BW$\cdot d^{-1}$. Diets were similar in feedstuff composition (25% wheat, 39% corn, 25% grass hay, 6% desugared molasses, and 5% wheat middling based supplement on a DM basis), isonitrogenous and isocaloric (14.0% CP, 2.12 Mcal $NE_m \cdot kg^{-1}$, and 1.26 Mcal $NE_g \cdot kg^{-1}$ DM), and offered once daily (15:00), individually to steers in a calan gate system. Beginning with d 0, BW was measured and plasma samples collected every 7 d until d 21 and every 21 d thereafter. Plasma Se for the first 21 d were 76.0, 144.3, 141.7 and 124.9 ± 9.1 ng$\cdot mL^{-1}$ for CON, WHT, HAY and SEO, respectively. All high Se treatments exhibited a quadratic ($P < 0.03$) increase in plasma Se from d 0 to 21; however, no changes ($P > 0.38$) were observed for CON. Plasma Se was not different ($P > 0.63$) between treatments on d 0 (79.2 ± 7.9 ng$\cdot mL^{-1}$), but on d 7, WHT and HAY, and on d 14 and 21, WHT, HAY and SEO were greater ($P < 0.03$) than CON. Plasma Se in HAY was also higher ($P < 0.02$) than SEO on d 14. Steer ADG were not different ($P > 0.33$) between treatments for the first 21 d and was 1.55, 1.65, 1.55 and 1.52 ± 0.11 kg$\cdot d^{-1}$ for CON, WHT, HAY and SEO, respectively. In conclusion, Se provided by WHT and HAY seemed to elevate plasma Se earlier (d 7 and 14) than SEO; however, by d 21, all high Se treatments were not different from each other and elevated over CON.

Key Words: Selenium, Wheat, Hay, Beef

119 Effects of time of daily cracked corn supplementation on site and extent of digestion in cattle grazing summer cool-season pasture. B. W. Hess*, P. A. Ludden, E. J. Scholljegerdes, and V. Nayigihugu, *University of Wyoming.*

Six Angus × Gelbvieh heifers (avg BW = 674 kg) and six Angus-crossed steers (avg BW = 586 kg) fitted with ruminal and duodenal cannulae were used to determine the effects of time of daily corn supplementation on site and extent of nutrient digestion. Beginning on July 5, 2000, cattle continually grazed a 6.5-ha pasture of predominantly bromegrass and received one of three supplement treatments: no supplement (CON); cracked corn (0.3% of BW) at 0600 daily (AM); or cracked corn (0.3% of BW) at 1800 daily (PM). Cattle were adapted for 14 d followed by 9 d of sample collections. Forage OM intake was reduced ($P = 0.02$) with PM corn supplementation and did not differ ($P = 0.33$) between AM and CON. However, total OM intake was greatest ($P = 0.03$) for AM-supplemented cattle and did not differ ($P = 0.22$) between PM and CON. Total flow of OM to the duodenum was greatest ($P = 0.03$) for AM-supplemented cattle, but duodenal flow of microbial OM was not affected ($P = 0.54$) by dietary treatment. Ruminal OM digestibility was less ($P = 0.05$) for AM (60.0%) compared to PM (66.4%) and CON (69.7%); however, OM digested in the rumen (g/d) did not differ ($P = 0.37$) among dietary treatments. Duodenal flow of microbial N and microbial efficiency were not affected ($P = 0.60$ to 0.98) by dietary treatment. Ruminal NDF digestibility and total tract N digestibility did not differ ($P = 0.25$ to 0.75) among treatments, but total tract OM digested was greatest ($P = 0.06$) for AM-supplemented cattle (9.3 kg/d) compared to PM (8.1 kg/d) and CON (7.6 kg/d). Substitution effects

were noted when cattle were given supplemental cracked corn in the PM. Although cattle supplemented in the AM had reduced ruminal OM digestibility, the AM-supplemented cattle had the greatest OM intake and total tract OM digestion. Thus, delivering grain supplements in the AM rather than in the PM will likely be a more effective means to improve production of cattle grazing summer pasture.

Key Words: Corn, Supplementation, Beef Cattle

120 Effect of degradable intake protein level on performance of cattle fed corn- or barley-based finishing diets.

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Two-hundred forty Angus x Salers steers (initial wt 381 ± 30 kg) were used in a randomized block design with a 2 x 3 factorial arrangement of treatments to determine the effect of grain type (corn and barley) and level of DIP on performance of finishing cattle. Cattle were blocked by weight and fed one of six dietary treatments twice daily. Treatments included corn- or barley-based finishing diets formulated to contain 11.5, 12.75 or 14% CP using soybean meal and urea. Grain was tempered (9% water added), then coarsely rolled. No differences were detected ($P > 0.05$) between treatments for initial weight, days on feed or internal fat. Corn-fed cattle had greater ($P < 0.05$) DMI, ADG, final weights and gain:feed than cattle fed barley-based finishing diets (9.89 versus 9.56 kg/d, 1.78 versus 1.52 kg/d, 602 versus 567 kg, and .179 versus .158, respectively). As dietary DIP levels increased, total gain and ADG increased linearly ($P < 0.05$). No effect ($P > 0.05$) of DIP level was detected for final weight and gain:feed. A grain type x DIP level interaction ($P < 0.05$) was detected for DMI. As DIP level increased in the barley diet, there was a quadratic effect on DMI, with DMI decreasing from 9.4 (low DIP) to 9.1 kg/d (medium DIP), then increasing to 10.2 kg/d (high DIP). Intake of DM for corn-based diets, however, only ranged between 9.8 and 10.0 kg/d across the DIP levels. Cattle fed corn-based diets had greater ($P < 0.05$) hot carcass weight, external fat, ribeye area, quality grade and yield grade than cattle fed barley-based finishing diets (373 versus 352 kg, 1.17 versus 1.04 cm, 35.6 versus 34.6 cm^2, 14.88 versus 13.35 [12-14 = low choice, 15 = choice] and 2.66 versus 2.45, respectively). External fat increased linearly as DIP level increased in the diets ($P < 0.05$). Growth performance variables of the grain type main effect were not interactive with DIP level, suggesting starch fermentability did not affect DIP requirement under the conditions of this experiment.

Key Words: Grain, Starch, Fermentability

121 Residual feed intake in beef steers: I. Correlations with performance traits and ultrasound measures of body composition.

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Residual feed intake (RFI), defined as individual variation from the regression of FI on BW and ADG, has been shown to be moderately heritable in cattle. Objectives of the study were to characterize RFI in growing steers and examine correlated responses with performance traits and ultrasonic measures of composition. Braunvieh-sired crossbred steers were individually fed a roughage-based diet (ME = 2.2 Mcal/kg; 13.7% CP, DM) using Calan feeders at College Station (N = 57) and McGregor (N = 112). Following 30 d of adaptation, weekly BW and daily FI were measured for 77 d. RFI was calculated as difference between actual FI and FI predicted from multiple regression of FI on mid-test $BW^{.75}$ and ADG. Ultrasound measures of 12th rib fat thickness (BF), longissimus muscle area (REA) and intramuscular fat (IM) were obtained on day 70. Overall, ADG, FI and RFI were 1.03 (SD = .21) kg/d, 9.74 (SD = 1.5) kg/d and 0.0 (SD = .82) kg/d, respectively. RFI was not correlated with final BW, ADG, REA or IM, but was correlated with FI (r = .60; P<.001), feed conversion ratio (FCR; r = .49; P<.001) and BF (r = .22; P<.01). FCR was correlated with ADG (r = -.72; P<.001) and initial BW (r = .29; P<.001), but not final BW, FI, BF, REA or IM. RFI of low (n = 56), medium (n = 57) and high (n = 56) one-third of steers were -.95, -.09 and .83 ± .07 kg/d. High RFI steers (low net feed efficiency) had higher (P<.001) FI (10.6 vs 8.9 ± .19 kg/d) and FCR (10.8 vs 8.8 ± .27), but similar ADG (1.02 vs 1.03 ± .03 kg/d) and final BW (324.7 vs 325.6 ± 5.3 kg) compared to low RFI steers. High RFI steers had greater (P<.05) BF (4.26 vs 3.93 ± .11 mm), but similar REA (53.9 vs 52.6 ± .9 cm^2) and IM (2.87 vs 2.84 ± .08%) compared to low RFI steers. Increased leanness may have contributed to enhanced feed utilization of low RFI steers, but the magnitude of this contribution was small.

Key Words: Net Feed Efficiency, Steers

122 Effect of Age and Grain Processing Method on Diet Digestibility of Beef Cattle.

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The objectives were to determine the effects of animal age (cows vs. calves) and barley processing method (whole vs. rolled) when fed as a supplement to medium quality grass hay (9.3% CP; 35% ADF, as fed basis), on diet and nutrient digestibility. Sixteen 31 mo old Angus crossbred cows (532 ± 27 kg) and 16 weaned steer calves (245 ± 24 kg) were used in a 2 x 2 factorial design. Cows and calves were individually fed using Calan gates for 25 d. Light test wt barley (19 kg/bu) was provided at 0.5% BW (2.7 $kg^{-1}\cdot cow^{-1}\cdot d$ and 1.25 $kg^{-1}\cdot calf^{-1}\cdot d$). Grass hay was provided to cows at 8.82 $kg^{-1}\cdot hd^{-1}\cdot d$ and to calves at 5.64 $kg^{-1}\cdot hd^{-1}\cdot d$. All animals received 0.23 $kg^{-1}\cdot hd^{-1}\cdot d$ of a 34.1% CP supplement. All animals were adapted to the diet and Calan gates over a 10 d period prior to beginning the experiment. Chromic oxide ($10g^{-1}\cdot hd^{-1}\cdot d$) was dosed orally via gelatin capsules from d 14 through 24 as an indigestible marker of digesta flow. Fecal grab samples were collected at 1400 h on d 21 through 24. Data were analyzed as a 2 x 2 factorial arrangement of treatments using the GLM procedure of SAS. The main effects of age and processing method were determined along with the corresponding interaction. Organic matter and N digestibilities (52.8 vs 43.3% and 39.2 vs 27.2%) were greater ($P < 0.01$) for calves compared to cows respectively. No treatment differences were observed for ADF and NDF digestibility. A processing method by age interaction was observed ($P < 0.05$) for starch digestibility. Processing method did not affect starch digestibility when fed to calves (avg of 80.7%), but rolled barley did dramatically improve starch digestibility when fed to cows (71.4% vs 23.3% for rolled vs whole). No differences were observed in starch digestibilities between cows and calves consuming rolled barley (71.5 vs 87.6%; $P = 0.12$). When whole barley was fed, starch digestibility was reduced by 68.4% in cows compared to calves (23.3 vs 73.7%; $P < 0.01$). These data suggest processing of barley is of greater concern for mature cows compared to younger calves.

Key Words: Barley, Starch Digestibilty, Grain Processing

123 Forage type and concentrated separator by-product effects on intake, site of digestion and microbial efficiency in beef steers.

