Fisher's LSD multiple-comparison test were used to determine the differences among genotypes. Feeding efficient varied from 5.20 to 6.87, with the highest feed efficiency in St. Croix lambs. Standardized daily live weight gain ranged from 0.34 to 0.55 kg, with the highest rate of gain in the Callipyge wool x St. Croix lambs. Whole sale weight (kg) was the highest in the Callipyge wool x wool (19.26) and lowest in the St. Croix (15.38). Quality grade among the seven genotypes of lambs ranged from 5.5 to 7.6, with the St. Croix and St. Croix x wool lambs having the higher values. The highest value for the percent wholesale body weight was observed in the Callipyge wool x wool (64.1) while the value for St. Croix was the lowest (55.6). Percent loin eye of carcass weight was the highest in the Callipyge wool x wool (4.5) and the lowest is the St. Croix (3.0). The overall sensory acceptance rating was the highest in the St. Croix (6.8) and the lowest in the Callipyge wool x wool.

Key Words: Carcass evaluation, Feed efficiency, Sheep

Beef Species: Beef cattle performance and genetic relationships in the feedlot

W148 Genetic relations among carcass fat, tenderness, and age at slaughter in beef cattle managed under a constant finishing program. T. L. Fernandes*[1], J. W. Wilton[1], I. B. Mandell[1], and C.J.B. Devitt[2], [1]*University of Guelph, Department of Animal and Poultry Science,* [2]*Beef Improvement Ontario.*

Objectives were to estimate genetic parameters on carcass fat traits, tenderness at 7 days of aging (Angus x Simmental cows), and age at slaughter. Data on 744 crossbred animals from 3 research herds, fed at the Elora Beef Research Centre. Each year throughout the five-year period, the cattle were fed either a high-energy diet from start to finish or a haylage based diet the first 112 days and then a high-energy diet. All animals were targeted to finish at a constant backfat thickness of 8 mm, as determined by ultrasound measurements taken every 28 days. Forty sires were included, with a range of 8 to 34 progeny per sire. Carcass fat traits included: subcutaneous fat % and intermuscular fat % as measured from a rib section dissected into lean, fat (subcutaneous, body cavity, and intermuscular fat), and bone. Subcutaneous fat (SUBQ) % and intermuscular fat (INTER) % were calculated as percentages of overall rib weight. Chemical fat was determined by ether extraction of the dissected lean. Marbling score was determined subjectively. Tenderness was measured using Warner-Bratzler shear force with samples aged for 7 days. A multiple trait model was used to analyze the data with the model including regression on breed proportion, the covariate carcass backfat, fixed effects of herd of origin and contemporary group (year, nutritional treatment, and sex), and the random effect due to animal. Heritability estimates were 0.42, 0.44, 0.23, 0.53, 0.22, and 0.22 for marbling, SUBQ %, INTER %, chemical fat, shear force and age at slaughter, respectively. The genetic correlation between marbling score and chemical fat was 0.90 indicating that subjective marbling score is a good indicator of intramuscular fat. Marbling had a genetic correlation of -0.08 with shear force, and 0.02 with INTER. Selection for marbling should not affect carcass quality for tenderness and intermuscular fat.

Key Words: Beef, Meat-quality, Selection methods

W149 Effects of growth promotant (Revalor-G) implantation on feed efficiency and meat quality in Korean native cattle. S. Sun*[1], B. Ahn[1], K. Myung[1], Y. Cho[2], and K. C. Olson[3], [1]*Chonnam national Univeristy, Gwangju, Korea,* [2]*National Livestock research Institute, Namwon, Korea,* [3]*University of Missouri, Columbia, MO.*

The objectives of this study were to examine improving feed efficiency and meat quality by implantation of growth promotant in Korean native cattle. Fourteen steers (Korean beef cattle, BW 250+10kg, 14-month-old) were randomly assigned to either a control and implanted group. Steers were castrated at 3 months of age. Growth promotant (Revalor-G, 120 mg TBA + 24 mg estradiol benzoate) was implanted subcutaneously in the ear of seven steers at 15 months old. Animals were managed in a feedlot unit and slaughtered locally. Concentrate ration was fed 1.5kg per animal per day from 14 to 20 months, and then fed at 1.0kg per animal per day from 21-28 months of age. Rice straw was fed ad libitum. The implanted group was slaughtered at 24 months old (BW 638±14kg) and the control group was slaughtered at 28 months old (BW 635±17kg). Live weight was measured every 60 d and feed consumption was calculated daily. Daily weight gain and feed consumption were increased 53.3% and 18.9%, respectively, but feed requirement was decreased 22.6% by growth promotant implantation ($P < 0.05$). Plasma glucose content was enhanced, but urea-N was diminished by treatment. Also, serum cholesterol level was decreased significantly ($P < 0.05$) by the treatment. Carcass weight and yield grade were slightly increased in treatment group. These results indicated that growth promotant implantation improved daily weight gain and feed efficiency, but meat quality was decreased in Korean native cattle.

Key Words: Korean native cattle, Growth promotant, Meat quality

Ruminant Nutrition: Dairy and Beef

W150 Ruminal and intestinal protein digestion of tropical alfalfa and corn silage measured by mobile nylon bag technique in steer. A. Taghizadeh, M. Danesh Mesgaran*, R. Valizadeh, and F. Eftekhar Shahroodi, *Ferdowsi university,Mashhad,Iran.*

The ruminal and intestinal disappearance of dry matter (DM) and crude protein (CP) of tropical (Iranian) alfalfa and corn silage were measured in three steers (370±16), with ruminal and intestinal canulae, using mobile nylon-bag technique. The experimental samples, 18 replicates, were placed in nylon bags (3 x 6 cm, pore size 47μm), then incubated in the rumen of steers for 12 h prior to being inserted into the intestine. Dry matter and crude protein disappearances in the rumen, intestine and total tract were calculated as the difference between the each nutrient in the intact feeds and the remaining after incubation in the rumen and intestine. The disappearance of DM in the rumen, intestine and total tract for alfalfa and corn silage was 410 and 380, 190 and 460, 540 and 810 g kg-1, respectively. The disappearance of CP in the rumen, intestine and total tract for alfalfa and corn silage was 510 and 290, 730 and 890, 870 and 730 g kg-1, respectively. the results of intestinal and total tract DM disappearance of alfalfa were significantly different from the corn silage data ($p< 0.05$). The alfalfa CP disappearance in the rumen, intestine and total tract was significantly higher compared with corn silage ($p< 0.05$). The disappearance resuts of DM and CP of alfalfa and corn silage may related to the growing condition, species ans conservative processing.

Key Words: Dry matter, Nylon bag, Intestine

W151 Influence of low-level protein supplementation on forage intake, diet digestion and selection by beef steers grazing tallgrass-prairie range during the fall. D. A. Llewellyn*, R. C. Cochran, T. T. Marston, C. G. Farmer, and T. A. Wickersham, *Kansas State University, Manhattan.*.

An experiment was conducted to evaluate the effect on forage utilization of providing a limited quantity of a high-protein (45.5% CP, DM basis) supplement to beef cattle grazing tallgrass-prairie during the fall period. Sixteen ruminally fistulated Hereford x Angus steers (BW = 259 kg) were blocked by weight and randomly assigned to one of two treatments (i.e., fall supplementation or no fall supplementation) in a two-period study to evaluate the effect of low-level supplementation on forage intake and digestion during September and November. Within each treatment, four steers were used for measuring diet selection (by ruminal evacuation) and four were used for total fecal collection (via fecal bags). Each period consisted of a 15-d diet adaptation, a 4-d diet sample collection period, and a 6-d period in which total feces production was measured. The diet to feces ratio of the internal marker acid detergent insoluble ash was used to calculate diet digestibility and this

value, in combination with measured fecal output, was used to calculate intake. Steers were individually fed the high-protein supplement at a rate of 0.14% of BW/d (as-fed basis) but prorated and delivered 3 d/wk. The effect of fall supplementation on diet selection, intake, and digestion was not dependent on the period in which the characteristics were measured. The quality of diet selected decreased as season progressed (CP decreased, P<0.01; NDF tended to increase, P = 0.08; ADF increased P<0.01) and as a result, digestible OM intake and total tract OM digestion were significantly lower (P = 0.04 and P = 0.02, respectively) during November. Fall supplementation did not significantly influence the quality of diet selected or forage intake but supplemented steers tended (P = 0.06) to digest their diet to a greater extent. In conclusion, although seasonal effects on intake and digestion were evident, little impact of low-level fall supplementation was observed.

Key Words: Beef cattle, Protein, Diet selection

W152 Rumen digestibility of five forages estimated from the *in situ* degradation and rate of passage.

M. Murillo-Ortiz*[1], F. O. Carrete-Carreon[2], and O. Ruiz-Barrera[3], [1]*Juarez University of Durango State,* [2]*INIFAP-DGO.,* [3]*University of Chihuahua.*

The objective was to estimate the ruminal dry matter digestibility (RDMD) of five forages from the potential degradability and the rate of passage. Forages evaluated are: alfalfa hay (AH), a mixture of oat and alfalfa hays (MH), ryegrass hay (RGH), beans straw (BS), and Sudan grass hay (SGH). Dry matter degradability was estimated introducing polyester bags with 5g of ground sample in the rumens of four sheep for periods of 3, 6, 9, 15, 24, 48, and 72h. The rate of passage was obtained introducing forage marked with ytterbium in the rumens of four sheep and collecting feces samples of each animal at 0, 4, 8, 12, 16, 20, 24, 30, 36, 48, 60, 72, and 96h post-dose. The model Y= a + b(1-e^{-kd*t}) was fit to the degradation data; where: Y= degradation at time t; a= soluble fraction that is quickly degraded; b= insoluble but potentially degradable fraction; and kd =degradation rate of b fraction (h^{-1}). Marker concentrations in feces were described by the model: Y= Ae$^{-k1(t-TT)}$ - Ae$^{-k2(t-TT)}$; where: Y= marker concentration in all the feed particles at time t; A=marker concentration in the compartment at dosing time; k1= rate of passage of particles through the rumen (h^{-1}); k2= rate of passage through the cecum and colon (h^{-1}); TT= transit time. RDMD was obtained with the model: RDMD (%)= a+b*(kd/(kd+k1)). RDMD was analyzed by analysis of variance using a completely randomized design. RDMD of AH (60.0%) and of RGH (55.6) were not different (P>0.05). RDMD of AH was different (P<0.05) to RDMD of MH (53.8%). There were not differences between the RDMD of RGH (55.6%) and SGH (44%) (P>0.05). RDMD of BS and SGH were different to the RDMD of AH, RGH, and MH (P<0.05). These results suggest that the combination of the parameters of ruminal degradation with the rate of passage let us to estimate the RDMD of forages with different nutritive value.

Key Words: Rumen, Degradability, Models

W153 Mean ruminal residence time of five forages estimated from the degradation and passage rates.

F. O. Carrete-Carreon*[1], M. Murillo-Ortiz[2], and O. Ruiz-Barrera[3], [1]*INIFAP-DGO,* [2]*Juarez University of Durango State,* [3]*University of Chihuahua.*

The objective was to estimate the mean residence time (MRT) of dry matter in rumen, using the characteristics of ruminal degradation and the rate of passage of five forages. *In situ* degradation of alfalfa hay (AH), oat hay (OH), ryegrass hay (RGH), oat straw (OS), and corn stover (CS) was determined. Polyester bags containing 5g of ground samples were introduced in the rumens of four sheep, and incubated for 3, 6, 9, 15, 24, 48, and 72h. Marked hay was introduced in the rumen and feces samples were collected at 0, 4, 8, 12, 16, 20, 24, 30, 36, 48, 60, 72, and 96h post dose to estimate the rate of passage. The degradability profiles of dry matter were described by the model: Y=a+b(1-e^{-kd*t}); where: Y=degradation of dry matter at time t; a=soluble fraction of dry matter that is rapidly degraded; b= insoluble but potentially degradable dry matter fraction; e= base of natural logarithms; and kd = degradation rate of fraction b (h^{-1}). Data of marker concentration in feces were described and parameters estimated by the model: Y=Ae$^{-k1(t-TT)}$ - Ae$^{-k2(t-TT)}$; where: Y=total concentration of the marker in all the particles at time t; A=marker concentration in the compartments at dosing time; k1=rate of passage of particles in rumen (h^{-1}); k2=rate of passage of particles through cecum and colon (h^{-1}), and TT=transit time. MRT of 1 kg of dry matter was obtained with the model: MRT (h)= (1-a-b/k1) + (b/(kd+k1)). Statistical analysis of MRT consisted on analysis of variance using a completely randomized design. The largest MRT was observed in OS (26.6 h) which was no different to CS (23.4 h) (P>0.05). MRT for OH, RGH, and AH were 14.8h, 13.6h, and 12.9h, respectively (P>0.05). MRT of OS and CS were different to MRT of the other forages (P<0.05). Different MRT among forages can be explained from the morphology and chemical composition of the forages. These results indicate that the combination of ruminal degradation characteristics with the rate of passage are good estimators of the MRT of forages.

Key Words: Rumen, Models, Degradability

W154 Effect of urea treatment and Fibrozyme® addition on *in situ* dry-matter degradability of corn bran.

J. I. Aguilera*[1], M. A. Castillo-Pecina[1], C. F. Arechiga[1], C. Arzola[2], and O. Ruiz-Barrera[2], [1]*UAMVZ-Universidad Autonoma de Zacatecas, Zacatecas, Mexico,* [2]*FZ-Universidad Autonoma de Chihuahua, Chihuahua, Mexico.*

Present work try to compare the effect of urea or hemicellulase (Fibrozyme®) on the *in situ* degradability of corn bran. Animals received a total-mixed ration based on oat hulls (33%), flaked corn (29%), alfalfa hay (20%), cotton-seed meal (16%), salt (1%), and a mineral premix (1%). A 4x4 latin-square design included 4 rumen-fistulated Holstein steers, under 4 different treatments: C) Control corn bran; CU) corn bran treated with 4% urea; CF) corn bran with Fibrozyme® (15 g/d); and CUF) corn bran treated with 4% urea and Fibrozyme®. Nylon bags containing 5 g (as dry matter basis) of each one of the treatments were immersed at 0, 6, 12, 24, 48, 72 and 96 h in the ventral rumen of the steers. Effective degradability was adjusted in the following model p=a + b (1 - e^{-ct}) considered in the Neway computer software. All treatments showed a 95% rumen degradability by 72 and 96 h. However, there were statistical differences in rumen degradability within treatments from 6 to 48 h of incubation. Specifically, at 12h, values were: C= 46.4%; CU= 50.52%; CF= 57.3%; and CUF= 38.78%. At 24 h C= 61.5%; CU= 62.2%; CF= 73.8%; and CUF= 46.0%. Effective degradability at 5% of outflow rate was 52.9, 50.1, 59.1 and 42.8% for C, CU, CF and CUF, respectively. Ruminal availability of corn bran was influenced by urea and/or Fibrozyme®. While Fibrozyme® addition enhanced effective degradability of corn bran, combination with urea or urea by itself tend to reduce it. Both, Fibrozyme® and urea treatments could provide a healthier ruminal environment feeding high levels of corn bran, by either accelerating or slowing down ruminal degradability, respectively.

Key Words: Corn bran, Urea treatment, Exogenous enzyme

W155 Effect of urea treatment and Fibrozyme® addition on *in situ* dry-matter degradability of oat hulls.

J. I. Aguilera*[1], M. A. Castillo-Pecina[1], C. F. Arechiga[1], C. Arzola[2], and O. Ruiz-Barrera[2], [1]*UAMVZ-Universidad Autonoma de Zacatecas, Zacatecas, Mexico,* [2]*FZ-Universidad Autonoma de Chihuahua, Chihuahua, Mexico.*

Present work try to compare the effect of urea or hemicellulase (Fibrozyme®) on the *in situ* degradability of corn bran. Animals received a total-mixed ration based on oat hulls (33%), flaked corn (29%), alfalfa hay (20%), cotton-seed meal (16%), salt (1%), and a mineral premix (1%). A 4x4 latin-square design included 4 rumen-fistulated Holstein steers, under 4 different in situ treatments: O) Control oat hulls; OF) oat hulls with Fibrozyme® (15 g/d); OU) oat hulls treated with 4% urea; and OF) oat hulls with Fibrozyme® and 4% urea. Nylon bags containing 5 g (as dry matter basis) of each one of the treatments were immersed at 0, 6, 12, 24, 48, 72 and 96 h in the ventral rumen of the steers. Effective degradability was adjusted in the following model p=a + b (1 - e^{-ct}) considered in the Neway computer software. Dry matter availability in rumen by 96 h was 42.6, 43.5, 62.5 and 60.4% for O, OF, OU and OFU, respectively. There was a statistical differences within treatments from 12 to 96 h of incubation, as well as for effective degradability at 5% of rumen outflow (38.7, 39.8, 47.5 and 46.6% for O, OF, OU and OFU, respectively. Urea treatment enhance the effective degradability of oat hulls. Whereas Fibrozyme® had no effect.

Key Words: Oat hulls, Urea treatment, Exogenous enzyme

W156 Effect of exogenous fibrolytic enzyme on digestibility of ammoniated or non-ammoniated bluegrass seed straw fed to beef cattle. J. I. Szasz*[1], C. W. Hunt[1], L. R. Kennington[1], and K. A. Johnson[2], [1]*University of Idaho,* [2]*Washington State University.*

Disposal of grass seed straw has become an environmental challenge, resulting in greater interest in enhancing its nutritive value for ruminants. Four ruminally cannulated primaparous beef heifers (mean BW 450 kg) were used in a 4 x 4 Latin square design experiment to determine the impact of an exogenous fibrolytic enzyme preparation on intake and digestibility of ammoniated and non-ammoniated bluegrass seed straw (2 x 2 factorial treatment arrangement). The exogenous enzyme contained xylanase and cellulase activity and enzyme activity was 676 μmol reducing sugars/g CP/min (20.9% CP). Heifers allocated to enzyme diets received straw treated with enzyme by hand spraying freshly prepared enzyme solution onto straw at a rate of 0.22 g enzyme (4.4 IU xylanase)/kg. Ammoniation resulted in greater ($P < 0.05$) *in situ* DM degradability at 8, 16, 24, 36, 72, and 96 h of ruminal incubation. Similarly, *in situ* NDF degradability was greater ($P < 0.05$) for ammoniated compared with non-ammoniated straw diets at 48 and 96 h of ruminal incubation and tended ($P < 0.10$) to be greater at 16, 24, 36, and 96 h. Total tract NDF and ADF digestibility was greater ($P < 0.01$) for ammoniated than non-ammoniated straws. No treatment effects were detected for DMI; however, heifers fed ammoniated straws consumed greater ($P < 0.05$) amounts of NDF than those fed non-ammoniated straws. Ammoniation resulted in lower ($P < 0.05$) ruminal fluid acetate, isobutyrate, and acetate:propionate, and greater propionate concentration at 0, 2, 8, 12, 16, and 18 h post-feeding. Addition of enzyme resulted in greater ($P < 0.05$) butyrate concentration at 0, 2, and 18 h post-feeding. No other enzyme effects ($P > 0.10$) were observed. For the diets evaluated in this experiment, optimum fiber digestibility appeared to have been achieved by the ruminal microorganisms without the complement of exogenous enzymes. Ammoniation improved digestibility of grass seed straw; however, exogenous enzyme was not effective for the conditions of this study.

