

M125 Evaluation of the effects of dietary fat, conjugated linoleic acid and ractopamine on the fatty acid profiles of fat and muscle tissue of lean gilts. T. E. Weber¹, B. T. Richert¹, M. A. Belury², Y. Gu³, and A. P. Schinckel*¹, ¹Purdue University, ²The Ohio State University, ³Research Institute of Bastyr University.

Lean gilts (n = 180), with an initial BW of 59 kg, were assigned to a 2 × 2 × 3 factorial arrangement consisting of ractopamine (RAC; 0 or 10 ppm), conjugated linoleic acid (CLA; 1% of a product containing 60% CLA isomers or 1% soybean oil), and dietary fat in an 8-wk feeding trial. Dietary fat treatments consisted of: 1) 0% added fat; 2) 5% choice white grease; and 3) 5% beef tallow. RAC treatments were imposed when the gilts reached an average BW of 85.5 kg and lasted for the final 4-wk until carcass data were collected at an average BW of 112 kg. Lipids from fat tissues of the belly, outer, and inner layers of backfat and *longissimus dorsi* were extracted and analyzed for fatty acid composition (six pigs/treatment; 72 pigs total). Dietary CLA increased the concentration of saturated fatty acids (43.1 vs. 35.9%; P < 0.001), decreased the concentration of monounsaturated fatty acids (41.4 vs. 47.5%; P < 0.001), and decreased IV values (56.1 vs. 63.0; P < 0.001) of the belly fat. Dietary fat reduced the concentrations saturated fatty acids (41.6 vs. 45.0%; P < 0.01) and increased IV values (60.7 vs. 57.4; P < 0.001) in the belly fat. Dietary CLA increased the concentration of saturated fatty acids in both the inner (44.1 vs. 37.6%; P < 0.01) and outer (43.1 vs. 35.9%; P < 0.001) layers of backfat. CLA increased the IV values of both layers of backfat (67.6 vs. 62.5%, inner 68.0 vs. 65.7%, outer; P < 0.001). Pigs fed diets containing 5% animal fat had increased IV values of the inner (66.5 vs. 62.1; P < 0.001) and outer layers (68.1 vs. 64.3; P < 0.01) over pigs fed diets without added fat. CLA increased the total saturated fatty acids (44.6 vs. 38.4%; P < 0.001) and reduced the IV values 57.9 vs. 65.2%; P < 0.001) in the *longissimus dorsi* muscle. Ractopamine decreased the intramuscular fat content of the *longissimus dorsi* (1.95 vs. 2.43%; P < 0.01) and increased the IV values of the outer (68.0 vs. 65.7; P = 0.07) and inner layer (66.2 vs. 63.9; P = 0.02) of backfat. These results indicated that CLA results in more saturated fat.

Key Words: CLA, Ractopamine, Fatty acids

M126 WITHDRAWN. . .

M127 A case for expanded spreadsheet use in animal science research. N. D. Paton*, Akey, Lewisburg OH.

Considerable effort is spent assembling datasets from research trials in preparation for statistical analysis. In many cases a spreadsheet such as Microsoft® Excel is used. Spreadsheets can be programmed to provide substantial amounts of information from data in the form of summaries and graphs before the statistical analysis is performed. These summaries assist the researcher in identifying problems and errors before a statistical analysis is made. These errors can be difficult or impossible to uncover if data has been passed to a statistical analysis package and checks are not performed there. Little emphasis has been placed on teaching students and researchers how to maximize the utility of spreadsheets. Consequently, many do not explore possibilities of dataset preparation beyond simple capabilities of summing and calculating averages for vectors of data. If researchers were aware of more complex formula they may develop spreadsheets that detect more errors allowing easier identification of problematic data. If spreadsheets were robustly built the same template sheet could be used to assemble numerous datasets in a rapid and efficient manner. In MS® Excel the use of the OFFSET, TRANSPOSE, MATCH, RAND, V and H LOOKUP, AND, OR, IF, CHOOSE, ISERROR and DATABASE (specifically DAVERAGE and DSUM) functions are of value to the animal science researcher. They facilitate rapid summarization of data. They ensure the continuity and interactivity of calculations that operate on raw data when summaries and means are calculated for analysis. Often discovery of an error in the raw data requires the regeneration of a summary before a statistical analysis is performed. If summaries are linked through formulas to raw data they change automatically when the raw data are altered. Formulas can be written to perform complex tasks. The programming of the spreadsheets is relatively simple and the uses of some of the above formula are detailed and can be easily taught. Spreadsheets are ubiquitous; most researchers have access to their use. Their utilization could be increased if effort was expended in learning more of their capabilities.

Key Words: MS Excel, Formulas, Dataset

Ruminant Nutrition

M128 In vitro gas production of Iranian barley silage treated and untreated by urea and formaldehyde. A. Taghizadeh¹, M. Danesh Mesgaran*², R. Valizadeh³, F. Eftekhar Shahroodi⁴, and K. Stanford⁵, ¹Ferdowsi university, Mashhad, Iran, ²Ferdowsi university, Mashhad, Iran, ³Ferdowsi university, Mashhad, Iran, ⁴Ferdowsi university, Mashhad, Iran, ⁵Lethbridge Research center, Alberta, Canada.

In Vitro gas production Technique was used to measure the production gas from barley silages as experimental feed. The feeds were barley silage (untreated)(BS), BS treated with urea (20 g kg⁻¹, DM)(BSU) or formaldehyde (4 g kg⁻¹, DM)(BSF) or urea and formaldehyde (20 g kg⁻¹ and 4 g kg⁻¹, DM, respectively)(BSFU). One steer (42018 Kg, fed a diet containing (as fed) 700 g kg⁻¹ alfalfa hay/timothy and 300 g kg⁻¹ a 15% CP concentrate) was used as ruminal fluid donor for the preparation of inoculums. The production of gas was measured in each vial after 0.0, 2, 4, 8, 12, 15, 24, 48, 72 and 96 h of incubation. Gas production data were fitted to an equation of $p = a + b(1 - e^{-ct})$; where (p) is the gas production at time, t, (a) is intercept and ideally reflects the fermentation of soluble and readily available, (b) is the fermentation of the insoluble (but with time fermentable) fraction, (c) is the fractional rate at which b is fermented per hour. The soluble fraction (a) for BS, BSU, BSF and BSFU was 3.392, 4.84, -2.33 and #1.05, respectively. The insoluble (but with time fermentable) fraction (b) was 222.39, 185.45, 231.29 and 204.15, respectively. The fractional rate of fermentation (c) was 0.0418, 0.041, 0.049 and 0.0398, respectively. The results showed that the soluble fraction (a) of BSU was significantly (p < 0.05) higher than the other feeds. The potential fraction (b) of both BS and BSF were significantly (p < 0.05) higher than those recorded for BSU and BSFU. The gas production fractional rate (c) was significantly (p < 0.05) lower for BSFU compared with the other feeds. The results showed that the using of urea and/or formaldehyde in barley silage caused to change the

fermentation parameters determined by In Vitro gas production Technique.

Key Words: Gas production, Barley silage, Urea

M129 The effects of dietary crude protein concentration on nitrogen absorption and retention by feedlot steers. A. Gueye¹, C. R. Richardson¹, J. H. Mikus¹, G. A. Nunnery*¹, N. A. Cole², and L. W. Greene³, ¹Texas Tech University, Lubbock, Texas, ²USDA-ARS-CPRL, Bushland, Texas, ³Texas Agricultural Experimentation Station, Amarillo, Texas.

Twenty seven crossbred steers (average BW = 353.2 ± 8.4 kg) were used in a metabolism trial with three collection periods (approximately 35, 95, and 155 d on feed) to evaluate the effects of dietary CP source and concentration on nitrogen balance by steers. Treatments were arranged in a factorial arrangement and consisted of three dietary CP concentrations (11.5, 13.0, and 14.5%) and three supplemental urea:cottonseed meal (CSM) ratios (100:0, 50:50, and 0:100 of supplemental N). During each nutrient collection period steers were housed in individual metabolism stalls and urine and feces excreted were collected and frozen. Collection periods consisted of a 2- to 5-d adaptation period followed by a 5-d collection period. On d 35 on feed, total N excretion increased linearly (P = 0.002) with increasing CP concentration. Nitrogen absorbed (g/d) and N retained (g/d) linearly increased (P < 0.0001 and P = 0.01, respectively) with increasing CP concentration. On d 95 on feed, total N excretion linearly increased (P < 0.0001) with increasing CP concentration. Nitrogen absorbed (g/d) and N retained linearly increased (P < 0.0001 and P = 0.001, respectively) when CP increased from 11.5 to 14.5%. On d 155 on feed, DM digestibility decreased linearly (P < 0.05) with increasing dietary CP. Fecal N excretion increased linearly (P < 0.0001) with increasing CP. Nitrogen absorbed (g/d) decreased linearly (P = 0.03) with decreasing urea:CSM ratio. Nitrogen

absorbed (% of intake) increased quadratically ($P = 0.05$) with decreasing urea:CSM ratio. As days on feed increased, total N excretion also increased ($P < 0.02$). Based on our observations, feeding growing steers diets containing 11.5 to 13.0% CP and supplemented with higher proportions of degradable protein may potentially optimize N utilization and potentially reduces N losses to the environment.

Key Words: Retention, Dietary protein, Steers

M130 Effects of dietary crude protein on serum and urine urea nitrogen in feedlot steers. A. Gueye*¹, C. R. Richardson¹, J. H. Mikus¹, G. A. Nunnery¹, N. A. Cole², and L. W. Greene³, ¹Texas Tech University, Lubbock, Texas, ²USDA-ARS-CPRL, Bushland, Texas, ³Texas Agricultural Experimental Station, Amarillo, Texas.

We evaluated the effects of dietary CP concentration and source on serum urea N (SUN) and urine urea N (UUN). A metabolism trial with three collection periods (approximately d 35, 95, and 155 on feed) was conducted using twenty seven crossbred steers (average BW = 353.2 ± 8.4 kg). Treatments were arranged in a factorial arrangement and consisted of three dietary CP concentrations (11.5, 13.0, and 14.5%) and three supplemental urea:cottonseed meal (CSM) ratios (100:0, 50:50, and 0:100 of supplemental nitrogen). During each collection period, steers were housed in individual metabolism stalls; urine collected and frozen; and blood samples obtained via jugular venipuncture. Collection periods consisted of a 2- to 5-d adjustment period followed by a 5-d collection period. On d 35 on feed, SUN as steers entered the stalls (SUN-in) increased linearly ($P = 0.001$) with increasing CP concentration. Urine urea nitrogen (mg/dL) responded linearly ($P < 0.05$) to increasing CP concentration, and steers in the 50:50 treatment tended ($P = 0.10$) to have higher UUN than steers in the 0:100 treatment. On d 95 on feed, SUN-in and SUN as steers exited the stalls (SUN-out) increased linearly ($P = 0.03$ and $P = 0.009$, respectively) when dietary CP increased from 11.5 to 14.5%. Urine urea N linearly ($P < 0.0001$) increased with increasing CP. On d 155 on feed, SUN-in and SUN-out linearly increased ($P = 0.005$ and $P = 0.003$, respectively) with increasing CP concentration. Urine output increased linearly ($P = 0.009$) when CP level increased from 11.5 to 14.5%. Increasing CP concentration produced a linear increase ($P = 0.04$) in UUN (mg/dL). Urine urea N (% of UN) decreased linearly ($P = 0.007$) with increasing CP. Results suggest that the amount and degradability of dietary protein affect urea metabolism by feedlot steers, as evidenced by changes in serum and urinary urea nitrogen.

Key Words: Urea nitrogen, Dietary protein, Steers

M131 Effect of a *Yucca Schidigera*-based surfactant on ruminal degradability of corn grain dry matter and starch. A. N. Hristov¹, J. K. Ropp*¹, and D. Greer², ¹Department of Animal and Veterinary Science, University of Idaho, Moscow, ID, ²AgriChem, Inc., Ham Lake, MN.

The effect of a *Yucca Schidigera*-based surfactant (Grain Prep[®], GP, containing 8.4% *Yucca Schidigera* saponins) on grain production and ruminal *in sacco* degradation parameters of flaked corn DM and starch was tested in a commercial feed mill setting. Over a two-day period, a total of 59 separate samples were collected. GP was applied at 22 g/ton grain; Control was water (average water addition during the flaking process was 3%). Three lactating Holstein cows fitted with ruminal cannulae, fed a 40% energy concentrate/17% protein concentrate/40% forage diet were used in the *in sacco* experiment. Flaked, intact corn kernels (34 lb./bu.) were incubated in the rumen for a period of 0, 2, 4, 6, 16, 24, 48, and 72 h. Bags were replicated within animal. Average DM and starch content of the grain were not different ($P > 0.05$) between treatments (meanSE): 80.00.17 and 73.11.07 %. Solubility of corn DM and starch was increased ($P < 0.001$) in GP compared to Control: 45.81.09 vs 39.61.11 % and 45.71.31 vs 38.61.36 % (DM and starch, respectively). The potentially degradable DM and starch in the rumen was reduced ($P < 0.05$) by GP compared to the Control: 52.11.88 vs 57.61.82 % and 55.42.06 vs 61.31.96 %, respectively. Rate of degradation of the potentially degradable DM or starch was not affected ($P > 0.05$) by treatment. Effective degradability of DM and starch in the rumen (calculated at 6% passage rate) was increased ($P < 0.001$ and $P < 0.05$, respectively) by GP compared to Control: 68.20.63 vs 65.10.64 and 70.90.75 vs 68.20.76 %, respectively. In conclusion, compared to untreated control, GP-treated corn had higher overall degradability of

DM and starch in the rumen of lactating dairy cows. The difference was mostly due to an increase in the soluble/instantly degradable DM or starch with the GP corn. Increased ruminal degradation of corn starch may result in enhanced microbial protein synthesis and production in the rumen.

Key Words: Saponins, Corn, Starch degradability

M132 Effect of grain type and *Yucca Schidigera*-based surfactant on bacterial utilization of ruminal ammonia *in vitro*. K. L. Grandeen¹, A. N. Hristov*¹, J. K. Ropp¹, and D. Greer², ¹Department of Animal and Veterinary Science, University of Idaho, Moscow, ID, ²AgriChem, Inc., Ham Lake, MN.

The objective of this study was to investigate the effect of grain type and a *Yucca schidigera* extract-based product, Grain Prep[®] (GP), on ruminal fermentation and specifically, ammonia utilization by mixed microbial populations, *in vitro*. Three, 8-h incubations were carried out with ruminal inoculum from two lactating dairy cows. GP-treated feed mix, containing 40% alfalfa hay/58% grain/2% soybean meal, was incubated at 1.5% concentration with buffer and ruminal inoculum. The grain part of the diet was either corn (C) or 50% corn and 50% high-amylopectin barley grain (B). GP was applied to the feed mix at 0, 60, and 120 ppm. At time 0 h, the ammonia pool was labeled with ¹⁵N. Inclusion of 50% barley into the grain mix slightly increased ($P < 0.05$) media pH (6.68 vs 6.71, C and B, respectively) and decreased ($P < 0.05$) ammonia concentration (13.0 vs 12.7 mmol/L, respectively). Concentration of total and individual VFA was not affected ($P > 0.05$) by type of grain. GP had no effect ($P > 0.05$) on ammonia or VFA concentrations. Incorporation of ¹⁵N into fluid bacteria tended to be greater ($P = 0.107$) in B than in C (0.69 vs 0.59 mg of ¹⁵N). Overall recovery of the ¹⁵N tracer was not affected ($P > 0.05$) by type of grain. The proportion of bacterial N originating from ammonia N was also not different ($P > 0.05$) between C and B (16.5 and 17.6%). GP had no effect ($P > 0.05$) on the tracer-related parameters. At 8 h, B treatments had greater ($P < 0.05$) recovery of ¹⁵N (23.5 vs 21.8 mg) and proportion of bacterial N originating from ammonia (35.1 vs 31.9%, respectively) than C. GP tended to increase ($P = 0.111$) the proportion of bacterial N originating from ammonia N (31.3, 33.6, and 36.2%, 0, 60, and 120 ppm GP). In conclusion, a 50% substitution of corn by barley had a positive effect on ammonia N utilization in the rumen, *in vitro*. A trend for enhanced bacterial incorporation of ammonia N was observed with GP addition.

Key Words: Saponins, Corn, Barley

M133 Changes in serum metabolites and growth characteristics of Korean steers fed alcohol-fermented feedstuffs. J. S. Shin*¹, B. W. Kim¹, and M. L. Eastridge², ¹Kangwon National University, ²The Ohio State University.

This study was carried out to assess whether feeding alcohol-fermented feedstuffs (AFF) affects the nutritional metabolism and growth characteristics of Korean steers. Ten Korean steers were randomly assigned to one of two treatment groups. The treatments were AFF (50% commercial feeds for beef + 30% alcohol-fermented soybean curd dregs + 20% rice straw) and control (80% commercial feeds for beef + 20% rice straw). The change of serum metabolites and growth characteristics were measured every 2 mo at 2 h after feeding during the whole 12 mo experiment period, and the relationships between serum metabolites and growth characteristics were examined. The AFF had significantly higher ($P < 0.05$) serum alcohol (11.9 mg/dl), serum glucose (63.1mg/dl) and inorganic phosphorous (IP)(8.4 mg/dl) concentrations than control (4.9, 56.6 and 7.0 mg/dl, respectively). In both treatments, the glucose concentration increased dramatically when the BW reached about 600 kg, while IP concentration decreased at the BW. Lower concentrations of blood urea nitrogen (BUN) and cholesterol were observed for steers fed AFF until about 450 kg BW. The IP concentration was correlated with concentrations of BUN, cholesterol, and glucose in AFF but not in the steers fed controls. Daily gain was higher for steers fed AFF, especially from 328 kg to 500 kg. In this study, it is considered that the AFF affects serum metabolites and changes protein, fat and energy metabolism.

Key Words: Serum metabolites, Korean steers, Alcohol-fermented feedstuffs

M134 Effects of long-acting estrogen implant with and without trenbolone acetate on performance, carcass characteristics and meat tenderness in Holstein steers. J. L. Beckett*¹, R. N. Brewer¹, L. K. Hendricks¹, R. Botts², D. Cook², and P. Anderson², ¹Cal Poly State University, ²VetLife, LLC.

Two hundred thirty-six Holstein steers (141 kg) randomly assigned to one of four treatment groups (A, B, C, D; n = 59) were used to investigate the effects of a long-acting estrogen implant with and without a trenbolone acetate/estradiol terminal implant on growth, performance and carcass characteristics. Implants contained zeranol (Z), progesterone (P₄), estradiol benzoate (EB) or trenbolone acetate (TBA) and estradiol (E₂). Animals were treated as described (table) and weight gain, average daily gain (ADG), and feed efficiency were calculated on 30-d intervals. Steers were harvested after 276 d on feed and carcass measurements were collected. All implanted groups had heavier (P<0.05) average final live weights and carcass weights, and improved ADG (P<0.05) compared with non-implanted controls. Cattle receiving the TBA/E₂ terminal implant produced heavier carcasses than implanted cattle not receiving the terminal implant (P<0.05). Average REA were significantly greater (P<0.05) for all groups receiving the terminal implant than either E₂ only or non-implanted groups. The percentage of carcasses with USDA quality grade of Choice or better was significantly lower (P<0.05) for treatment A (66.7%) than treatment B (83.9%) and non-implanted controls (85.2%), but treatment C (72.9%) was not different from any other treatment group. Based on these data, a long-acting estrogen implant is effective in increasing growth and efficiency compared with non-implanted controls. A TBA/E₂ terminal implant 180 d after the initial estrogen implant significantly improved growth and efficiency, yet did not significantly suppress quality grades compared with non-implanted controls.

Key Words: Holstein steers, Implants, Estrogen

M135 Use of exogenous fibrolytic enzymes and bluegrass seed straw in wintering beef cow feeding regimes. J. I. Szasz*¹, C. W. Hunt¹, K. A. Johnson², J. J. Michal², and D. J. Coonrad², ¹University of Idaho, ²Washington State University.

