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 Calippyge wool x St. Croix lambs. Whole sale weight (kg) was the highest in the Calippyge 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 Calippyge 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 Calippyge wool x wool (4.5) and the lowest is the St. Croix (3.0). The overall sensorial acceptance rating was the highest in the St. Croix (6.8) and the lowest in the Calippyge wool x wool.

Key Words: Carcass evaluation, Feed efficiency, Sheep

**W148 Genetic relations among carcass fat, tenderness, and age at slaughter in beef cattle managed under a constant finishing program.** T. L. Fernandes1, J. W. Wilton1, I. B. Mishra2, and C. Olson3, 1Kansas State University, Manhattan, 2University of Florida, Gainsville, Department of Animal and Poultry Science, 3Beef 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

**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 canule, 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 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 control (P < 0.05). The alfalfa CTD disappearance in the rumen, intestine and total tract was significantly higher compared with corn silage (P < 0.05). The disappearance results 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, Kan.

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 = 250 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 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 full supplementation on diet selection, intake, and digestion was not dependent on the period in which the characteristics were estimated. The quality of the 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, 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-Ortiz1, F. O. Carrete-Carreon2, and O. Ruiz-Barrera3, 1Juarez University of Durango State, 2INIFAP-DGO, 3University 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 at 5, 9, 12, 16, 20, 24, 30, 36, 48, 60, 72, and 96h post-dose. The model Y=a+b(1-e-k1t)=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 k1=degradation rate of b fraction (h−1).

Marker concentrations in feces were described by the model: Y= Aek1(t−TT) , where: Y=marker concentration in the compartment at dosing time; A=marker concentration in the compartment at dosing time; k1= rate of passage of particles in rumen (h−1); TT= transit time. RDMD was obtained with the model: RDMD (%)=100[Ae−k1(1−TT)]/A.

Mean ruminal residence time of five forages from the potential degradability and the rate of passage are good estimators of RDMD. These results suggest that the combination of the parameters 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. Aguilera1, M. A. Castillo-Pecina1, C. F. Arechiga1, C. Arzola2, and O. Ruiz-Barrera2, 1UAMVZ-Universidad Autonoma de Zacatecas, Zacatecas, Mexico, 2FZ-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−r1t) 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 3% of outflow rate was 52.9, 50.1, 59.4 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 addition 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. Aguilera1, M. A. Castillo-Pecina1, C. F. Arechiga1, C. Arzola2, and O. Ruiz-Barrera2, 1UAMVZ-Universidad Autonoma de Zacatecas, Zacatecas, Mexico, 2FZ-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 OFU) 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−r1t) 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 C, CU, CF and CUF, respectively. There was a 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 3% of outflow rate was 52.9, 50.1, 59.4 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 addition could provide a healthier ruminal environment feeding high levels of corn bran, by either accelerating or slowing down ruminal degradability, respectively.

Key Words: Oat hulls, Urea treatment, Exogenous enzyme
Effect of exogenous fibrolytic enzyme on digestion of ammoniated or non-ammoniated bluegrass seed straw fed to beef cattle. J. I. Szasz*1, C. W. Hunt1, L. R. Kennington1, and K. A. Johnson2, 1University of Idaho, 2Washington 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 digestion of ammoniated and non-ammoniated bluegrasses seed straw (2 x 2 factorial treatment arrangement). The exogenous enzyme contained xylanase and cellulase activity and enzyme activity was 670 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-ammoniatedstraws. No treatment effects were detected for DMI; however, heifers fed ammoniatedstraws consumed greater (P < 0.05) amounts of NDF than those fed non-ammoniated straws. Ammoniation resulted in lower (P < 0.05) ruminal butyrate, 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

Effect of exogenous fibrolytic enzymes (Fibrozyme) on in vitro digestibility of dry matter and cell wall of Bracharia cultivars hays. J. H. Avellaneda-Cevallos1, S. S. Gonzalez2*, J. M. Pinos-Rodriguez1, A. Hernandez2, R. Barcena2, M. Cobos1, D. Hernandez-Sanchez2, and M. Crosby-Galvan2, 1Universidad Tecnica Estatal de Quito, Ecuador, 2Colegio de Postgraduados, Mexico, 3Universidad Autonoma de San Luis Potosi, Mexico.

