P < 0.01), rumpfat (r^2=0.60, P < 0.01), and days in milk (r^2= 0.48, P < 0.01) were positively related to serum leptin. In the second experiment, twelve Holstein cows, fed anionic salts 2 weeks before calving were given three levels of supplemental fat (0, 3, and 6% added fat using MEGALAC-R®) post- calving. Dry matter intake and milk production were measured for 4 weeks post-calving. Leptin was analyzed on jugular blood samples taken two days before calving, two days after calving and at weekly intervals 1h before and 2h after feeding. Serum leptin increased (P < 0.01), 7.2% (4.54 vs. 4.87 0.07 ng/ml) in cows post-calving as compared to pre-calving. Leptin was negatively related to level of dietary fat(linear and quadratic, P < 0.01), decreasing 16.2 - 28.4% (4.75, 3.33, and 3.98 0.41 ng/ml). In the first four weeks after calving, milk production decreased (linear, P < 0.01) 8.6 to 21.6% due to fat in the diet. Dry matter intake increased (quadratic, P < 0.05) from 1.5 to 7.0% and leptin tended to follow a similar trend (P < 0.14). DMI increased (linear, P < 0.01) from 18.1 to 23.6 kg/d and milk production increased (linear, P < 0.01) from 27.3 to 43.1 kg/d during the first four weeks of lactation. Serum leptin did not change during this period. Although serum leptin is correlated with body condition of dairy cattle, it remains to be identified as a major determinant of intake regulation in transition cows fed dietary fat.

Key Words: Leptin, Intake, Transition cow

135 The ability of amide versus calcium salts of soybean oil to increase unsaturated fatty acid concentration in omasal and continuous culture samples. F. P. Lundy III*, T. C. Jenkins, W. C. Bridges Jr, and J. A. Bertrand, *Clemson University, Clemson, SC, 29634*.

Two studies were conducted to determine the ability of two forms of soybean oil to resist biohydrogenation by mixed ruminal microorganisms in vivo and in continuous culture. Four TMR consisting of forage and concentrate (1:1 DM basis) contained either; 1) soybean oil (SBO) added at 2.45% of DM, 2) amide of soybean oil (AMD) added at 2.75% of DM, 3) calcium salt of soybean oil (CAS) added at 2.75% of DM, and 4) a mixture (20:80, w/w) of the amide and calcium salts of soybean oil (MIX) added at 2.75% of DM. The four diets were fed ad-libitum to four multiparious lactating (103 DIM, SD 38) Holstein cows (fitted with ruminal cannulae) in expt 1, and were fed (30 g/d) in expt 2 to four dual flow continuous culture systems in a 4X4 Latin square design. The ability of the fat supplements to resist biohydrogenation was expressed as C18:1 or C18:2 concentrations (mg/g DM) in omasal (expt 1) or fermenter outflow samples (expt 2) divided by their concentrations (mg/g DM) in the feed. For C18:2, the omasal/feed concentrations in expt. 1 were 0.078, 0.098, 0.108, and 0.125 and in expt. 2 were 0.187, 0.261, 0.283, and 0.337 for the SBO, MIX, CAS, and AMD diets, respectively. Similar results for C18:1 were 0.296, 0.32, 0.321 and 0.67 in expt. 1 and 0.458, 0.52, 0.507, and 0.592 in expt 2. Concentrations of C18:1 and C18:2 were higher for the CAS and AMD diets when compared to SBO. In expt 2, the AMD diet had higher (P=0.016) concentrations of C18:2 in overflow contents than CAS (8.99 vs 6.62). The concentration of C18:1 was higher (P=0.018) in the omasum in expt. 1 and higher in the fermenter outflow (P=0.016) in expt. 2 for AMD vs CAS. These experiments demonstrate greater ability of fatty amides and calcium salts to increase the delivery and concentration of unsaturated fatty acids postruminally compared to triacylglycerols. Fatty amides generally provided greater protection of unsaturated fatty acids from biohydrogenation compared to calcium salts, which was more prevalent for oleic acid than for linoleic acid.

Key Words: Biohydrogenation, Amide, Calcium Salt

136 Comparison of three estrus detection systems during summer heat stress in a large commercial dairy herd. O. A. Peralta*, R. E. Pearson, and R. L. Nebel, *Virginia Polytechnic Institute and State University, Blacksburg*.