Key Words: Forage, Xylanase, Rumen fermentation

W157 Effect of exogenous fibrolytic enzymes (Fibrozyme) on dry matter and cell wall *in vitro* digestibility of Guinea grass (*Panicum maximum.* var Mombasa) hay. J. H. Avellaneda-Cevallos[1], S. S. Gonzalez*[2], J. M. Pinos-Rodriguez[3], A. Hernandez[2], R. Barcena[2], M. Cobos[2], D. Hernandez-Sanchez[2], and O. Montanez-Valdez[2], [1]*Universidad Tecnica Estatal de Quevedo, Ecuador,* [2]*Colegio de Postgraduados, Mexico,* [3]*Universidad Autonoma de San Luis Potosi, Mexico.*

This study was performed to evaluate the effect of exogenous fibrolytic enzymes (enzyme; Fibrozyme) on *in vitro* digestibility of dry matter (DMIVD), neutral (NDFIVD) and acid (ADFIVD) detergent fiber of Guinea grass (*Panicum maximum* var. Mombasa) hay cut 35 or 90 d after regrowth. Experimental design was completely randomized with a 2x4x6 factorial arrangement of treatments (forage cutting, enzyme dose, incubation time); means were compared using Tukey test. First phase of Tilley and Terry method (3, 6, 12, 24, 48 and 72 h) was used. Medium (40 mL McDougal saliva and 10 mL ruminal liquid) was placed in a 100 mL tube with 500 mg ground hay (1 mm mesh) dried at 60°C during 24 h, with or without 0.5, 1.0 and 1.5 g enzyme/kg DM hay. DMIVD (72 h) was larger (P<.05) for 35 d than for 90 d Guinea. Enzyme increased (P<.05) NDFIVD (3, 6 and 12 h) for 90 d Guinea; at 12 h there was no difference (P>.05) between control (no enzyme) and 0.5 or 1.0 g enzyme for 35 d Guinea. At 24, 48 and 72 h, NDFIVD and ADFIVD were larger (P<.05) for 35 d than for 90 d Guinea. NDFIVD was larger (P<.05) for 1.5 g enzyme at 48 h for 35 d Guinea and at 72 h for 90 d Guinea. Besides, enzyme increased (P<.05) ADFIVD for 35 d Guinea (3, 6, 12, 24, 48 and 72 h) and 90 d Guinea (24 and 72 h). Therefore, these exogenous fibrolytic enzymes have a positive effect on *in vitro* digestibility of fiber fractions of Guinea grass hay cut 35 and 90 d after regrowth.

Key Words: Fiber fractions, Exogenous fibrolytic enzymes, Tropical grass

W158 Effect of exogenous fibrolytic enzymes (Fibrozyme) on *vitro* digestibility of dry matter and cell wall of *Brachiaria* cultivars hays. J. H. Avellaneda-Cevallos[1], S. S. Gonzalez*[2], J. M. Pinos-Rodriguez[3], A. Hernandez[2], R. Barcena[2], M. Cobos[2], D. Hernandez-Sanchez[2], and M. Crosby-Galvan[2], [1]*Universidad Tecnica Estatal de Quevedo, Ecuador,* [2]*Colegio de Postgraduados, Mexico,* [3]*Universidad Autonoma de San Lius Potosi, Mexico.*

This study was done to evaluate the effect of exogenous fibrolytic enzymes (enzyme; Fibrozyme) on in vitro digestibility of dry matter (DMIVD), neutral (NDFIVD) and acid (ADFIVD) of hays of five cultivars of *Brachiaria* (*brizantha* var. Toledo (BT); *ruziziensis x brizantha* CIAT 46024 (RB); *decumbens* var. Seal (DS); *ruziziensis x brizantha* CIAT 36061 cv. Mulato (RBM); *brizantha* var. Insurgente (BI) cut 35 d after regrowth. The experimental design was completely randomized with a 5x2x6 factorial arrangement of treatments (cultivars, enzyme dose, incubation time); means were compared using Tukey test. First phase of Tilley and Terry method (3, 6, 12, 24, 48 and 72 h) was used. Medium (40 mL McDougal saliva and 10 mL ruminal liquid) was placed in a 100 mL tube with 500 mg ground hay (1 mm mesh) dried at 60° during 24 h, with or without 1.5 g enzyme kg/DM hay. DMIVD at 48 and 72 h, with or without enzyme, was larger (P<.05) for BT (50.24 and 49.36 %; 58.22 and 56.18 %) and BI (47.14 and 45.61 %; 57.05 and 55.82 %) than for RB (42.71 and 41.04 %; 49.41 and 50.1 %), DS (37.45 and 36.63 %; 43.56 and 43.67 %) and RBM (37.15 and 39.15 %; 48.47 and 49.44 %). Enzyme did not change (P>.05) DMIVD for the five *Brachiaria* cultivars. NDFIVD, at 48 and 72 h, was larger (P<.05) for BT (45.68 and 45.10 %; 58.25 and 58.29 %) and BI (47.44 and 51.03 %: 54.73 and 58.49 %), than for RB (37.15 and 41.70 %; 42.41 and 49.26 %), DS (38.18 and 43.05 %; 42.80 and 44.64 %) and RBM (39.51 and 41.42 %; 49.57 and 50.94 %). Enzyme increased (P<.05) NDFIVD at 72 h for RB. Also, ADFIVD was increased (P<.05) by enzyme for BT (7.52 vs 14.73 %) at 12 h; BT (12.80 vs 21.35 %) and DS (11.42 vs 19.49 %) at 24 h; BT (32.43 vs 39.21 %), RB (21.07 vs 28.68 %) and BI (38.85 vs 45.62 %) at 48 h. Therefore, these exogenous fibrolytic enzymes increase *in vitro* degradation of cell wall fraction of *Brachiaria* cultivars hays.

Key Words: Cell wall fractions, Exogenous fibrolytic enzymes, *Brachiaria* cultivars

W159 Effect of Leucaena (*Leucaena leucocephala*) supplementation on Aleman-grass (*Echinochloa polystachya*) ruminal degradability. J. Vergara-Lopez*[1], A. Rodriguez-Petit[2], A. Atencio[2], and C. Navarro[2], [1]*Instituto Nacional de Investigaciones Agrcolas (INIA),* [2]*Universidad Experimental Sur del Lago (UNESUR).*

In order to evaluate the supplementation effect of Leucaena on ruminal degradability, potential degradability of DM (PD), initial degradation (ID), maximum degradability (MD), degradation rate and ruminal pH of Aleman-grass an experiment was carried in a humid tropical forest in Venezuela. The evaluated treatments were: T1, Aleman-grass (pA) + 2 kg commercial concentrate (AC); T2, pA + 2 kg Leucaena once a day and T3 pA + 2 kg Leucaena twice a day (1 kg at 0800 h and 1 kg at 1500 h). Three Criollo Limonero steers fistulated with permanent rumen cannulas were exposed to treatments by a 14 days adaptation period before sampling (F1). Samples were taken during 5 days (F2). During F2, nylon bags were incubated 0, 6, 12, 24, 48, 72 and 96 h, while rumen contents pH were measured on 0, 3, 6, 9, 12 and 24 h post feeding. Ruminal degradability data was evaluated by non-linear model procedure and a switch-over design was used for statistical analysis. PD was higher (P<0.05) in T3 (62.91%) than T1 (58.31%) or T2 (59.17%). ID not shown statistical differences between treatments. Ruminal pH on T3 (6.74) was higher (P<0.05) than T1 (6.66) and T2 (6.65). We concluded that Leucaena supplied twice a day, increases DM degradability of Aleman-grass.

Key Words: Ruminal degradability, *Leucaena leucocephala*, *Echinochloa polystachya*

W160 Effect of barley varieties harvested for forage on backgrounding steer performance and diet digestibility. A. L. Todd*, J.G.P. Bowman, L.M.M. Surber, M. A. Thompson, J. J. Kincheloe, M. F. McDonnell, and P. F. Hensleigh, *Montana State University, Bozeman, MT*.

Barley harvested as hay is a significant source of winter forage for livestock producers in Montana. Limited data is available using hay barley as a roughage source for backgrounding steers. Ninety-six Angus cross steers were allotted to 16 pens in a randomized complete block design. The objectives of this study were to 1) determine the effects of four barley varieties on animal performance and diet digestibility, and 2) determine the effects of feeding awned vs. hooded head type barley. MT 981060, Westford, and Haybet are all hooded forage barley varieties while Valier is an awned feed barley variety. Steers were given ad libitum access to their roughage source, 2.6 kg head^{-1}d^{-1} of cracked feed barley, and 0.45 kg head^{-1}d^{-1} of a commercial 32% CP supplement. All roughage was chopped to 5.1 cm. Pen was the experimental unit in the 60 d trial. Steers were weighed and diet, ort, and fecal samples were obtained on d 28 and upon completion (d 60) of the trial. Diet and fecal samples were composited by pen and analyzed for DM, OM, N, NDF, ADF, and AIA. Acid insoluble ash was used to estimate fecal output. Steers fed MT981060 and Valier had 55% greater ($P < 0.01$) ADG when compared to steers fed Haybet and Westford barley (avg 3.29 vs. 2.75 kg/d, respectively). Dry matter intake was greatest ($P < 0.01$) for steers fed MT 981060 and Valier, intermediate for Haybet and least for Westford (avg 10.06 vs. 9.61 and 8.08 kg/d, respectively). Steers fed MT981060, Valier, and Westford barley had 14.4% improvement ($P < 0.01$) in feed efficiency (FE) when compared to steers fed Haybet barley (avg 15.07 vs. 12.9 kg gain / 100 kg feed, respectively). Feeding an awned variety did not impact DMI, ADG, or FE. MT981060 had superior feeding value for backgrounding steers and is scheduled for release by the Montana Agricultural Experiment Station.

Key Words: Backgrounding steers, Forage barley varieties, Barley

W161 Continuous culture fermentation of three fescue varieties supplemented at four energy levels. R. E. Vibart*, S. P. Washburn, V. Fellner, and J. T. Green, *North Carolina State University, Raleigh*.

Eight dual-flow continuous cultures (700 ml) were used to compare effects of endophyte-infected (E+), endophyte-free (E-), and nontoxic endophyte-infected (EN) (MaxQ) Jessup tall fescue (Festuca arundinacea L.) on rumen fermentation in a grazing simulation at four levels of concentrate supplementation (ground corn). For each of the fescue varieties (E+, E-, and EN), forage to concentrate ratios of 100:0, 85:15, 70:30, and 55:45 were used for a total of 12 experimental diets in a randomized incomplete block design with two replicates. Vegetative grasses were used with compositions as follows: E+ (12.3% CP, 59.9% NDF, 29.2% ADF), E- (13.4% CP, 60.7% NDF, 29.4% ADF), and EN (10.4% CP, 63.2% NDF, 31.4% ADF). Rumen cultures were adapted for 48 h before experimental diets were fed and then gradually adjusted to the final diets. Each culture vessel was offered a total of 15 g of DM per day including: four equal portions of grass (fed at 0300, 0900, 1500, and 2100 h); and two equal portions of corn (fed at 0900 and 2100 h). The fractional dilution rate was set at 6.25% per hour. Headspace gas and liquid samples were analyzed for methane, rumen culture pH, volatile fatty acids, and ammonia-N concentration to assess the rumen environment from the pasture-based diets. Methane concentrations were higher ($p < 0.05$) for E+ compared to E- or EN. Methane was also higher ($p < 0.05$) for E- than for EN but only when sampled after feeding corn. Ammonia-N concentrations also varied by grass: EN had lower ($p < 0.05$) values compared to E+ and E-. Rumen pH values, ammonia-N (mg/100 ml), acetate concentrations (mM), and the acetate:propionate ratio decreased linearly with increasing levels of energy supplementation, whereas propionate and butyrate increased linearly. Interactions of feeding time by grass and energy by grass were observed for concentrations of ammonia-N. Although some differences were observed among fescue varieties, fermentation responses were generally similar at similar levels of energy supplementation.

Key Words: Festuca arundinacea, Endophyte, Energy supplementation

W162 Effect of field peas inclusion on in situ disappearance rate of grass hay, soybean hulls, and field peas in beef steers fed medium concentrate diets. S. A. Soto-Navarro*, G. J. Williams, M. L. Bauer, G. P. Lardy, D. Landblom, and J. S. Caton, *North Dakota State University, Fargo*.

Four ruminally and duodenally cannulated steers (703.4 ± 41 kg initial BW) were used in a 4 x 4 Latin square to evaluate effects of field peas inclusion on in situ disappearance rate (%/h) of grass hay, soybean hulls, and filed peas in beef steers fed 55% concentrate diets. Steers were fed ad libitum at 0700 and 1900 daily and were allowed free access to water. Diets consisted of 45% grass hay (6.8% CP) and 55% concentrate mixture. Treatments consisted of: 1) control, no peas; 2) 15% peas; 3) 30% peas; and 4) 45% peas in the total diet, with peas replacing wheat middlings, soybean hulls, and barley malt sprouts in the concentrate mixture. Steers were adapted to diets for 9 d. Grass hay was incubated in situ, beginning on d 10, for 0, 2, 5, 9, 14, 24, 36, 72, and 98 h; and field peas and soybean hulls for 0, 2, 5, 9, 14, 24, 36, 48, and 72 h. Linear, quadratic, and cubic contrasts were used to compare increasing field pea levels. In situ DM and NDF disappearance rates of grass hay and soybean hulls decrease linearly ($P \leq 0.05$) with increasing field peas. Rate of grass hay in situ ADF disappearance also decrease linearly ($P \leq 0.05$) with increasing field peas. In situ DM disappearance rate of field peas demonstrated a quadratic effect ($P \leq 0.01$; 5.9, 8.4, 5.5, and 4.9 0.52 %/h, for 0, 15, 30, and 45% filed peas in the diet, respectively) with increasing field peas level. Rate of in situ CP disappearance responded quadratically ($P \leq 0.09$) for grass hay (4.2, 4.7, 2.7, and 2.2 ± 0.24 %/h), soybean hulls (7.0, 7.5, 7.6, and 5.7 ± 0.61 %/h), and field peas (6.7, 7.5, 7.5, and 5.8 ± 0.19 %/h for 0, 15, 30, and 45% of field peas inclusion, respectively). Inclusion of up to 45% field peas into medium concentrate diets consumed by beef steers reduces rates of in situ DM, NDF, and CP disappearance.

Key Words: Field Pea, Digestion Rate, Cattle

W163 Effects of sun-curing, formic acid-treatment or microbial inoculation on ruminal kinetic parameters of timothy. R. Martineau*[1], H. Lapierre[2], D. R. Ouellet[2], D. Pellerin[1], and R. Berthiaume[2], [1]*Universite Laval, Quebec, Canada,* [2]*Dairy and Swine R&D Centre, Agriculture and Agri-Food Canada, Lennoxville, Quebec, Canada*.

Effects of three methods of conservation on ruminal kinetic parameters of timothy (*Phleum pratense L.*) were investigated. Treatments were : 1) sun-cured hay (**H**: 48 h wilting), 2) formic acid-treated silage (**F**: 6 L of 85% formic acid per ton of fresh forage; 24 h wilting), or 3) microbial inoculated silage with *Lactobacillus plantarum* LPH-1 and *Pediococcus cerevisiae* PCH-3 (**I**: 1.25 X 10^{11} total CFU per ton of fresh forage; 20 h wilting). Percent DM were 84.9, 36.1 and 35.5 (SEM=1.34) and percent CP were 10.4, 13.6 and 15.1 (SEM=0.30) for treatments **H**, **F** and **I**, respectively. Six ruminally cannulated Holstein cows in mid lactation, consuming 15.9 kg DM per day (SEM=0.98; P=0.15), were randomly assigned to treatments. CP disappearance was estimated with the *in situ* nylon bag technique after a 40 day-adaptation period (forage:concentrate ratio = 56:44; incubation times = 0 up to 72 h in triplicate; bag pore size = 41.6 x 52 μm). Soluble fraction (A), total potentially degradable fractions (A+B), degradation rate (Kd) and estimated rumen degradable protein (RDP) at Kp 4% were lower for treatment **H** than for treatments **F+I** ($P \leq 0.01$). Fraction B was higher for treatment **H** than for treatments **F+I** ($P<0.01$). Treatment **F** decreased fractions A ($P<0.01$) and A+B (P=0.03) but increased fraction B (P=0.01) when compared to treatment **I**. Results suggest that formic acid-treatment limits protein breakdown in silage (lower fraction A and higher fraction B) when compared to microbial inoculation. However, formic acid-treatment is not as effective as sun-curing for limiting proteolysis.

		Treatments			Contrasts (P)	
Parameters	**H**	**F**	**I**	SEM	**H** vs **F+I**	**F** vs **I**
A (% CP)	16.7	36.6	49.1	0.88	<0.01	<0.01
B (% CP)	63.0	47.4	37.4	1.30	<0.01	0.01
A+B (% CP)	79.7	84.0	86.4	0.43	<0.01	0.03
Kd (% h^{-1})	7.2	13.7	11.8	0.79	0.01	0.18
RDP (% CP)	56.8	71.4	73.6	1.49	<0.01	0.38

Key Words: *in situ* Disappearance, Formic acid-Treatment, Microbial Inoculation

W164 The effects of distillers dried grain with solubles as the protein source in a creep feed. P. Lancaster*, J. Williams, J. Corners, L. Thompson, and M. Ellersieck, *University of Missouri-Columbia, Columbia, Missouri*.

A study was conducted to evaluate the effect of Corn Distillers dried grains with solubles (D) vs. soybean meal (S) as a protein source in a creep feed. Thirty-six steer calves (avg. 160.7 kg + 2.8; 2 groups / treatment) were used in a completely randomized design to compare the effects of D and S on the performance of calves to traditionally weaned (C) calves prior to (68 d) and after weaning (112 d). Steers were allotted by age (avg. 122.5 d + 2.5) to 1 of 6 endophyte-free tall fescue pastures with dams. The dietary supplements consisted of a cracked corn / soyhull mix with the protein source and were formulated to contain 14.2% CP and 1.39 Mcal/kg of NEg. Calves were placed in open drylots and adjusted to a receiving diet of cracked corn, soyhulls, and fescue hay with D and S treatments continued, while the C treatment received S as the protein source. During phase 2, the cracked corn was replaced with shelled corn and increased in the diet. During phase 3, steers were placed on a common diet of shelled corn, soyhulls, and fescue hay. Diets for phase 1, 2, and 3 were formulated to provide 13.5, 13.2, and 12.0% CP and 1.08, 1.23, and 1.27 Mcal/kg of NEg, respectively. Weight and ultrasound measurements were taken intermittently throughout the feedlot phase. Treatments D and S had greater ($P < .05$) ADG than C (1.06, 1.00 vs. 0.72 kg, respectively). The feed / extra gain was similar among treatments, while cost / kg of extra gain for D was lower ($P < .05$) than S ($0.88 vs. $1.89, respectively). For phases 1 and 2, weight of all treatments increased in a linear ($P < .01$) fashion, but the quadratic response differed between C vs D and S ($P < .05$). DMI was similar among treatments but ADG between C vs. D and S differed ($P < .01$) during phase 1. Feed / gain among treatments was similar for phase 1; during phase 2, all treatments differed ($P < .01$) with D being the highest and C the lowest. For phases 1 and 2, backfat depth and ribeye area for all treatments increased in a linear ($P < .01$) fashion, while the backfat depth of C also increased in a quadratic ($P < .05$) fashion. Final performance and carcass data will be presented later. In conclusion, protein source had no effect on ADG, however DDGS reduced cost / kg extra gain.