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Four ruminally and duodenally cannulated beef steers (444 40 kg) were used in a 4 x 4 Latin square to evaluate effects of forage type and concentrated separator by-product (CSB) addition on intake, site of digestion, and microbial efficiency. Treatments were arranged in a 2 x 2 factorial. Factors were forage type (alfalfa, ALF; or cornstover, STV) and CSB addition (0 or 10% of diet DM). Experimental periods were 21 d with 12 d adaptation. Intakes (g/kg BW) of OM (20.7 vs 7.9) and N (0.67 vs 0.07) were higher ($P < 0.01$) for steers fed ALF vs STV. Steers fed 10% CSB consumed more ($P < 0.1$) OM (15.1 vs 12.9 g/kg BW) and N (0.42 vs 0.32 g/kg BW) than no CSB. Total duodenal flow (g/d) of OM (4665.5 vs 2110.2) and N (243.1 vs 74.6) was greater ($P < 0.001$) for steers fed ALF than STV. Steers fed 10% CSB had increased ($P = 0.02$) duodenal microbial OM (864.4 vs 637.4 g/d) and N (80.8 vs 55.2 g/d) flow compared to no CSB. Microbial (1053.8 vs 448.1 g/d of OM; 101.1 vs 34.9 g/d of N) and non-microbial (3611.7 vs 1662.1 g/d of OM; 142.1 vs 39.7 g/d of N) duodenal flows were higher ($P < 0.01$) in ALF vs STV fed steers. Forage by CSB interaction ($P = 0.01$) existed for total tract digestibility (%) of N with ALF (67.4) and ALF/CSB (69.5) greater than those fed STV/CSB (31.9) which was greater than STV (-23.9). True ruminal OM digestion (%) was higher ($P = 0.005$) in steers fed ALF vs STV (60.5 vs 46.1) and higher ($P = 0.09$) in steers fed 10% CSB vs no CSB (56.6 vs 49.9). Forage by CSB interaction existed ($P = 0.06$) for true ruminal N digestion (%) with STV (-139.9) lower than STV/CSB (4.5), ALF (45.2), and ALF/CSB (56.7). Microbial efficiency

(g microbial N/kg OM truly fermented) was unaffected by CSB (21.1) vs no CSB (21.3) and higher ($P < 0.09$) in STV (24.4) vs ALF (18.0) fed steers. Forage type influences digestibility and microbial efficiency. CSB influences intake and digestibility and increases microbial N production.

Key Words: Forage, Steer, CSB

124 Influence of NutriDense corn on intake, digestion, and nitrogen retention by ruminants. M.H. Knight*, J.S. Caton, G.P. Lardy, and M.L. Bauer, *North Dakota State University.*

Two studies were conducted to evaluate the effects of NutriDense corn (NDC; Exseed Genetics; 10.33 % CP) compared with commodity corn (CC; 9.75 % CP) on intake, digestion rate, and N retention. In experiment one, four ruminally cannulated steers were used to evaluate in situ degradabilities of NDC compared with CC. Ruminal degradability was determined at 0, 2, 4, 8, 12, 16, 24, and 48 h. Results indicate rate of DM disappearance for NDC and CC was not different, (average 2.0 $\pm$ 0.3 %/h; $P = 0.58$). Rate of N disappearance for both corn types was also not different (average 3.7 $\pm$ 0.2 %/h; $P = 0.55$). Rumen degradable and undegradable protein were similar ($P > 0.21$) between NDC compared with CC and averaged 45.8 and 54.2 % assuming 6%/h passage rate, respectively. In experiment two, fifteen crossbred ram lambs (47.3 $\pm$ 6.7 kg BW) were used to evaluate the effects of NDC on intake, digestibility and N retention. Lambs were assigned to one of two treatments, either NDC or CC in a completely random design. Diets consisted of 79.7% corn (NDC or CC), 12.5% beet pulp, 5.0% molasses, and 2.7% supplement (DM basis). Intake and digestion of DM and OM were not influenced ($P > 0.15$) by NDC. Nitrogen intake was higher with diets containing NDC (27.4 vs 21.1 $\pm$ 1.5 g/d; $P = 0.01$). Nitrogen retention increased with NDC compared to CC (10.2 vs 6.7 $\pm$ 1.0 g/d, respectively; $P = 0.02$). Nitrogen retention, as a % of N intake, tended ($P = 0.14$) to be higher for NDC (36.9%) compared with CC (30.7%). However, no differences in N retention as a percentage of nitrogen digested (52.3 vs 47.2 $\pm$ 4.1%; $P = 0.38$) were noted. These data indicate that NDC has little effect on intake or digestion rate but may improve nitrogen retention in lambs.

Key Words: Intake, Digestion Rate, Nitrogen Retention

125 Effects of finishing system (confinement vs pasture), supplemental fat, and copper on performance, carcass characteristics, and lipid metabolism in finishing steers. M. K. Woolley*[1], T. E. Engle[1], J. W. Spears[2], and V. Fellner[2], [1]*Colorado State University, Fort Collins, CO,* [2]*North Carolina State University, Raleigh, NC.*

Sixty Angus steers (approximately 363 kg initial wt) were used to determine the effects of copper (Cu) and finishing system (confinement vs. pasture) on performance and lipid metabolism. Steers in confinement (n=20) were fed a high concentrate diet, individually using Calan gate feeders. Steers grazing pasture (tall fescue) were maintained in 4 replicates with each replicate consisting of 10 steers. Salt (2 replicates) or 7% soybean oil (SBO) with CaCl (SBO-CaCl; 2 replicates) was used to limit concentrate intake to approximately 50% of that observed in confinement steers. One half of the steers in each treatment received a CuO needle bolus at the initiation of the study while the remaining steers received no supplemental Cu. Equal numbers of steers per treatment were slaughtered after 84, 96, or 144 d on feed. Average daily gain was lower ($P < 0.01$) for pasture + salt and pasture + SBO-CaCl steers relative to steers fed in confinement (1.5, 1.5, 2.1 kg/d, respectively). Final plasma Cu concentrations tended ($P < 0.10$) to be lower in pasture + SBO-CaCl steers relative to pasture + salt steers. Final liver Cu concentrations were higher ($P < 0.001$) in Cu-supplemented steers. Final serum cholesterol concentrations tended to be lower ($P < 0.10$) in Cu-supplemented steers. Pasture + SBO-CaCl steers had higher ($P < 0.01$) serum cholesterol concentrations relative to pasture + salt steers. Copper supplementation had no effect on carcass characteristics. Marbling score, dressing percentage, hot carcass weight, backfat depth, kidney, pelvic, and heart fat, yield grade, ribeye area, and quality grade were lower ($P < 0.05$) in pasture-fed steers relative to steers fed in confinement. Longissimus muscle C18:1 trans, C18:3 and C18:2-conjugated dienes were higher ($P < 0.05$) in pasture-fed steers relative to steers fed in confinement. Furthermore, C18:3 was higher ($P < 0.05$) and C18:2-conjugated dienes tended ($P < 0.10$) to be higher in pasture + SBO-CaCl steers relative to pasture + salt steers. These results indicate that finishing cattle on pasture with limited grain increases C18:3 and C18:2-conjugated dienes in longissimus muscle and that Cu supplementation had minimal effects on lipid metabolism.

Key Words: Copper, Fatty Acid, Steer

126 Effects of copper source and concentration on performance, copper status, and immune function in growing and finishing feedlot steers. K. L. Dorton*[1], T. E. Engle[1], D. W. Hamar[1], P. D. Siciliano[1], R. S. Yemm[1], and C. K. Swenson[2], [1]*Colorado State University, Fort Collins, CO,* [2]*Zinpro Corporation, Eden Prairie, MN.*

Forty-eight purebred Angus steers (218 +/- 9.1 kg) were used to determine the effects of copper (Cu) source and concentration on performance, Cu status, and immune function. Steers were stratified by weight and initial liver Cu concentration and randomly assigned to one of five treatments. Treatments consisted of: 1) control (no supplemental Cu), 2) 10 mg Cu/kg DM from Cu sulfate (CuSO4), 3) 10 mg Cu/kg DM from a Cu-amino acid complex (Availa Cu), 4) 20 mg Cu/kg DM from CuSO4, and 5) 20 mg Cu/kg DM from Availa Cu. Steers were housed in individual pens and fed an alfalfa-corn based growing diet for 56 d then were switched to a high concentrate diet for 144 d. At the end of the growing phase, steers receiving 20 mg Cu/kg DM had heavier ($P < 0.02$) body weights and greater ADG ($P < 0.06$) than steers fed 10 mg Cu/kg DM. During the finishing phase, final body weights were heavier ($P < 0.01$) and ADG tended ($P < 0.15$) to be higher in steers supplemented with 10 mg Cu/kg DM from Availa Cu than steers receiving 10 mg Cu/kg DM from CuSO4. On d 56 of the growing phase and d 112 of the finishing phase, liver Cu concentrations were higher ($P < 0.01$) in Cu supplemented steers. Steers receiving 20 mg Cu/kg DM had higher ($P < 0.01$) liver Cu concentrations than steers receiving 10 mg Cu/kg DM. On d 112 of the finishing phase, steers receiving 20 mg Cu/kg DM from Availa Cu had higher ($P < 0.01$) liver copper concentrations than steers supplemented 20 mg Cu/kg DM from CuSO4. During the finishing phase, immunoglobulin (IgG) concentrations specific to PRBC were higher ($P < 0.03$) and antibody titers specific to ovalbumin (OVA) were lower ($P < 0.05$) in control steers relative to Cu supplemented steers. Steers receiving 20 mg Cu/kg DM had higher antibody titers specific to OVA ($P < 0.02$) than 10 mg Cu/kg DM steers. Steers receiving 20 mg Cu/kg DM from Availa Cu had higher ($P < 0.01$) antibody titers specific to OVA than steers supplemented with 20 mg Cu/kg DM from CuSO4. These results indicate that copper source and concentration may have an effect on performance and immune response. Furthermore, it appears that the immune response to an antigen varies depending on the type of antigen administered as well as the concentration and source of Cu supplemented.

Key Words: steers, immune function, copper

127 Gestational effects on trace mineral absorption in the cow and ewe. M. M. Vierboom*, T. E. Engle, P. D. Siciliano, and C. V. Kimberling, *Colorado State University, Fort Collins, CO.*

Six mature purebred Angus cows (3.5+/- 1.5 years of age, 631.36 +/- 8.63 kg), three pregnant (250 7 days pregnant) and three open and eight mature Suffolk ewes (6+/- 4 years of age) four pregnant (approximately 90 days pregnant) and four open were utilized in a five-day metabolic trial to determine the effects of gestational status (pregnant vs. open) on apparent absorption and retention of copper (Cu) and zinc (Zn). Cows and ewes were selected based on body weight, age and gestational status, and randomly assigned to metabolic crates for total fecal and urine collection. Animals were allowed to acclimate to their new environment for seven days. Pregnant and open cows and ewes were then paired (within a species) by body weight and pair-fed throughout the 5-day collection period. Copper and Zn intakes were similar for pregnant and open cows and ewes. Apparent absorption of Cu ($P < 0.06$) and Zn ($P < 0.04$) was higher in pregnant cows relative to open cows. Pregnant cows also had a higher apparent retention of Cu ($P < 0.05$) and Zn ($P < 0.06$) relative to open cows. Pregnant ewes had a higher ($P < 0.01$) apparent absorption and retention of Zn compared to open ewes. However, the apparent absorption and retention of Cu were similar for pregnant and open ewes. These data indicate that certain physiological and/or metabolic parameters are altered in pregnant cows and ewes

consuming an alfalfa-based diet that enhance the apparent absorption and retention of certain trace minerals.