Our objective was to compare the efficiency and accuracy of three estrus detection systems on a large commercial dairy (1000 lactating cows) during the summer of 2002. At ∼45 DIM, 282 cows were fitted with a HeatWatch (HW) device (HeatWatch® ; DDx Inc., Boulder, CO), an activity (A) sensor (ALPRO™; DeLaval Inc., Kansas City, MO), and observed visually (V) twice daily. Indicators of estrus included three standing events within 4 h for HW an activity level of 3 for A, and observed standing to be mounted for V. Onset of estrus was the first standing event both for HW and V. For A, onset of estrus was the hour after 3 consecutive h of twice baseline activity for that cow during the previous 10-d period. Pregnancy status was determined by uterine palpation 35 to 49 d following AI. The effects of DIM, parity, physical activity, standing events, months, AI technician, and interval from onset of estrus and AI on % pregnant were determined using linear contrast and logistic regression. Efficiencies for detection of estrus, determined by comparing detected periods of estrus with a theoretical total of 694, were 49.9% (V), 34.4% (A) and 41.6% (HW). Efficiency for the combination of all three methods was 76.4%. Percentage of inseminations resulting in a pregnancy (±SE) by method of detection was 20.6±4.9 for HW, 20.0±5.6 for A, 9.8±2.6 for V, 16.0±5.6 for V & A, 30.3±5.3 for V & HW, and 23.4±5.4 for A & HW. For estrus periods detected by HW, the probability of pregnancy increased as DIM and standing events increased (P<0.05). Estrus periods having 4 to 9 standing events recorded by HW had a lower (P<0.05) pregnancy outcome (19.8±2.8) compared with cows with estrus periods consisting of >10 standing events (34.0±5.0%). For estrus periods detected by A, the interval from the onset of estrus to AI had a direct effect on the probability of pregnancy (P<0.05); the highest % pregnant occurred between 13 and 18 h after the onset of estrus (38.5±7.9). The combination of all three systems resulted in ∼75% efficiency and the highest % pregnant occurred with the combination of V & HW, which confirms that multiple systems enhance both the efficiency and accuracy of detection.

Key Words: Detection of estrus, Estrous detection efficiency, Heat stress

WSASAS Graduate Student Paper Competition

137 Evaluation of perennial ryegrass straw as a forage source for ruminants. M. J. Fisher*[1], D. W. Bohnert[1], C. J. Ackerman[2], C. S. Schauer[1], T. DelCurto[1], A. M. Craig[2], D. L. Harmon[3], and N. F. Schrick[4], [1]*Eastern Oregon Agriculture Research Center, Burns,* [2]*Oregon State University, Corvallis,* [3]*University of Kentucky, Lexington,* [4]*The University of Tennessee, Knoxville*.

We conducted a 25-d metabolism trial to evaluate digestion and physiological variables in steers offered perennial ryegrass straw containing increasing levels of lolitrem B. Sixteen ruminally cannulated Angus × Hereford steers (231 ± 2 kg BW) were blocked by weight and assigned randomly to one of four treatments (TRT). Steers were provided perennial ryegrass straw at 120% of the previous 5-d average intake at 0730. Prior to straw feeding (0700), soybean meal was provided to meet the estimated requirement for degradable intake protein (0.1% BW; CP basis). Mixtures of a low (L) and high (H) lolitrem B straw (<100 and 1550 ppb, respectively) were used to formulate TRT diets. The TRT were Low (100% L), Low Mix (67% L:33% H), High Mix (33% L:67% H), and High (100% H). Intake and digestibility of DM and OM, along with ruminal pH and NH_3, were not affected by increasing lolitrem B concentration (P > 0.10). Ruminal indigestible ADF (IADF) fill increased linearly (P = 0.02) and IADF passage rate (%/hr) decreased linearly (P = 0.04) as lolitrem B level increased. Alkaloid concentration did not influence serum prolactin or heart rate (P > 0.31); however, a quadratic effect (P = 0.03) was noted for respiration rate, with the greatest values occurring with the Low Mix and High Mix diets. These data suggest that feeding perennial ryegrass straw containing up to 1550 ppb lolitrem B does not adversely affect nutrient digestion or physiological response variables.

Key Words: Lolitrem B, Perennial ryegrass, Straw

138 Risk factors associated with culling females in a composite beef herd. P. Rogers*[1], C. Gaskins[1], K. Johnson[1], and M. MacNeil[2], [1]*Washington State University,* [2]*USDA-ARS LARRL*.