Key Words: distillers dried grains with solubles, performance, creep

W165 Sodium and magnesium sulphates reduce water consumption by beef cattle. A. S. Zimmerman*[1], D. M. Veira[2], D. M. Weary[1], M.A.G. von Keyserlingk[1], and D. Fraser[1], [1]*University of British Columbia Animal Welfare Program*, [2]*Agriculture and Agri-Food Canada*.

Sulphate salts are present in many water sources found on rangeland and negatively affect water intake by cattle. The objective of this work was to determine water consumption by beef cattle when they were given access to water containing a range of concentrations of Na_2SO_4 and $MgSO_4$. In Exp. 1, 5 beef heifers (300-400 kg) were offered either *ad lib* access to tapwater (8 ppm SO_4) or water containing 3000 ppm SO_4 for two wks and restricted access (twice daily) for two wks. Exp. 2 was conducted as a taste test for 2 d where 8 animals were given water twice daily containing tapwater (11 ppm SO_4), Na_2SO_4 or $MgSO_4$ at 1500, 3200, or 4700 ppm SO_4. Each test was separated by 2 d of access to tapwater. Data was analyzed using paired t-tests in Exp. 1 and by Wilcoxon paired sample tests in Exp. 2. In Exp. 1 animals drank less ($P \leq 0.05$) water when it contained Na_2SO_4 (4.37 $\pm$ 0.90 kg/drink) compared to tapwater (9.00 $\pm$ 0.83 kg/drink) when given *ad lib* access. When access was restricted, average drink intake was 21.88 $\pm$ 2.15 kg for tapwater and 11.19 $\pm$ 2.89 kg for water containing Na_2SO_4 ($P \leq 0.01$). Average daily intake of tapwater was less ($P \leq 0.05$) when water access was restricted (44.26 $\pm$ 4.13 kg) compared to *ad lib* access (55.42 $\pm$ 5.62 kg); however, average daily intake of the SO_4 water was not different ($P \geq 0.05$) for *ad lib* (25.52 $\pm$ 5.16 kg) and restricted access (21.53 $\pm$ 5.74 kg). In Exp. 2 there was no difference ($P \geq 0.05$) between average water intake for $MgSO_4$ (20.71 $\pm$ 0.50 kg/drink) and Na_2SO_4 (18.78 $\pm$ 1.74 kg/drink) treated water at 1500 ppm SO_4; however at 4700 ppm SO_4 the average intake of $MgSO_4$ treated water was 6.70 $\pm$ 3.05 kg/drink compared to 15.38 $\pm$ 1.81 kg/drink for Na_2SO_4 ($P \leq 0.05$). There was considerable variation in intake between animals, particularly at higher SO_4 concentrations. These results suggest that guidelines for maximum allowable limits of SO_4 in cattle drinking water need to consider the associated cation and the variability in sensitivity between animals.

Key Words: Beef cattle, Water quality, Sulphate

W166 Kinetic parameters of digesta flow in calves under different herbage allowances of *Panicum maximum* cv. Tanzania-1. M. M. Gontijo Neto[1], D. Nascimento Júnior[2], V.P.B. Euclides[1], A. J. Regazzi[2], J. C. Pereira[2], L. F. Miranda*[3], D. M. Fonseca[2], and O. G. Pereira[2], [1]*Embrapa Gado de Corte, Brazil*, [2]*Universidade Federal de Viçosa, Brazil*, [3]*FEAD-Minas, Centro de Gestao Empreendedora, Brazil*.

The objective of the present study was to assess the kinetic parameters of digesta flow in calves under different herbage allowances of Tanzania grass (*Panicum maximum* cv. Tanzania-1). A randomized block design was used with two replications per block, four treatments, defined by average levels of herbage allowance (HA), and two blocks (sampling periods). Average herbage allowances (HA) were 6.1 $\pm$ 0.59; 11.1 $\pm$ 0.77; 18.0 $\pm$ 1.24 and 23.9 $\pm$ 1.15 kg DM green leaf blades/100 kg LW/day. Complex Cr-NDF was supplied to three Nelore calves (average weight: 245 kg) in each replication and stools were collected at 0, 12, 18, 24, 30, 36, 42, 48, 60, 72, 96, 120 and 144 hours. Chromium concentration data for each replication were adjusted by non-linear regression (Dhanoa et al., 1985) and the effects of herbage allowance were interpreted by regression analysis. Changes in herbage allowances of Tanzania grass directly affected the passage rate of digesta in the rumen (%/h) ($k_1 = 1.875 + 0.041$**HA; $r^2 = 0.991$), had no impact on passage rate in post-rumen ($k_2 = 15.383$ %/h), and generated a negative effect on mean retention time of digesta (h) (MRT = 67.21 - 0.481**HA; r^2 =0.905).

Key Words: Passage rate, Tropical forage, Beef cattle

W167 Comparison of commercial White and Yellow Corn from Sinaloa Mexico, on starch composition, in vitro digestibility, and physical characteristics. O. G. Lozano*[1], M. Chaidez-Ibarra[1], A. Sanchez-Bautista[1], X. Perales-Sanchez[1], C. Mora-Uzeta[1], and E. Vazquez-García[1], [1]*Universidad Autonoma de Sinaloa. Mexico*.

The objective of this experiment was to determinate the differences between White Corn (WC) and Yellow Corn (YC) for ruminant nutrition purpose. Six WC and five YC, commercial heterogeneous varieties from different companies, were sampled form Sinaloa Mexico. One YC, imported from USA, was included. The physical analysis were; density (g/L), weight of 1000 kernels (g), water absorption in 30 min (%), DM solubility (%), and PC solubility (%). The chemical analysis were; PC (%), and starch composition (α-amylase/amyloglucosidase kit; Methods AOAC 996.11 and AACC 76.13). The digestion analysis were, DM in vitro digestibility (DMIVD) at 4, 6, 8, 12, 24, and 48 h (Ankom DAISY) and rate of degradation (%/h).The experimental model was a completely random desing, with two treatments; WC and YC. There are not differences ($P>0.05$) between the WC and YC on: density (mean = 723 g/L 23.5); kernels weight (mean = 379 g, 30); water absorption (mean = 6.12 %, 0.6); DM solubility (mean = 7.99 %, 1.7); CP solubility (mean = 17.44 %, 3.4); and CP composition (mean = 9.78 %, 0.68). YC had a tendency of high starch concentration ($P=0.08$) than WC (74.18 % vs 71.37 %, respectively). DMIVD were not different ($P>0.05$) between WC and YC at all the hours. The rate of degradation was similar ($P>0.05$) among the grains (WC= 0.98, YC=0.96 %/h). As individual grains, the YC from USA and the WC of Pionner, in relation to the twelve grains (T-test analysis), presented a higher ($P<0.05$) DMIVD 48 h (means = 90.93 %, 1.54; 94.03 %, and 93.23 %, respectively) and higher water absorption (7.5 %; and 6.7 %, respectively). In general, there are not differences among commercial WC and YC in the physical, chemical, and digestive analysis presented in this experiment, however, must be considered that individual grains, white or yellow, showed higher DMIVD.

Key Words: White corn, Starch, Digestibility

W168 Fractionation and in vitro degradation kinetics of carbohydrates constituents of sugar cane with different cycles of production and three cut times. A. Fernandes*[1], A. Queiroz[2], E. Pereira[3], L. Cabral[4], and A. Alex[3], [1]*Universidade Estadual do Norte Fluminense,* [2]*Universidade Federal de Viçosa,* [3]*Universidade Estadual do Oeste do Paraná,* [4]*Universidade Federal do Mato Grosso*.

The objective of this work was to determine the fractions and rates of digestion of the carbohydrates for sugar cane, with different cycles of production (early and intermediate), in three cut times (426, 487 and 549 days). The total carbohydrates (TC), non-fibrous carbohydrates (NFC), fractions potentially digestible (B2) and indigestible (C) of the neutral detergent fiber (NDF), corrected for ashes and protein (NDFcp), were obtained. The kinetic parameters of NFC and fraction B2 were obtained from the technique of gas production in vitro. The contents of TC and fraction B2 did not differ among varieties, even though the early ones presented larger contents of the fraction C and smaller of NFC. By establishing a relationship between concentration of obtained lignin and observed C fraction, with adjustment of equation of simple linear regression, without intercept, it was obtained the value of 4.38 that differed of 2.4, suggested by the Cornell system. Therefore, for sugar cane, the fraction C could be estimated from the lignin multiplied by 4.38. The progress of the cut time caused linear increase of the C fraction and reduction of B2, without interaction with the cycle of production; although it has been linear, the increment was relatively small, 6 percentage of the fraction C, when compared to the other tropical gramineas, with the same cut time. The kinetic parameters, didn't present differences among varieties; however, the estimated average digestion rates for NFC were lower than the suggested by the Cornell system. The adjustment of the curve of cumulative gas production (bicompartimental system) was shown appropriate because the sugar cane has fractions of available carbohydrate very different with relationship to the digestion rate (CNF and B2). By presenting high content of NFC (sucrose) and low rate of digestion of the B2 fraction, researches with different sources of N to supplement sugar cane based diets are necessary.

Key Words: Carbohydrate digestible fraction, Digestible rate, Sugar cane

W169 Digestion of alfalfa and alfalfa:sainfoin mixture preserved as hay or as silage. Y. Wang*[1], B. P. Berg[2], L. R. Barbieri[1], and T. A. McAllister[1], [1]*Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB,* [2]*Alberta Agriculture, Food and Rural Development, Lethbridge, AB*.

Total tract digestibilities of alfalfa (A) and mixed alfalfa:sainfoin (A:S) forages preserved as hay or as silage were studied using 10 mature, ruminally cannulated wethers ($n = 5$). Sainfoin was cross-seeded into one of two alfalfa pastures as a means to introduce condensed tannins into an alfalfa-based diet. Alfalfa and A:S mixture (35% sainfoin, DM basis), were harvested at late bud and preserved as hay (92% DM) or wilted to 33% DM and ensiled for 80 d. The wethers were fed A or A:S silage in a total mixed ration with 24% pelleted concentrate and mineral/vitamin supplement for 22 d, then were then switched to hay-based TMR. Total fecal collections and ruminal metabolite determinations began after 14 d on each diet. Intake of DM was higher ($P < 0.01$) with hay than with silage, but did not differ ($P > 0.05$) between A and A:S. Digestibilities of DM ($P < 0.01$), OM ($P < 0.01$), NDF ($P < 0.05$) and ADF ($P < 0.05$) were greater in A:S compared with A, but all were similar ($P > 0.05$) between hay and silage. Interactive effects of forage type and preservation method on DMI or nutrient digestibilities were not observed ($P > 0.05$). Compared with wethers fed A, those fed A:S digested more ($P < 0.05$) N when the forages were preserved as hay. When silages were fed, N digestibility was higher ($P < 0.05$) with A:S than with A. Nitrogen retention tended ($P = 0.08$) to be higher with A:S than with A. With hay and with silage, ruminal concentrations of ammonia N and soluble protein were lower ($P < 0.05$), but concentration of volatile fatty acids was higher ($P < 0.01$) in wethers fed A:S compared with those fed A, but their protozoal populations were similar ($P > 0.05$). Sainfoin included in alfalfa pastures increased the digestibility of the forage whether preserved as hay or as silage, and reduced protein degradation in the rumen. Introducing condensed tannins into alfalfa forage through sainfoin incorporation may have potential to improve forage N utilization.

Key Words: Condensed tannins, Sainfoin, Forage digestibility

W170 Evaluation of associative effects of feeds using in vitro gas production. G. Getachew*[1], P.H. Robinson[1], and J.W. Cone[2], [1]*Department of Animal Science, UC Davis,* [2]*ID TNO Animal Nutrition,Lelystad, The Netherlands*.

A ration formulated for ruminants is often a mixture of individual feeds. Its energetic value is generally calculated by summing the energy value of the individual feeds in it, on the assumption that the energy value of individual feeds will be the same when they are fed in combination with other feeds. The in vitro gas production technique was used to determine whether associative effects of feeds occur. Two sets of four feeds from California (alfalfa hay, AL; barley grain, BR; corn silage, CS; soybean meal, SM) and four feeds from The Netherlands (grass silage, GS; corn silage, CS; citrus pulp, CP; corn gluten meal, CG) were incubated alone, and in various combinations, in buffered rumen fluid using an in vitro gas technique (Menke and Steingass, 1988; Anim. Res. Dev. 28:7-55). The percent increase in gas production measured on combinations of feeds vs. the gas calculated to have been produced based upon incubation of individual feeds was used to assess the extent of the associative effects. Among the California samples, the AL: SM combination resulted in as high as a 9% increase in gas production at 6 h of incubation compared to values calculated from incubation of the individual feeds. The percentage increase in gas production at 24 h of incubation was less than that at 6 h and there was no increase in gas production in feed mixtures incubated for 72 h. The AL: BR mixture produced 20% more gas than individual feeds incubated for 6 h, and there was no increase in gas production at 72 h of incubation in any feed mixtures compared to feeds incubated individually. The three feed combination of AL: SM: CS also resulted in as high as an 11% increase in gas production at 24 h incubation vs. that calculated from incubation of individual feeds. The four feed combination of AL: BR: SM: CS increased in vitro gas production by about 10% at 6 h of incubation. The percent increase in gas production with mixtures of feeds from the Netherlands followed similar trends. Results suggest that feed digestibility and energy supply to ruminants can differ from values derived from calculations based on individual feed digestibility. The extent of these differences appears to vary with type and level of feed, and time of incubation.

Key Words: In vitro gas production, Associative effects

W171 Effect of condensed tannins on in vitro digestion of alfalfa and mixed alfalfa:sainfoin silages. Y. Wang*[1], Z. Xu[1], B. P. Berg[2], L. R. Barbieri[1], and T. A. McAllister[1], [1]*Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB,* [2]*Alberta Agriculture, Food and Rural Development, Lethbridge, AB*.

Freeze-dried, ground (1.0 mm) alfalfa, alfalfa:sainfoin and sainfoin silages were incubated in buffered ruminal fluid ± polyethylene glycol (PEG) to determine the effects of sainfoin condensed tannins on ruminal digestibility of the silages. Chopped alfalfa (*Medicago sativa* cv. AC Grazeland Br®) and sainfoin (*Onobrychis viciifolia*) forages were hand mixed in ratios of 100:0, 75:25, 50:50, 25:75 and 0:100 (%, fresh weight) and ensiled in laboratory-scale silos for 1 or 72 d. Silages were incubated for 12, 24 and 48 h at 39°C ($n = 3$), with a $2 \times 2 \times 5$ factorial arrangement of treatments (1- or 72-d silage; 0 or 0.243% (w/v) PEG; substrates A, A75, A50, A25 and S). Inoculum included 0.75 g/L $(^{15}NH_4)_2SO_4$ as a microbial N incorporation (MN) marker. With all silages, over 93% of DM disappearance (DMD) occurred during the first 12 h of incubation. Compared with the 72-d silages, forage ensiled for 1 d had higher ($P < 0.001$) DMD and acetate:propionate ratio (A:P) at all time points and higher MN ($P < 0.01$) at 12 and 24 h, but production of VFA and NH_3-N release were lower. Sainfoin incorporation had a quadratic effect ($P < 0.001$) on DMD and production of VFA, but linearly increased ($P < 0.01$) MN and NH_3-N release during the 48-h incubation. Including PEG in the incubation did not affect ($P > 0.05$) DMD from any substrate, but it increased ($P < 0.05$) gas production from A75, A50, A25 and S, and this effect was greater ($P < 0.05$) with the 1-d than with the 72-d silages. Including PEG reduced ($P < 0.05$) VFA and MN at 12 and 24 h, but not at 48 h. Interactive effects ($P < 0.01$) between PEG and substrate were observed on A:P ratio and NH_3-N release. These values were increased ($P < 0.05$) by PEG only with 1-d A50, A25 or S silages. In the 72-d silages, NH_3-N release was similar ($P > 0.05$) across substrates. Incorporating sainfoin into alfalfa silage increased the silage nutritive value, but the effect of sainfoin condensed tannins on N metabolism was reduced during ensiling.

Key Words: Condensed tannins, In vitro digestibility, Silage

W172 The effect of concentrate restriction on performance of Holstein steers fed only liquid whey instead of water. A. R. Bayat*, R. Valizadeh, and A. Naseian, *College of Agriculture - Ferdowsi University - Mashhad - Iran.*

This experiment was conducted to study the effects of concentrate restriction on liquid whey consumption, performance, rumen and blood parameters of the Holstein steers in a 100 days period. 12 Holstein steers with average body weight of 150 ±27 Kg were assigned to treatments. Experimental design was Completely Randomized Design with 3 treatments. Treatments were: I. Normal concentrate feeding (ad lib) II. Concentrate restricted at the level of 2/3 of concentrate intake of treatment I, III. Concentrate restricted at the level of 1/3 of concentrate intake of treatment I. Alfalfa hay was fed at the level of 0.7 % (DM Basis) of body weight. Liquid whey was given ad lib. No drinking water was provided. Diet was formulated based on NRC (1989) recommendations. Rumen liquor and blood samples (from jugular vein) were taken 3h after morning feeding. Acid insoluble ash (AIA) was used for apparent digestibility determination. Whey consumption of treatment III increased by 12.68 percent in comparison to treatments I and II (54.6, 48.5 and 48.5 Kg/d respectively SE=4.13). The steers in treatments I, II and III obtained 41.2, 49.3 and 55.7 percent of their daily dry matter intake (DMI) from whey respectively. There was a significant difference between total DMI ($p<0.05$)(6.38, 5.43 and 5.31 kg/d for treatment I, II and III respectively). Alfalfa intake in treatment III was higher than treatments I and II ($p<0.05$). Among the apparent digestibilities (DM, OM, CP, CF, NDF and ADF) only digestibility of ADF in treatment III was significantly increased in comparison to the control ($p<0.05$)(64 vs. 24%). Increasing concentrate restriction leads to linear decrease of average daily weight gain although it was not significant. There was no significant difference among feed conversion ratios. Rumen and blood pH and ammonia nitrogen (NH_3-N)of rumen liquor were similar among the treatments. Plasma urea nitrogen in treatments II and III were significantly ($p<0.05$) less than the control (14.87 and 18.60 vs. 25.15 mg/dl, SE = 1.637) ($p<0.05$). It can be concluded that along with liquid whey feeding, concentrate restriction can be used in steer feedlot without any adverse effect on performance. Although this conclusion is highly dependent on the market price of feed ingredients.