Key Words: Cow, Ewe, Mineral

128 Effect of ruminal protein degradability and supplementation frequency on lamb growth and gastrointestinal organ mass. P. A. Ludden*, D. E. Carter, V. Nayigihugu, E. J. Scholljegerdes, R. S. Townsend, B. W. Hess, and D. C. Rule, *University of Wyoming*.

Twenty-four wether lambs (initial BW = 36.8 ± 0.7 kg) were used in a randomized complete block, 2 × 2 factorial designed experiment to evaluate the effects of ruminal protein degradability and supplementation frequency on growth and gastrointestinal (GI) organ mass. All lambs were individually fed chopped (7.6 cm) bromegrass hay (7.4% CP, 61.1% RDP, 59.3% NDF, 33.7% ADF) for ad libitum consumption, and either soybean meal (high ruminally degradable protein; RDP) or feather meal (low RDP) daily or on alternate days. Supplements were fed on an iso-N basis (0.28 and 0.20% of BW daily for the high and low RDP supplements, respectively), with alternate-day supplements fed at twice the level of daily supplementation. After 56 d on their respective treatments, all lambs were euthanized (6 lambs/d for 4 d), eviscerated, and empty BW (EBW) and GI organ mass was measured. No protein degradability × supplementation frequency interactions ($P \geq 0.24$) were noted. Supplementing protein on alternate days tended to reduce forage ($P = 0.11$) and total ($P = 0.11$) DM intake, but had no effect ($P \geq 0.28$) on ending BW, ADG, gain/feed, or EBW, irrespective of ruminal degradability of the supplemental protein. Weights (% of EBW) of the reticulorumen ($P \geq 0.95$) and liver ($P \geq 0.14$), and small intestine length ($P \geq 0.32$) were unaffected by treatment. Lambs fed low RDP had higher small intestine ($P = 0.01$) and total GI organ ($P = 0.09$) weights than those fed high RDP, but similar ($P \geq 0.18$) weights of the omasum, abomasum, and cecum + colon. Lambs supplemented on alternate days had higher omasum ($P = 0.09$), abomasum ($P = 0.03$), cecum + colon ($P = 0.02$), and total GI organ ($P = 0.04$) weights, but similar ($P = 0.31$) small intestine weights. Supplementing protein to forage-fed ruminants on alternate days may reduce forage DM intake, irrespective of ruminal degradability of the supplemental protein, but otherwise has no effect an animal performance. However, the potential for increased GI organ mass associated with alternate-day protein supplementation deserves further investigation.

Key Words: Protein Degradability, Supplementation Frequency, Gastrointestinal Organ Mass

129 Effect of level of supplemental degradable intake protein and carbohydrate types on low-quality forage utilization by beef steers. J. I. Arroquy*, R.C. Cochran, M Villarreal, T. A. Wickersham, D. A. Llewellyn, E. C. Titgemeyer, and D. E. Johnson, *Kansas State University*.

Sixteen ruminally fistulated beef steers (BW = 220 kg) were used to evaluate the interaction of carbohydrate (CHO) type and level of degradable intake protein (DIP) supplementation on low-quality forage utilization. Steers given ad libitum access to tallgrass-prairie hay (5.1% CP, 76.2% NDF) were used in a 15-treatment, 2-period crossover experiment. Steers were subjected to two 24-d periods (14 d of adaptation) that included periods for measuring intake and total fecal output, ruminal evacuation, and monitoring ruminal fermentation. Treatments were arranged as a 2 x 7 factorial, plus two additional steers served as a negative control in both periods (NC, no CHO or DIP supplementation). Treatments within the supplemented groups consisted of starch or dextrose (fed at 0.30% of initial BW) each offered with one of seven levels of DIP (0, 0.015, 0.051, 0.087, 0.123, 0.159, 0.195% of initial BW). Supplements were ruminally dosed once daily. No CHO x DIP level interactions were significant for intake or digestion measurements. Forage and total OM intake increased linearly ($P < 0.01$), whereas total digestible OM increased in a quadratic fashion ($P < 0.05$) in response to increased supplemental DIP. Carbohydrate type did not affect forage, ($P = 0.36$), total ($P = 0.36$) or digestible ($P = 0.44$) OM intake. In response to increasing DIP supplementation, digestion of OM increased linearly ($P = 0.03$) and NDF digestion responded quadratically ($P = 0.08$). Digestion of NDF was only depressed when DIP levels were low. Type of CHO did not affect OM ($P = 0.63$) or NDF ($P = 0.44$) digestion. In conclusion, provision of adequate DIP overcame CHO-induced depression of fiber digestion, regardless of whether starch or dextrose served as the supplemental CHO.

Key Words: Carbohydrate, Protein, Beef Cattle

130 Effect of 7-day, pre-harvest 40-g betaine regimen on dressing percent of feedlot steers. J.R. Brethour[1], B.J. Bock*[2], and S.R. Goodall[3], [1]*Agricultural Research Center - Hays, Kansas State University,* [2]*Fort Hays State University,* [3]*Gladwin A. Read Co., Omaha, NE*.

Eleven experiments were conducted over nine months to investigate the effects of feeding supplemental betaine (40 g/hd/d) during the last week before harvest on steer carcass dressing percent. Steers were comprised primarily of Angus, Limousin and Simmental crossbreds. Within each experiment, cattle were divided into two groups (control vs. betaine) seven days before harvest. Treatment groups were alloted by weight and ultrasound measures for backfat and marbling. A total of 565 cattle were used and averaged 51 head in each replication. Dressing percent was calculated by dividing hot carcass weight (adjusted for visual estimates of trim) by the final weights shrunk four percent. Cattle were fed primarily finely rolled milo with sorghum silage, soybean meal, urea, ammonium sulfate, calcium carbonate, sodium chloride as well as supplemental zinc, copper, manganese, iron, iodine, cobalt and Vitamin A. Rumensin (300 mg/hd/d) and Tylan (90 mg/hd/d) were also included in the diet. The statistical model included initial weight, carcass backfat and marbling. Data was analyzed using a non-parametric procedure (Hodges Lehman) to estimate the best average for each experimental group. Then this average was subjected to an analysis of variance to test the hypothesis of a response to betaine. The first experiment produced the highest dressing percent response (+1.62%, betaine vs. control), with the other ten experiments producing much smaller percentage responses (Exp. 2, +0.03; Exp. 3, -0.25; Exp. 4, +0.42; Exp. 5, +0.49; Exp. 6, +0.24; Exp. 7, +0.46; Exp. 8, +0.56; Exp. 9, +0.26; Exp. 10, +0.01; Exp. 11, +0.10). The overall weighted average increase in dressing percent was +0.34% ($P < .05$). If the cost of betaine is \$1.40/hd for the 7-day feeding or 40 g/hd/d, and carcass price received per pound was \$1.00, net returns back to the producer based on these experiments would be \$3.00/hd.

Key Words: Beef Cattle, Betaine, Dressing Percent

131 Influence of flake thickness of temper roasted rolled barley on beef cattle feedlot performance. D. D. Hinman* and S. J. Sorensen, *University of Idaho, Caldwell, ID*.

A cattle feeding trial was conducted to determine the effect of temper roasted rolled barley flake thickness on animal feedlot performance. Two hundred forty steers (initial wt 310 kg) were blocked by weight into eight blocks. Forty pens of six steers each were randomly allotted to one of the five grain treatments, with eight pens per treatment, one in each weight block. Grain treatments were dry-rolled barley (DRB), dry-rolled corn (DRC), temper roasted rolled barley, 32 kg/hl (RBLT), temper roasted rolled barley, 37 kg/hl (RBMD), and temper roasted rolled barley, 42 kg/hl (RBHY) (25, 29 and 33 lb/bu, respectively). The Baronesse barley had a bulk density of 68.6 kg/hl before processing (54 lb/bu.). Temper roasted rolled barley was tempered at 20% moisture for 24 h, roasted at 177° C for 5 min, and rolled while hot with roller settings adjusted to obtain the desired flake thickness. Diets contained 84% grain, 5% alfalfa hay, 7% corn silage and 4% supplement. Initial weight and final live weight did not differ ($P > .10$) among treatments. Dry-rolled barley had a greater ($P < .10$) ADG than RBMD (1.46 and 1.38 kg/d, respectively). Dry-rolled corn, RBLT, and RBHY ADG were similar ($P > .10$) to each other. Dry matter intake was greater ($P < .10$) for DRB than all other treatments. Therefore DRB fed steers had a higher ADG. Steers on the RBLT and RBMD diets consumed the least ($P < .10$) amount of dry matter per day. The steers consuming RBLT were the most efficient ($P < .10$) at converting feed to body weight. Steers were sent to the abattoir when after visual evaluation they were deemed to grade Choice. Marbling score, back fat, USDA yield grade, hot carcass weight and price/cwt received did not differ ($P > .10$) among treatments. Ribeye area was largest ($P < .10$) for DRC. The increase in feed efficiency for the steers fed thin-flaked temper-roasted barley suggests a change in the fermentation pattern of this grain compared to dry-rolled barley and corn.

Key Words: Roasted Barley, Bulk Density, Flake Thickness

132 In situ ruminal digestion rate of dry matter, protein and starch as influenced by roasted wheat flake thickness. Sharon Sorensen* and Dan Hinman, *University of Idaho, Caldwell ID.*

A 5X4 factorial in situ study with wheat treated four ways plus dry-rolled corn with four ruminally-cannulated steers was conducted to determine the effect of roasted wheat flake thickness on rate and extent of ruminal disappearance. Corn was dry rolled (DRC) and wheat was either dry rolled (DRW) or tempered roasted rolled to a bulk density of 45 (RWThin), 53 (RW Med) or 62% (RWThick) of original bulk density. Incubation hours were 0, 1, 2, 4, 6, 12, 24, and 48 h. Following DM determination, CP, ADF, starch and ADIN were determined on the dry residue. Data were analyzed by ANOVA using the SAS GLM procedure. Disappearance rates were determined using SAS REG procedure. Disappearance rate of DM for the 48 h period was fastest ($P < .10$) for DRC. Forty-eight hour ADF and ADIN disappearance rates were faster ($P < .10$) for DRC, followed by RWThick. Dry-rolled corn, RWThin and RWThick CP disappearance rates were less than ($P < .10$) DRW and RWMed for the 48 h period. Starch 48 h disappearance rates were similar ($P > .10$) for DRC and RWThick but less than DRW, RWThin, and RWMed ($P < .10$). During the first 6 h of incubation DRW and RWThick had the slowest ($P > .10$) DM disappearance rate. Dry-rolled corn had the fastest ($P < .10$) ADF 6 h disappearance rate while ADIN 6 h disappearance rate did not differ ($P > .10$) among treatments. Crude protein 6 h disappearance rate was fastest for DRW and slowest for RWThick. Starch disappearance rate at 6 h for DRC (6.29 %/h) was less than ($P < .10$) for DRW, RWThin and RWMed and similar ($P > .10$) to RWThick (13.35, 16.25, 14.17, 6.29, and 9.75%/h, respectively). Remaining DM for DRC and RWThick was numerically greater($P < .10$) at all incubation hours than DRW, RWThin and RWMed. Starch remaining at all hours was numerically greater($P < .10$) for DRC and RWThick than DRW, RWThin, and RWMed. Tempered roasted wheat rolled for a thicker flake had in situ DM and starch digestion rates similar to dry-rolled corn, suggesting an improvement in the feeding characteristics of wheat.