Our goal was to identify factors affecting risk of a beef female being culled. Data were from the CGC composite herd (Red Angus, Charolais, Tarentaise) at Miles City, MT in which heifers were exposed as yearlings. Binary logistic regression was used to assess factors affecting probability of calving as a two-yr-old **(P(C2))**, including heifer (n =

1,756) phenotypes and breeding values **(BV)**. March-born heifers were more likely to calve at two than heifers born thereafter ($P < 0.01$). As birth weight of the heifer increased P(C2) tended to decrease ($P < 0.10$). Conversely, P(C2) tended to increase as BV for cow weight increased ($P < 0.10$). Neither phenotype nor direct and maternal BV for preweaning gain affected P(C2) ($P > 0.10$). Relationships of age at culling with first calving measurements (n = 1,254) and genetic profiles (n = 1,382) of females were assessed in separate analyses using Cox regression. Independent variables were coded into evenly spaced categories. Records from pregnant cows that were sold and from cows in the herd in 2001 were treated as censored (33%). Age at first calving and birth weight and 200-d preweaning gain of her first calf did not influence age at culling ($P > 0.10$), but heifers experiencing dystocia were at 36% greater risk than cohorts that did not ($P < 0.01$). As BV for cow weight increased, risk of being culled decreased ($P < 0.01$). Cows with intermediate direct BV for preweaning gain were at lower risk of being culled than those with extreme BV ($P < 0.01$). On average, increasing maternal BV for preweaning gain increased risk of being culled ($P < 0.01$). Date of birth was more important than phenotype or genetic profile in determining whether or not a heifer calves at two years of age. Genetic profile of a female is a better indicator of age at culling than traits measured on her first calf.

Key Words: Longevity, Survival analysis, Beef cattle

139 LHRH fusion protein vaccines block estrous cycle activity in beef heifers. J. D. Stevens*, J. M. Sosa, D. M. deAvila, J. M. Oatley, J. A. Hernandez, K. P. Bertrand, and J. J. Reeves, *Washington State University, Pullman, WA*.

Two LHRH fusion proteins, thioredoxin (TL) and ovalbumin (OL), each containing seven LHRH inserts were tested. The objective was to evaluate immune and biological response from alternating the two fusion proteins in an immunization schedule. One hundred and ten heifers were equally divided into 11 groups. Control groups were spay and intact non-treated animals. Heifers in the other nine groups were immunized on wk 0, 4 and 8. Treatments were immunizations of the same protein throughout or alternating the proteins in different sequence. Blood was collected weekly for 22 wk and serum assayed for progesterone and LHRH antibody binding. At slaughter, reproductive tracts were removed from each heifer and weighed. Heifers with progesterone ≥ 1 ng/ml were considered to have a functional corpus luteum and thus have estrous cycle activity. All LHRH immunized groups of heifers had lower ($P \leq 0.05$) numbers of cycling animals after wk 6 when compared to the intact non-treated control group. There was no difference ($P \geq 0.05$) in number of heifers cycling between the immunized groups and the spayed heifers during wk 9 to 22. Luteinizing hormone releasing hormone antibody binding did not differ among immunized groups during wk 1 to 9 ($P \geq 0.05$). Starting wk 10 and continuing through the conclusion of the study, there was an overall difference among treatment groups for LHRH antibody binding ($P \leq 0.05$). Uterine weights differed between treatments ($P \leq 0.05$) with intact control animals having heavier uteri than all other groups ($P \leq 0.05$). Uterine weights were significantly negatively correlated with LHRH antibody binding ($r = -.51$). In summary, these LHRH fusion proteins were as effective as surgical spaying in suppression of estrous cycle activity, however, alternating the two proteins in an immunization schedule did not enhance the immunological or biological effectiveness of the vaccine.

Key Words: Immunization, LHRH, Heifers

140 Effects of fluxin meglumine on embryonic loss in stressed beef cows. M. L. Merrill*[1], R. P. Ansotegui[1], N. E. Wamsley[2], P. D. Burns[2], and T. G. Geary[3], [1]*Montana State University, Bozeman, MT,* [2]*Colorado State University, Fort Collins, CO,* [3]*USDA-ARS, Miles City, MT*.