This study was done to evaluate the effect of exogenous fibrolytic enzymes (Fibrozyme) on in vitro digestibility of dry matter (DMIVD), neutral (NDFIVD) and acid (ADFIVD) detergent fiber of Guinea grass (Panicum maximum var. Mombasa) hay. J. H. Avellaneda-Cevallos1, S. S. Gonzalez2*, J. M. Pinos-Rodriguez1, A. Hernandez2, R. Barcena2, M. Cobos1, D. Hernandez-Sanchez2, and M. Crosby-Galvan2, 1Universidad Tecnica Estatal de Quito, Ecuador, 2Colegio de Postgraduados, Mexico, 3Universidad Autonoma de San Luis Potosi, Mexico.

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 Ameal-grass an experiment was carried in a humid tropical forest in Venezuela. The evaluated treatments were: T1, Ameal-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 in 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 Ameal-grass.

Key Words: Ruminal degradability, Leucaena leucocephala, Echinochloa polystachya
Barley harvested as hay is a significant source of winter forage for live stock 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 pens in a randomized incomplete 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. MT981060, Westford, and Haybet barley varieties had superior feeding value for backgrounding steers and is scheduled for feeding an awned variety did not impact DMI, ADG, or FE. MT981060 Haybet barley (avg 15.07 vs. 12.9 kg gain / 100 kg feed, respectively). Steers fed MT981060, Valier, and Westford barley had 14.4% improvement in DMI (3.29 vs. 2.75 kg/d, respectively). Dry matter intake was greatest when feeding awned variety did not impact DMI, ADG, or FE. MT981060, Westford, and Haybet barley varieties had 14.4% improvement in DMI (3.29 vs. 2.75 kg/d, respectively). Dry matter intake was greatest when feeding awned variety did not impact DMI, ADG, or FE. MT981060, Westford, and Haybet barley varieties had 14.4% improvement in DMI (3.29 vs. 2.75 kg/d, respectively).

W161 Continuous culture fermentation of three forage varieties supplemented at four protein levels. R. E. Vibart*, S. F. Washburn, V. Felnier, 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 forage 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 kg of diet, respectively. Methane concentrations were higher (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.
allowable limits of SO₄ in cattle drinking water need to consider the associated cation and the variability in sensitivity between animals.

Key Words: Beef cattle, Water quality, Sulphate

W167  


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 Na₂SO₄ and MgSO₄. In Exp. 1, 5 beef heifers (300-400 kg) were offered either ad lib access to tapwater (8 ppm SO₄) or water containing 3000 ppm SO₄ for two weeks and restricted access (twice daily) for two weeks. Exp. 2 was conducted as a taste test for 2 d where 8 animals were given water twice daily containing tapwater (11 ppm SO₄), Na₂SO₄ or MgSO₄ at 1500, 3200, or 4700 ppm SO₄. 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 < 0.05) water when it contained Na₂SO₄ (3.47 ± 0.90 kg/drink) compared to tapwater (9.00 ± 0.83 kg/drink) when given ad lib access. When access was restricted, average drink intake was 21.88 ± 2.15 kg for tapwater and 11.19 ± 2.89 kg for water containing Na₂SO₄ (P < 0.01). Average daily intake of tapwater was less (P < 0.05) when water access was restricted (44.26 ± 4.13 kg) compared to ad lib access (55.42 ± 5.62 kg); however, average daily intake of the SO₄ water was not different (P > 0.05) for ad lib treatment (25.52 ± 5.16 kg) and restricted access (21.53 ± 5.74 kg). In Exp. 2 there was no difference (P ≥ 0.05) between average water intake for MgSO₄ (20.71 ± 0.50 kg/drink) and Na₂SO₄ (18.78 ± 1.74 kg/drink) treated water at 1500 ppm SO₄; however at 4700 ppm SO₄ the average intake of MgSO₄ treated water was 6.70 ± 3.05 kg/drink compared to 15.38 ± 1.81 kg/drink for Na₂SO₄ (P ≤ 0.05). There was considerable variation in intake between animals, particularly at higher SO₄ concentrations. These results suggest that guidelines for maximum