Key Words: Whey, Concentrate restriction, Steer

W173 Effects of dry and steam processing on in situ ruminal digestion kinetics of barley grain. A. Nikkhah and G. R. Ghorbani*, *Isfahan university of Technology, Isfahan, Iran.*

Effects of barley processing on rate and extent of digestion were evaluated with three ruminally cannulated ewes. Barley grain was processed with dry method (finely and coarsely ground), as well as it was steam rolled in four separate bulk densities. To distinguish four different degrees of steam-rolled barley, the processing index (PI) was measured as volume weight of barley after processing expressed as a percentage of its volume before processing which was 72.6. 63.8, 46.1, and 39.6 percent for coarse, medium, medium-flat, and flat flakes, respectively. The nylon bags containing 3 g of ground and steam-processed grains were incubated in rumen for 0, 2, 4, 8, 16, 24, and 48 h to estimate the kinetics of rumen degradation. The soluble fraction and fractional rate of DM and CP digestion were significantly higher for finely ground barley than those for other treatments. Among four degrees of steam-rolled barley grains, coarse and flat flakes had respectively the lowest and the highest soluble DM and CP as well as the fractional rate of digestion. The least amounts of slowly degradable DM and CP were for finely ground barley followed by flat, medium-flat, medium, and coarse flakes. In fact, raising the extent of both grinding and steam-rolling resulted in dramatic increase of effective degradability for DM and CP assuming two outflow rates of 5 and 8 percent h-1. The results of this study showed that steam processing can be more reliable than grinding of barley because it provides less amount of rapidly degradable fraction and more potential digestible DM in rumen. In other words, we can modulate the rate and extent of ruminal digestion more easily with steam processing rather than grinding of barley.

Key Words: Barley, Steam rolling, Degradability

W174 Effect of the processing method of soybean meal on production response of lactating cows. C. Leonardi*[1], W. Stockland[2], and L.E. Armentano[1], [1]*University of Wisconsin-Madison,* [2]*AG Processing Inc., Omaha, NE.*

The objective of this study was to evaluate production response of dairy cows fed soybean meal ruminally protected by three different methods. Treatments consisted of a control diet containing soybean meal (SBM) and three diets from which part of the soybean meal was replaced either by cooked-expelled soybean (EXP, SoyPlus®), or soybean meal non-enzymatically browned with xylose (CX, SoyPass®) or soybean meal cooked with soybean hulls and water (CSH, AminoPlus®). Twelve multiparous and four primiparous Holstein cows were utilized in a replicated 4 x 4 Latin Square design, with 21 d periods. Diets contained 22.5% alfalfa silage, 38.3% corn silage, 4.7% cottonseed and 34.5% concentrate (DM basis). Diets were formulated to be isonitrogenous (CP = 17.5%), isoenergetic and have similar NDF (29.6%) and fatty acids (4.6%) concentrations. The SBM diet was RUP deficient, while the other three were designed to have adequate and equal RUP levels. Contrasts tested RUP level (SBM vs. EXP, CX and CSH), method of ruminal protection: cooked-expelled vs. chemically treated (EXP vs. CX and CSH), and within chemical treatment the effect of different methods (CX vs. CSH). None of the tested contrasts were different for yield of milk fat, protein or DMI. Milk protein percentage was greater when feeding soybean meal vs. ruminally protected soybean products. Revenue ($/cow/d) was calculated for each cow within treatment, assuming $ 2.61 per kg of fat and $ 4.00 per kg of protein. Revenue 90% confidence interval (least squares means ± 1.64 x SED) was 7.92 ± 0.29 for SBM, 7.95 ± 0.29 for EXP, 7.94 ± 0.29 for CX, and 8.17 ± 0.29 for CSH.

	Diets					Statistical	Contrast	(P=)
	SBM (A)	EXP (B)	CX (C)	CSH (D)	SED	A vs. (B+C+D)	B vs. (C+D)	C vs. D
DMI,kg/d	23.0	23.7	22.7	23.4	0.5	0.52	0.14	0.18
Milk,kg/d	36.9	37.1	37.3	38.5	0.8	0.23	0.27	0.15
TP, %	2.93	2.91	2.89	2.89	0.02	0.05	0.36	0.84
TP, g/d	1081	1080	1078	1109	27	0.72	0.56	0.25
Fat, %	3.74	3.74	3.72	3.72	0.05	0.66	0.63	0.99
Fat, g/d	1377	1388	1388	1430	30	0.30	0.42	0.17

TP = True Protein

Key Words: Protein, Milk production

W175 Sugar cane fiber effectiveness in dairy rations. M.L.M. Lima*[1], W. Mattos[2], and L. G. Nussio[2], [1]*Escola de Veterinaria, Goiania - GO - Brazil* , [2]*Universidade de Sao Paulo, ESALQ, Piracicaba - SP - Brazil.*

Five ruminally and duodenally cannulated Holstein cows were used in a 5 x 5 Latin square design with 14-d periods to evaluate fiber effectiveness of sugar cane (SC) and sodium hydroxide (NaOH) treated sugar cane (SHSC). Low (LF) and high (HF) forage diets [14 and 22% of dietary DM from corn silage (CS) NDF, respectively] were compared to diets formulated to contain 14% CS NDF plus 8% of DM from SC NDF, SHSC NDF or alfalfa hay (AH) NDF. Forage particle size was determined using the Penn State Particle Size Separator on a wet basis. Concentration of indigestible NDF (INDF) in forage samples was determined by 144-h in vitro fermentation using the Ankom Daisy II technique. Potentially digestible forage NDF (DNDF) was determined as NDF-INDF. Forage retained on the upper and lower sieves and at the bottom pan was 26.7, 51.8 and 21.5%; 14.6, 66.0 and 19.4%; 14.6, 67.3 and 18.1% and 14.3, 24.5 and 61.2%, respectively for CS, SC, SHSC and AH. DNDF (% of NDF) was higher ($P < 0.05$) for CS (63.9) than SC (44.5), SHSC (55.1) and AH (49.7) and SC DNDF was increased ($P < 0.05$) by the NaOH treatment. Dry matter intake (17.0 kg/d), milk yield (18.2 kg/d) and milk fat (3.62 %) did not differ among diets. Mean rumen pH was higher ($P = 0.03$) for cows fed the SC and SHSC diets than for those fed the AH diet. Total VFA concentration did not differ ($P > 0.05$) among diets. Acetic acid (mol/100 mol) was higher and propionic acid (mol/100 mol) was lower for cows fed the SC and SHSC diets than for those fed HF and AH diets. This reflects the higher acetate:propionate ratio for cows fed the SC and SHSC diets. Ruminating (min/d and min/kg of DMI) and chewing (min/d and min/kg of DMI) activities were lower ($P < 0.01$) for cows fed the LF diet, but did not differ among HF, SC, SHSC and AH diets. Rumen mat consistency was lower ($P < 0.05$) for

cows fed the CS diets (LF and HF) than for those fed SC, SHCS and AH diets. NDF from SC, SHSC and AH were as effective as that from CS for maintaining milk fat test and stimulating chewing.

Key Words: Sugar cane, Corn silage, Fiber

W176 The effects of preweaning starter supplement and postweaning protein level on growth rates of Holstein heifers.

U. Moallem*, B. Erez, and R.A. Erdman, *University of Maryland, College Park*.

The study objectives were to test the effects of preweaning starter supplement and postweaning protein concentration on feed intake, body gain and skeletal growth rates from 4 to 180 d of age in dairy heifers. Forty two Holstein calves were individually housed and fed 4.5 kg/d milk replacer from 4 to 50 d age. Calves were fed starter supplements consisting of either a conventional calf starter mix (C) or a course starter mix (CS) containing 15% whole shell corn, 15% cottonseed, 15% ground alfalfa hay, 15% soybean meal, 15% ground corn and 25% whole barley plus minerals and vitamins (as fed basis). Beginning at 60 d, heifers were randomly assigned within pre-weaning groups to isocaloric (2.4 Mcal ME/kg DM) diets containing: low (L) (19.4% CP, 9.9% RUP); medium (M) (22.9% CP, 12.1% RUP); or high (H) (26.5% CP, 14.7% RUP) protein levels until 180 d age. Measurements included daily feed intake and weekly body weights, hip height and wither heights. Starter supplement had no effect on DM intake (0.70 vs 0.69 kg/d; C vs CS) prior to weaning. Postweaning DM intake was 3.75, 3.45, and 3.25 kg/d ($P < 0.001$) for the L, M, and H diets, respectively. There was a starter by protein interaction ($P = 0.06$) where calves fed the CS preweaning diet and L protein diet consumed greater DM postweaning than each of the other groups. Rates of body weight gain were decreased by the M and H diets ($P < 0.06$) while skeletal growth rates were unaffected. These results suggest that feeding a course starter supplement prior to weaning might encourage postweaning feed consumption. Although high dietary protein decreased feed intake and rates of body weight gain, skeletal growth rates were maintained, suggesting heifers fed the high protein diets had increased lean and decreased adipose tissue deposition.

	Protein Level				Treatment	Effects	($P <$)
Item	L	M	H	SEM	Starter (S)	Protein (P)	* S*P
Body weight gain, g/d	844	775	773	0.02	0.33	0.06	0.36
Wither height gain, cm/d	0.146	0.145	0.147	0.005	0.47	0.98	0.67
Hip height gain, cm/d	0.147	0.144	0.150	0.005	0.92	0.77	0.32

Key Words: Protein, Skeletal growth

W177 Physical and chemical properties and ruminal digestion of different corn grani genotypes in cows.

M. San Martn[1], J. C. Elizalde[1], F. J. Santini[2], and G. A. Pieroni[3], [1]*Faculty of Agriculture, Nat. Univ. of Mar del Plata,* [2]*Nat. Res. Agric. Inst. (INTA) Balcarce,* [3]*Manantiales Exp. Res. Sta. Bs As.*.

Two trials were conducted to study physical and chemical properties and ruminal digestion of 39 corn grain genotype. In the first trial physical and chemical properties and ruminal dry matter (DM) and starch (S) degradability (28 h of incubation) of all hybrids ground to 2 mm were evaluated. Three dry Holstein cows (703 kg) fed with 40% alfalfa hay and 60% concentrate were used. Hybrids were classified in colours yellow (Y) orange (O) and red (R) of endosperm according to visual evaluations. Hybrids were tested for: test weight (TW), thousand grain weight (TGW), apparent density (AD), percent floating grain (PFG), milling ratio (MR), colours index of whole (CIW) or ground kernels (CIG) to 2 mm, vitreousness (in eight hybrids evaluated in second trial), CP, NDF, and S. The Y hybrids had less (P<0.05) TW and MR than the average of O and R (78.3 vs 80.2 kg/hl and 3.67 vs 4.62, respectively). The PFG, CIW and CIG was higher (P<0.05) in Y than in O and R (41.0 vs 17.1, 72.9 vs 69.1 and 85.3 vs 83.3, respectively). The Y and O hybrids had higher (P<0.05) TGW (average 354.5g) than R (308.0g). The O and R hybrids (average 83.2%) tended (P<0.10) to had higher vitreousness than Y (72.7%). The CP was lower (P<0.05) in Y (8.6%) than O and R (9.5%). The ruminal degradability of S was higher (P<0.05) in Y (87.0%) than in R (72.7%) while O (73.3%) hybrids was not different (P>0.05) from both. Regressions between grains properties were significant (P<0.05) but only explained about 50% of the variation of ruminal S degradability. In the second trial the kinetics of ruminal DM, CP and S digestion was evaluated (in situ technique) in three Y and R and two O hybrids ground to 2 mm selected according to degradability from the first trial. We used three Holstein steers (621 kg) cannulated in rumen consuming the same diet as the first trial. The Y hybrids had higher (P<0.05) soluble fraction of S (14.3%) than average of O and R (5.23%). The rate of starch digestion was higher in Y (5.77%/h) than R (4.43%/h) hybrids, while O (5.06%/h) was not different (P>0.05) from both. The Y genotypes with low proportion of horny endosperm (lower vitreousness) may have intrinsic features reflected in difference physical and chemical grain properties which also make them more susceptible to ruminal digestion respect to other corn genotypes.

Key Words: Corn grain, Physical, chemical properties, Ruminal digestion

W178 Effect of ground canola on milk fat composition and milk yield of lactating dairy cattle.

M. Chichlowski*, J. W. Schroeder, C. S. Park, W. L. Keller, and D. E. Schimek, *North Dakota State University, Fargo ND/USA*.

The objective of this research was to investigate if blood metabolites and milk yield and composition are affected by adding raw, ground canola seed to the diet of early lactating cows. Twelve primiparous and multiparous Holstein cows (557.1 ± 60.4 kg BW; 28 ± 9 d in lactation) were assigned to one of two treatments: with and without raw canola seed. Diets were comprised of corn silage, alfalfa hay, soybean meal, bloodmeal, vitamins, and minerals and fed ad libitum as a total mixed ration. Canola meal and ground corn in the control diet was replaced by canola seed (14% of diet DM) in the treatment diet. Cows were milked twice daily, housed in tie stalls, and fed individually for 12 wk. Milk yield and DMI were recorded daily. Blood samples were collected at 3-wk intervals. Body weights and body condition scores (BCS) were also recorded at 3-wk intervals. Milk was sampled every 2 wk. Ruminal fluid was collected at the onset and at the end of the experiment. Data were analyzed using MIXED procedures of SAS. Fat corrected milk (3.5%), DMI, BW, and BCS were not different ($P > 0.05$) between treatments. Milk fat, protein, lactose, and solids-not-fat were not altered ($P > 0.05$). Serum glucose, urea nitrogen, and nonesterified fatty acids were not different ($P > 0.05$), whereas serum triglycerides were greater ($P = 0.05$) for cows fed canola seed. Ruminal pH was not different, although ammonia was lower ($P = 0.04$) in fluid from treatment cows. Adding 1.26 kg/d of raw, ground canola seed increases serum triglycerides without negatively affecting milk yield or composition.

Key Words: Canola seed, Lactation, Milk composition

W179 Evaluation of pet food grade poultry protein meal as supplement for lactating dairy cattle fed high fat and fiber rations.

M. A. Canseco, M. A. Froetschel*, H. E. Amos, and J. K. Bernard, *The University of Georgia, Athens, Georgia*.

Twenty-four high producing Holstein dairy cows were used in a randomized complete block design experiment to determine the utilization of pet food grade poultry protein meal (PPM) as a ruminally undegraded protein (RUP) supplement. All cows were fed diets relatively high in both fat and fiber to accentuate the need RUP. Cows in early lactation ranging between 30 and 120 DIM, were blocked into six groups based on their level of milk production. One cow from each block was assigned to each treatment group. The diets contained approximately 55% wheat silage, 31% forage NDF, 15.5% CP and 6.5% fat on a DM basis. Treatments varied due to protein supplementation that are described as: 1)positive control (PC) composed of soybean meal (SBM) and a RUP blend of fish meal, blood meal, and dry distillers grains 2) negative control (NC) composed of only SBM; 3) 50% PPM composed of 50% pet food grade poultry protein meal (PPM) substituted for the RUP blend in treatment 1; and 4)100% PPM composed of 100% substitution of PPM for the RUP blend in treatment 1. Cattle were fed

behind Calan gates a common diet for two weeks and treatment diets for 12 weeks. Daily DM intake (21.9 ± .79 kg) was 10% lower (P <.01) and milk production, corrected to 4% fat (30.6 ± 1.1 kg) was 5.5% lower (P < .1) with cattle fed NC as compared to the other diets. Milk fat, fiber digestibility and body weight loss were all lower in cattle fed NC as compared to other diets. Digestible energy (2.85 ± .07 Mcal/kg) and net energy of lactation (1.54 ± .05 Mcal/kg) was 4.6 and 6.0% (P <.05), lower for NC as compared to the other diets. Efficiency of net energy use did not differ among treatments. Back fat accretion, detected from ultrasonography, was 68% greater in cattle fed NC (.02 vs. .11 cm; P <.05). Blood urea nitrogen (22.6 ± .58 mg/dl) was 3.5% higher in cattle fed NC. In-situ ruminal dry matter and crude protein degradation kinetics were determined on all dietary components. Pet food grade poultry protein meal had a CP k_d of 2.45%/h, a RUP of 58.5% and an intestinal digestibility of 85.4%. These results indicate that cattle fed high fat and fiber diets require more RUP and PPM is an economic alternative for other animal-protein based sources of RUP.

Key Words: Dairy cattle, Rumen undegradable protein

W180 Effects of physically effective NDF on rumen fermentation and digestion of dairy cows fed diets based on barley or corn silage. W. Z. Yang*[1] and K. A. Beauchemin[1], [1]*Agriculture and Agri-Food Canada, Lethbridge, Canada*.

Two studies were conducted to investigate the effects of physically effective (pe) NDF content in dairy cow diets on rumen fermentation and digestion with two forage source. Each study was a double 3 x 3 Latin square design using six lactating dairy cows with ruminal and duodenal cannulas. The treatments included three levels of peNDF (high, medium and low) measured using the Penn State Particle Separator. In study 1, three levels of peNDF were prepared by using original, chopping once or chopping twice of corn silage, which had peNDF content 16.0, 14.8 or 13.2%, for high, medium or low, respectively. In study 2, two cutting barley silages were prepared, coarse (3/8 " TLC) and fine (3/16" TLC). The high, medium or low peNDF diets were formulated using coarse, equal coarse and fine or fine barley silage with peNDF content, 16.1, 14.8 and 13.6%, respectively. Cows were offered ad libitum access to a TMR. Dry matter intake was not affected by the treatments regardless of silage fed. Digestibilities of nutrients in the total tract were significantly increased (P<0.01) (from 67.7 to 71.5% and from 48.5 to 57.5% for OM and NDF, respectively) with increased peNDF content of the diet for cows fed corn silage based diet. However, effect of peNDF content of the barley silage based diet on digestibility in the total tract was limited. Only a quadratic effect of peNDF level on NDF digestibility was observed (P<0.08) when barley silage was fed. In addition, A linear effect (P<0.04) of peNDF content was observed for rumen total VFA concentration and proportion of propionate for cows fed corn silage based diet. However, this effect was not appeared for cows fed barley silage diets. The results suggest that manipulation of the peNDF content of the diet can improve feed digestion and rumen fermentation. However, the magnitude of the improvement depends upon forage source fed to dairy cows.

Key Words: Physically effective NDF, Forage source, Digestion

W181 Increased concentrations of wet corn distillers grains in dairy cow diets. A. R. Hippen*[1], K. N. Linke[1], K. F. Kalscheur[1], D. J. Schingoethe[1], and A. D. Garcia[1], *South Dakota State University, Brookings*.