The objective of this study was to determine if flunixin meglumine reduces early embryonic death in cows subjected to stress. Approximately 14 d following synchronization of estrus and artificial insemination (AI), 97 cows were assigned to one of three treatments by AI sire, AI date, and AI technician. Treatments were control (CON), induced stress (S), and induced stress with flunixin meglumine (1.1mg/kg, i.m; SFM). Rectal temperatures were recorded and blood samples collected (caudal venipuncture) for measurement of cortisol, and PGF metabolite (PGFM) concentrations before and after induced stress. Control cows remained at the ranch with their calves and had access to water but not feed, while S and SFM cows were loaded on semi-trucks and transported for 4 h (mean ambient temperature 24^o C). Cows were not exposed to clean-up bulls until after treatment. Transrectal ultrasonography was used to determine AI pregnancy status 55 to 57 d post AI. Pregnancy rates to AI tended ($P = 0.17$) to be higher among SFM cows (84%) than S cows (69%) while AI pregnancy rate of CON cows was intermediate (76%). Cortisol concentrations before and after treatment were 21 and 24 ng/ml, 23 and 17 ng/ml, and 18 and 8 ng/ml, for CON, S, and SFM cows, respectively. Change in cortisol concentration was different ($P < 0.06$) between CON and S or SFM, but not S versus SFM ($P > 0.10$). No changes ($P > 0.10$) in PGFM were detected among the three groups between the sampling periods. Body temperature decreased between the sampling periods for all treatments, but the change in temperature was greater ($P < 0.03$) for S and SFM cows compared CON. Across treatments, change in cortisol concentration between sampling periods did not influence ($P > 0.10$) AI pregnancy status, however, PGFM increased ($P<0.09$) 24.72 pg/ml or decreased 5.19 pg/ml in cows diagnosed open or AI pregnant. In summary, flunixin meglumine appears to decrease the stress-induced embryonic loss, but the role of PGF and cortisol remain unclear.

Key Words: Pregnancy, Stress, Cortisol

141 The effects of cattle gender on feedlot performance, carcass characteristics and muscle tenderness. W. T. Choat*[1], J. A. Paterson[1], B. M. Rainey[1], M. C. King[1], R. J. Lipsey[2], K. E. Belk[3], and G. C. Smith[3], [1]*Montana State University,* [2]*American Simmental Association,* [3]*Colorado State University*.

Effects of gender on rate of gain, carcass traits, shear force and trained sensory panel ratings of beef palatability were evaluated using 202 progeny of Angus or Simmental sires. Steers (n=99), heifers (n=57) and intravaginally spayed heifers (n=46) were commercially fed (161d). No implants were administered and heifers were not fed melengestrol acetate to suppress estrus. Steers had faster ($P < 0.01$) daily gains than spayed and intact heifers. The heavier ($P < 0.01$) final live weights of steers resulted in 25 kg heavier ($P < 0.01$) hot carcass weights at similar ($P = 0.86$) levels of fat thickness compared with heifers. Spayed heifers had a 5.7% smaller longissimus muscle area ($P < 0.05$) compared with steers and intact heifers, which were similar. Calculated yield grades and USDA quality grades were similar ($P = 0.21$) among treatments, although marbling scores were lower ($P < 0.01$) for steers compared to intact and spayed heifers. In order to directly examine gender effects on tenderness, shear force and sensory panel data were analyzed using an ANOVA model with marbling score as a covariate. Shear force values after 7 and 14 d of aging were lower ($P < 0.01$) for steers compared to intact and spayed heifers, which were not different from each other. Mean shear force values at 7 and 14 d of aging were 3.3 and 3.3 (steers) 3.8 and 3.6 (intact heifers) and 3.6 and 3.5 (spayed heifers), respectively, and did not differ ($P = 0.11$) among genders after 21 d of aging. A trained sensory panel evaluated steaks (aged 14 d postmortem) from 193 of the cattle for juiciness, muscle fiber tenderness, connective tissue amount and overall tenderness using an 8-point structured rating scale. Steaks from steers received more favorable ratings ($P < 0.01$) for muscle fiber tenderness, connective tissue amount and overall tenderness, compared with spayed and intact heifers. Under the genetic and environmental conditions of this experiment, steers had faster daily gains and produced heavier carcasses at similar levels of subcutaneous fat, compared to heifers. Intact and spayed heifers produced strip loin steaks that had higher average shear force values (i.e., were less tender) and lower average ratings for sensory panel overall tenderness than those for steaks from steers.

Key Words: Cattle, Gender, Tenderness

142 Influence of protein supplementation frequency on cows consuming low-quality forage: performance, grazing time, distance traveled, distance from water, and distribution. C. S. Schauer*[1], D. W. Bohnert[1], and D. C. Ganskopp[2], [1]*Eastern Oregon Agriculture Research Center, Oregon State University, Burns, OR,* [2]*Eastern Oregon Agriculture Research Center, ARS-USDA, Burns, OR*.