Key Words: Roasted Wheat, In situ, Flake Thickness

133 Dietary phosphorus requirements of calf-fed Holstein steers during the early growing period. R. A. Zinn*[1], M. Machado[1], A. Plascencia[1,2], S. A. Rodriguez[1], N. Torrentera[1,2], and R. A. Ware[1], [1]*University of California, Davis,* [2]*Universidad Autonoma de Baja California (Mexicali, Mexico).*

Ninety-six Holstein steer calves (120.7 5.3 kg) were used to evaluate the influence of dietary phosphorus level (.27, .31, .35, and .39%, DMB) on growth-performance during the initial 105 d on feed. The basal diet contained 77.05% steam-flaked corn, 8.00% alfalfa hay, 4.00% sudangrass hay, 4.00% cane molasses, 3.5% yellow grease, 1.10% urea, 0.40 trace mineralized salt, 0.15% MgO and 1.80% limestone. Dicalcium phosphate was the source of dietary phosphorus. All diets were formulated to contain .85% calcium (DMB). Dietary phosphorus level did not affect ($P > .10$) DMI. However, increasing dietary phosphorus level increased ADG (linear component, $P < .05$), gain efficiency (quadratic component, $P < .05$), and dietary NE (quadratic component, $P < .05$). Across dietary phosphorus levels observed dietary NEm values were 96, 99, 100, and 98% of expected based on diet formulation. Dietary phosphorus level did not affect ($P > .10$) body sizes measurements. We conclude that during the initial growing period ADG, gain efficiency and dietary NE are optimal at a dietary phosphorus level of .35%. This level is 17% lower than current NRC recommendations.

Key Words: Cattle, Feedlot, Phosphorus

134 Determination of free amino acids in serum by capillary gas chromatography. L. Chen*[1], W. Allen[1], and J. R. Strickland[1], [1]*New Mexico State University.*

A method for the rapid determination of free amino acids in serum using capillary gas chromatography is described in this report. The method includes a derivatization reaction with ethyl chloroformate, in which the derivatization of all the reactive groups (amino and carboxyl groups) is completed simultaneously within a few minutes. The derivatization reaction medium maintains optimum acidity and polarity for high reaction efficiency. A solid phase extraction procedure was used for cleaning up serum samples. Evaluation of this method has been made with twenty-three amino acids, using a DB- 1701 column (20 m X 0.18 mm X 0.4 mum). Sufficient separation was achieved in less than 18 min for 22 amino acids with exception of arginine. Detection limits (3 S/N) for the 22 amino acids are on the level of nmol mL^{-1}, from 0.11nmol mL^{-1} to 2.93 nmol mL^{-1} (based on 200 μL serum extraction), and recoveries vary from 79.4% to 129.3% for the 22 amino acids. The broad range of the recovery data is mainly due to the quantification of a few amino acids. The high detection limit of tyrosine and tryptophan as well as overlapping (unresolved) chromatographic peaks for histidine/tyrosine and cystine/glutamine may be the cause of this wide range. Future work will focus on enhancing and improving these important analytical performances. Spiked serum samples demonstrated parallelism, indicating that this method can be applied to the analysis of serum samples within reasonable recovery range and without apparent matrix interference.

Key Words: Serum, Amino Acids, Capillary Gas Chromatography

135 Methylglyoxal: A novel tool to assess nitrogen status of the rumen. S. L. Lodge-Ivey*, M.K. Petersen, and T. May, *New Mexico State University.*

An experiment was conducted to determine the effects of low quality forage supplemented with steam-flaked corn on ruminal production of methylglyoxal. Methylglyoxal is a highly reactive electrophile produced by bacteria in response to an imbalance of carbohydrate (excess) to nitrogen (limitation) in growth medium. Therefore, methylglyoxal levels in ruminal contents could be used as a tool to assess the effectiveness of degradable protein supplementation strategies. Four ruminally fistulated mature cows were used in a 4 x 4 Latin square design. Treatments included 1) control (CONT), 2) 1.36 kg steam flaked corn (SFC; LC) (DM basis), 3) 2.72 kg SFC (MC; DM basis), 4) 4.08 kg SFC (HC; DM basis). Cows were fed a basal diet containing 7.7 kg sorghum-sudan hay (5.6 CP; DM basis), which served as the control diet. Steam-flaked corn and a trace mineral supplement were added to the basal diet for the remaining treatments. Treatments had no effect on ruminal ammonia (P=.48), serum glucose (P=.17), blood urea nitrogen (P=.40) or methylglyoxal concentration calculated as area under curve (P=.29). Ruminal ammonia levels were very low (<2.6 mg/dL) because of low CP level of basal diet and addition of starch. Mean methylglyoxal level was increased by 62.5% with addition of SFC (MC vs CONT; P<.01). Total VFA concentration was increased with increasing level of SFC (P< .001). Acetate, propionate, butyrate, and valerate increased linearly (P< .03). These results indicate that the ruminal bacteria produced methylglyoxal when exposed to nitrogen limitation. Further research is needed to determine the usefulness of methylglyoxal as a tool to assess nitrogen status of the rumen.

Key Words: Methylglyoxal, Ruminal Bacteria, Cattle

136 Influence of barley grain processing on the site and extent of digestion of feedlot cattle. R. A. Zinn[1], E. G. Alvarez[2], L. Corona*[1,2], D. D. Hinman[3], M. F. Montano[2], A. Plascencia[2], and S. Sorensen[3], [1]*University of California,* [2]*Universidad Autonoma de Baja California,* [3]*University of Idaho.*

Five Holstein steers (312 kg) with cannulas in the rumen and proximal duodenum were used in a 5 x 5 Latin square design experiment. Dietary treatments consisted of a finishing diet containing 80% grain (DMB) as 1) steam-flaked corn (SFC); 2) steam-flaked barley (SFB); 3) dry rolled barley (DRB); 4) tempered rolled barley (TRB) and 5) tempered roasted rolled barley (TRRB). Barley processing technique did not influence ($P > .10$) ruminal digestion of OM, and NDF. Ruminal digestion of starch was greater (4%, $P < .05$) for TRB than for DRB. Ruminal digestion of feed N was greater for DRB than for SFB (15%, $P < .10$). Ruminal N efficiency was greater (7%, $P < .10$) for SFB than for DRB. Given that the UIP value of SFC was 57%, then the corresponding UIP values for SFB, DRB, TRB, and TRRB were 38, 28, 34, and 33%, respectively. Barley processing technique did not effect ($P > .10$) total tract digestion of OM, starch, N, or NDF. Ruminal microbial efficiency (g microbial N/kg OM fermented) was lower (15%, $P < .05$) for SFC than for barley treatments. Ruminal digestion of feed N was also lower (20%, $P < .05$) for SFC than for barley treatments. Total tract digestion of OM, NDF, and N was greater (7, 17, and 4%, respectively, $P < .05$) for SFC than for barley treatments. We conclude that digestibility of rolled barley in finishing diets for feedlot cattle can be sufficiently high so that modifications in digestion due to further processing are primarily related to

site, rather than extent of starch and N digestion. Most notable is the marked increase (36%) in UIP value of barley due to flaking.

Key Words: Barley, Cattle, Metabolism

137 Partial substitution of alfalfa hay with grass hay (sudangrass, elephant grass) in diets for lactating dairy cattle: Digestive function. E. G. Alvarez-Almora*[1], E. Arellano[1], M. A. Gastelum[1], V. M. Gonzalez[1], A. Lopez-Soto[1], A. Plascencia[1], and R. A. Zinn[2], [1]*Universidad Autonoma de Baja California (Mexicali, Mexico),* [2]*University of California, Davis.*

Four lactating Holstein cows with cannulas in the rumen and proximal duodenum were used in a 4 x 4 Latin square experiment to evaluate the influence of partial replacement of alfalfa hay with grass hay (sudangrass, elephant grass) on digestive function. Cows were fed a steam-flaked corn-based diet containing (DMB): 1) 49% alfalfa hay; 2) 24% alfalfa hay and 16% sudangrass hay; 3) 24% alfalfa hay, 8% sudangrass hay, and 8% elephant grass hay; and 4) 24% alfalfa hay and 16% elephant grass hay. Diets were formulated to contain 30% NDF (DMB). There were no treatment effects (P > .10) on ruminal digestion of OM, and NDF, averaging 51 and 31%, respectively. Microbial efficiency (g microbial N/ kg OM fermented) was greater (20%, P = .07) for alfalfa (30) than for grass hay substituted diets (25). Nonammonia N flow to the small intestine, as a percentage of N intake (ruminal N efficiency) averaged 101%, and was lower (linear effect, P < .10) for elephant grass than for sudangrass hay. There were no treatment effects (P > .10) on total tract digestion of OM, and NDF, averaging 70 and 43%, respectively. Digestible energy content of the diet was lower (4%, P < .05) for alfalfa hay (64.5%) than for the grass hay substituted diets (67.5%). We conclude that although substitution of a portion (40%) of alfalfa hay with grass hay in diets for lactating cows may slightly decrease ruminal microbial efficiency, the impact on ruminal and total tract digestion of OM and NDF are small. Due to differences in NDF content of alfalfa hay and grass hays, the substitution with grass hay will result in less total forage, permitting greater dietary energy density.

Key Words: Forage, Cows, Metabolism

138 Comparison of acid detergent insoluble ash (ADIA) as an internal marker with total fecal collection to estimate digestibility coefficients of forage-based diets fed to beef steers. T. N. Bodine*[1], L. A. Appeddu[2], H. T. Purvis II[1], A. La Manna[1], R. Basurto[1], and J. S. Weyers[1], [1]*Oklahoma Agricultural Experiment Station, Stillwater,* [2]*USDA-ARS Grazinglands Research Laboratory, El Reno, OK.*

Internal markers must be 100% recoverable and indigestible to be effective estimators of apparent digestibility. Four Latin-square design experiments with ad libitum forage access were conducted to determine the recovery and digestibility of acid-detergent insoluble ash (ADIA) for use as an internal marker to estimate digestibility of forage-based diets. In Exp. 1, eight steers were fed prairie hay and supplemented with two levels of corn (0 or 0.75% of BW) and four levels of soybean meal (0 to 0.38% of BW). In Exp. 2, eight steers were fed alfalfa with no supplement, supplemented with 0.5% of BW of corn every day, every other day (1% of BW/feeding), or every third day (1.5% of BW/feeding). In Exp. 3, six steers were fed alfalfa, bermudagrass, or prairie hay without supplementation. In Exp. 4, seven steers were fed prairie hay with no supplement, a cottonseed/soybean meal cube, or similar amounts of one of two liquid feeds. Composite feed and fecal samples were analyzed for DM, OM, ADF, ash-free ADF, and ADIA. Treatment did not alter recovery or digestibility ($P > 0.54$) of ADIA within experiments, but differences were observed across experiments. In Exp. 1, ADIA recovery was 70.1% and digestibility was 26.9%, which differed ($P < 0.01$) from 0. In Exp. 2, ADIA recovery was 97.5%, and digestibility (2.5%) was equal ($P > 0.42$) to 0. In Exp. 3, ADIA recovery was 99.3% and digestibility (0.7%) was equal ($P > 0.32$) to 0. Recovery and digestibility of ADIA in Exp. 3 (unsupplemented forages) was similar ($P > 0.54$) across forage types. In Exp. 4, ADIA recovery was 83.3% and digestibility (16.7%) differed ($P < 0.01$) from 0. These results suggest that ADIA has the potential to be an accurate internal marker to estimate digestibility for alfalfa, bermudagrass, and unsupplemented prairie hay diets. Even though differences were found between actual and estimated digestibilities for steers consuming supplemented prairie hay diets, the consistent results observed across treatments may allow ADIA to be used as an internal marker, providing it is validated for experimental conditions.