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

W165  

Sodium and magnesium sulphates reduce water consumption by beef cattle. A. S. Zimmermann1, D. M. Weira1, D. M. Weary2, M.A.G. von Keyserlingk1, and D. Fraser1, 1University of British Columbia Animal Welfare Program, 2Agriculture and Agri-Food Canada.

Salt is an essential component of the diet for ruminants and is important for maintaining water balance and bone health. However, excessive salt intake can lead to sodium toxicity and health problems. The objective of this study was to evaluate the effects of sodium chloride (NaCl) and magnesium sulphate (MgSO₄) on water intake and performance of beef cattle. In the first experiment (Exp. 1), six beef steers (270 kg) 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 1.39 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 1.39 Mcal/kg of NEg, respectively. Weight and ultrasound measurements were taken intermittently throughout the feedlot phase. Treatments D and S had greater (P < 0.01) 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 < 0.05) than S ($0.88 vs. $1.89, respectively). For phases 1 and 2, weight of all treatments increased in a linear (P < 0.01) fashion, but the quadratic response differed between C vs D and S (P < 0.05). DMI was similar among treatments but ADG between C vs. D and S differed (P < 0.01) during phase 1. Feed / gain among treatments was similar for phase 1; during phase 2, all treatments differed (P < 0.01) 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 fashion, while the backfat depth of D also increased in a quadratic (P < 0.05) 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
The objective of this work was to determine the fractions and rates of digestion of the different carbohydrates for sugar canes with different cycles of production and three cut times. A. Fernandes, 1 E. Pereira, 1 P. Cabral, 1 and A. Alex 2

1 Universidade Estadual do Norte Fluminense, 2 Universidade Federal de Viçosa, 3 Universidade Estadual do Oeste do Paraná, 4 Universidade Federal do Mato Grosso.

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 digestion efficiency of the chopped alfalfa and sainfoin. The four feeds from The Netherlands (grass silage, GS; corn silage, CS; citrus pulp, CP; corn gluten meal, CG) were incubated individually. The three feed combination of AL: BR: SM: CS increased in vitro gas production technique (Menke and Steingass, 1988; Anim. Res. Dev. 28:7-55). The percent increase in gas production measured on combinations of feed vs. the calculated gas production to have been produced based upon incubation of individual feeds was used to assess the extent of the associative effects. Among the different cycles of production and three cut times. 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

Evaluation of associative effects of feeds using in vitro gas production. G. Getachew 1, P. H. Robinson 2, and J. W. Cone 1

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 energetic value of individual feeds will be the same when they are fed in combination with other feeds. The individual digestibilities of feeds can be 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 (Kluytmans and Steingass, 1982; Anim. Res. Dev. 28:7-55). The percent increase in gas production measured on combinations of feeds vs. the calculated gas production to have been produced based upon incubation of individual feeds was used to assess the extent of the associative effects. Among the different cycles of production and three cut times. 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: Condensed tannins, In vitro digestibility, Silage
The objective of this study was to evaluate production response of dairy cows fed soybean meal ruminantly 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 by-cooked/expelled soybean meal (EXP, SoyPlus®), or split by ruminal enzymatically browned with xylese (CX, SoyPan®) or soy meal cooked with soybean hulls and water (CFS, 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%), is energetic 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 CFS), method of ruminal protection: cooked-expelled vs. chemically treated (EXP vs. CX and CFS), and within chemical treatment the effect of different methods (CX vs. CFS). None of the tested contrasts were different for yield of milk fat, protein or DM. Milk protein percentage was greater when feeding soybean meal ruminantly 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 ± 1.65 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 CFS.