Our objective was to determine the influence of CP supplementation frequency (SF) on cow performance, grazing time, distance traveled, maximum distance from water, and cow distribution within three 810-ha pastures. One hundred-twenty pregnant (approx. 60 d) cows (467 ±

4 kg BW) were used in a 3 x 3 Latin square for one 84-d period in each of three years. Cows were stratified by age, body condition score (BCS), and weight and assigned randomly to one of three pastures. Treatments (TRT) included an unsupplemented control (CON), daily supplementation (D; 0.91 kg/d; DM basis), and supplementation once every six d (6D; 5.46 kg/6d; DM basis). Cottonseed meal (43% CP; DM basis) was provided as the supplemental CP source. Water, mineral/salt, and supplement placement within each pasture were maintained in the same location each year of the study. Four cows from each treatment (each year) were fitted with global positioning system collars to estimate grazing time (hr/d), distance traveled (m/d), maximum distance from water (m/d), and cow distribution (% ha occupied·pasture^{-1}·yr^{-1}). Cow weight and BCS change were more positive ($P \leq 0.03$) for supplemented TRT compared with CON. No weight and BCS differences ($P \geq 0.14$) occurred between D and 6D. Grazing time was greater ($P = 0.04$) for CON compared with supplemented TRT with no difference ($P = 0.26$) because of SF. Distance traveled, maximum distance from water, and cow distribution were not affected ($P \geq 0.40$) by supplementation or SF. Results suggest that CP supplementation, provided daily or once every 6 d, of cows grazing low-quality forage increases weight and BCS gain, while decreasing grazing time. Additionally, cow distribution may not be affected by CP supplementation or SF.

Key Words: Protein supplementation, Frequency, Distribution

143 Livestock response to rest-rotation, deferred-rotation, or continuous grazing systems on forested rangeland.

L. G. Wood*, K. C. Olson, R. D. Wiedmeier, and J. E. Bowns, *Utah State University, Logan, UT*.

A 6-yr study was conducted to evaluate the influence of rest-rotation, deferred-rotation, and continuous grazing on the performance of cow-calf (*Bos taurus*) and ewe-lamb (*Ovis aries*) units on mountain rangeland in southern Utah. Treatments were arranged in a 3 grazing method (continuous, deferred-rotation, or rest-rotation) by 6 yr factorial using a randomized-complete block design with 2 blocks. All animals were individually weighed and cows received a body condition score (BCS) at the beginning, mid-point, and end of each grazing season. Average daily gain (ADG) was greater (P<0.05) for calves, lambs, and ewes grazed continuously (1.12, 0.26, and 0.095 kg d^{-1}, respectively) or under deferred-rotation (1.09, 0.25, and 0.096 kg d^{-1}, respectively) than under rest-rotation grazing (1.06, 0.24, and 0.077 kg d^{-1}, respectively). There was no difference in ADG for calves, lambs, or ewes grazed continuously or with deferred-rotation (P>0.05). Cows gained more (P<0.05) in continuous pastures (0.71 kg d^{-1}) than in deferred- (0.58 kg d^{-1}) or rest-rotation (0.54 kg d^{-1}) pastures. Cow ADG was similar (P>0.05) in deferred- and rest-rotation pastures. Change in BCS by cows was similar among grazing treatments (P>0.05). Calves, lambs, and ewes gained more per ha (P<0.05) in continuous (9.95, 18.43, and 4.52 kg ha^{-1}, respectively) and deferred-rotation pastures (9.84, 17.11, and 4.21 kg ha^{-1}, respectively) than in rest-rotation pastures (7.98, 12.95, and 2.61 kg ha^{-1}, respectively). Gain per ha was similar (P>0.05) between continuous and deferred-rotation grazing for calves, lambs, and ewes. Cows gained more per ha (P<0.05) in continuous (6.21 kg ha^{-1}) than rest-rotation pastures (4.18 kg ha^{-1}). Cow gain ha^{-1} under deferred-rotation (5.07 kg ha^{-1}) was intermediate and similar (P>0.05) to both continuous and rest-rotation. Rest-rotation grazing reduces animal production per ha and weaning weights of calves and lambs, resulting in lower profits for livestock operations.