Grass seed aftermath is abundant throughout many regions of Northwest US and may have potential as an economic feed resource for wintering beef cattle. A 2 x 2 factorial treatment arrangement was utilized to examine the impact of ammoniation and exogenous fibrolytic enzyme on performance of cows fed bluegrass straw diets. Approximately four months prior to the calving season, 89 crossbred beef cows (mean initial BW 636 kg) were stratified by days-to-parturition and randomly allotted the following treatments: 1) bluegrass straw, 2) ammoniated bluegrass straw, 3) bluegrass straw with enzyme, or 4) ammoniated bluegrass straw with enzyme. Cows were offered grass straw treatments *ad libitum*. Cows fed ammoniated straw also received 4.6 kg alfalfa daily while cows fed non-ammoniated straw received 6.1 kg alfalfa. The enzyme utilized contained xylanase and cellulase activity and enzyme activity was 676 μ mol reducing sugars/g CP/min (20.9% CP). Enzyme was administered to straw by hand-spraying freshly prepared enzyme solution onto straw at a rate of 0.22 g enzyme (4.4 IU xylanase)/kg. When initial measurements served as a covariate, BW and condition score were not different (P > 0.10) among treatments at 260 d of gestation or at 2, 30, and 45 (adjusted) d post-partum. Calf BW at 2, 30, and 205 (adjusted) d of age did not differ (P > 0.10) among dietary treatments. Pregnancy rate at 60 and at 90 d post-partum did not differ (P > 0.10) between treatments. Likewise, treatment differences were not detected (P > 0.10) for percentage of cows pregnant at weaning. Cows fed ammoniated straws consumed less DM (P < 0.001) compared with cows fed non-ammoniated straw. No enzyme or enzyme by ammoniation effects were observed (P > 0.10) for any variable measured. Data indicate that while cows fed ammoniated straw diets consumed less DM, they maintained similar levels of production. Ammoniation of bluegrass straw may be cost-beneficial by reducing dependence on more expensive alfalfa hay to maintain proper body condition.

Key Words: Xylanase, Forage, Ammoniation

M136 Evaluation of alfalfa cubes with or without incorporated barley in beef cattle diets. P. A. Szasz*, C. W. Hunt, J. I. Szasz, and T. M. McCalmant, University of Idaho.

Metabolizable energy can often be supplied more economically from grain than from forages; however logistics often preclude inclusion of grain in wintering beef cattle rations. Incorporation of grain into pressed alfalfa cubes may provide a means of delivering energy via processed grain. Four ruminally cannulated Jersey steers were used to evaluate diets containing alfalfa fed coarsely chopped or as pressed cubes. These diets were fed with or without substituted barley. For the barley-containing diets, dry rolled barley was included at 40 percent of the diet DM as a separated ingredient when fed with chopped alfalfa or as an incorporated ingredient with the cubed alfalfa. Steers were fed a restricted amount of their respective diet equal to 1.2 times calculated maintenance requirement. Cubing the alfalfa had an inconsistent effect on *in situ* degradability. Substitution of barley into the diet reduced (P < 0.05) *in situ* DM and NDF disappearance of alfalfa for short ruminal incubation times (8, 16, and 24 h); however, DM and NDF disappearance was actually greater (P < 0.05) for longer incubation times (48, 72, and 96 h) when barley was included in the diet. No treatment differences were observed (P > 0.10) for ruminal pH. *In situ* degradability and fluid pH data indicate that barley substitution did not have an enduring detrimental effect on the ruminal environment. Total tract digestibility of DM and NDF was greater (P < 0.05) for diets containing barley suggesting that providing a portion of the dietary ME from barley might have actually increased ruminal microbial fibrolytic activity. Amount (kg/d) and percentage of DM and NDF digested was lower for the cubed alfalfa without barley diet than the other diets (cube x barley, P < 0.05). Results of this study indicate that isocaloric substitution of barley, either as a separate ingredient or as an ingredient of a pressed cube, is a feasible alternative strategy for meeting the energy requirements of wintering beef cattle.

Key Words: Grain, Metabolizable energy, Rumen fermentation

M137 Fermentation characteristics of ensiling wet corn distillers grains in combination with corn silage. K. F. Kalscheur*, A. D. Garcia, A. R. Hippen, and D. J. Schingoethe, South Dakota State University, Brookings.

Wet corn distillers grains (WDG) have become increasingly available as a feedstuff for cattle. The objective of this study was to evaluate the fermentation and preservation characteristics of ensiling WDG with corn silage (CS). Combinations of CS and WDG were ensiled in silo bags as follows: 1) 100% CS; 2) 75% CS + 25% WDG; 3) 50% CS + 50% WDG; and 4) 100% WDG. Samples from each treatment were collected for analyses prior to ensiling. Samples were collected from the silo bag at d 3, 7, 14, and 129 and evaluated for fermentation characteristics. The initial pH was the greatest for 100% CS and decreased (P < 0.05) as concentration of WDG increased (5.7, 4.6, 4.0, and 3.1 for 100%, 75%, 50%, and 0% CS, respectively). Dry matter of the feedstuffs prior to ensiling was 27.7, 28.6, 30.0, and 30.8% for 100%, 75%, 50%, and 0% CS, respectively. Concentrations of ammonia-nitrogen (1.2, 2.7, 4.1, and 5.1% DM) and crude protein (9.9, 15.6, 20.7, and 30.8% of DM) increased with increasing concentrations of WDG. Lactic acid prior to ensiling was greatest for 100% WDG (0.9% of DM) and decreased as CS was included in the treatments. Acetic, propionic, and butyric acids were not present prior to ensiling. There was no change in DM content, but Kjeldahl N and ammonia-nitrogen increased over time (P < 0.05) in all silages. The pH of the ensiled feeds had dropped below 4.0 by d 3, with no further decrease over time. Acetic acid increased (P < 0.05) from less than 0.01% of DM at d 0 to 3.89, 5.67, 4.32, and 0.23% of DM at d 129 as concentration of WDG increased. There was no ethanol detected prior to ensiling; however, it increased (P < 0.05) with time in all treatments. Ethanol concentration was highest (2.36% of DM) for 50% WDG on d 129. Ensiling WDG with CS can be an effective method of preserving WDG. Combining both feedstuffs at the 50% ratio resulted in a blend with an initial pH of 4.0 (day 0). The low initial pH coupled with the high acetic acid concentration verified for this treatment during days 3 (2.77%), 7 (3.25%), 14 (3.34), and 129 (4.32) suggests preservation could be enhanced by combining both feedstuffs.

Key Words: Wet distillers grains, Corn silage, Fermentation

M138 Increasing glucogenic precursors in range supplements fed to young postpartum beef cows. R. L. Endecott^{*1}, D. L. Dunlap¹, R. C. Waterman¹, A. C. Fitzgerald¹, V. A. Munn¹, C. A. Loest¹, D. E. Hawkins¹, K. K. Kane¹, F. Valdez², and M. K. Petersen¹, ¹New Mexico State University, ²Kemin Industries, Inc.

Greater energy demands during late gestation and lactation may amplify the need for supplementation of cattle grazing dormant New Mexico range and metabolic glucose availability may affect postpartum energy balance. A study was conducted to evaluate responses of postpartum 2-year-old beef cows ($n = 27$) to supplements differing in glucogenic precursors. Cows were group fed (slick bunk 6 h post-feeding) a mixture of wheat straw and alfalfa hay adjusted monthly to match the CP percentage of native range (5 to 8% CP, OM basis) in central New Mexico from February to May. Supplements were individually fed three times weekly at $908 \text{ g} \cdot \text{cow}^{-1} \cdot \text{d}^{-1}$ for 90 d postpartum and provided 1) 327 g CP, 118 g UIP, 47 g glucogenic potential (GP) (LGP), 2) 327 g CP, 158 g UIP, 63 g GP (MGP), or 3) 327 g CP, 164 g UIP + 100 g propionate salt (NutroCal, Kemin Industries, Inc.), 144 g GP (HGP). A glucose tolerance test was conducted 35 d postpartum and cows were milked by machine 50 d postpartum. Glucose and insulin areas under the curve were similar ($P > 0.05$) among treatments ($11862, 10309, \text{ and } 11805 \pm 1063 \text{ and } 462, 442, \text{ and } 428 \pm 49$ for LGP, MGP, and HGP, respectively). Glucose half-life averaged 87, 77, and 95 ± 10 min, for LGP, MGP, and HGP, respectively ($P > 0.05$). Cows supplemented with HGP tended ($P = 0.13$) to produce more milk than did cows fed LGP, while MGP cows were intermediate ($5087, 5220, \text{ and } 5846 \pm 330 \text{ g} \cdot \text{d}^{-1}$ for LGP, MGP, and HGP cows, respectively). A similar trend ($P = 0.14$) existed for lactose produced ($251, 260, \text{ and } 286 \pm 16 \text{ g} \cdot \text{d}^{-1}$ for LGP, MGP, and HGP cows, respectively). Cows supplemented with HGP lost 30% more weight ($P < 0.05$) from pre-calving to BW nadir than did MGP-supplemented cows ($59, 53, \text{ and } 69 \pm 4 \text{ kg}$ for LGP, MGP, and HGP, respectively). Results suggest that the supply of additional glucogenic precursors from HGP supplementation of confinement-fed cows was used to produce more milk.

Key Words: Glucose, Propionate, Protein supplements

M139 Effects of corn flake weight on nutrient intake and retention by finishing heifers. B. S. Obeidat^{*}, C. A. Loest, P. J. Defoor, J. E. Sawyer, V. A. Munn, and E. Y. Bsoul, *New Mexico State University, Las Cruces, NM.*

Eight Charolais-cross heifers ($359 \pm 28 \text{ kg}$) were used in a two period crossover design experiment to determine the impact of corn flake weight on nutrient intake and retention. Heifers were randomly assigned to one of two 85% concentrate diets (79% steam-flaked corn, 15% alfalfa hay, 3.0% molasses/fat blend, 0.5% urea, and 2.5% supplement) with corn steam-flaked at either 1) 322 g/L (25 lb/bu; SF25) or 2) 387 g/L (30 lb/bu; SF30). Dietary treatments were fed ad libitum to individually penned heifers. Each period lasted 14 d; 9 d for adaptation to dietary treatments and 5 d for daily collections of feed samples, feed refusals, and total fecal and urine output (using fecal bags). Rectal grab samples of feces were collected daily at 5 h after feeding to determine fecal pH. Daily fecal and urine output were mixed thoroughly and 5% aliquot retained and frozen for subsequent analysis. Feed, feed refusals, and fecal plus urine samples were composited for each heifer by period and analyzed for DM, OM, NDF, and N. Intakes of DM ($7.72 \text{ and } 8.64 \pm 0.11 \text{ kg}$ for SF25 and SF30), OM ($7.26 \text{ and } 8.09 \pm 0.10 \text{ kg}$ for SF25 and SF30), NDF ($2.01 \text{ and } 2.18 \pm 0.03 \text{ kg}$ for SF25 and SF30), and CP ($1.02 \text{ and } 1.19 \pm 0.02 \text{ kg}$ for SF25 and SF30) decreased ($P < 0.01$) with lighter flake weight corn (SF25). Retention of DM ($76.1 \text{ and } 77.8 \pm 1.0\%$ for SF25 and SF30), OM ($81.1 \text{ and } 81.8 \pm 1.0\%$ for SF25 and SF30), and NDF ($56.5 \text{ and } 59.7 \pm 2.3\%$ for SF25 and SF30) were not affected ($P > 0.15$) by level of corn processing, but CP retention ($48.2 \text{ and } 52.9 \pm 2.1\%$ for SF25 and SF30) tended ($P = 0.15$) to be greater for SF30 than SF25. Fecal pH ($6.48 \text{ and } 6.40 \pm 0.04$ for SF25 and SF30) was not affected ($P = 0.21$) by treatments. Results suggest that greater degree of corn steam-flaking decreases dietary intakes but does not affect nutrient retention and fecal pH of heifers fed an 85% concentrate diet.

Key Words: Heifers, Steam-flaked corn, Nutrient retention

M140 Effects of processing and bulk density of barley when fed to backgrounding calves. D. L. Boss^{*}, J.G.P. Bowman, L.M.M. Surber, D. G. Sattroiva, and T. K. Blake, *Montana State University.*

A study was initiated to evaluate the effects of light or heavy bulk density (BD) barley fed whole or dry rolled to calves on a backgrounding diet. Eighty commercial Angus steers were allotted to 16 pens on an equal pen weight basis with treatment being randomly assigned to pen. A 2×2 factorial arrangement was used to test the effects of barley BD (light; 51.1 kg/hl vs. heavy; 61.7 kg/hl), processing (whole vs. dry rolled) and their interaction. Steers had ad libitum access to feed and water throughout the 56-d trial. The diets were balanced to meet or exceed all NRC requirements and to provide 1.45 Mcal/kg NEm and 0.86 Mcal/kg NEg, enabling a 340 kg steer to gain 0.9 kg/d. Diets were offered once daily at 0800 as a TMR and consisted of 49.0% Pubescent wheat grass (chopped to pass a 7.6 cm screen), 45.0% barley ("Morex") and 5.7% commercial backgrounding pellet on a DM basis. Water was used as a diet conditioner. Data were analyzed using GLM procedure of SAS. No interactions were detected ($P > 0.10$). Dry matter intakes were not different ($P = 0.51$, avg 8.9 kg/d) for the 56-d trial. There was no difference ($P > 0.05$) in final weights or ADG when light (380 kg, 1.1 kg/d) or heavy (382 kg, 1.1 kg/d) BD barley was evaluated. Feeding dry rolled barley resulted in heavier final weights ($P = 0.06$; 387 vs 375 kg) and increased ADG ($P = 0.001$; 1.2 vs 0.99 kg/d) when compared to whole barley-fed steers. Bulk density did not affect steer performance in the trial. However, processing the barley (dry rolling) before feeding it to steers in a backgrounding diet increased performance by 17% when compared to feeding the barley whole.

Key Words: Barley, Processing, Bulk density

M141 Effect of water and mineral source on performance of growing heifers. J. H. Mikus^{*}, C. R. Richardson, G. A. Nunnery, and A. Gueye, *Texas Tech University, Lubbock, TX.*

Ninety-six beef heifers (British x Continental; average initial BW = 335.54 kg) were used in a randomized complete block design to determine the effects of water sulfate concentration and supplemental mineral source on animal performance. Two water and three mineral sources were applied in a 2×3 factorial arrangement. Water treatments contained either 39.5 mg/kg sulfate (no added sulfate; NS) or 1,810 mg/kg sulfate (added sulfate; WS). Mineral treatments were: no supplemental Zn, Cu, Mn, and Co (NTM); inorganic sources of Zn, Cu, Mn, and Co (ITM); and organically complexed sources of Zn, Cu, Mn, and Co (CTM). Mineral treatments were supplied via three separate supplements included in a 90% concentrate finishing diet. Heifers were fed for 56 d and weights were recorded on d 0, 28, and 56. Average daily gain of heifers consuming NS water was greater ($P = 0.04$) than WS heifers (1.83 and 1.61 kg/d, respectively) for the first 28 d, however, water source had no effect ($P = 0.07$) on ADG for the 29-56 d period or for the entire 56-d trial ($P = 0.77$). Mineral source had no effect ($P = 0.31$) on ADG for the length of the study. Dry matter intake was not affected by either water ($P = 0.70$) or mineral source ($P = 0.18$) for any period of the trial. Heifers consuming NS water were more efficient ($P = 0.01$) than heifers consuming WS water (4.41 and 5.01, respectively) for d 0-28. However, water source had no effect on feed to gain for d 29-56 ($P = 0.06$) or 0-56 ($P = 0.44$). Mineral source had no effect ($P = 0.39$) on feed to gain for the length of the study. Results from this trial indicate that heifers introduced to high sulfate drinking water (1,800 mg/kg) require an adjustment period, but soon perform at levels similar to animals consuming water with very low sulfate levels. Moreover, neither level nor source of supplemental trace minerals affected heifer performance, however, this may be a result of the relatively short duration of the trial.

Key Words: Heifers, Sulfate, Mineral source

M142 Effects of barley or corn on steer performance and digestibility in finishing diets. J. J. Kincheloe^{*}, J.G.P. Bowman, L.M.M. Surber, D. L. Boss, M. F. McDonnell, K. A. Anderson, and T. K. Blake, *Montana State University, Bozeman, MT, USA.*

Barley is an important feed grain throughout Canada and the Pacific Northwest, while corn is the predominant grain source in finishing diets

throughout the United States. Limited comparisons are available evaluating differences between the feed value of corn and barley. Eighty steers (avg initial wt 344 kg) were fed finishing diets for 112 d to determine the effects of corn and three barley varieties (H3, Harrington, and Valier) on feedlot performance, nutrient digestion, carcass characteristics, and grain energy content. Grains were dry-rolled, and diets were formulated to contain 2.4% N, 2.03 Mcal/kg NE_m and 1.37 Mcal/kg NE_g. Steers were allotted by weight to 16 pens in a completely randomized design with pen as the experimental unit. Steers were weighed every 28 d and diet, ort, and fecal samples were collected, composited by pen, and analyzed for DM, N, ADF, AIA, and starch. Fecal output was estimated using acid insoluble ash as an internal marker. Steers were harvested when 70% were visually estimated to grade Choice. There were no differences ($P > 0.10$) among diets for ADG (avg 1.58 kg/d), feed efficiency (FE; avg 16.31 kg gain/100 kg feed), DMI (avg 9.62 kg), or starch digestibility (avg 97%). Fat thickness was greatest ($P = 0.03$) for steers fed corn (avg 1.2 cm), and least for steers fed H3 and Valier (avg 0.93 cm). Steers fed corn had higher ($P = 0.07$) yield grades than steers fed barley (avg 3.1 vs 2.8, respectively); however, there were no differences ($P > 0.10$) detected for any other carcass characteristic. Barley had similar ($P > 0.10$) NE_m and NE_g values as compared to corn (avg 2.19 and 1.53 Mcal/kg, respectively). Lack of differences in animal performance and grain energy values suggest that barley has equal feeding value to corn in finishing diets, and that the NRC may underestimate net energy values for barley.

Key Words: Barley, Corn, Grain net energy values

M143 Growth and carcass fatty acid composition of beef steers fed soybean oil for increasing duration before slaughter. P. A. Ludden*, B. W. Hess, D. C. Rule, and W. J. Means, *University of Wyoming*.

Ninety-six Gelbvieh × Angus rotationally-crossed steers (293.6 ± 3.9 kg) were used in a 189-d experiment to evaluate duration of soybean oil (SBO) supplementation on feedlot performance, carcass traits, and *longissimus dorsi* (LD) fatty acid composition. Steers were blocked by initial BW and randomly assigned to one of 16 pens (6 steers/pen) in a randomized complete block design. Four experimental treatments consisted of 0, 77, 137, or 189 d of SBO supplementation before slaughter. Diets contained 78% cracked corn, 12% chopped (2.54 cm) oat hay, and 10% protein supplement, with or without 5% added SBO. Duration of SBO supplementation had no effect ($P \geq 0.44$) on ADG, DMI, or feed efficiency. Similarly, carcass traits were not affected ($P \geq 0.20$) by SBO supplementation. Total fatty acid content of the LD did not differ ($P = 0.15$) across treatments (avg = 34.9 ± 3.8 mg/g of fresh tissue). Duration of SBO supplementation did not influence total saturated ($P = 0.19$) or polyunsaturated ($P = 0.47$) fatty acid concentrations of LD. Total ($P = 0.09$) and 18-carbon ($P = 0.10$) monounsaturated fatty acid concentrations of LD tended to decrease linearly because C18:1c9 concentrations decreased linearly ($P = 0.03$) as duration of SBO supplementation increased. Neither isomer of conjugated linoleic acid (CLA) was affected ($P \geq 0.18$) by SBO supplementation (C18:2c9t11 = 0.08 ± 0.009 or C18:2t10c12 = 0.01 ± 0.001 mg/g of fresh tissue). However, total C18:1-trans tended ($P = 0.07$) to increase linearly because LD concentrations of C18:1t11 (TVA) tended to linearly increase ($P = 0.07$) with increased duration of SBO supplementation. Although supplementing SBO at 5% of dietary DM for 77 to 189 d decreased monounsaturated fatty acid concentrations, total saturated fatty acid content of beef was not affected by SBO supplementation. Despite the lack of improvement in CLA content, enhanced TVA concentrations associated with increasing duration of SBO supplementation may benefit consumers of lean beef.