Key Words: Digestibility Coefficients, Internal Markers, Techniques

139 Niche-targeted versus conventional finishing programs for beef steers. J. E. Sawyer*, C. A. Loest, C. P. Mathis, D. A. Walker, K. J. Malcolm-Callis, L. A. Blan, and R. Taylor, *Clayton Livestock Research Center, New Mexico State University, Clayton NM.*

Due to widespread interest in value addition via niche marketing programs for finished beef cattle, 64 crossbred steers were placed on 140 d finishing programs to evaluate the effects of an implant protocol and antimicrobial feed additives on economical production traits. Steers were blocked by weight and assigned to one of four treatment combinations in a randomized complete block design. Treatments were arranged in a 2 × 2 factorial with factors being an implant protocol (Synovex S + Revalor S) versus no implants, and feed additives (33 mg kg^{-1} monensin + 11 mg kg^{-1} tylosin) versus no additives. Pen (8 steers per pen) was the experimental unit. Steers were fed (*ad libitum*) a 90% concentrate diet and marketed on a formula basis. There were no implant × feed additive interactions for economically significant production traits. Feed additives tended to improve feed efficiency (0.142 vs. 0.135, P<0.16) and numerically improved most other production measures. Implants improved ADG (1.83 vs. 1.51 kg d^{-1}; P<0.01) and feed efficiency (0.143 vs. 0.133, P<0.08) despite an increase in DMI (9.42 vs. 8.38 kg d^{-1}; P<0.01). Feed additives tended to improve marbling (5.04 vs. 4.73; P<0.12), but increased backfat (1.43 vs. 1.30 cm; P<0.11); resulting in little influence on gross carcass income. Implants increased carcass weight (363.0 vs. 328.2 kg; P<0.01) and ribeye area (86.1 vs. 78.7 cm^2; P<0.01) but reduced marbling (4.57 vs. 5.20; P<0.05). Despite a reduction in carcass price due to quality discounts ($2.507 vs. $2.527 kg^{-1}; P=0.10), gross carcass value was greater for implanted steers ($908.90 vs. $828.53; P<0.01). These results indicate that, while cattle targeted for niche markets (requiring abandonment of antimicrobials and(or) growth promotants) had improved quality grades and good performance, a substantial price premium must be garnered to make these programs economically competitive with conventional finishing programs.

Key Words: Niche Markets, Implants, Feed Additives

140 Utilization of low-quality forage as affected by beef cow body condition score. R. D. Wiedmeier*, K. C. Olson, B. A. Kent, and P. R. Schmidt, *Utah State University, Logan, Utah.*

Ruminant animals in low BCS normally respond to diets composed of medium and high-quality forages with increased digestible dry matter intake (DDMI). The objective of this study was to determine if beef cows with low BCS could respond to a low-quality forage diet with increase DDMI. Twelve mature, crossbred beef cows were stratified into two treatment groups of six cows each. All cows were dry and approximately 100 d in gestation at the beginning of the study. Cows were housed in individual pens. Groups were of similar BW (655 kg) (P = 0.80) and BCS (5.74) (P = 0.69) at the beginning of the study. One group was assigned a diet designed to result in a reduction in BCS over a 50 d period (LBCS). The other group received a diet designed to maintain BCS (MBCS). The LBCS cows lost 0.87 ± 0.088 BCS (5.78 to 4.92) (P = 0.0001). At the end of this period all cows were allowed ad-libitum access to ammoniated wheat straw plus 1.75kg protein-vitamin-mineral supplement daily for a 21 d adaptation period followed by a 5 d collection period during which DDMI was measured. The LBCS cows tended (P = 0.13) to consume less ammoniated wheat straw than MBCS cows (7.55 versus 8.33 kg/d, respectively). Digestibility of DM, NDF, and ADF were not affected by BCS (P > 0.60). Thus, DDMI was not affected by the BCS associated with this study (P = 0.31). Under these conditions, it appears that cattle consuming low-quality forage (LQF) could not increase intake in response to low body condition. However, the BCS of the LBCS cows was 4.92, which may not be low enough to be of practical significance.

Key Words: Beef, Nutrition, Forage

141 Interaction of steam delivery rate and tempering on feeding value of flaked corn for feedlot cattle. S. Rodriguez*[1], J. F. Calderon[2], M. Machado[1], R. A. Ware[1], and R. A. Zinn[1], [1]*University of California, Davis,* [2]*Universidad Autonoma de Baja California.*

Two delivery rates of steam to the steam chest (steam-line injection pressure of 17 vs 55 psi) were evaluated with, and without tempering in a 2 x 2 factorial arrangement. The boiler was set at 70 psi. Steam temperature, just prior to entering the steam chest, averaged 145 C. Steam-flaked corn was prepared as follows. A chest situated directly above the rollers (46 X 61 cm corrugated) was filled to capacity (441 kg) with corn. Corn was steamed according to designated treatment at atmospheric pressure for approximately 20 min. The first approximately 441 kg of SF corn was allowed to pass from the rollers before material was collected for use in the trial. Tempering consisted of spraying .075 L/kg water mixed with 181 mg/kg of a tempering agent (Sar Temp#; Sar Tec, Anoka, MN) on the corn 30 min before applying steam. For all processing treatments corn was flaked to a density of .31 kg/L (as measured directly beneath the rolls). Diets contained (DM basis) 4% alfalfa hay, 8% sorghum sudan hay, 75.7% flaked corn, 6% molasses, 3% yellow grease, 1.1% urea, 1.5% limestone, .2% magnesium oxide and .5% trace mineralized salt. Eighty crossbred heifers (248 kg) were used in a 105-d randomized complete block design experiment to evaluate treatment effects on growth-performance. There were no treatment effects ($P > .10$) on ADG, DMI, gain efficiency, or dietary NE. Four Holstein steers (140 kg) with ruminal and proximal duodenal cannulas were used in a 4x4 Latin square design experiment to evaluate treatment effects on digestive function. Tempering did not affect ($P > .10$) ruminal digestion of OM, starch, or N. However, it increased ($P < .05$) post ruminal and total tract digestion of OM and N. Increasing steam injection pressure from 17 psi to 55 psi increased ($P < .05$) post ruminal starch digestion and total tract OM digestion (.8%). Ruminal and total tract starch digestion averaged 90 and 98%, respectively. We concluded that optimal feeding value can be achieved from flaked corn using considerably less steam than is customary in the industry. However, under conditions of lower steam delivery rates, more than 50 min tempering time may be required to soften the corn sufficiently to maintain high roller output rates.

Key Words: Steam, Corn, Cattle

142 Performance of beef cows wintered on ammoniated wheat straw as affected by limiting intake. R. D. Wiedmeier*, K. C. Olson, B. A. Kent, and P. R. Schmidt, *Utah State University.*

Limiting intake of beef cows wintered on low-quality forage (LQF) to save feed costs may not reduce performance due to the negative correlation between intake and digestibility. Our objective was to quantify the effects of limiting intake of beef cows wintered on LQF on digestible dry matter intake (DDMI), BW, and BCS. Thirty-two mature, crossbred beef cows (565 ± 64 kg) in the last trimester of gestation were stratified into eight groups of four cows each. Four groups were allowed ad-libitum access to ammoniated wheat straw (AWS) plus 1.75 kg/hd/d of a protein-vitamin-mineral supplement (ADLB). The other four groups were assigned a similar diet; except the intake of AWS was limited to 91.5% of the ADLB groups (LMT). Dietary treatments were applied for a 65 d period with BW and BCS measured at d 0, 30, and 60 of the study. On d 61-65, DDMI was estimated. As designed, DMI from AWS was 10.1 kg and 9.2 kg for ADLB and LMT treatments ($P = 0.0001$), respectively. No differences in digestibility of DM (63.8% versus 62.7%, $P = 0.66$), NDF (70.6% versus 69.0%, $P = 0.51$), or ADF (60.9% versus 59.2%, $P = 0.64$) were detected between ADLB and LMT treatments, respectively. However, due to the designed difference in dry matter intake, ADLB cows consumed about 10% more digestible dry matter (DDM) than LMT cows (6.4 versus 5.8 kg, $P = 0.07$). Treatments had no effect on BW ($P = 0.43$) or BCS ($P = 0.90$). Thus, although ADLB cows consumed more DDM, there was no improvement in performance. Higher heat increment associated with ADLB treatment may have equalized net energy.

Key Words: Beef, Nutrition, Forage

143 Effect of feeding Megalac on milk yield, milk composition, body weight change, and feed intake in lactating does. I. Tovar-Luna*[1], R. Espinosa-Santiago[1], and D. M. Hallford[2], [1]*Universidad Autónoma Chapingo. URUZA, Bermejillo, Dgo. 25230 ,* [2]*New Mexico State University. Animal & Range Science Dept. Las Cruces, NM. 88003.*

Twenty-five lactating Alpine does (45.97 ± 1.44 kg BW, 11 ± 4.5 d of lactation) were used to study the effect of feeding increasing amounts of Megalac in the diet on BW change, feed intake, milk yield, and milk composition, and serum insulin concentration for a 40 d feeding period. Does were stratified by days of lactation and BW, and randomly assigned to one of five levels of Megalac (0, 33, 66, and 99 g/d). All does were individually fed (ad libitum intake) a basal diet (39% alfalfa hay, 14% oats hay, 16.1% flaked corn grain, 3.85% soybean meal, 8.75% flaked sorgum, 6.3% cotton seed, 2% minerals) and a supplement supplying 50 g/d of ruminally undegradable intake protein. Data were analyzed as a completely randomized design. No significant treatment differences were found in body weight change (-2.35, -1.29, -2.07, and -1.02 kg, SE = 0.35), dry matter (6.12, 6.47, 6.2, and 6.18 % BW, SE = 0.3), or milk production (3.17, 3.27, 3.17, and 3.09 kg/d, SE = 0.2). Similarly, milk concentrations of protein, fat, lactose, solids non-fat, and total solids, and serum insulin concentration were not affected ($P > 0.05$) by Megalac level in the diet. Additional reseach is needed to find out the appropriate amount of supplemental fat in the diet of lactating does consuming different types of feeds.