Sixteen multiparous Holstein cows were used in a replicated 4 × 4 Latin square design to measure the effects of increasing wet corn distillers grains in dairy cow diets. The forage portion of the diets was constant and consisted of (DM basis) 30% corn silage and 15% grass hay. Wet corn distillers grains (WDG) was included at 10, 20, 30, or 40% of the diet DM. The WDG replaced soybean meal, soybean hulls, and animal fat as inclusion rates increased. All diets were balanced to provide (DM basis): 1.65 mcal NEL/kg, 18% CP, 22.8% forage NDF, 20.9% ADF, and 6.5% ether extract. Ruminally undegradable protein was estimated to be near the high end of recommended inclusion rates. Diet DM decreased (46.9, 43.9, 39.4, and 36.5% for 10, 20, 30, and 40% WDG, respectively) as diet WDG increased. Dry matter intakes decreased (P < 0.01) as diet WDG increased (22.9, 23.0, 19.4, and 17.2 kg/d). Milk production also decreased (27.3, 26.9, 25.0, and 25.5 kg/d; P < 0.05) in respect to diet WDG concentration. Concentrations of fat (2.80, 2.90, 2.80, and 2.72%), protein (3.45, 3.55, 3.57, and 3.52%), urea nitrogen (14.9, 15.4, 14.9, and 14.4 mg/dl), and lactose (4.78, 4.86, 4.80, and 4.78%) in milk did not change (P > 0.10) with diets; however, yields of milk fat (0.72, 0.72, 0.68, and 0.67 kg/d), lactose (1.28, 1.25, 1.20, and 1.18 kg/d), and urea nitrogen (41.4, 40.2, 38.9, and 35.7 g/d) were decreased (P < 0.05) by increasing diet WDG. Increasing WDG above 20% of dry matter in diets of lactating dairy cows decreased DMI and yield of milk and milk components.

Key Words: Wet corn distillers grains, Dairy cow, Lactation

W182 Performance of lactating dairy cows fed wet corn gluten feed. G. D. Marx*[1], C. R. Dahlen[1], A. DiConstanzo[2], T. L. Durham[3], and R. T. Ethington[4], [1]*University of Minnesota, Crookston,* [2] *University of Minnesota, St. Paul,* [3] *ADM Corn Processing, Marshall, MN,* [4]*Kansas Feeds, Inc., Dodge City, KS*.

Sixty-nine lactating Holstein cows were used to determine the effects of dietary inclusion of wet corn gluten feed on milk production, component production, and DMI. The objective of the study was to determine the replacement value of CGF for corn grain and soybean meal. Cows were assigned to one of two treatments: 1) diet DM consisting of alfalfa haylage (25%), corn silage (25%), high moisture corn (32.5%), soybean meal (12%), sunflower seeds (3.2%), and a vitamin and mineral supplement; Control (n = 39), or 2) diet DM consisting of alfalfa haylage (23%), corn silage (23%), high moisture corn (20%), wet corn gluten feed (20%), soybean meal (8.5%), sunflower seeds (3.2%), and a vitamin and mineral supplement; CGF (n = 30). Cows were housed in an individual tie-stall barn. Feed was mixed in a truck-mounted TMR and delivered once daily. Milk production was measured daily and feed intakes and refusals were determined once weekly. Body weight and BCS were measured on d 0, 35, and 71 of the experiment. Cows were assigned to one of two dietary treatments based on body weight, BCS, milk production, DIM, and lactation number. Cows were adapted to their respective diet over a period of 14 d prior to the initiation of the 70d trial. General linear models of SAS were utilized to determine statistical significance of the data. Daily milk production, milk fat and milk protein for cows fed CGF were 38.34, 1.28 and 1.21 kg and control cows were 38.18, 1.29 and 1.21 kg. Milk production and milk components did not differ (P>0.05) between treatments. Daily DMI was similar (P>0.05) for both the CGF and control group with 22.65 and 22.04 kg. Average body weight gains during the experimental period for the CGF and control cows were 0.47 and 0.36 kg. Ending BCS of the CGF and control cows were similar with scores of 3.56 and 3.54. No unusual health conditions or nutritional disorders occurred with any of the cows. Results of this feeding trial indicate that the wet corn gluten feed was an acceptable component when fed at 20% of the ration dry matter for lactating dairy cows.

Key Words: Corn gluten feed, Lactating dairy cows, Byproduct feeding

W183 Total antioxidant capacity: A tool for evaluating the nutritional status of dairy heifers and cows. P. Mandebvu*[1,2], J. B. Castillo[1], D. J. Steckley[1], and E. Evans[1], [1]*Maple Leaf Foods Agresearch, Guelph, ON, Canada,,* [2]*W.H. Miner Agricultural Research Institute, Chazy, NY 12921, USA*.

The nutritional status of dairy heifers and multiparous cows in Nova Scotia and Ontario was evaluated by measuring the total antioxidant capacity (TAC) of antioxidants in plasma relative to a synthetic vitamin E analogue. In Nova Scotia 4 heifers, 5 dry cows and 50 lactating cows were fed a TMR containing corn silage, timothy-alfalfa haylage and concentrate for ad libitum intake during the winter, and allowed to graze pasture in addition to receiving supplementary feed in the late spring, summer and early fall. In Ontario 24 dry cows and 111 lactating cows were fed a TMR containing ingredients similar to the TMR fed in Nova Scotia for ad libitum intake throughout the year. Lactating cows had higher TAC levels compared to dry cows (P < 0.01). The TAC levels in cows were higher in Ontario compared to Nova Scotia (P < 0.001), and varied with seasons (P < 0.001). Animals fed different dietary regimes had different TAC levels, suggesting that TAC could be used as a tool to evaluate the nutritional status of animals when different diets or dietary ingredients are being fed, or to evaluate the general nutritional status of animals throughout the year or season.

Site	Season	Dry cows-n	Dry cows TAC mean	Dry cows TAC s.d.	Lact cows-n	Lact cows TAC mean	Lact cows TAC s.d.
Nova Scotia	Fall	5	0.878	0.214	50	0.837	0.163
	Winter	5	0.928	0.053	51	0.997	0.068
	Spring	3	0.923	0.032	44	0.972	0.040
	Summer	7	0.964	0.042	53	0.999	0.041
Ontario	Fall	31	0.956	0.105	193	1.028	0.085
	Winter	25	0.975	0.047	84	0.998	0.045
	Spring	23	1.106	0.054	78	1.127	0.080
	Summer	15	0.967	0.079	89	0.993	0.067

Lact denotes lactating. The mean TAC value forthe 4 heifers used in Nova Scotia was 0.860±0.106.

Key Words: Total antioxidant capacity, Nutritional status, Dairy cows

W184 Utilization of sugarbeet pulp and a high-sugar product for early lactation dairy cows. G. D. Marx*[1], C. R. Dahlen[1], and A. C. Cox[2], [1]*University of Minnesota, Crookston, MN,* [2]*Malt-O-Meal Company, Northfield, MN.*

In the first of two feeding trials, 40 early lactation primiparous and multiparous Holstein cows were assigned equally to either a diet containing 10% sugarbeet pulp (SP) or a control diet containing corn and forage (CF) at equal ration nutrient and DM content. The second trial utilized 18 early lactation cows with three equal treatment groups including a control (C), cows fed 0.45 (S1) or 0.90 kg (S2) of a 24.9% sucrose breakfast cereal product. The objective of these studies was to determine the ration substitution value of these byproducts. Both trials were conducted using a 1 wk standardization period followed by a 12 wk experimental period. Total mixed rations were fed once daily and balanced to meet NRC requirements for high producing cows. All cows were kept in individual tie stalls and fed to appetite plus 1.8 kg adjusted daily according to intake. Daily DMI and feed refusal were measured on each individual cow. General linear models of SAS were used to determine statistical significance of the data. Daily milk production, milk fat and milk protein for cows fed SP were 40.9, 1.34 and 1.24 kg and cows fed CF were 42.1, 1.30 and 1.30 kg and resulted in no differences (P>0.05) between treatments. Peak milk was 47 kg for both SP and CF fed cows. Average daily DMI did not differ between treatments and were 23.8 and 25.1 kg for the SP and CF cows. Average body condition scores were similar for both the SP and CF groups with scores of 3.22 and 3.35. Average daily BW gains of cows during the experimental period for both the SP and CF were 0.18 kg and 0.32 kg. In the second trial, average daily 4% FCM for the C, S1 and S2 treatment groups were 36.7, 34.6 and 34.4 kg. Milk production and milk components were not significant (P>0.05) between groups. Average daily DMI were similar (P>0.05) with 25.0, 24.3 and 24.2 kg for the C, S1 and S2 fed cows. No unusual health conditions or nutrient disorders occurred on either trial. These feeding trials indicate that 10% beet pulp in the diet can be substituted for equal nutrients from corn grain and forage and that a high-sugar breakfast cereal product can be a useful ingredient in lactating dairy cow rations.

Key Words: Sugarbeet pulp, Early lactation cows, Byproduct feeding

W185 The effect of corn silage particle size on eating behavior, chewing activities, and rumen fermentation in lactating dairy cows. P. J. Kononoff*, A. J. Heinrichs, and H. A. Lehman, *The Pennsylvania State University.*

The objective of this experiment was to evaluate effects of reducing corn silage particle size on eating behavior, chewing activity, and rumen fermentation in lactating dairy cows. Four cannulated, multiparous cows (110 ± 4 DIM; 675 ± 70 kg BW) were randomly assigned to a 4 × 4 Latin Square. During each of four periods, animals were offered one of four diets that were chemically similar but varied in corn silage particle size: short (SH), mostly short (MSH), mostly long (MLG), and long (LG). Reducing particle size increased dry matter intake (DMI) linearly (28.0, 26.8, 26.8, 25.7 kg/d for SH, MSH, MLG, and LG respectively). At 8, 16 and 24 h post feeding, the NDF concentration of feed remaining in the bunk decreased linearly with reduced particle size. Time spent eating or ruminating was not different across treatments, however, total chewing activity (TC; sum of time spent eating and ruminating) exhibited a quadratic response with highest chewing activities observed for diets with shortest and longest particle size. Eating or ruminating time per kg of DMI was not affected by corn silage particle size, but TC per kg of DMI decreased linearly with decreasing particle size. In comparison, when expressed as minutes per unit of NDF intake (NDFI), eating, ruminating, and TC were linearly reduced as particle size decreased. Rumen pH was not affected by corn silage particle size even though total concentration of VFA increased linearly from 89.1 mM/L to 93.6 mM/L as diet particle size decreased. The same linear effect was observed for acetate and butyrate concentrations, but propionate exhibited a quadratic effect with the highest concentration observed in animals consuming the shortest ration. Milk yield and protein were similar across diets and averaged 41.6 kg and 2.8%. However, 3.5% FCM showed a quadratic response, with highest production observed on MSH and MLG treatments. Results of this experiment suggest that reducing corn silage particle size may increase DMI, positively affect rumen fermentation, and reduce sorting behavior. Particle size measurement is useful in understanding some factors that affect feeding behavior and rumen fermentation of high producing dairy cows.

Key Words: Eating behavior, pH, Rumination

W186 Effect of forage to concentrate ratio on the efficiency of utilization of energy for milk production in dairy cows. E. Kebreab*[1], J. France[1], J.A.N. Mills[1], L. A. Crompton[1], R. E. Agnew[2], and T. Yan[2], [1]*The University of Reading, Reading, United Kingdom,* [2]*The Agricultural Research Institute of Northern Ireland, Hillsborough, United Kingdom.*

The objective of the study was to investigate the effect of quantity of concentrate in dairy cow diets on the efficiency of utilization of metabolizable energy intake (MEI) for milk production (k_l). A database containing 652 dairy cow observations was assembled from calorimetry studies in the UK. The dataset was subdivided into four sets containing diets with a forage:concentrate ratio of 0.10 to 0.39 (FC1), 0.40 to 0.74 (FC2), 0.75 to 0.99 (FC3) and 1.0 (all forage, FC4). The following equation was fitted to the dataset:
$E_l = a + b\ [MEI - (T_g/k_g)] - (T_l \times k_t) + \epsilon$,
where E_l is milk energy (MJ/kg $W^{0.75}$/d), a is the intercept and b is k_l. T_g and T_l (both in MJ/ kg $W^{0.75}$/d) are tissue energy gain and loss respectively, k_g and k_t are the efficiencies of utilization of energy for growth and body stores for milk production respectively, and ϵ is an error term. Meta-analysis of the data using a nonlinear mixed model procedure estimated the values of k_g and k_t to be 0.84 and 0.66 respectively, which were significantly different from previous reports of 0.6 for k_g and 0.84 for k_t. The value of k_l was estimated to be 0.60 (SE 0.0054), 0.59 (SE 0.0069), 0.60 (SE 0.0018) and 0.40 (SE 0.051) for FC1, FC2, FC3 and FC4 subsets, respectively. There was no significant difference in the estimate of k_l among forage:concentrate ratios of 0.1 to 0.99 (FC1, FC2 and FC3). However, there was a very significant difference in k_l when compared to cows fed diets containing forage only. It appears that dietary energy consumption is converted to milk energy with an average efficiency of about 60% in cows consuming diets containing concentrates but in cows fed concentrate free diets, the efficiency decreased by about 40%.

Key Words: Energy utilization, Dairy cows, Forage:concentrate ratio

W187 Estimation of mean ruminal retention time of DNDF in dairy cows based on combined data from rumen evacuations and marker excretion curves. P. Lund*, M. R. Weisbjerg, and T. Hvelplund, *Danish Institute of Agricultural Sciences, Denmark.*

Mean retention time (MRT) of digestible neutral detergent fiber (DNDF) has been determined *in vivo* in fistulated Holstein dairy cows, based on the ratio between rumen pool size determined using rumen evacuations and rumen output. However, uncritical use of this method for calculation of MRT of DNDF overestimates MRT, due to the contemporary digestion and passage, as the one compartment model does not account for selective retention. We propose that MRT of DNDF can be calculated as MRT_{COR} by solving the equation: $(k_d \cdot k_p)(y\text{-}y^2) \cdot MRT_{COR}{}^2 + k_p \cdot MRT_{COR} - 1 = 0$, based on an equation by Allen & Mertens (1988), and where fractional rates of digestion (k_d) and passage (k_p) of DNDF are obtained using the rumen evacuation method, and the distribution of MRT_{COR} between the first (y) and the second

compartment (1-y), y[0;1], can be estimated from duodenal excretion curves of ytterbium and MRT of INDF. MRT and MRT_{COR} of DNDF were evaluated in four 4x4 latin square experiments. Two hays [grass (GH) and alfalfa (AH)] and six silages [early cut grass (ECGS), late cut grass (LCGS), whole crop barley (WCBS), corn (CS), whole crop pea (WCPS) and clover/grass (CGS)] were fed *ad libitum* to dry cows or cows in late lactation as the only feed (Unsuppl.), or supplemented with concentrate (5.8 kg DM/day) high in starch and low in NDF and fed to cows in early or mid-lactation (Suppl.). DNDF was determined from 21 d rumen *in situ* incubations. MRT_{COR} varied from 59 h for CS (Unsuppl.) to 129 h for EGS (Unsuppl.). MRT estimated from the rumen evacuation method was overestimated with on average 46 h, equal to 47% compared to MRT_{COR}. MRT_{COR} for DNDF was on average 29 h higher than MRT for INDF, indicating a selective retention.

Unsuppl.[a]	ECGS	LCGS	WCBS	GH
MRT	213±33	144±33	111±33	177±33
MRT_{COR}	129±25	88±25	78±26	112±37
Suppl.[a]	ECGS	LCGS	WCBS	GH
MRT	117±4	97±3	72±3	98±3
MRT_{COR}	94±5	75±4	65±4	76±4
Unsuppl.[b]	AH	CS	CGS	GH
MRT	206±71	86±4	180±24	225±39
MRT_{COR}	108±26	59±3	103±10	130±14
Suppl.[a]	AH	CS	PS	GH
MRT	115±14	67±14	111±14	114±14
MRT_{COR}	70±10	51±10	92±10	81±10

[a]Lsmean [b]Mean

Key Words: Kinetics, NDF, Selective retention

W188 Prediction of Elephantgrass (*Pennisetum purpureum*, Schum.) dry matter intake and rumen-fill of lactating cows from degradation characteristics. J.P.G. Soares[1,4], L.J.M. Aroeira*[2], T. T. Berchielli[3], F. Deresz[2], R. S. Verneque[2], and P. Andrade[3], [1]*Embrapa Rondonia, Porto Velho-RO-Brasil,* [2]*Embrapa Gado de Leite, Juiz de Fora-MG-Brasil,* [3]*FCAVJ/UNESP , Jaboticabal-SP-Brasil,* [4]*Part of Ph.D. Thesis of the 1st author at FCAV/UNESP- Jaboticabal, Supported by FAPESP.*

The goal of this trial was to compare the DMI and NDF rumen fill, directly measured of fistulated crossbred cows, with milk production averaging 13.5 kg, with the results estimated by different equations based on elephantgrass rumen degradation parameters. The experimental design was a Latin Square (3 x 3), with three cows, three periods and three treatments (chopped elephant grass harvested at 30, 45 and 60 days, offered*ad libitum*). The Latin Square was repeated three times over time. Within each treatment a split-plot design was included four schedules of ruminal evacuation: 0, 2, 4 and 6 hours after feeding. Daily DMI were measured in a Calan Gates system by the difference between offered and refused feed. The different equations based on in situ degradation parameters were: DMI = -1.19 + 0.035 (a+ b) + 28.5c(**1**), DMI = [%FDN]*[NDFI]/[(1-a-b)/K_P+b/(c+ k_p)]/24](**2**),DMI= -0.822+0.0748(a+b)+40.7c (**3**)and DMI=[%FDN]*[consumption of FDN]/[(1-a-b)/K_P+b/(c+k_P)]/24]-(**using directly measured values**)(**4**). The equations overestimated the average DMI obtained directly (9.0 kg/cow/day) in Calan-Gates, except the equation (**3**) that underestimated (7.7 kg/cow/day). The mean elephantgrass DMI of 13.7 and 13.4 kg/cow/day obtained, respectively, in the equations (**1**) and (**2**) were similar (P>.05) and both are higher (P<.05) than the 9.7 kg/cow/day obtained in the equation (**4**). The values measured directly in Calan-Gates (9.0 kg/cow/day) were similar (P>.05) to the 9.7 kg/cow/day,obtained by the equation (**4**) and higher (P<.05) than the 7.7 kg/cow/day obtained by the equation (**3**). The average NDF rumen fill (7.5 kg) was higher (P<.05) than the mean value (5.2 kg) estimated by the equation (**2**). The prediction equations based on rumen degradation characteristics were not efficient in the DMI and NDF rumen fill estimations of chopped elephantgrass harvested with 30, 45 and 60 days of age.