Key Words: Soybean oil, Conjugated linoleic acid, Beef

M144 Influence of grinding oats and barley on cattle performance and in vitro starch degradability. M. H. Poore* and J. A. Moore, *North Carolina State University, Raleigh, NC*.

Small beef producers often supplement growing cattle with small grains, and economics of processing are often questioned. Studies were conducted over a 3-yr period to determine the benefit of finely grinding (G) oats (O) and barley (B) compared to feeding whole grain (W). Hay and minerals were fed free-choice. In yr 1, 30 heifers (216 kg) were allotted to six pens and fed 2.4 kg (DM) per head daily of either WB or GB.

Hay was 14.8 % CP and 32% ADF, while B was 13.1% CP, 5.5% ADF and 58% starch. Total DMI (7.2 kg/d) and hay DMI (4.8 kg/d) did not differ, but ADG (0.56 vs 0.85 kg/d) and gain to feed (0.076 vs 0.124) were lower ($P < .05$) for WB. In yr 2, 40 heifers (220 kg) were assigned to 8 pens and fed 2.3 kg (DM) per head daily of B or O, either G or W in a 2x2 factorial. Hay was 11.5% CP and 39% ADF, while O and B were 12.1 and 10.4 % CP, 12.3 and 7.6% ADF, and 47 and 60% starch, respectively. There was a grinding by grain interaction for ADG ($P < .06$; 0.31, 0.66, 0.49 and 0.64 for WB, GB, WO and GO, respectively) and gain to feed ($P < .09$; 0.045, 0.096, 0.072 and 0.093, respectively), but hay DMI (4.5 kg/d) and total DMI (6.9 kg/d) did not differ. In yr 3, 36 steers (219 kg) were assigned to 6 pens and fed hay only or hay plus 2 kg (DM) per head daily WO or GO. Hay was 13.1% CP and 38% ADF, and O were 11.8% CP, 12.7% ADF and 42.9% starch. Hay DMI (7.1, 5.6, and 5.7 kg/d, for hay, GO and WO, respectively) was higher ($P < .05$) for hay only than either O treatment, but total DMI (7.5 kg/d) did not differ. ADG (0.61, 0.81 and 0.82 kg/d for hay, GO and WO, respectively) and gain to feed (0.089, 0.109 and 0.108, respectively) was lower ($P < .05$) for hay only than for either O treatment. Whole grains from each study were ground coarse, medium or fine and 1-h in vitro enzymatic glucose release was used to estimate starch degradability. Grain, particle size, and grain by particle size interaction effects ($P < .01$) were noted. Starch degradability was 37, 30, 15, 53, 50 and 46% for fine B, medium B, coarse B, fine O, medium O and coarse O, respectively. These data suggest that grinding has less of an influence on performance of cattle fed O than B because particle size reduction is less important for starch digestion in O than it is in B.

Key Words: Small grains, Processing, Beef cattle

M145 Effects of exposure to ammoniated wheat straw as a suckling calf on subsequent utilization as a yearling beef heifer. R. D. Wiedmeier*, P. R. Schmidt, B. A. Kent, B. R. Bowman, and D. M. Meek, *Utah State University, Logan, Utah*.

Ten crossbred yearling beef heifers (355 kg) were selected for the study. Five heifers were from cows wintered on an ammoniated wheat straw (AWS) diet from late gestation through early lactation (exposed). The other five heifers were from cows wintered on alfalfa-grass hay through the same period of time (nave). After weaning, heifer calves were placed in a common pen and fed a grower diet composed of alfalfa hay, corn silage, dry-rolled barley and vitamin-mineral premix until they were yearlings. Yearling heifers were then placed in individual pens to measure utilization of AWS. Each heifer received 2.94 kg DM of supplement daily that was composed of ground alfalfa hay, sugar beet pulp, dry rolled barley and vitamin-mineral premix. All heifers were offered ad libitum access to AWS with intake measured daily. Diets were fed for a 21 d adaptation period followed by a 5 d diet and fecal collection period to estimate DM digestibility. Acid insoluble ash was used as an internal marker to estimate apparent nutrient digestibility. Exposed heifers consumed more AWS than nave heifers (5.45 vs 4.89 kg/d, $P = 0.04$). Digestibility of DM was not affected by previous exposure to AWS (60.61% vs 60.17%, $P = 0.45$, exposed vs nave, respectively). Consequently, exposed heifers consumed 8% more DDM than nave heifers (5.09 vs 4.71 kg, $P = 0.05$, respectively). Heifer calves from cows wintered on AWS diets from late gestation through early lactation will exhibit higher AWS intake as yearlings compared to heifer calves without such exposure.

Key Words: Heifers, Ammoniated straw, Nutrition

M146 Effects of RumaPro on plasma ammonia and urea concentrations in beef steers. G. Huntington and J. Spears, *North Carolina State University, Raleigh NC*.

The objective of the experiments was to describe the ability of a slow urea release product (RumaPro) to alter plasma concentrations of ammonia and urea in steers after ingestion of a potentially toxic dose of urea. In Exp. 1, Four Angus beef steers (471±41 kg body weight) were group-fed ad libitum a high-concentrate diet (17% NDF, 15% CP) for several weeks before the start of the experiment. Steers were fed once daily, and water was available free choice. In Exp. 2, Six Angus steers (339±14 kg body weight) were fed fescue hay (63% NDF, 11.3% CP), for 3 wk before their initial dosing. Hay, mineralized salt, and water were provided ad libitum. Each experiment had a crossover design with steers selected at random to receive initial oral doses of urea or RumaPro (0.25 g of urea per kg of BW from either source). On sampling day, two hours after feeding, blood samples were collected into heparinized tubes -5,

5, 15, 30, 45, 60, 90, and 120 minutes after oral dosing with urea or RumaPro. Seven days later the process was repeated to complete the crossover design. ANOVA was conducted on ammonia and urea concentrations after concentrations were adjusted by subtraction of pre-dosing values within steer and treatment. Steers in both experiments had lower ($P < 0.05$) adjusted plasma concentrations of ammonia with RumaPro (0.066 mM) compared with the urea (0.122 mM). Area under the curve calculations show that the amount of added ammonia over the time of the experiments was at least 1.6 times greater when urea was dosed than when RumaPro was dosed. Compared with steers fed the all-hay diet (Exp. 2), steers fed the high-grain diet (Exp. 1) had lower adjusted peak concentrations (0.15 vs 0.20 mM) and returned sooner to pre-dose ammonia concentrations. Treatments did not affect ($P > 0.15$) adjusted plasma urea-N concentrations (2.78 mM). The pattern of increased plasma urea-N concentration after dosing was similar between treatments in both experiments. We conclude that at doses calculated to be equivalent to 25% of the steers' daily CP requirement, RumaPro reduced hydrolysis of urea in the rumen and decreased ammonia absorption by approximately 50%.

Key Words: Beef Steer, Ammonia, Urea

M147 Effects of five grain conditioners, water, and bulk density on processing ease and flake quality with regards to steam-flaking corn. C. R. Richardson¹, K. F. Wilson^{*2}, and G. V. Pollard³, ¹Texas Tech Univ., Lubbock, ²Loveland Ind., Greeley, CO., ³Southwest Texas State Univ., San Marcos.

Processing ease for the five conditioners and water were determined by steam-flaking 27.2 kg batches of corn at bulk densities of .34, .36, .38, and .41 kg/L and measuring time to process (sec.), energy usage (kWh), and feeder speed (oscillations/sec.). To determine flake quality, flake durability (%) and fines (%) were collected and analyzed. Before processing, batches were treated with a commercial conditioner per recommended dosage rate and tempered to 18% moisture. Conditioners tested in this study were EZ-Flake[®], EZ-RollTM, an alcohol based (AC), and a yucca based 1 (YU1) and 2 (YU2). Processing ease was determined on the running machine and flake qualities on subsequent samples of the batches. Data were analyzed as a factorial with resulting means separated by main effects, no interactions were observed. Time to process, energy usage, and flake durability revealed main effect differences for the products and bulk densities. However, feeder speeds and fines showed only bulk density differences. Means separation illustrated that when compared to water, EZ-Flake[®] and EZ-RollTM improved ($P < 0.05$) processing time and decreased ($P < 0.05$) energy usage by approximately 20%, where as the AC conditioner increased time to process and energy usage by approximately 5%. Furthermore, improvements ($P < 0.05$) of roughly 1% were observed for flake durability with EZ-Flake[®], EZ-RollTM, and YU2 when compared to water. As expected, increasing the bulk density decreased ($P < 0.05$) time to process, energy usage, and fines. Additionally, increasing the bulk density resulted in increased ($P < 0.05$) feeder speeds and flake durabilities. Results indicated that these conditioners, with the exception of the AC conditioner, were sufficient in improving processing ease and flake qualities as compared to water. These results are consistent with recognized characteristics of grain conditioners and were effective across all bulk density treatments.

Key Words: Grain conditioner, Bulk density, Steam-flaking

M148 Effects of five grain conditioners, water, and bulk density on the chemical constituents of steam-flaked corn. G. V. Pollard^{*1}, K. F. Wilson², and C. R. Richardson³, ¹Southwest Texas State Univ., San Marcos, ²Loveland Ind., Greeley, CO., ³Texas Tech Univ., Lubbock.

Chemical constituent evaluations were determined by steam-flaking corn with one of five conditioners or water, and processed to a bulk density of .34, .36, .38, or .41 kg/L. Before processing, batches were treated with commercial conditioner per recommended dosage rate and tempered to 18% moisture. Conditioners tested in this study were EZ-Flake[®], EZ-RollTM, an alcohol based (AC), and a yucca based 1 (YU1) and 2 (YU2). All chemical constituents were analyzed from samples collected underneath rolls and frozen for subsequent evaluation. Analyses of chemical constituents consisted of moisture (%), starch availability (%), gelatinization score (%), free sulfhydryls (mol), dry-matter digestibility (%), and moisture uptake (mL). Data were analyzed as a factorial with resulting means separated by main effects or interaction. Interactions (P

< 0.05) were observed for moisture, starch availability, gelatinization score, and free sulfhydryls. However, a statistical trend ($P < 0.05$) was noted for water yielding greater starch availability when compared to the conditioners, and EZ-Flake[®] yielding a greater gelatinization score and free sulfhydryls when compared to other conditioners and water. Main effect differences ($P < 0.05$) for bulk density were observed for dry-matter digestibility and moisture uptake. Furthermore, conditioner inclusion improved ($P < 0.05$) moisture uptake when compared to water. Results indicate that the conditioners tested and rates of application were not sufficient to improve starch availability, however, YU1 and EZ-Flake[®] tended ($P < 0.05$) to have the most improvement in the chemical constituents tested. Gelatinization scores and free sulfhydryls were improved ($P < 0.05$) by EZ-Flake[®] and YU1 treatment. All tested conditioners were superior to water for facilitating moisture uptake. While a grain conditioner's primary function is to improve processing ease and production, this study indicated constituent enhancement could occur.

Key Words: Grain conditioner, Bulk density, Moisture uptake

M149 Finishing diets with elevated levels of α -linolenic acid increase feed efficiency but do not alter beef carcass quality. S. L. Archibeque^{*1}, D. K. Lunt¹, R. K. Tume², and S. B. Smith¹, ¹Texas A&M University, College Station, TX, ²Food Science Australia, Tingalpa D. C. Queensland, Australia.

We hypothesized that there would be an interaction between dietary α -linolenic acid and whole cottonseed (WCS) on beef cattle carcass quality and feed efficiency. Forty-five Angus steers (358 kg BW) were utilized in a completely randomized block design with a 3 x 3 factorial arrangement of treatments. The factors included the dietary inclusion rate of whole cottonseed (0, 5, or 15% DM) and the type of energy source (corn, flaxseed plus corn, or milo) fed for 135 d. During the feeding period, steers receiving the flaxseed or corn diet had a greater ($P < 0.01$) ratio of weight gained to feed consumed (0.119 and 0.108, respectively) than steers receiving the milo diet (0.093). There was a tendency ($P < 0.06$) for this gain to feed ratio to decrease with increased WCS inclusion in steers fed the milo diet. There were no differences in the ADG or final live weight among treatment groups. Following transportation to a local abattoir and overnight deprivation of food, there was a reduced ($P < 0.01$) percentage decrease in weight (i.e., shrink) in the steers fed the flaxseed diet (1.51%) than in the steers fed the corn (2.89%) or milo diet (3.11%). Marbling score was not affected by WCS ($P = 0.14$) nor was there an interaction between grain source and WCS ($P = 0.16$). There was an interaction ($P < 0.02$) in that lean maturity decreased with increasing percentages of WCS when the steers were fed the corn or milo diets, yet lean maturity remained unchanged in steers fed flaxseed. Ribeye area of steers fed milo was less ($P < 0.01$) than that of steers fed the corn or flaxseed diets. These data indicate that a ration formulated to provide increased levels of α -linolenic acid (i.e., flaxseed) will increase feed efficiency without altering either the quality or composition of the beef carcasses. Additionally, the inclusion of WCS in milo diets may cause a decrease in efficiency and less salable lean.

Key Words: Steers, Linolenic acid, Cottonseed

M150 Effect of feeding diets containing corn grain with corn rootworm protection (event MON863), control, or conventional varieties on steer feedlot performance and carcass characteristics. L. L. Berger^{*1}, N. D. Robbins¹, J. R. Sewell¹, E. P. Stanisiewski², and G. F. Hartnell², ¹University of Illinois-Urbana, ²Monsanto Company, St. Louis, MO.

A steer finishing trial was conducted to determine the effect of feeding corn that was genetically modified to protect against corn rootworm (CRW) (event MON863) on performance and carcass characteristics. All hybrids were grown in Illinois, ground through a tub grinder and then stored in Harvestore silos. Continental-cross steers ($n = 196$) were assigned to one of four dietary treatments differing only in the corn hybrid fed. There were 7 pens with 7 head/pen in each treatment-group. Steers were adapted to a common finishing diet based on a commercially available corn over a 21-d period prior to starting the study. Feed intakes were adjusted for each pen on a daily basis and orts collected as needed. Two consecutive daily weights were taken and averaged for initial weight. All steers were harvested at a commercial packing plant after 102 d on trial. Data were analyzed using the PROC MIXED procedure of SAS with pen as the experimental unit for performance data and individual steer for carcass data. There were no significant differences

($P < 0.05$) in performance or carcass measurements of cattle fed corn protected against CRW or genetically similar control corn and reference corns.

	Treatments ^a				
	RX740	DK647	RX670	CRW	SEM
Performance					
Initial BW, kg	456	458	458	457	3
Final BW, kg ^b	598	609	614	609	7
DMI, kg/d	7.57	7.46	7.94	7.76	.16
ADG, kg/d	1.39	1.49	1.53	1.49	.06
ADG/DMI	.184	.198	.193	.193	.008
Carcass characteristics ^c					
Carcass wt, kg	367	374	377	374	4
Marbling score ^d	484	470	489	493	9
REA, sq cm ^e	97.3	99.5	95.6	97.2	1.5
Fat, cm	0.85	0.89	.99	0.92	.05
Yield grade	1.9	1.9	2.3	2.1	.1

^aRX740, DK647=commercial hybrids containing no MON863, RX670=genetically similar control without MON863, and CRW=MON863. ^bCarcass weight adjusted by common dressing % (61.4%). ^cCarcass observations were n=195. ^dMarbling score where Slight 50=450. ^eREA is the longissimus dorsi area measured at the 12th rib.

Key Words: Corns, Corn rootworm, Feedlot performance

M151 Effects of trace mineral source and growth implants on performance and lipid metabolism of steers.

K. L. Dorton*, T. E. Engle, C. V. Kimberling, G. Parsons, D. R. Ames, and R. M. Ames, *Colorado State University*.

Three hundred and twenty three steer calves (249 kg 1.9) were used to determine the effects of trace mineral (TM) source and growth implants on performance, carcass characteristics, and lipid metabolism. Steers were blocked by ranch and stratified by initial body weight and randomly assigned to one of 36 pens (n=9 to 12 steers/pen). Pens within a block were then randomly assigned to treatments. Treatment consisted of: 1) control (no supplemental Cu, Zn, Mn, or Co), 2) inorganic mineral (CuSO₄, ZnSO₄, MnSO₄, and CoCO₃), and 3) organic mineral (iso-amounts of Cu, Zn, Mn, and Co). At the beginning of the experiment, 6 pens of animals/treatment received an implant and the other 6 pens of animals/treatment received no implant. Steers were fed a corn silage-based growing diet for 56 d then were gradually switched to a high concentrate finishing diet for 132 or 156 d. At the beginning of the finishing phase, previously implanted steers were reimplanted. Treatments during the finishing phase consisted of: 1) control (no supplemental Zn); 2) inorganic Zn (30 mg of Zn/kg DM from ZnSO₄); and 3) organic Zn (iso-amounts of organic Zn). During the growing phase, implant and TM supplementation had no effect on ADG, ADFI, and FE. During the finishing phase, steers that were implanted had greater final body weights ($P < 0.01$) and ADG ($P < 0.02$) than non-implanted steers. Overall, implanted steers had lower ($P < 0.01$) marbling scores than non-implanted steers and steers that were supplemented with TM had greater ($P < 0.05$) dressing percentage than controls. Longissimus muscle of implanted steers had greater ($P < 0.01$) C18:2 and lower C16:1 ($P < 0.01$) and C18:1 ($P < 0.01$) than longissimus muscle of non-implanted steers. Steers supplemented with inorganic TM had greater C18:O ($P < 0.01$) and C18:1 ($P < 0.03$) and lower ($P < 0.03$) C22:6 than steers supplemented with organic TM. These results indicate that TM source and growth implants may affect performance, carcass characteristics, and lipid metabolism in steers.

Key Words: Zinc, Implant, Carcass characteristics

M152 Influence of linseed supplementation on quality and fatty acids in beef.

I. Holló¹, E. Szücs², K. Ender³, J. Csapó¹, G. Holló¹, J. Seregí¹, J. Seenger², and I. Repa¹, ¹University of Kaposvár, Kaposvár-Hungary, ²Szent István University, Gödöllo-Hungary, ³Research Institute for the Biology of Farm Animals, Dummerstorf-Germany.

Full fat linseed meal supplementation of diet on meat quality and fatty acid composition of intramuscular fat was investigated in this study. Hungarian Grey (HG) Holstein-Friesian (HF) growing-finishing bulls were fed rations consisting of either grass silage and concentrate or

maize silage and concentrate with and without linseed supplementation according to 2x2 factorial experimental design in four groups A and B vs. C and D, respectively. Equal number (n=10 in each group) of animals were assigned to treatments above. Concentrates for groups A and C were supplemented 20% linseed meal containing 40% linolenic acid fed in the last month of growing-finishing period. Average final weights were actually identical in all groups (512.4±58.4 kg). The animals were slaughtered and after a 24hr chilling LD samples were taken from the right half carcasses. Data processing was made by SPSS 10.0 program package. Statistical differences were recorded between feeding intensities for dressing percentage, and that of lean and fat content of carcass ($P < 0.001$), and pH₄₅ ($P < 0.01$). Meat color was measured by Minolta Chromameter the results of which differed among treatments in terms of a* and b* value ($P < 0.01$, $P < 0.001$), but L*($P > 0.05$). Dry matter and the moisture content of LD showed significant variation due to treatments, as well ($P < 0.001$). Marked statistical differences were present for crude protein ($P < 0.001$) and ether extract of LD ($P < 0.01$) except for groups A and C. Higher concentrations of palmitic, stearic and oleic acids content in intramuscular fat were recorded in groups B and D than in A and C ones (79-82% vs. 73-74%, $P < 0.001$). The rate of oleic acid seems to decline significantly ($P < 0.001$) as a result of linseed supplementation. Means for group A and C were 29.6±1.9 and 28.3±2.5 vs. B and D 36.3±1.5 and 35.5±1.5, respectively). The ratio of PUFA increased. Means were as follows: groups A and C 13.7±3.0 and 16.5±3.4; groups B and D 7.3±1.8 and 9.4±2.5, respectively ($P < 0.001$) with simultaneous decrease of n-6/n-3 ratio (A and C 3.4-4.1 vs. B and D 7.7-10.3, $P < 0.001$). In conclusion, the fatty acid composition of intramuscular fat of beef can be modified favorably by feeding grass and concentrate supplementation rich in unsaturated fatty acids.