**Key Words:** Soybean, Milk production

### Diets and Statistical Contrasts

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<th>Diets</th>
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<td>(D)</td>
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</tr>
<tr>
<td><strong>DM, kg/d</strong></td>
<td>23.0</td>
<td>23.7</td>
<td>22.7</td>
<td>23.4</td>
<td>0.5</td>
<td>0.52</td>
<td>0.14</td>
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<tr>
<td><strong>Milk, kg/d</strong></td>
<td>36.9</td>
<td>37.1</td>
<td>37.1</td>
<td>38.5</td>
<td>0.8</td>
<td>0.23</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>TP, kg/d</strong></td>
<td>1081</td>
<td>1080</td>
<td>1078</td>
<td>1109</td>
<td>0.27</td>
<td>0.72</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Fat, kg/d</strong></td>
<td>3.47</td>
<td>3.47</td>
<td>3.74</td>
<td>3.74</td>
<td>0.05</td>
<td>0.66</td>
<td>0.63</td>
</tr>
<tr>
<td><strong>Fat, %</strong></td>
<td>13.77</td>
<td>1388</td>
<td>1388</td>
<td>1430</td>
<td>30.0</td>
<td>0.30</td>
<td>0.42</td>
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</table>

**Statistical Contrasts**

<table>
<thead>
<tr>
<th>(A) vs. (B+C+D)</th>
<th>(C+D)</th>
<th>D</th>
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<td><strong>SBM</strong></td>
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<td><strong>EXP</strong></td>
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<td></td>
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<tr>
<td><strong>CFS</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TP = True Protein

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### References

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% for CS (44.5%), 14.4, 67.3 and 18.1% for 14.4, 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 = 0.01) 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 DM) and chewing (min/d and min/kg of DM) 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

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The study objectives were to test the effects of preweaning starter supplement and postweaning protein concentration on feed intake, body growth 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 Meal 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 in 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.

<table>
<thead>
<tr>
<th>Protein Level</th>
<th>Treatment Effects (P &lt;)</th>
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<tbody>
<tr>
<td>Item</td>
<td>L</td>
</tr>
<tr>
<td>Body weight gain, g/d</td>
<td>844</td>
</tr>
<tr>
<td>Wither height gain, cm/d</td>
<td>0.146</td>
</tr>
<tr>
<td>Hip height gain, cm/d</td>
<td>0.147</td>
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**Key Words:** Protein, Skeletal growth

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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 (705 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 (PPG), milling ratio (MR), colors 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. 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

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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 (corn 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 the canola seed diet. Urinary pH was not different (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 hybrids 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 (5.7%/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

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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 un degraded 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 ± 0.79 kg) was 10% lower (P < 0.01) and milk production, corrected to 4% fat (30.6 ± 1.1 kg) was 5.5% lower (P < 0.1) 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 ± 0.07 Mcal/kg) and net energy of lactation (1.54 ± 0.05 Mcal/kg) was 4.6 and 6.0% (P < 0.05), 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 (0.2 vs. 0.11 cm; P < 0.05). Blood urea nitrogen (22.6 ± 0.58 mg/dl) was 3.3% higher in cattle fed NC. In-situ rumen dry matter and rumen degradation kinetics were determined on all dietary components. Pet food grade poultry protein meal had a CP kg 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 reduced respectively) as diet WDG increased. Dry matter intakes decreased (46.9, 43.9, 39.4, and 36.5% for 10, 20, 30, and 40% WDG, respectively) as diet WDG increased. Wet matter intake decreased (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 re- spective of peNDF content was observed for rumen to- tal VFA concentration and proportion of propionate for cows fed corn silage based diet. However, this effect was not appeared for cows fed corn gluten feed. 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 vita- min E analogue. In Nova Scotia 4 heifers, 5 dry cows and 50 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 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.