Key Words: Elephant grass, Prediction equations, Rumen fill

W189 The effect of amylase on rumen development in neonatal dairy calves. A. M. Gehamn, A. J. Heinrichs*, M. R. Long, and K. E. Lesmeister, *The Pennsylvania State University.*

Fifteen Holstein bull calves were fed 0, 6, or 12 g/d of amylase (Amaize, Alltech Inc.) in calf feed to compare rumen development from birth to 5 weeks of age. Calves received milk replacer (20% all-milk protein, 20% fat) reconstituted to 12.5% dry matter twice daily at 10% of arrival body weight/d. Calf starter and water were fed once a day on an ad-lib basis. Body weight, heart girth, withers height, and hip width were measured at birth and weekly thereafter at 4 h post a.m. feeding. Fecal and health scores were monitored daily. Blood samples were taken at each weekly weighing via jugular venipuncture and analyzed for hematocrit and beta-hydroxybutyrate. Calves were euthanized at 35 d of age, and GI tracts and rumens were harvested. Papillae length, width, papillae per cm^2, and rumen wall thickness were measured in 9 regions to quantify development in the entire reticulorumen. Regions sampled included: caudal portion of the caudal ventral blind sac, right and left caudal dorsal blind sac, right and left cranial dorsal blind sac, right and left cranial ventral sac, and right and left caudal ventral blind sac. Milk and grain intake were similar for all treatments. Papillae length was greater ($P < 0.10$) for the 6 g treatment in 4 areas when compared to the 12 g treatment and one area compared to control. Papillae width was greater ($P < 0.05$) in 6 areas for the 6 g group compared to the control and greater in 4 areas compared to the 12 g treatment. Papillae length and width were similar in all regions for the 12 g group and control. Number of papillae per cm^2 was greater ($P \leq 0.05$) for the 6 g treatment than the control in 3 regions. More papillae per cm^2 were observed for the 12 g treatment compared to the 6 g treatment in 2 regions; the 12 g treatment also had more papillae per cm^2 than the control in 2 regions. Rumen wall thickness and blood beta-hydroxybutyrate were not affected by treatment. All animal growth measurements were similar for all treatments. When fed at 6 g/calf per d, amylase appeared to be beneficial in increasing rumen papillae length and width in 5-wk-old dairy calves. Results of feeding higher levels of amylase generally were not different from controls, except in papillae counts.

Key Words: Calves, Rumen development, Amylase

W190 Grain processing, forage:concentrate, and forage length effects on ruminal N degradation and flows of amino acids to duodenum in lactating dairy cows. W. Z. Yang*[1], K. A. Beauchemin[1], and L. M. Rode[2], [1]*Agriculture and Agri-Food Canada, Lethbridge, Canada,* [2]*Rosebud Technologies Development, Ltd. Lethbridge, Canada.*

The objectives of this study were to evaluate effects of dietary factors on rumen N degradation, microbial protein synthesis and amino acid (AA) flows to the duodenum. The experiment was a double 4×4 Quasi-Latin square with a 2^3 factorial arrangement of treatments. The dietary factors were extent of barley grain processing, coarse (processing index [PI]=75.5%) or flat (PI=60.2%); forage to concentrate (F:C) ratio, low (35:65) or high (55:45); and forage particle length (FPL), long (7.59 mm) or short (6.08 mm). Eight lactating cows with ruminal and duodenal cannulas were offered ad libitum access to a TMR. Passage of microbial protein to the duodenum was improved ($P<0.09$) with increased F:C of the diet but was not affected by grain processing or FPL. Ruminal digestibility of N was increased ($P<0.04$) by 21 or 18% with increased F:C or reduced FPL, respectively. Increased grain processing enhanced ($P<0.08$) duodenal flows of AA from 2.0 to 2.3 kg/d. In contrast, reducing FPL tended to lower ($P<0.15$) flows of AA to the duodenum. Increased F:C of the diet did not change flow of total AA (2.2 kg/d), but there was a reduced ($P<0.05$) flow of dietary AA (0.90 vs 0.60 kg/d) and increased ($P<0.05$) flow of microbial AA (1.27 vs 1.55 kg/d). An interaction between grain processing and FPL was detected for flows of AA. Diets formulated with flatly rolled barley plus long FPL consistently increased ($P<0.05$) Arg, His, Thr, Asp, Glu, Ser, Tyr, total, EAA and NEAA by more than 40% compared to other combinations of grain processing and FPL. The results indicate that manipulation of dairy cow diets can improve ruminal N degradation and flows of AA to duodenum. Combining dietary factors can be more beneficial than changing individual dietary factors for improving the delivery of AA to the small intestine.

Key Words: Grain processing, Forage particle length, Amino acid flow

W191 Grain processing, forage:concentrate, and forage length effects on intestinal digestibility of amino acids by lactating dairy cows. W. Z. Yang*[1], K. A. Beauchemin[1], and L. M. Rode[2], [1]*Agriculture and Agri-Food Canada, Lethbridge, Canada,* [2]*Rosebud Technologies Development, Ltd. Lethbridge, Canada.*

Eight lactating cows with ruminal and duodenal cannulas were used in a study designed as a double 4×4 Quasi-Latin square with a 2^3 factorial arrangement of treatments to examine effects of dietary factors on digestibility of amino acids (AA) in the intestine. The dietary factors were extent of barley grain processing, coarse (processing index [PI]=75.5%) or flat (PI=60.2%); forage to concentrate (F:C) ratio, low (35:65) or high (55:45); and forage particle length (FPL), long (7.59 mm) or short (6.08 mm). Cows were offered ad libitum access to a TMR. Increased grain processing improved ($P<0.05$) N digestibility both in the intestine (15%) and in the total tract (8%). Reduction in the FPL of the diets reduced ($P<0.05$) intestinal N digestion by 14% without affecting the N digestion in the total tract. Digestibility of essential AA in the intestine (68%) was higher ($P<0.05$) than that of nonessential AA (63%) but digestion of total AA (65%) was similar to that of total N (66%), confirming that intestinal N digestibility is a good predictor of total AA digestibility in the intestine. Digestibilities of individual AA in the intestine ranged from 46 to 77%, and were improved ($P<0.05$) with increasing grain processing. However, effects of F:C or FPL on digestion of AA were limited. Similarly, amount of AA absorbed in the intestine (range of 1.25 to 1.59 kg/d) was increased ($P<0.03$) with increasing grain processing. The magnitude of increase (27%) in the amount of absorbed AA was much higher than the increase (6%) in digestibility, indicating that actual quantity of AA absorbed depends largely on the amounts entering the duodenum. Dietary treatments resulted in no differences in the ranking of limiting AA relative to milk protein synthesis. The results indicate that manipulation of dairy cow diets, especially grain processing, can significantly improve AA availability in the intestine.

Key Words: Grain processing, Forage length, Amino acid digestion

W192 Chemical composition of sugar cane varieties (Saccharum spp l.) with different cycles of production in three cut time. A. Fernandes*[1], A. Queiroz[2], L. Cabral[3], E. Pereira[4], and A. Arruda[4], [1]*Universidade Estadual do Norte Fluminense,* [2]*Universidade Federal de Viçosa,* [3]*Universidade Estadual do Oeste do Paraná,* [4]*Universidade Estadual do Oeste do Paraná.*

The objectives of this work were to determine the chemical composition, the potentialy degradable fraction of NDF (B2) and undegradable fraction (C) and to estimate the ruminal fill of sugar cane with different cycles of production (early and intermediate), in three cut times (426, 487 and 549 days). The laboratorial analysis consisted in dry matter (DM), organic matter, ash, crude protein (CP), ether extract, lignin, neutral detergent fiber (NDF), neutral detergent fiber corrected for ash and protein, acid detergent fiber (ADF), neutral detergent insoluble protein, acid detergent insoluble protein and neutral detergent protein soluble. The TDN was calculated by chemical composition. The degradable and undegradable fractions, and fiber digestion rate, as well as the ruminal fill were estimated by kinetic parameters obtained throught in situ incubation. The advanced cut time increased the DM in 9.5 percentage. The intermediate varieties presented higher TDN than early varieties, which had the highest contents of NDF and ADF, whose respective values were 487.56 and 471.03, and 287.87 and 247.54 g/kg DM for the early and intermediate varieties, respectively. The TDN increased linearly with the cut time, varying from 62.45 to 63.50 percentage however the NDF and ADF contents presented quadratic behavior. The early varieties presented higher content of CP than the intermediate only in the cut time of 549 days; contrarily, the brix of the sugar cane was superior to the intermediate varieties in the last cut. The early varieties presented larger total ruminal fill and lower fiber digestion rate. The degradable fraction of the fiber was reduced and the undegradable fraction was linearly increased with the age of the plants.

Key Words: Carbohydrate, Sugar cane, Ruminal degradation

W193 Statistical properties of nutrients within selected conserved forages. P. R. Tozer*, *Pennsylvania State University.*

Nutrient analysis data from three conserved forages: corn silage; alfalfa silage; and alfalfa hay were used to determine the statistical properties of the nutrients within each forage. The data was collected from a commercial feed analysis laboratory in the northeast of the US. Distributions of 16 nutrients were studied: these nutrients were dry matter (DM), crude protein (CP), soluble protein (SP), acid detergent fiber (ADF), neutral detergent fiber (NDF), lignin, ash, non-structural carbohydrates (NSC), calcium, phosphorous, magnesium, potassium, iron, manganese, zinc, and copper. The nutrient distributions were analyzed for higher order statistical properties, including skewness and kurtosis. These properties indicate whether the nutrients are distributed normally. Of the 48 nutrients examined, all showed statistically significant differences from the normal distribution. Correlation analysis also showed that many nutrients exhibited strong relationships with others within the same feed. In conclusion the results suggest that the assumption of normally distributed nutrients, within the feeds examined, does not hold. This may have important implications for livestock producers, ration formulators and researchers when they attempt to provide rations that are of consistent quality to achieve the goals of the livestock business, or to quantify or qualify the response of animals to a particular nutrient or nutrition program.

Key Words: forages, nutrient composition, normality

W194 Effect of feeding a live yeast product (LYP) to bull calves with failure of passive transfer on performance and patterns of antibiotic resistance. K. N. Galvao*, S. O. Juchem, A. Coscioni, M. Villaséor, W. M. Sischo, J.E.P. Santos, P. G Nunes, and C. J. Pinto, *University of California - Davis.*

Objectives were to determine the effects of a LYP on performance and patterns of antibiotic resistance in fecal Escherichia coli in dairy calves. Forty-eight Holstein calves, 6 d of age with serum total protein (STP) below 5.2 g/dl and IgG below 1.5 g/dl, were blocked by body weight (BW) and STP and randomly assigned to one of four treatments: 1. no added LYP (Control); 2. LYP added to the starter grain (LYG; Saccharomyces cerevisiae; Levucell SC); 3. LYP added to the milk replacer (LYMR; S. cerevisiae, spp boulardii; Levucell SB); and 4. LYP added to the starter grain and to the milk replacer (LYGMR). Calves were offered 440 g of milk replacer DM containing 20% CP and 20% fat for the first 42 d of study and grain (18.1% CP and 3.1 Mcal of ME/kg) for ad libitum intake. Calves were weighed every 2 wk during 84-d study. Blood was sampled weekly for analyses of concentrations of glucose and -hydroxybutyrate. A fecal swab was collected from every calf every 2 wk for isolation of E. coli and determination of antibiotic resistance patterns. Continuous, binomial, and count data were analyzed using the MIXED, LOGISTIC, and GENMOD procedures of SAS (2001), respectively. Grain intakes (g/d) tended to be higher (P=0.07) for calves fed LYP prior to and after weaning and they were, respectively, 438 and 2194 for Controls, 682 and 2576 for LYG, 611 and 2379 for LYMR, and 500 and 2400 for LYGMR. Feeding LYP improved BW gain prior to weaning (298 vs 420 g/d; P=0.04), but not after weaning (907 vs 996 g/d; P=0.27). Feed efficiency (DM intake/BW change) was unaffected by treatment (P=0.40). Plasma glucose was higher for calves fed LYP than controls (74.3 vs 78.9 mg/dl; P=0.02). Number of days with diarrhea prior to weaning tended to be lower for calves fed LYP compared to controls (5.8 vs 4.4; P=0.06). Patterns of antibiotic resistance in E. coli were affected by age of calves, but not by treatment. Addition of a LYP to the diet of calves with failure of passive transfer has the potential to improve animal performance by increasing feed intake and decreasing days with diarrhea.

Key Words: Yeast, Calves, Antibiotic resistance

W195 Effect of age on ruminal fermentation in growing calves fed high concentrate diets with two levels of NDF. A. Rotger, A. Ferret*, S. Calsamiglia, and X. Manteca, *Universitat Autonoma de Barcelona.*

There is limited information on rumen development in calves from weaning to 250 kg BW on ruminal fermentation profile (VFA, ammonia nitrogen concentration, pH and ruminal passage rate). Six female Holstein calves (initial BW 81.1 3.2 kg) fitted with ruminal cannula were used

to describe the changes in the rumen fermentation profile during the growth period. Animals were offered ad libitum one of two TMR diets (15% CP; 2.75 Mcal ME/kg DM). The diets differed in the forage to concentrate ratio (11 to 89 vs. 30 to 70) and the NDF level (19% vs. 28%). A repeated measure trial with three experimental periods at 85, 155 and 258 kg of BW was conducted. Data were analyzed using the PROC MIXED procedure of SAS for a completely randomized design. The model contained effects of diet, period and their interaction. Animal was the random effect and period the repeated factor. Intake of DM increased with age and no differences were observed in the intake of DM, OM, CP and NDF between treatments even when the offered diets were different in the NDF content, suggesting that animals selected feed ingredients. Diet and age had no significant effect on average ruminal pH (6.36 0.16) or on the time pH was below 5.8 (5.1 3.8 h). Ammonia nitrogen concentration was lower in the high fiber diet (5.5 vs.13.1; $P < 0.05$). Diet had no effect on total and individual VFA concentrations. Total VFA concentration ($P < 0.05$) and molar percentage of propionic acid ($P < 0.01$) increased with age. Molar percentage of acetic acid ($P < 0.05$) and the acetic to propionic ratio ($P < 0.01$) decreased with age. Solid passage rate, estimated with chromium, was not affected by diet or age (0.063 0.0033 /h). Liquid passage rate, estimated with Co-EDTA, increased with age ($P < 0.05$) and was higher in the high NDF diet. Overall, ruminal fermentation seemed to increase with age presenting no problems of acidosis. The lack of significant differences between diets could be explained by no differences in nutrient intake.

Key Words: Age, Calves, Ruminal fermentation

W196 Effect of age on in situ degradation kinetics of plant protein supplements in growing calves fed high concentrate diets with two levels of NDF. A. Rotger, A. Ferret*, S. Calsamiglia, and X. Manteca, *Universitat Autonoma de Barcelona.*

Six female Holstein calves (initial body weight 81.1 3.25 kg) fitted with ruminal cannula were used to study the effect of age and NDF intake on degradation kinetics of plant protein supplements. Animals were offered one of two TMR (15% CP; 2.75 Mcal ME/kg DM) ad libitum. The two diets differed in the forage to concentrate ratio (11 to 89 vs. 30 to 70) and the NDF level (19% vs. 28%). Three experimental periods were conduced at 85, 155 and 258 kg of BW in this repeated measure trial. Degradation kinetics of CP of four protein supplements (peas, soybean meal, lupin seeds and sunflower meal) and degradation kinetics of NDF of alfalfa hay were estimated with in situ incubations. A fractional passage rate of 0.06 /h was used to estimate ruminal degradability. Data were analyzed using the PROC MIXED procedure of SAS for a completely randomized design. The model contained fixed effects of diet, period and their interaction. Animal was the random effect and period the repeated factor. Intake of DM increased with age. There were no differences in the intake of DM, OM, CP and NDF between treatments even the differences in the offered rations, suggesting that animals selected feed ingredients. Degradation of CP increased with age ($P < 0.01$) in sunflower meal and tended to increase in peas and lupin seeds ($P < 0.10$). Degradability of CP in lupin seeds ($P < 0.01$) and NDF in alfalfa hay ($P < 0.05$) was higher in the high NDF diet. Age and diet had no significant effect on the soluble or potentially degradable fraction of any protein supplement. The fractional rate of degradation increased with age ($P < 0.10$) in all plant protein supplements except for soybean meal. In general, protein degradability and the fractional rate of degradation increased with age suggesting an increase in the fermentative potential of the rumen. The similar nutrient intake between diets may be responsible for the lack of diet effect on CP degradation in most supplements.

Key Words: Age, Calves, CP degradation

W197 Effect of substitution of a corn-canola meal blend by cull chickpeas on apparent digestibility of diets for sheep. J. F. Obregon*, R. Barajas, and A. Estrada, *FMVZ-Universidad Autnoma de Sinaloa (Mxico).*

To determining the effect of substitution of a corn-canola meal blend by cull chickpeas on apparent digestibility of diets for sheep, a digestibility experiment was conducted. Four Pelibuey sheep, males (BW=25±0.79 kg) were used in a cross over design experiment. The animals were placed individually in metabolic crates (0.6×1.2 m), and were randomly assigned to consume one of two diets in that consists the treatments: Treatment 1) Diet 14.77 % of CP and 3.36 Mcal of DE/kg, containig (DM basis), ground corn 55 %, canola meal 12 %, sudan grass hay 18 %, sugarcane molasses 12 %, urea 0.8 %, limestone 1.2 %, and mineral premix 1 % (control); and Treatment 2)Diet 14.88 % CP and 3.47 Mcal DE/kg, containing ground corn 28 %, cull chickpeas 39 %, sudan grass hay 18 %, sugarcane molasses 12 %, urea 0.8 %, limestone 1.2 %, and mineral premix 1 %. Diets were offered twice a day (800 and 1600 h), after six days of adaptation period, samples of diets (1 kg) and the total of feces produced were collected during four continuous days. Samples were dried, and weighed. DM and CP analyses were performed, and apparent digestibility was calculated. The inclusion of cull chickpeas not affected ($P>0.10$) dry matter digestibility of the diet with values of 77.5 % vs. 77.1 % for control and chickpeas diet, respectively. The digestibility of crude protein was similar between treatments (3.31 vs. 3.30 Mcal/kg), as consequence of that, the DE content of cull chickpeas was estimate to be proximate to 3.66 Mcal/kg, that is the calculate DE value for the 31:69 corn-canola meal blend that was substituted by cull chickpeas in the diet. It is concluded, that cull chickpeas can be include up to 40 % in sheep diets substituting usual ingredients as corn or canola meal, and that its DE content is close to 3.66 Mcal/kg.

Key Words: Cull chickpeas, Canola meal, Digestibility

W198 Silage characteristics,apparent digestibility,and performance of lambs fed apple pomace ensiled with different levels of wheat straw. F. T. Sleiman*, R. A. Sarkis, M. G. Uwayjan, E. K. Barbour, M. T. Farran, and M. N. Nimah, *American University of Beirut, Beirut, Lebanon.*

Fermentation characteristics,consumption and apparent digestibility of apple pomace(AP) ensiled with different levels of wheat straw(WS) were studied using 12 Awassi ram lambs averaging 58kg BW.The study was conducted for a 4wk trial with 1wk collection period.The experimental treatments were: I)100% AP silage(APS), II)100% barley silage(BS)as control, III)70% APS + 30% WS and IV)60% APS + 40% WS.In addition to ad libitum silage feeding, each lamb received 0.8kg concentrate(14% CP on DM basis)per day.Changes in temperature of ensiled AP(treatments I,III and IV)were not significantly different ($P>0.05$) at 7 and 21d after ensiling(18.5, 21.5 and 19.5 C) and (13.0, 15.2 and 14.1 C), respectively. PH of APS treatments were significantly different ($P<0.05$)with treatment I having the lowest value by 7 and 21d after ensiling (3.4 Vs 3.9 and 4.3) and (3.3 Vs 3.9 and 4.1), respectively. Silage DMI of treatments IV and II(control)were similar but not significantly higher ($P>0.05$) than those of I and III (0.5 Vs 0.3 and 0.3kg/h/d), respectively. All lambs gained weight by the end of trial. The highest but not significantly different ($P>0.05$) BWC was recorded for treatment IV as compared to I, II and III (0.39 Vs 0.14, 0.15 and 0.16 kg/h/d),respectively. Similarly, the highest but not significantly different ($P>0.05$) apparent DM digestibility was observed for treatment IV as compared to I, II and III(73.9 Vs 72.3, 72.6 and 71.6%),respectively. In addition, treatment IV had significantly higher($P<0.05$) digestibility of CF (67.9 Vs 48.6, 57.7 and 55.5%), ADF (63 Vs 43.4, 53.5 and 45.0) and NDF (68.5 Vs 67.3, 61.1 and 59.3%)as compared to I,II and III,respectively. Results of this study indicate that ensiling wheat straw with apple pomace improved silage fermentation characteristics,apparent digestibility and animal response.