Key Words: Goats, Milk, Dietary Fat

144 Influence of level of yellow grease addition on the comparative feeding value of finishing diets for feedlot cattle. A. Plascencia*[1], E. G. Alvarez[1], M. F. Montano[1], M. Machado[2], S. Rodriguez[2], R. A. Ware[2], and R. A. Zinn[2], [1]*Universidad Autonoma de Baja California (Mexicali, Mexico),* [2]*University of California, Davis.*

One hundred crossbred yearling steers with an average initial weight of 446 kg were used in a 100-d finishing trial. Steers will be blocked by weight and randomly allotted within weight groupings to 20 pens (5 steers/pen). Dietary treatments consisted of a steam-flaked corn-based finishing diet supplemented with 0, 1.5, 3, or 4% yellow grease. Fat supplementation increased ADG (13%, quadratic effect, $P < .05$), DMI (3%, quadratic effect, $P < .05$), feed efficiency (8%, linear effect, $P < .05$), and dietary NE (7%, linear effect, $P < .05$). Optimal response in ADG, feed efficiency and dietary NE occurred with 3% supplemental fat (6.4% total dietary fat). Three Holstein steers with cannulas in the rumen and proximal duodenum were used in a 4 # 3 Youden square experiment to evaluate treatment effects on characteristics of digestion. There were no treatment effects ($P > .10$) on ruminal digestion. However, there were cubic effects of supplemental fat on postruminal digestion of OM ($P < .10$), NDF ($P < .10$), and fat ($P < .01$). There were also cubic effects ($P < .01$) of supplemental fat on total tract digestion of DM and OM. There was a quadratic effect ($P < .05$) of supplemental fat on total tract NDF digestion. Observed fatty acid digestion was consistent with expected (101 and 99%, respectively) for treatments 1 and 3. However, observed fatty acid digestion was slightly lower then expected (7.0% and 6.6%, respectively) for treatments 2 and 4. In order to more adequately assess changes in intestinal fat digestion over small increments (1.5%) in levels of fat supplementation, more animal observation are needed. We conclude that low levels of fat supplementation (1.5 to 3.0%) will stimulate growth performance of feedlot cattle and increase the NE value of the diet above that expected based on the NE value of the supplemental fat, itself (positive associative effects).

Key Words: Fat, Cattle, Performance

145 Effect of increasing levels of byproducts on in vitro organic matter digestibility of various quality forages. T. A. Baumann*, J. S. Caton, V. L. Anderson, and G. P. Lardy, *North Dakota State University, Fargo, North Dakota.*

Combinations of forages (FOR) and supplements (SUP) were evaluated using in vitro OM digestibility (IVOMD). The trial was arranged as a 7 x 5 x 3 factorial. Factors included three FOR types: wheat straw (STR, 4.4% CP, 44.8% IVOMD), low quality hay (LH, 8.6% CP, 50.9% IVOMD), and medium quality hay (MH, 13.9% CP, 53.5% IVOMD), seven SUP: corn (CRN), barley (BAR), dried beet pulp (BP), wheat

middlings (WM), dried corn gluten feed (DCGF), soybean hulls (SH), and barley malt sprouts (BMS), and five supplement levels (LEV): 0, 10, 20, 30, and 40% of DM. Each combination was duplicated in each of two IVOMD runs. Ruminal fluid was collected from two ruminally fistulated steers fed equal parts of STW, LH, and MH (DM basis). An interaction ($P < 0.01$) for FOR x SUP x LEV was observed. With STR, a linear increase ($P < 0.01$) in IVOMD was noted with increasing LEV of SH, WM, BP, DCGF, and BMS; increasing level of BAR and CRN resulted in quadratic increases ($P \leq 0.05$) in IVOMD. With LH, a linear increase ($P < 0.01$) in IVOMD was noted with WM, BP, DCGF, and BMS. Increasing LEV of BAR cubically increased ($P = 0.02$) IVOMD; CRN increased ($P = 0.03$) IVOMD quadratically with LH. With MH, increasing LEV of BAR, CRN, DCGF, SH and BMS linearly increased ($P \leq 0.04$) IVOMD; increasing level of BP and WM increased ($P < 0.01$) IVOMD cubically. In contrast to our expectations, additions of CRN and BAR did not result in large negative effects on IVOMD of FOR and SUP combinations. In addition there are significant differences in digestibility among SUP and SUP types also interacted with FOR type. Additional research in this area should focus on effects on NDF and ADF digestibility in vitro and the effect of increasing SUP LEV on ruminal fermentation and digestion.

Key Words: Byproduct, Forage, Digestibility

146 Influence of enzyme supplementation on digestive function of cattle. M. F. Montano*[1], L. Corona[2], J. Rosales[2], and R. A. Zinn[2], [1]*Universidad Autonoma de Baja California (Mexicali, Mexico),* [2]*University of California, Davis.*

Four Holstein steers (164 kg) with cannulas in the rumen and proximal duodenum were used in a 4 x 4 Latin square design experiment to evaluate the influence of Effective Microorganisms (EM[#],a mixed culture of lactic acid bacteria, yeast and photosynthetic bacteria; EM Hawaii, Inc., Honolulu) on characteristic of ruminal and total tract digestion. The basal diet contained (DMB) 55.10% steam-flaked corn, 10.00% alfalfa, 18.00% sudangrass hay, 3.00% yellow grease, 8.00% cane molasses, 3.50% fishmeal, .50% trace mineralized salt, .80% urea, .80% limestone, and .30% chromic oxide. Experimental period were of 14-d duration, with 10d for diet adaptation and 4d for sampling. Steers were fed twice daily at 0800 and 2000. Treatments were 0, .4, .8, and 1.2 mL culture/L of drinking water. Microbial supplementation slightly decreased ruminal (linear component, P < .10) and total tract (quadratic component, P < .05) starch digestion. There were no treatment effects (P > .10) on ruminal microbial efficiency, or on ruminal and total tract digestion of OM, NDF, and N. Daily water intake was not affected by treatments (P >.10), averaging 30 L/d. We conclude that under the conditions of this trial, supplementation with EM (to reduce fecal odor) will not have appreciable effects on digestive function in cattle.

Key Words: Enzyme, Cattle, Metabolism

147 Influence of pelletization on the feeding value of rice straw in growing-finishing diets for feedlot cattle. R. A. Ware*[1], E. G. Alvarez[2], M. Machado[1], M. F. Montano[2], S. Rodriguez[1], and R. A. Zinn[1], [1]*University of California, Davis,* [2]*Universidad Autonoma de Baja California (Mexicali, Mexico).*

Seventy-two yearling crossbred steers were used in a 125-d finishing trial to evaluate the influence of pelletizing on the feeding value of rice straw. Treatments consisted of a steam-flaked corn-based diet containing 12% sudangrass (SG), 12% pelletized rice straw (PRS)or 24% pelletized rice straw (DMB). Sudangrass hay was ground to pass through a 2.6 cm screen prior to incorporation into complete mixed diets. There were no treatment effects (P > .10) on ADG. At the 12% forage level, DMI, gain efficiency and diet NE were similar (P > .10) for sudangrass and pelletized rice straw. Increasing the inclusion rate of pelletized rice straw from 12 to 24% increased (11%, P < .05) DMI, and decreased (P < .05) gain efficiency (14%) and dietary NE for maintenance and gain (5 and 6%, respectively). Three steers with cannulas in the rumen and proximal duodenum were used in a 3 x 3 Latin square experiment evaluate treatment effects on digestion. There were no treatment effects (P > .10) on ruminal digestion of OM, NDF, and feed N. Ruminal starch digestion was similar (P > .10) for 12% SG and 12% PRS, but increased (5%, P<.05) with 24% PRS. Total tract digestion of OM and DE were similar (P > .10) for 12% SG and 12% PRS, but decreased (5 and 6%, respectively, P < .05) with 24% PRS. There were no treatment effects (P > .10) on total tract digestion of NDF, N, and starch. We conclude that at lower inclusion rates (12% forage level), the NEm and NEg values of pelletized rice straw are equivalent to sudangrass hay (1.18 and .61 Mcal/kg, respectively). At higher forage levels (24%), the NEm and NEg values of pelletized rice straw are enhanced (1.46 and .87 Mcal/kg, respectively).

Key Words: Pellet, Rice Straw, Cattle

148 Phase feeding strategies to meet metabolizable protein requirements of calf-fed Holstein steers. M. Machado*[1], J. F. Calderon[2], and R. A. Zinn[1], [1]*University of California, Davis,* [2]*Universidad Autonoma de Baja California (Mexicali, Mexico).*

Two hundred sixteen Holstein steers (114 kg) were used to evaluate phase feeding metabolizable protein (MP). Four strategies were evaluated: 1) from d 1 to finish steers received a steam-flaked sorghum-based growing-finishing diet, formulated to meet average MP requirements for the 322 d feeding period (urea was the sole source of supplemental N); 2) from d 1 to d 56 steers received a starter diet formulated to meet the MP requirements during the initial 56-d feeding period (10% fishmeal), and thereafter were fed diet 1; 3) from d 1 to d 112 steers received a starter diet formulated to meet MP requirements during the initial 112-d feeding period (6.5% fishmeal), and thereafter were fed diet 1; and 4) from d 1 to d 168 steers received a starter diet formulated to meet MP requirements during the initial 168-d feeding period (4% fishmeal), and thereafter were fed diet 1. Steers were blocked by weight and assigned to 36 pens (6 steers/pen). Fresh feed was provided twice daily. During the initial 168 d of the trial, increasing duration of the starter phase (0, 56, 112, and 168 d) increased ADG (6%, linear component, P < .01), gain efficiency (8%, quadratic component, P < .01), and dietary NE (6%, linear component, P < .01), and decreased hip height:weight ratio (5%, linear component, P < .01). However, across the entire 322-d feeding period, treatment effects on growth performance were null (P > .10). We conclude that although phase feeding to meet MP requirements during a particular growing phase will enhance growth performance during that phase, there is no long-term or carryover benefit.

Key Words: Protein, Holstein, Feedlot

149 Influence of level of enzyme supplementation on growth performance of growing-finishing cattle. J. Rosales*[1], E. G. Alvarez[2], M. Machado[1], A. Plascencia[2], S. Rodriguez[1], R. A. Ware[1], and R. A. Zinn[1], [1]*University of California, Davis,* [2]*Universidad Autonoma de Baja California (Mexicali, Mexico).*

Ninety-six crossbred steer calves (184 kg) were used in 261-d randomized complete block experiment to evaluate the influence of level of fibrolytic enzyme supplementation (0, 5, 10, and 15 g/d Fibrozyme[#], Alltech Inc., Nicholasville, KY) on growth performance. During the first 70-d (growing phase) the basal diet contained 22% forage (10% alfalfa hay, 12% sudangrass hay) and 64% steam-flaked corn. From d-71 to d-261 (finishing phase) the basal diet contained 12% forage (4% alfalfa hay, 8% sudangrass hay), and 76% steam-flaked corn. Enzyme supplementation tended (linear component, P = .12) to increase DMI. Enzyme supplementation increase ADG during both the growing (cubic component, P < .10) and finishing (linear component, P < .05) phases. Overall, enzyme supplementation increased ADG 9% (linear component, P < .05), and gain efficiency 3% (linear component, P < .10). Improvements in growth performance due to enzyme supplementation were due to treatment effects on feed intake. The effect of enzyme supplementation on dietary NE was small (1%; cubic component, P = .13). We conclude that fibrolytic enzyme supplementation of both growing and finishing diets may enhance energy intake, and growth performance of feedlot cattle. Optimum growth performance responses are obtained with 10 g/d enzyme supplementation.

Key Words: Fiber, Enzyme, Cattle

150 Effects of fibrolytic enzymes on ruminal degradability of mature forages *in vitro*. V. A. Munn*, C. A. Loest, C. P. Mathis, M. K. Petersen, R. L. Endecott, T. Powers, and R. C. Waterman, *New Mexico State University, Las Cruces, NM*.