Key Words: Beef Cattle, Sheep, Grazing Systems

144 Impact of trace mineral supplementation and source on grazing beef cattle over a two-year period.

J. K. Ahola*, T. E. Engle, D. S. Baker, L. R. Sharpe, P. D. Burns, R. M. Enns, and R. G. Mortimer, *Colorado State University, Fort Collins, CO USA*.

Over a two-year period, crossbred, multiparous beef cows (n=164/year) were used to determine the effect of trace mineral supplementation from 90 d prior to parturition through 120 d post parturition on cow performance. Cows were blocked by expected calving date, body weight, body condition score, and liver mineral status, and assigned to one of three treatments: 1) control (no supplemental copper (Cu), zinc (Zn), or manganese (Mn)); 2) ORG (50% organic and 50% inorganic Cu, Zn, and Mn); and 3) ING (100% inorganic CuSO4, ZnSO4, and MnSO4). Mineral treatments were provided ad libitum in free choice mineral feeders. At the end of year one, liver Cu, Zn, and Mn concentrations were higher (P<0.01) in supplemented relative to control cows and liver Cu concentrations were higher (P<0.01) in ORG relative to ING cows. At the end of year two, supplemented cows had higher liver Cu (P<0.01) and Mn (P<0.02) concentrations relative to controls. Overall 60 d pregnancy rate tended (P=0.10) to be higher for supplemented cows relative to controls. A year by treatment interaction was present (P<0.05) for pregnancy rate to artificial insemination (AI). In year one, there was a trend (P=0.07) for ORG cows to have a higher pregnancy rate to AI than ING cows. In year two, supplemented cows had higher (P<0.05) pregnancy rates to AI vs. control cows. When AI was based on estrus, supplemented cows had higher pregnancy rates (P<0.05) than control cows. From this large, two-year study it can be concluded that trace mineral supplementation and source has an effect on fertility if Cu, Zn, and Mn are not supplemented for more than one year.

Key Words: Trace mineral supplementation, Beef cattle, Performance

145 Effects of supplemental high-linoleate or high-oleate safflower seeds on production and lipogenesis by adipose tissue of postpartum cows.

S. L. Lake*, B. W. Hess, D. C. Rule, C. M. Murrieta, E. J. Scholljegerdes, V. Nayigihugu, and R. L. Atkinson, *University of Wyoming*.

Three-year-old Angus × Gelbvieh rotationally crossed beef cows (n = 36) nutritionally managed to achieve a body condition score (BCS) of 4.2 ± 0.3 (BW = 481.2 ± 29.3 kg) or 6.0 ± 0.3 (BW = 554.3 ± 39.3 kg) at parturition were used to determine the effects of dietary supplemental fat on production and adipose tissue fatty acid metabolism. Within BCS, and beginning 3 d postpartum, cattle were randomly assigned to be individually fed native grass hay (CP = 8.7%) and a low fat control supplement (C) or supplements consisting of high-linoleate safflower seeds (L) or high-oleate safflower seeds (O) until d-60 of lactation. Safflower seeds were cracked and supplements were formulated to provide 5% DMI as fat. Rations were formulated to be isonitrogenous and isocaloric. Adipose tissue biopsies were collected near the tail-head region of cows on d-30 and d-60 of lactation. Body condition score was not affected ($P = 0.43$) by dietary treatment, nor did BCS change ($P = 0.53$) from d-3 through d-60 of lactation; however, cows were heavier ($P = 0.04$) at d-30 than d-60. Milk production ($P = 0.24$) and milk fat percentage ($P = 0.80$) were not influenced by dietary treatments. Milk protein percentage was greater ($P = 0.03$) for cows with BCS 6.0 than BCS 4.2. Dietary treatment did not affect ($P \geq 0.12$) adipose tissue lipogenesis. Rates of palmitate incorporation into diacylglycerol and acetyl-CoA carboxylase activity were greater ($P = 0.001$) at d-30 than d-60, suggesting a proclivity for greater substrate esterification and biosynthesis by adipose tissue at d-30 of lactation. Lipoprotein lipase activity ($P = 0.01$) and palmitate incorporation ($P = 0.02$) into triacylglycerol were greater in BCS 4.2 compared to BCS 6.0. Hence, cows in sub-optimal condition retained a higher propensity to incorporate circulating triacylglycerol into stored adipocyte lipid.

Key Words: Beef cows, Fat supplementation, Lipid metabolism

146 Balancing supply of essential amino acids to the small intestine in cattle consuming restricted amounts of forage plus supplementary ruminally undegradable protein.