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

W180 Effects of physically effective NDF on rumen fermentation and digestion of dairy cows fed diets based on barley or corn silage. W. Z. Yang1 and K. A. Beauchemin1, 1Agriculture and Agri-Food Canada, Lethbridge, Canada.

Two studies were conducted to investigate the effects of physically ef- fective (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 cannula. 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 twice with peNDF content, which had peNDF content 16.0, 14.8 and 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 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 regard- less of peNDF content. 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. Increasing peNDF content of the diet increased DM intake of cows fed corn silage based diet, but this effect was not appeared for cows fed barley silage based 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 diet 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. Hippen1, K. N. Linke1, K. F. Kalscheur1, D. J. Schingoethe1, and A. D. Garcia1, 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 de- creased (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 and milk components 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 4.79%) 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: Dairy cattle, Rumen undegradable protein

W182 Performance of lactating dairy cows fed wet corn gluten feed. G. D. Marx1, C. R. Dahlen1, A. DeConstanza2, T. L. Durham1, and R. T. Ethington3, 1University 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, compo- nent 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 (25%), corn silage (21%), high moisture corn (28%), 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 mea- sured 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 lin- ear 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 nutri- tional 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. Mandevu1,2, J. B. Castillo1, D. J. Steckley1, and E. Evans1, 1Maple Leaf Foods Research, Guelph, ON, Canada, 2W.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 vita- min 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 dairy cows. Different diets or dietary ingredients are being fed, or to evaluate the general nutritional status of animals throughout the year or season.
At 8, 16 and 24 h post feeding, the NDF concentration of feed remaining on each of four periods, animals were offered one of four diets that were chemically similar but varied in corn silage particle size on eating behavior, chewing activity, and rumen fermentation. The objective of this experiment was to evaluate effects of reducing corn silage particle size on eating behavior, chewing activity, and rumen fermentation. Key Words: Eating behavior, pH, Rumination

**W184 Utilization of sugarbeet pulp and a high-sugar product for early lactation dairy cows.** G. D. Marx1, C. R. Dahl1, and A. C. Cox2, 1University of Minnesota, Crookston, MN, 2Malt-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 forage (CF) at equal ratio 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 DMI were similar (P>0.05) between treatments. 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% FC 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 cows.

**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. Kononoff1, 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±44 kg BW) were assigned to a 4 x 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 mL/L to 93.6 mL/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:** Total antioxidant capacity, Nutritional status, Dairy cows

**W186 Effect of forage to concentrate ratio on the efficiency of utilization of energy for milk production in dairy cows.** E. Kebeab1, J. France3, J.A.N. Mills2, L. A. Crompton1, R. E. Agnew2, and T. Yan2, 1The University of Reading, Reading, United Kingdom, 2The 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 (k1). 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 data:

\[ \text{E}_1 = a + b [\text{MEI} \cdot (\text{TF} / \text{k1})] + (\text{TF} \times 1 + \epsilon) \]