An *in vitro* experiment was conducted to determine the effects of fibrolytic enzymes on degradability of alfalfa hay (*Medicago sativa*), dormant blue grama (*Bouteloua gracilis*), dormant tabosa (*Hilaria mutica*), and wheat straw (*Triticum aestivum*). Rumen fluid was collected from two ruminally cannulated Angus cows fed alfalfa hay. Anaerobic fermentations (24 h incubations at 39C) were conducted by adding 25 mL rumen fluid and 25 mL McDougal's buffer to 0.5 g of forage substrate (ground to pass a 1-mm screen). *In vitro* tubes were randomly assigned to treatments, which were an enzyme complex (cellulase plus hemicellulase) added at 0, 0.05 (0.25 mg), and 0.50% (2.50 mg) of forage substrate. Residuals were filtered and analyzed for DM, OM, and NDF. Blank tubes containing 25 mL rumen fluid and 25 mL McDougal's buffer, but no forage or treatment, were used to correct for degradabilities. Enzyme addition had no effect (P>0.10) on OM (53.6, 54.3, and 67.7 ± 1.70% for 0, 0.05, and 0.50%) or NDF (32.2, 41.8, and 41.7 ± 1.60% for 0, 0.05, and 0.50%) degradability of alfalfa. Degradability of OM (42.2, 48.6, and 30.2 ± 1.70% for 0, 0.05, and 0.50%) increased (P<0.05) for blue grama in response to 0.05% enzyme addition. Degradability of NDF (30.1, 28.5, and 32.2 ± 1.60% for 0, 0.05, and 0.50%) tended to increase (P=0.11) for blue grama between 0.05 and 0.50% enzyme; a similar increase (P=0.10) was observed for OM degraded (31.3, 27.9, and 32.6 ± 1.96% for 0, 0.05, and 0.50%) for tabosa. Addition of 0.50% enzyme tended to increase (P=0.15) NDF degradability (16.4, 17.1, and 20.0 ± 1.60% for 0, 0.05, and 0.50%) for tabosa. Degradability of NDF (29.6, 29.9, and 29.1 ± 1.60% for 0, 0.05, and 0.50%) for wheat straw was not affected, but OM degraded (33.7, 37.9, and 35.7 ± 1.70% for 0, 0.05, and 0.50%) tended to increase (P=0.09) at the 0.05% treatment. Results suggest that the effects of fibrolytic enzymes on the degradability of mature forages are small.

Key Words: Fibrolytic Enzyme, Forage, Degradability

151 Effect of salt levels on growth performance, carcass characteristics, cost of gain and manure salinity on finishing beef steers. W.R. Flatt*[1], T.L. Stanton[2], D. Schutz[3], J. Davis[2], and T.E. Engle[2], [1]*Premium Standard Farms,* [2]*Colorado State University-Fort Collins,* [3]*Eastern Colorado Research Center*.

Two hundred eighty-eight British cross beef steers (average BW=305 ± 2 kg) were fed for 163 d at the Eastern Colorado Research Center, in a randomized experimental design, to evaluate effects of four levels of supplemental salt (NaCl) on cost of gain, growth performance, morbidity/mortality, carcass characteristics and manure salinity. Calves were weighed, unshrunk, and stratified by weight, randomized by breed, and assigned to one of four NaCl treatments; 0.0, 0.125, 0.25 %, or block salt (DM basis; n= 72 steers/treatment). Average daily gain (kg/d) was not affected by dietary NaCl level (1.68, 1.64, 1.67, 1.67; P > 0.05). Average daily feed intake (9.40, 9.29, 9.26, 9.24; kg·head^{-1}day^{-1}), feed efficiency (feed: gain ratio; 5.60, 5.68, 5.78, 5.56), cost of gain (59.53, 59.05, 59.03, 58.12; dollars/100 kg gain) nor DM digestibility (60.28, 66.33, 63.75, 68.34 %) appeared to be affected by dietary NaCl supplementation (P > 0.05). Neither mortality (1.41, 0.0, 1.43, 0.0 %), morbidity (11.27, 8.11, 8.57, 6.85 %) or final, unshrunk, weight (579, 571, 576, 579 kg) was statistically different, due to increasing salt levels. Conversely, increasing NaCl levels, tended to reduce dressing percentage (P = 0.07; 62.60, 62.43, 61.77, 61.47 %) and hot carcass weight (P= 0.08; 351, 345, 345, 344 kg), respectively. As dietary NaCl increased, concentrations of Na and Mg increased, linearly, from core manure samples taken behind the pen aprons (P < 0.05). In this experiment, no apparent advantage of NaCl supplementation at or above NRC (1996) recommendations, on growth performance, diet digestibility, cost of gain or feed efficiency, was observed. However, by decreasing dietary NaCl levels, hot carcass weight and dressing percentage increased while NaCl concentration decreased in the manure.

Key Words: Beef Cattle, Salt, Manure

152 Feeding value of barley vs. corn in finishing diets. J. J. Kincheloe*, J.G.P. Bowman, L.M.M. Surber, D. L. Boss, K. A. Anderson, and T. K. Blake, *Montana State University, Bozeman, MT, USA*.

Two feedlot studies (Havre, MT and Bozeman, MT) were conducted to evaluate ADG, nutrient digestibility, carcass characteristics and grain energy content when steers were fed corn or one of three barley varieties (Chinook, Logan, and H3). Grains were dry-rolled, and diets were balanced to contain 2.24% N, 2.01 Mcal/kg NE_m and 1.35 Mcal/kg NE_g. Eighty crossbred steers were assigned by weight to 16 pens at both Havre and Bozeman (initial BW 370 kg and 391 kg). Pen was the experimental unit. Steers were weighed and diet, ort, and fecal samples were collected every 28 d, composited by pen, and analyzed for DM, N, ADF, AIA, and starch. Fecal output was estimated using AIA as an internal marker. Steers were slaughtered when 70% were visually estimated to grade Choice. At Havre, no differences ($P > 0.10$) were seen in ADG (1.7 kg), FE (16.7 kg gain/100 kg feed), DMI (10.1 kg), DMD (70.7%) or starch digestibility (86.9%) between diets. Corn and barley had similar ($P > 0.10$) NE_m and NE_g values (2.3 Mcal/kg and 1.6 Mcal/kg). Carcass weights were higher ($P = 0.07$) for corn-fed than barley-fed steers at Havre (324 vs. 313 kg); however, there were no other carcass differences ($P > 0.10$). In Bozeman, ADG was higher ($P = 0.001$) for barley-fed steers (1.9 kg) compared to corn-fed steers (1.7 kg). Steers fed Chinook and Logan had higher ($P = 0.03$) FE (15.9 kg gain/100 kg feed) than steers fed corn (14.3 kg gain/100 kg feed). Barley diets had higher ($P = 0.001$) DMD (70.5%) and starch digestibility (93%) than corn, (61.4% DMD and 80.6% starch digestibility), and higher ($P = 0.01$) NE_m and NE_g values (2.19 and 1.53 Mcal/kg) than corn (1.99 and 1.35 Mcal/kg). No differences in carcass characteristics were seen at Bozeman. Barley performed as well as corn in both locations, and in Bozeman, steers fed barley had 14% improved ADG. Differences between locations could be due to genetics, environmental conditions, and feeding management.

Key Words: Barley, Feed Quality, Feedlot Performance

153 Effects of level of supplemental soybean oil on duodenal fatty acid flow in beef heifers fed bromegrass hay. E. J. Scholljegerdes*, B. W. Hess, M. B. Whitney, and D. C. Rule, *University of Wyoming*.

Eight ruminally cannulated Angus × Gelbvieh rotationally crossed heifers were used in a replicated 4 × 4 Latin square experiment to determine the effects of supplemental soybean oil level on duodenal flow of fatty acids (FA). Heifers were fed either chopped (2.54 cm) bromegrass hay (99.2%) plus 0.8% calcium carbonate (HAY), HAY (74%) plus cracked corn (19.9%) and 6.1% soybean meal, HAY (77.6%) plus cracked corn (12.8%), soybean meal (6.7%), and 2.9% soybean oil, or HAY (81.7%) plus cracked corn (4.8%), soybean meal (7.8%), and 6.2% soybean oil. Experimental periods were 14 d in length with 10 d adaptation and 2 d of intensive sample collection. Total FA intake and flow to the duodenum increased linearly ($P < 0.0001$) as soybean oil was added to the diet. Biohydrogenation of unsaturated FA, especially 18:2*cis-9,12* increased linearly ($P < 0.0001$) as supplemental soybean oil increased. Total biohydrogenation of C18 FA was greatest ($P = 0.01$) for the diets with soybean oil (avg. 94.7%). Therefore, duodenal flow of 18:0 increased ($P = 0.01$) in supplemented heifers when compared to non-supplemented heifers. Duodenal flow of 18:1*trans-11* (TVA) was greater ($P = 0.0002$) for supplemented heifers and increased linearly ($P < 0.0001$) as dietary soybean oil increased. No differences ($P = 0.07$) were observed among dietary treatments for duodenal flow of 18:2*cis-9*. Total conjugated linoleic acid (18:2*cis-9, trans-11*, 18:2*trans-10, cis-12*, 18:2*cis-10, cis-12*) flow was not different ($P \geq 0.07$) between HAY and supplemented heifers but increased linearly ($P = 0.01$) as intake of soybean oil increased. Total unsaturated FA flow to the duodenum increased ($P = 0.001$, linear) in heifers receiving supplements. Provision of supplemental soybean oil to beef heifers consuming bromegrass hay increased the amount of unsaturated FA, TVA, and CLA flowing to the small intestine, which may be favorable in regard to enhancing reproduction and increasing CLA status of beef cattle fed forage-based diets.

Key Words: Beef Cattle, Fatty Acids, Supplementation

154 Effects of supplemental corn and high-oil corn on duodenal fatty acid flows for beef heifers grazing summer pasture. S. L. Lake*, B. W. Hess, E. J. Scholljegerdes, L. Brokaw, and D. C. Rule, *University of Wyoming*.

Nine Angus × Gelbvieh heifers (539 ± 62 kg initial BW) with ruminal and duodenal cannulae were used in a split-plot designed experiment to determine the effects of supplemental corn or high-oil corn on the flow of duodenal fatty acids (FA). Beginning July 15, heifers continually grazed a 6.5-ha pasture predominated by bromegrass (*Bromus* spp.) while being supplemented with one of three treatments: no supplementation (CON); daily supplementation of corn (4.9% crude fat) at 0.5% BW (CRN); or daily supplementation of high-oil corn (11.7% crude fat) at 0.5% BW (HOC). Three 26-d periods consisted of 17 d adaptation followed by 9 d of sample collections. Treatment and sampling period effects were evaluated using orthogonal contrasts. Duodenal FA flow of conjugated linoleic acid (CLA; 18:2$c9$,$t11$, 18:2$c10$,$c12$, and 18:2$c10$,$t12$) and 18:3 was greater ($P \leq 0.03$) for CON heifers compared to heifers fed supplement; however, duodenal flow of 18:0, 18:1$t11$ (TVA), 18:1$c9$, 18:2$c9$,$c12$, total saturated FA (SFA), monounsaturated FA (MUFA), and PUFA increased ($P \leq 0.02$) in supplemented heifers. Supplementing heifers with HOC increased ($P \leq 0.04$) duodenal flow of MUFA because flow of 18:1$c9$ in HOC was 27.8 g/d compared to 7.4 g/d in CRN heifers. Duodenal flow of 18:0, TVA, 18:1$c9$, 18:2$c9$,$t11$, SFA, MUFA, and total FA decreased ($P \leq 0.02$) linearly as the grazing period advanced. Duodenal flow of MUFA and 18:1$c9$ decreased ($P \leq 0.05$, quadratic) with advancing season, whereas flow of 18:2$c9$,$c12$ and PUFA increased from period 1 to period 2 then decreased during period 3 ($P \leq 0.001$, quadratic). Although CON heifers had greater duodenal flow of CLA at the duodenum, heifers fed corn supplements had increased ($P \leq 0.006$) flow of TVA, which is the precursor to the principle form of CLA (18:2$c9$,$t11$) in ruminant animal tissues. Moreover, the potential to increase MUFA status was enhanced with the provision of supplemental HOC to cattle grazing brome pastures in the summer.