Key Words: Intramuscular fat, Fatty acids, Linseed supplementation

M153 Sodium monensin and Lasalocid used in growing calves consuming high levels of brewers grain.

J. A. Piña, J. A. Fernandez, J. I. Aguilera, R. Bañuelos*, C. F. Arechiga, and S. Mendez, *UAMVZ-Universidad Autonoma de Zacatecas, Zacatecas, Mexico*.

Present work intended to evaluate the effect of sodium monensin and lasalocid on calves growth in the feedlot consuming high levels of brewers grain. The study was performed in north-central Mexico (22° 52' north latitude, 102° west longitude, 2,153 m above the sea level. Calves (n=29) with an average body weight of 218 kg were allotted into 3 treatments: T1 Control group, T2 Lasalocid (30 g/ton) and T3 Monensin (50 g/ton). Rations included 70% of a conventional diet and 30% of brewers grain, offered throughout 89 d. Feed consumption and body weight were recorded daily and bi-weekly, respectively. There were no significant differences ($P > 0.11$), within treatments for daily weight gain, but there was a difference within the Control group and Lasalocid ($P < 0.05$). Average daily gain was 1.24, 1.36, y 1.35 kg/d for Control, Lasalocid and Monensin respectively. Average feed conversion was 6.97, 6.48 and 6.49 kg in a dry matter basis. Annual profitability was 35, 49.4 and 49.6%, respectively. In conclusion, ionophores increase weight gain, conversion, and profitability in growing calves fed brewers grain.

Key Words: Ionophores, Brewers grain, Feedlot

M154 Effect of condensed-tannins addition to a corn-sunflower meal based feedlot diet.

A. J. Pordomingo*, M. P. Azcarate, and N. A. Juan, *INTA Anguil Experiment Station, La Pampa, Argentina*.

Addition of condensed tannins in ruminant diets has been suggested to reduce rate and extent of rumen degradation of soluble proteins and increase nitrogen and feed efficiency. This experiment evaluated the effects of adding 2 levels of tannins, compared with a control and a metabolizable-protein (MP) balanced diet, on weight gain and feed efficiency of feedlot steers during a 92-day period. Ninety six Angus steers (live weight = 200 ± 5 kg) were distributed in a completely randomized design of 24 pens with 4 steers each. Treatments applied were: T1= Diet based on sunflower meal, alfalfa hay and corn grain, T2= Similar to T1 plus 2.5% tannins added on dry-matter (DM) basis, T3 = Similar to T1 plus 3.5% tannins; and T4 = Diet based on corn, no tannins added, and balanced for MP supply (NRC, 2000) with sunflower, feather and fish meal. Diets were equivalent in metabolizable energy content.

A mineral and vitamin mix (3%-DM basis) and monensin (33 mg/kg of mixed feed) were added to all diets. Treatment T1 served as control for tannin effects and T4 as a reference for maximum potential. Weight gains (ADG) were determined on day 0 and at the end of 4 periods on days 24, 46, 69 and 92 of trial, after a 17-hour fast. Feed intake was measured daily by pen and averaged by period. Albeit treatment by period interactions ($P < 0.05$), after the 92 days of trial ADG resulted greater ($P < 0.01$; $SE = 0.029$) for T2 (1.67 kg/d), compared with the other treatments (1.56 kg/d; $P > 0.257$). Addition of tannins did not affect ($P > 0.25$) DM intake. Treatments 1, 2 and 3 resulted in greater intakes ($P < 0.01$) than T4 (8.73 vs 8.16 kgDM/d, $SE = 0.262$), maybe due to effects of protein profiles supplied Treatment 4, however, yielded the greatest feed efficiency (5.29:1 vs 5.42:1 for T4 and the combined T1, T2 and T3, respectively; $SE = 0.226$). Fitted to NRC (2000) model, treatments 2 and 4 showed improved nitrogen use efficiency compared with T1 and T3 ($P < 0.05$).

Key Words: Protein use efficiency, Feedlot cattle, Condensed tannins

M155 Effect of age, sex, and grain processing method on rate and efficiency of gain of beef cattle. B. M. Rainey*, J. A. Paterson, M. C. King, L. W. Barney, and W. T. Choat, *Montana State University, Bozeman, MT.*

The objectives of this factorial growth study were to determine the effects of animal age (cows vs. calves), animal gender (steers vs. heifers) and barley processing method (whole vs. rolled) on rate and efficiency of gain when fed as a supplement to medium quality grass hay (12.3% CP; 37.7% ADF, DM basis). Also evaluated was a control treatment in which animals were not supplemented with barley. Forty, 36 mo old, Angus cows (493 \pm 49 kg), twenty-one, heifer calves (98 \pm 8 d of age) (107 \pm 15 kg), and nineteen, steer calves (99 \pm 7 d of age) (121 \pm 16 kg) were allotted to treatments in a 2 x 2 + 1 arrangement. All cattle were blocked by age and sex and fed for 65 d. Pen was the experimental unit. Light test weight barley (20.9 kg·bu⁻¹) was provided at 0.5% BW (2.4 kg·cow⁻¹·d⁻¹ and 0.6 kg·calf⁻¹·d⁻¹, DM basis). Grass hay was provided to cows at 9.7 kg·d⁻¹·d⁻¹ and to calves at 2.8 kg·hd⁻¹·d⁻¹ (DM basis). Rations were formulated to be isonitrogenous using a 31.6% CP supplement and cows received 0.9 kg·hd⁻¹·d⁻¹, while calves received 0.45 kg·hd⁻¹·d⁻¹. Individual full weights were taken on two consecutive days at the beginning and end of the study. Data were analyzed as a factorial for the main effects of animal age, barley processing method and the processing x age interaction. No interactions were measured in this study. Animals fed the control diet had a similar rate and efficiency of gain as supplemented animals. Barley processing had no effect on rate or efficiency of gain for cows or calves ($P > 0.05$). However, age (cow vs. calves) was significant ($P < 0.0001$). Cows gained more weight than calves, consumed more DM but were less efficient (5.73) than either heifers (3.2) or steers (3.73). Similarly, ADG was faster ($P < 0.01$) for cows than calves. These data suggest that improved performance was not measured when the barley was rolled. Also, even though cows gained at a faster rate than calves, gains were more efficient for calves than cows (1.04 kg vs 0.58), cow vs heifer and ($P = 0.0019$), (1.04 kg vs 0.51 kg) for cows vs steers. These data suggest that calves which are out performed are still more efficient in their gains than older animals.

Key Words: Barley, Processing, Cattle

M156 The effects of cottonseed hulls added to diets with and without live yeast or mannanoligosaccharide in Holstein calves. S. R. Hill*, B. A. Hopkins, S. Davidson, S. M. Bolt, C. Brownie, T. Brown, G. B. Huntington, and L. W. Whitlow, *North Carolina State University.*

The objective of this study was to investigate the effects of fiber from cottonseed hulls (CSH) added to the starter and of live yeast (YST) or mannanoligosaccharide (MOS) added to milk, on growth, intake, rumen development, and health parameters in calves. Bull and heifer calves (n=116) were assigned randomly at birth to one of six treatments for 63 d. Calves were dehorned at 42 d. Bulls were elastrated by 14 d. Calves were fed 3.8 L of colostrum once daily for the first 2 d and then 3.8 L of whole milk supplemented with either no additive, 4g YST, or 3g MOS once daily through weaning at 42 d. Treatments included: 1) a corn/soybean meal based starter, 20% CP, 6% ADF (CON), 2) a blend of 85% starter and 15% CSH, 18% CP, 15% ADF (CON + CSH),

3) starter and MOS (CON + MOS), 4) starter with CSH and MOS (CON + CSH + MOS), 5) starter and live yeast (CON + YST), and 6) starter with CSH and live yeast (CON + CSH + YST). Starter diets were offered from 1 d and daily amounts were increased by 0.09 kg when orts were 0 kg. Weekly measurements included body weight (BW), wither height, hip width, and dry matter intake from starters (DMI). Daily measurements included rectal temperatures, fecal, and respiratory scores. Twelve steers (2 per treatment) were sacrificed for rumen tissue samples. Data were analyzed for the main effects of CSH, YST, and MOS. Average DMI was greater for calves consuming CSH diets (0.41 kg) than diets without CSH (0.34 kg). Calves fed CSH treatments (54.9 kg) had greater BW than those fed diets without CSH (53.3 kg) ($P < 0.05$). Average daily gain was greater for calves fed CSH diets (0.58 kg/d) than diets without CSH (0.51 kg/d) ($P < 0.05$). However, calves fed diets without CSH had a greater feed efficiency (0.67 kg feed/kg BW gain) than those fed CSH diets (0.73 kg feed/kg BW gain) ($P < 0.05$). There were no significant effects of YST or MOS on DMI, gain, or feed efficiency ($P > 0.05$).

Key Words: Dairy calves, Cottonseed hulls, Yeast

M157 Effects of grazing fresh forages on milk fat CLA. S. J. Freeman*¹, J. A. Bertrand¹, T. C. Jenkins¹, B. W. Pinkerton¹, and D. L. Palmquist², ¹*Clemson University, Clemson SC / USA*, ²*Ohio State University, Columbus OH / USA.*

The objective was to determine effects of grazing different forages on concentrations of *cis*-9, *trans*-11 conjugated linoleic acid (CLA) in milk fat of Jersey and Holstein cows. Two treatment groups were utilized for each of three studies: control (C) or pasture (P). Cows on C were fed a total mixed ration (TMR) ad libitum, and P cows were fed pasture and supplemental feed, which was limited to 60% of ad libitum dry matter intake (DMI). In Experiment 1, Holstein and Jersey cows on P grazed ryegrass pasture. Milk samples from each cow were taken at the end of two three-week periods for four consecutive milkings. In Experiment 2, Holstein and Jersey cows on P grazed dwarf hybrid pearl millet pasture. Weekly milk samples were taken at four consecutive milkings for the six-week study. In Experiment 3, Jersey cows on P grazed rye pasture. Weekly milk samples were taken at four consecutive milkings during two five-week periods. Linolenic acid (C18:3) content was higher in P diets compared to C (31% and 4%, respectively). Saturated fatty acid content (C16:0 and C18:0) was higher in C diets than P (51% and 30%, respectively). For all three forages, C18:3 was the fatty acid in highest concentration, ranging from 48% of total fatty acids (TFA) in dwarf hybrid pearl millet, 49% in ryegrass, to 57% in rye. Palmitic (C16:0) and linoleic (C18:2) acids concentrations were each approximately 11% of TFA. DMI from pasture ranged from 54% to 77%. Milk fat CLA as a percentage of TFA were significantly higher for P cows in all experiments. In Experiment 1, milk fat CLA for cows on P was 0.47% of TFA for Holsteins and 0.42% for Jerseys. In Experiment 2, milk fat CLA for cows on P was 0.57% of TFA for Holsteins and 0.45% for Jerseys. In Experiment 3, milk fat CLA for cows on P was 0.44% of TFA. Substitution of fresh forage for a portion of TMR in dairy cows significantly increases CLA concentrations to twice that of the control, as well as differences between Jersey and Holstein breeds. Cows responded similarly to all three forages.

Key Words: Pasture, CLA, Dairy cows

M158 Effect of dietary cation-anion difference and crude protein content on milk yield and blood metabolites of lactating dairy cows during hot weather. C. D. Wildman*, J. W. West, and J. K. Bernard, *The University of Georgia, Tifton, GA.*

Thirty-two lactating Holstein cows averaging 225 \pm 63 DIM were used in a 6 wk randomized complete block trial to determine the response to dietary cation-anion difference (DCAD) and dietary crude protein (CP) concentration fed during hot weather. The study was conducted from July 17 through August 27. Mean maximum and minimum temperature, relative humidity, and temperature-humidity index (THI) were 29.9 and 22.5°C; 98.1 and 65.7%; and 80.5 and 72.3, respectively. Treatments were arranged as a 2 x 2 factorial to provide 15 or 17% CP and DCAD of 25 or 50 meq/100g DM (Na+K-Cl). A DCAD x CP interaction ($P = 0.09$) was detected for average daily milk yield with high DCAD resulting in lower yield (27.8 kg/d) than low DCAD (31.4 kg/d) at high dietary CP. No differences were noted at low CP. High DCAD ($P < 0.01$) and CP ($P = 0.06$) resulted in higher milk fat percentage than low DCAD and

CP respectively. No differences between treatments were observed for intake of DM or milk protein percentage. Blood urea nitrogen (BUN) was higher for 17% CP than 15% CP ($P < 0.01$). A DCAD x CP interaction ($P < 0.01$) was noted for blood Na ($P < 0.01$). At 17% CP, blood Na was higher at DCAD 50 versus 25. At 15% CP, no difference was observed. Fractional excretion of K ($P < 0.01$) was greater at DCAD 50 than DCAD 25. A DCAD x CP interaction ($P = 0.05$) was noted for fractional excretion of Na with a greater increase with increasing DCAD at 15% CP than at 17% CP. A difference was also observed for urinary bicarbonate level for low (47.7 mmol/l) and high (88.8 mmol/l) DCAD ($P < 0.01$). No CP differences were observed for fractional excretion. While results of this research indicate a relationship between DCAD and dietary crude protein, the mechanism behind this relationship is unknown.

Key Words: Dietary cation-anion difference, Dietary crude protein, Heat stress

M159 Amino acid composition of ruminant feeds and feed fractions. D. A. Ross* and M. E. Van Amburgh, *Cornell University, Ithaca, NY.*

To improve the ability to predict amino acid flows in ruminants, which will enhance the efficiency of use of absorbed nitrogen (N), a better description of the amino acid (AA) content of feeds used in ruminant diets is necessary. The objective of this study was to analyze the AA composition of some common dairy feeds to determine variation among and within feed fractions and to evaluate typical fractionation methods for AA recovery. Twelve feeds (three alfalfa silages (AS), four soy products (SOY) and five corn silages (CS)) were partitioned to yield six N containing fractions: whole feed (W), insoluble N (IN), true soluble N, neutral detergent (ND), acid detergent (AD) and lignin (L). Residues from these fractions were analyzed for AA content using HPLC after acid hydrolysis or preoxidation followed by acid hydrolysis. Dry matter, ash and N were determined on all fractions. True soluble N was precipitated with 10% tungstic acid. The IN, ND and AD residues were prepared using standard procedures; lignin was obtained by hydrolysis of AD residue in 72% sulfuric acid for 3 hr. Amino acid values are presented as the mean \pm sd as the percent of the crude protein in the residue (CP, % DM). Within AS, the mean Arg contents of the fractions (W, IN, TIN, ND, AD and L) were 4.13 0.21, 4.51 0.59, 5.84 0.89, 3.15 0.85, 1.59 0.43, 1.94 0.80 (CP % DM) ($P < 0.008$). Within the ND residues of the AS the Met content was 1.16 0.56. Among the CS fractions the Leu contents were 8.47 0.40, 11.16 1.45, 14.62 5.10, 7.31 1.36, 4.80 2.24, 6.44 2.45 (CP % DM), respectively ($P < 0.001$). Within the CS the Lys contents of the W and IN fractions were 2.30 0.63 and 3.40 0.38 ($P < 0.039$) while the Thr contents were 3.26 0.09 and 4.08 0.37 ($P < 0.01$). For the SOY the mean Leu content of the ND residues was 7.16 3.92 with a range of 1.75 to 10.70 (CP, % DM). The Leu content of the AD residue of the SOY ranged from 7.16 to 14.67 with a mean of 10.96 3.07. The mean Phe contents of the SOY AD and L fractions were 6.12 1.86 and 3.35 1.13, respectively ($P < 0.012$). The results of this work demonstrate that variation exists among similar feeds and within routine chemically determined feed fractions.

Key Words: Amino acid, Feed, Nitrogen

M160 Effects of feeding graded amounts of liquid molasses to high producing dairy cows. G. A. Broderick* and W. J. Radloff, *U.S. Dairy Forage Research Center, Madison, WI.*

Previously, we observed that feeding sugar as sucrose or dried molasses increased DMI and fat yield in lactating cows. This trial tested effects of replacing dietary high moisture shelled corn (HMSC) with liquid molasses. Multiparous Holstein cows (48) were assigned by DIM to 12 blocks; cows were fed a covariate diet formulated to 17% CP and 26% NDF containing (DM basis): 30% alfalfa silage, 20% corn silage, 37.4% HMSC, 7.0% soybean meal, 4.4% roasted soybeans, plus 1.2% minerals and vitamins. After a 2-wk covariate period, cows within blocks were randomly assigned to TMR supplemented with (DM basis): 0% molasses, 37.4% HMSC (covariate diet); 3% molasses, 34.4% HMSC; 6% molasses, 31.4% HMSC; or 9% molasses, 28.4% HMSC. Cows were fed experimental diets for 8 wk. Milk yield and DMI were measured daily. Yield of milk components was determined one day during the covariate period and every 2 wk during the trial. The statistical model included average covariate and treatment for each production trait. Least square means are reported. There were linear declines in yield with increasing

molasses; this was driven by a reduction in all production traits at 9% molasses. Unlike previous trials, there was no quadratic effect on fat yield with feeding sugar. However, there were quadratic responses for DMI and yield of milk, FCM, protein, lactose, and SNF with a maximum at 3% molasses. A cubic response was noted for DMI. Replacing HMSC with liquid molasses optimized yield and DMI when fed at about 3% of dietary DM.

Item	Molasses, %				SE	L ¹	Q ¹	C ¹
	0	3	6	9				
	(kg/d)							
DMI	25.6 ^b	27.9 ^a	26.4 ^b	26.2 ^b	0.4	0.93	< 0.01	0.01
Milk	44.3 ^a	45.5 ^a	44.6 ^a	42.2 ^b	0.6	0.01	< 0.01	0.79
3.5% FCM	45.6 ^a	47.4 ^a	45.3 ^{ab}	42.1 ^b	1.2	0.02	0.04	0.61
Fat	1.63 ^{ab}	1.71 ^a	1.61 ^{ab}	1.51 ^b	0.06	0.11	0.16	0.51
Protein	1.39 ^a	1.41 ^a	1.35 ^a	1.23 ^b	0.03	< 0.01	0.01	0.65
Lactose	2.13 ^b	2.24 ^a	2.17 ^{ab}	1.99 ^c	0.04	0.01	< 0.01	0.74
SNF	3.91 ^a	4.06 ^a	3.91 ^a	3.57 ^b	0.07	< 0.01	< 0.01	0.76

¹Probability of linear (L), quadratic (Q) and cubic (C) effects. ^{a,b,c}Means in rows without common superscripts are different ($P < 0.05$)

Key Words: Liquid molasses, Dietary sugar, Milk yield

M161 Soy hulls as barley grain replacement in pellets fed to lactating cows; effect on digestion and milk performance. J. Miron, E. Yosef*, M. Nikbachat, E. Maltz, and D. Ben-Ghedalia, *Dept of Dairy Science, The Volcani Center, ARO, Israel.*

The potential of soy hulls rich in primary cell walls for replacing of barley grain when included as major components in pellets fed to dairy cows was measured. Hypothesis being that this replacement can avoid the inhibitory effect of starch on neutral detergent fiber digestion and utilization in the rumen, while improving milk fat synthesis by the cow. Ten lactating cows, similar in initial average performance, were divided into two dietary groups of five cows each and fed two different diets based on 73% pellets and 27% oat plus vetch hays (2:1). The two dietary groups differed in the pelleted ingredient of the diets composing of either 48% rolled barley grains in B group or 48% soy hulls in the SH cows. The hays and pellets were mixed together and fed ad-lib in three meals during the day, allowing for 10% ortos. Chromium oxide marker was used to measure digestibility. Cows were allocated for 42 d in individual metabolic stalls, had free access to water and milked twice daily. Data of individual cows were analysed by ANOVA using the GLM procedure of SAS (1996). Dry matter and NDF intakes were significantly higher in the SH cows (20.4 and 9.63 kg/d, respectively, $P = 0.05$) compared to the B group (16.9 and 4.95 kg/d, respectively). The in vivo digestibility of organic matter was slightly higher ($P = 0.06$) in the B cows, however, NDF digestibility was significantly higher in the SH group (50.9 vs 36.2%, $P = 0.02$). This difference is probably a result of the inhibitory effect of barley starch on the cellulolytic population of the rumen in the B cows. Intake and digestibility differences were reflected in higher content of milk fat ($P = 0.04$) and higher yield of milk fat and 3.5% fat-corrected-milk ($P = 0.01$) of the SH cows (3.65%, 1.13kg/d and 31.6 kg/d, respectively) compared to the B group (2.32%, 0.67kg/d and 24.1kg/d, respectively). Milk and milk protein yields were similar in both groups. This study demonstrates that a dietary regime based on feeding high proportion of concentrated pellets to dairy cows (e.g. in dairy herds using robots for milking or concentrate feeders) should be based on soy hulls as starchy grains replacement, in order to maintain high milk fat level.