where \( \text{E}_1 \) is milk energy (MJ/kg W0.75/d), \( \alpha \) is the intercept and \( \beta \) is the efficiencies of utilization of energy for growth and body stores for milk production respectively, and \( \epsilon \) is an error term. Meta-analysis of the data using a nonlinear mixed model procedure estimated the values of \( \beta \) and \( k_1 \) to be 0.84 and 0.66 respectively, which were significantly different from previous reports of 0.6 for \( \beta \) and 0.84 for \( k_1 \). The value of \( k_1 \) 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 \( k_1 \) among forage:concentrate ratios of 0.1 to 0.99 (FC1, FC2 and FC3). However, there was a very significant difference in \( k_1 \) 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. Lund1, M. R. Weiberg1, 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 marker 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 MRTCOR by solving the equation: \( (k_1 \cdot \text{MRT} - k_0) \cdot \text{MRT} + k_2 \cdot \text{MRT} \cdot \text{MRT} - 1 = 0 \), based on an equation by Allen & Mertens (1988), and where fractional rates of digestion (k0) and passage (k2) of DNDF are obtained using the rumen evacuation method, and the distribution of MRTCOR between the first (y) and the second...
compartments (1-2y), y(0,1), can be estimated from duodenal excretion curves of ytterbium and MRT of feed. MRT and MRT$_{COR}$ of DNF 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 (WCB), corn (CS), whole crop pea (WCP), 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 DNF was on average 29 h higher than MRT for INDF, indicating a selective retention.

| Treatment | ECGS | LCGS | WCBS | GH | AH | CS | CGS | GH
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<tbody>
<tr>
<td>Unsuppl.</td>
<td>MRT</td>
<td>117±4</td>
<td>97±3</td>
<td>72±3</td>
<td>98±3</td>
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<tr>
<td>Suppl.</td>
<td>MRT</td>
<td>94±5</td>
<td>75±4</td>
<td>65±4</td>
<td>76±4</td>
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*Mean

Key Words: Kinetics, NDF, Selective retention


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 include 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 = [%FDN]*[NDF]/[(1-a-b)/[K+P+b+c/kp]24]/2(2), DMI = [%FDN]*[NDF]/[(1-a-b)/[K+P+b+c/kp]24]/2(3) and DMI = [%FDN]*[consumption of FDN]/[(1-a-b)/[K+P+b+c/kp]24]/2(4), using directly measured feeding values (4). The equations overestimated the average DMI obtained directly (9.0 kg/cow/day) in Colan-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>0.05) and both are higher (P<0.05) than the 9.7 kg/cow/day obtained in the equation (4). The values measured directly in Colon-Gates (9.0 kg/cow/day) were similar (P>0.05) to the 9.7 kg/cow/day obtained by the equation (4) and higher (P<0.05) than the 7.7 kg/cow/day obtained by the equation (3). The average NDF rumen fill (7.5 kg) was higher (P<0.05) 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


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 daily 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 to 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 reticularum. Regions sampled included: caudal portion of the caudal ventral blind sac, right and left caudal 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<0.05) 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<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 feed provided less than 30 g 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. Yang1, K. A. Beauchemin1, and L. M. Rode1, 1Agriculture and Agri-Food Canada, Lethbridge, Canada, 2Rosebud 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 objectives were to compare the effects of 6 dietary treatments, a 2 × 3 × 5 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
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 high (55:45); and forage particle length (FPL), long (7.59 mm) or short (6.08 mm) extent of barley grain processing, coarse (processing index [PI]=75.5%); 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.

## 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*, A. Queiroz, L. Cabral, E. Pereira, and A. Arruda.

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. Growth rates were affected by age of calves, but not by treatment. Addition of a LYP to the diet of calves with failure of passive transfer on perfor-

### Key Words:
- Yeast
- Calves
- Antibiotic resistance


Nutrient analysis data from three conserved forages: corn silage; alfalfa; 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), neutral detergent fiber (ADF), neutral detergent fiber (NDF), lignin, ash, non-structural carbohydrates (NSC), calcium, phosphorus, 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 deviations 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

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

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 ± 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 acetate acid (P < 0.05) and the acetate 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. Ferrer*, 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 conducted 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-canaola meal blend by cull chickpeas on apparent digestibility of diets for sheep. J. F. Obregon*, R. Barajas, and A. Estrada, *FMVZ-Universidad Autonoma de Sinaloa (Mexico)*