Key Words: Fatty Acids, High-Oil Corn, Supplementation

155 Effect of supplemental soybean oil on duodenal flow of long chain fatty acids in beef heifers grazing summer pasture. D. E. Carter*, B. W. Hess, E. J. Scholljegerdes, and D. C. Rule, *University of Wyoming*.

Nine Angus × Gelbvieh heifers (avg BW = 347 ± 2.8 kg) fitted with ruminal and duodenal cannulae were used in a split plot designed experiment to determine the effects of soybean oil (SBO) or corn supplementation on duodenal flow of fatty acid (FA). Beginning on June 8, 1998, heifers continually grazed a 6.5-ha pasture of predominately bromegrass and received one of three treatments: no supplement (CON); daily supplementation of cracked corn (CRN; 0.345% BW); or daily supplementation of a supplement containing cracked corn, corn gluten meal (CGM), and SBO (12.5% of supplemental DM; OIL) provided at 0.3% of BW. Soybean oil replaced corn on a TDN basis and CGM was included to provide equal quantities of supplemental TDN and N. Three 23-d periods consisted of 14 d of adaptation followed by 9 d of sample collections. Treatment and sampling period effects were evaluated using orthogonal contrasts. Intake of PUFA decreased linearly ($P < 0.01$) because of a linear decrease ($P < 0.01$) in intake of 18:3 as the grazing season progressed. Duodenal flow of monounsaturated FA (MUFA) and PUFA decreased linearly ($P < 0.01$) because flow of 18:1*cis-9*, 18:1*trans-11*, and 18:3 decreased linearly ($P < 0.01$) with advancing season. Total FA flow to the duodenum decreased ($P = 0.02$, quadratic) as the grazing season advanced. Total FA intake was greatest ($P < 0.01$) for OIL heifers. Supplementation increased ($P = 0.03$) duodenal flow of total unsaturated FA, PUFA, 18:1*cis-9*, and 18:2*cis-9,12*. Heifers fed OIL had greater duodenal flow of total FA ($P = 0.02$), MUFA ($P = 0.03$), PUFA ($P = 0.04$), 18:1*cis-9* ($P = 0.02$) and 18:2*cis-9,12* ($P < 0.01$), and duodenal flow of 18:1*cis-11* tended to be greater ($P = 0.06$) in OIL compared to CRN heifers. We conclude that FA intake by heifers grazing summer pasture declines as the forage matures. Feeding soybean oil supplements to grazing heifers will increase duodenal flow of FA, thereby increasing the FA status as well as energy available for animal metabolism.

Key Words: Beef Cattle, Soybean Oil, Supplementation

156 Comparison of elk (*Cervus elaphus*) fecal and rumen microbial suspension to predict feed degradation and adaptation. M. Blummel*, R. E. Short, and E. E. Grings, *USDA-ARS, Miles City, MT*.

Substitution of fecal (FMS) for rumen microbial suspension (RMS) could aid researchers when rumen cannulation is problematic such as in elk, which often share grazing habitats with cattle, yet differ in digestive adaptations. Three rumen-cannulated female elk (approximately 250 kg BW) offered alfalfa hay ad libitum were used to compare *in vitro* fermentation characteristics of alfalfa hay (AH), barley straw (BS), and corn silage (CS) and their NDF preparations in RMS versus FMS. Adaptation of microorganisms to pine needles (PN), which cause abortion in cattle but not in elk, was investigated by feeding increasing amounts (0.5, 0.75, and 1 kg) of PN through the rumen cannulas of the elk for 2 wk. *In vitro* gas production was measured 16 times during 96 h of incubation. Apparent degradability and volatile fatty acid production were measured after 24 h. Exponential (Mitscherlich) and sigmoidal (Gompertz) models were fit to time series measurements of gas production. Except for AH and AH-NDF, gas production profiles were better ($P < 0.05$) described by the sigmoidal than by the exponential model in both RMS and FMS. Using the best-fit model, similar asymptotic gas volumes were obtained for RMS and FMS ($R^2 = 0.78$, $P = 0.006$) and with a slope not different ($P > 0.05$) from 1. Times to 50% of maximal asymptotic gas production (T_{50}) in RMS and FMS were highly correlated ($R^2 = 0.90$). However, T_{50} was 2.9 times longer in FMS than RMS. No significant relationship ($P = 0.06$) was found between 24 h degradability in RMS and FMS. Mean acetate proportion was less ($P < 0.0001$) in RMS (0.63) than in FMS (0.74). Adaptation of elk to PN had little impact on asymptotic gas volumes from PN but T_{50} was decreased from 17:12 to 9:06 h ($P < 0.0001$) in RMS with adaptation. This was reversed for PN incubated in FMS from adapted elk where T_{50} was 16:24 h compared to 13:36 h ($P = 0.03$) in FMS from un-adapted elk. The use of FMS to inoculate *in vitro* gas production systems did not provide results similar to RMS for all measures evaluated.

Key Words: Gas Production, Elk, In Vitro

157 The effect of various extrusion temperatures on protein utilization of canola meal by chicks. J. A. Southwick*, R. O. Kellems, N.P. Johnston, D. L. Eggett, and B. L. Webb, *Brigham Young University, Provo, UT/USA*.

The objective of this study is to determine the effect of heat extrusion on protein utilization of canola meal (CM). Canola was pressed, extruded (ext.) at five different temperatures (temp.) (110, 120, 130, 140, and 150 °C.), then pressed again to remove additional oil. Laboratory analysis was conducted on the ext. CM to determine CP, ether extract, and rumen CP degradability (deg.). Remaining fat in the ext. CM was extracted (ether) out and the rumen CP deg. was again determined. A broiler growth trial was conducted to evaluate the effect ext. CM at five different temp., would have on growth rate and feed conversion. Seven broiler diets were formulated to contain 23% CP, 3700 kcal/kg ME, 0.9%Ca, 0.33% avail. P, and 0.9% Met and Cys. Two control diets (solv. extracted soybean meal and solv. extracted CM) and five treatment diets using CM ext. at five different temp. as protein supplements. One hundred and five male broiler chicks (Cornish, Rock cross) were used in a 26 d growth trial. Three replicates of five chicks were randomly assigned to each of the treatment groups. Each chick was weighed on d 1, 7, 14, 21, and 26. Feed consumption was determined on a pen basis and weighbacks were collected and on d 7, 14, 21, and 26. Survivability between each treatment found not to be different ($P>0.05$). Results are summarized in the following table.

	Treatment						
Item	110	120	130	140	150	CM	SBM
Lab Analysis							
CP deg. %	70.8^{ab}	71.9^{a}	69.1^{b}	57.9^{c}	52.4^{d}	-	-
CP deg. (no fat)%	68.7^{a}	64.9^{b}	64.0^{b}	51.2^{c}	31.7^{d}	-	-
Broiler Growth Trial							
Consumption/ wk. (g)	632^{a}	614^{a}	571^{b}	634^{a}	553^{b}	611^{a}	625^{a}
Total gain (g)	1421	1421	1339	1496	1329	1444	1687
Feed:gain (g)	1.8	1.74	1.75	1.72	1.58	1.78	1.49

^{abcd}Means in rows with unlike superscripts differ (P < 0.05)

Key Words: Canola Meal , Extrusion, Protein Degradability

158 Predicting efficiency of microbial production in diets by in situ and in vitro degradation characteristics of diet ingredients. M. Bluemmel*[1], E. Zerbini[2], S. Fernandez-Rivera[1], A. Karsli[3], and J. R. Russell[3], [1]*ILRI India/Ethiopia,* [2]*Agribrands Europe Regional Lab,* [3]*Iowa State University, Ames.*

High efficiency of microbial production (EMP) increases microbial protein flow to the small intestine and reduces carbon losses into CO_2 and CH_4. Yet, many feeding systems are still based on assumptions of constant EMP, which is largely due to a lack of simple techniques for the prediction of variations in EMP. Five isonitrogeous (CP = 10.6%) diets (D1 to D5) formulated from corn crop residues, alfalfa hay, oat-berseem hay, soybean meal and corn were offered *ad libitum* to ruminally and duodenally cannulated sheep in 5x5 Latin Square design. Digesta flow was estimated by chromium-mordanted fiber and microbial biomass in duodenal chymus was estimated by purine analysis. Two laboratory techniques were employed for detecting differences in EMP. Synchronization indices (SI) of N: OM release of diets were calculated based on in situ degradability of N and OM of ingredients. An hourly release of 25 g N/kg OM over a 24 h period is described by a SI of 1 while SI of < 1 describe levels of asynchronization. In vitro gas production profiles of ingredients were measured in an automated gas test using a 3-phasic model and time of maximum microbial production (TMAX) of diets was calculated. Truly degraded substrate (TSD) of ingredients was determined by refluxing the incubation residue with NDS at TMAX. The efficiency of microbial production in D 1, 2, 3, 4 and 5 was 31.2, 33.3, 34.4, 32.6 and 36.4 g per kg organic matter truly degraded in the rumen (P < 0.05). Synchronization indices were 0.771, 0.788, 0.812, 0.781 and 0.832 for D 1, 2, 3, 4 and 5, respectively and accounted for 90% (P = 0.015) of the variation in EMP. A negative association (r = -0.93, P = 0.02) was found between TMAX and EMP. The ratio of TSD (mg) to gas (ml) produced at TMAX was positively (r = 0.95, P = 0.015) associated with EMP. We conclude that variations in EMP of diets can be predicted by simple in situ and in vitro analysis of diet ingredients.

Key Words: In Situ, Gas Production, Microbial Efficiency

TEACHING

159 Western Center for Integrated Resource Management's dynamic approach to a Master's degree education at Colorado State University. K.E. Miller*, R.K. Peel, J.C. Whittier, and G.D. Niswender, *Colorado State University, Fort Collins, CO.*

Changes in the American West are dictating a new education for those responsible for the care and management of the land. A multidisciplinary approach is necessary to prepare individuals who can keep pace with an ever-changing world. This type of manager must be able to creatively evaluate how resources such as land, water, wildlife, livestock, humans, and finances affects sustainability. The Western Center for Integrated Resource Management (WCIRM) at Colorado State University seeks to develop these individuals through hands-on approaches to learning, as well as focusing on problem solving skills. The Master's degree program will provide the framework for graduates to develop a systematic approach to the problems encountered when managing land resources to sustain profitability. The partnership of six departments in four colleges at Colorado State University delivers an integrated education enabling graduates with the diverse knowledge required of contemporary resource managers. The program consists of 11 modular courses, each with a central theme, but presented from an integrated perspective facilitated by a multi-disciplinary team of course leaders. Each course will be conducted over 2 weeks with 6 hours of instruction per day. This approach enables the program to achieve two goals: 1) to provide students a focused, in-depth presentation of course material; 2) allow the coursework to be accessible to part-time students and practitioners. The courses are designed to stand alone, thus enabling the practitioners to select those courses that satisfy their needs.

Key Words: Integrated Resource Management, Agriculture Education, Sustainability