E. J. Scholljegerdes*, B. W. Hess, F. S. D'Angieri, and P. A. Ludden, *University of Wyoming, Laramie*.

Twelve Angus crossed cattle (avg BW = 594 ± 44.4 kg) fitted with ruminal and duodenal cannulae were used in a 4 × 4 Latin square double cross-over designed experiment to determine intestinal supply of essential amino acids (EAA) when consuming restricted amounts of forage plus a ruminally undegradable protein (RUP) supplement. Cattle were fed chopped (2.54 cm) bromegrass hay (11.4% CP, 57% NDF) at 30, 55, 80, or 105% of maintenance. Cattle fed below maintenance were given increasing amounts of RUP supplement (6.8% blood meal, 24.5% feather meal, and 68.7% fish meal; DM basis) in an effort to equalize duodenal EAA flow to that of the 105% of maintenance diet. Experimental periods were 19 d in length with 17 d of adaptation followed by 2 d of intensive sample collection. Due to greater amounts of supplemental RUP provided to cattle as forage intake decreased, total and individual EAA intake increased linearly ($P < 0.0001$) as forage intake decreased to 30% of maintenance. However, total duodenal flow of EAA did not differ ($P = 0.39$) across all levels of forage intake. The variation

in duodenal EAA proportions ranged from as low as 11.1 to 11.2% of total EAA for phenylalanine to 12.3 to 14.3% of total EAA for lysine. Although profile of EAA (individual EAA as a % of total EAA) reaching the duodenum differed ($P = 0.02$) for all 10 of the EAA, duodenal flow did not differ ($P = 0.10$ to 0.65) for 8 out of the 10 EAA. Specifically, duodenal flow of arginine increased linearly ($P = 0.01$) whereas duodenal flow of tryptophan decreased linearly ($P = 0.002$) as forage intake decreased from 105 to 30% of maintenance. Our results demonstrated that balancing intestinal essential amino acid supply in beef cattle can be accomplished with proper RUP supplementation.

Key Words: Restricted intake, Amino acids, Supplementation

Breeding & Genetics: Dairy cattle breeding for production traits

147 Individual curve fitting of Italian Simmental cow milk test day data. N.P.P Macciotta*[1], D. Vicario[2], G. Pulina[1], and A. Cappio-Borlino, [1]*Universitá di Sassari,* [2]*Italian Association of Simmental cow Breeders.*

The evolution of milk production over time can be modelled by several mathematical linear and non-linear functions. Observed differences in fitting of average lactation curves of homogeneous groups of animal for the most commonly used lactation models are rather small. On the other hand, a very wide range of goodness of fit can be observed for individual lactation pattern, essentially due to the random biological variation between cows and not to the inadequacy of the mathematical model used. Therefore, in order to study the effects of some systematic environmental factors on the shape of lactation curves, it is more useful to fit a simple model whose parameters possess a clear, technical significance to curves that are not too far from the typical lactation pattern. In this study, the incomplete Wood's gamma function $y=a(b\hat{t})\exp(ct)$ was fitted to 13,739 lactations of Italian Simmental cows, with at least 7 records each and with the first recorded test day within the 15th days in milking, of six parity classes (1 to 6). The overall mean adjusted r-square was 0.71. A reduced data set of 6830 regular lactation curves was extracted with the constraints of having the b parameter positive and the adjusted r-square greater than 0.75. Values of parameter a, b and c were analysed with a linear model in order to evalue the effect of herd, parity, year and season of calving on the lactation curve shape. Parity affected all the three parameters, with primiparous cows having the lowest values for the a (12.82) and c (-0.00417) parameter, thus indicating a lower level of production and a higher persistency of lactation in comparison with older cows. Also calving season affected all the parameters, with highest values of the scale parameter a for cows calving in March and April. Finally an increasing trend for the level of production and lactation persistency has been observed during the period considered (1989-1999).