To determine the effect of substitution of a corn-canaola 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 x 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, containing (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 12 %, sugarcane molasses 12 %, urea 0.8 %, limestone 1.2 %, and mineral premix 1 % (treatment 1). Diets were offered twice a day (0800 and 1600 h), after six days of adaptation period, samples of diets (1 kg) and the total of feaces produced were collected for 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-canaola 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 58 kg 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 days (18.5±0.5 and 19.5±0.6), but at 21d (13.0±0.5 and 14.1±0.4). 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±3.9 and 4.3) and (3.3±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±0.3 and 0.3±0.1 kg/d), respectively. All lambs gained weight by the end of trial. The highest but not significantly different (P>0.05) BW was recorded for treatment IV as compared to I, II and III (0.39 Vs 0.14, 0.15 and 0.16 kg/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±72.3, 72.6 and 71.6%), respectively. In addition, treatment IV had significantly higher(P<0.05) digestibility of CF (67.9±52.6, 57.7 and 55.5%), ADF (63±50.3, 45.5 and 40.0) and NDF (68.5±63.7, 61.9 and 50.3%) 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, *FMVZ-Universidad Autonoma de Sinaloa (Mexico)*

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. Estrada*, R. Barajas, and J. F. Obregon, 1FMVZ-Universidad Autonoma de Sinaloa (Mexico).

To determine the effect of substitution of a alfalfa meal blend by cull chickpeas on apparent digestibility of diets for sheep, a digestibility experiment 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 were randomly assigned to consume one of two diets in that consists the treatments: Treatment 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 9.5%, 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 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. Clitoria hay diminished (P<0.02) in 14.9% 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 (0.890) than in alfalfa hay diet (1.05). The digestibility of DM of clitoria was calculated 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 calculated 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 clitoria 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 weight. The groups of the probe were assigned one of eight nylon bags (2×3 m), fitted with metal feed bunks (1×0.33 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 0.54%, limestone 1.15%, and mineral premix 1.15% (control); and 2) Diet as control, but containing 50% of clitoria hay (19.09% CP), that sustain 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 no 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*, J. F. Obregon, and A. Estrada*, 1FMVZ-Universidad Autónoma de Sinaloa (Mexico).

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 (Peliguey, males BW=34 kg) fitted with ruminal cannula were used. The animals were individually placed in concrete flour pens (1.5×1.8×2 m), 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 experimental 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 determined. Solubility was measured by five minutes immersion 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 suppressers (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 losing 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 (Mexico).

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 continuous 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 CSN 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, Cotton seed meal digestibility, Sheep


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 Neocallimastis frontalis (e.g., 3 hours) in treated cultures but not thereafter. Mobile zoospores matured into germination entities more rapidly in treated cultures, and when powdered product was used, 38% (P≤0.05) more motile zoospores were produced by 50 h of fungal growth. Furthermore, by 110 h of growth 97% (P>0.05) more 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≤0.01) and 2.7-fold (P<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≤0.05) higher levels of secreted enzymes including amylase (23%), CMCase (22%) and β-glucosidase (34%). Culture gas production was higher (P≤0.04) at 48 and 66 h of growth in extract treated cultures but not thereafter. Culture utilization of glucose increased by 37% in treated cultures yet high levels of extract (e.g., 5 times recommended) inhibited glucose utilization. AO fermentation extract effects the physiology of
W204 Effects of *Asperillus 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 *Asperillus 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* ≤ 0.05) increased the initial (up to 4 h) growth rate of *Saccinunobius amylolytica* B24 (Sa) (RRI), increased (*P* ≤ 0.01) the growth rate of *Selenomonas ruminantium* NADL GA-192 (Sr) (RRI) throughout the 10 h experiment, and significantly decreased (*P* ≤ 0.02) the growth rates of *Succinivibiro decarboxilans* 6554 Sd (Sd) (RRI) and *Evabacterium 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* ≤ 0.1) to be larger, whereas Ec and Sd tended (*P* ≤ 0.1) to be smaller, and Pr, Sa and Sr were unchanged in size. Extract failed (89% in control versus 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* ≤ 0.05) in co-cultures treated with AO extract whereas total protein and total gas produced were unchanged. Xylanase was significantly (*P* ≤ 0.01) decreased in all extract treated co-cultures. Gel electrophoresis methods revealed only slight differences in protein patterns of cellular lysates from bacteria grown 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 fungus, Cellulase