Key Words: Apple pomace silage, Apparent digestibility, Ram lambs

W199 Effect of substitution of alfalfa hay by hay from long time stored mature Clitoria ternatea on apparent digestibility of diets for growing sheep. A. Estrada*, R. Barajas, and J. F. Obregon, [1]*FMVZ-Universidad Autonoma de Sinaloa (México).*

With the objective of determining the effect of substitution of alfalfa hay by hay from long time stored mature Clitoria ternatea on apparent digestibility of diets for growing sheep, a digestibility experiment by total fecal collection was conducted. Four Pelibuey sheep, males (BW=12.37 kg) were used in a cross over design experiment. the animals were placed individually in metabolic crates (0.6 x 1.2 m), and randomly were assigned to consume one of two diets in that consists the treatments: 1)Diet 18.3% of CP and 3.015 Mcal of DE/kg, containing (DM basis), alfalfa hay 50%, ground corn 27.8%, soybean meal 9.75%, sugar cane molasses 9.58%, urea 0.57%, limestone 1.15%, and mineral premix 1.15% (control); and 2)Diet similar to control, but containing 50% of hay obtained from Clitoria ternatea harvested at 57 days after previous cut and stored by one year, that substitute all alfalfa hay of

the control diet. Diets were offered twice a day (800 and 1600 h), after six day of adaptation period, samples of diets (1 kg) and the total of feces produced were collected during four continuous days. Samples were dried, and weighed. DM and CP analyses were performed, and apparent digestibility was calculated. Clitoria hay diminished (P=0.02) in 14.5% the dry matter digestibility of the diets, with values of 63.4% and 74.1% for clitoria hay and alfalfa hay diets, respectively. Crude protein digestibility, tended (P=0.06) to be 6% lower in the clitoria hay diet than alfalfa hay diet (73.1% vs. 78.0%). The DE content of the diet was decreased (P<0.05) in 14.9% by inclusion of clitoria hay (2.692 vs. 3.164 Mcal/kg). The observed/expected DE of the diet was lower (P<0.05) in clitoria hay diet (0.89)than in alfalfa hay diet (1.05).The digestibility of DM of clitoria was calculate to be 21% lower than alfalfa DM digestibility. The CP of clitoria was 10% less digestible than alfalfa CP, and the DE content of the mature clitoria was calculate to be near of 2.2 Mcal/kg. It is concluded, than Clitoria ternatea harvested after bloom is not a good substitute of alfalfa in diets for growing sheep.

Key Words: Clitoria ternatea, Alfalfa hay, Digestibility

W200 Effect of substitution of alfalfa hay by clitoria hay (Clitoria ternatea L.) on performance of sheep feed growing diets. A. Estrada*, R. Barajas, and J. F. Obregon, *FMVZ-Universidad Autonoma de Sinaloa (Mexico)*.

To determine the effect of substitution of alfalfa hay by cltoria hay (Clitoria ternatea L.) on performance of sheep fed growing diets, a 28 days growth performance experiment was conducted. Twenty-four pelibuey sheep, male (initial BW=15.23 kg) were used in a complete randomized block design experiment. The animals were weighed and grouped by weigh, in groups of three they were allocated in one of eight ground soil pen (2x3 m), fitted with metal feed bunks (1x0.33 m)and drinkers. The pens inside of blocks were randomly assigned one of two diets in that consists the treatments: 1)Diet 18.3% of CP and 3.015 Mcal of DE/kg, containing (DM basis), alfalfa hay 50% (18.01% CP), ground corn 27.8%, soybean meal 9.75%, sugar cane molasses 9.58%, urea 0.57%, limestone 1.15%, and mineral premix 1.15% (control); and 2)Diet as control, but containing 50% of clitoria hay (19.09% CP), that sustitute all alfalfa hay of the control diet. The animals were weighed at day 1 and 28 of experiment, DM intake was recorded daily. The mean final weight of experiment was 20.77 kg and was not altered (P=0.58) by roughage source in diets. Dry Matter intake was not affected (P=0.67) by treatments with values of 0.876 and 0.884 kg/day for alfalfa and clitoria diets, respectively. Average daily gain was similar (P=0.76) for both treatments with means of 0.197 and 0.199 kg/day for alfalfa and clitoria diets, respectively. There are not differences (P=0.98) in the dry matter intake/ADG ratio, with values of 4.45 and 4.24 kg/kg for alfalfa hay and clitoria hay diets respectively. It is concluded that clitoria hay can be included up to 50% in the diets of growing sheep substituting alfalfa hay without detrimental effect on performance.

Key Words: Clitoria ternatea, Alfalfa hay, sheep

W201 Ruminal degradation of dry matter of sudan grass hay grew in a subtropical weather, harvested at two ages in rumen of sheep using nylon bag technique. R. Barajas*[1], J.F. Obregon[1], and A. Estrada[1], [1]*FMVZ-Universidad Autnoma de Sinaloa (Mxico)*.

With the objective of determining the ruminal degradation of dry matter of sudan grass hay grew in a subtropical weather, harvested at two ages in rumen of sheep using nylon bag technique, four sheep (Pelibuey, males BW=34 kg) fitted with ruminal cannula were used. The animals were individually placed in concrete flour pens (1.5×2 m), and fed twice a day (800 and 1600 h) with a 37:63 roughage:concentrate diet. Nylon bags (10×18 cm) containing 5 g of sudan grass hay harvested 60 days after homogenization cut (SGH-60), or sudan grass hay harvested 90 days after homogenization cut (SGH-90), in agreement with a complete randomly experiment design, were randomly designed to be incubated in rumen of sheep during 24, 48, and 72 hours. Once complete the incubation time, the bags were washed with tap water, dried, and DM was determinate. Solubility was measured by five minutes inmersion of bags in a 0.15 N solution of NaCl at 39 Celsius degrees. The solubility of DM of SGH-60 was higher (P<0.05) than SGH-90 (10.6 % vs. 8.5 %). Rumen degradability of DM from SGH-60 at 24 h incubation time was higher (P<0.05) than the correspondent to SGH-90 (40.3 % vs. 30.1 %). At 48 h incubation time, the digestibility of DM from SGH-60 suppers (P<0.05) to DM ruminal degradability of DM of SGH-90 (44.1 % vs. 39.7 %). After 72 h of incubation in rumen, the degradability of DM of SGH-60 continued be higher (P<0.05) than DM of SGH-90 (47.4 % vs. 44.1 %). It is concluded, that sudan grass grew in a subtropical weather, needs be harvested near of 60 days after previous cutting, to prevent loosing of its nutritional value as roughage for ruminants.

Key Words: Sudan grass, Sheep, Rumen degradability

W202 Effect of substitution of sesame meal by cotton seed meal on apparent digestibility of diets for sheep. R. Barajas*, J. F. Obregon, and J. J. Portillo, *FMVZ-Universidad Autónoma de Sinaloa (México)*.

With the objective of determining the effect of substitution of cotton seed meal by sesame meal on apparent digestibility in diets for sheep, a digestibility experiment was conducted. Four Pelibuey sheep, males (BW=21.25±0.95 kg)were used in a cross over design experiment. The animals were placed individually in metabolic crates (0.6×1.2 m), and were randomly assigned to consume one of two diets in that consists the treatments: 1) Diet 19.6 % of CP and 3.106 Mcal of DE/kg, containing (DM basis), cotton seed meal 29.7 %, ground corn 37.3 %, sudan grass hay 19.6 %, sugar cane molasses 10.7 %, urea 0.54 %, limestone 1.1 %, and mineral premix 1.1 % (control); or 2) Diet similar to control, but containing 29.7 % of sesame meal as substitute of cotton seed meal. Diets were offered twice a day (800 and 1600 h), after six days of adaptation period, samples of diets (1 kg) and the total of feces produced were collected during four continuos days. Samples were dried and weighed. DM and CP were performed, and apparent digestibility was calculated. Dry matter digestibility was not affected (P>0.10) by treatments with values of 69.2 % and 69.6 % for cotton seed meal and sesame meal diets, respectively. The apparent CP digestibility of the diets containing sesame meal was higher (P<0.05) than CSM diet (73.1 vs. 68.5 %). The digestible energy content of diets was not affected by treatments (P>0.10), as consequence of that DE of sesame meal was estimate to be near of 3.13 Mcal/kg, that is the value atributted to cotton seed meal, ingredient that was substitute by sesame meal. It is concluded, that sesame meal can be a substitute of cotton seed meal as protein source in the diets for sheep, without affect negatively the nutritional value of the diet.

Key Words: Sesame meal, Cottton seed meal digestibility, Sheep

W203 Effect of *Aspergillus oryzae* fermentation extract on zoospore physiology and carbon source utilization in the rumen fungus *Neocallimastix frontalis*, EB 188. J. Schmidt, S. Albright, K. Tsai, G. Calza, J. Chang, and R. Calza*, *Washington State University, Pullman*.

Direct fed microbials based on the fermentation of *Aspergillus oryzae* (AO) have been used as feed supplements for cattle but with inconsistent results. To improve the consistency of animal response, the mechanism of action needs to be understood. Therefore, we measured the effects of AO extract in powdered or liquid form in both stationary and stirred cultures of a rumen fungus, *Neocallimastix frontalis* EB 188 (ATCC #76100). Cultures were periodically sampled and assayed for extracellular and intracellular protein and enzymes, gas production, zoospore production and maturation, and carbon source utilization. Mobile zoospores matured into germination entities more rapidly (e.g., 3 hours) in treated cultures, and when powdered product was used, 38% ($P \leq 0.05$) more motile zoospores were produced by 50 h of fungal growth. Furthermore, by 110 h of growth 97% ($P \leq 0.01$) more germinated zoospores were found in treated cultures than in controls. Levels of intracellular zoospore malate dehydrogenase and lactate dehydrogenase were increased in treated cultures by 6.4-fold ($P \leq 0.01$) and 2.7-fold ($P \leq 0.05$), respectively. The wheat bran used as carrier for the product and tested as either soluble extract or powder had little effect on fungal cultures. Soluble extract increased fungal physiology and treated cultures produced significantly (at least $P \leq 0.05$) higher levels of secreted enzymes including amylase (213%), CMCase (22%) and β-glucosidase (34%). Culture gas production was higher ($P \leq 0.04$) at 48 and 66 h of growth in extract treated cultures but not thereafter. Culture utilization of glucose was increased by 37% ($P \leq 0.1$) in treated cultures yet high levels of extract (e.g., 5 times recommended) inhibited glucose utilization. AO fermentation extract effects the physiology of

rumen fungi and such information gained in vitro might help determine a mode of action in vivo for these types of direct fed microbials.

Key Words: AO Supplement, Rumen fungus, Cellulase

W204 Effects of *Aspergillus oryzae* fermentation extract on growth, enzyme production, and carbon source utilization of rumen bacteria grown separately and in co-culture with and without rumen fungi. S. Albright, G. Calza, and R. Calza*, *Washington State University, Pullman*.

Soluble components of *Aspergillus oryzae* (AO) were tested *in vitro* using rumen bacteria and a fungus in single and mixed cultures. Bacteria (from ATCC or Rowett Research Institute (RRI) and rumen fungus, *Neocallimastix frontalis* EB188 (ATCC #76100), were grown and periodically assayed for protein and enzymes, culture gas production and carbon source utilization, growth rate, and cellular size. Extract of AO had no effect on the growth rate of monocultures of *Prevotella ruminicola* GA 33 (Pr) (RRI), significantly ($P \leq 0.05$) increased the initial (up to 4 h) growth rate of *Succinimonas amylolytica* B24 (Sa) (RRI), increased ($P \leq 0.01$) the growth rate of *Selenomonas ruminantium* NADL GA-192 (Sr) (RRI) throughout the 10 h experiment, and significantly decreased ($P \leq 0.02$) the growth rates of *Succinivibrio dextrinosolvens* 0554 (Sd) (RRI) and *Eubacterium cellulosolvens* 6 (Ec) (RRI). Measurements of cell size using FACS suggested *Fibrobacter succinogenes* (Fs) (ATCC # 19169), and *Ruminococcus albus* (Ra) (ATCC # 27210) grown in the presence of extract tended ($P \leq 0.1$) to be larger, whereas Ec and Sd tended ($P \leq 0.1$) to be smaller, and Pr, Sa and Sr were unchanged in size. Extract failed (89% in control verses 91% in treated) to increase the extent of cellulose utilization in co-cultures containing all bacteria and the rumen fungus. Supernatant and intracellular amylase and β-glucosidase were higher ($P \leq 0.05$) in co-cultures treated with AO extract whereas total protein and total gas produced were unchanged. Xylanase was significantly ($P \leq 0.01$) decreased in all extract treated co-cultures. Gel electrophoresis methods recorded only slight differences in protein patterns of cellular lysates from bacteria growth either with or without extract. Mixed cultures grown *in vitro* might provide clues to the mode of action *in vivo* for AO based direct fed microbials.

Key Words: AO supplement, Rumen bacteria, Co-cultures

W205 RUSITEC to characterize *Aspergillus oryzae* extracts effects on *in vitro* fermentation and populations of microorganisms. R. Calza*[1], F. McIntosh[2], J. Wallace[2], and J. Newbold[2], [1]*Washington State University, Pullman/U.S.A.*, [2]*Rowett Research Institute, Aberdeen/Scotland*.

Rumen simulation devices possessing 15 vessels, fed daily with hay, with or without Amaferm® extract or an inhibitor isolated from the extract were used to measure *in vitro* fermentation. Vessels were monitored periodically and run for a total of 21 days. There were no significant differences (at $P \leq 0.05$) in the number of total bacteria, fungi, or protozoa in vessels. Cellulolytic bacteria numbers were different ($P \leq 0.01$) at 1.93 x 10^7/ml for control vessels, 4.73 x 10^7/ml for treated vessels, and 2.70 x 10^7/ml in inhibitor containing vessels. Total (Menke) gas and methane production were similar in all vessels as were concentrations of ammonia and major VFA's but lactate tended to be lower ($P \leq 0.1$) in inhibitor treated vessels at 0.60 mmol/d. Measured pH values were similar in all vessels and ranged between 6.65-6.68 on days 11 and 20. Dry matter disappearance was significantly different ($P \leq 0.05$) in control vessels (5.53 g/24 h), treated vessels (6.11 g/24 h), and inhibitor containing vessels (5.07 g/24 h). Serum bottles containing antibiotics to inhibit bacteria and promote fungal growth were set up from RUSITEC vessels at day 20, and assayed over 2-7 days. We failed to record differences in displacement gas or methane produced between treatments at any time of experiment. Fungal produced H_2 was lower ($P \leq 0.06$) in control bottles at 757 μml than in treated bottle at 870 μml ml and lower yet at 505 μml in bottles containing inhibitor. Zoospore numbers tended to be lower ($P \leq 0.1$) at 9.4 x 10^5/ml in controls than in treated bottles at 12.9 x 10^5/ml but both higher than inhibitor containing bottles at 4.9 x 10^5/ml at day 7. Fungal cellulase was lower ($P \leq 0.04$) in the control bottles (2.94 mIU/ml) than in treated bottles (4.29 mIU/ml) but there was no difference between those samples and inhibitor treated bottles (3.13 mIU/ml). Research suggests that Amaferm® influences microbial populations including rumen fungi in RUSITEC.

Key Words: RUSITEC, Amaferm®, Fermentation

W206 Growth antagonist in *Aspergillus oryzae* fermentation extract: Effects on *Bacillus subtilis* and the rumen fungus, *Neocallimastix frontalis* EB188 and component analysis. J. Schmidt, S. Albright, E. Harper, G. Calza, and R. Calza*, *Washington State University, Pullman*.

The presence of growth inhibitor in extracts of *Aspergillus oryzae* (AO) cultures was determined in a common bacteria and a rumen fungus. *Bacillus subtilis* (ATCC #6633) exposed to AO extract (1 h water extraction) dried on discs at concentrations of 0.5, 2, and 4 times the dietary recommended level as supplement, resulted in zones of inhibition surrounding the exposure discs on growth plates measuring 0.2 +/- 0.1, 1.4 +/- 0.2, and 2.1 +/- 0.4 mm, respectively. Twenty-four to 30 h of mixing of AO powder with water was necessary to extract components that completely inhibited the growth of rumen fungus, *Neocallimastix frontalis* EB 188 (ATCC #76100). Fungal and bacterial growth inhibiting compounds were extracted effectively and rapidly using ethyl acetate but not with hexane or methanol. Boiling, freezing, bleach (hypochlorite), and protease pre-treatments of crude extract tended ($P \leq 0.1$) to reduce the inhibition of secreted cellulase in rumen fungus to 67,7%, 49,9%, 96.6%, and 80.1% of control, respectively. Fractions that strongly absorb 340-365 nm light and stimulated or inhibited fungal growth have been partially purified using HPLC and TLC. At least 4 growth inhibitors were detected from the ethyl acetate extract at TLC Rf values of 0.14 to 0.40 when developed with benzene-ethyl acetate (10:1). Anion exchange chromatography separated inhibitor fractions that caused a significant ($P \leq 0.01$) reduction (49% of controls) in the growth of rumen fungus. Such inhibitor fractions reduced (both at $P \leq 0.05$) cellulase and amylase secretions in rumen fungus to 25% and 6% of controls, respectively. Dialysis membranes possessing a nominal exclusion of 3Kd molecular weight resulted in partial removal or inactivation (to 77% of controls) of column separated inhibitor(s). Additional detailed purification studies are needed to identify the inhibitor components of AO.

Key Words: Bacteria, Rumen fungus, AO extract inhibitor

W207 Ruminal degradation of crude protein of raw cull Chop suey beans (Vignia radiata L.,Wilzek) in sheep. J. F. Obregon*, J. C. Robles, R. Barajas, and A. Estrada, *FMVZ-Universidad Autónoma de Sinaloa (México)*.