Key Words: Lactation curve, Italian Simmental

148 Estimates of genetic parameters and lactation curves with a cubic spline model for Holstein cows treated with bovine somatotropin. B. J. DeGroot*[1], J. F. Keown[1], S. D. Kachman[1], and L. D. Van Vleck[2], [1]*University of Nebraska, Lincoln, NE,* [2]*USDA, ARS, USMARC, Lincoln, NE.*

The objective was to estimate genetic parameters and response to bovine somatotropin (bST) from individual test-day milk yields with a cubic spline model for first three lactations. A total of 263,034 test-day milk records of Holstein cows treated with bST and 405,265 test-day records of untreated cows that calved between 1996 and early 2002 were obtained from Dairy Records Management System, Raleigh, North Carolina. Estimates of (co)variances for a cubic spline with five knots were obtained with REML. Estimates of heritabilities for test-days and estimates of genetic and phenotypic correlations between test-days were obtained from estimates of variances and covariances from the cubic spline analysis. Genetic parameters were estimated at the average day within each of the ten 30-d test day intervals. The cubic spline model included herd test-day, age at first calving, treatment, and treatment by linear as fixed effects and treatment by spline as random effects. Cubic splines were fitted for the overall lactation curve within treatments, additive genetic effects, and permanent environmental effects. The cubic splines used five intervals determined by days 0, 50, 135, 220, and 310. The treatment differences were measured for bST treated and untreated cows. Estimates of heritability for test-day one to test-day ten ranged from 0.09 to 0.16, 0.10 to 0.17, and 0.10 to 0.18 for lactations one, two, and three. Estimates of genetic correlations for milk yield at pairs of test-days ranged from 0.99 to 0.45 for lactation 1, 0.99 to 0.32 for lactation 2, and 0.99 to 0.35 for lactation 3. The differences of 3.17, 2.27, and 2.30 kg between treated and untreated cows at day 100 were maintained until about day 220 of lactations one, two, and three. Estimates of heritability increased over the course of the lactation and estimates of genetic correlations decreased for pairs of test-days further apart.

Key Words: Heritability, Genetic correlations, Milk yield

149 Environmental sensitivity of genetic merit for milk, fat and protein yield estimated by a random regression model. M. P. L. Calus* and R. F. Veerkamp, *ID-Lelystad.*

Environmental sensitivity of genetic merit for milk, fat and protein yield was estimated using a random regression model to evaluate the effect of combining these traits in an economic index for different herd environments. To describe herd environments fourteen environmental parameters were defined based on the data available. Variance components and breeding values of sires for milk, fat and protein yield were modeled as a function of an environmental parameter. Up to the third order polynomial random regressions were applied. Fixed linear and quadratic regressions were included for age at calving and fixed effects to account for herd-year-season groups. A fixed polynomial regression was applied to the environmental parameters, to account for the average level in each herd. The residual variance was modeled for ten different groups, to account for heterogeneous residual variances in the model. ASREML was used for all analyses. Herd-year peak date of calving, herd average protein, body condition score, calving interval and age at calving gave most environmental sensitivity, mainly resulting from a change in scale of the genetic and residual variances for extreme herds and little re-ranking. The sire variances of milk, fat and protein yield followed more or less the same pattern across the environmental scale. Most genetic correlations across environments were close to unity for each individual trait. The change in variances had a large scaling effect on the economic weights, but the effects were similar for milk, fat and protein yields. Therefore, also very little re-ranking occurred based on the economic index, but the use of high merit bulls seemed more beneficial in herds with peak date of calving in the fall or winter, high average protein, high body condition score, short calving intervals and young age at calving.

Key Words: Environmental sensitivity, Random regression model, Environmental parameter

150 Estimation of genetic parameters for test-day records of French Holstein cows with an AI-REML algorithm. T. Druet*, F. Jaffrézic, and V. Ducrocq, *Station de Génétique Quantitative et Appliquée, INRA.*

Genetic parameters for lactation test-day records of French Holstein cows were estimated as a first step towards the implementation of a national genetic evaluation with a test-day model. Test-day records were considered up to 335 days in milk. The fixed part of the lactation curve was modeled with regression splines with 6 knots. Genetic parameters were estimated with an Average Information REML algorithm where the average information matrix and the first derivatives of the likelihood functions were pooled over 10 samples. This approach made it possible to handle larger data sets. The logarithm of the residual variance was modeled with several parametric functions of days in milk such as polynomial function or regression splines. Quartic Legendre polynomials were used to estimate (co)variances of random effects. The estimates were within the range of most other studies and were very close to those obtained in a previous study where lactation length was limited to 305 days. The largest genetic variance was in the middle of the lactation while residual and permanent environmental variances mostly decreased during the lactation. The resulting heritability ranged from 0.17 to 0.37. For a large part of the lactation genetic correlations were higher than 0.90. For both the genetic and permanent environmental variances, the first two eigenvalues represented more than 90 % of the total variation. The corresponding eigenvectors seemed to make sense biologically. They were used as covariables to estimate the genetic