W205 RUSITEC to characterize *Asperillus oryzae* extracts effects on *in vitro* fermentation and populations of microorganisms. R. Calza†1, F. McIntosh2, J. Wallace3, and J. Newbold2, †Washington State University, Pullman/U.S.A., 2Rowett 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* ≤ 0.05) in the number of total bacteria, fungi, or protozoa in vessels. Cellulolytic bacteria numbers were different (*P* ≤ 0.01) at 1.93 x 10⁷/ml for control vessels, 4.73 x 10⁷/ml for treated vessels, and 2.70 x 10⁷/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* ≤ 0.1) in inhibitor treated vessels at 0.60 mmol/d. Measured pH values were similar in all vessels and ranged between 6.65-6.64 on days 11 and 20. Dry matter disappearance was significantly different (*P* ≤ 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 H₂ was lower (*P* ≤ 0.06) in control bottles at 757 µmol than in treated bottle at 870 µmol ml and lower yet at 505 µmol in bottles containing inhibitor. Zoospore numbers tended to be lower (*P* ≤ 0.1) at 9.4 x 10⁵/ml in controls than in treated bottles at 12.9 x 10⁵/ml but both higher than inhibitor containing bottles at 4.9 x 10⁴/ml at day 7. Fungal cellulase was lower (*P* ≤ 0.04) in the control bottles (2.94 µIU/ml) than in treated bottles (4.29 µIU/ml) but there was no difference between those samples and inhibitor treated bottles (3.13 µIU/ml). Research suggests that Amaferm® influences microbial populations including rumen fungi in RUSITEC.

**Key Words:** RUSITEC, Amaferm®, Fermentation


The presence of growth inhibitor in extracts of *Asperillus 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* ≤ 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* ≤ 0.01) reduction (49% of controls) in the growth of rumen fungus. Such inhibitor fractions reduced (both at *P* ≤ 0.05) cellulase and amylase secrections 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


To determine the ruminal degradation of crude protein of raw cull Chop suey beans (Vigna radiata L., Wilzeck) 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 chop suey beans. Nylon bags (10 x 18 cm) containing 5 g of raw cull chop suey 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 AP 18 h incubation time was higher (P<0.01) than SBM-CP (96 % vs. 77 %). 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
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=92 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 steers to be offered at least 0.25 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 tanks 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 (0.52 vs 0.72 kg/d) when discarded accumulated feed was subtracted from feed delivery data. Leaving discarded accumulated feed in the feedlot, 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 hanks 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 received 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 implant treatments increased animal performance during 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. Pyatt1, L. L. Berger1, D. B. Faulkner1, and P. M. Walker2, 1University 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 17.5 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 longissimus 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 cm2 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 (R2 0.45), DMI (0.42), HCW (0.25) and YG (0.31). %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


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 or 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

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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 ovariolectomized (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 1 ng/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 in 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 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 ovarioectomized 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 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 (< 1 ng/mL by 1 h). 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. Whitworth1, D. W. Forrest1, L. R. Sprott1, B. G. Warrington2, and J. W. Valentine2, 1Department of Animal Science, Texas A&M University, College Station, 2Texas 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 allocated to treatment groups. Results were as follows: Brahman (n=6) and Bosmara (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 Brahman (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, Bosmara (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 to treatment groups based on 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 Multimin® between 2 to 3 wks pre-calving (TREATMENT 2 n=186). An equal dose was repeated between 38 to 45 days in lactation. Two hundred and twenty eight similar cows