To determine the ruminal degradation of crude protein of raw cull Chop suey beans (Vignia radiata L., Wilzek) in sheep. Two Pelibuey sheep (31.5 kg) fitted with ruminal cannulas were used. The animals were fed with a diet 25:75 roughage:concentrate, containing 20 % of raw cull chopsuey beans. Nylon bags (10×18 cm) containing 5 g of raw cull chopsuey beans (CCB) or soybean meal (SBM), and were randomly designed to be incubated in rumen of sheep during 3, 6, 9, 12, 18, 24, or 36 hours. Once complete the incubation time, the bags were washed with tap water, dried, and CP was determined. The ruminal degradation of CCP-CP at 18 h incubation time was higher ($P<0.01$) than SBM-CP (96 % vs. 77.4 %). After 36 h of rumen incubation, there are no differences ($P>0.10$) between CCB-CP and SBM-CP (96.9 % vs. 94.3 %). Soluble fraction(a), degradable fraction (b) and rate of degradation by CCB-CP were 28.63 %, 71.7 % and 0.13 % /h, respectively. While by SBM-CO were 11.75%, 95.5% and 0.06%/h for fraction a, b, and c, respectively. The effective crude protein of CCB degraded in rumen was calculated in 90.6 %. It is assumed that undergradable crude protein content of CCB is 9.4 %. It is conclude that crude protein of raw cull Chop suey beans is highly and rapid degraded in rumen of sheep.

Key Words: Chop suey beans, Rumen degradability, Sheep

W208 Effects of slick vs non-slick bunk management on intake, performance, and carcass merit responses by finishing beef steers. P. J. Defoor*, D. A. Walker, and K. J. Malcolm-Callis, *New Mexico State University, Clayton Livestock Research Center, Clayton, NM.*

Slick bunk management (SB) offers feedyards the potential to simplify daily feed allocation decisions. However, the effects of SB on performance and carcass quality are unclear. Therefore, we evaluated SB and non-slick bunk management (NSB) in a 122-d finishing trial using 192 Angus steers (initial BW=392 kg) stratified by BW and assigned randomly within BW strata to one of two treatments (SB or NSB) in a randomized block design with eight pens per treatment and 12 steers per pen. All cattle were fed the same 91% concentrate diet (steam-flaked corn base with 9% alfalfa). The objective of the SB treatment was for bunks to contain at least 0.23 kg of feed per steer at 2230 and 0.0 kg at 0700, before feeding at approximately 0800. The objective of the NSB treatment was for bunks to contain approximately 0.23 kg of feed per steer at 0700 before feeding at approximately 0800. When the quality of accumulated feed in the NSB treatment became compromised, it was removed, weighed, and analyzed for DM. Average DMI for each pen was determined with and without removed accumulated feed. Cattle were weighed individually on d 0, 41, and on d 122 before harvest and subsequent carcass data collection. Daily DMI averaged 0.20 kg/d less (P = 0.16) for the SB treatment (9.52 vs 9.72 kg/d) when discarded accumulated feed was subtracted from feed delivery data. Leaving discarded accumulated feed in the feed log, as would occur in a commercial feedyard, resulted in 0.25 kg/d less (P = 0.09) apparent DMI for the SB treatment. Feed efficiency did not differ (P > 0.33) using DMI derived by either method. No difference (P = 0.65) in ADG (1.84 vs 1.86 kg/d for SB and NSB, respectively) was observed between the treatments, however, marbling score was lower (P = 0.04) for SB than for NSB, and Chi-square analyses indicated a greater (P = 0.09) proportion of carcasses with a modest or higher degree of marbling for the NSB treatment. These data indicate that it is possible to manage bunks to obtain the slick status described herein without adversely affecting performance. However, carcass data indicate the possibility that marbling could be adversely affected by SB; possibly as a result of the slightly reduced DMI and(or) effects on central energy metabolism.

Key Words: Beef cattle, Bunk management, Performance

W209 Effects of winter implant status and monensin feeding on winter and subsequent summer performance by steers grazing tallgrass prairie. T. N. Bodine, H. T. Purvis II, G. W. Horn, and D. A. Cox, *Oklahoma Agricultural Experiment Station.*

We conducted three experiments to evaluate the effects of winter implant status and monensin feeding on winter and subsequent summer grazing performance. Experiment 1 evaluated Synovex-S implants given during the winter and/or summer with season-long grazing. Experiment 2 evaluated winter Synovex-S implants and two summer season-long stocking rates (single and double). Experiment 3 evaluated winter Synovex-S and Revalor-G implants, as well as monensin feeding, followed by summer intensive early stocking. Winter implant usage and monensin feeding increased ($P < 0.05$) winter ADG by 33 and 49%, respectively, across all three studies. During summer grazing in Exp. 1, steers that had been implanted in the winter had 3% lesser ($P < 0.04$) ADG, whereas steers with summer implants had 6% greater ($P < 0.01$) ADG. Additionally, steers without winter implants that recieved summer implants had 10% greater ($P < 0.01$) ADG than steers that received both implants. In Exp. 2, steers with or without winter implants had similar ($P > 0.21$) summer ADG when double-stocked. However, single-stocked steers without winter implants had 6% greater ($P < 0.03$) ADG than steers with winter implants. Across the combined winter and summer grazing period, double-stocked, winter-implanted steers had greater ($P = 0.03$) ADG than steers without winter implants, whereas, single-stocked steers had similar ($P > 0.17$) ADG among winter implant status. Steers with winter implants and steers fed monensin had decreased ($P < 0.02$) summer ADG (-6, -10%) than steers without implants or monensin in Exp. 3. Combined winter and summer grazing period ADG was not different ($P > 0.15$) due to winter implants or monensin. The use of implants or monensin increased animal performance during winter grazing. When potential summer ADG is low, steers implanted in the winter retained their greater BW. However, when summer gain potential is greater, winter implant status and monensin feeding had no effect on combined winter and summer total weight gain.

Key Words: Growth promoters, Ionophores, Stocking rate

W210 Correlation of marbling and yearling weight EPD's with performance and carcass characteristics of early-weaned Simmental steers. N. A. Pyatt*[1], L. L. Berger[1], D. B. Faulkner[1], and P. M. Walker[2], [1]*University of Illinois at Urbana-Champaign,* [2]*Illinois State University, Normal.*

One hundred forty-four early-weaned three-quarter or greater Simmental steers of known genetics were individually fed to determine correlations of marbling EPD (MARB) and yearling weight EPD (YW) with feedlot performance and carcass characteristics. Mean MARB was 0.04 (range -0.12 to 0.25), and YW was 56.4 (range 17.8 to 88). Steers were weaned at 87.0 14.9 days and fed a high concentrate diet for approximately 90 days prior to allotment. Calves were implanted with Synovex C at weaning and successively with Synovex S and Revalor S. Steers were fed a 90% concentrate, whole shelled corn and corn silage diet, supplemented to contain 15% CP using soybean meal for 247.0 9.1 days and harvested at 422.0 19.9 days of age. Final weight was calculated by dividing hot carcass weight (HCW) by a common dressing percent. Samples of *longisimus dorsi* (LD) were collected to verify percent intramuscular fat (%FAT). Steers gained 1.63 0.19 kg/d, consumed 8.99 1.29 kg DM/d, and converted 0.183 0.025 kg gain/kg DM. Steers finished with 649.0 kg final weight, 402.8 kg HCW, 1.12 cm 12th rib fat, and 93.8 cm^2 LD area. USDA yield grades (YG) were 23.2% 1's, 54.9% 2's, 20.4% 3's and 1.4% 4's. USDA quality grades (QG) were 17.7% Select, 44.7% low Choice (C^-) and 36.9% average Choice or better. The American Simmental Association database reported steers of the same breed type graded 55% C^- or better under traditional management, while early weaning resulted in 81.6% C^- or better QG. MARB was correlated (P < 0.01) with gain to feed (G:F) (-0.29), DMI (0.41), QG (0.20), University of Illinois (UI) determined QG (0.26), marbling score (MS) (0.25) and %FAT (0.28). YW was correlated (P < 0.01) with G:F (-0.35), DMI (0.42), HCW (0.25) and YG (-0.31). LD %FAT was correlated (P < 0.01) to ADG (0.27), QG (0.63), UI QG (0.70), MS (0.72), YG (0.31) and UI calculated YG (0.50). R-values for ADG with G:F, ADG with DMI, and G:F with DMI were 0.40, 0.49 and -0.59, respectively (P < 0.01). Selecting for greater MARB can improve carcass quality. Selecting for greater YW may increase HCW and lower YG.

Key Words: Early-weaned, EPD, Correlation

W211 Effects of weaning programs on performance and serum concentrations of non-esterified fatty acids and urea nitrogen in first calf heifers or mature cows. T. R. Whitney*, G. C. Duff, S. P. Cuneo, D. W. Shaefer, and D. A. Henderson, *The University of Arizona, Department of Animal Sciences, Tucson 85721.*

Our objective was to investigate effects of early weaning calves on first calf heifer and mature cow performance and serum concentrations of non-esterified fatty acid (NEFA) and serum urea nitrogen (SUN). Treatments were arranged in a 2 x 2 factorial and included 14 crossbred (Angus x Gelbvieh x Hereford x Barzona x Senepol or Red Angus x Charolais x Tarentaise) first calf heifers and 14 crossbred (Angus x Gelbvieh x Hereford x Barzona x Senepol x Salers) mature cows assigned randomly to one of two treatments: early weaned (EW, calves weaned at 114 d) or normal weaned (NW, calves weaned at 197 d). Blood samples were collected on d 114, 141 197, and 205 post-partum via jugular venipuncture. Overall, BW was greater (P ¡ 0.01) for mature cows vs heifers and for EW vs NW dams (P ¡ 0.01). Heifers with calves EW had 3.06% increase (P ¡ 0.01) in BW than heifers with calves NW, but no change (P ¿ 0.10) in BW was observed for mature cows. Early weaning increased body condition (P ¡ 0.05) and change in body condition compared with NW. No effects of weaning or parity were observed for ADG (P ¿ 0.10). There was no parity x weaning x d or parity x weaning interactions observed (P ¿ 0.10) for NEFA or SUN. There was a parity x d interaction for both NEFA (P ¡ 0.10) and SUN (P ¡ 0.05), but no differences (P ¿ 0.10) were observed between first calf heifers and mature cows within d. Early weaning decreased (P ¡ 0.10) SUN compared with NW status. We hypothesize that early weaning decreased SUN concentrations due to decreased metabolism of muscle protein. Results suggest that EW

can increase BW and body condition in first calf heifers and decrease SUN concentrations in both first calf heifers and mature cows in open rangeland conditions of the desert southwest.

Key Words: Beef cattle, Early weaning, Parity

Production, Management, and the Environment

W212 Serum progesterone in cycling ewes treated with progesterone-impregnated intravaginal inserts on the day of estrus. J. L. Duffey*, D. M. Hallford, C. A. Gifford, and R. L. Rosencrans, *New Mexico State University, Las Cruces, NM/USA*.

Progesterone-impregnated intravaginal inserts (CIDR) can synchronize estrus in ewes but conception may be reduced. This study compared progesterone (P4) profiles in cycling Rambouillet ewes (control, n = 10) with those in cycling ewes (n = 10) receiving a CIDR (0.3 g P4, Pharmacia and Upjohn Ltd. Co., Auckland, NZ) on the day of estrus (d 0) and ovariectomized (OVX, n = 6) ewes treated with a CIDR. The CIDR's were removed after 14 d; intact ewes were then placed with raddled rams during a 21-d breeding season. Ewe BW were similar (P = 0.68) among groups averaging 74 ± 3 kg and serum P4 was less than 1ng/mL on d 0 in all ewes. On d 1, serum P4 differed in controls and in CIDR-treated intact and OVX ewes (0.2 < 2.9 < 4.4 ± 0.3 ng/mL, respectively; P < 0.01). On d 3, control ewes had a P4 concentration of 0.8 ng/mL (P < 0.01) compared with 3.4 ± 0.2 ng/mL in CIDR-treated intact and OVX ewes. This similarity in P4 value in the two CIDR treatments (P > 0.10) continued through d 7 at which time ewes in all three groups averaged approximately 4 ng/mL. Serum P4 in control ewes rose during the luteal phase to peak at 6.4 ± 0.5 ng/mL on d 12 and was greater (P < 0.01) on d 12 through 14 than values in both CIDR-treated groups. However, serum P4 was similar (P > 0.10) in CIDR-treated intact and OVX ewes from d 12 to 14 (2.8 and 1.9 ± 0.5 ng/mL, respectively, on d 14). Serum P4 averaged 6.2 ± 0.7 ng/mL in controls (P < 0.01) compared with 0.3 and 0.2 ng/mL in the two CIDR-treated groups on the day after CIDR removal. Control ewes were marked by rams on an average of d 17.9 compared with d 15.5 (± 0.4) for CIDR-treated intact ewes (P < 0.01). Ten percent of control ewes were marked by rams at a subsequent cycle compared with 60% of CIDR-treated intact ewes (P = 0.02). Results demonstrate that intact cycling ewes produce more P4 during the mid and late luteal phases than that released by the CIDR. The observation that ewes receiving a CIDR on d 0 have the same P4 on d 12 to 14 as CIDR-treated OVX ewes suggests premature demise of the corpus luteum which may have influenced the poor conception rate. (Thanks to Meg Oeller, DVM, CVM, FDA for INAD 10-321)

Key Words: Sheep, CIDR, Synchronize

W213 Progesterone release and clearance patterns of progesterone-impregnated intravaginal inserts in ewes. C. A. Gifford*, J. L. Duffey, R. L. Rosencrans, and D. M. Hallford, *New Mexico State University, Las Cruces, NM/USA*.

Six ovariectomized Rambouillet ewes (BW = 73 ± 4 kg) were utilized to determine progesterone (P4) uptake and clearance patterns after insertion and removal of P4 containing controlled internal drug releasing devices (CIDR, 0.3 g P4, Pharmacia and Upjohn LTD. Co., Auckland, NZ). Animals were maintained in a single pen (12 x 4 m) under ambient conditions with access to shade, water, salt, and alfalfa hay (2 kg/d). In period 1, serum was collected before and hourly for 12 h after CIDR insertion. Serum P4 concentration was 4.7 ± 0.6 ng/mL 1 h after CIDR insertion compared with 0.1 ng/mL (P < 0.01) immediately before CIDR insertion on d 0. Serum P4 peaked at 6.3 ± 0.6 ng/mL (h 4) and remained elevated for the remaining 12 h on d 0. Additional samples were collected daily for 14 d in period 1, and all P4 values were 2 ng/mL or greater. Each CIDR was removed on d 14, and serum was collected intensively for 12 h after CIDR removal. At 15 min after CIDR removal, serum P4 was 1.2 compared with 1.9 (± 0.1) ng/mL before removal. At 1 and 2 h after CIDR removal, serum P4 values averaged 0.8 and 0.7 (± 0.1) ng/mL, respectively; and 12 h after CIDR removal, P4 had declined to 0.2 ng/mL. After 2 wk, the same CIDR was reinserted in the same ewe from period 1 for second and third 14-d periods. Daily P4 concentrations were compared to determine the efficiency of using a CIDR multiple times. Serum P4 averaged 4.4, 2.1, and 0.7 (± 0.4) ng/mL on d 1 of periods 1, 2, and 3, respectively (P < 0.01). On d 7, period 1 P4 value was 3.6 ng/mL compared with 1.5 and 0.3 (± 0.3) ng/mL during periods 2 and 3, respectively (P < 0.01). Serum P4 was < 1 ng/mL after d 9 of period 2 and never averaged greater than 0.7 ng/mL during period 3. On d 14, P4 values were 1.9, 0.7, and 0.3 (± 0.2) ng/mL in the three respective periods. Results show that P4 from the CIDR rapidly enters the circulation (within 1 h) at the time of insertion and is rapidly cleared after CIDR removal (< 1ng/mL by 1 h). Also after 2, 15-d periods in situ, CIDR's were no longer able to increase serum P4 concentrations. (Thanks to Meg Oeller, DVM, CVM, FDA for INAD 10-321)

Key Words: Sheep, CIDR, Synchronize

W214 Effects of seminal traits and mating behavior on number of progeny sired in multi-sire herds. W. A. Whitworth[1], D. W. Forrest*[1], L. R. Sprott[1], B. G. Warrington[2], and J. W. Holloway[2], [1]*Department of Animal Science, Texas A&M University, College Station,* [2]*Texas Agricultural Experiment Station, Uvalde*.

Effects of serving capacity (SC), social dominance rank (SDR) and physical characteristics of bulls on reproductive performance in multi-sire herds were evaluated. Spermatozoal traits and presence of fertility-associated antigen (FAA) were also assessed. In experiment one, Braunvieh (n=6) and Bonsmara (n=6) bulls (18-24 mo of age) were evaluated for body condition score (BCS), SDR, SC, sperm motility and morphology, and FAA status (positive/negative). Bulls were joined with multiparous cows (n=305) for 90 d. Paternity was verified by DNA typing of 251 calves. Regression analyses were used to determine traits associated with variability in number of calves sired per bull. Chi square analyses were used to determine effects of morphology and FAA status on numbers of calves born early (<41 d) or late. All bulls were FAA-positive and more calves were sired by Braunvieh (P<0.05) bulls. Bull breed, motility, morphology, and SDR rank were positively associated with variability in number of calves sired per bull (P<0.05, R-square = 0.75). Bulls with >80% normal sperm sired more calves early in the calving season (P<0.05). In experiment two, Bonsmara (n=6, 13-14 mo of age), Tuli (n=6, 15-18 mo of age), and Waygu (n=6, 18-19 mo of age) bulls were evaluated as in experiment one, along with BW, scrotal size and service efficiency (ratio of mounts to services). Bulls were joined with multiparous cows (n=290) for 90 d. Sire was determined for male calves (n=125). More calves were sired by older (Waygu) bulls (P<0.05). Age of bull, FAA-status, and BW explained variation in number of calves sired per bull (P<0.01, R-square = 0.64). There was a linear relationship (P<0.05) between service efficiency and number of calves sired per bull. Assessment of FAA status of sperm, SDR, and service efficiency in conjunction with a breeding soundness exam will identify bulls that can potentially sire increased numbers of early-born calves.

Key Words: Beef cattle, Bull fertility

W215 Effects of an injectable trace mineral supplement on conception rate of lactating dairy cows. J. A. Vanegas*, J. Reynolds, and R. Atwill, *University of California, Davis. Veterinary Medicine Teaching and Research Center, Tulare CA*.

A total of 830 dairy cows from a commercial dairy farm located in central California were used to evaluate the effects of a single or double dose of a trace mineral supplement(Multimin®)on first service conception rate. Cows were randomly allocated into treatment or control group to either a single (Experiment 1) or a double dose regime (Experiment 2). Allocation was based on days on lactation for the Experiment 1 and the length of their gestation period for Experiment 2. In Experiment 1, cows between 38 to 45 days in lactation (TREATMENT 1 n=191) received a single injection of 5ml of Multimin®. Two hundred and twenty eight similar cows were used as a CONTROL 1. In Experiment 2, cows received an initial injection of 5ml of Multimin® between 2 to 3 wks precalving (TREATMENT 2 n=186). An equal dose was repeated between 38 to 45 days in lactation. Two hundred and twenty eight similar cows