Key Words: Dairy cows, Soy hulls pellets, Barley pellets

M162 Effects of prepartum dietary energy level and calcium propionate supplementation on energy metabolism in transition dairy cows. C. C. Stanley*¹, C. C. Williams¹, H. G. Bateman¹, A. E. Beem¹, D. T. Gant¹, Y. H. Chung¹, and F.R. Valdez², ¹ Louisiana State University Agricultural Center, Baton Rouge, LA, ²Kemin Americas, Des Moines, IA.

Forty-one Holstein cows were grouped by anticipated parturition date and assigned to one of four treatments that were arranged as a 2x2 factorial based on 105 and 145% (NRC, 2001) of prepartum dietary energy requirements with or without addition of Ca-Propionate (113.5 g/d provided as NutroCALTM, Kemin Americas, Des Moines, IA). Cows were fed treatment diets from 21 d prior to their anticipated parturition date

until parturition. After parturition, all cows were fed a standard lactation diet with Ca-propionate supplementation continued as assigned prepartum. Individual cow DMI were measured daily. Blood samples were collected during wk -3,-2,-1, +1, +2, and +3 relative to calving for glucose, nonesterified fatty acids (NEFA), urea nitrogen (PUN), insulin, and thyroxine concentrations. Cortisol and glucagon concentrations were measured at wk -1 and +1. At wk -1 and +1, minimal model intravenous glucose tolerance tests were performed to assess glucose effectiveness (S_G), insulin sensitivity (S_I), and the acute insulin response relative to glucose administration ($AIR_{Glucose}$). Glucose, NEFA, insulin, cortisol, and glucagon concentrations were not affected by diet energy level or Ca-propionate supplementation. There were diet by week by Ca-propionate interactions ($P < 0.05$) for thyroxine and PUN concentrations. The S_I and $AIR_{Glucose}$ were not affected by Ca-propionate supplement or diet. The S_G were not affected by Ca-propionate supplement but were greater for cows fed the low energy diet ($P < 0.05$). Clinical health problems not related to dietary treatments of the experimental herd pre- and post-partum may have affected DMI, and therefore these data may not accurately reflect treatment effects on glucose metabolism.

Key Words: Calcium propionate, Glucose metabolism, Transition cows

M163 Conjugated linoleic acid and transvaccenic acid content of milk from cows fed fish meal and extruded soybeans for an extended period of time. A. A. AbuGhazaleh*, D. J. Schingoethe, A. R. Hippen, and K. F. Kalscheur, *South Dakota state University, Brookings.*

The objective of this study was to determine the effect of feeding a conjugated linoleic acid (CLA)-stimulating diet for an extended period of time on milk CLA and transvaccenic acid (TVA) concentrations. Twenty cows (16 Holstein, 4 Brown Swiss) were divided into 2 groups ($n=10$ /treatment) for the 10 wk study. Cows in the first group were fed a traditional corn-soybean meal-basal diet. Cows in the second group were fed a blend of 0.5% fish oil from fish meal (FM) and 2% soybean oil from extruded soybeans (ESB) to achieve higher milk fat CLA and TVA. Diets were formulated to contain 18% crude protein and were composed (dry basis) of 50% concentrate mix, 25% corn silage and 25% alfalfa hay. Intake of DM was not affected by diet (29.3 and 27.7 kg/d for groups 1 and 2, respectively). Milk production (34.5 and 38.9 kg/d) increased ($P < 0.05$) when fed the blend of FM and ESB. Milk fat percentages (3.74 and 3.17), and milk protein percentages (3.39 and 3.18) decreased ($P < 0.05$) with the FM and ESB diet. However, milk fat yield (1.29 and 1.21 kg/d) and protein yield (1.16 and 1.23 kg/d) were not affected by treatments ($P > 0.05$). Concentrations of milk *cis-9*, *trans-11* CLA (0.33 and 1.16 g/100g of fatty acids) and TVA (0.58 and 2.1 g/100g of fatty acids) were 2.5-fold greater ($P < 0.05$) for cows fed the FM and ESB diet during the 10 wk trial, increasing to approximately 3.5-fold higher than the control diet by wk 3, decreasing during wk 4 and 5, and remaining constant at approximately 2.3-fold higher throughout the remainder of the experiment. Yields of *cis-9*, *trans-11* CLA and TVA in milk fat can be increased by feeding a blend of FM and ESB and that increase is relatively constant after 5 wk on the diet.

Key Words: Conjugated linoleic acid, Milk, Fish meal

M164 The effect of short vs long term yeast supplementation during the transition period of Holstein cows. J. D. Ward*¹, ¹LSU AgCenter, Southeast Research Station.

A 56 d study using 30 component fed Holsteins was conducted to determine the effect of yeast culture supplementation during the transition period. Treatments were control, yeast supplementation from 21 d prior to expected calving date through 21 d after calving (short regimen) and yeast supplementation 21 d prior to expected calving date through 56 d after calving (long regimen). Prior to calving, cows received 3.6 kg of DM per d of a concentrate mix, ad libitum access to bermudagrass hay and pasture, and 3.8 kg of DM of corn silage every other d. After parturition, multiparous cows and primiparous cows received 8.1 or 7.3 kg of DM per d, respectively, of a concentrate mix. All cows received, for ad libitum consumption, a mixture containing on a DM basis 13.0% corn silage, and 7.6 and 113.4 g after calving) to the concentrate of treatment cows. Plasma was collected on d 7, 14, 21, 28, and 56 for BHBA analysis. Milk components were analyzed every 14 d. Milk production, BHBA on d 7, 14, 21, and 28 d, DMI, and milk component data were

analyzed using the mixed models of SAS and differences among treatments were tested using single degree of freedom contrasts. General linear models of SAS were used to analyze BHBA concentrations on d 56 and differences among treatments were analyzed using single degree of freedom contrasts. The contrasts were yeast supplementation vs no supplementation, and length of yeast supplementation. Overall, yeast supplementation had no effect on DMI, or milk production. However, cows on the long regimen had greater ($P = 0.02$) milk production (36.2 vs 33.7 kg per d) and less ($P = 0.06$) grain intake (7.3 vs 7.4 kg of DM per d) than cows on the short regimen. Neither yeast supplementation nor length of supplementation had any effect on BHBA during the first 28 d of the study. However, on d 56 cows on the long regimen had lower ($P = 0.06$) plasma BHBA concentration than cows on the short regimen (5.11 vs 7.4 mg/dL). Neither yeast supplementation nor length of yeast supplementation had any effect on SCC or milk fat. However, yeast supplementation decreased ($P = 0.09$) milk protein content (2.67 vs 2.81) beneficial when fed throughout the entire study.

Key Words: Transition cow, Yeast, Heat stress

M165 Silymarin and lycopene in peripartum dairy cows: Effect on milk productivity and quality. D. Tedesco*¹, S. Galletti¹, M. Tameni¹, S. Steidler¹, A. Costa¹, and P. Morazzoni², ¹Department VSA, University of Milan, Italy, ²Indena S.p.A., Milan, Italy.

Objective was to test silymarin + lycopene (Indena S.p.A.) in transient cows, in a period when oxidative stress can impair health status. Silymarin is a hepatoprotective and antioxidant substance which has shown a positive effect on productivity and health in transition cows. Lycopene is a scavenger of oxygen radicals. 20 cows selected according to parity, previous production and BCS, were divided into two groups. From 7 d before expected date of calving to 14 d after calving, 10 cows received 50 g/d of a mixture of silymarin + lycopene by oral drench. Milk production was recorded daily for 305 d and samples were collected at 7, 14 and 21 DIM. The BCS was evaluated at -7, 0, 7, 14, 21d from calving. Body weight was recorded at 0, 21 and 30d after calving. Blood samples were collected at -7, 0 and 14 d from calving to evaluate anti-oxidant power (OXY) and reactive oxygen metabolites (ROMs) in sera with two colorimetric micromethods. Treatment increased milk production. The a, b and c parameters from Wood equation of both lactation curves showed significant differences ($P < .05$), on average 2.5 kg/d for each animal. No difference was found in BCS and body weight between groups. Protein, fat, lactose and urea content in milk was not influenced by treatment. No inhibent activity was detected in milk. Somatic cell count (SCC) was lower in treated animals. The values were significantly different at 14 and 21 DIM (respectively 337700 vs. 62625 and 261500 vs. 66333; $P < .05$). At the start of trial (-7d) a lower OXY level (expressed in μ M HClO neutralized by serum) was found in the treated group. Antioxidant treatment significantly increased this value at calving ($P < .05$). No variations were found in the control group in all the considered days. No differences were found in ROMs values (expressed in mM H_2O_2) considering treatment and day effect ($P > .05$). These results suggest that silymarin + lycopene treatment increases milk production and may have an effect on udder health.

Key Words: Dairy cow, Somatic cell count, Silymarin + Lycopene

M166 Development of a method to assess nutritional motivation in dairy cattle. K. V. Shore*, T. M. Widowski, J. P. Cant, W. J. Bettger, and B. W. McBride, *University of Guelph, Guelph, Ontario, Canada.*

The objective of this experiment was to develop an apparatus to assess nutritional motivation. A push door was designed to fit within a cow's tie stall manger area, the width 92 centimeters and the height of the door 130 centimeters. The apparatus works by the animal pushing the door open with the crown of the head in a lunging action. Successive addition of weights was used to determine the level of nutritional motivation for a food reward. For validation, three non-lactating dairy animals of varying body weights were fasted for 0, 24, 48, and 72 hours. At these designated time points motivation was assessed with the offering of dry hay. The test was completed once the animal would no longer push the door to receive the reward. With advanced duration of fast, there was a significant increase ($p > 0.05$) in the amount of weight pushed (0 to 24 hours - 19 ± 3.8 kg or 3% of body weight; 24 to 48 hours - 49.5 ± 3.7 kg or 7% of body weight; 48 to 72 hours - 83.5 ± 5.1 kg or 13% of

body weight). In conclusion, the push door proved an effective tool in determining the level of motivation to receive a food reward.

Key Words: Nutritional motivation, Push door, Dairy cattle

M167 Production efficiency of mid-lactation dairy cows fed yeast culture during the summer. K. N. Linke¹, D. J. Schingoethe^{*1}, K. F. Kalscheur¹, A. R. Hippen¹, D. R. Rennich¹, and I. Yoon², ¹South Dakota State University, Brookings, ²Diamond V Mills, Inc., Cedar Rapids, IA.

Thirty-eight Holstein cows (26 multiparous and 12 primiparous), which averaged 105 d postpartum at the start of the experiment, were used to evaluate the feeding of yeast culture (Diamond V XPTM) on production efficiency during hot summer weather. After a 2 wk covariate period, cows were fed a control diet or control diet with 60 g yeast culture/cow daily for 12 wk from early June until early September. Weekly daytime high temperatures averaged 33degC (28 to 39degC) during the 12 wk period. Total mixed diets contained 28.5% of DM as corn silage, 21.5% as alfalfa hay, and 50% as concentrate mix with the yeast culture added to the TMR at the time of feeding. Milk production (34.9 and 35.4 kg/d, for control and yeast culture, respectively), 4% fat-corrected milk (31.2 and 32.0 kg/d), and DM intake (22.9 and 22.2 kg/d) were similar ($P > 0.05$) for cows fed control and yeast culture diets. Percentages of milk fat (3.34 and 3.41) and true protein (2.85 and 2.87) were similar ($P > 0.05$) for both diets. Production efficiency defined as kg fat-corrected milk/kg DM intake was improved ($P < 0.04$) by 8% (1.38 and 1.49) for cows fed the yeast culture. Body weights (629 and 616 kg) and body condition scores (3.12 and 3.16) were similar ($P > 0.05$) for both groups. The results suggest that the yeast culture can improve production efficiency of dairy cows in mid-lactation.

Key Words: Yeast culture, Lactating cows, Production efficiency

M168 Effects of diet forage:concentrate ratio on splanchnic nutrient metabolism in lactating dairy cows. C. K. Reynolds^{*1}, J. A. Benson¹, P. C. Aikman¹, B. Lupoli¹, M. D. Hanigan², D. E. Beever¹, and J. C. MacRae³, ¹The University of Reading, Reading, UK, ²Purina Mills LLC, St. Louis, MO, ³The Rowett Research Institute, Aberdeen, UK.

The objective was to determine the effects of diet forage:concentrate ratio on the net absorption and metabolism of nutrients by the portal-drained viscera (PDV) and liver of 6 multiparous, catheterized, lactating (214 DIM) Holstein X Friesian cows (713 kg BW). Treatments were forage (60:40 dehydrated alfalfa:grass silage) or an isonitrogenous concentrate (2.64 % N) fed as a TMR in ratios (DM basis) of 60:40 (F) or 40:60 (C) in a single-reversal study with 5 wk periods. Blood flow (L/h) and net PDV and liver nutrient flux (mmol/h) were measured hourly ($n = 6$) on the last d of each period. Diets were offered hourly at below ad libitum DMI and equal calculated ME, but DMI (18.9 vs. 19.6 kg/d) and N intake (488 vs. 510 g/d) tended ($P > 0.16$) to be lower for F, thus ME intake was greater ($P < 0.03$) for C (202 vs. 221 MJ/d). Milk yield (20.2 kg/d) and composition were not affected by diet, but milk fat concentration was numerically lower for C (44.6 vs. 40.8 g/kg, SEM = 2.0). Blood flow for PDV (1874) and liver (2267) and net PDV flux of oxygen, ammonia, urea, acetate, n-butyrate, β -OH-butyrate, or glucose (-3562, 736, -472, 2618, 169, 232, and -35, respectively) were not affected ($P > 0.10$) by diet. Similarly, net liver flux of oxygen, ammonia, urea, acetate, n-butyrate, and β -OH-butyrate (-3458, -754, 779, 563, -138, and 330, respectively) were not affected ($P > 0.12$) by diet. However, greater ($P < 0.03$) net PDV release of lactate (146 vs. 177) and numerically greater net PDV release (862 vs. 1140, SEM = 122) and liver removal (796 vs. 1074, SEM = 115) of propionate were associated with greater ($P < 0.04$) net liver release of glucose (620 vs. 713) and less ($P < 0.10$) net liver removal of lactate (69 vs. 28) for C. In conclusion, greater ME intake, from a higher concentrate diet, increased net splanchnic supply of glucose and lactate to peripheral tissues of late lactation dairy cows.

Key Words: Portal-drained viscera, Liver, Lactation

M169 Effect of the replacement of corn by citrus pulp on fiber effectivity. G. A. Andrade¹, J. C. Teixeira^{*1}, J.R.O. Perez¹, J. A. Muniz¹, P.C.A. Paiva¹, and J. S. Oliveira², ¹Universidade Federal de Lavras, ²Embrapa Gado de Leite.

The objective of this experiment was to compare the part (CP50) and total (CP100) replacement of citrus pulp by finely ground corn (CP00) in lactating dairy cow diets in which the forage source was corn silage on fiber effectivity of the by-product. The hypothesis was that the use of citrus pulp in the place of corn increases the fat content in milk, the chewing activity and ruminal pH. Twelve cows at the middle third of lactation with an average yield of 28.5 kg of milk were utilized. The animals were fed twice per day with three diets ranging only the levels of NDF and ADF. The design was a replicate 3 x 3 Latin square design with 21-day periods. Two orthogonal contrasts for data analysis I (CP00 x CP100), II (2* CP 50 x CP 00 + CP 100) were utilized. The observations were of rumination, intake, mouth inactivity and water consumption, also the ruminal pH. The design was a replicate 3 x 3 Latin square design with 21-day periods. Two orthogonal contrasts for data analysis I (CP00 x CP100), II (2* CP 50 x CP 00 + CP 100) were utilized. The observations were of rumination, intake, mouth inactivity and water consumption, also the ruminal pH. No difference among the intake parameters according to the levels of replacement in relation to the CP00 treatment was detected, only the time spent with water consumption of kg of NDF was shorter for the animals when they were given CP100 diets. The time spent for rumination and of Kg of NDF was shorter for the animals fed CP100 diet. The time of mouth inactivity was longer for the animals when submitted to any of those experimental treatments utilized. Milk fat yield was higher for the animals when fed the CP100 diet and less when fed the CP00 diet.

Key Words: Citrus pulp, Corn meal, Fiber effectivity

M170 Feed consumption and efficiency of lactating cows submitted to part and total replacement of corn by citrus pulp. J. C. Teixeira^{*1}, G. A. Andrade¹, J. S. Oliveira², P.C. A. Paiva¹, J. A. Muniz¹, and J. R. O. Perez¹, ¹Universidade Federal de Lavras, ²EMBRAPA Gado de Leite.

The objective of this work was to compare the part (CP50) and total (CP100) replacement of citrus pulp by finely ground corn (CP 00) in lactating dairy cow diets in which the source of forage was corn silage on milk yield and composition. The hypotheses were that use of citrus pulp in the place of corn does not show any fall in milk yield and increases the percent of fat and protein. Twelve cows at the middle third of lactation with an average yield of 28.5 kg of milk per day in two daily milkings were used. Milk samples were collected proportionally soon after milking and led to the analyses. The animals were fed twice per day with three diets containing the same nutritional pattern ranging only the replacement of corn by pulp. The experiment was a replicate 3 x 3 Latin square design with periods of 21 days. Two orthogonal contrasts were utilized for data analysis I (CP00 x CP100), II (2* CP50 x CP00 + CP100). Milk yield of the animals when they were fed the CP 50 diet was less than when the same animals were fed the CP00 and CP 100 diets, 28.32, 28.81, 28.58, respectively. Total yield and percent fat was less for the animals which were fed the CP00 diet and higher when they were fed the CP 100 diet, 0.96 x 1.10 kg and 3.37 x 3.84 %, respectively. The values for total yield and percent protein were the inverse of the found for fat with higher yields for the animals fed the CP00 diet and less for CP 100 (0.90 x 0.84) and 3.10 x 2.97.

Key Words: Citrus pulp, Corn meal, Milk production

M171 Effect of the replacement of corn by citrus pulp on nutrient consumption by lactating cows. G. A. Andrade¹, J. C. Teixeira^{*1}, J. A. Muniz¹, J. R. O. Perez¹, J. S. Oliveira², and P. C. A. Paiva¹, ¹Universidade Federal de Lavras, ²EMBRAPA - Gado de Leite.

The aim of this experiment was to compare the part (CP50), total (CP 100) replacement of citrus pulp by finely ground corn (CP00) in diets for lactating dairy cows in which the forage source was corn silage on feed consumption. The hypothesis was that the use of citrus pulp in the place of corn keeps the intake of dry matter with greater consumptions of neutral detergent fiber (NDF) and acid detergent fiber (ADF). Twelve cows at the middle third of lactation with an average yield of 28.5 kg of milk were utilized. The animals were fed twice per day with three diets ranging only the NDF and ADF levels. The experiment was a replicate 3 x 3 Latin square design with 21 days periods. Two orthogonal periods for data analysis I (CP 00 x CP 100), II (2* CP50 x CP00

=+ CP100) were used. DM consumption was higher for the animals fed CP00 and decreased according to the replacement of citrus pulp by corn (CP 00, 21.53; CP 50, 3.73; CP100, 4.26) was inverse to the dry matter consumption due to the large amount of fiber present in citrus pulp. The intakes of minerals, protein and energy among the animals fed the different diets was of same behavior of dry matter intake.

Key Words: Citrus pulp, Corn meal, Intake

M172 Use of intra-ruminal monensin capsules in dairy cows under alfalfa grazing conditions. I. Milk yield and composition. M. R. Gallardo¹, A. R. Castillo^{*2}, M. C. Gaggiotti¹, H. C. Castro¹, S. Aronna¹, S. Lettieri¹, D. Quattrin¹, and H. Perez-Monti³, ¹Experimental Station Rafaela, INTA, Argentina., ²UC Davis Cooperative Extension, U.S.A., ³Elanco Animal Health Div. Argentina..

This experiment evaluated short-term effects of intra-ruminal capsules of monensin on lactating dairy cows under alfalfa grazing condition. Fifty-six Holstein dairy cows (46 multiparous and 10 primiparous) were used in a repeated measures randomized design. The cows were blocked in pairs by calving date, previous milk yield, body weight and lactation number in two treatments: Control and Monensin. Treated cows received the intraruminal capsules 30 days before the expecting calving date and 60 days after calving. Short-term effects were evaluated during 150 DIM. All the cows were fed with the same diet, during the dry period a TMR and after calving alfalfa pasture and supplemented with TMR. Corn silage, alfalfa hay, corn grain, cottonseed, mineral and vitamins composed the TMR. Mean quality of the diet pre and postpartum were: 57.8 and 45.6%; 12.7 and 18.8%; 1.51 and 1.65 Mcal/kgDM; 52.1 and 35.8% for DM; CP; NEL; and NDF respectively. Dry matter intakes (DMI) were determined by offer and refusal in two different periods (25 and 50 DIM). Milk yield was recorded daily and milk composition twice weekly from calving to 60 DIM and once a week until 150 DIM. Dry matter intakes were comparable (P>0.05) between treatments, averaging 14.16 and 9.25 kgDM/cow/d TMR and alfalfa respectively. There were significant differences (P<0.05) in milk yield and milk composition (fat, protein, and non-fat solids). Monensin capsules improved lactation performance of dairy cows under alfalfa grazing conditions.

	Control	Monensin	Dif.	
Milk yield (L/d)	26.60	27.65	1.05	***
Milk composition (%)				
Fat	3.60	3.51	-0.09	*
Protein	3.25	3.24	-0.01	
Non-fat solids	8.94	8.95	0.01	
Components yield (kg/d)				
Fat	0.952	0.965	0.013	
Protein	0.860	0.890	0.030	***
Non-fat solids	2.374	2.460	0.086	**

* P<0.05; ** P<0.01; *** P<0.001

Key Words: Monensin capsules, Dairy cows, Alfalfa grazing

M173 Intake and milking performance of high producing cows fed starchy vs primary cell wall-rich pelleted additive. J. Miron¹, E. Yosef^{*1}, M. Nikbachat¹, E. Maltz², I. Halachmi², and D. Ben-Ghedalia¹, ¹Institute of Animal Science, ²Institute of Agricultural Engineering.

The potential of byproducts rich in primary cell walls for replacing commonly used starchy grains in pellets supplemented to a basic TMR of lactating cows was examined. Twenty four high producing cows were divided into two groups of 12 cows each similar in initial performance (45 kg milk/d, 59 DIM) and fed individually ad-libitum for seven weeks a diet containing 75% (on a DM basis) basic TMR (1.5 Mcal NEL, 17% CP) plus 25% additive of pellets. The two experimental diets differed only in the pelleted additive composed of either starchy grain plus soybean meal in the control pellets or soy hulls plus gluten feed in the experimental pellets. The two types of pellets contained 17% CP, and served

to cows on top of the basic TMR in individual feeders in three meals, at around milking hours. The cows ingested the two types of pellets within 10-30 minutes after serving. This unique feeding system resembled the feeding regime commonly occurred in dairy barns using automatic feeders of concentrates or milking robots. Total NDF content was 40.3% and 31.0% in the experimental and control diets, respectively. Average voluntary DMI was higher in the experimental compared to the control cows (27.3 and 25.1 kg/d, respectively, P=0.01). Average daily milk fat content, milk fat yield and 3.5% FCM yield were higher (P<0.02) in the experimental cows (3.31%, 1.49 kg and 43.7 kg, respectively) compared to the control group (2.79%, 1.24 kg and 39.9 kg, respectively). Average milk and milk protein yields were similar in both treatments (44.6 and 1.39 kg/d). Data support our concept that pellets made of primary cell wall rich byproducts encourage milk fat production in cows when supplemented in concentrate feeders or milking robots.

Key Words: starchy pellets, primary cell wall-rich pellets, performance of dairy cows

M174 Effect of whole cottonseed, whole canola seed and crushed canola seed on milk yield and composition of primiparous Holstein cows. L. J Erasmus^{*1}, P. C Haasbroek², and J. B. J. Van Rysse¹, ¹Dept. Animal and Wildlife Sciences, University of Pretoria, Pretoria, South Africa, ²Agricultural Research Council, Pretoria, South Africa.

Canola is relatively new as a feedstuff in South Africa and is gaining in popularity. This study investigated the effect of replacing 10% of the traditionally fed oilseed, whole cottonseed (WCS) with either 10% whole canola seed (WCA) or 10% roller milled crushed canola seed (CCA). Thirty primiparous Holstein cows were used in randomized block design and blocked on average production from d 17 - d 20 post partum. After blocking the cows were fed one of three experimental diets (WCS, WCA, CCA) for a period of 60 d. The diets were similar in chemical composition (17% CP; 11.4 MJME/kg DM) and based on lucerne hay, oat hay, corn and oilseeds. Dry matter intake (20.5; 20.2; 20.3 kg/d), milk production (28.5; 29.4; 29.0 kg/d) body weight (553; 547; 549 kg) and body condition score (3.0; 2.9; 2.7) did not differ between treatments WCS, WCA and CCA respectively. Cows fed the WCA and CCA diets produced milk with a higher fat/%, compared to the cows fed WCS (3.84 and 3.95% vs 3.47%; P = 0.01). Supplementation with CCA decreased the concentration of C16:0 and increased some long chain fatty acids in milk compared to the cows fed the WCS diet (P<0.05). Processing of canola also decreased the C16:0 to C18 total fatty acid ratio from 0.48 to 0.36 (P<0.05) for cows fed the WCS and CCA diets respectively. It can be concluded that there is no need to process canola seed when fed to cows with an intake of around 20 kg DM/d and milk production of 28 - 30 kg/d. At higher intakes (>25 kg DM/d) it might be necessary to process canola due to higher ruminal outflow rates. If the objective is to produce a healthier milk with reduced C16:0 to total C18 fatty acids ratio, then processing would be necessary.

Key Words: Dairy cows, Canola, Milk composition

M175 Hepatic palmitate metabolism of periparturient dairy cows as affected by nutrients supplied in vitro. M. S. Piepenbrink^{*} and T. R. Overton, Cornell University, Ithaca, NY.

Liver from Holstein cows (n=7) entering second or later lactation was utilized to measure responses of palmitate metabolism to candidate nutrient effectors. Liver slices were prepared from biopsy samples collected 21 d prepartum and 1, 21, and 63 d postpartum. Concentrations of nutrients used in liver incubations were: control (B), 75 μM choline chloride (C), 75 μM L-Met (M), C + M (CM), 75 μM D,L-2-hydroxy-4-(methylthio)-butanoic acid (H), 650 μM sodium propionate (P), 80 μM linoleic acid + 20 μM linolenic acid (E), C + E (CE), and M + E (ME). Liver incubated with CE had greater capacity for conversion of [1-¹⁴]palmitate to CO₂ than P [4.1 vs. 3.5 nmol converted/(g wet weight x h)] and tended to be greater than liver incubated with C, CM, E, and ME (3.7, 3.6, 3.7, 3.6 nmol converted/(g wet weight x h)). On d 21 prepartum, slices incubated with CM tended to have lower conversion to CO₂ than those incubated with H and CE [2.98 vs. 3.8 nmol converted/(g wet weight x h)]. Liver incubated with P or E on d 1 postpartum tended to have lower capacities to synthesize CO₂ from [1-¹⁴]palmitate than B. On d 63 postpartum, liver incubated with CE had the highest capacity for [1-¹⁴]palmitate oxidation to CO₂ compared to all other treatments except E. The capacity of liver to store [1-¹⁴]palmitate intracellularly as

esterified products (SEP) tended to increase from prepartum values on d 1 postpartum and then declined on d 21 and 63 postpartum [225, 241, 197, 197 nmol converted/(g wet weight x h)]. Overall treatment means of SEP tended to be lower for liver incubated with H, E, and ME compared to B [210, 206, 208 vs. 227 nmol converted/(g wet weight x h)]. Effects of treatment within day were only apparent on d 1 for SEP such that liver incubated with C (232; $P < 0.17$), E (231; $P < 0.15$), and ME (228; $P < 0.13$) tended to be lower than B (264 nmol converted/(g wet weight x h)). These data suggest that choline and essential fatty acids modulate liver fatty acid metabolism during the immediate postpartal period.

Key Words: Periparturient cow, Liver, Fatty acids

M176 Evaluation of dry matter intake equations by examining predicted change in bodyweight throughout lactation in dairy cows. J. L. Ellis*, F. Qiao, and J. P. Cant, *University of Guelph, Guelph, Ontario, Canada.*

In the dynamic modelling of dairy cow performance over a full lactation, the difference between NE intake, NE used for maintenance and output in milk accumulates in body stores. To select, out of some common DMI prediction equations, the one that results in a minimum cumulative bias in body energy deposition, a simple dynamic model of NE balance was constructed. Fat corrected milk yield (kg/d) was calculated as $a*[1-b_0*e^{-b_1*t}]*[e^{-c*t}]$, where a, b0 b1 and c were obtained by nonlinear fit to experimental data. Dry matter intake (DMI) was predicted from FCM yield and bodyweight, with one of the 4 CNCPS equations, the ARC equation or the NRC equation. Energy balance was calculated according to NRC as $DMI*1.7-FCM*0.749-BW^{0.75}*0.08$. Bodyweight change was 0.203 times NE balance if the balance was negative and 0.195 times balance if positive. The instantaneous bodyweight of cattle at progressive weeks of lactation (WOL) was then simulated as the numerical integral of the bodyweight change. Predicted DMI and body weight from each DMI equation were compared statistically with published observations on Holstein dairy cows with a variety of frame sizes and body conditions, and fed a variety of diets. Regression analysis was performed on all predicted DMI and body weight curves to determine goodness of fit. All equations over predicted body weight, with an increasing difference between predicted and observed body weight as lactation progressed, and this suggests a problem in energy balance calculation, most likely in the maintenance factor. A maintenance cost of 0.11 Mcal/kg^{0.75} minimized residual sums of squares of body weight prediction, and taking into account this adjustment the body weight/energy balance of each DMI equation was examined.

Key Words: Energy balance, Dry matter intake, Dynamic modelling

M177 Effect of Tween 80 on milk production by Holstein cows. J. Baah*¹, J. A. Shelford², T. A. McAllister¹, and K.-J. Cheng³, ¹*Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB*, ²*University of British Columbia, Vancouver, Canada*, ³*Academia Sinica, Taipei, Taiwan ROC.*

The effects of the surfactant Tween 80 on milk yield and composition, feed intake and body weight were studied using 108 multiparous Holstein cows in a 12-wk trial. Cows were ranked by previous milk yield and days in milk (DIM) and randomly assigned to three diets. Within diet, cows were further grouped as <30 or ≥ 30 DIM. The diets (CON, T1 and T2) were partial mixed rations (PMR) containing barley grain, grass silage, corn silage, grass hay, canola, bypass protein, mineral mix and 0, 0.25% or 0.50% Tween 80 (w/w). Diets were balanced to NRC requirements for milk production of ≤ 29 kg/d, and offered for ad libitum consumption. Cows producing >29 kg/d were also fed dairy concentrate (1 kg per 3 kg milk in excess of 29 kg/d). Data were analyzed using PROC GLM with LSMEANS, with diet and DIM (<30 or ≥ 30) as main effects, and significance set at ($P < 0.05$). Across DIM groups, cows fed T1 and T2 produced more ($P < 0.05$) milk with lower ($P < 0.05$) fat content, than those fed CON. However, PMR intake and milk protein content were similar ($P > 0.05$) across diets. Milk yield by cows fed CON, T1 and T2 averaged 30.8, 34.0 and 33.1 kg/d, respectively, with 3.7, 3.5 and 3.5% milk fat content. Among cows ≥ 30 DIM, intake of PMR was similar ($P > 0.05$) across diets, but those fed T1 and T2 produced 3.75 and 3.03 kg/d more ($P < 0.05$) milk, than those fed CON. Milk fat was reduced ($P < 0.05$) from 4.0% with CON to 3.6 and 3.8% with T1 and T2, respectively, and protein content from 3.33% (CON) to 3.2 and 3.17% (T1 and T2, each $P < 0.05$). Milk yield among cows <30 DIM at the start of the

trial was similar to that observed in cows ≥ 30 DIM, however, milk fat and protein contents with T1 (3.4 and 3.0%, respectively) did not differ ($P > 0.05$) from CON (3.5 and 3.0%), and both were higher ($P < 0.05$) than with T2 (3.2% fat and 2.9% protein). Body weight losses by T1 and T2 cows were 50 and 80% lower ($P < 0.05$), respectively, than those fed CON. Milk yield by dairy cows is improved by including Tween 80 in the diet.

Key Words: Tween 80, Milk production, Cows

M178 Comparison of analytical methods and the influence of milk components on milk urea nitrogen recovery. A. B. Peterson*, R. A. Kohn, and E. Russek-Cohen, *University of Maryland, College Park, Maryland.*

The objectives of this study were to determine the differences among analytical methods and to determine if any components in milk affected the recovery of milk urea nitrogen (MUN). Duplicate milk samples were collected from 100 Holstein cows fed one ration on a commercial dairy herd with a rolling herd average of 20,600 lbs. One of each duplicate was spiked with a known quantity of urea N (final concentration 4 mg/dl) while the other was not. Recovery was calculated as the difference in MUN between the two samples divided by 4 mg/dl. Each pair of milk samples was sent to 14 independent laboratories involved in the MUN Quality Control Program through National DHIA and analyzed for MUN, fat, protein, lactose, somatic cell count, and total solids. The laboratories analyzed MUN using CL-10 (n=3), Skalar (n=2), Bentley (n=3), Foss 4000 (n=3) or Foss 6000 (n=3) systems. When recovery of MUN was evaluated among the 5 analytical methods, the mean recoveries for the CL-10, Skalar, Bentley and Foss 6000 systems were 85.3, 90.5, 92.8, and 94.0%, respectively and did not differ from each other (or from 100%). However, MUN recovery for the Foss 4000 system was much lower at 46.9% (SE = 6.7%) compared to the other systems and differed from 100% ($P < 0.05$). Recoveries from all systems except Skalar were influenced by the random effect of lab ($P < 0.0001$) and the variation associated with recovery was not influenced by the random effect of cow. However, as MUN concentration increased, recovery decreased using the CL-10 and Bentley systems ($P < 0.05$) and tended to decrease using the Foss 4000 system ($P = 0.05$). As milk protein concentration increased, MUN recovery tended to decrease using the Bentley system ($P < 0.10$). Recovery of MUN using four of the methods was unaffected by most milk components and did not differ from 100%. Only 47% of MUN was recovered using the Foss 4000 system which depended on the lab, and tended to be affected by MUN concentration.

Key Words: Milk urea nitrogen

M179 Feed intake and milk production of Holstein cows fed rations with glucogenic supplements during the transition period. T. I. Beloso*, M. S. Gulay, M. Liboni, M. J. Hayden, and H. H. Head, *University of Florida.*

Multiparous Holstein cows were used to evaluate glucogenic supplements added to daily TMR. Treatments were 1) control, none, n=29; 2) Nutro-CAL (Kemin AmericasTM), 0.114 kg/d, n=33; 3) Metaxerol (Pestell AmericaTM), 0.454 kg/d, n=31; and 4) propylene glycol, 0.300 kg/d, n=31. All cows were fed twice daily and intakes recorded from -21 d prepartum through 28 d postpartum. Supplements were mixed with ~13.5 kg of the TMR fed in a.m. Afternoon feed allotment contained no supplement and amount was adjusted for expected 5%orts. Close-up dry TMR was fed through day of calving then fresh cow TMR was fed through 100 DIM, but supplements were discontinued after d 28. Milk yields (MY) were recorded at each of the 3 daily milkings. Body weight (BW) and BCS were recorded weekly beginning -21 d prepartum. Prepartum feed intake (kg/d) at wk -3 (28.85), wk -2 (31.91) and wk -1 (28.89) did not differ due to TRT, except during wk -2 prepartum (1>2; 30.20 vs 27.37 kg/d). Feed intake decreased 17.8-30.9% the week before calving, greatest decrease was during the 2 d before calving. Postpartum feed intake increased in all TRT groups during each of the 4 wk (26.79, 32.78, 36.32, 38.03 kg/d, respectively). Within week no differences in intake were detected due to TRT except during wk 4 (1>2; 39.18 vs 36.50, $P = 0.0608$) and (3>2; 39.05 vs. 36.50, $P = 0.0698$). MY for TRT groups did not differ during the first 4 wk when supplements were fed, except that cows in TRT 4 produced less milk (~2.5 kg/d; $P \leq 0.0356$). Overall, 3.4 kg/d less milk was produced during hot season. MY did not differ due to TRT for 28-70 ($P = 0.7127$) or 4-100 DIM ($P = 0.9072$) and no TRT comparisons were significant; overall means were 41.77 and

40.26 kg/d. BCS and BW prepartum and postpartum did not differ due to TRT and no TRT comparisons were significant. Cows showed reduced BW and BCS after calving and through 60 d postpartum. Overall, results showed that cows in all groups had similar MY, maintained BW and BCS equally well, and had similar patterns of feed intake during prepartum and postpartum periods.

Key Words: Glucogenic precursors, Milk yield, Feed intake

M180 Effects of prepartum dietary carbohydrate source and monensin on expression of gluconeogenic enzymes in liver of transition dairy cows. E. L. Williams*¹, M. M. Pickett², L. C. Griel², K. S. Heyler², G. A. Varga², and S. S. Donkin¹, ¹Purdue University, ²Pennsylvania State University.

Adequate provision of gluconeogenic precursors is crucial to the health of transition dairy cows. Non-forage fiber source (NFFS) diets act to increase dry matter intake in transition cows and therefore availability of glucose precursors. Feeding monensin favors enhanced supply of propionate for gluconeogenesis. The objective of this study was to determine the effects of NFFS and monensin on expression of gluconeogenic enzymes in the liver of transition dairy cows. Twenty-one multiparous Holstein cows were used in a complete randomized block design. The addition (+) or absence of (-) supplemental monensin (0 or 330 mg/d) was evaluated in a prepartum conventional (CONV) diet and a NFFS diet in a 2 x 2 factorial arrangement of treatments. The CONV diet contained 70% forage and 28% of the forage was replaced with cottonseed hulls and soyhulls in the NFFS diet. Diets were formulated to contain 1.55 Mcal NE_L/kg, 14% CP, and 40% NDF on a dry matter basis. Treatments began at dry off and continued through parturition. Monensin was topdressed from 28 d pre-calving through parturition. At calving all cows were placed on the same lactation diet. Liver biopsy samples obtained at -28, -14, +1, +14, and +28 d relative to calving (DRTC) were used to determine pyruvate carboxylase (PC) and phosphoenolpyruvate carboxykinase (PEPCK-C) mRNA expression. There was an overall effect ($P < 0.05$) of DRTC on PC and PEPCK expression. Expression of PC mRNA differed ($P < 0.05$) with prepartum diet and DRTC x diet but there was no effect of diet on PEPCK mRNA. Feeding NFFS+ increased PC expression on +1 DRTC ($P < 0.10$) compared with CONV (0.48 0.12 vs. 0.84 0.16; CONV vs. NFFS+). Feeding NFFS+ and monensin results in a combined effect to induce PC expression at calving. Expression of PC mRNA is induced when transition cows are fed conventional diets. The data indicate that NFFS and monensin act in concert to further induce PC expression at calving and consequently suggests increased capacity for gluconeogenesis from lactate.

Key Words: Transition cows, Monensin, Liver

M181 Effects of method of lipid supplementation and physical form of the forage on milk yield and fatty acid composition of milk fat. J. J. Brownfield, E. J. DePeters, J. W. Pareas, and S. J. Taylor, University of California Davis.

Objective was to determine the effect of method of lipid supplementation and forage length on milk yield and composition, particularly the fatty acid composition of milk fat. Four primiparous Holstein cows were fed one of four diets containing soybean oil fed as part of a TMR (T) or as an individual meal prior to consuming their TMR diet (I). The forage portion of the diet was either chopped (C) through a 2.5 cm screen or sliced to an approximate 7.5 cm length by a bale slicer (S). Cows were fed 454 g soybean oil a day, 227 g in each feeding. Experimental design was a 4x4 Latin square. Periods were 21 d with the last 7 days of each period used for data collection. Statistical contrasts were I vs T and S vs C. Milk yield (kg/d), DMI (kg/d) and milk fat (%) were not affected by either method of oil feeding or forage length. Milk yield, milk fat and DMI for IS, IC, TS and TC were: 37.4, 3.73, 21.9; 38.1, 3.50, 21.4; 37.8, 3.65, 21.2; 39.2, 3.89, 22.9, respectively. Total fatty acids and sn-2 fatty acid composition of milk fat were determined by GLC. Differences in fatty acid profiles were observed for C18:0, C18:1 trans9, C18:1trans11, and C18:2 cis9 trans11 (CLA). An increase in C18:0 was observed in milk fat of cows fed soybean oil as T compared to I with means 14.49 (IS), 14.57 (IC), 16.01 (TS), 15.66 (TC) g/100g fat [IvT $P = .04$]. Increases in C18:1trans 9 occurred for I compared to T [IvT $P = .00$]. Both method of lipid supplementation and forage length affected concentrations of C18:1trans 11 and CLA in milk fat with I greater than T and C greater than S averaging 1.69 (IS), 2.16 (IC), 1.41 (TS), 1.48 (TC) g/100g fat [IvT $P = .00$, SvC $P = .03$], and 0.79 (IS), 1.01 (IC), 0.62 (TS),

0.60 (TC) g/100g fat [IvT $P = .00$; SvC $P = .05$] respectively. Method of lipid supplementation and forage length did not affect milk yield and fat percentage, but the fatty acid composition of milk fat was altered.

Key Words: Soybean oil, Dairy cows, Milk fatty acid

M182 Effect of a liquid oral drench at parturition on blood metabolites and incidence of metabolic diseases in Holstein cows. M. A. von Keiserlingk*¹, W. K. Vanderkooi², and L. M. Rode³, ¹University of British Columbia, Vancouver, BC, ²Nutritech Solutions Ltd., Abbotsford, BC, ³Rosebud Technology Development Ltd., Lethbridge, AB.

Seventy multiparous Holstein cows, within a commercial dairy herd, were used to determine the impact of a complex oral nutrient drench on plasma metabolites and the incidence of metabolic diseases at parturition. Cows were paired according to age, previous lactation production, and expected calving date, then randomly assigned to one of two treatments: Control or Drench. Prior to calving, all cows were fed a negative DCAD diet. Control cows were drenched with a placebo (16 L warm water) while the treated cows received 2.2 kg of a premix containing alfalfa meal (41.4%), Ca propionate (34.0%), Mg sulfate (10.0%), KCl (7.5%), monosodium phosphate (6.0%) and a probiotic preparation. The premix was suspended in 16 L of warm water prior to drenching. All cows were drenched within 6 h of calving. Blood plasma was obtained via venipuncture and subsequent centrifugation at 0 h (just prior to drenching) and at 12 and 48 ± 2 h. after parturition. Plasma samples were analyzed for total Ca, Mg, total P, NEFA and beta hydroxy butyrate (BHBA). Data were analyzed using the PROC MIX procedure (SAS Version 8) with the 0-h sample serving as the covariate. Cows receiving the drench had higher ($P \leq 0.03$) plasma Ca levels compared to Control cows (2.18 ± 0.025 vs. 2.10 ± 0.024 mmol/L) at 12 h post-calving but plasma Ca was unaffected by treatment by 48 h (2.018 ± 0.032 mmol/L for both groups). No treatment differences ($P \geq 0.25$) were detected for plasma Mg, P, or NEFA at either time point. There was a time x treatment interaction with plasma BHBA concentrations. At 12 h, treated cows had lower BHBA (0.52 ± 0.31 vs 0.62 ± 0.029; $P \leq 0.05$) whereas at 48 h, treated cows had higher BHBA levels (0.75 ± 0.060 vs 0.70 ± 0.057; $P \leq 0.05$). There was no difference between treatment groups in the incidence of metabolic diseases. In this study, there was no measurable benefit to the use of a complex drench compared to a placebo drench of warm water other than a transient increase in plasma Ca. However, this elevated level of Ca is similar to what has been reported previously for less complex oral drenches containing Ca propionate/Ca chloride.

Key Words: Hypocalcemia, Drench, Parturition

M183 Feeding behaviour of dairy cows at peak lactation. T. J. DeVries*, M. A. G. von Keyserlingk, D. M. Weary, and K. A. Beauchemin, The University of British Columbia, Vancouver, Canada.

New technology has been developed that allows monitoring of feeding behaviour of cows fed via a feed alley in a free stall barn. Objectives were to: 1) determine which measures of feeding behaviour were most repeatable, and 2) describe changes in these measures over peak lactation. The Growsafe™ system recorded cow presence (hits; 6 s resolution) at the feed bunk for 21 lactating cows for two 8 d periods starting at 57 ± 16 (mean ± SD) and 94 ± 16 DIM. Meal criterion (27.74 min) was calculated using a mixed distribution model to fit the log frequency distribution of the intervals between hits. This criterion was then used to calculate meal frequency (meals d⁻¹) and duration (min d⁻¹). Total hits d⁻¹ and hits per meal min (hits d⁻¹ / meal duration) were calculated. Linear regression was used to determine within cow repeatability from period 1 (independent) to period 2 (dependent). Regression coefficients were significant ($P < 0.05$) for all measures. Within cow repeatability was highest for hits d⁻¹ ($R^2 = 0.90$) and hits per meal min ($R^2 = 0.91$), moderate for duration ($R^2 = 0.75$), and low for frequency ($R^2 = 0.22$). Estimates for intercept and slope of the regressions were used to determine if cows changed their feeding behaviour over time (intercept not equal to 0) and if this change was relative to initial values (slope not equal to 1). Slopes (± SE) were significantly ($P < 0.001$) higher than 1 for hits d⁻¹ (1.40 ± 0.11) and hits per meal min (1.67 ± 0.12) indicating an increase in feeding activity and intensity across the two periods. Meal duration and frequency intercepts tended to be above 0 (68.18 ± 37.17 and 3.04 ± 1.70) and slopes tended to be less than 1 (0.79 ± 0.11 and 0.53 ± 0.23), indicating that cows with high duration and frequency

tended to reduce these values, and those that began lower tended to increase. These results illustrate that some measures of feeding behaviour are highly repeatable within cows and demonstrate that feeding activity and intensity within a meal increase over peak lactation.

Key Words: Feeding behaviour, Dairy cattle, Lactation

M184 Implementation of a “user friendly” rumen simulation model through mixed language programming. J. A. N. Mills*, E. Kebreab, L. A. Crompton, and J. France, *The University of Reading, Reading, UK.*

Current rationing models for dairy cows tend to be factorial and static and consider energy and protein requirements. They demand little in terms of computational power and as a result have proved valuable as quick and easy methods for rationing dairy cattle. However, they are requirements based and do not predict the yield of milk constituents. Therefore, over the last three decades there has been considerable development of dynamic mechanistic models of ruminant metabolism. This approach offers the potential to predict responses to nutrient intake and quantify the outputs of fat, protein, and lactose in the milk. Although, many benefits have been observed in a research environment, their application on-farm has been limited firstly through computational requirements and more recently due to the esoteric nature of the specialist modelling software. However, this research has used mixed language programming as an alternative to the Advanced Continuous Simulation Language, in order to allow non-specialist users to interact with an extant rumen model. The model and the numerical integration routines were coded in FORTRAN 95 and the Graphical User Interface (GUI) was written using Visual Basic (VB) 6.0. The interface between FORTRAN and VB was handled with C routines, with code optimized for Pentium 4 processors. The GUI facilitates use by different user groups from farmers to scientists, each with their own information needs. A “drill-down” menu system prevents the user becoming overwhelmed with non-relevant information. Data are displayed graphically or in tabular form, at the discretion of the user. There are many advantages to the programming techniques used other than the ability to reach a wider audience. There are improvements in speed of processing, and the ease with which model simulations can be run. This project demonstrates the principles for developing a nutrient based feed evaluation system for dairy cows that can be applied on-farm.

Key Words: Model, Rumen, Programming

M185 Manipulating rumen fermentation of dairy cows fed fresh alfalfa using feed additives. A. R. Castillo*¹, M. R. Gallardo², M. C. Gaggiotti², M. S. Garcia², O. Quaino², and C. Arakiki², ¹UC Davis, Cooperative Extension, U.S.A., ²Experimental Station Rafaela, INTA, Argentina.

The purpose of this study was to evaluate the effects of different feed additives on rumen fermentation and performance of dairy cows fed springtime fresh cut alfalfa pasture. Eight Holstein lactating cows, four primiparous rumen fistulated (60 DIM) and four late lactating multiparous cows were used in two 4x4 Latin squares designs (4 wk periods). The treatments were the following: a controlled diet (Control) with no feed additives; a dietary buffer (DB) 200 g/cow/d comprised of a mix of sodium bicarbonate, magnesium oxide, calcium carbonate and bentonite; antibiotics (M+V), 300 mg monensin + 30 mg virginiamycin per cow per day and a yeast cultures commercial preparation (YC) 15 g/cow/day. A basal diet containing fresh alfalfa (pre-bloom, 16.4% DM, 25.9% CP and 33.9% NDF) was fed *ad lib* to each cow in individual pens. Fresh alfalfa was cut twice daily and supplied to each cow at 9 a.m. and 5 p.m. Intake, *in-vivo* digestibility, milk yield and composition was measured in multiparous cows. Rumen fluid samples from fistulated cows were collected at pre- and 2, 4, 6 hours post-feeding and analyzed for pH, NH₃, VFA and concentration of amylolytic and celulytic bacteria. Dry matter intake (DMI), organic matter digestibility (OMD), milk yield, milk composition and ruminal pH were not affected by the treatments. Ammonia was decreased by M+V and YC. Also, M+V had lower concentrations of total VFA and cellulolytic microorganisms (1.94 MPN_{x109/ml}) compared to those under other treatments (averaging 2.36 MPN_{x109/ml}) Based on these results future experiments under grazing could be defined

	Control	DB	M+V	YC	SED	P<
Multiparous Cows						
DMI (kg/d)	18.70	18.70	18.90	18.90	0.248	0.87
OMD (%)	74.96	74.85	74.40	75.66	0.907	0.62
Milk (kg/d)	16.30	16.90	16.20	16.40	0.871	0.84
Fat (%)	3.90	4.01	4.10	4.07	0.142	0.79
Protein (%)	3.46	3.43	3.48	3.50	0.036	0.40
Fistulated Cows						
pH	6.78	6.81	6.89	6.83	0.045	0.14
NH ₃ (mg/dl)	39.30	36.00	33.80	33.80	1.889	0.02
VFA (mmol/L)	138.80	143.50	122.50	140.70	5.015	0.01

Key Words: Rumen fermentation, Alfalfa pasture, Feed additives

M186 Evaluation of a novel anionic product for transition dairy cows. P. C. Aikman*¹, E. Virtanen², U. Tennberg², A. K. Jones¹, C. K. Reynolds³, and D. E. Beever¹, ¹CEDAR, The University of Reading, UK, ²Kemira Animal Nutrition, Helsingborg, Sweden, ³The Ohio State University, Wooster.

The objective was to test the efficacy of gypsum-coated calcium chloride (GCC) as an anion source for altering dietary cation-anion difference (DCAD; mEq [(Na+K)-(Cl+S)]/kg DM) and urine pH of transition dairy cows. In experiment one, six dry, non-pregnant Holstein X Friesian cows were used in a balanced 6 x 4 Latin Square experiment with 10 d periods. Treatments were a control, maize silage-based diet (DCAD = 113) or the control diet plus either GCC, liquid hydrochloric acid (HCl) or hydrochloric acid bound to diatomaceous earth (HCl-Damolin). Anionic treatments reduced DCAD to -87. Anions reduced urine pH from 7.8 to less than 6.5 (P < 0.001), but DMI (7.7 kg/d) was unaffected. Urinary Ca excretion (g/d; estimated from urine creatinine) was increased (P < 0.001) by anions (2.55 versus 7.19, 7.15 and 7.18 for HCl, HCl-Damolin and GCC respectively). In experiment two, 26 multiparous Holstein X Friesian cows were assigned to one of three treatments three weeks prior to day 305 of gestation. Treatments were: a control maize silage-based ration (mean DCAD of 249; n = 10) or control plus GCC (n = 8) or a commercial anionic supplement (CAS) supplying chloride anions and micronutrients (n = 8). Anions reduced DCAD to a mean of -91. Blood and urine samples were taken weekly until calving. DMI (kg/d) was not affected by anions, but was lower (P < 0.06) for GCC versus CAS (11.1, 12.2, and 10.4 for control, CAS, and GCC, respectively). Anions decreased (P < 0.001) blood (7.45, 7.43 and 7.38) and urine (8.52, 6.16 and 5.62) pH (shown for control, CAS and GCC, respectively), but GCC lowered blood (P < 0.004) and urine (P < 0.016) pH more than CAS. Estimated urine Ca excretion (g/d) was increased by anions (1.70, 7.60 and 8.31 for control, CAS and GCC respectively; P < 0.003). The low urine pH on the GCC treatment indicates more efficient use of anions in this product. Reducing the dose of GCC may overcome the decrease in DMI. However, dose-response relationships need to be developed.

Key Words: Anionic salts, DMI

M187 Effect of parity and prior energy intake on development of fatty liver during feed restriction in dairy cattle. M. C. Rich*, S. J. Bertics, D. G. Mashek, and R. R. Grummer, *University of Wisconsin, Madison.*

Our hypotheses were that development of fatty liver differs between heifers and cows and that cows experiencing moderate feed restriction would be less susceptible to fatty liver during severe feed restriction. Twenty Holstein cows and 10 heifers were blocked by expected date of calving, each block consisting of two pregnant multiparous cows and one pregnant nulliparous heifer. Each of the multiparous cows were randomly assigned within the block to one of two treatments and fed a diet providing either 160% (MH) or 80% (ML) of their estimated maintenance energy needs. Nulliparous heifers were fed at 80% of estimated energy requirements for maintenance and growth (NL). All animals were fed a control diet *ad libitum* from 75 to 60 days prepartum during which covariate measurements were made. Treatment diets were fed from d-61

to d-40. On d-39 through d-32, all animals were fed an estimated 30% of maintenance energy needs to induce fatty liver. DMI for MH, ML, and NL were 12.7, 7.9, 8.0 kg/d from d-60 to d-40 and 2.8, 2.9, 3.5 kg/d from d-39 to d-32, respectively. There was a tendency for cows to have higher liver TG on d-32 and a larger change from d-39 to d-32 than heifers. At d-39, plasma non-esterified fatty acid (NEFA) concentrations were higher in ML compared with MH and blood glucose concentrations were higher in NL compared with MH and ML. This data suggests that cows are more susceptible than heifers to fatty liver development during feed deprivation and that prior energy intake did not influence development of fatty liver in multiparous cows. Values below are LSM (SE).

	Treatment			MH+ML vs. NL	MH vs. ML
	MH	ML	NL		
Actual Energy Intake ¹	140	83	75	P=	
d-39 Liver TG, %DM	1.3 (0.2)	1.8 (0.2)	1.3 (0.2)	NS	NS
d-32 Liver TG, %DM	16.7 (3.5)	15.3 (3.1)	7.8 (3.8)	0.08	NS
Liver TG Change	15.61 (3.4)	14.2 (3.4)	6.5 (3.8)	0.08	NS
d-39 NEFA, μ Eq/L	146 (30.8)	279 (31.1)	238 (38.8)	NS	0.006
d-39 Glucose mg/dl	64.6 (1.2)	64.5 (1.2)	68.9 (1.5)	0.02	NS
d-39 BHBA ² , mg/dl	3.6 (0.5)	4.2 (0.5)	3.0 (0.6)	NS	NS

¹ % of requirement from d-61 to d-40. ² β -hydroxybutyric acid.

Key Words: Parity, Energy intake, Fatty liver

M188 A mechanistic model of glucose metabolism and ketosis development in early lactation cows. J. Guo*, R. Kohn, and R. Peters, *University of Maryland at College Park Maryland.*

The coordinated changes in metabolism that initiate lactation imply that ketosis problem should be approached in a dynamic way to account for the non-steady state conditions of periparturient cows. A dynamic mechanistic model was constructed to study the mechanism of ketosis, and evaluated with regard to its ability to simulate published experimental data for the development of ketosis in transition cows. In the model, it was assumed that glucose was the limiting nutrient, and lactose synthesis in mammary gland was assigned to the highest priority according to the concept of homeorhesis. The driving variables for the model were dry matter intake, feed composition, milk production, and initial body fat content. For the developmental data set, the model simulates the adipose tissue loss and the changes in plasma glucose, nonesterified fatty acids (NEFA), and beta hydroxybutyrate (BHBA) during the first four weeks postpartum. The model predicted blood glucose, NEFA, and BHBA concentrations with a root mean square prediction error (RMSPE) of 3.4, 0.5, and 1.0 mmol/l, which represented 10.1, 18.4, and 41.5 % of mean predictions respectively. The maximum mobilization rate of adipose tissue occurred at around 5 d postpartum while blood BHBA level peaked at about 12 d after calving. The evaluation of the model by behavioral and sensitivity analysis revealed that glucose availability played an important role in the development of ketosis. Comparison of model predictions to data from three published studies showed that the model under-predicted glucose concentrations by 9.6 % of mean prediction, and over-predicted NEFA and BHBA by 32.6 and 82.7% respectively ($p < 0.05$). The prediction errors for NEFA decreased as predictions increased ($p < 0.05$). The model predicts that ketosis in transition cows can result from the homeorhetic states of glucose and fat metabolisms, and from the interaction between these two metabolisms.

Key Words: Mechanistic model, Ketosis, Transition cows

M189 Effect of an exogenous phytase enzyme blend and dietary phosphorus content on P excretion in lactating cows. K. F. Knowlton*, J. M. McKinney¹, K. F. Wilson², and C. Cobb², ¹*Virginia Polytechnic Institute and State University*, ²*Loveland Industries, Inc.*

The effect of an exogenous phytase blend and dietary P content on P partitioning and excretion was evaluated in 9 early lactation cows (6

ruminally cannulated; mean = 27 DIM). Cows were assigned to treatments in 3, 3x3 Latin squares. Squares were balanced for residual effects of diet, and each cow received each treatment sequentially in 3, 21 d periods. Diets were 45% forage (all corn silage), 17.3% CP, 25.9% NDF, and 0.95% Ca, and included supplemental P (High P; 0.47%), no supplemental P (Low P; 0.32%), or no supplemental P with exogenous phytase (Low P-phytase; 0.32%). Pre-planned contrasts were used to evaluate the effect of dietary P (High P vs. Low P and Low P-phytase) and phytase addition (Low P vs. Low P-phytase). Total collection of milk, urine, and feces was conducted on d 19-21 of each period. Neither dietary P content nor exogenous phytase affected DMI (21.8 kg/d); milk yield (39.6 kg/d), or milk composition. Excretion of feces (5.85 kg/d DM and 37.9 kg/d wet) were unaffected by diet, but urine excretion was lower by cows fed the low P diets than cows fed High P (16.5 vs. 21.3 kg/d; $P < 0.01$). Compared to cows fed High P, cows fed the low P diets had reduced P intake (68.1 vs. 103.9 g/d; $P < 0.01$), reduced fecal (34.4 vs. 51.3 g/d; $P < 0.01$) and urinary P excretion (2.8 vs. 9.2 g/d; $P < 0.01$), and lower P balance (-8.0 vs. 4.4 g/d; $P < 0.01$). Milk P secretion as a percent of P intake was higher in cows fed the low P diets than in cows fed High P (51.5 vs. 34.9%; $P < 0.01$). Addition of exogenous phytase did not affect P intake, milk P, fecal P, or urinary P excretion, but apparent P digestibility tended to be higher in cows supplemented with phytase (50.1 vs. 40.5% for Low P-phytase and Low P, respectively; $P < 0.11$).

Key Words: Phosphorus excretion, Phytase, Lactating cows

M190 Milk fatty acids profile of dairy cows fed fresh alfalfa and different feed additives. A. R. Castillo*, P. T. Garcia², R. B. Páez², M. A. Taverna², M. S. Garcia², M. C. Gaggiotti², N. Pensel², and A. Quatrin², ¹*UC Davis Cooperative Extension, U.S.A.*, ²*Estación Experimental Agropecuaria Rafaela, CICV, INTA, Argentina.*

The aim of this work was to evaluate the effect of different feed additives on milk fatty acids (FA) profile of lactating dairy cows fed fresh cut alfalfa pasture. Four late lactating multiparous Holstein cows were used in a 4x4 Latin square design (4 wk periods). The treatments were the following: a controlled diet (Control) with no feed additives; a dietary buffer (DB) 200 g/cow/d comprised of a mix of sodium bicarbonate, magnesium oxide, calcium carbonate and bentonite; antibiotics (M+V), 300 mg monensin + 30 mg virginiamycin per cow per day and a yeast cultures commercial preparation (YC) 15 g/cow/day. A basal diet containing fresh alfalfa (pre-bloom, 16.4% DM, 25.9% CP and 33.9% NDF) was fed *ad lib* to each cow in individual pens. The alfalfa pasture was cut twice daily and supplied to each cow at 9 a.m. and 5 p.m. Three milk samples of each cow per period were frozen at -20C. At the end of the trial, milk samples were thawed and mixed as a compound sample by cow per period and analyzed for FA profiles. Lipid extraction was performed according to the Folch method, followed by acid methylation. Fatty acid methyl esters were separated by gas chromatography with a CP-Sil 88 capillary column (100m x 0.25 mm i.d.). There were not significant effects ($P > 0.05$) of the treatments on the milk FA composition. The results are reported as percentage of total FA, as follow:

Treatments	Control	DB	M+V	YC	SEM	P<
Fatty Acids						
4:0-13:0	6.14	5.85	5.90	6.41	0.507	0.24
14:0	8.59	8.83	9.13	8.75	0.356	0.44
14:1-15:0	2.10	2.42	2.38	2.24	0.169	0.18
16:0	27.55	27.11	28.29	27.20	2.004	0.37
16:1	1.67	1.40	1.46	1.50	0.107	0.34
18:0	11.07	10.95	11.33	10.87	0.279	0.72
18:1t	4.70	5.02	4.98	4.69	0.242	0.70
18:1c	21.02	20.09	19.99	19.91	2.096	0.33
18:2n6	2.09	1.98	2.07	2.00	0.023	0.23
18:3n6	0.28	0.25	0.27	0.29	0.002	0.65
18:3n3	1.46	1.48	1.57	1.47	0.017	0.46
cis9, trans11 CLA	1.20	1.26	1.32	1.26	0.016	0.83
20-22:6	1.34	1.48	1.16	1.48	0.16	0.29

Key Words: Milk fatty acids, Alfalfa pastures, Feed additives

M191 Prediction of methane emission from ruminal coenzyme M. M. M. S. Oatley, M. L. Nelson*, K. A. Johnson, and M. Ney, ¹Washington State University, Pullman.

Four mid-gestation, ruminally cannulated Hereford cows (629 ± 10.5 kg) were fed, at maintenance, full bloom Timothy hay plus 0% fat (control), 6% beef tallow (T), 6% yellow grease (YG) or 3% T and 3% YG in a 4 x 4 Latin Square design to quantify the relationship between Coenzyme M (CoM) in Archaea in the rumen and the amount of methane emitted measured using SF₆ dilution. An improved analytical procedure for CoM was developed and the impact of freezing (-25°C) and storage for 0, 1, 2, 14 or 28 d was determined. Freezing had no effect on the CoM standard but, due to small increases over time, may have improved CoM extraction from rumen contents, particulate, liquid and protozoal-rich fractions. Ruminal protozoa numbers (primarily *Entodinium spp.*, 5.2 vs 4.8 ± .08 Log₁₀ scale) and methane emissions (157 vs. 98 ± 4.6 L/d) were greater (P ≤ .01) for control than fat supplemented cows suggesting less methanogenic endosymbionts to produce methane. Ruminal fermentation end products, volume, mass, and rates of passage were not affected (P ≥ 0.10) by dietary fat treatment. The best regression equation was CH₄ (mol/d) = 1036.4 (CoM, mmol/rumen) - 573.2 with an R² of .94 using treatment means. Using ruminal CoM concentration is a new alternative for estimating methane emission.

Key Words: Methane, Cows, Fat

M192 Leucine metabolism in skeletal muscle of lactating dairy cows. K. A. Cummins* and D. R. Mulvaney, Auburn University, AL.

A study was designed to assess the effect of transition into lactation on skeletal muscle oxidation of branched chain amino acids. Muscle biopsies were taken from the semi-tendinosus muscle of 5 multiparous Jersey cows at -14, 5, 50, and 150 DIM. Biopsies were taken under local lidocain anesthesia. Muscle fibers were separated from surrounding tissue while still attached at each end and held under tension using a system of clips. Triplicate samples were then removed from the muscle and incubated in a Krebs-Ringer buffer system containing either 10 mM leucine labeled with carbon 14 at the 1 position or keto-isocaproate (the transamination product of leucine) labeled in the same manner. After 60 m incubation, carbon dioxide released from oxidation of leucine was trapped in KOH, and then carbon dioxide was non-enzymatically cleaved from any keto-isocaproate formed from the action of leucine aminotransferase but not further metabolized. This carbon dioxide was then trapped. The cows were fed corn silage-based TMRs throughout the study that were 16 % CP and 1.72 Mcal/kg DM basis until 90 DIM, then 15 % CP and 1.66 Mcal/kg. Mean production during the study was 5570, 281, and 211 kg of milk, fat, and protein, respectively. Milk production over the entire lactation for the 5 cows ranged from 5198 to 6253 kg. Milk production

at 50 and 150 DIM was 27.5 and 21.1 kg/d, respectively. Transamination of leucine was 13, 11.2, 11.3, and 6.7 pMol/mg protein per minute at -14, 5, 50, and 150 DIM, respectively. Subsequent decarboxylation of keto-isocaproate formed from leucine was 2.0, 1.9, 2.1, and 1.2 pMol/mg protein per minute at -14, 5, 50, and 150 DIM, respectively. No differences were found with stage of lactation for either metabolite (P>0.1). However, decarboxylation of keto-isocaproate provided directly to muscle strips was 7.4, 33.6, 31.5, and 20.5 pMol/mg protein per minute at -14, 5, 50 and 150 DIM, respectively. Onset of lactation resulted in an increase in metabolism of keto-isocaproate (P<0.1). Skeletal muscle of lactating dairy cows appears to develop the capacity to metabolize large amounts of leucine after the onset of lactation but control mechanisms associated with initial transamination prevent this occurrence

Key Words: Dairy , Transition, Muscle

M193 Effects of short-term drenching of transition cows with propylene glycol on early lactation performance and health. V. E. Lenkaitis, L. L. Contreras, C. M. Ryan, and T. R. Overton*, Cornell University, Ithaca NY.

Three-day drenching strategies of postparturient cows with propylene glycol (PG) have effectively decreased circulating concentrations of NEFA and BHBA during early lactation. Our objective was to determine whether a three-day drench of PG beginning at parturition would affect milk yield and circulating BHBA concentrations of dairy cows on commercial dairy farms. Holstein cows (n = 457) on three commercial dairy farms were assigned to a control (no drench) or a PG treatment (500 ml) administered on the day of parturition and the subsequent two days. Performance data were collected during the first four monthly test days of lactation. Milk yield (42.0 vs. 40.9 kg/d), milk fat percentage (3.52 vs. 3.54%), milk fat yield (1.52 vs. 1.48 kg/d), milk true protein percentage (2.80 vs. 2.84%), and milk true protein yield (1.22 vs. 1.18 kg/d) were not different (P > 0.15) between controls and PG-drenched cows, respectively. A trend (P < 0.15) for a treatment by month interaction existed for body condition score such that cows drenched with PG maintained slightly increased body condition score during early lactation. Concentrations of BHBA in plasma samples collected from each cow during d 5 to 10 of lactation were not different between treatments (8.8 vs. 8.7 mg/dl; P > 0.15). Cows assigned to the two treatments had similar reported incidences of ketosis, milk fever, displaced abomasum, and metritis; however, cows drenched with PG had decreased (P < 0.05) incidence of retained placenta. Overall, results from this experiment indicate that routine short-term drenches with PG beginning at parturition do not affect cow performance and most health variables. Further research should investigate herd-based factors that would be predictive of response to PG.

Key Words: periparturient cow, propylene glycol

M194 A commercial blend of essential oil components reduces ruminal degradation of protein supplements in ruminants. R. Molero¹, M. Ibaras¹, S. Calsamiglia¹, A. Ferret¹, M. Frehner², P. Williams³, and R. Losa², ¹Universitat Autònoma de Barcelona, Bellaterra, Spain, ²Crina S.A. / Akzo Nobel, Gland, Switzerland, ³Akzo Nobel, Davis, CA.

A proportion of the dietary crude protein (CP) is degraded during its transit through the rumen; thus only the undegraded proportion remains available for direct absorption in the small intestine. Essential oils (EO) can modulate rumen fermentation. In the present experiment (exp), the effect of the feed additive Crina[®] ruminants (commercial blend of EO components, BEOC) was estimated in situ on the rumen degradability of different raw materials. In 2 exp, degradation of test materials (TM) was determined after incubation in Dacron bags in the rumen of 4 fistulated Holstein heifers used in a 4 x 4 Latin Square. Treatments were assigned in a 2 x 2 factorial design (diet: exp 1: 15F [85/15, concentrate/straw] or 60F [60/40, alfalfa hay/concentrate] and exp 2: 65F [65/35, forage/concentrate] or 40F [40/60, forage/concentrate]; BEOC: exp 1 & 2: with or without 0.7 g / day of BEOC). Adaptation was 10 and 28 days in exp 1 & 2, respectively, prior to TM incubations. TM (soybean meal, SBM; corn gluten feed, CGF; lupin seeds, LS; green peas, GP; sunflower meal, SFM; fish meal [exp 1] or alfalfa hay [exp 2]) were incubated in the rumen for up to 72 h. Results were analyzed with the PROC MIXED (SAS, 1989) and differences significant at P<0.05. Exp 1: In heifers fed 15F, CP degradation was lower than in those fed 60F (average 72.8 vs 77.9%). BEOC in 15F reduced CP degradation

of LS (84.6 vs 81.9%), GP (82.2 vs 76.9%) and SFM (80.3 vs 75.8%). There was no effect of BEOC in 60F. Exp 2: In heifers fed 40F, CP degradation of SBM and SFM was lower than in those fed 65F (64.5 vs 69.5% and 82.9 vs 84.1%, respectively). BEOC in the 65F diet reduced CP degradation of SBM (70.8 vs 68.2%) and SFM (85.1 vs 83.0%). The use of BEOC can reduce ruminal degradation of CP of some raw materials after a 10 day adaptation period when fed a high concentrate diet, or after a 28 day period when fed a high forage diet. Thus the use of BEOC could be economically interesting.

Key Words: Bypass protein, Rumen metabolism, Essential oil

M195 Methodology for estimation of Volatile Fatty Acid (VFA) kinetics in cattle. X. Markantonatos¹, J.W. Young², R. Tucker², L.F. Richardson², and G.A. Varga^{*1}, ¹The Pennsylvania State University, ²Elanco Animal Health.

Four rumen cannulated Holstein heifers weighing 380 kg ± 25kg were used to develop methodology based on ¹³C stable isotope to quantify in vivo VFA production in the rumen. Heifers were fed either low (L) concentrate (25%) a high (H) concentrate (70%) diets at amounts to provide for 0.34kg/d of BW gain. Isotopic tracers (1-¹³C₃Na, 1-¹³C₂Na, 1-¹³C₄Na) at 20% enrichment were bolused and intraruminally infused. Three days prior to sampling, heifers were fed every 4 h for 2 d followed by 2 h feeding intervals 1 d prior to and the day of sampling. Before tracer administration, cows were restricted from water to keep fluid volume of the rumen as constant as possible. Sampling times were -30, -20, -10, 5, 10, 15, 20, 50, 80, 110, 140, 170, 200, 230, 260, 290, 320, 350, 380, 410, 440, and 480 min relative to initiation of tracer infusion. Values for Tracer to Tracee Ratio (TTR) were determined by a GLC-mass spectrometry. The reported TTR values for the tracee were corrected (CTTR) for skeweness, graphed, and the disappearance TTR for the primary tracee was converted to the natural log form. Endogenous Pool Size (EPS) for acetate (Ac) was significantly higher for the L vs H diet (1.94 moles vs 1.13 moles). However, heifers fed the H diet had a larger EPS for propionate (Pr) (0.21 moles vs 0.33 moles) and the slower rate constant (0.49%/h vs 0.72%/h) for Pr turnover. EPS of butyrate (Bu) was 0.34 moles vs 0.31 (L vs H), while comparable values for rate constant were 0.57%/h vs 0.51%/h respectively. The plots of CTTR showed that there was only a trace of ¹³C transferred to Pr, but no evidence for meaningful transfer from Pr to other VFA. However, CTTR plots suggested a higher incorporation of ¹³C into Bu, presumably direct transfer from Ac, and small incorporation of ¹³C from Bu back to Ac. Results from the three ¹³C-VFA showed that each individual VFA acts kinetically as a single pool in the rumen. The study suggests that ¹³C, a stable and non-radioactive isotope, could be used to quantitatively evaluate VFA production of the three major VFA in cattle.

Key Words: ¹³C stable isotope, VFA kinetics

M196 Effects of supplemental amylase on in vitro fermentation by mixed ruminal cultures and the growth of pure cultures of ruminal bacteria. J. M. Tricarico* and A. E. Kozenski, Alltech Biotechnology Inc. Nicholasville KY.

A series of studies was performed to evaluate the effects of a supplemental enzyme preparation containing amylase activity on fermentation of feed by mixed ruminal cultures and the growth of pure cultures of representative strains of ruminal bacteria. The addition of 60.0 units amylase to 1-L ruminal-simulating continuous cultures fed a 30% forage-70% concentrate diet reduced the molar proportion of propionate (0.305 vs 0.291, $P < 0.05$) and increased the molar proportion of butyrate (0.180 vs 0.206, $P < 0.05$) after supplementation for 72 h and 96 h, respectively. Total VFA concentrations, molar proportion of acetate and pH did not differ in control or enzyme-supplemented cultures during the 5 d supplementation period. Growth of *Butyrivibrio fibrisolvens* strains D1, 49, and A38, *Streptococcus bovis* strain S1, *Megasphaera elsdenii* strain T81, and *Selenomonas ruminantium* strain GA192 was evaluated on pure cultures incubated anaerobically on medium 10 broth containing 1.0 g*L⁻¹ soluble potato starch. Enzyme treatment was applied immediately prior to bacterial inoculation to provide a final concentration of 60.0 units amylase*L⁻¹. Microbial growth was estimated in each culture by measuring turbidity (600 nm) over time. The addition of supplemental amylase enhanced the growth rates of *Butyrivibrio fibrisolvens* strain D1 (0.007 vs. 0.168 OD*h⁻¹, $P < 0.05$), *Selenomonas ruminantium* strain GA192 (0.004 vs. 0.085 OD*h⁻¹, $P < 0.05$) and

Megasphaera elsdenii strain T81 (0.012 vs. 0.036 OD*h⁻¹, $P < 0.05$). Supplemental amylase had no effects on the growth rates of *Streptococcus bovis* strain S1 and *Butyrivibrio fibrisolvens* strain 49 and reduced the growth rate of *Butyrivibrio fibrisolvens* strain A38 (0.131 vs. 0.076 OD*h⁻¹, $P < 0.10$). We conclude that low concentrations of supplemental amylase enhances the growth of specific strains of ruminal bacteria and may be used to manipulate ruminal fermentation.

Key Words: Ruminant, Enzyme, Amylase

M197 Oxidation of glucose, glutamate, and glutamine by isolated ovine enterocytes in vitro is decreased by presence of other metabolic fuels. M. Oba*¹, R. L. Baldwin, IV², and B. J. Bequette¹, ¹Department of Animal and Avian Sciences, University of Maryland, College Park, MD, ²Bovine Functional Genomics Laboratory, ANRI, USDA-ARS, Beltsville, MD.

The objective of this study was to evaluate oxidative metabolism of glucose, glutamate, and glutamine by isolated ovine enterocytes in presence of other metabolic fuels in vitro. Mucosal enterocytes were isolated from crossbred wether sheep (n=6) fed a mixed forage-concentrate diet, and incubated for 90 min with 1 mM U-¹⁴C-glucose, -glutamate, or -glutamine and alternative substrates (AS; water as negative control, acetate, propionate, butyrate, glucose, glutamate, or glutamine) at concentrations of 0.1, 1.0, and 10.0 mM. Oxidation of labeled substrates to CO₂ and net production of lactate and pyruvate in incubation media were measured. Oxidation of glucose and glutamine to CO₂ was decreased by all AS except acetate, and the extent of reduction differed by type and concentration of AS in incubation media. Our observations that glutamine oxidation can be reduced by presence of AS is contrary to observations in the literature using enterocytes from non-ruminants, indicating that ruminant enterocytes might rely on glutamine to a less extent as an energy source. Total glucose utilization was reduced by propionate (10 mM) by 16% compared to control, but was not affected by other AS. Glutamate oxidation to CO₂ was reduced by the presence of propionate (10 mM) or glutamine (1.0 and 10 mM), but not by that of the other AS. Acetate did not affect oxidation of glucose, glutamate, and glutamine. Propionate reduced oxidation of glucose and glutamate only at the highest concentration (10 mM), indicating that the sparing effects of propionate on substrate oxidation is affected its concentration in the incubation media. These observations indicate that ruminant enterocytes can alter substrate preference for oxidative metabolism depending on type and concentration of available AS.

Key Words: Sheep, Enterocytes, Oxidative metabolism

M198 Effects of urea and ammonia treatment on nutritive value of corn silage. A. Davtalabzarghi*, R. Valizadeh, and A. Naserian, Ferdowsi University of Mashhad, Khorasan, Iran.

Corn crop as a high energy cereal is cultivated and largely used in form of silage in Iranian dairy industry. Ammonia treatment has resulted: a) an economical source of crude protein b) Prolonged bunk life during feeding c) Less molding and d) decreased protein degradation in silo. The objective of this experiment was to determine the effect of urea and ammonia treatment on the nutritive value of corn silage. Corn crop was harvested, chopped (2-5cm) from the Ferdowsi University Dairy Farm in September. Poly-propylene containers with capacity of 1-2 kg were used for the following treatments; a) The control (corn silage) b) corn silage + 0.7Corn silage + 0.4crop, mixed manually and filled into the silos with aid of a hydraulic tool. Ammonia was injected in equivalent amount of nitrogen to urea by specific nosle. Silos were sealed properly. Three silos were prepared for each treatment. The silos were opened after 0, 2,3,21,45 days of ensiling. Therefore 12 containers (silos) were used. Two 50 gram samples from each treatment at different opening periods were diluted in 450 ml sterile deionised water and blended for 1 min. Silage pH was determined immediately. Dry matter, Crude Protein, ADF, NDF were measured by the methods of AOAC (1984). Ammonia-N was measured with sodium tetraborate (16g/L) and titrated with 0.1 N Hcl. The pH of forages was increased up to 9 following treatment with urea and ammonia while the pH of control was 6.2. pH of treated silage remained higher at subsequent samplings. There were no significant differences between DM, ADF, NDF in different treatments and each time point. CP and N-NH3 were significantly higher ($P \leq 0.01$) in treated silages.

Key Words: Ammonia and urea, Nutritive value, Corn silage